AD-A084 373 BAKER (MICHAEL) JR INC BEAVER PA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. SOUTH RIVER NUMBER 6 (ID VA-01509)--ETC(U)
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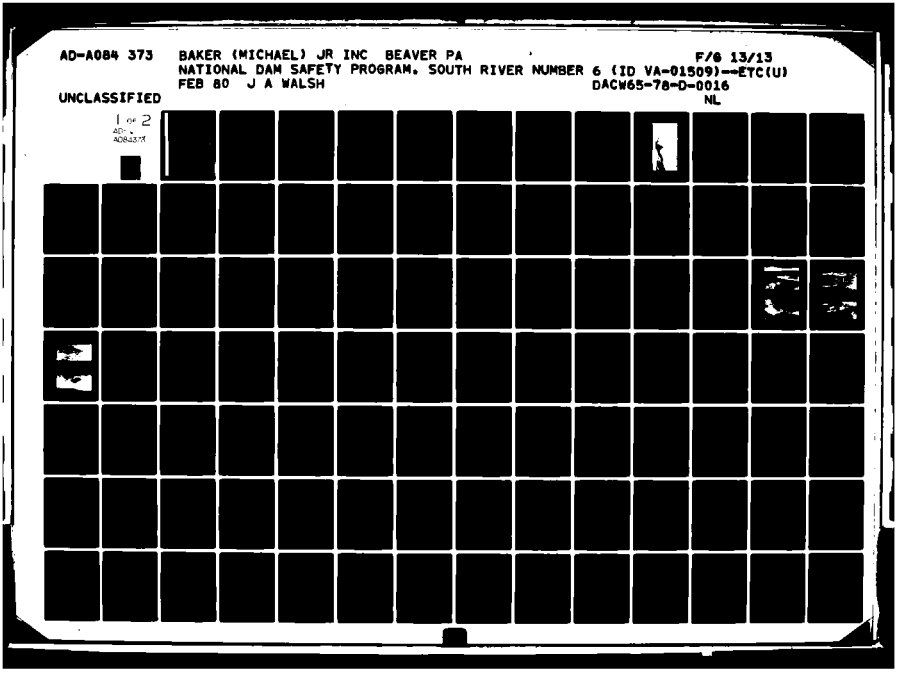
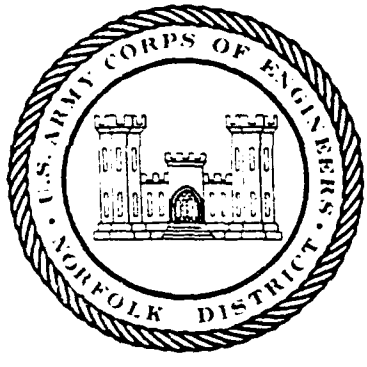


POTOMAC RIVER BASIN

Name of Dam: South River No. 6
Location: Augusta County, State of Virginia
Inventory Number: VA 01509

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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February 1980

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(See reverse side) (6) National Dam Safety Program. South River Number 6 (ID VA-01501), Potomac River Basin, [illegible] Augusta County, Virginia. Phase I Inspection Report.

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

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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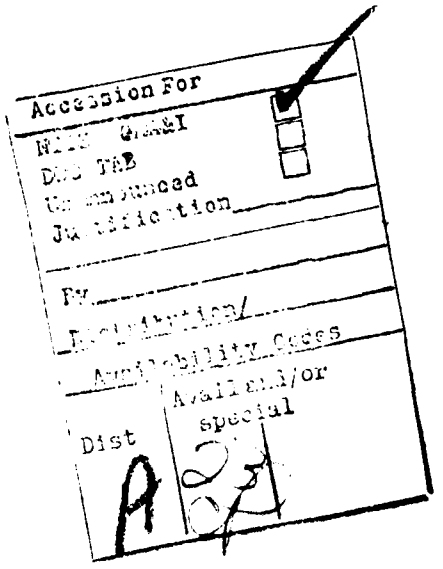

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: South River No. 6
State: Virginia
County: Augusta
USGS 7.5 Minute Quadrangle: Big Levels, VA
Stream: Gum Springs Branch, Deep Pond Run, Cold Spring Branch
Date of Inspection: 14 November 1979

BRIEF ASSESSMENT OF DAM

South River No. 6 dam is an earthfill dam with an embankment approximately 910 feet long and 56 feet high, and a 175 foot wide vegetated earth emergency spillway. The dam, located approximately 2.2 miles south of Greenville, Virginia, is used for flood control and recreation. The dam is owned by Mr. David Willingham. South River No. 6 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.

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 1.3 feet with an average critical velocity of 5.3 f.p.s. Total duration of dam overtopping would be approximately 3.0 hours. The emergency spillway is capable of passing only 60 percent of the PMF and is adjudged as inadequate, but not seriously 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.

A warning system should be installed to alert campers and downstream residents of rising water within the reservoir. The warning system should be approved by the state and by the local conservation district. An emergency action plan should also be developed.

It is recommended that the following repair items be accomplished as part of an annual maintenance program:

1) Fill the animal burrow below the toe on the right side of the embankment.

2) Reseed the areas of sparse vegetation on the embankment.

3) Install a staff gage in the reservoir to monitor high water levels.

The owner should contact the local Soil and Water Conservation District about possible replacement or repair of the emergency drawdown head gate, which is operable but reportedly difficult to reseal.

The owner should also give serious consideration to relocating the campground office/store from the emergency spillway to an elevation higher than the dam crest.

MICHAEL BAKER, JR., INC.

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

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

SUBMITTED: Original signed by JAMES A. WALSH

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Chief, Design Branch

RECOMMENDED: Original Signed by: Ronald G. Vann for

Jack G. Starr, P.E.
Chief, Engineering

APPROVED: Original signed by: Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: MAR 14 1980

NAME OF DAM: SOUTH RIVER No. 6

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: SOUTH RIVER No. 6 ID #VA 01509

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 Guideline for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: South River No. 6 dam, a flood control dam designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS), is also known by its local name, Senger's Mountain Lake. The earthfill embankment is approximately 56 feet high[1] and 910 feet long. The embankment has side slopes of 2.5H:1V (Horizontal to Vertical) and 3H:1V on the downstream and upstream faces respectively. There is a 10 feet wide berm on the downstream face of the embankment at elevation 1616.25 feet Mean Sea Level (M.S.L.) Seepage control is provided by an impervious core, a cut-off trench, and a seepage drain. The seepage drain is located approximately 112 feet from the downstream toe of the dam and consists of a filter and a 6 inch perforated bituminous coated corrugated metal pipe. The drain system exits through a single 6 inch unperforated bituminous coated corrugated metal pipe, immediately to the left of the principal outlet pipe, into the stilling basin.

[1]Measured from invert of outlet pipe to crest of dam.

The principal spillway is a fixed crest (elevation 1601.5 feet M.S.L) drop inlet structure consisting of a reinforced concrete riser approximately 11 feet high with a 24 inch diameter reinforced concrete outlet pipe. The outlet pipe is 337 feet long and is fitted with 8 reinforced concrete anti-seep collars on 24 foot centers as it passes through the embankment. The outlet discharges into a riprap-lined and tapered 12 feet wide and 20 feet long stilling basin. The basin has side slopes of 1:1 and a level bottom.

The emergency spillway, a 175 feet wide vegetated earth channel, is located outside the left abutment of the dam. The approach channel of the emergency spillway rises at a slope of 3 percent to the control section at elevation 1635.0 feet M.S.L. A campground office/store is constructed in the approach channel. Beyond the 20 foot long control section the discharge channel slope is 3 percent.

The emergency drawdown valve, located on the principal spillway riser, is a 24 inch circular head gate controlled by a handwheel lift mechanism located on top of the riser platform.

1.2.2 Location: South River No. 6 dam is located on Cold Spring Branch approximately 2.2 miles southeast of Greenville, Augusta County, Virginia. A Location Plan is included with this report.

1.2.3 Size Classification: The maximum height of the dam is 53 feet; the reservoir storage capacity at the crest of the dam (elevation 1642.0 feet M.S.L.) is 1263 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: Within 1 mile downstream of the dam are 3 permanent residential structures and 2 mobile homes. The permanent structures are constructed on relatively high ground while the mobile homes are in a low-lying area. Loss of life is highly probable along with economic losses. South River No. 6 dam is therefore 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 location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by Mr. David Willingham, Senger's Mountain Lake, Greenville, Virginia.

1.2.6 Purpose of Dam: The dam is used for flood control and recreation.

1.2.7 Design and Construction History: The existing facility was designed by the SCS. The dam, completed in 1959, was constructed by the George Via Construction Company.

1.2.8 Normal Operational Procedures: The reservoir is normally operated at the level of the fixed crest riser, elevation 1601.5 feet M.S.L. No formal operating procedures are followed for this structure. See paragraph 4.1 for detailed operating procedures.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area for South River No. 6 dam is 4.1 square miles.

1.3.2 Discharge at Dam Site: Maximum discharge at the dam site is unknown. The owner indicated that water has never reached the emergency spillway level since dam construction.

Principal Spillway:
Pool level at top of dam . . . . 86 c.f.s.

Emergency Spillway:
Pool level at top of dam . . . . 10,786 c.f.s.

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

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Capacity Area acres	Reservoir Capacity Acre-feet(a)	Reservoir Capacity Watershed inches	Length feet
Top of dam	1642.0	52.0	1263	5.8	2200
Emergency spillway invert	1635.0	49.2	885	4.1	2060
Principal spillway crest (normal pool)	1601.5	12.3	30.2	0.1	935
Streambed at downstream toe of dam	1586.1	-	-	-	-

(a) Includes sediment storage of 30.2 acre-feet.

SECTION 2 - ENGINEERING DATA

2.1 Design: The geologic and design reports and the as-built plans were available for use in preparing this report. (Other information, such as soils laboratory testing and slope stability analyses, was not available.) The geology report was prepared by L.A. Gorman, Geologist from the Richmond, Virginia office of the SCS. Glenn W. Grubb, Design and Construction Engineer, from the Upper Darby, Pennsylvania office of the SCS, prepared the design report.

The original geologic investigation was conducted during August of 1957. Soil samples were taken from twelve feet deep and later analyzed. After the results were reviewed, further and deeper investigations were deemed necessary to collect additional samples for triaxial shear and time compaction[2] tests. The results of the lab tests were not available for use in the preparation of this report. According to the geology report, the dam site is covered by alluvial material and no bedrock outcrops in the vicinity of the structure. The bedrock under the alluvium includes shale, sandstone, limestone, and dolomite which can weather into the type of residual clay soil found in the area.

Along the centerline of the dam (within the valley floor and through the east and west abutment), 10 test pits were dug and 4 test borings were cored. The soil and rock profile indicated that the foundation appeared adequate to support the dam structure and that the abutments appeared sound. The east abutment material was more dense and harder than that of the west abutment and valley floor. Tests also indicated that some leakage might occur along the valley floor, but that it would be controlled by the drains. (Conditions under the proposed principal spillway were similar to those of the valley floor, and it was suggested that the spillway be located in the east abutment. It was subsequently located on the floodplain.)

The geologic report indicated that adequate borrow material would be available; however, the report strongly suggested that no material be removed from the permanent pool area. (Pertinent sections of the Geologic Report may be found in Appendix V.)

[2]Apparently consolidation.

After review of the geologic data, the design report called for the construction of a compacted earth dam atop alluvium and alluvial terrace material. The proposed principal spillway would be a drop inlet type with a reinforced 24 inch inside diameter concrete pipe and a reinforced concrete riser resting on silty clay. The emergency spillway was excavated into silty sand and clay of the left abutment. Hydrologic/hydraulic design data from this report is discussed in paragraph 5.1.

2.2 Construction: As-built drawings were available for review and were subsequently verified in the field. Construction was performed by the George Via Construction Company and was completed in 1959.

2.3 Evaluation:

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

2.3.2 Construction: No construction logs were available for review. The width of the emergency spillway was changed from 150 to 175 feet some time after the original design work was performed and the surface area of the normal pool was reduced from 37 acres to 12.3 acres. Other than these changes, the as-built drawings do not indicate any changes or modifications that were made during construction.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was conducted on 14 November 1979. Skies were overcast and the temperature was 38°F. At the time of the inspection, the pool elevation was 1601.8 feet M.S.L. and the tailwater elevation was 1586.1 feet M.S.L. Ground conditions were somewhat damp due to previous rain showers. The embankment and appurtenant structures were found to be in good condition. 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. The Headwaters Soil and Water Conservation District conducts a yearly inspection program for the dam with the assistance of the District Conservationist, and deficiencies which are found are corrected in conjunction with this inspection. The report on the 1978 inspection is given in Appendix IV.

3.1.2 Dam: The embankment was found to be in good condition with no surface cracks, slumps or sloughs, or other indications of instability either on the embankment or at the toe. The slopes are generally well covered with grass; however, there are areas of sparse, dried out vegetation stretching horizontally across the embankment below the bench. These areas should be reseeded. Wave erosion is taking place on the upstream face. There is an animal burrow on the right side of the downstream embankment near the toe.

3.1.3 Appurtenant Structures: The principal spillway intake is a rectangular concrete riser with a drop inlet. The concrete on the riser is in good condition with no visible signs of cracking or spalling. There is no trash rack on the riser, but there was no noticeable debris around the intake. The outlet structure is a 24 inch steel-lined concrete pipe protruding from a concrete head wall. The structure is in good condition. One toe drain outlet is present and located to the left of the principal spillway outlet. The toe drain was

not flowing at the time of the inspection. The emergency spillway is well defined and well vegetated with grass. The emergency spillway has a bottom width of 175 feet, as measured during the inspection. The campground's access road and office/store building are located within the spillway. The construction of the building by the previous owner was not authorized by the SCS or the conservation district. The SCS and the conservation district have instructed the present owner that addition to or occupation of the building is strictly prohibited. No other major obstructions are present.

3.1.4 Reservoir Area: The reservoir functions as a swimming and fishing area for the campground. The principal spillway intake is covered by a platform/dock structure complete with diving board. Additional docks are present along the shore. Sand cover along the right shoreline creates an artificial beach for campers. There are grassy and wooded gradual slopes on the left and upstream shoreline. The right side is wooded and more steeply sloped. Three streams (Cold Spring Branch, Deep Pond Run, Gum Springs Branch) empty into the reservoir. The design report estimated a sedimentation rate of 0.604 acre-feet per year for the reservoir area.

3.1.5 Downstream Channels: The channel is fairly clear; however, the overbank areas are wooded. There are three houses and two mobile homes located downstream.

3.2 Evaluation: In general, the dam and appurtenant structures are in good condition. Seeding is recommended for the brown and dormant vegetation areas. The animal burrow should be filled. The berm on the upstream face should be observed during annual inspections and riprap should be installed if erosion continues.

The owner should give serious consideration to relocating the campground office/store from the emergency spillway to an elevation higher than the dam crest.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: The reservoir is used for recreation and flood control and as such operation is automatic. The normal pool is maintained at elevation 1601.5 feet M.S.L. by means of the fixed crest of the principal spillway riser. When inflow to the reservoir exceeds the principal spillway capacity, water will rise behind the dam, creating a larger pool. During a major storm, inflows may be sufficient to discharge waters over the emergency spillway around the dam and back into the downstream channel.

4.2 Maintenance of Dam: The Headwaters Soil and Water Conservation District is responsible for the maintenance of the dam. The annual maintenance responsibilities include liming, fertilizing, and mowing the embankment and spillways; seeding and mulching bare areas; and repairing gullies that occur in the dam and spillway areas.

4.3 Maintenance of Operating Facilities: The Headwaters Soil and Water Conservation District is responsible for the maintenance of the emergency drawdown facilities. Additionally, the owner assists the District in the normal maintenance of the structure as part of his operation of the campgrounds.

The emergency drawdown head gate on the principal spillway riser is operable, according to the owner. However, the previous owner reportedly had difficulty resealing the gate.

4.4 Warning System: At the present time, there is no formal warning system or evacuation plan in operation.

4.5 Evaluation: Maintenance of the dam is considered adequate. A warning system should be installed to warn campers and downstream residents of rising waters in the reservoir. This system should be based upon the rate of rise of the flood pool and its relation to adequate notification time to campers and downstream residents. An emergency action plan should also be implemented. The emergency action plan should contain instructions that the campground office/store is not to be used by campers for shelter during periods of heavy rain. Both the warning system and the emergency action plan should be approved by the state and the conservation district. The owner should contact the SCS about possible replacement or repair of the emergency drawdown head gate.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Normal pool (elevation 1601.5 feet M.S.L.) is maintained by fixed crest drop inlet structure with a total weir length of 12.0 feet and a 24 inch reinforced concrete outlet pipe. The weir crest was established at the elevation sufficient to store the 50-year sediment accumulation.

The crest (elevation 1635.0 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 (1642.0 feet M.S.L.) was established by use of the freeboard hydrograph. The freeboard hydrograph was developed for a class "C" structure and was obtained by using a 6-hour point rainfall of 27.3 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. The owner indicated that the water level has never approached the crest of the emergency spillway.

5.4 Flood Potential: The Probable Maximum Flood (PMF) and the 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-discharge data. Clark's T_c and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to the unit hydrograph was obtained from the National Oceanic and Atmospheric Administration's publication (Reference 17, Appendix VIII). 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 information are shown in Table 1.1, paragraph 1.3.3.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the weir crest of the principal spillway inlet structure with an elevation of 1601.5 feet M.S.L. Water entering over the crest of this inlet structure flows through the dam in a 24 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 1635.0 feet M.S.L.

Discharge capacity for the principal and emergency spillways was computed by hand; reservoir area and storage capacity were taken from the SCS design report and extrapolated for elevations above the top of dam. The flood routings were begun with the reservoir level at normal pool.

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(a)	Hydrographs 1/2 PMF	Hydrographs PMF(b)
Peak flow, c.f.s.			
Inflow	5	8,935	17,871
Outflow	5	8,620	17,798
Peak elev., ft. M.S.L.	1601.8	1641.05	1643.32
Emergency spillway (c) (elev. 1635.0 feet M.S.L.)			
Depth of flow, ft.	-	6.0	8.3
Average velocity, f.p.s.	-	11.4	13.4
Duration of flow, hrs.	-	9.5	13.8
Non-overflow section (c) (elev. 1642.0 feet M.S.L.)			
Depth of flow, ft.	-	-	1.3
Average velocity, f.p.s.	-	-	5.3
Total duration of overtopping hrs.	-	-	3.0
Tailwater elev., ft. M.S.L.	1586.1	-	-

(a) Conditions at time of inspection.
(b) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.
(c) Depth and velocity estimates were based on critical depth at control section.

5.7 Reservoir Emptying Potential: A 24 inch circular head gate located on the principal spillway riser is available to dewater the reservoir. The gate is operated from the top of the riser platform. Neglecting inflow, the reservoir can be drawn down from normal pool in approximately 1 day. This is equivalent to an approximate drawdown rate of 8.5 feet per day based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 Evaluation: South River No. 6 dam is an "intermediate" size - "high" hazard dam requiring evaluation for a spillway design flood (SDF) equal to the PMF. The PMF was routed through the reservoir and found to overtop the dam by a maximum depth of approximately 1.3 feet with an average critical velocity of 5.3 f.p.s. Total duration of overtopping would be approximately 3.0 hours. The spillway is capable of passing only 60 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: A geology report prepared by the SCS was available for use in preparing this report. Excerpts from the geology report are given in Appendix V. South River No. 6 dam is located in the Shenandoah Valley region of Virginia. No bedrock outcrops in the vicinity of the dam site because the area is covered by alluvial material. The rocks which are present under the alluvium include the Waynesboro formation, Elbrook Dolomite, and Conococheague Limestone. These formations include shale, sandstone, limestone, and dolomite, which can weather into the type of clay deposits found in this vicinity. According to the as-built plans furnished by the SCS, the seepage drain consists of a 3 foot by 4 foot filter of pit-run sand and gravel running the length of the embankment. The central section of this bed contains a perforated, 6 inch diameter bituminous coated corrugated metal pipe. Near the principal spillway conduit, this pipe connects with a non-perforated, 6 inch corrugated metal pipe which discharges into the stilling basin. According to the as-built plans, the dam is keyed into the foundation.

6.2 Embankment

6.2.1 Materials: It is known that the embankment materials came from the vicinity of the dam. The alluvial terrace material in this area consists of weathered sandstone cobbles and gravel, and low-plastic, sandy silts and clays; as stated in to the SCS geology report. The as-built plans show that the embankment is zoned.

6.2.2 Stability: There are no available stability calculations. the dam is 56 feet high and 17 feet wide. it has a measured upstream slope of 3H:1V and a measured downstream slope of 2.5H:1V. The dam exists at normal storage pool. The reservoir level has never yet approached the elevation of the emergency spillway. The dam has a freeboard of approximately 33.5 feet from maximum control storage. The dam is subjected to a sudden drawdown because the approximate reservoir drawdown rate of 8.5 feet per day exceeds the critical rate of 0.5 foot per day for earth dams. According to the guidelines presented in Design of Small Dams, U.S. Department of the Interior, Bureau of Reclamation, for small

homogeneous dams with a stable foundation, subjected to a drawdown, and composed of low-plastic fines (CL, ML); the recommended slopes are 3H:1V upstream and 2.5H:1V downstream. The recommended width is 21 feet. Based on these guidelines and considering the fact that there is a 10 feet wide bench on the downstream embankment, the width and embankment slopes are considered to be adequate.

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

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. However, the visual inspection revealed no apparent instability. Also, based on the Bureau of reclamation guidelines, the dam's width and slopes are adequate. Based on these conditions, the embankment is considered stable for normal pool conditions. Maximum control storage conditions are unknown.

Despite the inability of the spillway to pass the design flood, the depth, duration, and rate of overtopping flows are not considered detrimental to the embankment. Overtopping flows are shallow, last only 3 hours, and the velocity is less than 6 f.p.s., the effective eroding velocity for a vegetated earth embankment.

Based on the above, stability calculations are not required.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The dam and appurtenant structures are generally in good overall condition. No 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 South River No. 6 dam. It has been determined that the dam would be overtopped by the SDF to a maximum depth of 1.3 feet with an average critical velocity of 5.3 f.p.s. and would remain above the top of dam for 3.0 hours. The spillway is capable of passing only 60 percent of the PMF and is therefore adjudged as inadequate, but not seriously inadequate.

Since access to the campground above the dam is through the emergency spillway and may be cut off during a major flood, a warning system should be developed and put into operation. An emergency action plan should also be implemented.

The other recommended remedial measures are not considered urgent and therefore may be accomplished as part of an annual maintenance and inspection program.

7.2 Recommended Remedial Measures: A warning system should be installed to warn campers and downstream residents of rising waters in the reservoir. This system should be based upon the rate of rise of the flood pool and its relation to adequate notification time to campers and downstream residents. An emergency action plan should also be implemented. Both the warning system and the emergency action plan should be approved by the state and the conservation district.

It is recommended that the following repair items be accomplished as part of an annual maintenance program: fill animal burrows and small erosion channels, reseed the areas of sparse vegetation on the embankment, and install a staff gage in the reservoir. The owner should contact the local Soil and Water Conservation District about possible replacement or repair of the emergency drawdown valve, which is reportedly operable but difficult to reseal.

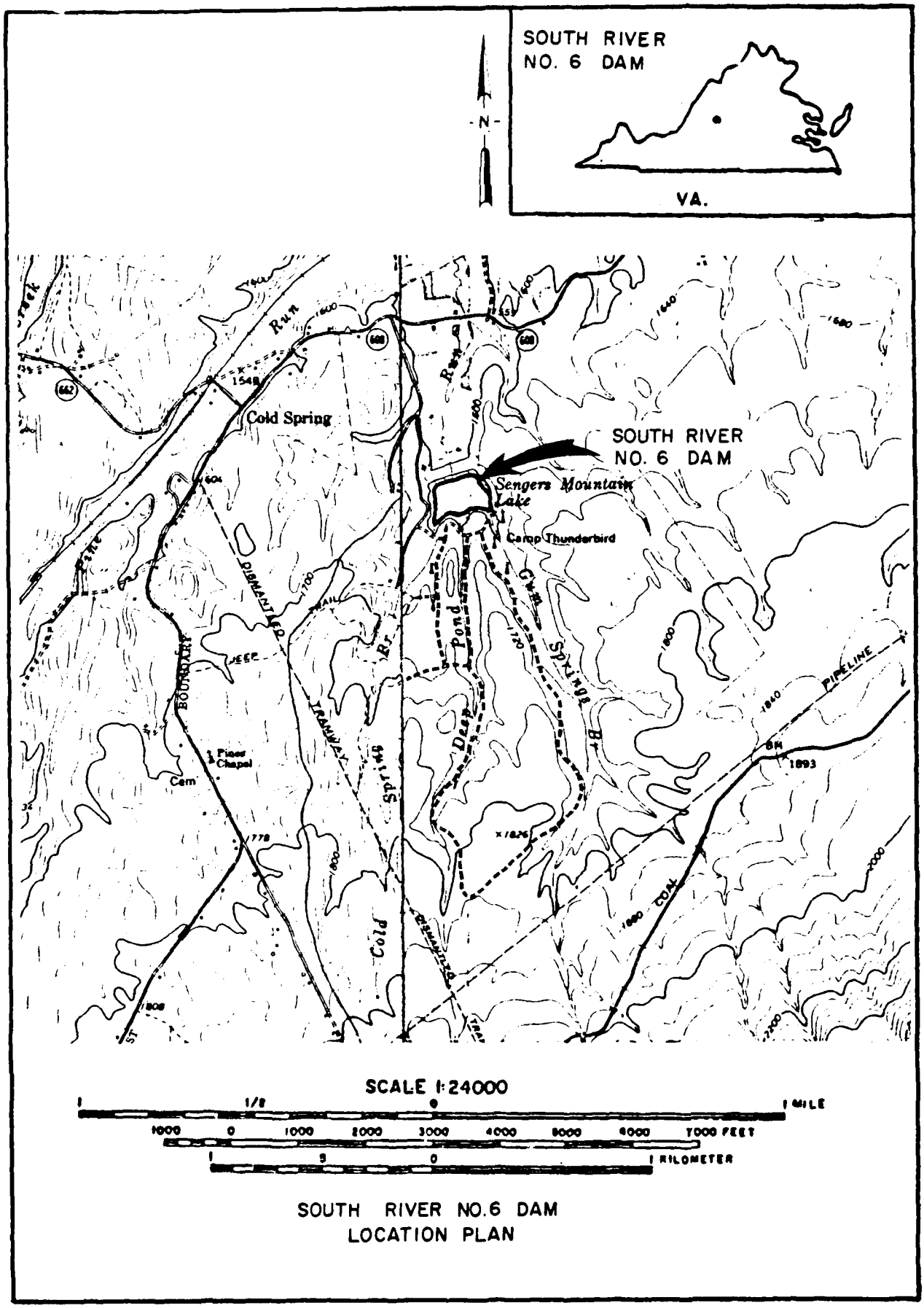
The owner should also give serious consideration to relocating the campground office/store from the emergency spillway to an elevation higher than the dam crest.

APPENDIX I

PLATES

CONTENTS

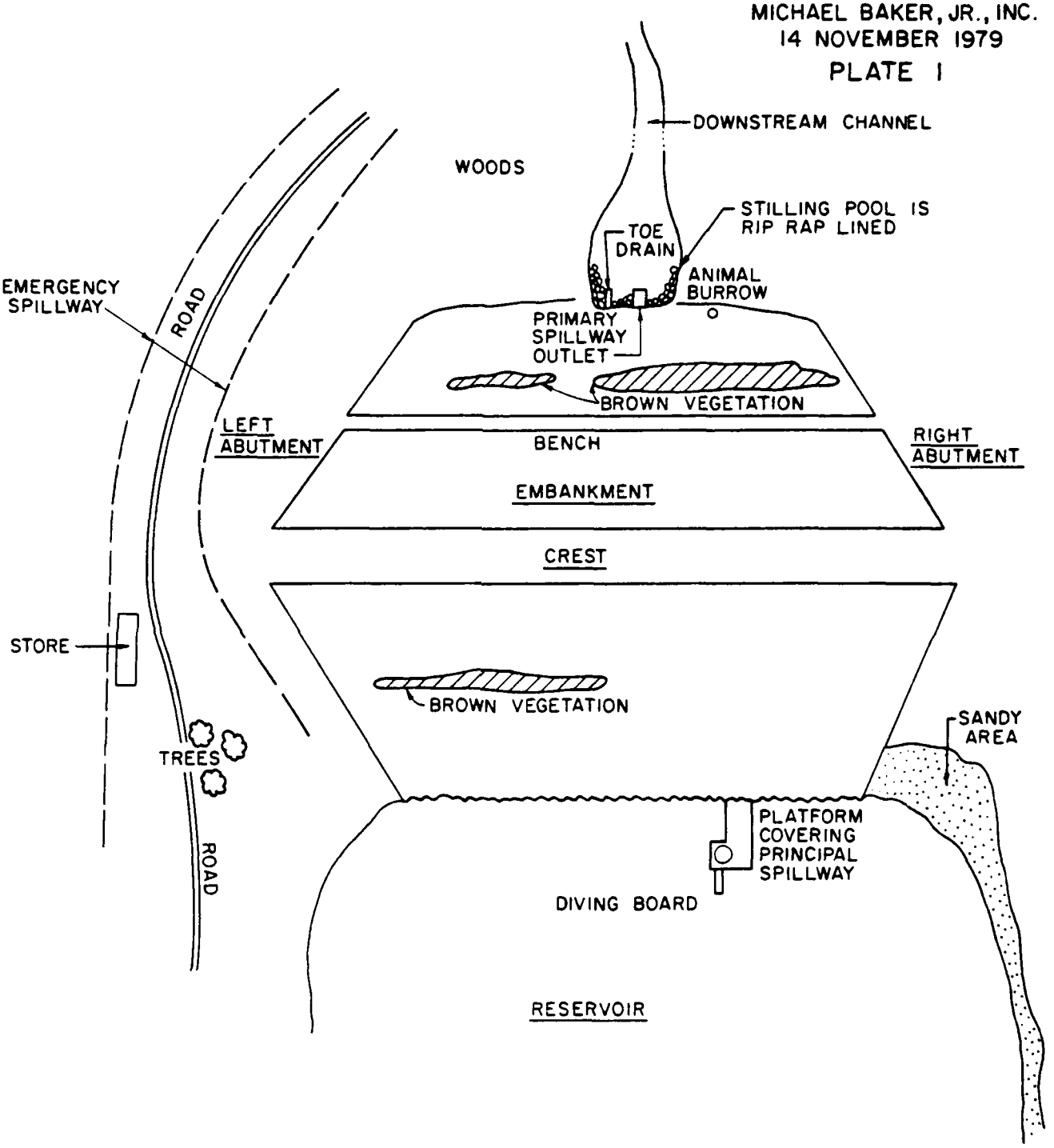
Note: On Plate 5, the emergency spillway width is shown as 150 feet. On Plate 2, the emergency spillway width is shown as 175 feet. During the inspection, the width of the emergency spillway was measured as 175 feet.



SOUTH RIVER NO.6 DAM
LOCATION PLAN

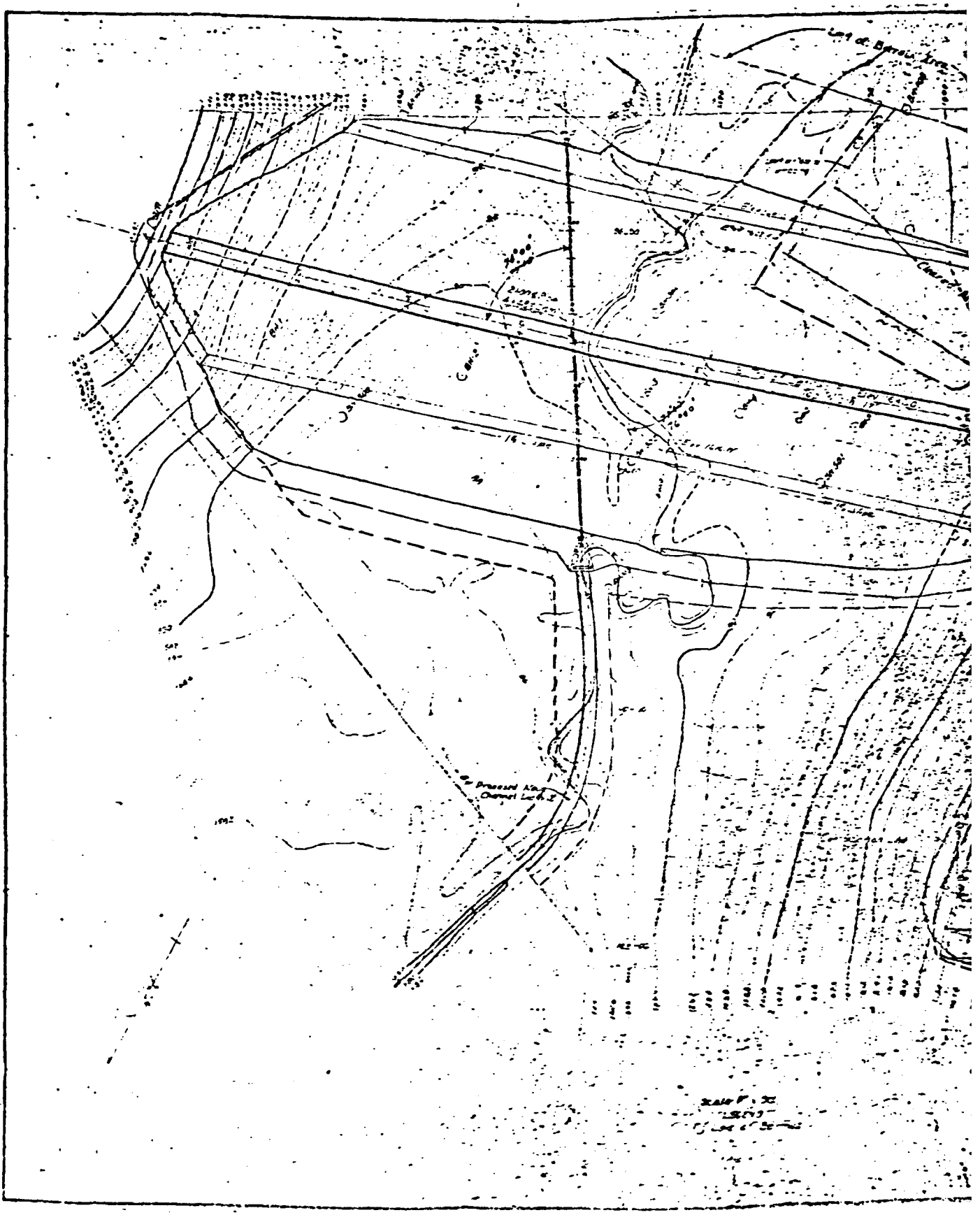
FIELD SKETCH

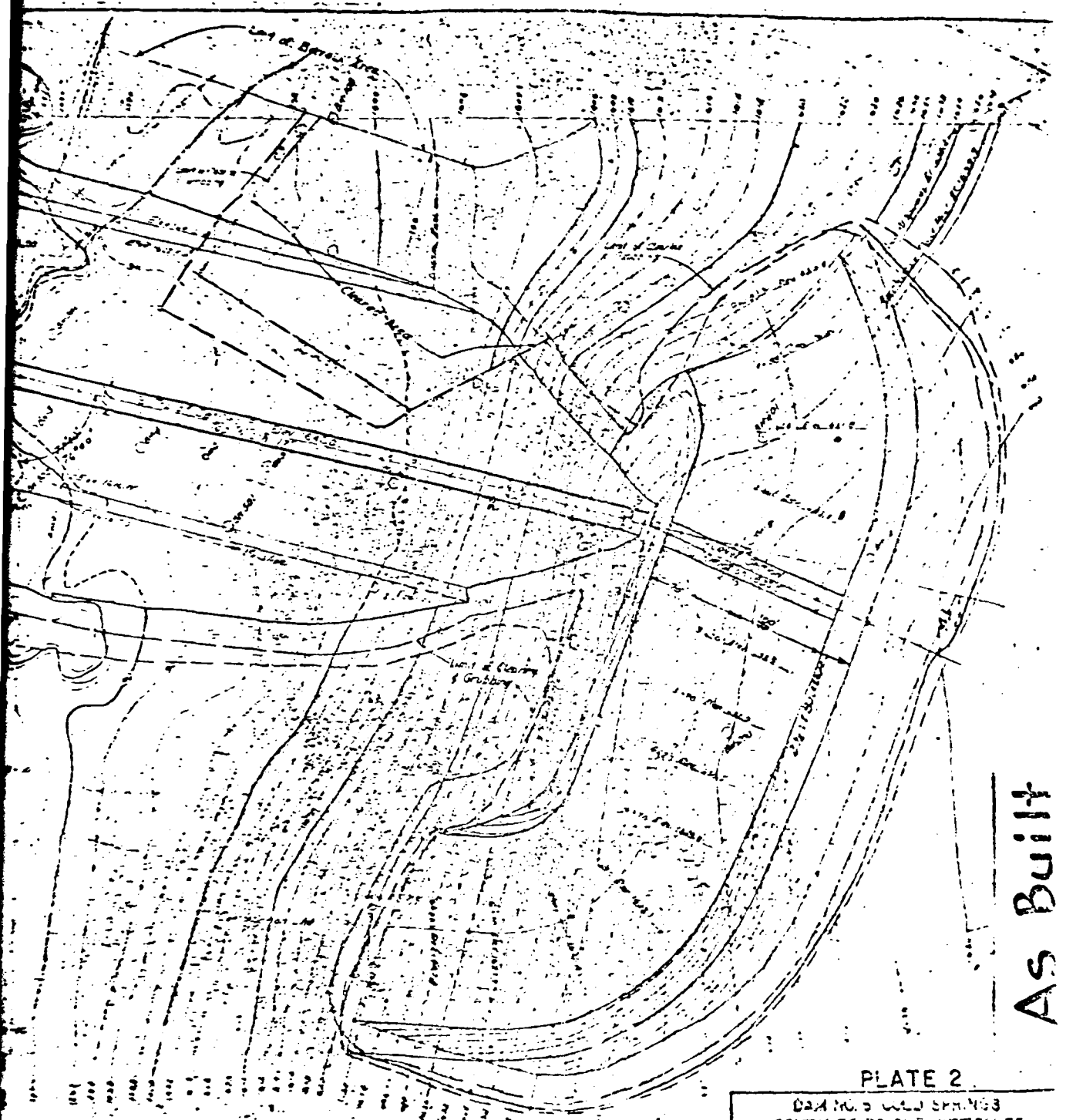
SOUTH RIVER DAM#6
MICHAEL BAKER, JR., INC.
14 NOVEMBER 1979
PLATE 1



NOTE:
BENCH ON DOWNSTREAM EMBANKMENT TILTS BACK TOWARD THE EMBANKMENT — STANDING WATER PRESENT IN TROUGH ON BENCH
MANY MOLE BURROWS / TRACKS PRESENT ON DAM

NO SCALE



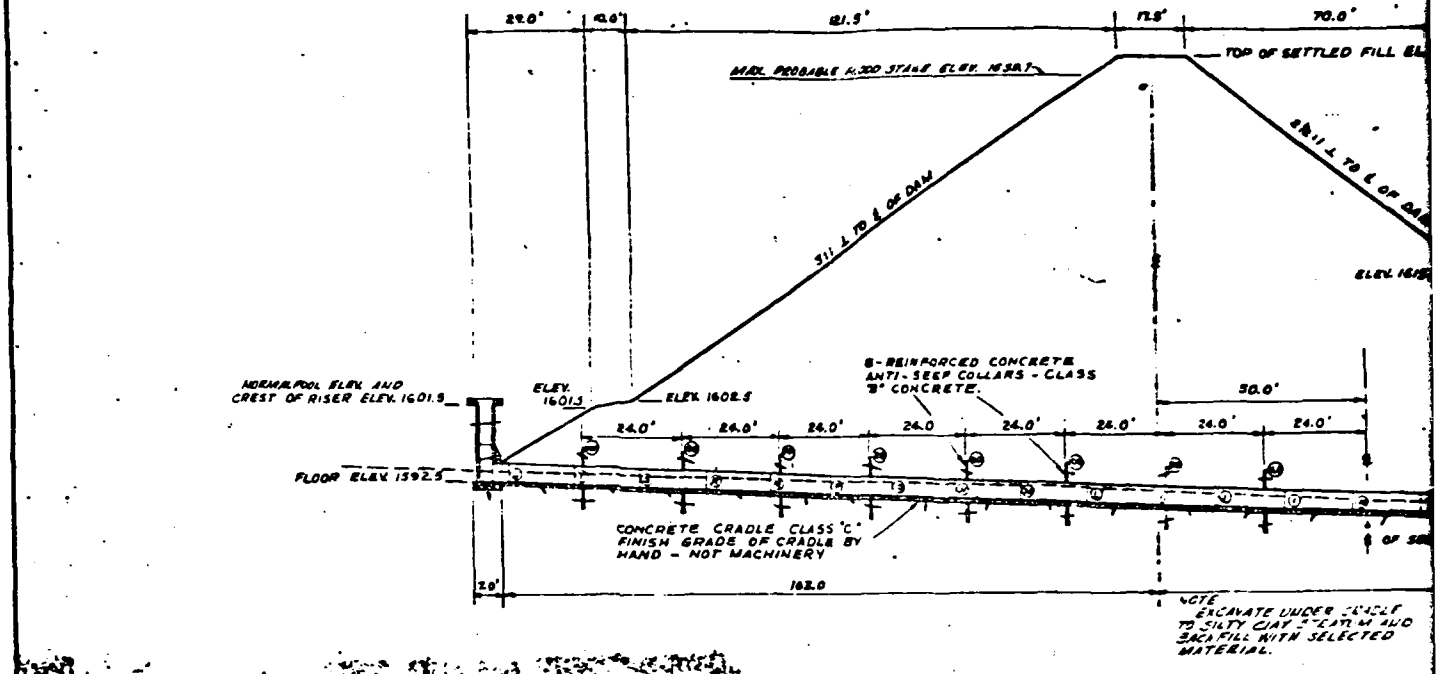


As Built

PLATE 2

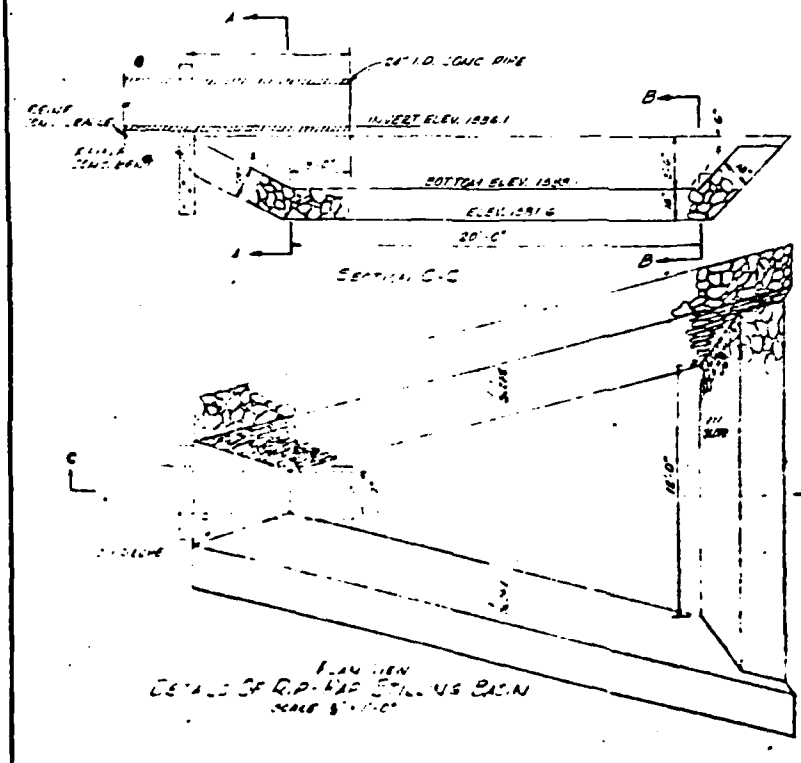
DAM NO. 3 WILD SPRINGS
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED, STAFFORD, VIRGINIA
SITE LOCATION MAP

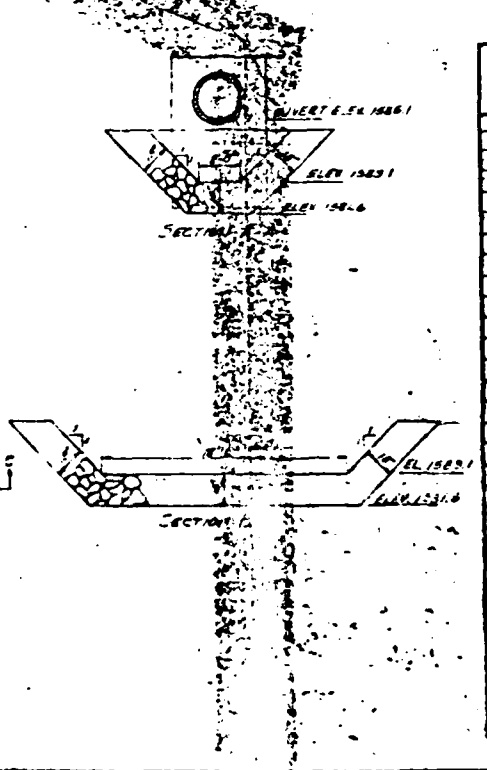
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



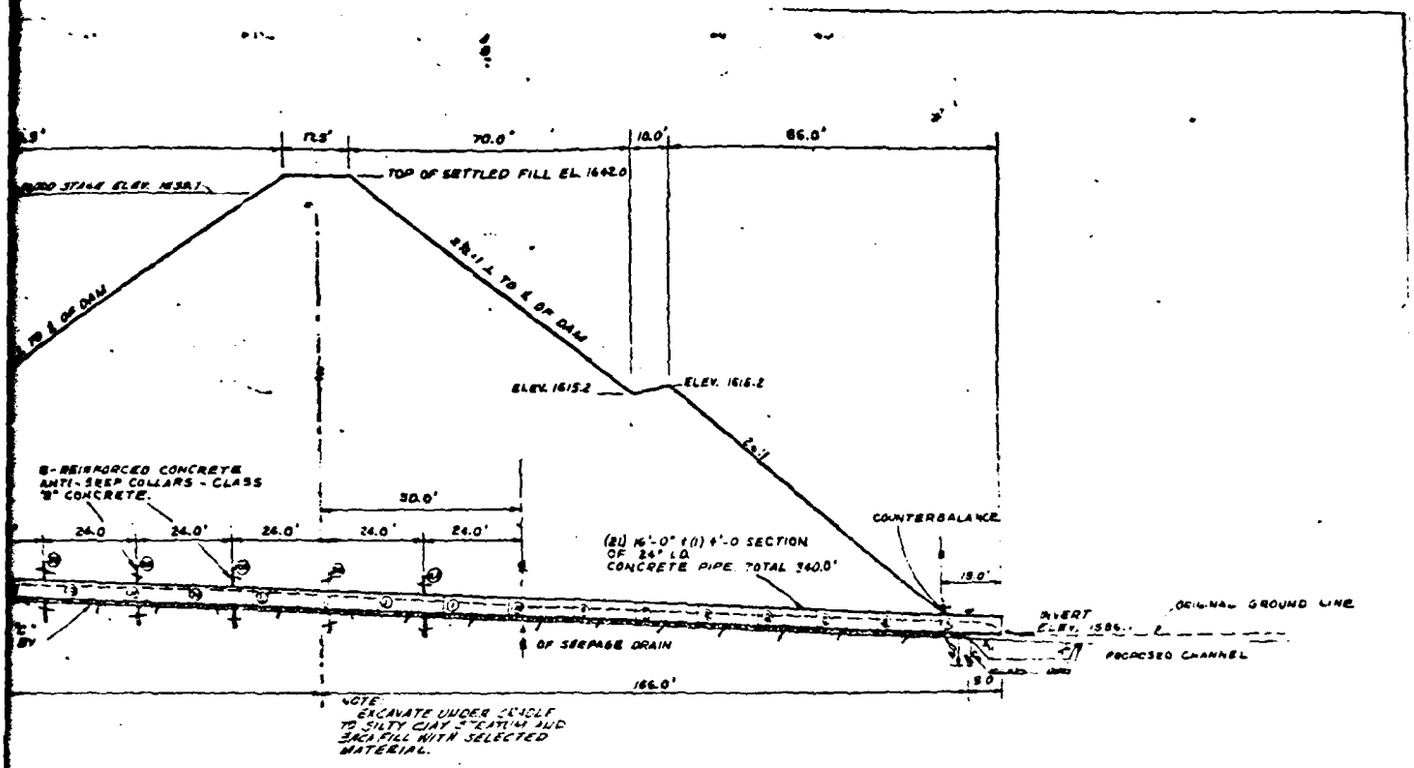
PROFILE OF PRINCIPAL SPILLWAY

SCALE: HOR. - 1" = 20'; VERT. 1" = 10'-0"



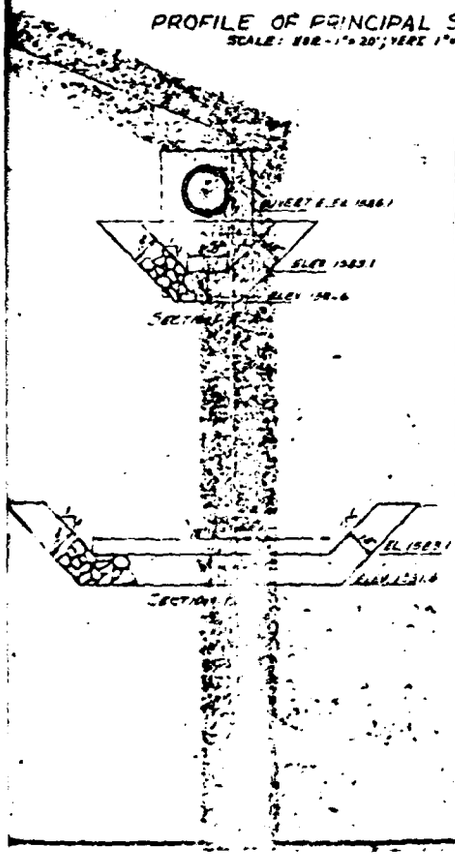


POINT	DISTANCE DISCHARGE OF 24"
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
U	
AA	
BB	
CC	
DD	
EE	
FF	
GG	
HH	



PROFILE OF PRINCIPAL SPILLWAY

SCALE: HOR. 1" = 20'; VERT. 1" = 10'-0"



POINT	DISTANCE FROM DISCHARGE END OF 24" PIPE (FT)	ELEVATION OF INVERT 24" PIPE
	0	1536.1
A	18	1586.46
B	32	1586.82
C	48	1587.18
D	64	1587.54
E	80	1587.93
F	96	1588.26
G	112	1588.62
H	128	1588.98
I	144	1589.34
J	160	1589.70
K	176	1590.06
L	192	590.42
M	208	590.98
N	224	1590.76
O	240	1591.00
P	256	1591.23
Q	272	591.47
R	288	591.70
S	304	1591.94
T	320	592.17
U	336	592.41
AA	352	1592.90
BB	368	1593.36
CC	384	593.81
DD	400	1594.28
EE	416	594.71
FF	432	595.18
GG	448	595.64
HH	464	596.09

Typical Section of Outfall Channel

PLATE 3

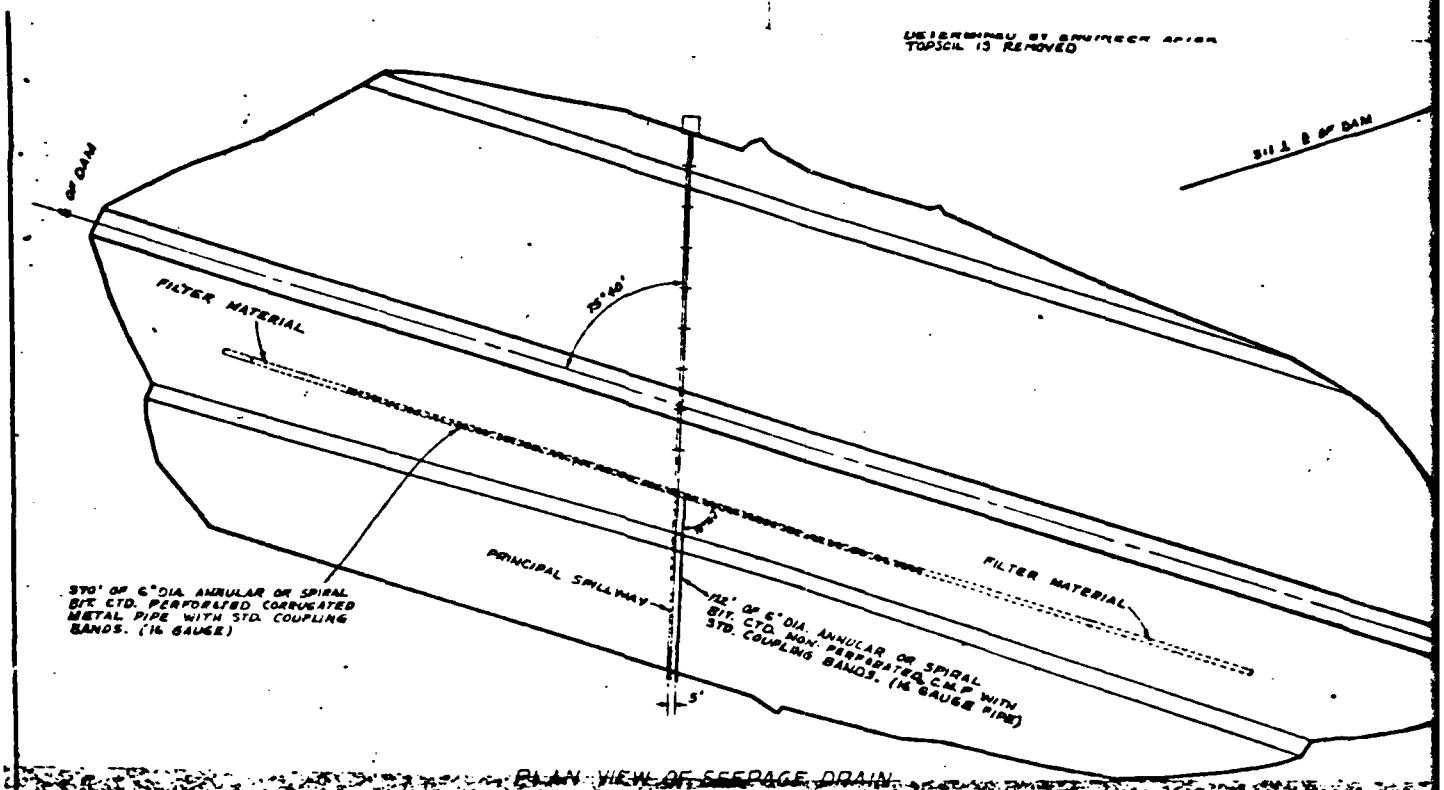
As Built

DAM NO. 6 COLD SPRINGS
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED, AUGUSTA CO., VIRGINIA
SECTION ALONG ℄ OF PRINCIPAL SPILLWAY

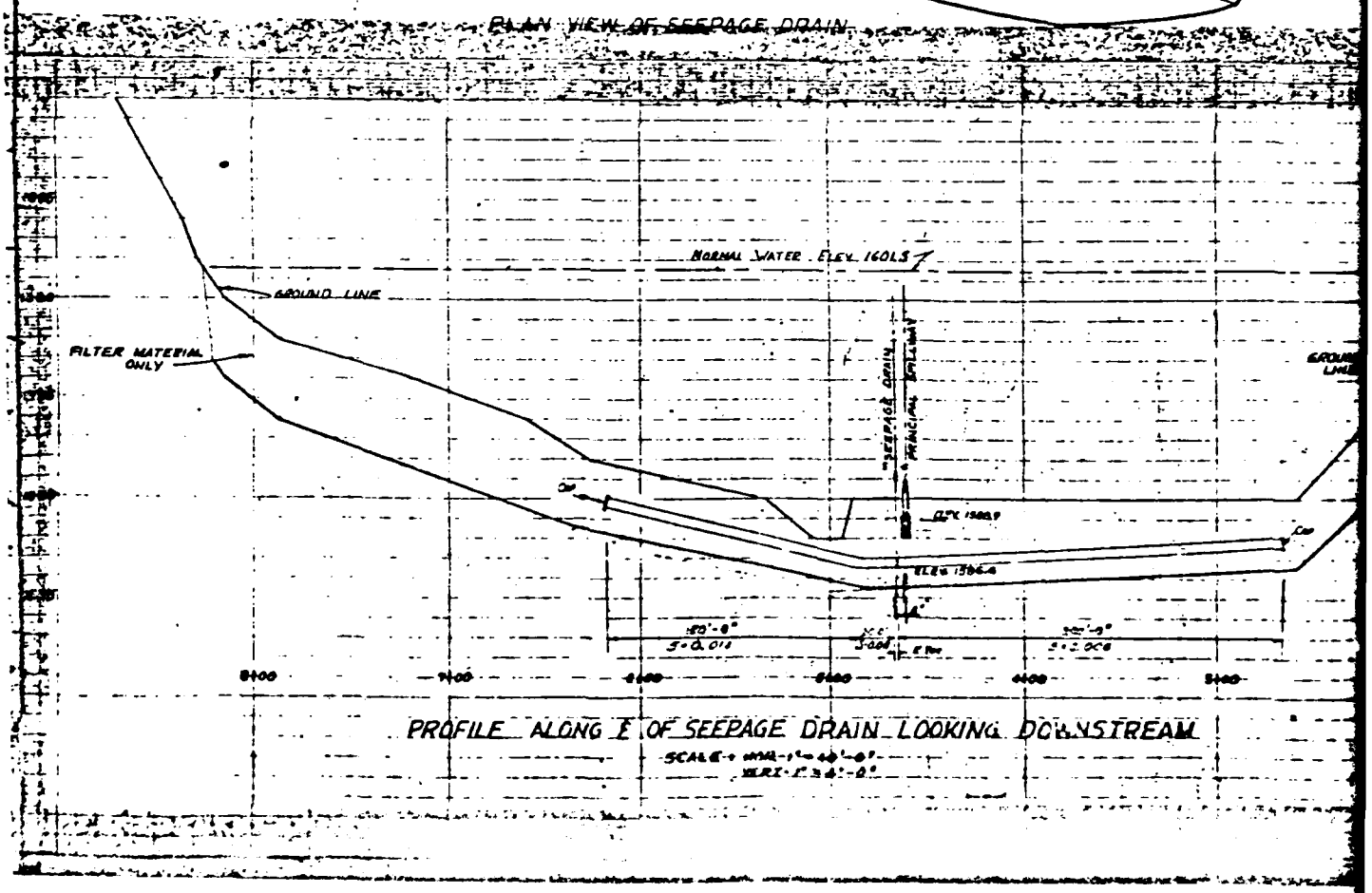
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-336-P

2

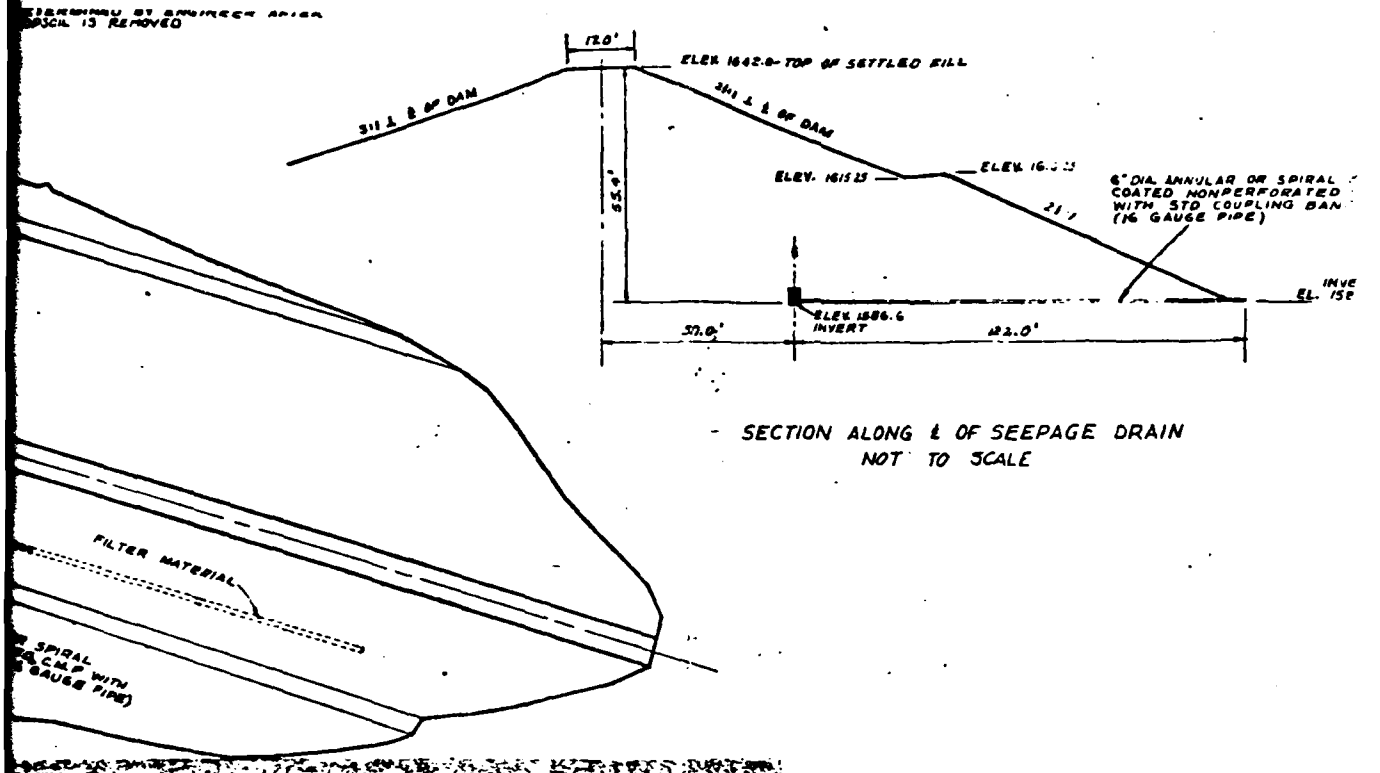


PLAN VIEW OF SEEPAGE DRAIN

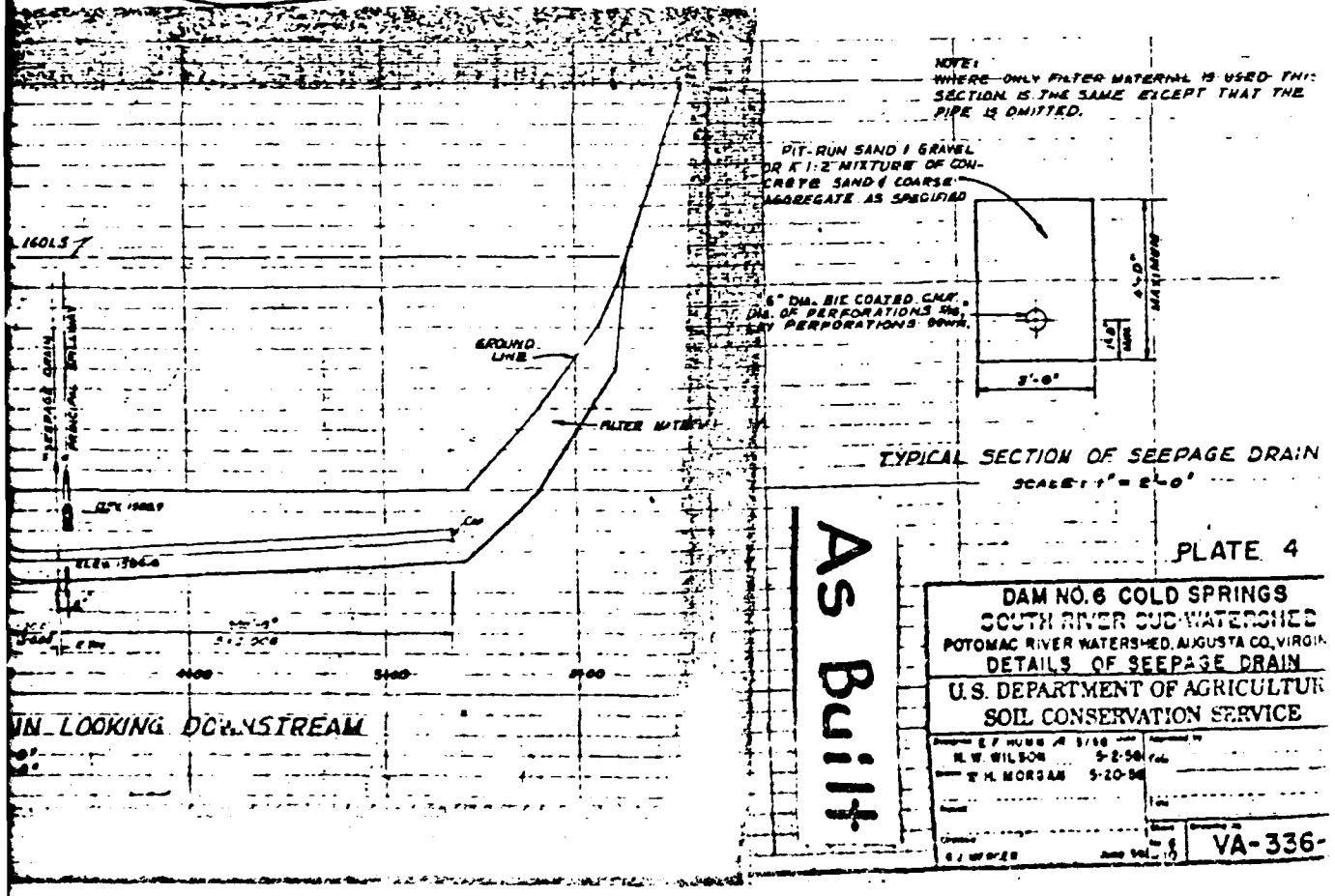


PROFILE ALONG ℄ OF SEEPAGE DRAIN LOOKING DOWNSTREAM

SCALE: HORIZ. 1"=40'-0"
VERT. 1"=4'-0"



SECTION ALONG ℄ OF SEEPAGE DRAIN
NOT TO SCALE



TYPICAL SECTION OF SEEPAGE DRAIN
SCALE: 1"=5'-0"

IN LOOKING DOWNSTREAM

As Built

PLATE 4

DAM NO. 6 COLD SPRINGS
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED, AUGUSTA CO., VIRGIN
DETAILS OF SEEPAGE DRAIN
U.S. DEPARTMENT OF AGRICULTUR
SOIL CONSERVATION SERVICE

E. F. HUMB A 5/58
R. W. WILSON 5-2-58
W. H. MORGAN 5-20-58

VA-336-

BH-500 SS-1

BH-501

BH-1

BH-2 SS 2

BH-3 SS-11 12 13

BH-4 SS-3

BH-102

BH-103

BH-104

BH-105
NO HOLE

BH-106

BH-107 SS-8 9 10

BH-302

BH-303

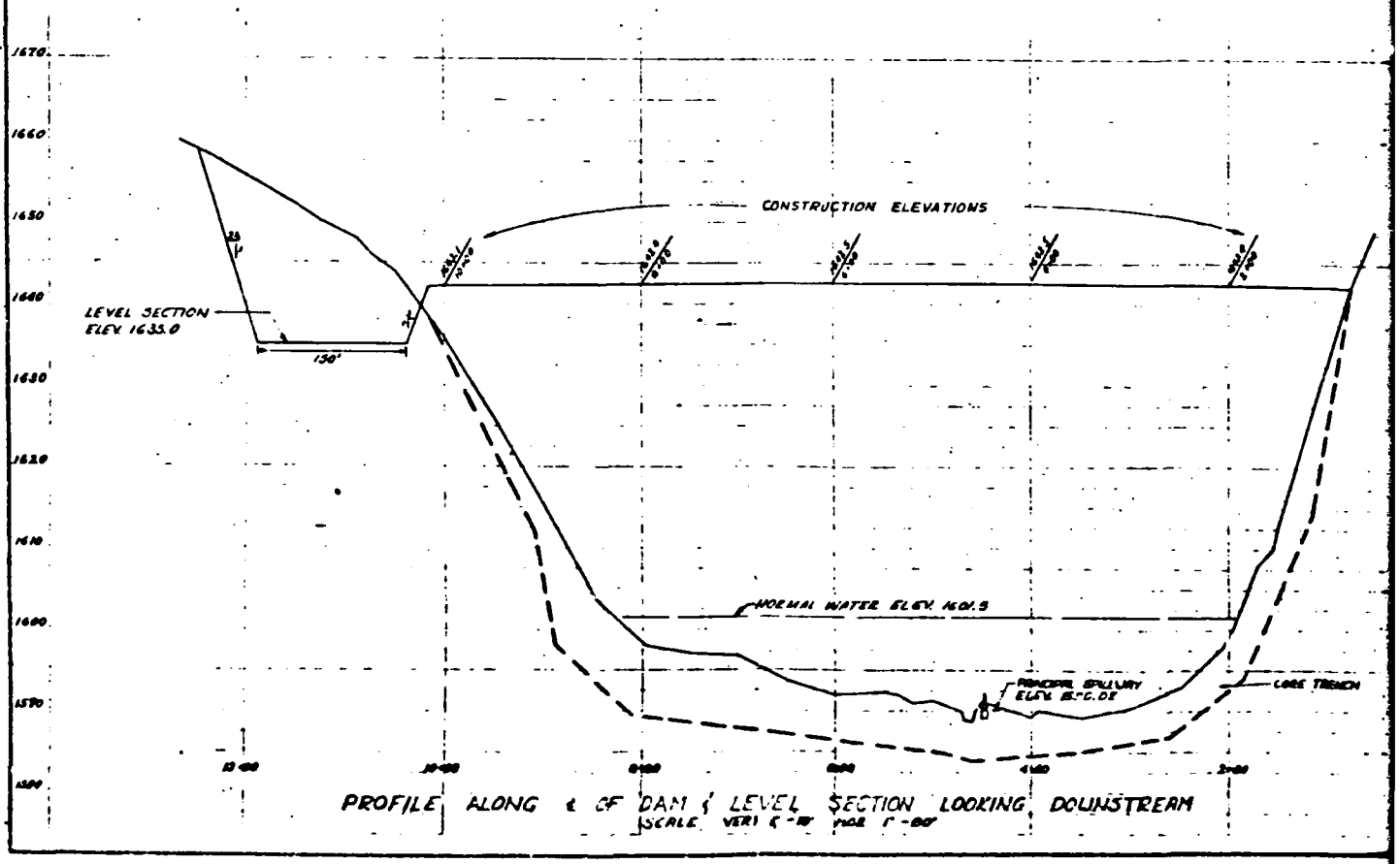
BH-7

BH-8

BH-9

BH-10 SS-14 15

FOR LOCATION OF SOIL BORINGS AND PITS
SEE PLAN VIEW SHEET 3 of 10



PROFILE ALONG ℄ OF DAM ℄ LEVEL SECTION LOOKING DOWNSTREAM
SCALE VERT 1"=10' HOR 1"=80'

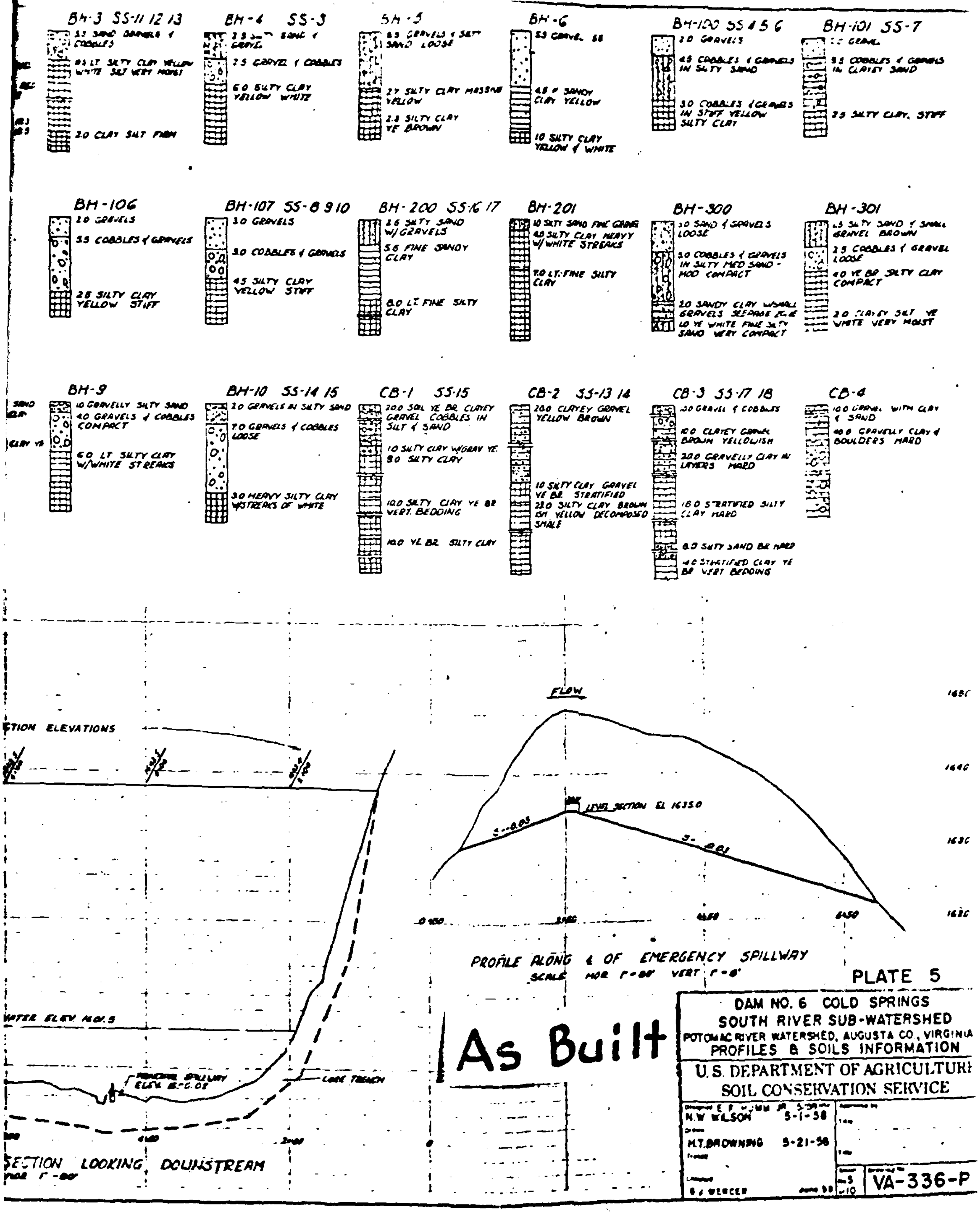


PLATE 5

DAM NO. 6 COLD SPRINGS
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED, AUGUSTA CO., VIRGINIA
PROFILES & SOILS INFORMATION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

N.W. WILSON 5-1-58
H.T. BROWNING 5-21-58

VA-336-P

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 14 November 1979.

NAME OF DAM: SOUTH RIVER No. 6

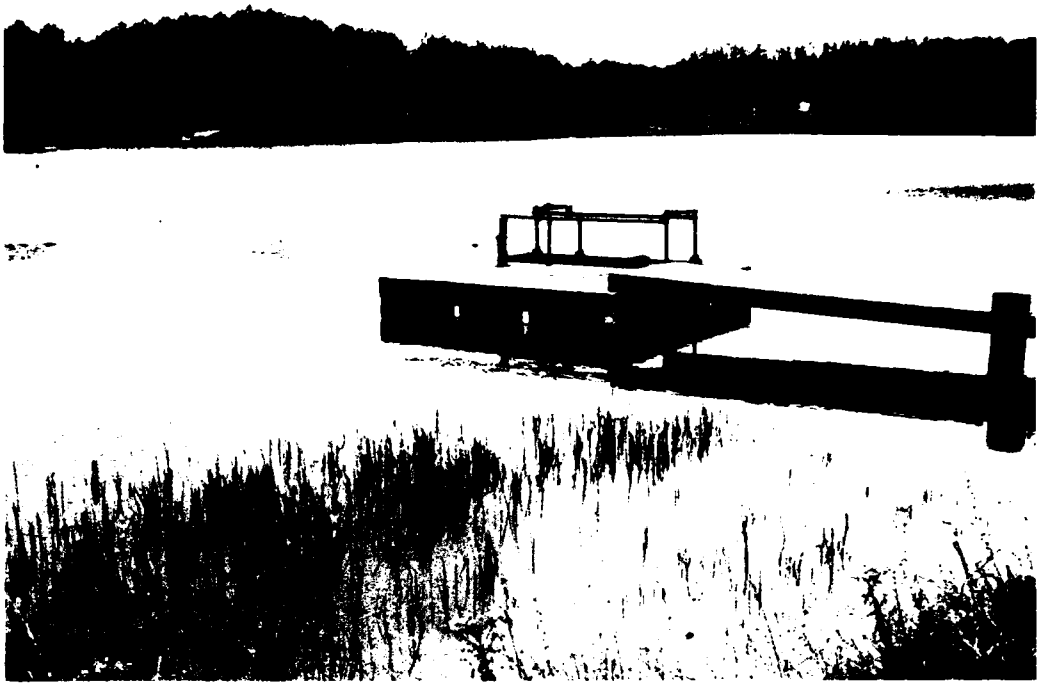


PHOTO 1. Principal Spillway Riser with Lift Pedestal for Reservoir Drain

PHOTO 2. Outlet Conduit and Stilling Pool, Toe Drain Outlet Located to the Right

PHOTO 3. Emergency Spillway Approach Channel (Background) and Small Erosion Berm Forming at Waters Edge

PHOTO 4. Location of Office/Store in the Emergency Spillway Approach Channel

PHOTO 5. Exit Channel of Emergency Spillway (Background)
Note Well Maintained Condition of Embankment

PHOTO 6. Downstream Damage Area

APPENDIX III

VISUAL INSPECTION CHECK LIST

Check List
Visual Inspection
Phase 1

Name of Dam South River No. 6 County Augusta State Virginia Coordinates Lat. N3759.5°
Long. W7907.4°

Date of Inspection 14 November 1979 Weather Overcast Temperature 38°F.

Pool Elevation at Time of Inspection 1601.8 ft. M.S.L. Tailwater at Time of Inspection 1586.1 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:	Virginia Water Control Board:	Owner's Representatives:
David J. Greenwood, P.E.	Leon Musselwhite	David Willingham (owner)
Jeffrey A. Quay	David Bushman	
Leslie K. Black		

David J. Greenwood Recorder

EMBANKMENT

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None visible	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	There is minor erosion on the right downstream embankment where it joins the abutment. The slopes are generally well covered with grass; however, there are areas of sparse, dried out vegetation stretching horizontally across the embankment below the bench.	The areas where erosion has begun should be filled and reseeded. Areas of sparse vegetation on the downstream embankment should also be reseeded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The horizontal and vertical alignments of the crest are good. There is an animal burrow on the right side of the downstream embankment near the toe.	The animal burrow should be filled and reseeded.
RIPRAP FAILURES	There is no riprap on the dam face. An erosion berm is just beginning to form at the water's edge.	The erosion should be checked periodically. Consideration should be given to placing riprap at the normal pool elevation.

EMBANKMENT

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junctions are well seeded and show little sign of erosion except for some small areas along the right downstream abutment.	The areas where erosion has begun should be filled and reseeded.
ANY NOTICEABLE SEEPAGE	None visible	The normal pool is quite low and provides very little hydraulic head above the toe.
STAFF GAGE AND RECORDER	None	A staff gage should be installed.
DRAINS	A toe drain is shown on the as-built drawings. The outlet pipe for the toe drain is located on the left side of the primary spillway outlet. The toe drain was not flowing at the time of the inspection.	The silty clay materials used in the dam should allow continual seepage through the toe. If no flow is ever observed, the drain has probably been plugged and should be reamed.

OUTLET WORKS

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The conduit is a 24 in. steel pipe encased in concrete. The concrete and steel appear to be in good condition.	
INTAKE STRUCTURE	The intake structure is an old SCS type box riser with four-directional inflow controlled by a fixed concrete crest. The concrete on the riser is in good condition, with no visible signs of cracking or spalling. There was no debris around the intake at the time of the inspection.	
OUTLET STRUCTURE	The outlet structure is a 24 in. concrete pipe over a steel liner, protruding from a concrete head wall. The concrete on both the pipe and the head wall was in good condition at the time of the inspection.	
OUTLET CHANNEL	The outlet channel is in good condition and shows no signs of erosion even after recent heavy storms. The riprapped stilling basin was submerged during the inspection.	
EMERGENCY GATE	The emergency gate, located on the intake structure, is operable, according to the owner. The previous owner reportedly had considerable trouble resealing the gate.	According to the owner, owners of other SCS dams of approximately the same age as this one are also experiencing problems with their emergency gates. The SCS is investigating.

UNGATED SPILLWAY

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	The campground office and store is located in the approach channel. The entrance road to the campground is located in the spillway. Other than the office and store, there are no major obstructions in the approach channel. The channel is well vegetated with grass and is mowed regularly.	The SCS and the conservation district have both advised the owner that he may not make any additions to the building in the spillway, and warned him that he will lose the building if a major flood occurs. The building should be removed because it restricts flow through the spillway. The building was constructed by the previous owner of the dam.
DISCHARGE CHANNEL	There are no major obstructions in the discharge channel. The discharge channel is well vegetated with grass and is mowed regularly.	
BRIDGE AND PIERS	None	

INSTRUMENTATION

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	Permanent markers were not found.	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes on the left side and the upstream end of the reservoir are gradual. The hillside on the steeper right side of the reservoir shows no signs of slumping or erosion. Sand has been placed on the right side to create a beach. The slopes on the left side of the reservoir are grassy and wooded; those on the right side are wooded.	
SEDIMENTATION	None was observed during the inspection. In the SCS design report, sedimentation was estimated as 0.604 ac.-ft. per year.	The watershed consists almost entirely of forested land.
TRIBUTARIES	The reservoir is fed by three streams: Cold Spring Branch, Deep Pond Run, and Gum Springs Branch.	

DOWNSTREAM CHANNEL

Name of Dam: SOUTH RIVER No. 6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel is fairly clear; the channel banks appear to be stable.	
SLOPES	The downstream channel is fairly steep, with a slope of approximately 2.7%. Vegetation in the overbanks consists of moderately dense trees and brush.	
APPROXIMATE NO. OF HOMES AND POPULATION	The downstream damage area contains three houses and two mobile homes; the number of occupants is estimated at twenty.	The campground office and store in the emergency spillway is also in the damage reach.

APPENDIX IV

OPERATION AND MAINTENANCE INSPECTION REPORT

OPERATION AND MAINTENANCE INSPECTION

of

South River Watershed Structures

An inspection team of Jackson Betts, Wayne Hypes, John Crist, Folger Taylor, and William E. Lucas, Jr. on April 5, 1978, visited the following dams of the South River Watershed of the Potomac River Watershed.

Site #3 - Greenville Correction Center - The dam is in good shape with good vegetative cover and has been mowed. Posts have been set to indicate firing stations in the emergency spillway and using the spillway bank as a pellet stop. When the firing training is completed the posts should be removed. This structure is being used rather wisely.

Site #4 - Kiwanis Lake - The spillway pipe and riser appear to be in good shape. All of the dam has been mowed. The Ky 31 is becoming thin on the front of the dam (wet side) and needs to be overseeded with Ky 31 and fertilized. The road on the top of the dam needs to be graveled on the steeper parts. The back part of the dam (dry side) has some woody growth that should be cut and deadened. There is about 1 Ac. that needs to be seeded to Ky 31. The entire dam and emergency spillway area should be limed and fertilized.

Site #6 - Sangers Lake - This structure is kept mowed. Some overseeding of Ky 31 would be helpful. Some Crownvetch has been started on it. The riser and spillway pipe appear to be in good shape. The berm is showing effects of wave erosion and would be improved by shaping with large stone.

Site #7 - Wilda - This dam has received much attention, such as brushogging, Fall spraying for knapweed, Spring seeding of Ky 31, application of 10-10-10 fertilizer, and the owner will spot spray for weeds this growing season. The riser and pipe spillway appear to be in good shape, but the slide gate control rod and gate frame show much rust when the lake level is low.

Site #11 - Canada Run - County Dump - The woody growth was cut and sprayed last year. This dam should be mowed this year. The riser, pipe spillway and emergency spillway appear to be sound.

Site #24 - Happy Hollow Lake - This site has good vegetative cover and is kept mowed. The riser and pipe spillway appear sound. The emergency spillway is in good condition with good cover. The wooden trash rack is scheduled to be replaced.

Site #25 - Toms Branch - This dam has very little woody growth on it. The pipe spillway and emergency spillway are in good condition. Stone has been applied to the road on the dam and has improved the dam by eliminating the standing water on the top of the dam. This dam should be mowed in the next two years. The road banks above the dam (road going to Shirey camp) should be seeded to cut down the silt and erosion.

Wayne McHypes Sec'd

APPENDIX V

EXCERPTS FROM GEOLOGY REPORT

GEOLOGY REPORT

SOUTH RIVER WATERSHED
COLD SPRINGS, SITE NO.6
COLD SPRINGS, AUGUSTA COUNTY, VIRGINIA

GEOLOGY REPORT NO. VA-336-G
Prepared by: L. A. Gorman
Geologist, SCS,
Richmond, Virginia

Robert F. Fonner
Geologist, S.C.S. Upper Basin, Va.

Introduction

General

State - Virginia; County - Augusta
Watershed - South River
Location - Cold Springs, 2 miles east of Greenville, Virginia
Explored by - L. A. Gorman, R. F. Fonner, Norman Wilson, and French Hursey
Equipment used - Sprague and Henwood #40 Core Drill and tractor mounted Backhoe

Site Data (Approximate)

Drainage Area 4.23 sq. mi. - 2,707 acres
Type of structure - Earthen Dam; Purpose - Conservation
Height of fill - 46 feet; Length - 1,400 feet
Volume of fill required - 148,000
Location of emergency spillway Left (West) abutment
Surface area of normal pool - 37 acres

Site No. 6, South River Watershed, is located about one mile east of Cold Spring Station on Cold Spring Branch. The headwaters originate from Cellar Mountain, elevation 3,645, flowing almost due north to the site, approximate elevation 1,590'.

The original geologic investigation was made during the week of August 5, 1957 with the following SCS personnel participating: R. F. Fonner, geologist; Norman Wilson, engineer, and French Hursey, soil scientist. The pits were dug with a Shawnee backhoe mounted on a heavy duty farm tractor which dug to depths of approximately 12 feet.

After the results of the soil sample tests were received, it was decided that deeper investigations were necessary, to collect additional samples for tri-axial shear and time compaction tests. The Cunningham Core Drilling and Grouting Corp., Salem, Virginia, was awarded the contract to do the additional exploration. The drilling was done with a Sprague and Henwood #40 Core Rig during the period of November 13 - 22, 1957 under the supervision of L. A. Gorman, geologist, SCS, Richmond, Virginia.

The drilling was done using a carbide tipped bit for the softer materials and a diamond tipped core bit for the more consolidated sections and to core the bedrock. The hole size was standard NX. Sampling was accomplished by means of a push tube. Two length samples were taken,

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. VA-336-G SHEET 1 OF 20 DATE 1-16-58

GEOLOGY REPORT

SOUTH RIVER WATERSHED
COLD SPRINGS, SITE NO.6
COLD SPRINGS, AUGUSTA COUNTY, VIRGINIA

one foot for the harder material and two foot samples for the softer material. The samples were sealed with wax and marked for later identification at the laboratory. Samples were to be taken at ten foot intervals but generally the material was too hard and therefore samples were taken wherever possible. A total of five samples were taken in the four holes drilled.

GEOLOGY AND PHYSIOGRAPHY

The area under consideration in this report is covered by alluvial material so no bedrock crops out in the vicinity of the structure site. The rocks which are present under the alluvium are of Cambrian and Ordivician age, these include the Waynesboro Formation, Elbrook Dolomite and the Conococheague Limestone (Fig.1) These formations include shale, sandstone, limestone and dolomite which can weather into the type of clay deposits found in this vicinity.

The alluvium present in this valley is typical of the Piedmont alluvial terraces found in the Shenandoah Valley. Cold Spring is a subsequent stream superimposed upon this terrace material of weathered sandstone cobbles and gravel, sandy silts and clays. Its valley is over 60 feet deep and 1,100 feet wide with valley walls sloping 10 - 25 percent. The drainage pattern is dendritic.

CENTERLINE OF DAM

Along the centerline of the dam 10 test pits were made with the backhoe and 4 with the core drill. Test pits were dug along the centerline of the dam as follows:

East abutment - test pit Nos. BH-1
Valley floor - test pits Nos BH-2, 3, 4, 5, and 6
West abutment - test pits Nos. BH-7, 8, 9, and 10

The four core drill holes were located as follows:
West abutment - CB-1
Valley floor - CB-2 and 3
East abutment - CB-4

The West abutment test hole CB-1 consisted of:

0	- 20'	Yellowish brown clayey gravel with quartzite cobbles
20	- 21	Silty clay with gravel yellowish brown (Sample #15, 20-21')
21	- 30	Stratified silty clay (Very light weight) Chocolate brown
30	- 40	Stratified silty clay yellow brown, vertical bedding (May be decomposed shale.)
40	- 50	Yellow brown silty clay-not as well stratified as above, some white streaks and specks.

REFERENCE:	U.S.DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. VA-336-G SHEET 2 OF 20 DATE 1-16-58

GEOLOGY REPORT

SOUTH RIVER WATERSHED
COLD SPRINGS, SITE NO. 6
COLD SPRINGS, AUGUSTA COUNTY, VIRGINIA

The holes located in the valley floor (CB-2 and 3) indicated the following:

0	- 10'	Gravel with quartzite cobbles clay and sandy matrix
10	- 20	Clayey gravel Yellowish brown (too hard to sample)
20	- 30	Gravelly clay in layers (too hard to sample)
30	- 40	Gravelly clay, silty, stratified (horizontal)
40	- 50	Stratified silty clay - hard (bedding? vertical)
50	- 58	Stratified silty clay - some sand (Sample #17, 50-51.8')
58	- 64	Hard silty sand, brown
64	- 78	Stratified clay (may be decomposed shale) Vertical bedding yellow brown - Dark brown some black (Possibly organic material - Sample #18, 64-66')

The drill hole in the East abutment (CB-4) showed the following material:

0	- 10'	Soil, Gravel with clay and sand
10	- 50'	Gravelly clay and boulders (too hard to sample)

The foundation appears sound although further testing of the fine material below the gravelly layer should be done before any final decisions can be made. This softer material is probably decomposed shale which should supply an adequate foundation.

Conclusions:

1. The foundation appears adequate to support the structure.
2. The abutments appear sound, the material in the west abutment is very similar to the material found under the valley but that under the east abutment is of a more stable nature and no difficulty should be anticipated.
3. Some leakage could possibly take place along the valley but this could be taken care of by toe drains.

SPILLWAYS

The conditions under the proposed principal spillway are the same as the valley floor. Additional soil tests are being made. To prevent any difficulty it might be advantageous to relocate the principal spillway in the east abutment area where no appreciable settlement would take place. (See CB-4)

The emergency spillway is located on the west abutment according to BH-200, 201 the material can be removed by normal excavation methods. No bedrock was encountered.

Vegetal cover should be adequate for erosion control.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. VA-336-G SHEET 3 OF 20 DATE 1-16-58

GEOLOGY REPORT

SOUTH RIVER WATERSHED
COLD SPRINGS, SITE NO.6
COLD SPRINGS, AUGUSTA COUNTY, VIRGINIA

BORROW AREAS

Available borrow material can be found anywhere in the vicinity of the structure. For type of borrow material see EE 200,201. The emergency spillway cut will supply a large amount of fill and the additional fill material can be found below Station 94 in both valley walls. It is strongly suggested that no borrow material be taken from the permanent pool area.

Selection of core material and suitable borrow material for the fill and drain will be determined from the laboratory tests.

CONCLUSIONS:

Further testing is necessary before final conclusions can be reached.

1. Adequate borrow material is available.
2. No bedrock was found in test pits in the emergency spillway, so normal methods of excavation should be adequate.
3. Erosion control of the emergency spillway can be achieved with proper vegetation and soil amendments.
4. Due to the fineness of the material in the valley fill, additional soil testing will be necessary before the adequacy of the foundation material can be determined.
5. No evidence of landslides, springs, or excessive seepage was noted.
6. Suggest locating the principal spillway in the east abutment area.
7. Strongly suggest no borrow material be removed from the permanent pool area.

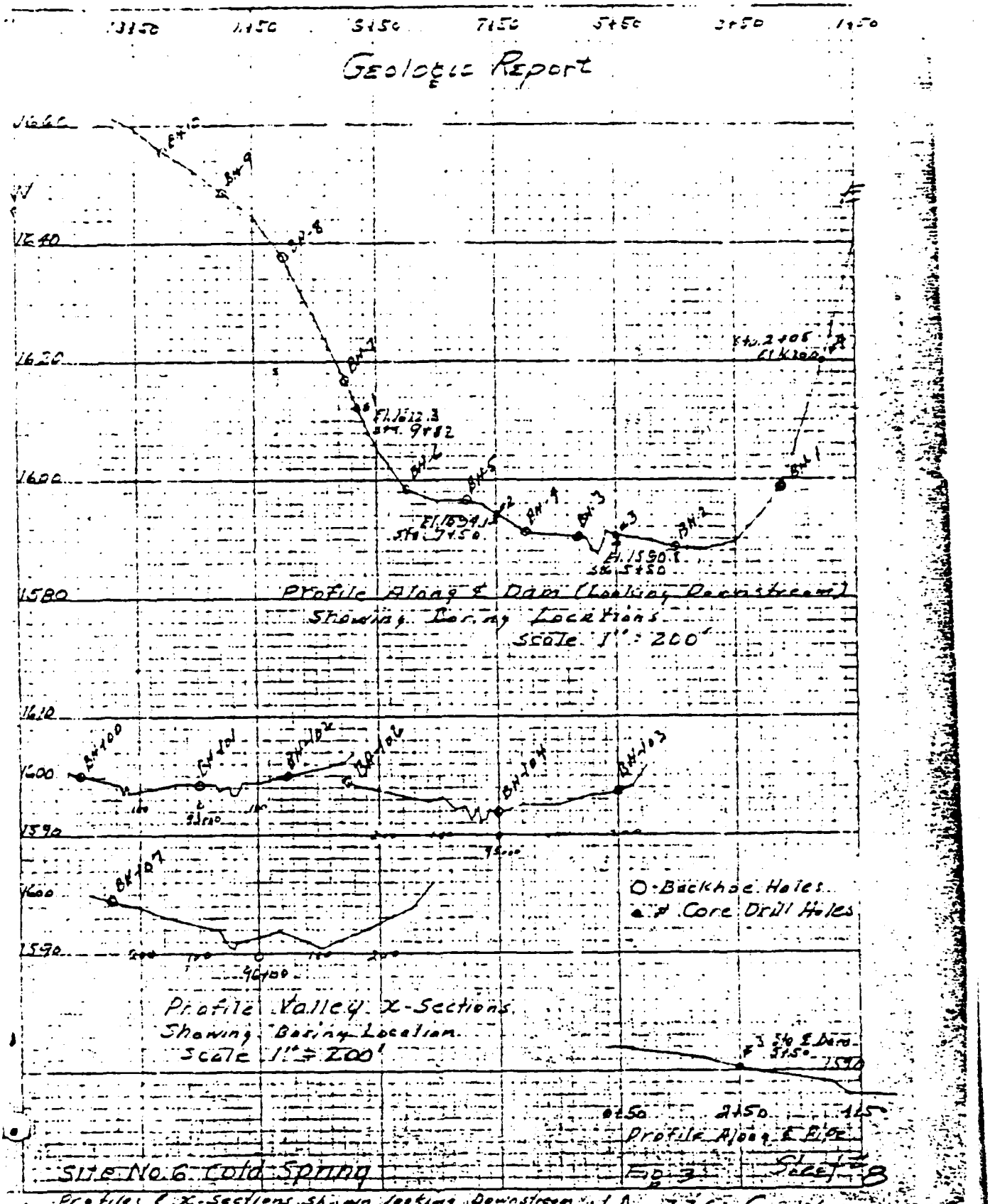
SOIL SAMPLES

Disturbed soil samples were taken of each distinct horizon found throughout the site. Undisturbed samples were taken of the fine silty clay material in the valley fill. These samples were taken to the Virginia State Highway Soils Mechanics Laboratory, Charlottesville, Virginia, for testing. Push tube samples were taken during the core drilling and sent to the Soils Mechanics Laboratory at Lincoln, Nebraska and the results are pending.

As an aid to correlating the results of the tests with the location of the soil sample, the following table can be used.

REFERENCE:	U.S.DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. VA-336-G SHEET 4 OF 20 DATE 1-16-58

Geologic Report



Site No. 6 Cold Spring

Profiles & X-Sections Showing Looking Downstream or to the Right Bank of the Conduit &

VA-336-G 12/1957

Form SCS-533
MAY 65

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. 6

Logged by R.F. Fonner, N.W. Wilson, F.W. Hurbey Date 8/5 & 6 1957 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Toe Drain

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-500	3/60 C/L	0.0	3.0	Silty sand w/small gravels (trace of clay).				
	D.S.	3.0	6.0	Gravels & cobbles in loose clayey sand.	1	D	3.0	6.0
	1587.6	6.0	6.2	Manganese cemented gravels, black coating.				
		6.2	10.4	Silty clay w/lenses of moist fine sandy clay, seepage planes coated with manganese -				
				pockets & lenses of very moist white silty clay (Bauxite or Kaolinite) plastic but (				
				of sticky brown, yellow and white varigated.				
BH-501	7/75 C/L	0.0	2.5	Silty sand w/fine gravel.				
	D.S.	2.5	5.0	Gravels & cobbles in loose sand trace of clay.				
	1594.2							

Sheet 2 of 2 Sheets

* Disturbed - undisturbed - rock core. 1 Copy to F and WP unit. Distribute other copies as directed by State Conservationist.

Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. 6

Logged by R.F. Fonner, N.W. Wilson, F.W. Hursey Date 8/5 & 6, 1957 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Book Hoe Location of borings Centerline of Dam

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Sample No.	Sample Type *	Depth From Ft.	Depth To Ft.
BH-1	2/75 C/L	0	2.5	Silty sand & gravel, brown.				
	1598.6	2.5	5.0	Gravels & cobbles, w/ss, in clayey sand matrix, loose				
		5.0	9.0	Gravels & cobbles, w/ss, imbedded in clayey sand, tight				
		9.0	11.0	Silty clay, red & yellow varigated, compact				
BH-2	4/50 c/L	0	3.0	Clayey sand, brown				
	1588.7	3.0	5.0	Cobbles & gravels, sandstone	2	D	6.0	13.0
		5.0	18.0	Clay, massive, red & yellow varigated, loaded w/mn cone vert. seepage zone coated w/clay column struct.				
			8/5	Water at 10.3 Seepage thru mn pockets - Bauxite core.				
			8/6	Water at 10.5				
BH-3	6/12 C/L	0.0	5.5	Sand, gravels & cobbles	11	D	1.0	5.5
	2/50 Con-	5.5	11.0	Lt. silty clay yellow white varigated, Mn coating on root channels & seep planes				
	duit	11.0	16.0	Very moist - high silt content at 11.0 to 16.0+	12	D	6.5	11.0
	1590.1	16.0	18.0	Clay silt, firm & drier	13	D	18.0	20.0
					14	Undis	11.0	

Sheet 1 of 20 Sheets

* Disturbed - undisturbed - rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist

Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. 6

Logged by R.F. Fenner, H.W. Wilson, F.W. Hursey Date 8/5 & 6 19 57 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Borrow Area

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-100	93/00 B.L.	0.0	2.0	Gravels in silty sand				
	200' L	2.0	6.5	Cobbles & gravels in silty sand	4	D	0.0	2.0
	1599.5	6.5	9.5	Cobbles & gravels in yellow silty clay	5	D	2.0	6.0
				Stiff, massive, heavy	6	D	7.0	9.5
BH-101	93/00 B.L.	0.0	2.0	Gravel in silty sand				
	1598.6	2.0	7.5	Cobbles & gravels in clayey sand				
		7.5	10.0	Stiff, heavy massive silty clay w/white streaks & pockets	7	D	7.5	10.0
BH-102	93/00 B.L.	0.0	5.5	Cobbles & gravels in silty sand				
1599.2	150' R	6.5	10.0	Silty sandy clay, stiff, heavy, massive slight varving at 10.0'				
BH-103	95/00 B.L.	0.0	7.0	Cobbles & gravels in silty sand				
	200 R	7.0	8.5	Yellow & brown silty clay w/scattered sand & small gravels				
	1597.2	8.5	10.0	Clayey silt, yellow, white, brown -varved - $\frac{C.P.}{A}$ shear zones in coated.				

Sheet 1 2 of 2 0 Sheets

*Disturbed - undisturbed - rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

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Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No 6

Logged by R.P. Fonner, N.F. Wilson, F.W. Horsey Date 8/5 & 6/ 1957 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Centerline of Dam

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth of which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-4	7/00 C/L	0.0	2.5	Silty sand & gravel w/few cobbles	3	D	8.0	11.0
	1591.1	2.5	5.0	Gravels & cobbles in med sand, loose				
		5.0	11.0	Silty clay, yellow white varigated light rock channels seepage planes coated w/clay mat.				
BH-5	8/00 C/L	0.0	5.5	Gravels & silty sand, brown - loose - as gravels				
	1596.4	5.5	8.0	Yellow brown silty clay massive - w/mn coating on seepage planes slow perm.				
		8.0	8.2	Black Mn lense				
		8.2	10.0	Ye brown silty clay - high silty content (white silty clay none				
		10.0	10.5	Ye brown silty clay, irregular varves				
BH-6	9/00 C/L	0.0	5.5	95 gravel included in silty sand				
	1598.4	5.5	10.0	F. sandy clay yellow with white ~~xxx~~ concretions				
		10.0	11.0	Silty clay, yellow & white, irregular varving (high silt cont.)				

Sheet 1 of 20 Sheets

*Disturbed-undisturbed-rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

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Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner — State Va. Area —

Watershed Potomac River Sub-watershed South River Site No. C -

Logged by R.F. Fonner, E.W. Wilson, S.W. Thrasy Date 8/5 & 6 19 57 Project: WP1 — WP2 — FP X Pub. 46 -

Sampling Equipment Back Hoe Location of borings Emergency Spillway

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth of which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-200	12/00 C.L.	0.0	2.5	Gravelly silty sand.				
	1650 D.S.	2.5	8.0	Fine sandy clay (sand cont. variable).	16	D	2.0	5.0
	1649.6	8.0	12.0	Lt. fine silty clay (yellow-red w/streaks of white).	17	D	8.0	12.0
BH-201	12/00 C.L.	0.0	1.0	Silty sand (few fine gravel)				
	20' U.S.	1.0	5.0	Heavy silty clay w/white streaks.				
	1639.4	5.0	12.0	Lt. fine silty clay (silt varies)(few white streaks).				

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Sheet 14 of 20 Sheets

* Disturbed - undisturbed - rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist

Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. _____

Logged by R.F. Conner, N.W. Wilson, F.W. Bursey Date 8/5 & 6 1957 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Borrow Area

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth of which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-104	95/00 B.L.	0.0	7.0	Cobbles & gravels in silty sand.				
	1593.6	7.0	10.5	Silty clay, stiff, heavy, massive - water at 9.5'.				
BH0105	No hole.							
BH-106	95/00 B.L.	0.0	2.0	Gravels in silty sand.				
	250' L	2.0	7.5	Cobbles & gravels in silty sand.				
	1599.0	7.5	10.0	Yellow silty clay, stiff, heavy, massive.				
This hole hit the edge of an old stream channel where cobbles & gravels in silty sand went to 10.0'.								
BH-107	96/00 B.L.	0.0	3.0	Gravels in silty sand.	8	D	0.0	3.0
	250' L	3.0	6.0	Cobbles & gravels in silty sand.	9	D	3.0	6.0
	1598.9	6.0	8.5	Yellow silty clay, stiff, heavy, massive.	10	U	6.0	10.5
		8.5	10.5	Yellow silty clay, stiff, heavy - some layering.				

Sheet 13 of 20 Sheets

* Disturbed, undisturbed, rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

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Form SCS-533
MAY 55

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. _____

Logged by R.F. Fonner, W. W. Wilson, F. W. Sursey Date 8/5 & 6 1957 Project: WP1 ___ WP2 ___ FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Mechanical Spillway

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth of which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
BH-300	1/10	0.0	3.0	Sand & gravels, loose.				
	1591.5	3.0	8.0	Cobbles & gravels in silty med sand - mod compact.				
		8.0	10.0	Sandy clay w/small gravels, brown, black, yellow - Seepage zone.				
		10.0	11.0	Ye white varved fine silty sand - slumped - very compact.				
BH-301	1/75	0.0	2.5	Silty sand & small gravel, brown.				
	1592.1	2.5	5.0	Cobble & gravel in silty sand - loose.				
		5.0	9.0	Ye br silty clay, compact w/black th core moist.				
		9.0	11.0	Ye white varved clayey silt, slumped, high moist content (undisturbed sld).				
BH-302	3/00	0.0	6.3	Cobbles & gravels in silty sand, brown.				
	1586.7	6.3	9.3	Clayey silt, ye red white black varigated - slight varving at bottom.				
BH-303	4/10	0.0	4.5	Cobbles and gravels in silty sand, brown.				
	1586.9	4.5	9.5	Ye & red silty clay varigated, varving at 7.5, massive.				

Sheet 15 of 20 Sheets

*Disturbed-undisturbed-rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist

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Form SCS-535
MAY 55

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS
LOG OF BORINGS

Location Cold Springs Owner _____ State Va. Area _____

Watershed Potomac River Sub-watershed South River Site No. 6

Logged by R.F. Fenner, N.T. Wilson, F. N. Hurney Date 8/6 & 6 19 57 Project: WP1 WP2 FP X Pub. 46

Sampling Equipment Back Hoe Location of borings Centerline of Dam

Hole No.	Location & Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
DH-7	10/00 C/L	0.0	1.0	Gray, silty sand				
	1616.8	1.0	5.0	Clayey fine sand few scattered gravels & cobbles				
		5.0	8.5	Lt. silty clay (sand variable), streaks of white				
		8.5	10.5	Lt. fine silty clay (silt variable) liberally streaked w/whitish mater				
DH-8	11/00 C/L	0.0	1.0	gravelly silty sand				
	1637.9	1.0	4.0	Heavy silty clay (sand content variable)				
		4.0	11.0	Lt. fine silty clay yellowish streaked with white				
DH-9	12/00 C/L	0.0	1.0	Gravelly silty sand				
	1648.8	1.0	5.0	Gravels & cobbles, comp. w/lt. fine sandy clay				
		5.0	11.0	Yellowish - red variegated lt. silty clay w/white streaks				
DH-10	13/00 C/L	0.0	2.0	Gravels in silty sand				
	1665.7	2.0	9.0	Gravels & cobbles in loose clayey sand	14	D	2.0	9.0
		9.0	12.0	Heavy silty clay w/streaks of white	16	D	9.0	12.0

Sheet 16 of 20 Sheets

*Disturbed - undisturbed - rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

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Form SCS 533
Rev. Feb. 56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS

LOG OF BORINGS

Location 2 miles East of Greenville Owner _____ State Va. Area _____
Watershed South River Sub watershed Cold Springs Site No. 6
Logged by L. A. Gorman Date 11/26 19 57 Project: WP1 ____ WP2 ____ FP X Pub. 46 ____
Sampling Equipment Sprague & Henwood #40 Core Rig (Skid) Location of borings 9 + 82 Near Spillway on left abutment

Hole No.	Location and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Type of Bit used	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
CB-1	1612.7	0	10	Soil, Yellow Brown Clayey Gravel, Quartzite Cobbles	Drive Pipe				
	"	10	20	" " " " " "					
		20	21	Silty Clay with gravel Yellowish Brown		15	Push Tube	20	21
		21	30	Stratified silty clay (Very light weight) Chocolate Brown					
		30	40	Stratified silty clay Yellow Brown vertical bedding					
				May be decomposed shale.					
		40	50	Yellow brown silty clay - not as well stratified as					
				above, some white streaks and specks.					
				Hole bottomed @ 50'					

Sheet 17 of 20 Sheets

*Disturbed-undisturbed-rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

Form SCS-531
Rev. Feb. 56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS

LOG OF BORINGS

Location 2 miles East of Greenville Owner _____ State Va. Area _____

Watershed South River Sub-watershed Cold Springs Site No. 6

Logged by L. A. Gorman Date 12/25 19 57 Project: WP1 ____ WP2 ____ FP X Pub. 46 ____

Sampling Equipment Sprague & Henwood #40 Core Rig (Skid) Location of borings 7 + 50 On ℄ of Dam Left side of floodplain looking down stream

Hole No.	Location and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Type of Bit used	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
CB-2	1594	0	10	Soil, Clayey gravel Yellow brown	Drive Pipe				
		10	20	Clayey gravel					
		20	21	Silty clay some gravel Yellow Brown, Stratified			Push		
				with black streak and specks		13	Tube	20	21
		21	30	Silty clay stratified, vertical bedding, Brownish Yellow					
				with white specks (May be decomposed shale)					
		30	31	Stratified silty clay vertical bedding (may be decomposed		14	"	30	31
				shale)					
		31	40	Same as above					
		40	50	Yellow brown silty clay - some black along bedding					
				planes (looks like decomposed shale)					
				Hole bottomed at 50'					

Sheet 18 of 20 Sheets

*Disturbed, undisturbed, rock core. - 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

Form SCS-533
Rev. Feb. 56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS

LOG OF BORINGS

Location Augusta County - 2 miles East of Greenville Owner _____ State Va. Area _____

Watershed South River Sub-watershed Cold Springs Site No. 6

Logged by L. A. Gorman Date 12/2 1957 Project: WP1 ____ WP2 ____ FP X Pub. 46 ____

Sampling Equipment Sprague & Henwood #40 Core Rig (Skid) Location of borings 5 + 50 ℄ of Dam - Right side of floodplain

Hole No	Location and Surface Elev	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Type of Bit used	Sample No.	Sample Type	Depth From Ft.	Depth To Ft.
3	1590.8	0	10	12/2/57 Gravel Cobbles (Quartzite) some clay & sand matrix	Diamond	None			
		10	20	Clayey Gravel (Brown)(Yellowish)(Tried to sample @20'Too much gravel)					
		20	30	Gravelly clay In layers (Too hard to sample)					
	12/3								
		30	40	Gravelly clay (silty clay stratified) Too hard to sample (Horizontal)					
		40	50	Stratified silty clay - hard(bedding ? vertical)					
		50	58	Stratified silty clay - some sand		17	Push	50	51.8
		58	64	Harder silty sand Brown					
		64	66	Stratified clay may be decomposed shale (Vertical)		18	"	64	66
				Yellow Brown - Dark brown some black (Possible vegetable matter)					
		66	78	Same as above - too hard to sample					
				Bottomed hole					

Sheet 17 of 20 Sheets

Disturbed-undisturbed-rock core. 1 Copy to E and WP unit. Distribute other copies as directed by State Conservationist.

Form SCS-533
Rev. Feb. 56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL AND FOUNDATION INVESTIGATIONS

LOG OF BORINGS

Location 2 miles East of Greenville Station Owner _____ State Va. Area _____

Watershed South River Sub-watershed Cold Springs Site No. 6

Logged by Driller Date 11/27 1957 Project: WP1 ____ WP2 ____ FP X Pub. 46 ____

Sampling Equipment Sprague & Henwood #40 Core Rig (Skid) Location of borings 2 + 05 ℄ of Dam Right Abutment

Hole No.	Location and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material (note depth at which water occurs)	Type of Bit used	Sample No.	Sample Type*	Depth From Ft.	Depth To Ft.
C.P.-4	1620	0	10	Soil, Gravel with clay and sand					
		10	50	Gravelly clay and boulders					
				No samples taken					
				Material too hard and coarse to sample					

Sheet 20 of 20 Sheets

*Disturbed-undisturbed-rock core. 1 Copy to E and WP Unit. Distribute other copies as directed by State Conservationist.

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APPENDIX VI

DESIGN REPORT

DESIGN REPORT

SOUTH RIVER SUBWATERSHED
COLD SPRINGS, SITE NO. 6
COLD SPRINGS, AUGUSTA CO., VIRGINIA

Site 6, South River Subwatershed is located in the Shenandoah Valley about one mile east of Cold Spring Station on Cold Spring Branch.

The geographic location of this site may be found on the Vesuvius Quadrangle, published by the U S Geological Survey, by scaling 2-7/16 inches right (longitude 79°, 07' 22" west) and 5-3/16 inches up (latitude 37° 5,' 28" north) from the lower left hand corner of the quadrangle. Sheet 3 of this report is a transparent overlay that can be used to locate the proposed dam. By placing this overlay on the appropriate latitude and longitude lines on the Vesuvius Quadrangle, the location of the proposed dam may be found.

The purpose of this detention reservoir is to reduce flood flow in and around the town of Waynesboro and other points along the stream.

The dam has a watershed of 2708 acres. It is to be constructed of compacted earth on alluvial terrace material over silty clay. The principal spillway will be a drop inlet spillway with a reinforced concrete cylinder pipe, 24 inches inside diameter, and a reinforced concrete riser. It is to rest on silty clay. Maximum settlement is predicted to be 1.0'.

The riser is to be 3.0'x3.0' inside dimensions. An emergency spillway will also be provided which is to be cut into silty sand and clay on the west abutment.

The elevation of the sediment pool is based on the assumption that sediment will accrue in the reservoir area at the rate of 0.604 acre-feet per year. This assumption caused the level of the sediment pool to be set at an elevation of 1601.5. This elevation is the crest elevation of the principal spillway riser.

The flood routing procedure used in the design is described in Engineering Handbook, Section 5, Hydraulics, U. S. Department of Agriculture, Soil Conservation Service.

The flood routing procedure was used to determine the maximum stages shown in the table below.

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO VA-336-R SHEET 1 OF 3 DATE 6-20-58

DESIGN REPORT

Factor Which Determines Stage	Surface Area Acres	Runoff in Inches	Peak Flow in CFS	Elev. of Max. Stage	Storage in Ac.-Ft.	Element of Structure Determined by Maximum Stage
50 year sediment deposit	6.5				30.2	Crest of riser
100 year frequency storm		3.96	2120	1634.2	820	Crest of emergency spillway
1 x6 hour pt. rainfall, moisture condition III		9.56	4990	1639.7	1102	Design high water

A freeboard of 2 feet was selected. This freeboard was added to the distance from the crest of the 1 x 6 hour point rainfall and moisture condition III, to determine the top of the dam, elevation 1642.0.

The reinforced concrete design procedure was based on Engineering Handbook, Section 6, Structural Design, U. S. Department of Agriculture, Soil Conservation Service. The data used were for class B concrete as described in this publication.

The inflow hydrographs for the 100 year storm and the 1 x 6 hour point rainfall, moisture condition III, are constructed by the method described in Section 3.21 of the Hydrology Guide.

A copy of the Geology Report (VA-336-G) is attached.

Copies of Sections 5 and 6 of the Engineering Handbook and Section 3.21 of the Hydrology Guide may be obtained from Mr. Frank A. Edminster, State Conservationist, USDA, SCS, Richmond, Virginia.

Glenn W. Grubb
Design and Construction Engineer

Concurred:

Vincent McKeever
Hydrologist

Robert F. Fonner
Geologist

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY PENNSYLVANIA	DRAWING NO. VA-336-R SHEET 2 OF 3 DATE 6-20-58

APPENDIX VII

EXCERPTS FROM DESIGN CALCULATIONS

Colo. Springs, Site #6

Ja 336-4
sheet 1 of 11

From Mass Rainfall Curve - 100 Yr. Storm
where $f = 0.30$ "/hr. $(I-f)_{max} = 3.96$"

From Hydrology Sec., Suppl. A, NEH 4

$T_c = 13.0$" D.A. = 2708 $A_c = 4.23$ sq. mi.

Modification factor, Fletcher = 0.90

$P_m = 13.0 \times 0.90 = 11.70$"

Moderate Hazard Coeff. = 1.0

T_c (From Mockus Information) = 4.1 hrs.

$$T_p = \frac{D}{2} + 0.6\,T_c$$

$$T_b = 2.67\,T_p$$

$$q_r = \frac{484\,AQ}{T_p}$$

Total distance of water travel in watershed = 20,000 ft.
Difference in elev. = 2,000 ft.

?-29
-x Sheet for Tabular Computations

Sheet 2 of 11

Site No 6 Cold Springs Va-336-H

Revised Computation of Subhydrograph Peaks to Set Crest of Emergency Spillway

Moderate Hazard Curve 65 for Moisture Condition II

(I-F) = 3.96" T_c = 4.1 Hrs. T_p = 2.71 T_b = 7.24 q_p = 754 ΔD = 0.5 hr.

① Time (hrs)	② Factors From Curve B	③ Accumul. P (inches)	④ Accumul. Q (inches)	⑤ ΔQ (inches)	⑥ q_p ΔQ ⑤×754 (cfs)	⑦ Starting time (hrs)	⑧ Peak time ⑦+2.71 (hrs)	⑨ Ending time ⑦+7.24 (hrs)
0.0	0.0	0.00	0					
				0	0	0.0	2.71	7.24
0.5	0.035	0.28	0					
				0	0	0.5	3.21	7.74
1.0	0.080	0.65	0					
				0	0	1.0	3.71	8.24
1.5	0.135	1.09	0					
				0.10	75.4	1.5	4.21	8.74
2.0	0.220	1.86	0.10					
				1.48	1115.9	2.0	4.71	9.24
2.5	0.600	4.86	1.58					
				0.56	422.2	2.5	5.21	9.74
3.0	0.705	5.71	2.14					
				0.46	346.8	3.0	5.71	10.24
3.5	0.780	6.32	2.60					
				0.32	241.3	3.5	6.21	10.74
4.0	0.835	6.76	2.92					
				0.31	233.7	4.0	6.71	11.24
4.5	0.885	7.17	3.23					
				0.25	188.5	4.5	7.21	11.74
5.0	0.925	7.49	3.48					
				0.28	211.1	5.0	7.71	12.24
5.5	0.965	7.82	3.76					
				0.20	150.8	5.5	8.21	12.74
6.0	1.000	8.10	3.96					

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Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Sheet 2 of [illegible]
5/22/58

Cold Spring Site #6 VA-226-[illegible]

Computation of Sub Hydrograph Peaks To Set Capacity of Emergency Spillway

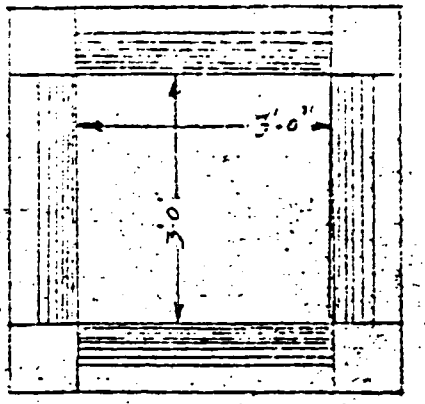
Moderate Hazard - Curve #83 - Moist. Cond. III T_c=4.1 T_p=2.96 T_b=7.90 AD=1.6

q_p=690.23 P=11.70

① Time (hrs)	② Factors From Curve "B"	③ Acc P (inches)	④ Acc Q	⑤ ΔQ	⑥ q_p ΔQ or ⑤	⑦ Starting time	⑧ Peak Time	⑨ Ending Time
0	0.0	0.0	0.0					
				0.10	69.02	0.0	2.96	7.90
1.0	0.080	0.936	0.10					
				1.10	759.25	1.0	3.96	8.90
2.0	0.230	2.69	1.20					
				5.01	3458.05	2.0	4.96	9.90
3.0	0.705	8.25	6.21					
				1.48	1021.54	3.0	5.96	10.90
4.0	0.835	9.78	7.69					
				1.01	697.13	4.0	6.96	11.90
5.0	0.925	10.82	8.70					
				0.86	593.60	5.0	7.96	12.90
6.0	1.000	11.70	9.56					

5/13/58

DAM No 6 -
COLD SPRINGS



WEIR FLOW

$Q = CLH^{3/2}$

$C = 3.4$

$L = 12.0'$

$Q = 40.8\ H^{3/2}$

PIPE FLOW $\quad Q_p = C_p H_p^{1/2}$

$$C_p = A_p \sqrt{\frac{2g}{1 + K_r + K_p f_p + K_c f_r \left(\frac{A_p}{A_r}\right)^2}}$$

$K_r = 1.45$

$n = 0.011$

$d = 24"$

$l_p = 2.87$

$A_p = 3.142$

$A_r = 9.0$

$S_p = 0.010\,45$

$K_p = 0.000\,883$

Assume $K_c f_r \left(\frac{A_p}{A_r}\right)^2 = 0$

$\left(\frac{A_p}{A_r}\right)^2 = \left(\frac{3.142}{9.0}\right)^2 = (0.349)^2 = 0.1219$

$$C_p = A_p \sqrt{\frac{64.32}{1 + 1.45 + 2.87 + 0}} = A_p \sqrt{\frac{64.32}{5.77}} = A_p \sqrt{13.454}$$

$$= 3.14 \times 3.67 = 11.52$$

$Q_p = 11.52\ H^{1/2}$

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Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Ja-336-
Sheet 5 of
5/26/58

Cold Spring Site #6

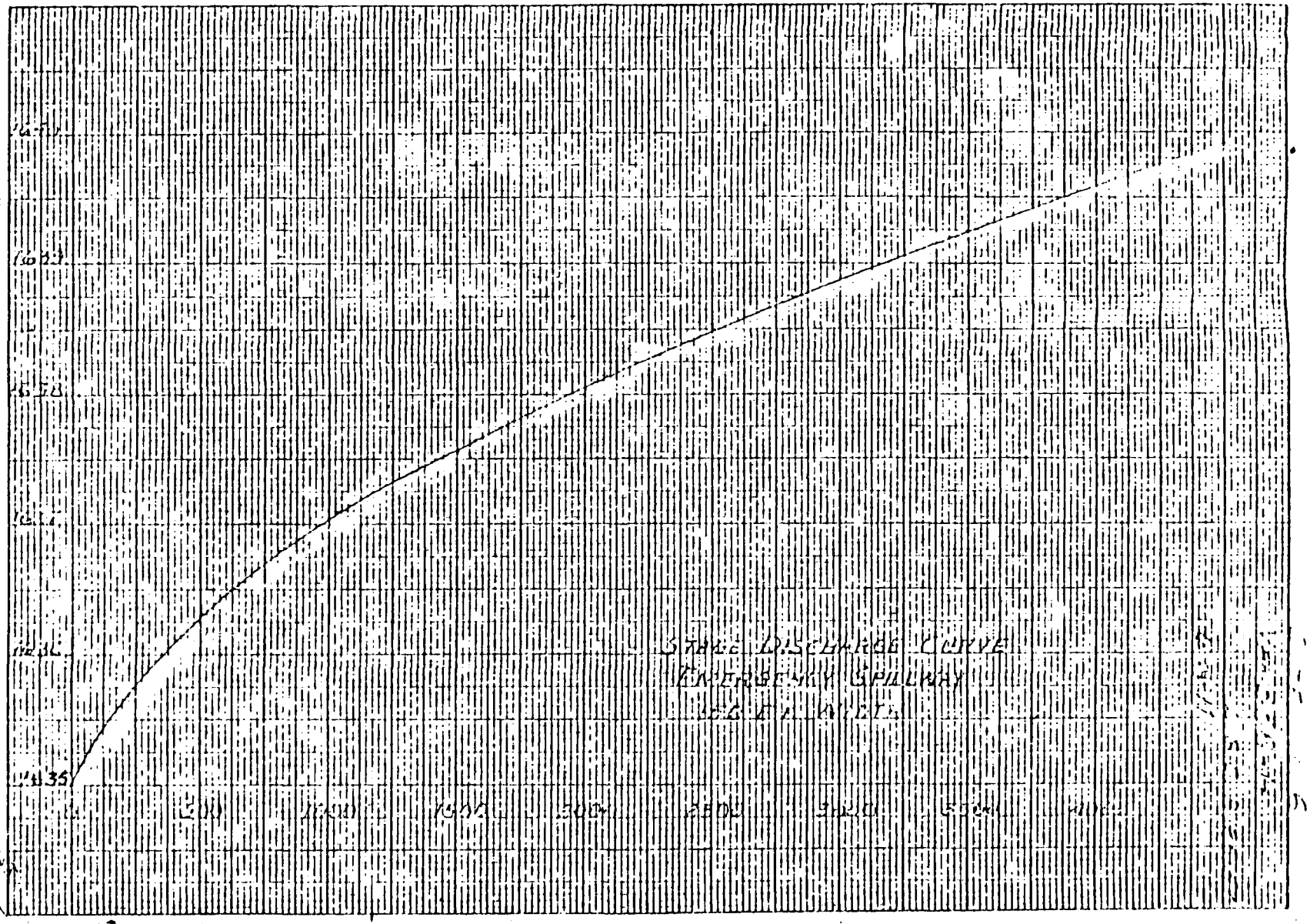
Emergency Spillway - Stage Discharge Data

b = 150' z = 3 L = 180'

Crest at Elev. 1635.0 n = 0.04

Q	$q_c = \frac{Q}{b}$	d_c	$w = b + z d_c$	$q = \frac{Q}{w}$	d_c	$w = b + z d_c$	H_p	Stage
500	3.34	0.70	152.10	3.29	0.70	152.10	1.32	1636.32
1000	6.67	1.12	153.36	6.52	1.10	153.30	2.05	1637.05
1500	10.01	1.50	154.50	9.71	1.43	154.29	2.56	1637.56
2000	13.34	1.75	155.25	12.88	1.73	155.19	3.04	1638.04
2500	16.67	2.08	156.24 ~~157.40~~	16.00 ~~15.91~~	~~1.98~~	~~155.94~~		1638.50
				~~16.02~~	2.00	155.99	3.50	
3000	20.01	2.35	157.05	19.10	2.32	156.96	3.88	1638.88
3500	23.34	2.56	157.68	22.20	2.48	157.44	4.24	1639.24
4000	26.68	2.80	158.40	25.25	2.70	158.10	4.58	1639.58
4500	30.01	3.06	159.18	28.27	2.92	158.76		1639.90
				~~28.34~~	~~2.92~~		4.90	
5000	33.35	3.27	159.81	31.29	3.22	159.66	5.20	1640.20

6-16-58



VA 330-11
7-2-11

E. MECHANICAL SPILLWAY DISCHARGE [illegible]

8	9	10	11	12	13	14	15	16		
			CONDUIT 24"			CONDUIT 30"				
[illegible] ×40.8 cfs	Q	ELEV.	H FEET	$H^{1/2}$	Q (12)×11.52 cfs.	H	$H^{1/2}$	Q (15)×[illegible] cfs	[illegible]	9/3/57
		[illegible]	6	2.45	28	5.75	2.40	45		
		[illegible]	11	3.32	38	10.75	3.28	62		
0		[illegible]								
14.43	14	[illegible]								
40.80	41	[illegible]								
74.95	75	[illegible]								
15.38	115	[illegible]								
		[illegible]	16	4.0	46	15.75	3.97	75		
		[illegible]	21	4.58	53	20.75	4.55	86		
		[illegible]	26	5.10	59	25.75	5.08	96		
		[illegible]	31	5.57	64	30.75	5.55	105		
		[illegible]	36	6.0	69	35.75	5.98	113		
		[illegible]	41	6.40	74	40.75	6.38	121		
		[illegible]	46	6.78	78	45.75	6.76	128		
		[illegible]	51	7.14	82	50.75	7.12	135		

FOR FLOW OF 3200 (MAX FLOW) IN EMERGENCY SPILLWAY, $d_c = 2.37$ ft AND $W' = 157.10$ ft,
$q_c = 20.37$ cfs AND $S_c = 0.0177$
$n = 0.040$

FOR 25% MAX. FLOW OR 800 cfs.
$d_c = 0.94$ ft AND $W' = 152.20$
$q_c = 5.24$ cfs AND $S_c = 0.0239$
$n = 0.040$

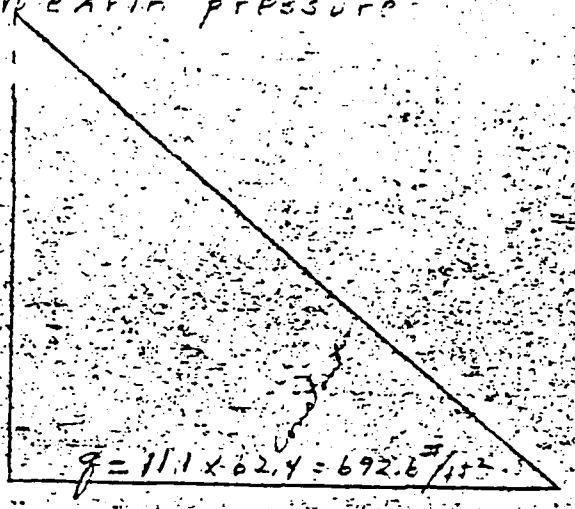
∴ AN EXIT SLOPE OF 0.030 IN EMERGENCY SPILLWAY WILL BE SATISFACTORY.

Cold Springs #6
Vc - 304 - D

M.L.W.
5/20/58
sheet 1 of 8

Riser Design

Ht of riser = 1601.5 - 1592.4 = 9.1'
Assume water 2' over crest of riser & riser Empty.
No earth pressure



$V_c = \frac{1}{2} q l_c = \frac{692.6 \times 3}{2} = 1038.9$ #

d required = Less Than 3"
Use 1' effective 7.5" Total d = 10"

Then $M_{(end)} = \frac{1}{12} q l^2 = \frac{692.6 \times 3.83^2}{12} = 846.6$ '#

A_s (required) = Less than 0.1 □"
Use Temperature Steel
All Horizontal ~~#4 @ 15"~~ Use #4 @ 12"

All Vertical #5 @ 15"

6" Conc

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EM STUDY — HYDROGRAPH COMPUTATION

DATE
COMPUTED BY
CHECKED BY

WATERSHED OR PROJECT SOUTH RIVER

STATE VIRGINIA

STRUCTURE SITE OR SUBAREA 6

DR. AREA 4.23 SQ. MI. STRUCTURE CLASS C

T_c 4.1 HR. STORM DURATION 6 HR.

POINT RAINFALL 11.8 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR — IN.

DURATION : FACTOR — IN.

RUNOFF CURVE NO. 65

Q ~~6.46~~ 7.15 IN.

HYDROGRAPH FAMILY NO. B 2

COMPUTED T_p 2.87 HR.

T_o ~~4.30~~ 4.9 HR.

(T_o / T_p): ~~1.50~~ 1.71

COMPUTED ~~1.64~~ ; USED 1.5

REVISED T_p ~~4.30~~ 3.27

$q_c = \frac{484A}{\text{REV. } T_p} =$ ~~1141~~ 626 CFS.

$(Q)(q_p)$ = ~~1141~~ 476 CFS.

t(COLUMN) = (t / T_p) REV. T_p q(COLUMN) = $(q_c / q_p)(Q)(q_p)$

Q(COLUMN) = $(Q_t / Q)Q$

	$t=(t/T_p)$Rev. T_p	$q=(q_c/q_p)(Q)(q_p)$	$Q_t=(Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2			
3			
4			
5			
6	~~4.10~~	~~2.43~~	
7			
8	5.04	3536	
9			
10			
11			
12			
13			
14			
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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

METHOD OF RESERVOIR FLOOD ROUTING

State [illegible] Watershed [illegible] Site C

Class C V_{us} = ____ AF V_{ub} = ____ AF V_{ud} = ____ AF V_u = ____ AF

Storm Em. Spwy. DA 4.23 mi² Runoff 7.15 in. Q_I = 3736 cfs

Hydrograph Family 2 T_o/T_p 1.5 V_I = 53.33 x Runoff x DA. = 1613 AF

Q_A = ____ cfs E_n = ____ ft V_{sf} = ____ AF V_{sx}/V_I = ____

Q_A/Q_I = ____ V_{th} = ____ AF V_{sf}/V_I = ____ V_{od}/V_I = ____

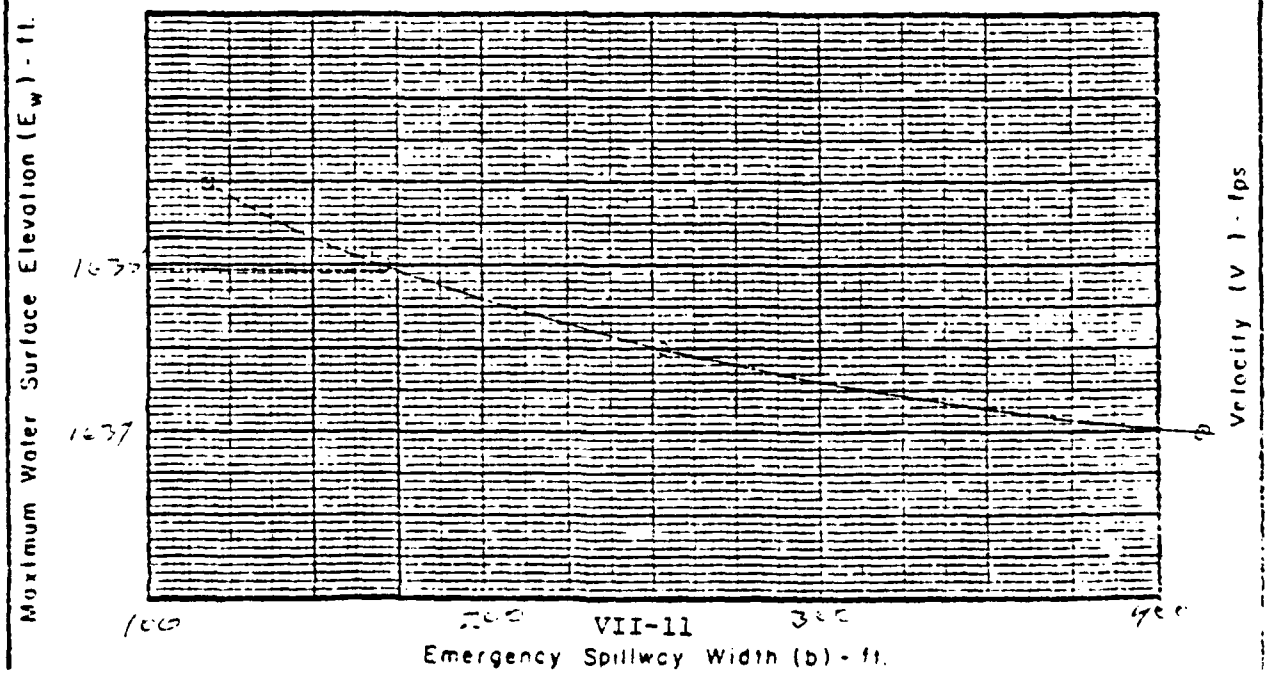
E_e = 1635.0 ft z = 3 L = 150 ft V_{sp}/V_I = 0.324

V_{te} = ____ AF Case Z S_o = 2 % $V_{sp}/V_I + V_{od}/V_I$ = ____

V_{sp} = 553 AF Q_h = 62.4 cfs V_{sp}/V_I = 0.342

Q_{pr} = 78 cfs Q_r/Q_I = 0.0177 V_{od}/V_I = 0.018

1	2	3	4	5	6	7	8	9	10	11	12
E_w ft	V_{tw} AF	V_{sw} AF	V_{sw}/V_I	V'_{sw}/V_I	Q_O/Q_I	Q_O cfs	Q_e cfs	H_p ft	Q_e/b	b ft	v fps
1637.0		955	0.592	0.606	0.73	2720	2542	2.0	6.15	414	
1637.5		980	0.606	0.620	0.69	2580	2322	2.5	4.50	243	
1638.0		1007	0.624	0.638	0.63	2225	2147	3.0	2.90	170	
1638.5		1035	0.642	0.656	0.58	2042	1964	3.5	2.40	118	



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Rev. (2 - 66)

EXAMPLE

HYDROGRAPH COMPUTATION

DATE
COMPUTED BY
CHECKED BY

WATERSHED OR PROJECT SOUTH RIVER

STATE VIRGINIA

STRUCTURE SITE OR SUBAREA #6

DR. AREA 4.23 SQ. MI. STRUCTURE CLASS C

T_c 4.1 HR. STORM DURATION 6 HR.

POINT RAINFALL 13.0 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR 0.9 IN. 11.7

DURATION : FACTOR _____ IN. _____

RUNOFF CURVE NO. ~~83~~ M.C. III

Q 9.56 ~~9.31~~ IN.

HYDROGRAPH FAMILY NO. 1

COMPUTED T_p 2.57 HR.

T_o 5.50 HR.

(T_o / T_p):
COMPUTED 1.92 ; USED 2.0

REVISED T_p 2.75

$q_p = \frac{484A}{REV.\ T_p}$ = 744 CFS.

(QXq_p) = 6914 CFS.

t(COLUMN) = (t / T_p) REV. T_p q(COLUMN) = $(q_c / q_p)X(QXq_p)$

Q(COLUMN) = $(Q_t / Q)Q$

	$t=(t/T_p)$Rev. T_p	$q=(q_c/q_p)(Q)(q_p)$	$Q_t=(Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2			
3			
4			
5			
6	2.750	6914	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
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[illegible] DEPARTMENT OF AGRICULTURE
[illegible] SOIL CONSERVATION SERVICE

[illegible] METHOD OF RESERVOIR FLOOD ROUTING

State [illegible] Watershed [illegible] Site C

Class C V_{us} = _____ AF V_{ld} = _____ AF V_{ud} = _____ AF V_{uf} = _____ AF

Storm EM. SPWY D.A. 4.23 mi² Runoff 9.56 in. Q_I = 50.45 c s

Hydrograph Family 1 T_o/T_p 2.6 V_I = 53.33 x Runoff x D.A. = 215.7 A F

Q_f = _____ cfs E_h = _____ ft V_{sf} = _____ AF V_{sf}'/V_I = _____

Q_f/Q_I = _____ V_{th} = _____ AF V_{sf}/V_I = _____ V_{of}/V_I = _____

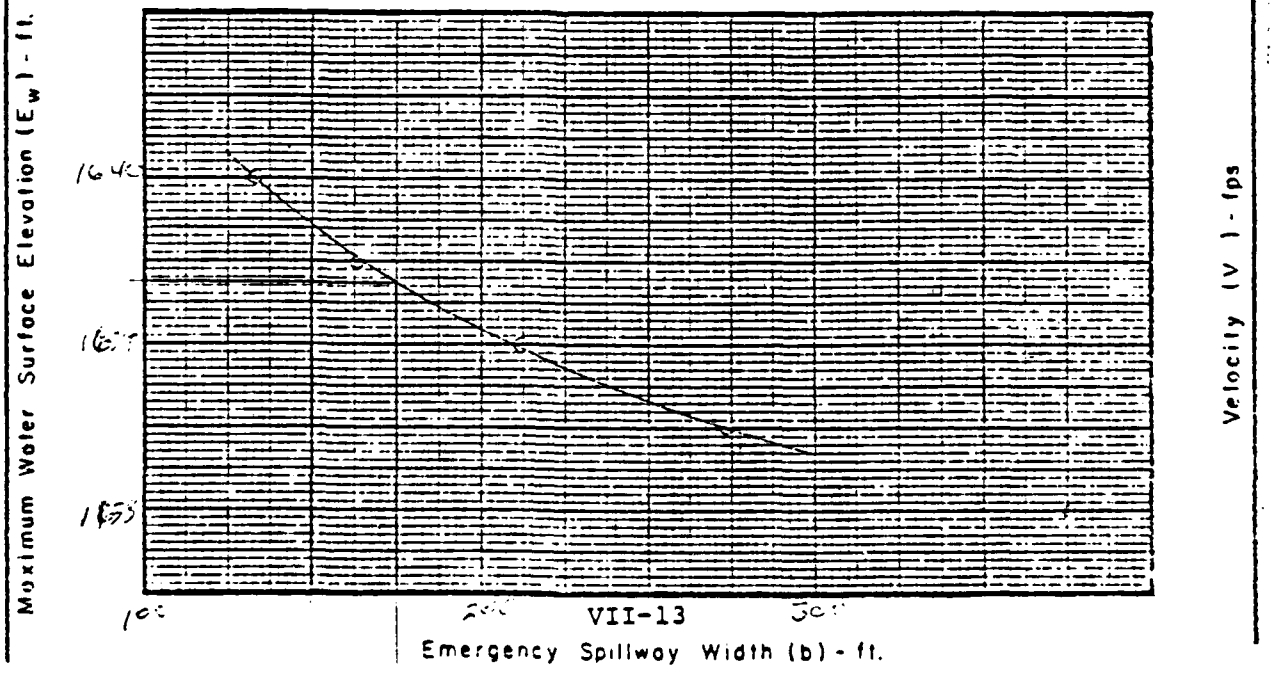
E_e = 1633.0 ft z = 3 L = 150 ft V_{sp}/V_I = 0.396

V_{te} = _____ AF Case 2 S_o = 2% $V_{sp}/V_I + V_{cf}/V_I$ = _____

V_{sp} = 853 AF Q_h = 62.4 cfs V_{sp}'/V_I = 0.401

Q_{ph} = 75 cfs Q_h/Q_I = 0.0117 V_{op}/V_I = 0.005

1	2	3	4	5	6	7	8	9	10	11	12
E_w ft	V_{tw} AF	V_{sw} AF	V_{sw}/V_I	V_{sw}'/V_I	Q_O/Q_I	Q_O cfs	Q_e cfs	H_p ft	C_e/b	D ft	v fps
1635.0		1067	0.468	0.473	0.55	4790	4712	3.0	12.6	377	
1632.5		1035	0.451	0.456	0.52	4625	4542	2.5	16.6	273	
1630.0		1060	0.492	0.497	0.50	4510	4432	4.0	21.0	211	
1627.5		1090	0.506	0.511	0.76	4290	4212	4.5	25.5	167	
1840.0		1116	0.517	0.522	0.73	4120	4042	5.0	31.0	133	



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[illegible] HYDROGRAPH COMPUTATION

DATE
COMPUTED BY
CHECKED BY

WATERSHED OR PROJECT South River

STATE Virginia

STRUCTURE SITE OR SUBAREA 6

DR. AREA 4.23 SQ. MI. STRUCTURE CLASS C

T_c 4.1 HR. STORM DURATION 6 HR.

POINT RAINFALL 27.3 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR — IN.

DURATION : FACTOR — IN.

RUNOFF CURVE NO. 65

Q 2.75 IN.

HYDROGRAPH FAMILY NO. 1

COMPUTED T_p 2.87 HR.

5.45

T_o 5.37 HR.

(T_o / T_p): 1.90

COMPUTED 1.96 ; USED 2.00 1.70

2.66

REVISED T_p 2.72

770753

$q_p = \frac{484A}{\text{REV. } T_p}$ = CFS.

16,745

(Qxq_p) = 16378 CFS.

t(COLUMN) = (t / T_p) REV. T_p q(COLUMN) = $(q_c / q_p)xQxq_p$

Q(COLUMN) = $(Q_t / Q)Q$

	$t=(t/T_p)$Rev. T_p	$q=(q_c/q_p)(Q)(q_p)$	$Q_t=(Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2			
3			
4			
5			
6	2.73	12,824	
7	[illegible]	[illegible]	
8			
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34			

[illegible] METHOD RESERVOIR FLOOD ROUTING

State [illegible] Watershed [illegible] Site [illegible]

Class C V_{ud} = ____ AF V_{ub} = ____ AF V_{uc} = ____ AF V_{uf} = ____ AF

Storm [illegible] D.A 4.23 mi^2 Runoff 2.77 in. Q_I = 12,120 cfs

Hydrograph Family 1 T_o/T_p 3.00 V_I = 53.33 x Runoff x D.A. = 4467 AF

Q_i = ____ cfs E_n = ____ ft V_{sd} = ____ AF V_{sd}/V_I = ____

Q_x/Q_i = ____ V_{th} = ____ AF V_{sf}/V_I = ____ V_{of}/V_I = ____

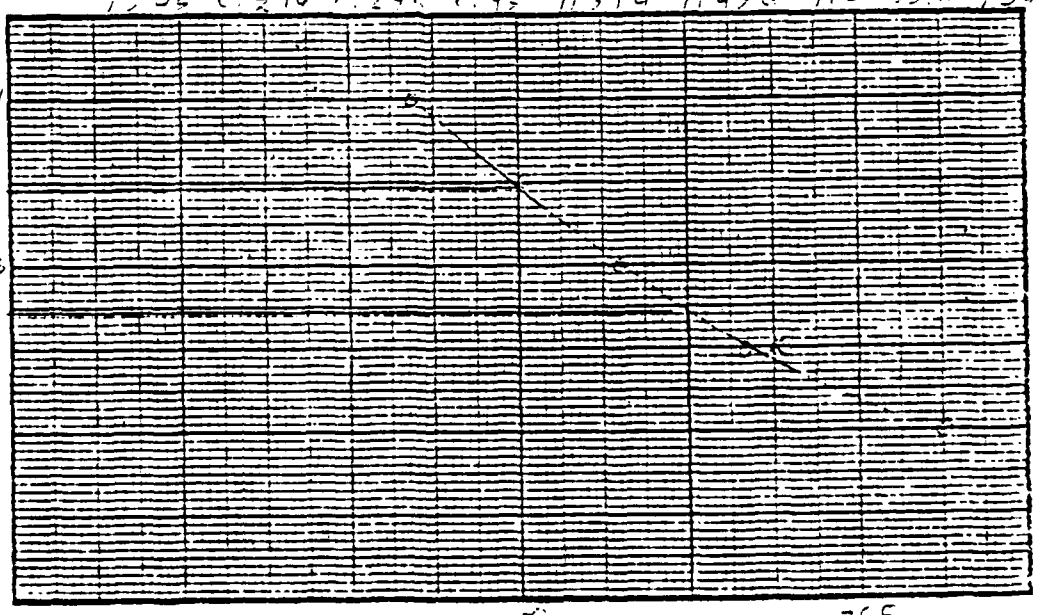
E_e = 1635.0 ft z = 3 L = 150 ft V_{sp}/V_I = 0.174

V_{te} = ____ AF Case 2 S_o = 2% $V_{sp}/V_I + V_{of}/V_I$ = ____

V_{sp} = 553 AF Q_n = 62.4 cfs V'_{sp}/V_I = 0.175

Q_{ph} = 78 cfs Q_h/Q_I = 0.00514 V_{oc}/V_I = 0.004

1	2	3	4	5	6	7	8	9	10	11	12
E_w ft	V_{tw} AF	V_{sw} AF	V_{sw}/V_I	V'_{sw}/V_I	Q_O/Q_I	Q_O cfs	Q_e cfs	H_p ft	Q_e/b	b ft	v fps
1641.		1168	0.233	0.242	0.98	11875	11800	6.0	42.2	280	
1641.5		1173	0.244	0.248	0.97	11756	11678	6.5	45.2	260	
1642.0		1220	0.243	0.252	0.97	11756	11678	7.0	55.0	212	
1642.5		1256	0.262	0.266	0.96	11636	11558	8.0	72.0	165	
1642.5		1275	0.260	0.264	0.95	11514	11436	7.5	82.5	153	
1643.5		1314	0.268	0.272	0.96	11636	11555	8.5	96.5	152	
1644.0		1355	0.276	0.280	0.95	11514	11436	7.0	85.0	134	



SCS - 02E
Rev. (2 - 65

HYDROGRAPH COMPUTATION

DATE
COMPUTED BY
CHECKED BY

WATERSHED OR PROJECT SOUTH RIVER

STATE VIRGINIA

STRUCTURE SITE OR SUBAREA 6

DR. AREA 4.23 SQ. MI. STRUCTURE CLASS C

T_c 4.1 HR. STORM DURATION 6 HR.

POINT RAINFALL 27.3 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR — IN.

DURATION : FACTOR — IN.

RUNOFF CURVE NO. 65

Q 21.75 IN.

HYDROGRAPH FAMILY NO. 2

COMPUTED T_p 2.87 HR.

T_o 5.45 HR.

(T_o / T_p):
COMPUTED 1.90 ; USED 2.00

REVISED T_p 2.72

$q_p = \frac{484A}{\text{REV. } T_p} =$ 753 CFS.

$(QXq_p) =$ 16378 CFS.

t(COLUMN) = (t / T_p) REV. T_p q(COLUMN) = $(q_c / q_p X Q X q_p)$

Q(COLUMN) = $(Q_t / Q)Q$

	$t=(t/T_p)$Rev. T_p	$q=(q_c/q_p XQXq_p)$	$Q_t=(Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2			
3			
4			
5			
6			
7	4.57	11,710	
8			
9			
10			
11			
12			
13			
14			
15			
16			
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32			
33			
34			

State [illegible] Watershed [illegible] Site [illegible]

Class C V_{us} = ____ AF V_{ub} = ____ AF V_{ud} = ____ AF V_{f} = ____

Storm FREEBOARD D.A. 4.77 $m.^2$ Runoff 3.477 in. Q_I = 11,715 cfs

Hydrograph Family 2 T_c/T_p 2.0 V_I = 53.33 x Runoff x D.A. = 11967 AF

Q_f = ____ cfs E_h = ____ ft V_{sf} = ____ AF V'_{sf}/V_I = ____

Q_f/Q_I = ____ V_{th} = ____ AF V_{sf}/V_I = ____ V_{cf}/V_I = ____

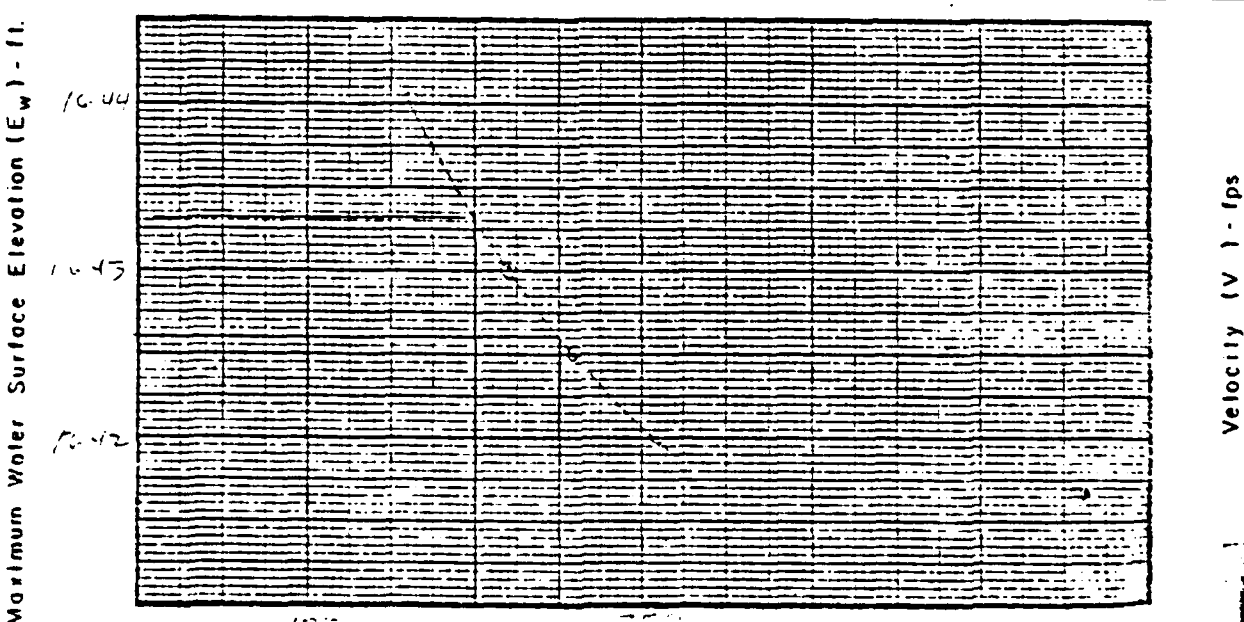
E_e = 1035 ft z = 3 L = 150 ft V_{sp}/V_I = 0.174

V_{fe} = ____ AF Case 2 S_o = 2 % $V_{sp}/V_I + V_{cf}/V_I$ = ____

V_{sp} = 553 AF Q_h = 62.4 cfs V'_{sp}/V_I = 0.179

Q_{ph} = 75 cfs Q_h/Q_I = 0.00532 V_{op}/V_I = 0.004

1	2	3	4	5	6	7	8	9	10	11	12
E_w ft	V_{fw} AF	V_{sw} AF	V_{sw}/V_I	V'_{sw}/V_I	Q_O/Q_I	Q_O cfs	Q_e cfs	H_p ft	Q_e/b	b ft	v fps
1042		1225	0.243	0.252	0.98	11387	11251	7.0	55.0	205	
1042.5		1275	0.266	0.260	0.98	11374	11231	7.5	62.5	180	
1043.0		1256	0.262	0.266	0.96	11242	11164	8.0	70.0	168	
1043.5		1314	0.265	0.272	0.96	11242	11164	8.5	76.5	146	
1044.0		1345	0.274	0.278	0.96	11242	11164	9.0	85.0	131	



Emergency Spillway Width (b) - ft.

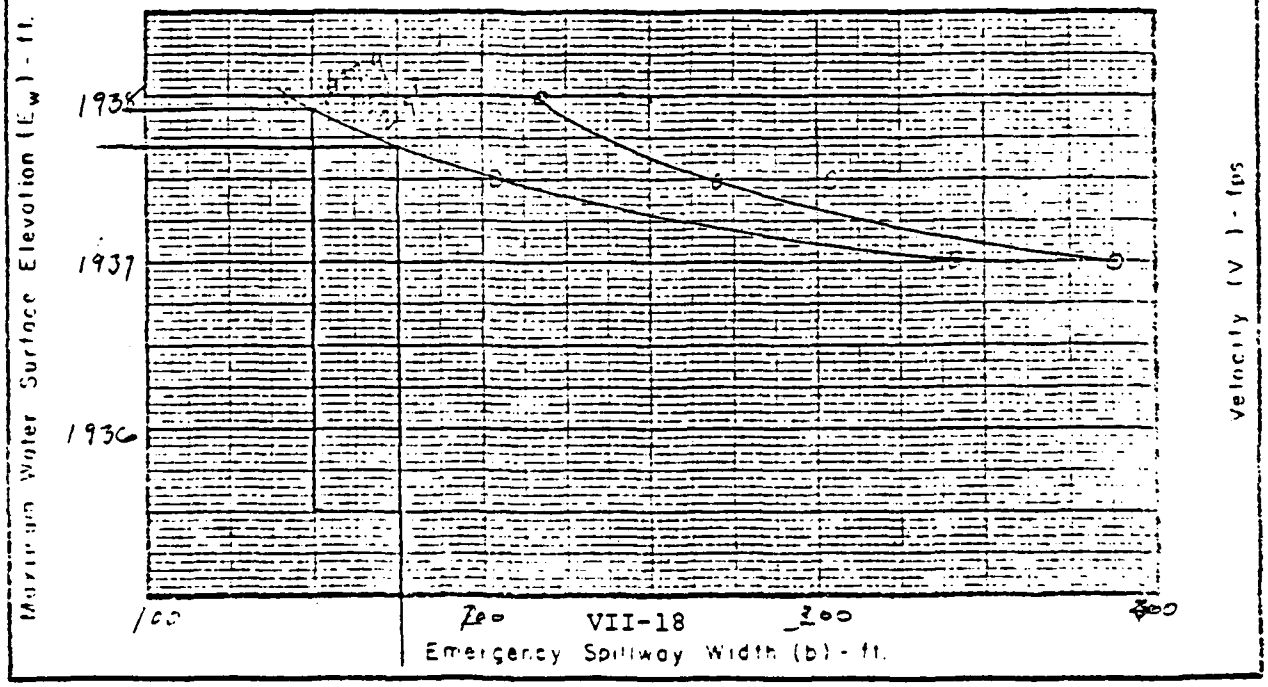
1A		POTOMAC RIVER SOUTH RIVER		6			
C	V_c =	AF	V_{cb} =	AF	V_c =	AF	V =

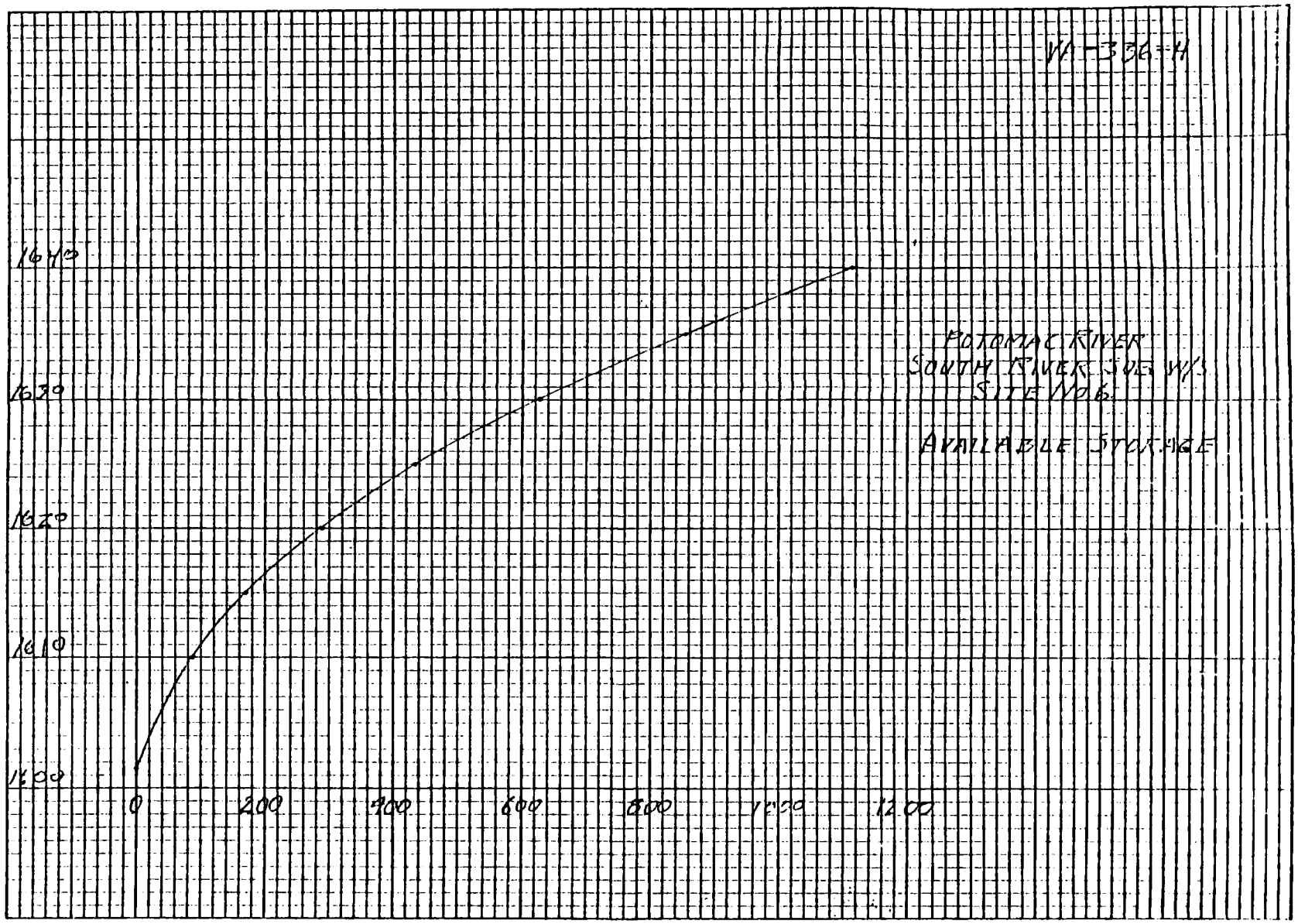
Str. Em. Spwy. D.A. 4.23 mi² Runoff 6.70 in. Q_I = 2831 cfs
Hydrograph Family 2 T_c/T_p 1.5 V_I = 53.33 x Runoff x D.A. = 1511 AF

Q_I = ______ cfs E_h = ______ ft V_{s2} = ______ AF V_{s2}/V_I = ______
Q_2/Q_I = ______ V_{fh} = ______ AF V_{s}/V_I = ______ V_{s}/V_I = ______

E_e = 1635.0' ft z = 3 L = 150' ft V_{sp}/V_I = 0.564
V_{fe} = ______ AF Case 2 S_o = 3 % $V_{sp}/V_I + V_{ox}/V_I$ = ______
V_{sp} = 853. AF Q_h = 62.4 cfs 553+ V_{sp}/V_I = 0.538
Q_{oh} = 78. cfs Q_h/Q_I = 0.022 .01 V_{ox}/V_I = .024 .017

1	2	3	4	5	6	7	8	9	10	11	12
E_w ft	V_{fw} AF	V_{sw} AF	V_{sw}/V_I	V'_{sw}/V_I	Q_O/Q_I	Q_O cfs	Q_e cfs	H_p ft	Q_e/b	[illegible] ft	[illegible]
1636.0		900	0.596	0.620	0.75	2122	2044	1	1.85	135	133
1637.0		954	0.631	0.655	0.65	1840	1762	2	6.15	288	[illegible]
1637.5		982	0.650	0.672	0.58	1641	1563	2.5	9.20	170	[illegible]
1638.0		1005	0.665	0.652	0.56	1557	1479	3.0	12.60	147	143





SCS-319 6 (3-61)

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HYDROGRAPH COMPUTATION

EM SPILLWAY

WATERSHED OR PROJECT POTOMAC RIVER SOUTH RIVER STATE VA

STRUCTURE SITE OR SUBAREA 6 COLD SPRINGS

DR. AREA 4.23 SQ. MI. T_c 4.1 HR. class "C" RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 65 . STORM DISTRIB. CURVE B . HYDROGRAPH FAMILY NO. 2

STORM DURATION 6 HR. RAINFALL: POINT 11.3 IN. AREAL 11.3 IN.

0.7 Tc

Q 6.70 IN. COMPUTED T_p 2.87 HR. T_o 4.83 HR.

$(T_o \div T_p)$: COMPUTED 1.68 ; USED 1.5 . REVISED T_p 3.22

$q_p = \frac{484\ A}{REV.\ T_p}$ = 636 CFS. Q_{q_p} = 4231 3584 CFS.

I(COLUMN) = (t/T_p) REV. T_p. q(COLUMN) = (q_u/q_p) Q_{q_p}

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1			21			41		
2			22			42		
3			23			43		
4			24			44		
5			25			45		
6			26			46		
7			27			47		
8	.792	2831	28			48		
9			29			49		
10			30			50		
11			31			51		
12			32			52		
13			33			53		
14			34			54		
15			35			55		
16			36			56		
17			37			57		
18			38			58		
19			39			59		
20			40			60		

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APPENDIX VIII

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GENERAL REFERENCES

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