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NATIONAL DAM INSPECTION PROGRAM. UPPER ROCK CREEK WATERSHED SIT--ETC(U)
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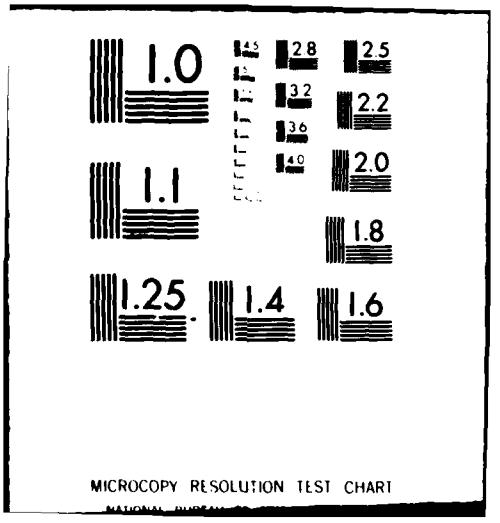
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UPPER ROCK CREEK WATERSHED SITE NO5

MD 00043

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

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~~POTOMAC RIVER BASIN~~

(6) National Dam Inspection Program

UPPER ROCK CREEK WATERSHED SITE #5
(LAKE NEEDWOOD)
~~MONTGOMERY COUNTY, MARYLAND~~
(NDI-~~MD~~-MD-00046)

Number

Potomac River Basin, Rock Creek
Montgomery County, Maryland

PHASE I INSPECTION REPORT
~~NATIONAL DAM SAFETY PROGRAM~~

(11) August 1979

(12) 48

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: WATER RESOURCES ADMINISTRATION
Department of Natural Resources
Tawes Building
Annapolis, Maryland 21401

Date: August, 1979

memo of understanding between State of Md and Corps.

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 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 frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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 (greatest reasonably possible storm runoff), or fractions thereof. The spillway 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 INSPECTION PROGRAM

NAME OF DAM:	Upper Rock Creek Watershed Site #5 (Lake Needwood)
STATE	Maryland
COUNTY:	Montgomery
STREAM:	Upper Rock Creek
DATE OF INSPECTION:	June 15, 1979

ASSESSMENT: Based on the evaluation of the conditions as they existed on the date of the inspection and as revealed by visual observations, the condition of the dam at Upper Rock Creek Site #5 (Lake Needwood) is assessed to be good. This dam is an intermediate size, class I structure.

The spillway capacity is classified as adequate because it will pass the recommended spillway design flood of full Probable Maximum Flood according to the recommended criteria.

The following remedial measures and recommendations should be implemented as soon as possible: (See Section 7.2).

1. Re-establish the operating condition of the gated drain within the cold water release chamber.

2. Backfill and reseed all eroded areas and animal burrows.

3. Document operating proceedures in writing.

4. Develop a warning system to warn downstream residents of large spillway discharges during periods of heavy rainfall and runoff or failure of the dam.

SUBMITTED BY: WATER RESOURCES ADMINISTRATION
DAM SAFETY DIVISION

8/16/79
Date

APPROVED BY:

11 Sep 79
Date

James W. Peck
Colonel, Corps of Engineers
District Engineer

UPPER ROCK CREEK WATERSHED SITE #5
LAKE NEEDWOOD
MD 00046

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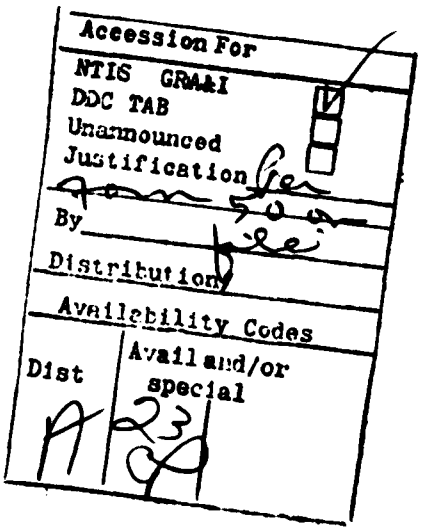


PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
UPPER ROCK CREEK WATERSHED SITE #5
(LAKE NEEDWOOD)
NDI NO. MD 00046

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by the National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The dam at Upper Rock Creek Site #5, known locally as Lake Needwood, consists of a compacted zoned earth fill embankment approximately 65 feet high and 426 feet long. A cutoff trench, 12 to 20 feet wide, extends to the weathered rock in the foundation, 20 feet upstream of the dam's longitudinal centerline. At the same location, a grout curtain was installed on the right floodplain right abutment. The grassed slopes rise at 3H:1V upstream and downstream. A 12 foot berm is located on the upstream slope one foot below normal pool at elevation 322.5. Rock riprap extends from this level to elevation 327.5. The principal spillway riser concrete control towers connects to a 42-inch concrete outlet pipe which discharges to an excavated stilling basin. These facilities discharge uncontrolled normal flows up to the calculated 100 year frequency flood event and cold water releases through three gated inlets. Flood flows exceeding the calculated 100 year flood levels may be discharged through a trapezoidal grassed emergency spillway located beyond the left abutment. The emergency spillway crest is 27.5 feet above the normal pool elevation and 12.6 feet below the top of dam elevation.

b. Location. Lake Needwood is located approximately 2.5 miles northeast of Rockville in Montgomery County, Maryland. The structure impounds Rock Creek, eventually flowing through Washington, D.C. to the Potomac River.

c. Size Classification. The maximum height of the dam is 65 feet. The reservoir volume to the top of the dam at elevation 363.6 is 7320 acre-feet. Therefore, the dam is in the "intermediate" size category.

d. Hazard Classification. Damage to downstream roads, intensely used recreational areas, and loss of more than a few lives would likely result from a failure of the dam. Accordingly, the dam is classified in the high hazard category.

e. Ownership. Lake Needwood is owned by the Maryland National Capital Park and Planning Commission, 6700 Needwood Road, Derwood, Maryland.

f. Purpose of Dam. The dam provides the multiple purposes of flood control and recreation.

g. Design and Construction History. The structure was designed by the Soil Conservation Service, Engineering and Watershed Planning Unit, Upper Darby Pennsylvania, in 1964. Construction was accomplished by Harris and Brooks and directed by the Soil Conservation Service. Construction began on August 14, 1964 and was completed on May 21, 1965.

h. Normal Operating Procedure. The dam operates as an uncontrolled structure. Normally, the pool level is maintained at elevation 323.5 by passage of base flows into the riser tower through the twin ungated orifices.

1.3 Pertinent Data

a. Drainage Area. Lake Needwood has a drainage area of 12.77 square miles.

b. Discharge at Dam Site. The maximum discharge at the dam site through the emergency spillway at elevation 351.0 is 25,652 cubic feet/sec. The maximum flood discharge at the dam site is unknown. However, Hurricane Agnes in June, 1972 caused a rise in pool elevation on to the approach slope of the emergency spillway approximately 26.5 feet above the normal pool.

c. Elevation (feet above mean sea level)

Top of Dam	363.6
Design High Water	355.5
Emergency Spillway Crest	351.0
Principal Spillway Riser Crest	335.5
Normal Pool	323.5
Streambed at Centerline of Dam	299.0

d. Reservoir (Miles)

Length of maximum pool	1.8
Length of normal pool	1.1

e. Storage (acre feet)

Normal pool	600
Principal Spillway Riser Crest	1755
Emergency Spillway Crest	4300
Design High Water	5100
Top of Dam	7320

f. Reservoir Surface (acres)

Top of dam	317
Design High Water	248
Emergency Spillway Crest	214
Principal Spillway Riser Crest	121
Normal Pool	74

g. Dam

Type	Earthfill
Length (feet)	426
Height (feet)	65
Top width (feet)	22
Side slopes - Upstream	3H:1V, 12 ft berm 1 ft. below normal pool
- Downstream	3H:1V
Impervious Core	Zoned construction
Cutoff trench	Compacted earthfill 20 ft upstream of centerline 12 to 20 ft. bottom width, 1H:1V side slopes, 17 ft. maximum vertical depth
Foundation Seepage Control	Single grout curtain, at cutoff trench centerline

h. Diversion and Regulating Tunnel

None

i. Emergency Spillway

Type	Trapezoidal, grassed, cut into natural earth beyond left abutment
Bottom width at control sec.	180
Crest elevation (feet above M.S.L.)	351.0
Gates	None
Approach Slope (%)	1
Exit slope (%)	2.0 for 150 ft
Total Length (ft)	840
Downstream channel	Spillway discharges perpendicular to dam axis to Rock Creek

j. Principal Spillway

Type	Reinforced concrete riser and 42 inch diameter R.C. outlet pipe
Riser height	36.5 ft.
Riser crest elevation (MSL)	335.5
Riser dimensions	
Inside	3.5 x 10.5 ft.
Outside	5.5 x 12.5 ft.

Length of Weir at elevation 335.5	2 @ 10.5 ft.
Length of connecting 42 inch pipe	Approximately 408 ft.

k. Regulating Outlets

Gated 3-24-in. dia. Rodney Hunt	280 series Sluice Gates @ elev 315.0 for cold water release @ elev 308.5 for cold water release @ elev 303.0 for drain
1-Shop fabricated Sluice	2 x 3.5 ft. @ elev. 303.0 for cold water release
Ungated 2-2 x 3 ft. openings	@ elev. 325.5 for normal release

SECTION 2
ENGINEERING DATA

2.1 Design:

a. Data Available: The dam at Upper Rock Creek Watershed Site No. 5, Lake Needwood Dam, was designed by the Soil Conservation Service, Engineering and Planning Unit, Upper Darby, Pennsylvania in 1964. The engineering data reviewed for this project consists of a Design Report, design drawings, construction and material specifications, as-built drawings dated April 1964, and Annual Operation and Maintenance Inspection Reports. A portion of the drawings are presented in Appendix "C", Location Map and Plans. The design report contains hydrologic and hydraulic data, laboratory consolidation and consolidated undrained triaxial tests for representative soil samples, slope stability studies, settlement analyses, estimates of seepage quantities through the foundation, structual analyses of appurtenant structures, and material quantity estimates. Logs of subsurface explorations including rock cores and water pressure tests are contained in the design drawings.

b. Design Features

1. Hydrology and Hydraulics - The top of dam and the configuration of the outlet works were designed in accordance with Soil Conservation Service criteria for a Class "C" structure which corresponds to a high hazard dam as defined by the Phase I inspection guidelines. A complete discussion of the hydrologic and hydraulic design is contained in Section 5.

2. Embankment - The design drawings and specifications indicate the embankment to be zoned earth fill rolled to a minimum density of 95 per cent of the maximum dry density attained in accordance with the Standard Proctor Test (ASTM Standard D-698). The embankment is placed upon a foundation of medium dense to dense residual soil which was prepared by clearing and grubbing operations. The design drawings provide for a grout curtain cutoff on the right side of the dam. A cutoff trench of impervious soil extends approximately 3 feet into weathered rock with 1H to 1V side slopes and a bottom width varies from 12 feet along the right side of the foundation to 20 feet at the center and left side. The cutoff trench in continuous with an impervious zone in the embankment which extends from the base of the dam to a crest at elevation 337.5. The crest line of the impervious core is approximately 30 feet upstream of, and parallel to, the centerline of the dam. Both the trench and impervious zone were to be constructed of residual silty clay and clayey silt excavated from the floor of the emergency spillway and a nearby supplemental borrow area.

The main portion of the embankment consists of silty sand placed at a 3H to 1V configuration for both the upstream and downstream slopes. A berm, 12 feet in width, was constructed one foot below the normal pool elevation of 323.5. Riprap slope protection extends from the berm to a level 5 feet above the berm.

Internal drainage of the embankment is provided by a network of hydraulically connected filter trenches, blanket drain and rock fill toe on the downstream side of the dam. The filter trenches are situated along the steep left and right downstream abutments, extend vertically from the stripped groundline to a level about 3 feet below the weathered rock horizon, and drain into the seepage blanket near the downstream toe. The seepage blanket and trenches are constructed of well graded sand and gravel designed in accordance with methods recommended by the U.S.D.I., Bureau of Reclamation. A rock fill is placed at the downstream toe to provide free drainage of the internal seepage control system.

3. Appurtenant Structures - An overflow spillway riser of reinforced concrete is located on the left side of the dam and is drained by a 42 inch reinforced concrete pipe extending through the embankment to a riprap lined plunge pool. The riser structure is supported on a concrete pad with the foundation level to be determined during construction by the Engineer.

The spillway pipe is supported along most of its length by a reinforced concrete cradle and is surrounded by eleven concrete antiseep collars, 14 feet wide by 9 feet high minimum, placed at intervals of 24 feet. The spillway pipe trench is over excavated to a level several feet below the top of weathered rock and backfilled with impervious material to the pipe foundation level.

The riser tower contains a gate controlled drain with an intake invert at elevation 303.0, two 24-inch diameter gate controlled, cold water intakes at elevations 308.5 and 315.0, two low stage orifices at elevation 325.5 and two high stage weirs with crest elevations at 335.5. The low stage and high stage intakes are provided with trash racks.

The emergency spillway is located beyond the left abutment of the dam and is formed by cut into weathered schist material. The emergency spillway floor is 180 feet in width, rises at a grade of 1% for a length of 280 feet, reaches a 20 foot wide level crest at elevation 351.0, drops at a grade of 2% for 150 feet and .25% for 427 feet. The side slopes of the emergency spillway are constructed at a 2 1/2H to 1V configuration.

2.2 Construction: Construction specifications and as-built drawings are the only available construction documents. The as-built drawings generally reflect the intent of the design report, the design drawings and existing conditions. The as-built drawings indicate the details of the grouting program for the foundation along the right side of the dam including the spacing, depth, and grout quantities for each grout hole. Notations on the drawings indicate that the impervious zone within the embankment was extended to include an area from the upstream embankment toe to a location within 60 feet of the downstream toe. The extension was implemented to utilize excess quantities of clayey materials excavated in the borrow areas. Also, the downstream outer shell of coarse granular material was deleted due to the fact that the weathered schist was sufficiently disaggregrated upon excavation and placement to be classified as a silty sand. The rockfill at the downstream toe was extended several

feet to more adequately protect the spillway pipe outlet at the plunge pool. The spillway riser foundation is shown to extend to competent rock.

2.3 Operation. Lake Needwood Dam was designed primarily as a self operating flood control structure with uncontrolled outlet works. Secondary benefits are derived from water recreation activities for Rock Creek Park operated by the Maryland National Capital Park and Planning Commission. Reports entitled "Annual Operation and Maintenance Inspection" are prepared by the Montgomery County Soil Conservation District and the owner on a regular basis. The only operational features on the dam are cold water intake gates on the spillway riser for downstream water quality. A cable controlled slide gate drain is also located at the base of the riser. At the time of inspection the cable was severed and the gate was inoperable.

2.4 Evaluation

a. Availability. The Design Report, design drawings, construction specifications, and as-built drawings are available in the files of the State of Maryland Water Resources Administration, Dam Safety Division and the Soil Conservation Service.

b. Adequacy. The available data is complete and adequate to evaluate the dam and appurtenant structure for the purposes of a Phase I study. Based upon review of this data the facility generally has been designed in accordance with accepted engineering practice.

c. Operating Records. The only written operating records are the Annual Operation and Maintenance Inspection reports prepared by the local Soil Conservation District and the owner.

d. Post Construction Changes. Minor post construction changes consist of re-vegetating the embankment slopes and installing a fence network to deter foot traffic from the embankment slopes.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The dam and its appurtenant structures were found to be in good overall condition at the time of the inspection, June 15, 1979. The complete visual inspection check list is presented in Appendix A.

b. Dam.

1. There is no cracking, sloughing or other appreciable movement in the embankment.

2. The vertical and horizontal alignment are good with no evidence of settlement. The as-built camber remains evident.

3. At the time of the inspection, there were no noticeable seepage areas.

4. There was one animal burrow located on the downstream slope.

5. There was a small eroded area on the service roadway beyond the right abutment.

c. Appurtenant Structures.

1. The concrete associated with the visible portions of the intake tower was in good condition.

2. The cable operating a drain gate on the cold water chamber is broken.

d. Reservoir Area. The reservoir slopes are primarily wooded. Sedimentation is reported by the owner in the upper reaches of the pool area. The forebay area upstream of Needwood Road was designed to trap sediment. Past flocculation experiments have been discontinued and, currently, biannaul dredging is performed.

e. Downstream Channel. The discharge from the principal spillway and emergency spillway during rare flood events join approximatley 2000 feet below the dam. In the immediate vicinity of the dam, Rock Creek flows beneath the Maryland Route 28 bridge and through parkland owned and operated by the Maryland National Capital Park and Planning Commission. The present demand of these lands as a recreational facility is reported to be 500,000 visitors annually.

3.2 Evaluation. With the exception of the inoperable draingate, the dam and its appurtenant structures are in good condition.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The purpose of the dam at Upper Rock Creek Site #5 is to provide for recreation and flood control. Discharges to the downstream areas are uncontrolled through the intake tower and thence through the 42 inch concrete outlet pipe. Additionally, three different levels of controlled cold water releases may be accomplished.

4.2 Maintenance of the Dam. No written maintenance program has been established, but the general appearance of the dam indicates a high degree of care. The Maryland National Capital Park & Planning Commission has the responsibility to maintain the dam. It should be noted that the owner has, in the past, requested, received and followed advice of the Soil Conservation Service.

4.3 Maintenance of Operating Facilities. Reportedly, the inoperative conditions at the intake tower have spanned the last year. A written operating and maintenance policy should preclude, in the future, a similar condition.

4.4 Warning System. There is no formal warning system in effect.

4.5 Evaluation. The general operational procedures are satisfactory except that no formal warning system is in effect and maintenance procedures are unwritten.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. The dam at Upper Rock Creek Watershed Site #5 was designed for recreational and flood control purposes. The complete hydraulic design, satisfying the Soil Conservation Service's class "C" criteria, is included as the Hydrology and Hydraulics Section of the Engineer's Design Report dated April, 1964. The development of the inflow design flood under class "C" criteria closely approximates the recommended Spillway Design Flood of the full Probable Maximum Flood (PMF). According to the Design Report, the crest of the principal spillway riser is at the elevation attained by a 10 year frequency flood event. The crest of the emergency spillway was set at the elevation attained by the 100 year frequency flood event. Design High Water was then calculated by routing a flood hydrograph having 8.6 watershed inches of volume by starting at a pool elevation approximately 3 feet above normal pool to account for possible mutiple storm events. The top of the embankment was set by routing a flood hydrograph having 24.7 watershed inches of runoff volume with the same assumption of starting elevation.

b. Experience Data As previously stated, the dam at Upper Rock Creek Watershed Site #5 is classified as an intermediate size dam in the high hazard category. Under the recommended criteria for evaluating spillway discharge capacity, such structures are required to pass the Probable Maximum Flood (PMF). Since the dam was constructed, the maximum pool elevation was attained during Hurricane Agnes in 1972 and reportedly reached within 1 foot of the emergency spillway crest. According to the Design Report, the storm of record (August, 1933) would have reached pool elevation 352.2 or approximately 1 foot above the emergency spillway crest. No written or verbal records indicate that the emergency spillway has been activated.

c. Visual Observations. On the date of the inspection no conditions were observed that would indicate that the emergency spillway of the dam could not operate satisfactorily in the event of a flood.

d. Overtopping Potential. To check the Freeboard Hydrograph procedure as applied to the dam, the full PMF inflow hydrograph was routed through Lake Needwood according to the recommended guidelines. The results are presented in Appendix E. The analyses indicate that the full PMF can be discharged without overtopping the embankment.

e. Spillway Adequacy. The Design Report together with the current results indicate that the reservoir storage and spillway capacity can discharge the full PMF. Accordingly, the spillway is considered adequate.

f. Downstream Conditions. As previously discussed in Section 3, damages, as a result of dam failure, to Rock Creek Park, and State roads are considered likely. Due to the heavy recreational use, loss of life is probable.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. No visible signs of appreciable movement or distress were detected in the earthen embankment or appurtenant structures. No seepage points or wet zones were detected on the downstream face of the dam, at the toe or beyond the toe. The water in the stilling basin was clear and no indication of loss of embankment or internal drain filter material was detected. The vegetative cover of emergency spillway was well established and the side slopes uniform and stable. With the exception of the inoperative drain gate, visual observations revealed the dam and appurtenant structures to be in excellent condition.

b. Design and Construction Data.

1. Embankment. Based upon the subsurface data, the embankment was placed on dense to medium dense residual soil which appears competent to support the design load. A consolidation test was performed on a portion of the least dense silt sample obtained during the foundation exploration, and a settlement analysis utilizing the test results indicated that approximately 6 inches of foundation settlement was anticipated in the design. This sample and another sample representative of average conditions within the foundation soil were subjected to triaxial testing and the lowest strength parameters of $\emptyset$ equal to 20.5° and cohesion equal to 825 p.s.f. were utilized in slope stability analyses.

Representative samples of compacted embankment material were also subjected to triaxial testing and average strength values of $\emptyset$ equal to 31° and C=300 p.s.f. were recommended for use in slope stability studies. These values are considered reasonable for effective stress analysis of the clayey silts, silty clays and silty sands utilized in the embankment construction. Slope stability analyses were performed for the upstream slope utilizing the Swedish Circle method with the slide arc assumed to occur from the downstream crest of the embankment through the upstream toe of slope. Four trials were performed and the lowest factor of safety computed was 1.59 which was conservatively derived utilizing the lowest strength foundation material and low strength values for the embankment material. The downstream slope was analyzed by a sliding block analysis which yielded a minimum factor of safety of 1.51 assuming no cohesion in the foundation materials. Based upon the design review, these analyses are considered to have adequately addressed the static slope stability of the dam.

In order to compensate for residual settlement of the embankment and foundation materials upon completion of the dam, two feet of fill was added to the design crest at the maximum section. The additional height was determined by a settlement analysis utilizing the results of the consolidation test on the foundation materials and an estimate of consolidation of the embankment materials from the consolidation phase of the triaxial tests. The analysis was apparently conservative since the camber provided for the crest during construction is still readily visible.

Design data for the internal seepage control system was limited to the details on the as-built drawings of the filter drain trenches, filter blanket, cutoff trench, and grouting program along the right side of the dam. Filter design was based upon the coarse granular weathered rock material which was anticipated by the designers to be excavated in the emergency spillway and placed as a pervious zone in the downstream slope. Since this material disaggregated substantially upon excavation, placement, and compaction, this zone was deleted during construction. In addition, an abundance of silty clay and clayey silt borrow materials caused the impervious core to be extended downstream over the seepage control filter blanket. The as-built drawings do not indicate any modification of the design filter gradation to account for the finer material placed over the filter. As such, the drainage efficiency of the filter blanket may decrease due to migration of a larger percentage of fines than intended.

Average seepage quantities through the foundation were estimated to range between 40 gallons per minute at normal pool to 142 gallons per minute with the reservoir level at el. 350. These quantities were based upon average permeability values of 10 feet per day for the upper 20 feet of foundation material and 5 feet per day for the next 20 feet of depth, assuming no grouting of the foundation. Flow nets, derivation of exit gradients, seepage quantity estimates after partial grouting, and filter trench drainage capacities were not addressed in the design report. The geologic interpretations of the water pressure testing and rock core fractures relative to the foundation grouting along the right side of the dam were also not addressed in the design report. Review of the subsurface data did not reveal any substantial differences to warrant grouting of the one side of the foundation and not the other. Based upon the observed dry conditions downstrea, however, the grouting program and internal drainage system appear to be functioning satisfactorily.

2. Appurtenant Structures. Based upon the data in the design report, the appurtenant structures were designed in accordance with good engineering practice. The reinforced concrete elements were analysed for maximum loading conditions by the working stress method utilizing 300 p.s.f. concrete and a steel allowable stress of 20,000 k.s.i.

c. Operating Procedures

Detailed operating procedures are unwritten and were unavailable for review. The Annual Operation and Maintenance Inspection sheets were reviewed and they did not reveal any major deficiencies which might affect the integrity of the dam.

d. Post Construction Changes

The post construction changes of re-vegetation and fencing of the embankment slopes should aid in maintaining the stability of the dam.

e. Seismic Stability

Lake Needwood Dam is located in seismic zone 1 and seismic stability is predicated upon static stability with conventional margins of

safety. The static stability is considered sufficient to withstand minor earthquake induced forces.

SECTION 7
ASSESSMENT, REMEDIAL MEASURES AND RECOMMENDATIONS

7.1 Dam Assessment.

a. Safety. Based upon visual inspection and review of design and construction documents, the dam at Upper Rock Creek Watershed Site #5 appears to presently be in good condition. Preliminary hydrologic and hydraulic analyses indicate the emergency spillway is capable of passing PMF without overtopping of the dam.

b. Adequacy of Information. The available information consists of as-built construction drawings, Engineer's Design Report and Test Results. The available information is adequate to assess the project.

c. Urgency. The recommendations should be implemented as soon as possible.

d. Necessity for Additional Studies. No additional engineering studies are necessary at this time.

7.2 Remedial Measures and Recommendations.

a. Dam and Appurtenant Structures

1. Re-establish the operating condition of the gated drain within the cold water release chamber.

2. Backfill and reseed all eroded areas and animal burrows.

b. Operation and Maintenance Procedures

1. Document operating procedures in writing.

2. Develop a warning system to warn downstream residents of large spillway discharges during periods of heavy rainfall and runoff or failure of the dam.

APPENDIX A

CHECK LIST - VISUAL INSPECTION, SITE SKETCH, PHASE I

Check List
Visual Inspection
Phase I

Name of Dam Upper Rock Creek Watershed Site #5 ID # MD 00046

Common Name of Dam / Lake Lake Needwood

County Montgomery State Maryland

Type of Dam Earth Hazard Category 1

Date(s) of Inspection 6 /15/79 Weather Clear / Sunny

/ / Temperature 75°F

Pool Elevation at Time of Inspection 323.5± MSL Tailwater 298.2± MSL

Normal Pool Elevation 323.5 MSL

Inspection Personnel:

Water Resources Administration	M.N.O.P.P.C.	U.S.D.A.-S.C.S.	Montg.S.C.D.
J. O. Smith	Jerry Bush	Richard Nagel	Bob Rakestraw
T. J. Moynahan	John M. Bowen (Mac)	Larry Herrington	
J. M. Wagner		George Daelemans	
R. T. Folkman			
L. J. Arthurs			

Recorder J. O. Smith

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
SURFACE CRACKS	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good, camber on crest is discernable
RIPRAP FAILURES	No failures on upstream slope No failures at toe

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No noticeable erosion
ANY NOTICEABLE SEEPAGE	None
STAFF GAGE AND RECORDER	N/A
DRAINS	Cable snapped for drain gate, other 3 gates operable.

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None
INTAKE STRUCTURE	No cracking or spalling
OUTLET STRUCTURE	No discernable deflection, see site sketch for chipping pipe top.
OUTLET CHANNEL	Well vegetated channel bank.
EMERGENCY GATE (DRAIN)	Cable broken

VISUAL INSPECTION
PHASE I
UNGATED EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
CONCRETE WEIR	N/A
APPROACH CHANNEL	Short grass and clear.
DISCHARGE CHANNEL	Short grass and clear
BRIDGE AND PIERS	N/A

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

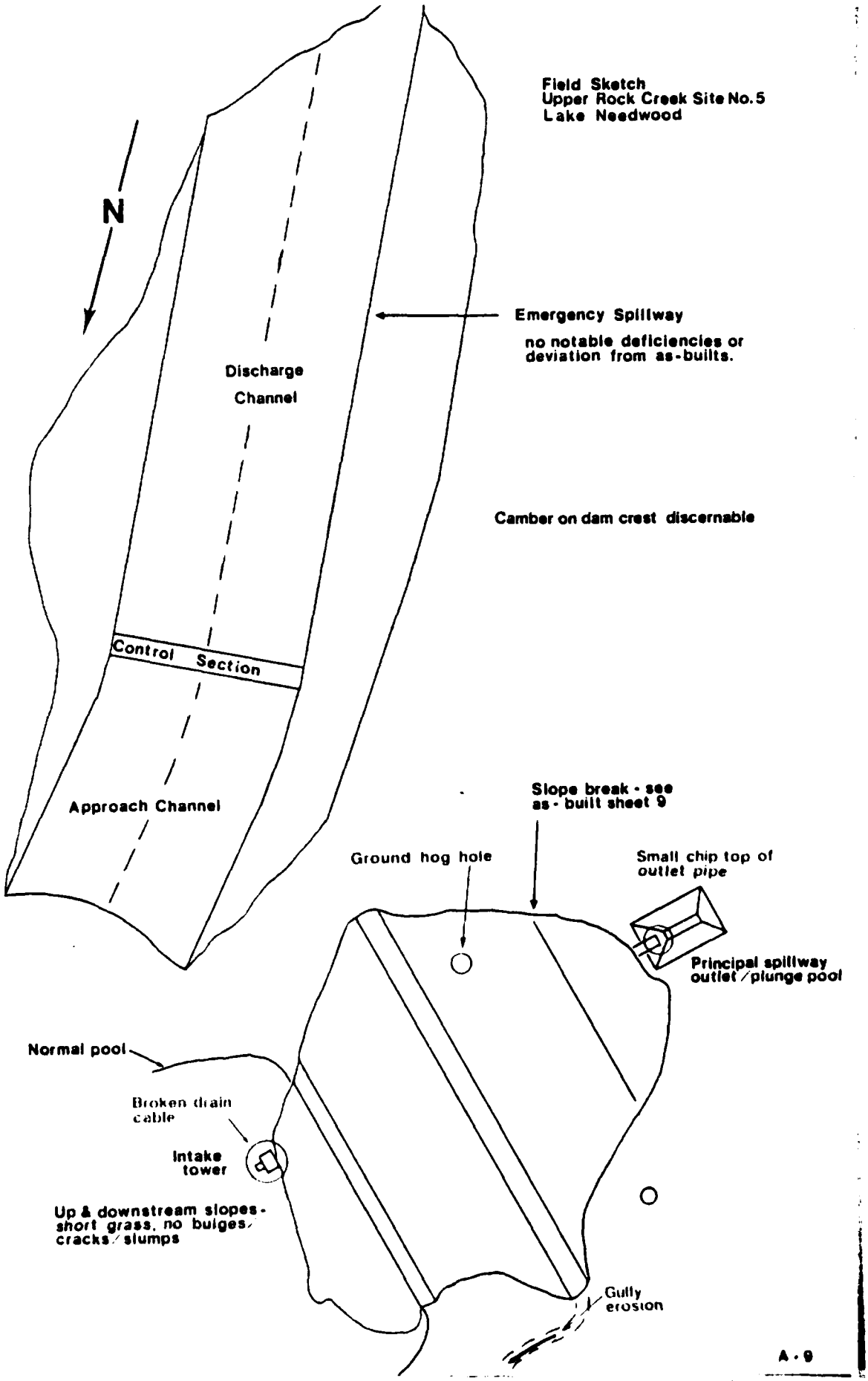
VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
MONUMENTATION/SURVEYS	Bench marks for sedimentation survey in pool area. No verticle or horizontal control for emabnkment or spillway
OBSERVATION WELLS	None
WEIRS	None
PIEZOMETERS	None

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
SLOPES	Stable in recreation areas, are maintained as beach of walkway areas.
SEDIMENTATION	Floculation experiments in forebay area (Dow Chemicals) discontinued. Forebay was designed to fill up; however, forebay is dredged out every two years (upstream of Needwood Rd.).

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS/RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS,ETC.)	None at present, has been cleaned in past (5 years).
SLOPES	Stable well vegetated banks, gravelly bottom.
APPROXIMATE NO. OF HOMES AND POPULATION	No homes apparent in immediate danger reach but heavy recreational use of downstream Rock Creek Park, Md. Rte. 28 downstream.
MISC.	4-500,000 annual usage of lake facilities.


Field Sketch
Upper Rock Creek Site No. 5
Lake Needwood
N
Emergency Spillway
no notable deficiencies or
deviation from as-builts.
Discharge
Channel
Camber on dam crest discernable
Control Section
Approach Channel
Slope break - see
as-built sheet 9
Ground hog hole
Small chip top of
outlet pipe
Principal spillway
outlet/plunge pool
Normal pool
Broken drain
cable
Intake
tower
Up & downstream slopes -
short grass, no bulges,
cracks/slumps
Gully
erosion

APPENDIX B

CHECK LIST - ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION,

PHASE I

DAM NAME: Upper Rock Creek Site #5
COMMON NAME: Lake Needwood
ID #: MD 00046

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded stream valleys, farming and new home development. SCS design Runoff Curve Number 82.

ELEVATION TOP OF NORMAL POOL (STORAGE CAPACITY): 323.5 (600)

ELEV. TOP OF FLOOD CONTROL POOL (STORAGE CAPACITY): 351.0 (4300)

ELEVATION MAXIMUM DESIGN POOL: 355.5 (5100)

ELEVATION TOP OF DAM: 363.6

CREST-Principal Spillway Riser

a. Elevation 355.5 (crest) 317.0 (top slab)
b. Type Reinforced Concrete Riser
c. Width Two 10.5 ft. long crests
d. Number and Type of Gates Three 24" diameter Rodney Hunt 280 Series Sluice Gates, one at 315.0, one at 308.5, both for cold water release; one at 303.0 for drain. One 2 ft. x 3.5 ft. wide sluice gate at elev. 303.0 for drain.
e. Ungated Orifice Twin 2 ft. x 3 ft. wide openings at elev. 325.5 for normal releases.

CREST-Emergency Spillway (Earth Cut)

a. Elevation 351.0
b. Width 180.0 feet
c. Length 840 feet
d. Location beyond left abutment

OUTLET WORKS:

a. Type 42" R.C. Pipe
b. Location station 3+01 (left of center of dam)
c. Entrance Inverts 303.0
d. Exit Inverts 299.0
e. Emergency Drawdown Facilities
f. Length 408 feet

HYDROMETEOROLOGICAL GAGES:

		Daily	Hourly
a.	Type	NOAA-NWS	NOAA-NWS
b.	Location	Rockville 3 NE	College Park
c.	Records	32 yrs. of record	93 yrs. of record

ITEM	REMARKS	
	EMERGENCY	PRINCIPAL
SPILLWAY PLAN	Refer to plan sheet 3 for layout	Refer to plan sheet 3 for layout
SECTIONS	Refer to plan sheet 7 for profile	Refer to plan sheet 9 for profile
DETAILS	N/A	Refer to plan sheet 17,18,19,20, for structural details.
OPERATING EQUIPMENT PLANS & DETAILS		Refer to plan sheet 17 for gate location & nomenclature.

ITEM	REMARKS
MONITORING SYSTEMS	None installed
MODIFICATION	1-Winch operated slide gate for bottom orifice of cold water mixing chamber designed by College Park office of SCS, plan sheet dated 8/16/67.
HIGH POOL RECORDS	Not recorded
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	Annual Operation & Maintenance Inspection Report by SCS dated 3/30/67, 4/25/68, 12/12/74 & 11/3/77. Trip Report 13 July 72 by Corps of Engineers. Water Quality Studies 12/7/67 by Water Resources Administration.
PRIOR ACCIDENTS OF FAILURE OF DAM DESCRIPTION, REPORTS-	None Verbal report of high water during Hurricane Agnes.

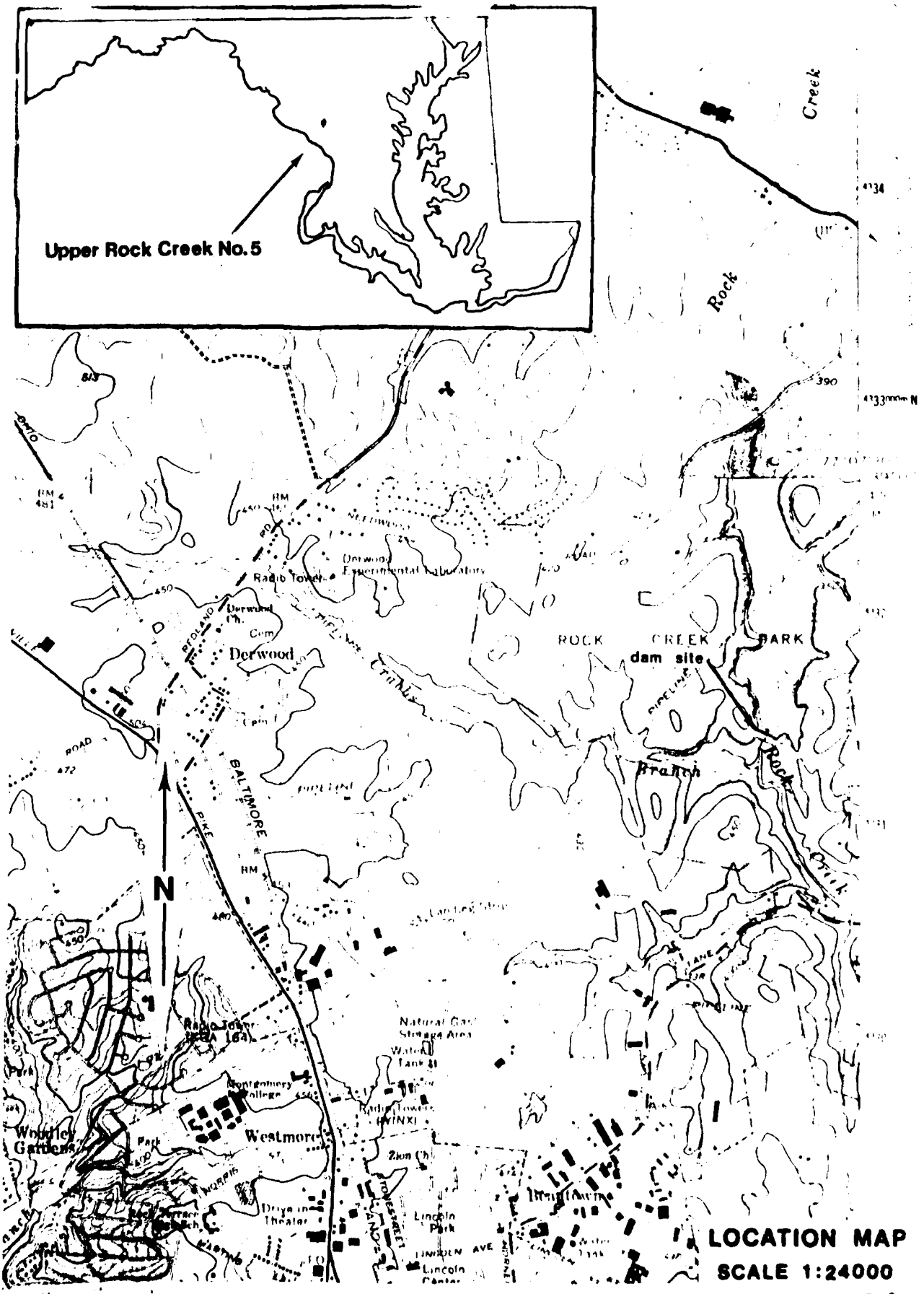
ITEM	REMARKS
MAINTENANCE OPERATION RECORDS	No written history of maintenance performed, see annual O&M reports for deficiencies/remedial measures recommended.
MISC.	Water Resources Construction Permit 64-OB-0003 dated May 14,1964.
DESIGN REPORTS	Design Report for Upper Rock Creek Watershed Site No. 5 Dated April, 1964 by USDA-SCS Upper Darby, Pa.
GEOLOGY	Included in Design Report Section II.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Included in Design Report Included in Design Report as Section III Included in Design Report as Section IV Included in Design Report as Section IV

ITEM	REMARKS
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Included in Design Report as Section II. For borings see plan sheets 11-16. Included in Design Report as Section II.
POST CONSTRUCTION SURVEY OF DAM	See as-built drawings
BORROW SOURCES	See plan sheet 5.
AS BUILT DRAWINGS	Available
REGIONAL VICINITY MAP	Available

ITEM	REMARKS
CONSTRUCTION HISTORY	
TYPICAL SECTIONS OF DAM	See as-built drawings
OUTLET-PLANS -DETAILS -CONSTRAINTS -DISCHARGE RATINGS	See as-built drawings See as-built drawings See Design Report Section III, Sheet 24
RAINFALL/RESERVOIR RECORDS	Daily rainfall records obtained by owner for National Weather Service in vicinity of Regional Park; no pool records maintained.

APPENDIX C

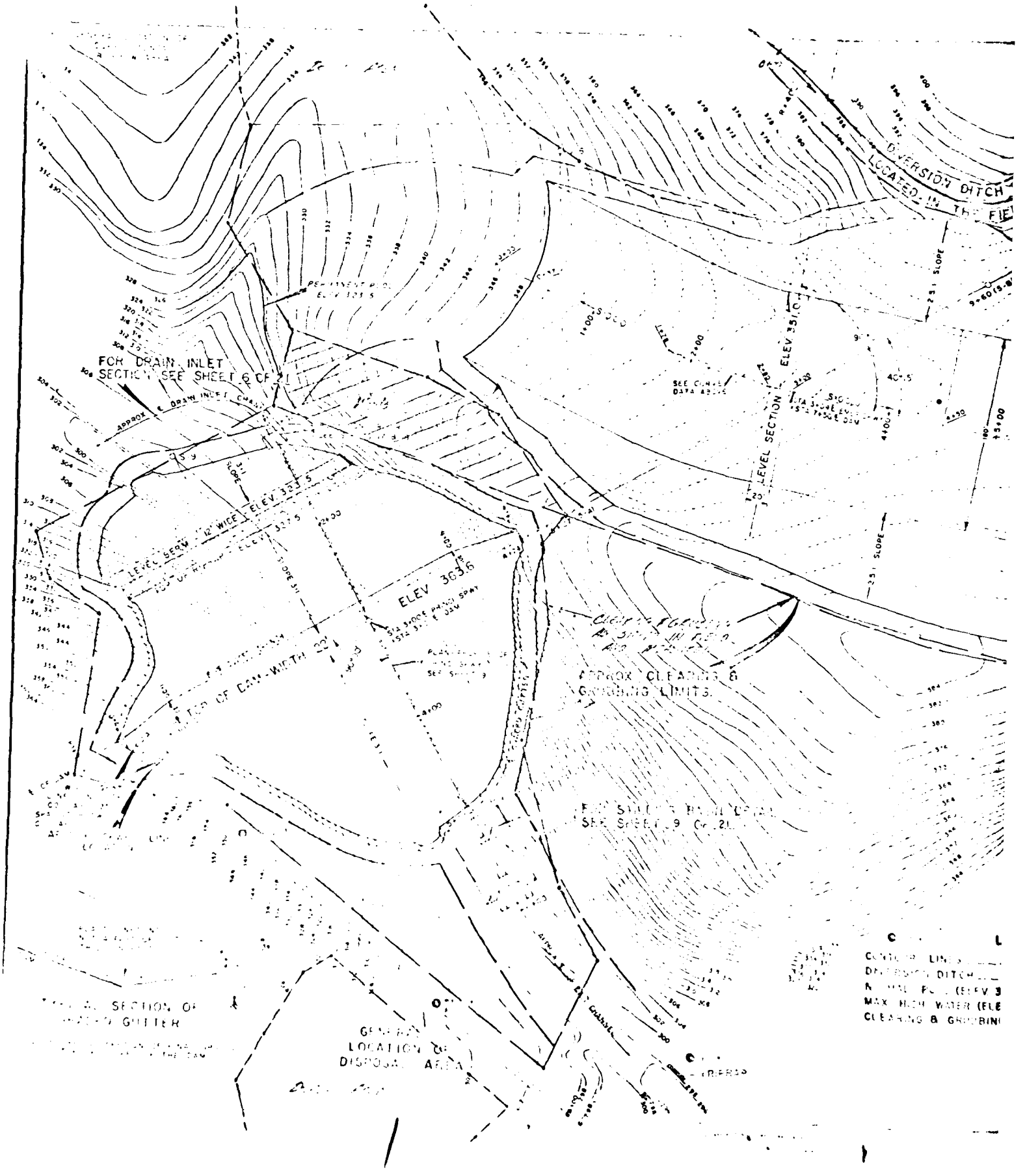
LOCATION MAP & PLANS

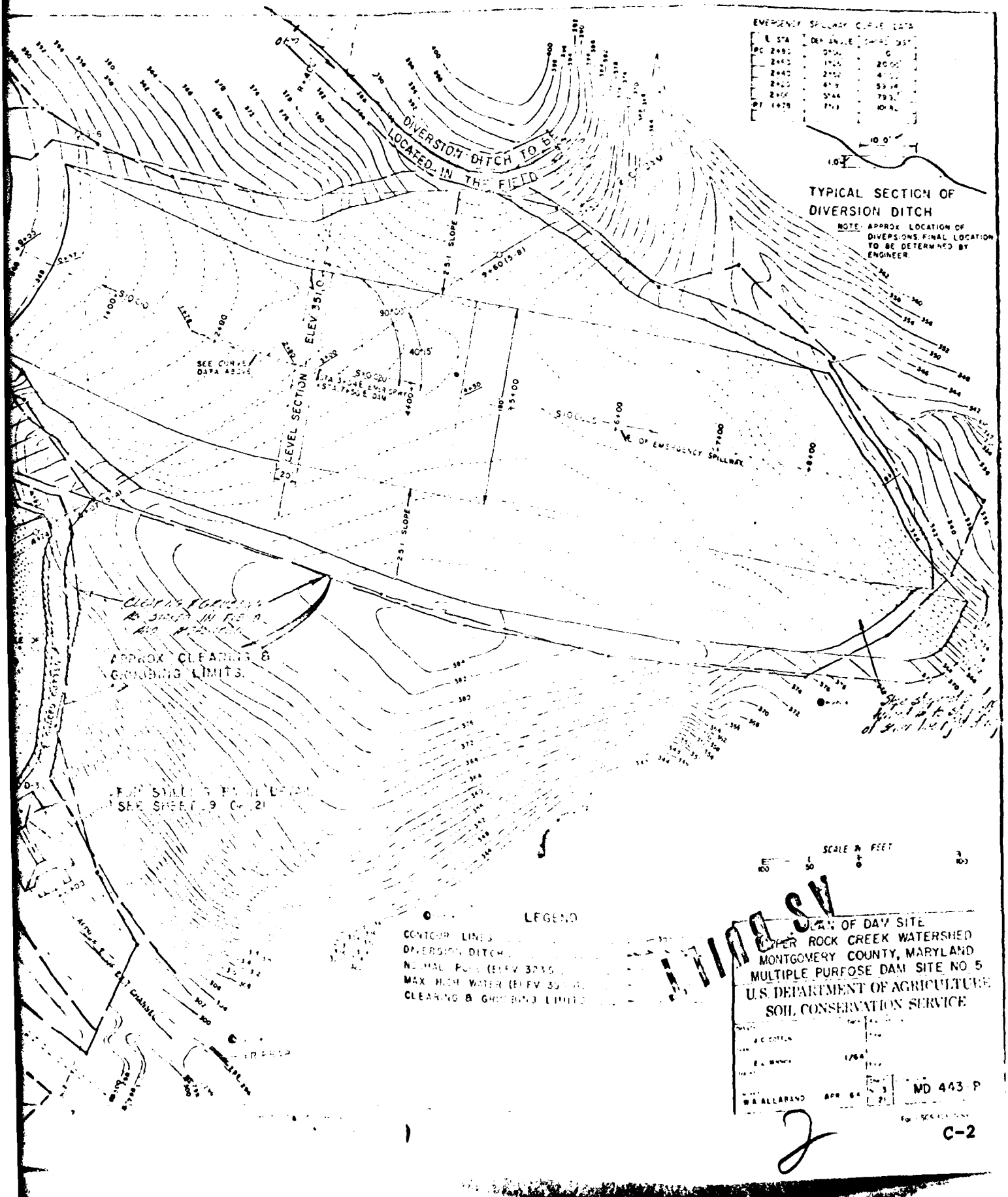


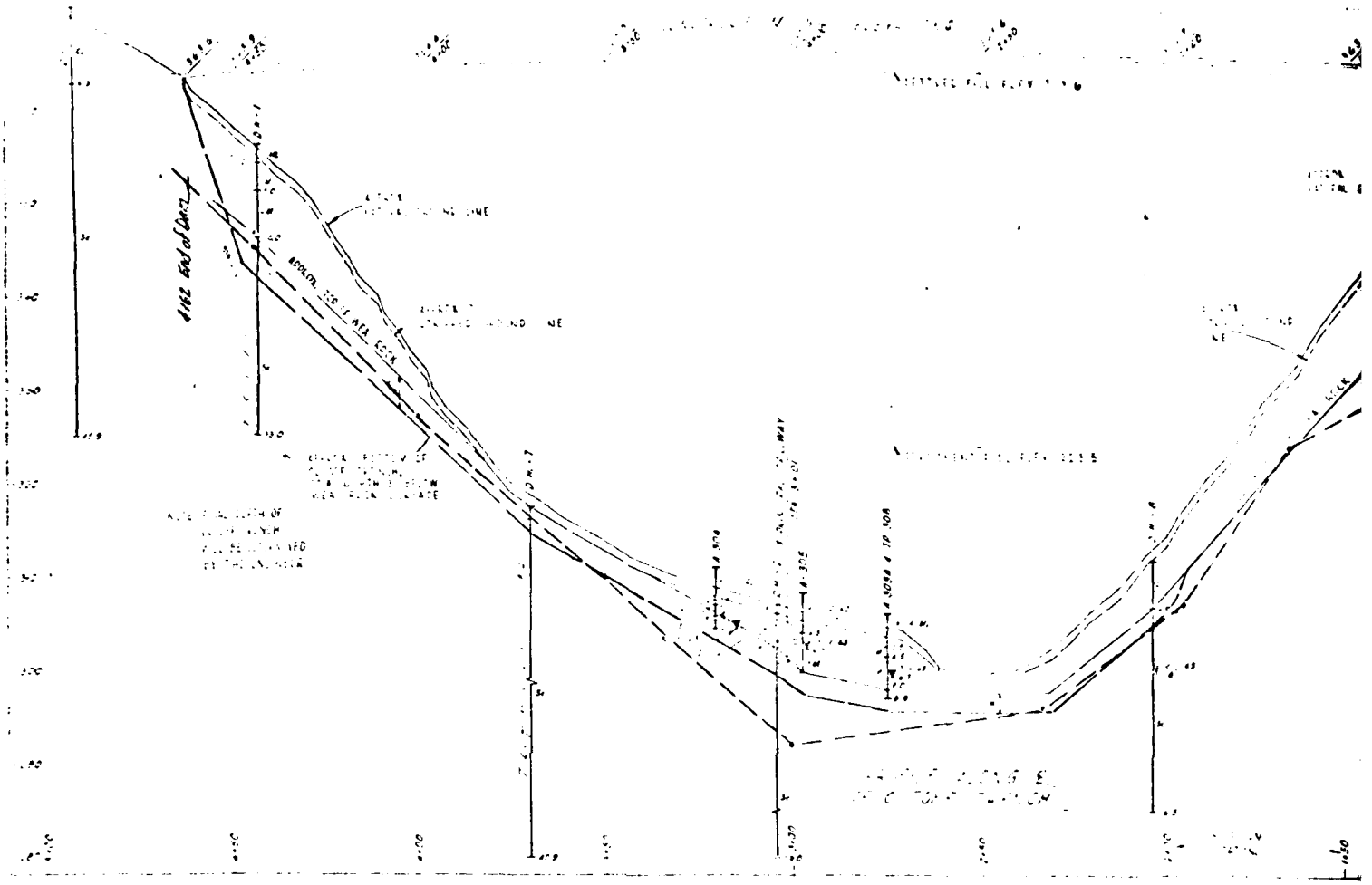
LOCATION MAP

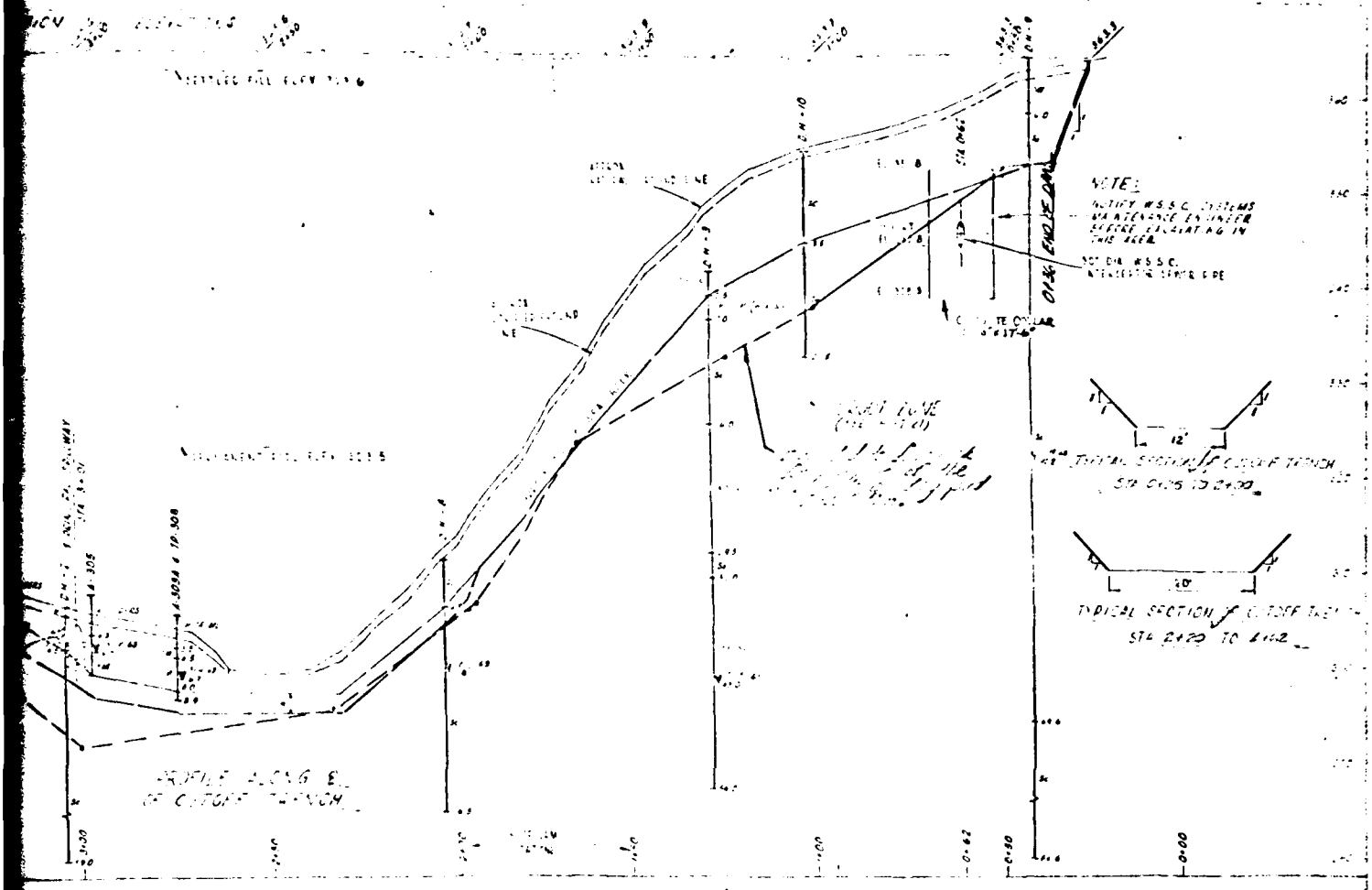
SCALE 1:24000

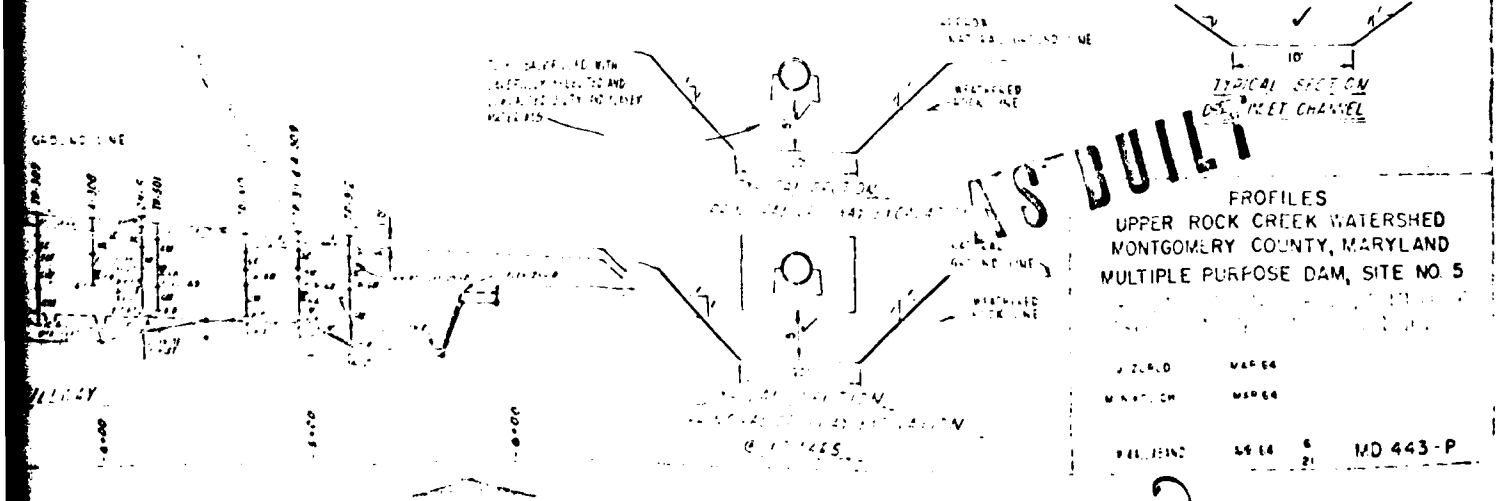
C-1


DIVERSION DITCH
FOR DRAIN INLET
SECTION SEE SHEET 6 OF 21
ELEV 351.0
LEVEL SECTION
ELEV 3636
APPROX CLEARING & GRUBBING LIMITS
SEE SHEET 9 OF 21
TYPICAL SECTION OF GUTTER
GENERAL LOCATION OF DISPOSAL AREA
CLEARING & GRUBBING


EMERGENCY SPILLWAY CURVE DATA
TYPICAL SECTION OF DIVERSION DITCH
NOTE: APPROX LOCATION OF DIVERSIONS, FINAL LOCATION TO BE DETERMINED BY ENGINEER.
DIVERSION DITCH TO BE LOCATED IN THE FIELD
LEVEL SECTION ELEV 351.0
2:1 SLOPE
SEE CURVE DATA ABOVE
CENTER OF EMERGENCY SPILLWAY
APPROX CLEARING & GRUBBING LIMITS
SCALE IN FEET
LEGEND
CONTOUR LINES
DIVERSION DITCH
NORMAL POOL (ELEV 329.0)
MAX HIGH WATER (ELEV 351.0)
CLEARING & GRUBBING LIMITS
PLAN OF DAM SITE
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM SITE NO 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MD 443-P
C-2





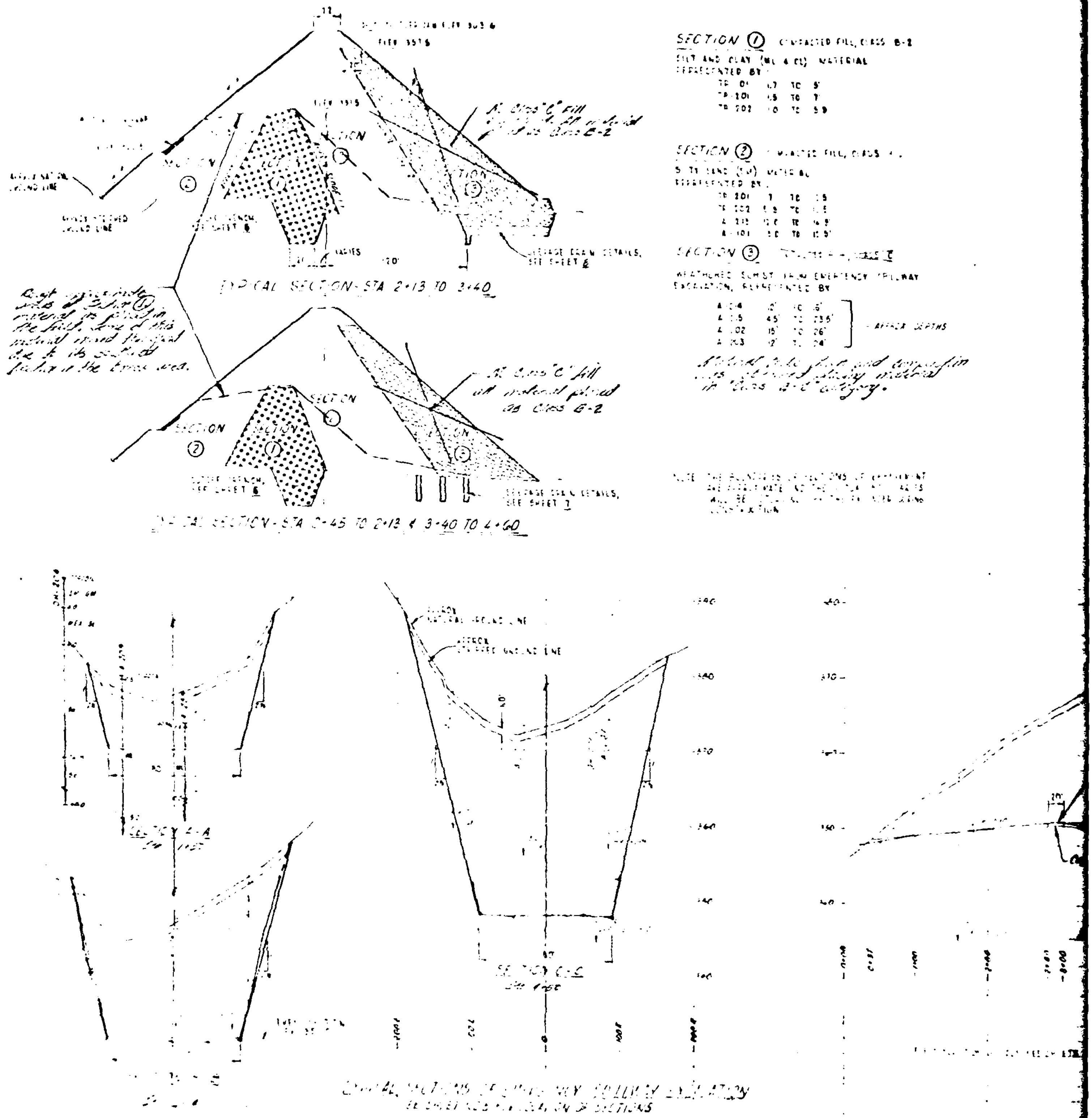


AS BUILT

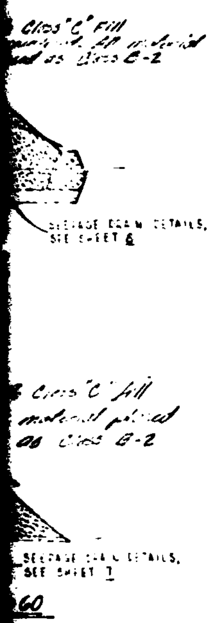
PROFILES
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO. 5

MD 443-P

C-3



SECTION ①
SILT AND CLAY (ML & CL) MATERIAL
SECTION ②
SECTION ③
WEATHERED SCHIST FROM EMERGENCY SPILLWAY
APPROX. DEPTHS
TYPICAL SECTION - STA 2+13 TO 3+40
SEEPAGE DRAIN DETAILS, SEE SHEET
SECTION C-C



SECTION ① COMPACTED FILL, CLASS B-2

SILT AND CLAY (ML & CL) MATERIAL
REPRESENTED BY:

TP-01	4.7	TO	5'
TP-201	1.5	TO	7'
TP-202	1.0	TO	5.9'

SECTION ② COMPACTED FILL, CLASS [illegible]

SILTY SAND (SM) MATERIAL
REPRESENTED BY:

TP-201	7'	TO	[illegible]
TP-202	5.9'	TO	[illegible]
A-215	[illegible]	TO	14.9'
A-101	[illegible]	TO	15.9'

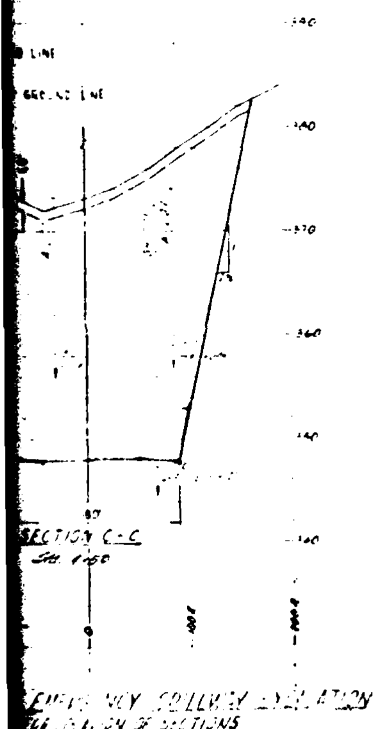
SECTION ③ [illegible]

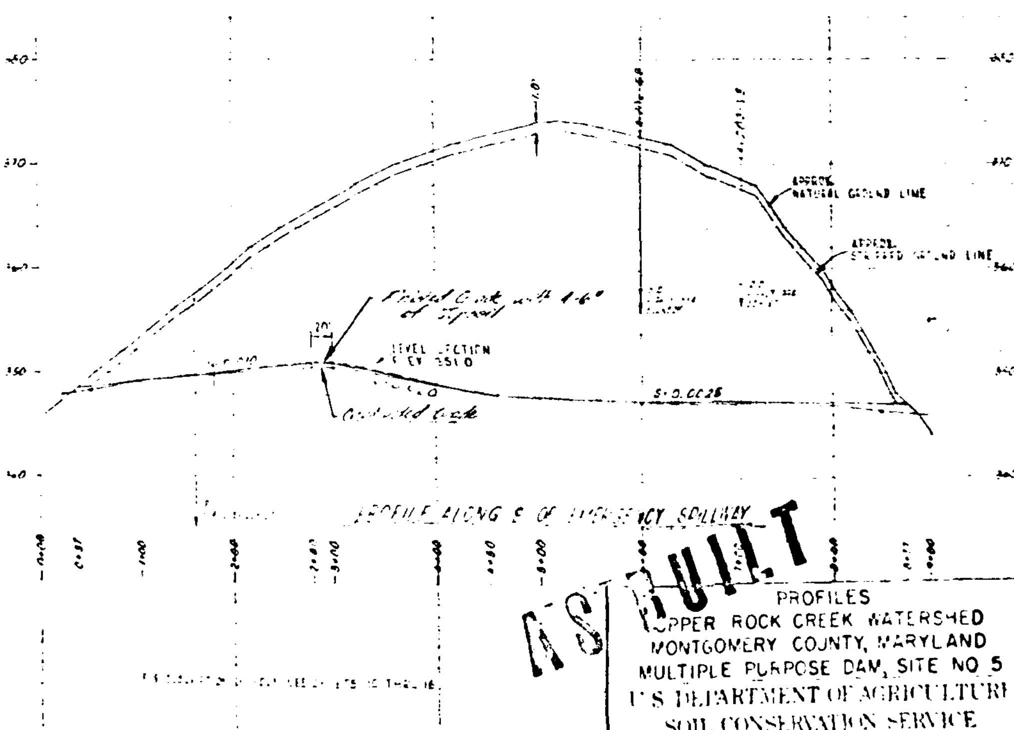
WEATHERED SCHIST FROM EMERGENCY SPILLWAY EXCAVATION, REPRESENTED BY

A-214	2'	TO	6'	– APPROX. DEPTHS
A-215	4.5'	TO	23.5'	
A-202	15'	TO	26'	
A-203	12'	TO	24'	

[illegible]

NOTE: THE BOUNDARIES OF SECTIONS OF EMBANKMENT ARE APPROXIMATE AND THE ACTUAL BOUNDARIES WILL BE DETERMINED BY THE ENGINEER DURING CONSTRUCTION.



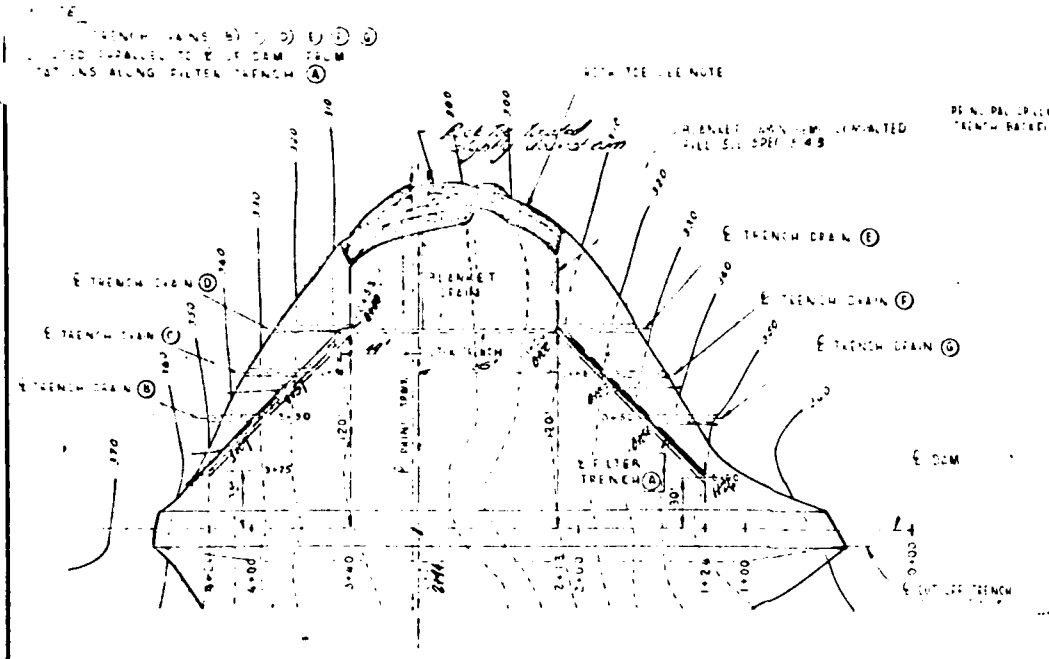


AS BUILT

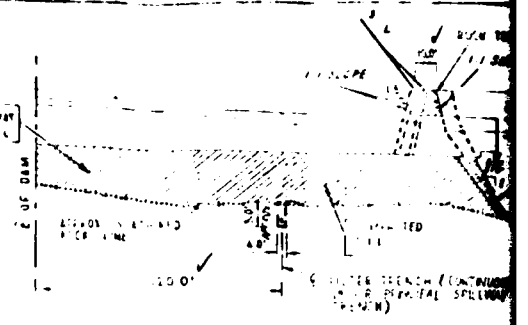
PROFILES
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO. 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MD-443-P

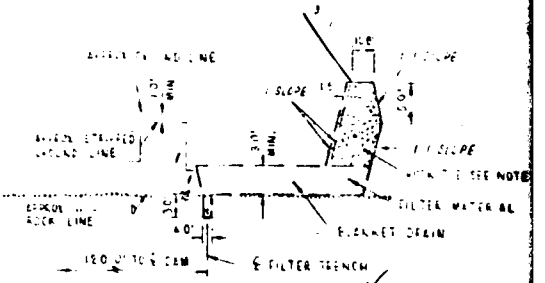
2



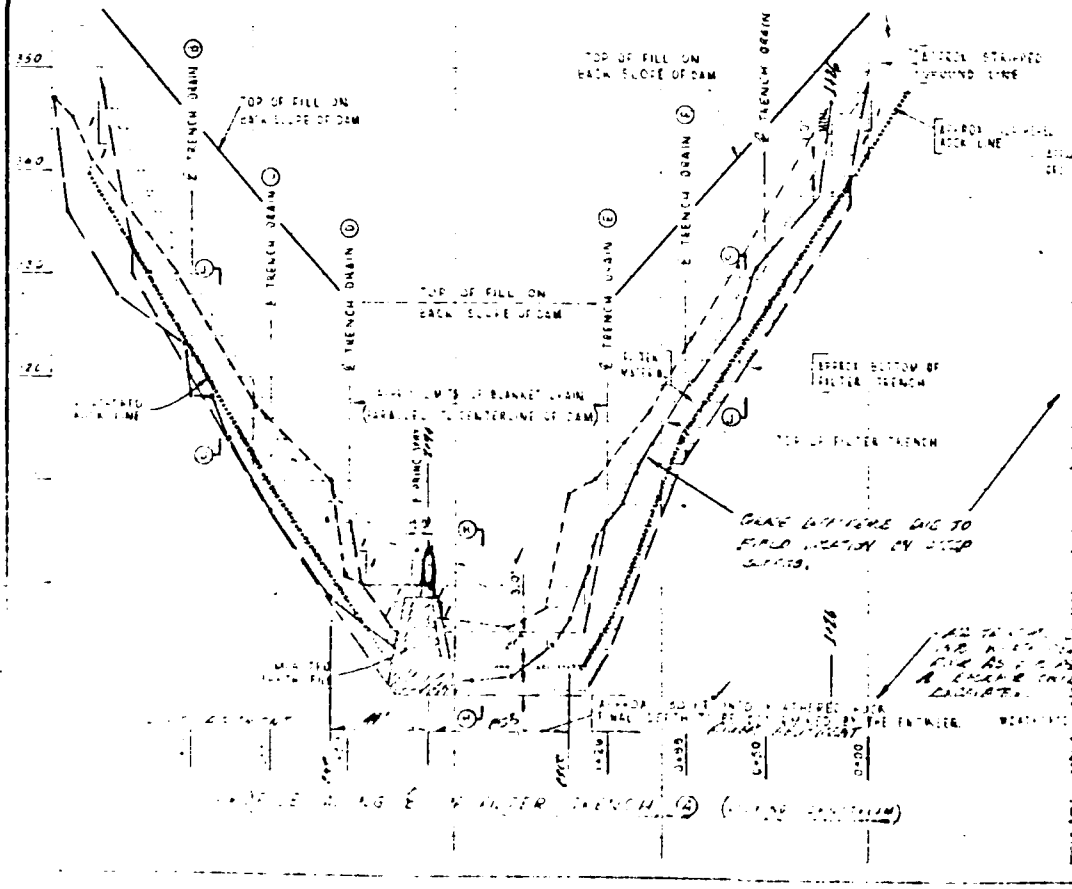
PLAN VIEW OF BLANKET & TRENCH DRAINS

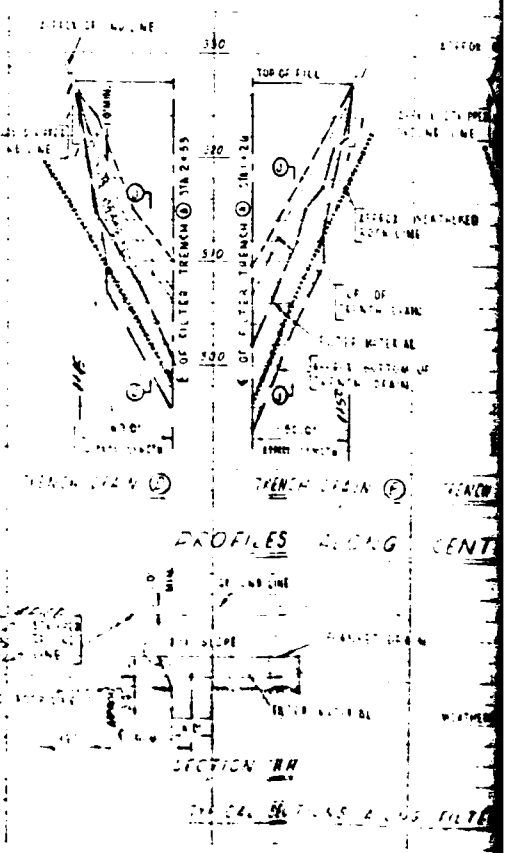


TYPICAL SECTION OF ROCK TOE & BLANKET DR



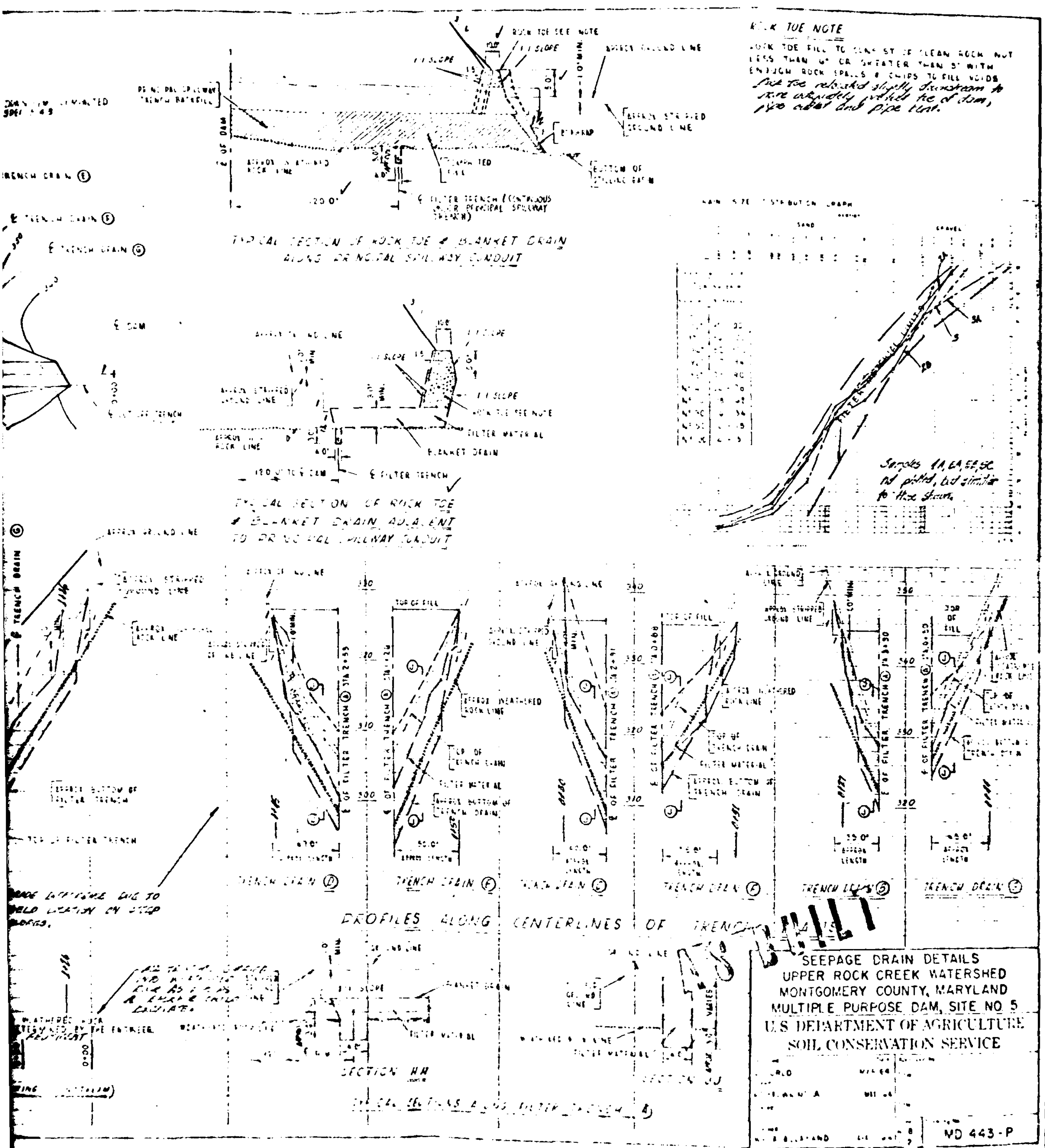
TYPICAL SECTION OF ROCK TOE & BLANKET DRAIN ADJACENT TO PRINCIPAL SPILLWAY CONDUIT

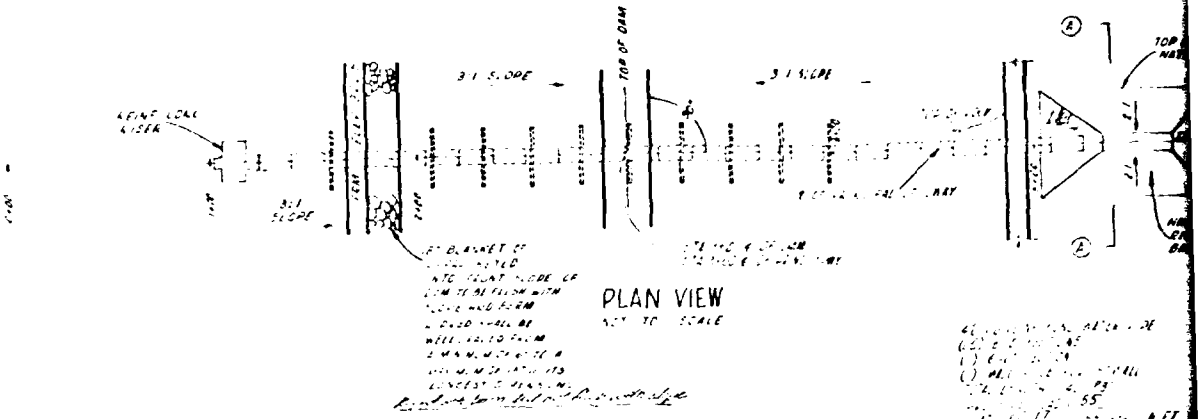




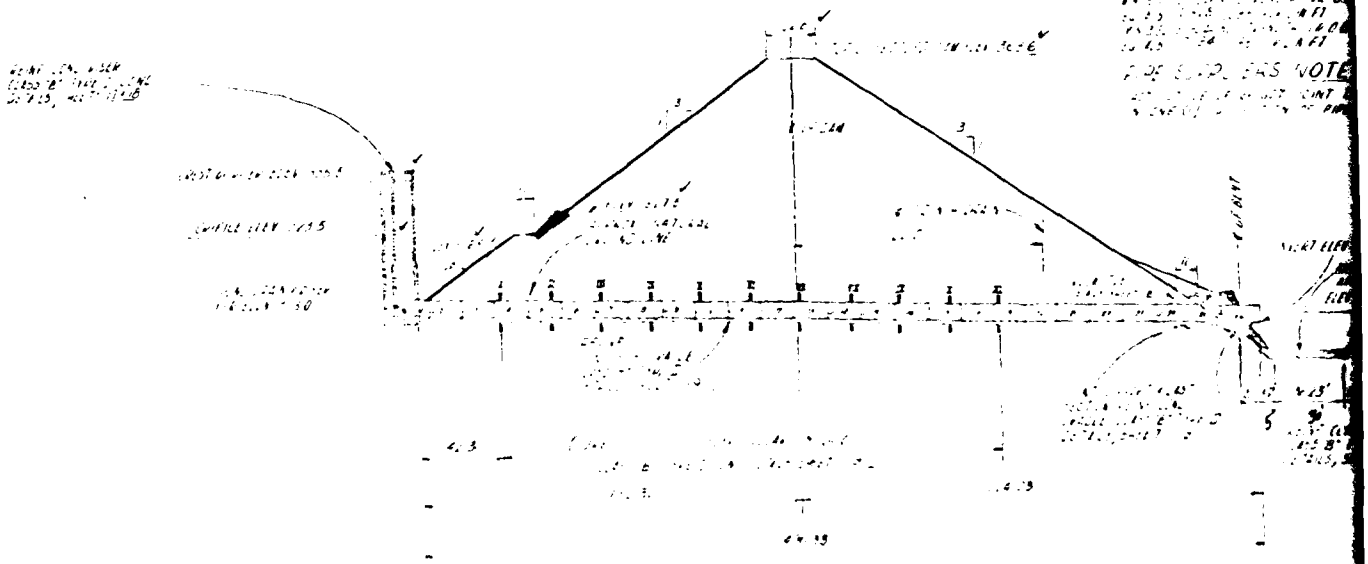
PROFILES ALONG CENT

SECTION RR

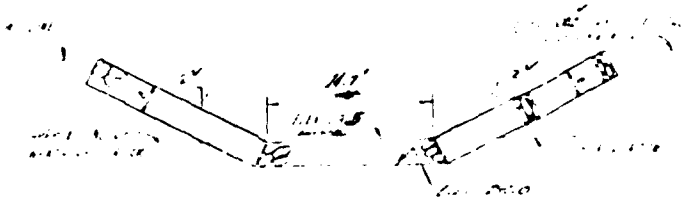

ROCK TOE NOTE
ROCK TOE FILL TO CONSIST OF CLEAN ROCK NOT LESS THAN 4" OR GREATER THAN 8" WITH ENOUGH ROCK SPALLS & CHIPS TO FILL VOIDS
Rock toe relocated slightly downstream to save extensively within toe of dam, pipe outlet and pipe tent.
TYPICAL SECTION OF ROCK TOE & BLANKET DRAIN ALONG PRINCIPAL SPILLWAY CONDUIT
TYPICAL SECTION OF ROCK TOE & BLANKET DRAIN ADJACENT TO PRINCIPAL SPILLWAY CONDUIT
ROCK TOE SEE NOTE
FILTER MATERIAL
BLANKET DRAIN
℄ FILTER TRENCH
℄ DAM
Samples 1A, 6A, 5E, 5C not plotted, but similar to those shown.
TRENCH DRAIN Ⓓ
TRENCH DRAIN Ⓕ
TRENCH DRAIN Ⓖ
TRENCH DRAIN Ⓔ
TRENCH DRAIN Ⓢ
TRENCH DRAIN Ⓒ
PROFILES ALONG CENTERLINES OF TRENCH DRAINS
SECTION HH
SECTION JJ
TYPICAL SECTIONS ALONG FILTER TRENCH
AS BUILT
SEEPAGE DRAIN DETAILS
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MD 443-P



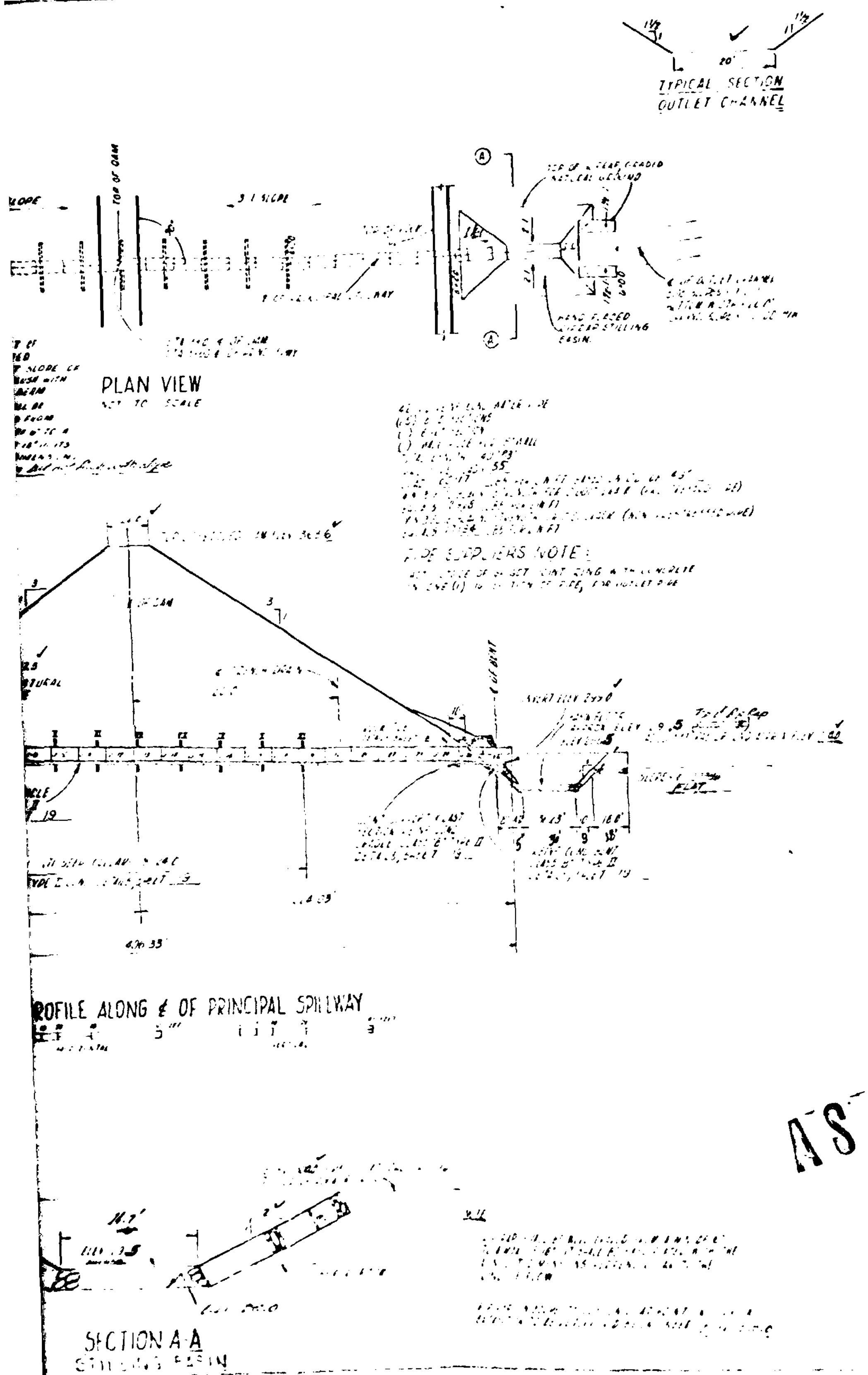
PLAN VIEW
NOT TO SCALE



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY



SECTION A-A



JOINT	DISTANCE FROM ℄ RISER WALL	INVERT ELEV OF 42" DIA PIPE	SLOPE	JOINT GAP
J-1	[illegible] 33	303 00	[illegible]	1/16"
J-2	6 33	302 95		1/4"
J-3	22 33	302 81		1/4"
J-4	38 33	302 68		3/16"
J-5	54 33	302 55		1/4"
J-6	70 33	302 41		1/4"
J-7	86 33	302 28		1/4"
J-8	102 33	302 15		1/4"
J-9	118 33	302 01		1/4"
J-10	134 33	301 88		1/4"
J-11	150 33	301 75		3/16"
J-12	166 33	301 61		1/4"
J-13	182 33	301 48		1/4"
J-14	198 33	301 30		1/16"
J-15	214 33	301 13		1/4"
J-16	230 33	300 95		1/4"
J-17	246 33	300 77		1/4"
J-18	262 33	300 59	S = 0.01107	3/16"
J-19	278 33	300 42		1/4"
J-20	294 33	300 24		1/8"
J-21	310 33	300 06		1/8"
J-22	326 33	299 89		1/4"
J-23	342 33	299 71		1/8"
J-24	358 33	299 53		1/4"
J-25	374 33	299 35		1/4"
J-26	390 33	299 18		1/4"
OUTLET	406 33	299 00		—

NOTE: Dimensions for lengths of pipe are based on nominal lengths and do not include [illegible]

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV OF 42" DIA PIPE
I	42 3	302 66
II	66 3	302 45
III	90 3	302 25
IV	114 3	302 05
V	138 3	301 85
VI	162 3	301 65
VII	186 3	301 44
VIII	210 3	301 19
IX	234 3	[illegible]
X	258 3	300 66
XI	282 3	300 40

AS BUILT

PLAN-PROFILE OF PRINCIPAL SPILLWAY
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MD 443-P

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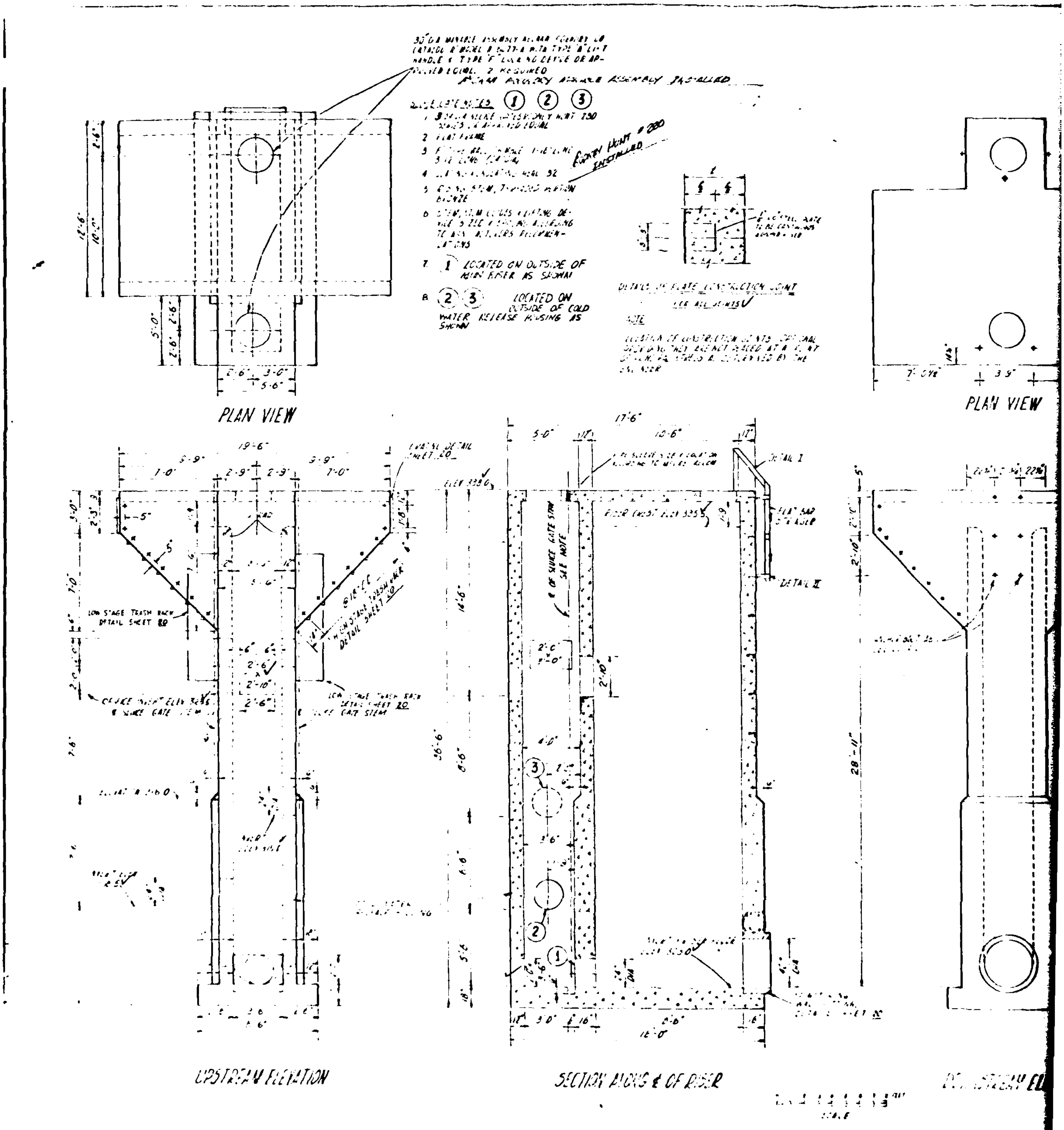
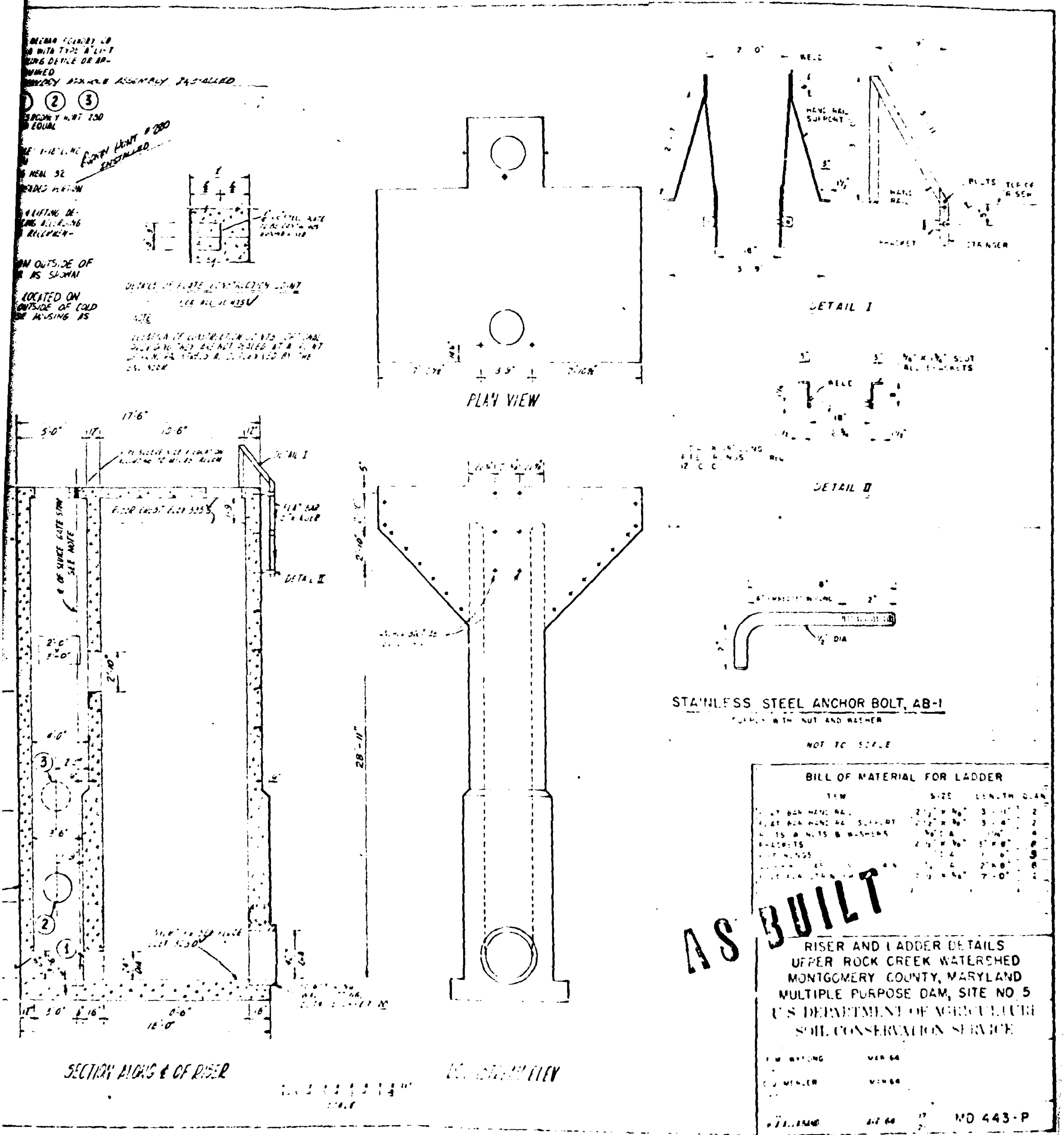
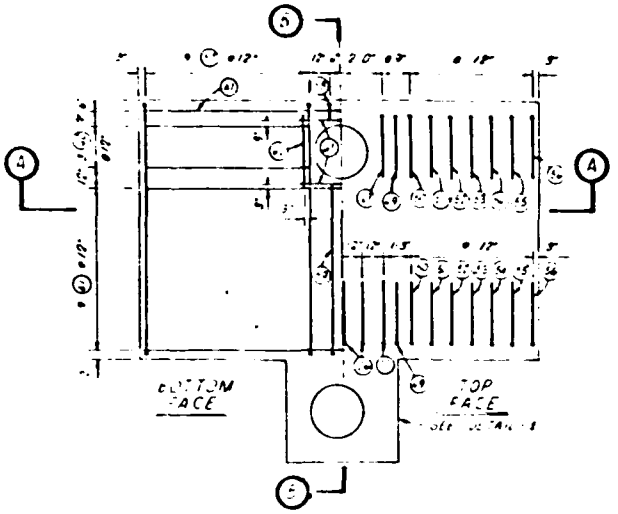
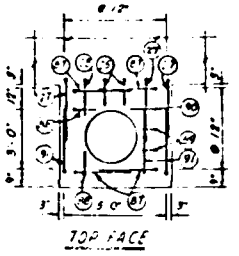


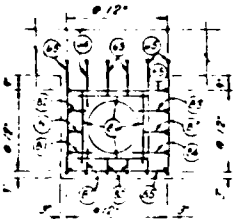
PLAN VIEW
LOCATED ON OUTSIDE OF MAIN RISER AS SHOWN
LOCATED ON OUTSIDE OF COLD WATER RELEASE HOUSING AS SHOWN
PLAN VIEW
UPSTREAM ELEVATION
SECTION ALONG ℄ OF RISER


DETAILS OF PLATE CONTRACTION JOINT
PLAN VIEW
DETAIL I
DETAIL II
SECTION ALONG ℄ OF RISER
STAINLESS STEEL ANCHOR BOLT, AB-1
NOT TO SCALE
BILL OF MATERIAL FOR LADDER
ITEM
SIZE
LENGTH
AS BUILT
RISER AND LADDER DETAILS
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO. 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MD 443-P

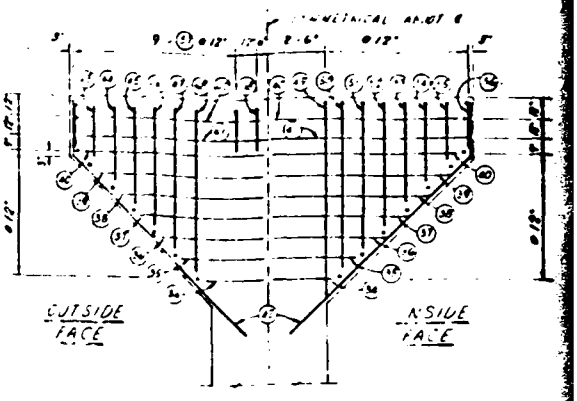


TOP SLAB

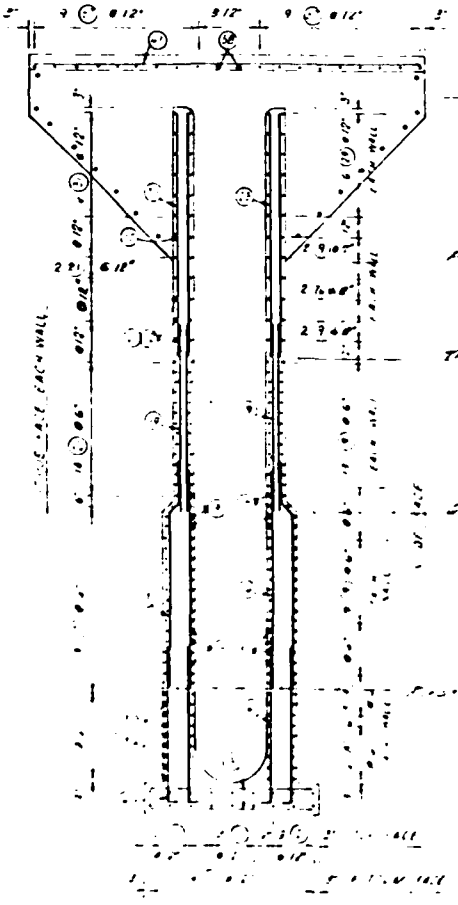




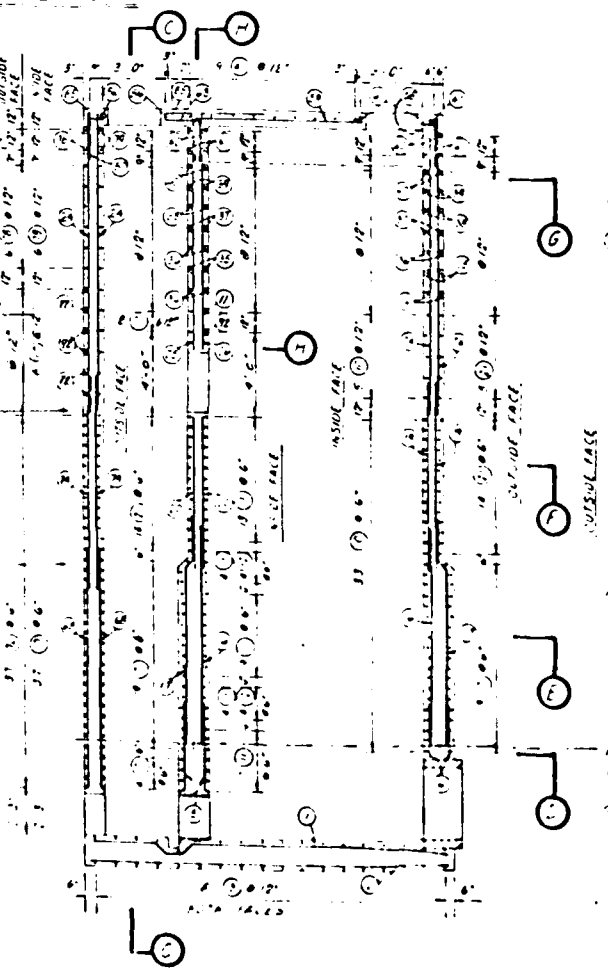
DETAIL - 1



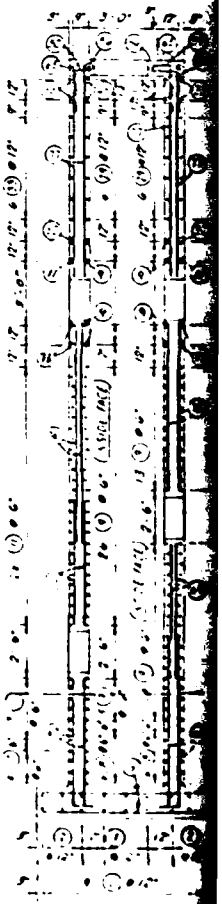
SECTION H-H



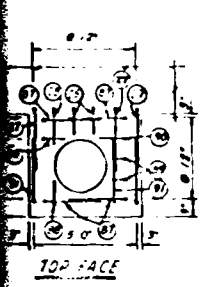
SECTION A-A

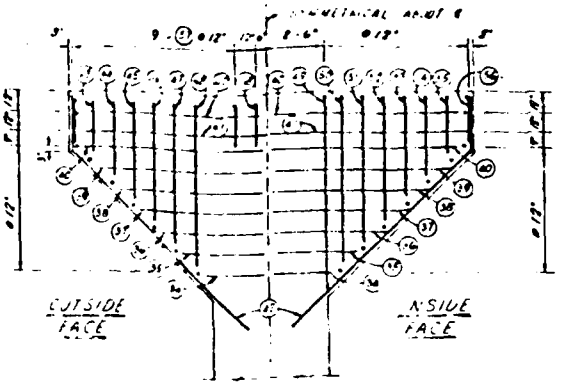


SECTION B-B



SECTION C-





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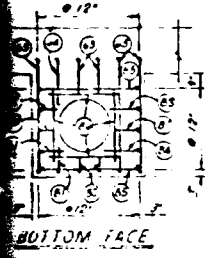

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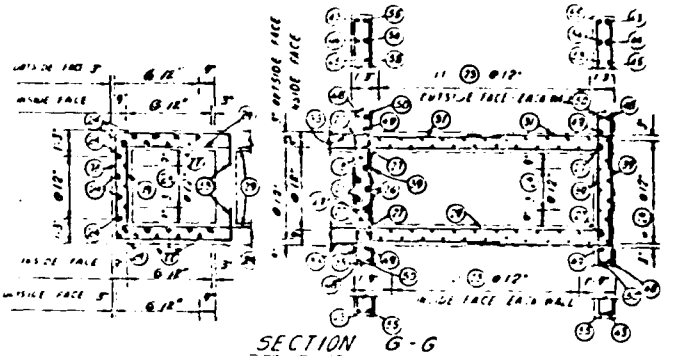

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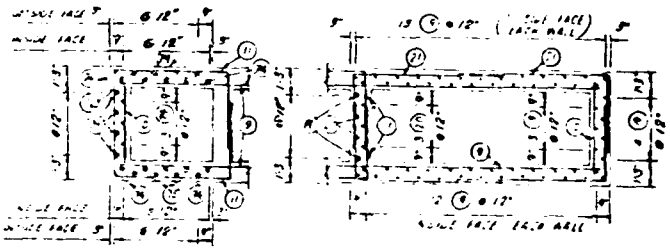

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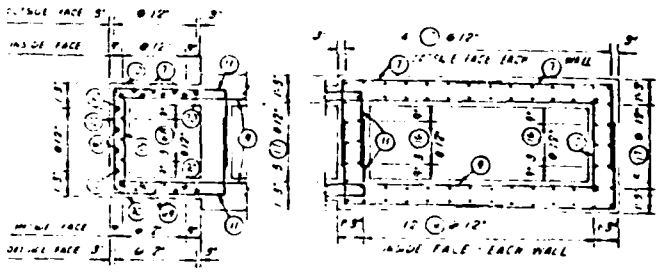

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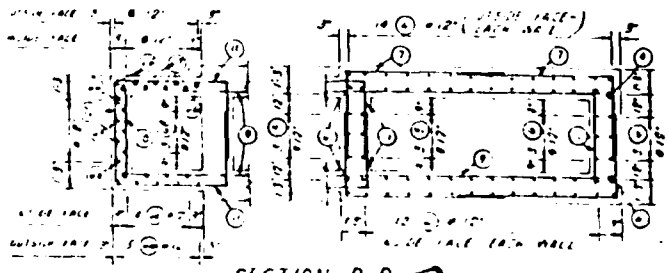

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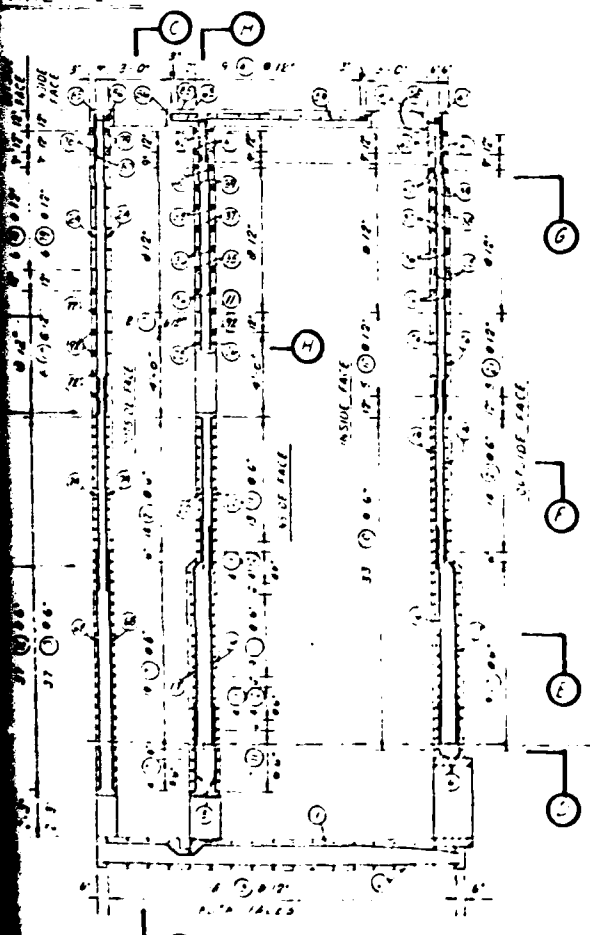

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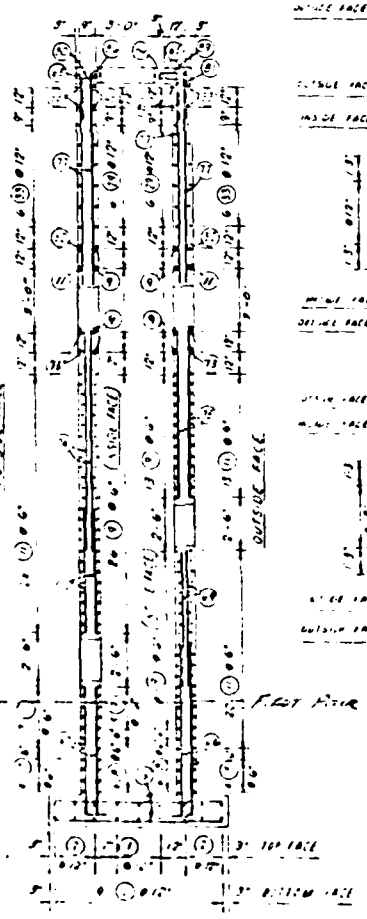
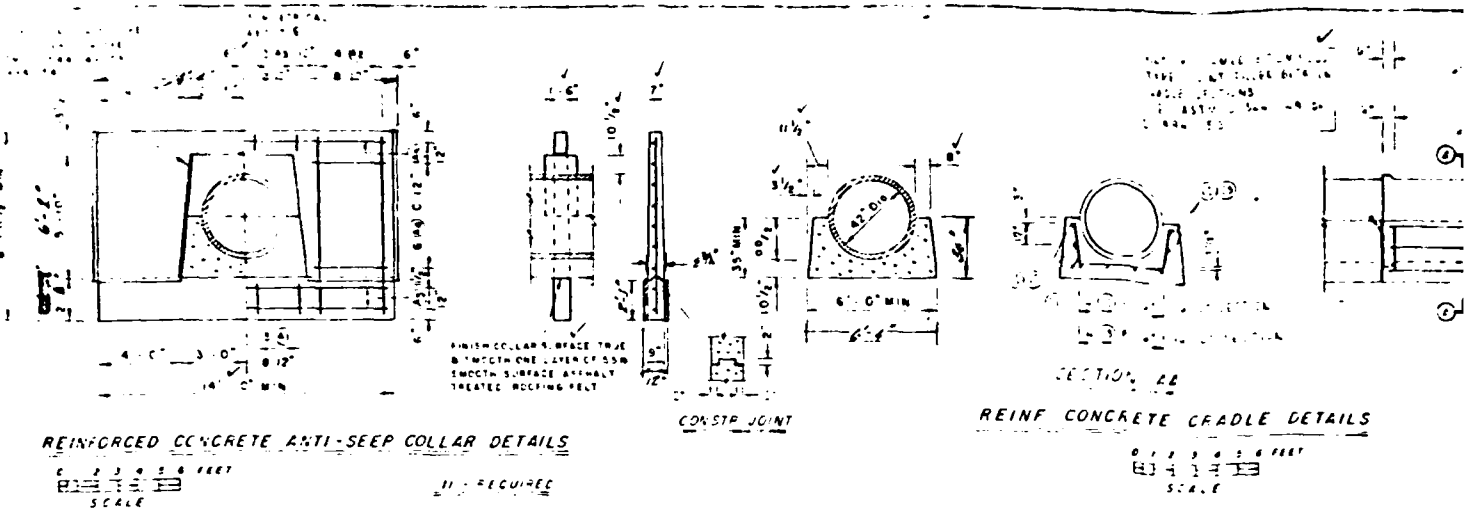


SECTION C-C

AS BUILT

USER-REINF. STEEL DETAILS
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO. 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MD 443-P

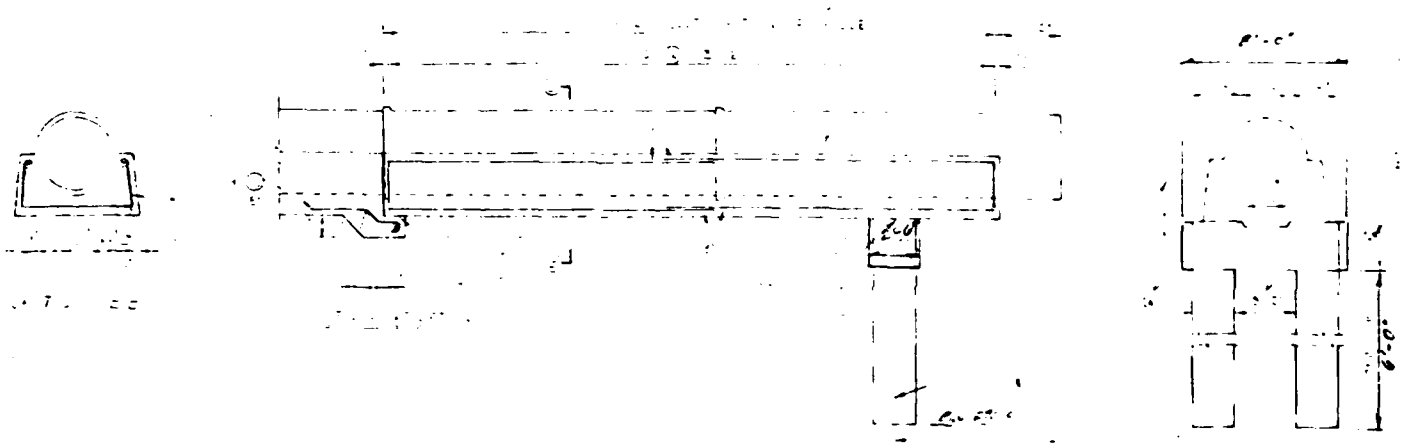


REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS

CONSTR JOINT

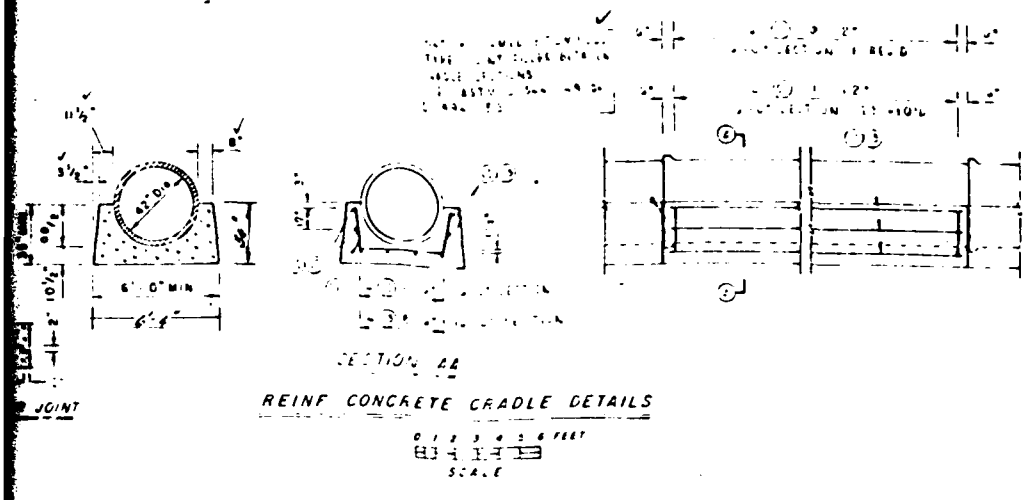
SECTION EE

REINF CONCRETE CRADLE DETAILS



REINFORCED CONCRETE CRADLE & PILE BENT DETAILS

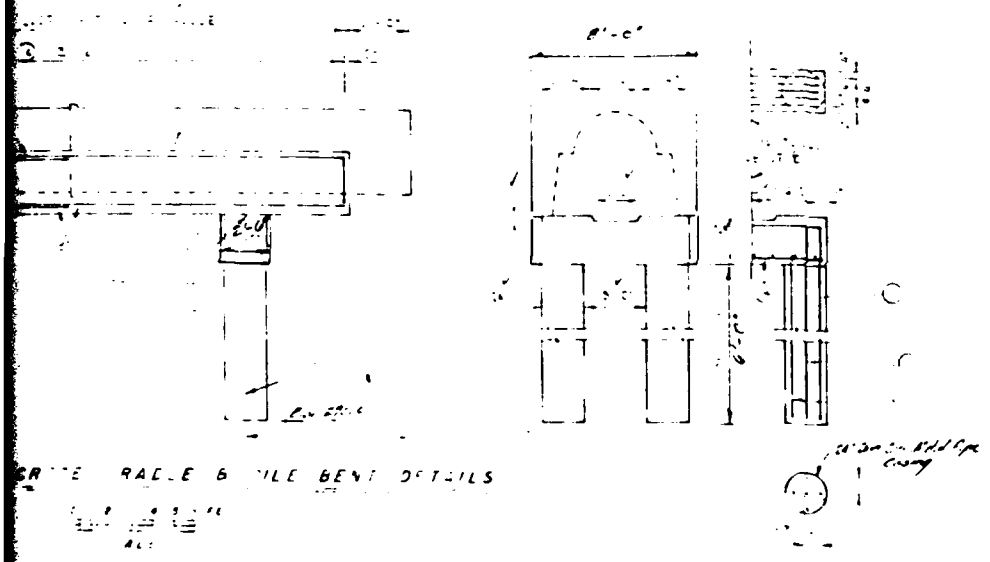
GENERAL NOTES



SECTION AB

REINF CONCRETE CRADLE DETAILS

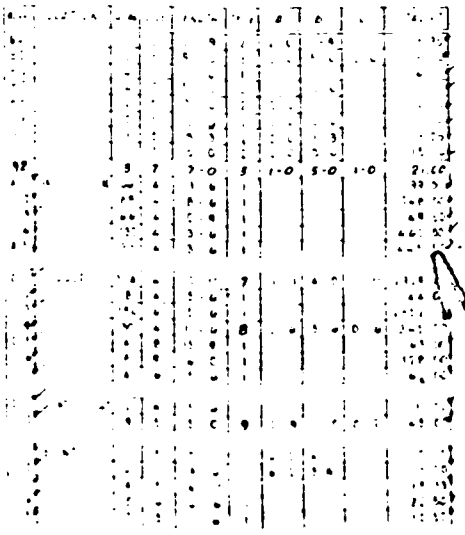
SCALE

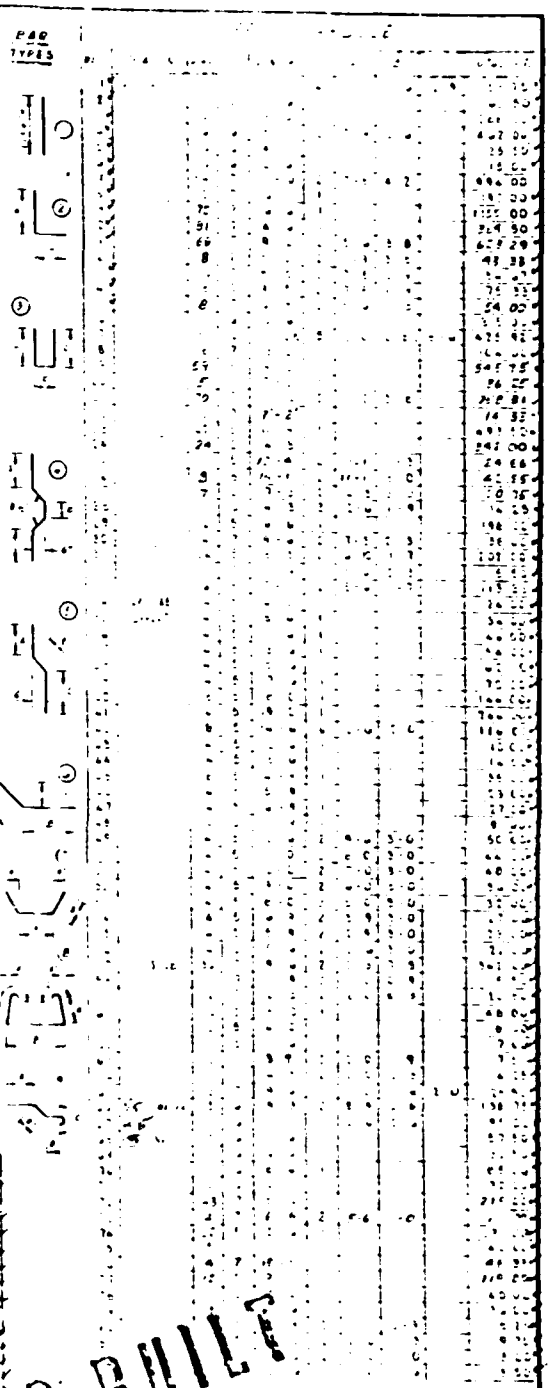


CRADLE & PILE BENT DETAILS

SCALE

GENERAL NOTES

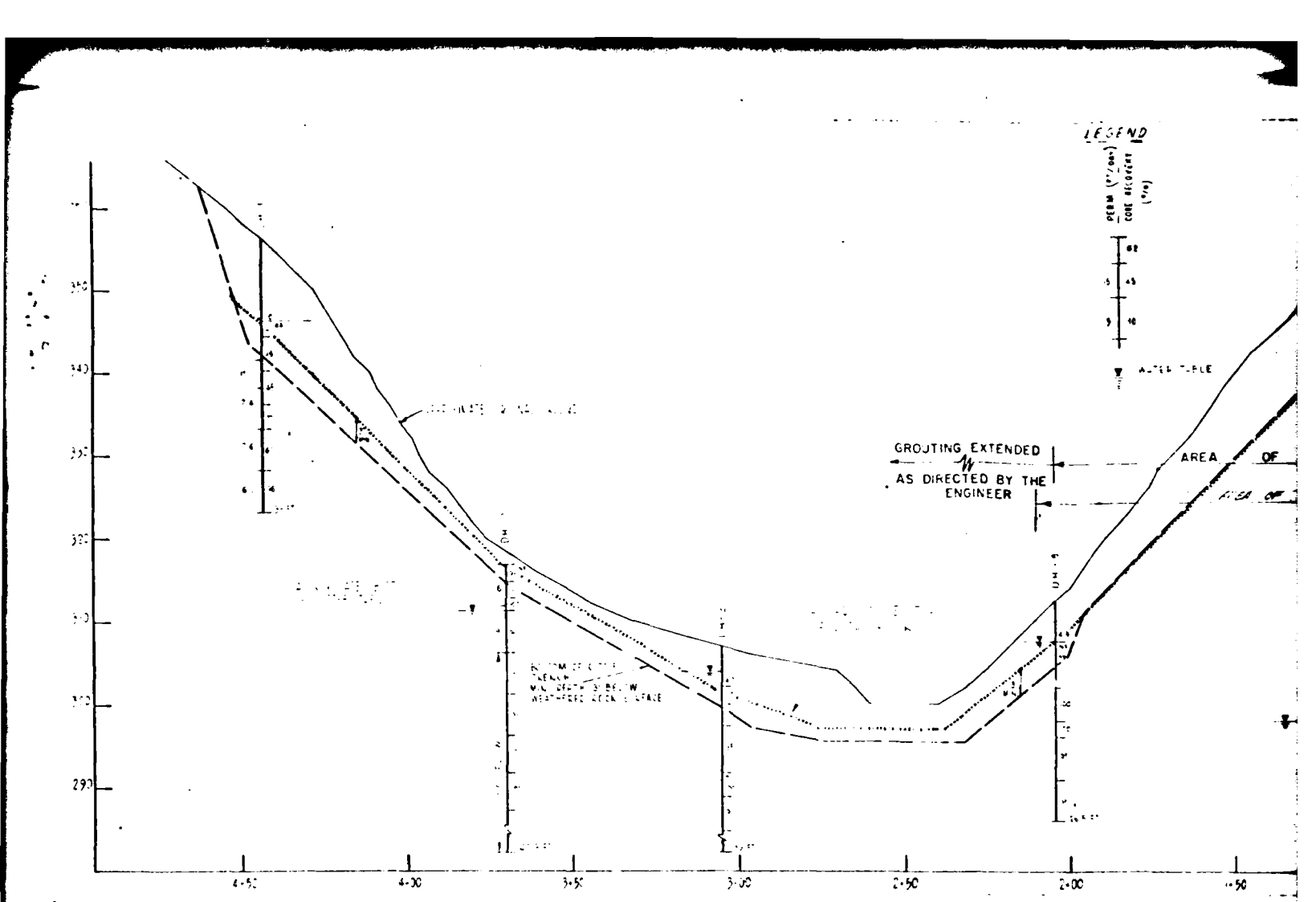


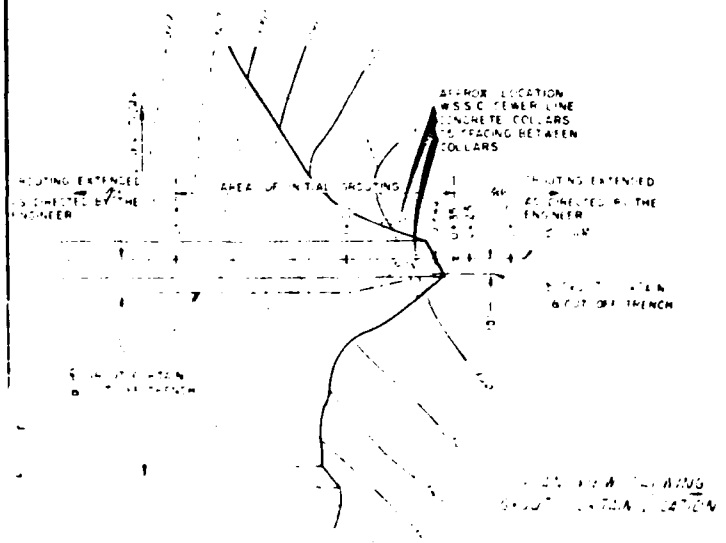


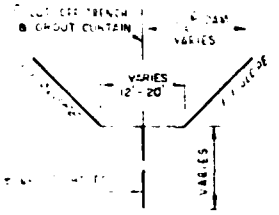
AS BUILT

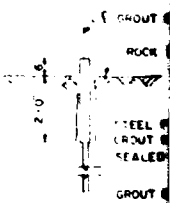
CRADLE, COLLAR & BENT DETAILS
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MD 443-P









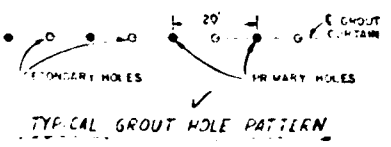
TYPE I

TYPICAL

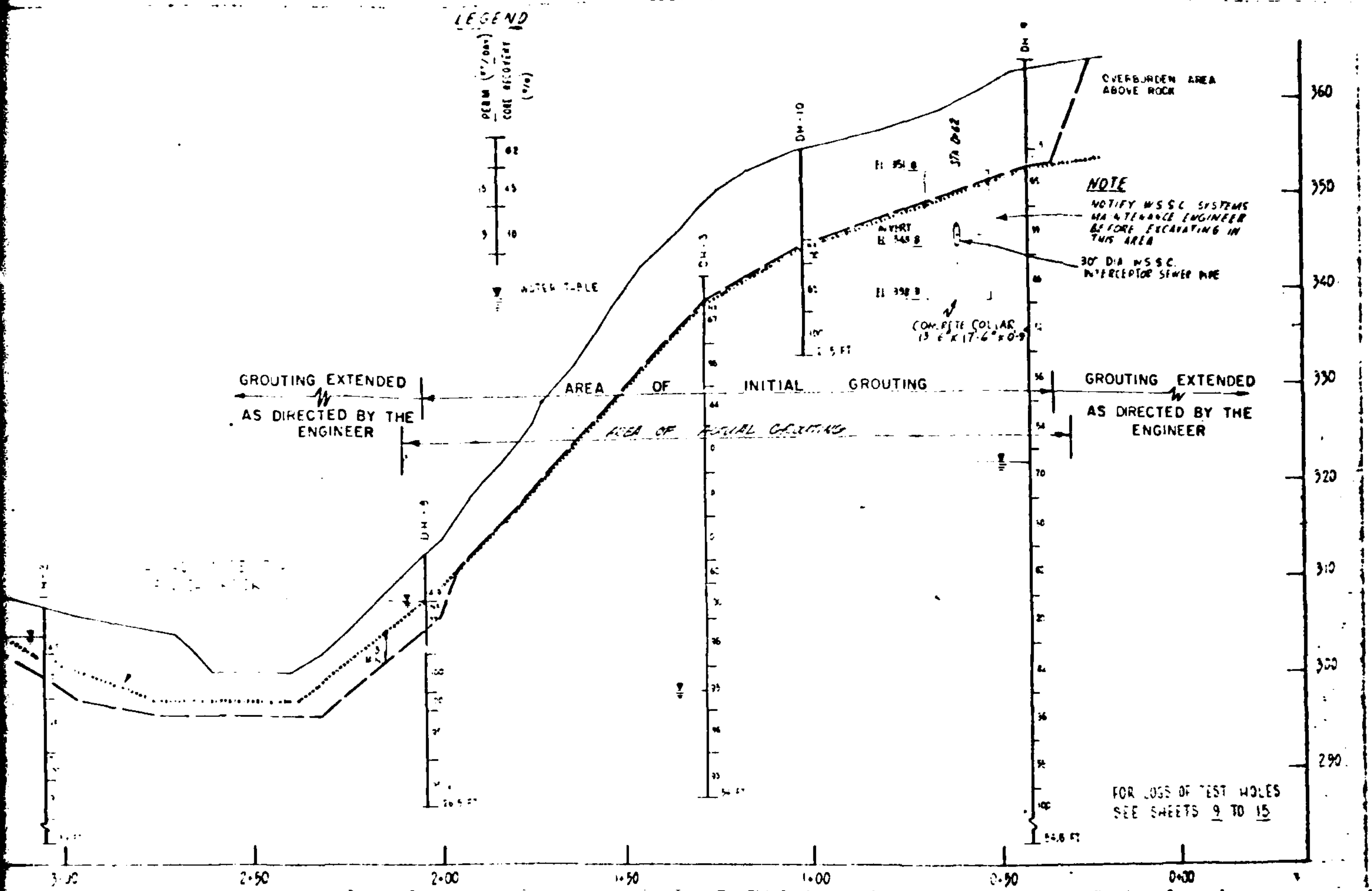
NOTES:

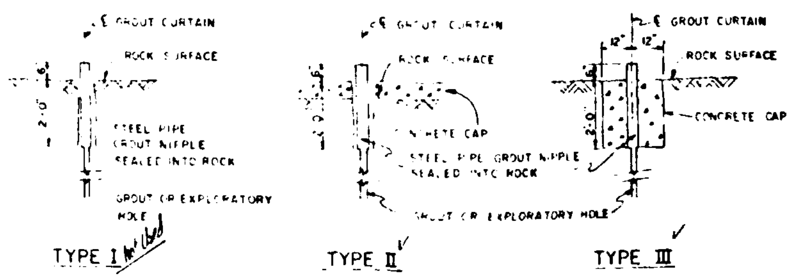
1 SETTINGS TYPE I, II & III FOR GROUT USED AS DIRECTED BY THE ENGINEER

2 GROUTING IS PRIMARILY REQUIRED IN GROUTING SHALL PROCEED TOWARDS TIGHT ROCK IS ENCOUNTERED



TYPICAL GROUT HOLE PATTERN

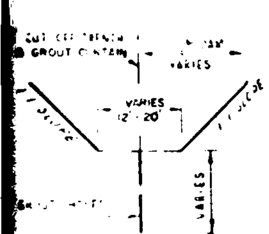




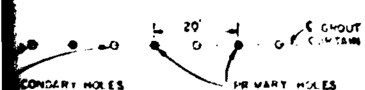
TYPE I   TYPE II   TYPE III

TYPICAL NIPPLE SETTING FOR GROUT OR EXPLORATORY HOLES DRILLED FROM ROCK SURFACE

No Scale



TYPICAL SECTION OF GROUT CURTAIN



TYPICAL GROUT HOLE PATTERN

NOTES:
1. [illegible] TYPE I, II, III [illegible] NIPPLES SHOWN ABOVE [illegible] USED AS DETERMINED BY ROCK CONDITIONS ENCOUNTERED AND DIRECTED BY THE ENGINEER
2. GROUTING IS PRIMARILY REQUIRED IN THE RIGHT ABUTMENT. HOWEVER, GROUTING SHALL PROCEED TOWARDS THE LEFT ABUTMENT UNTIL TIGHT ROCK IS ENCOUNTERED

See Reworked Sheet 11A for details of grouting.

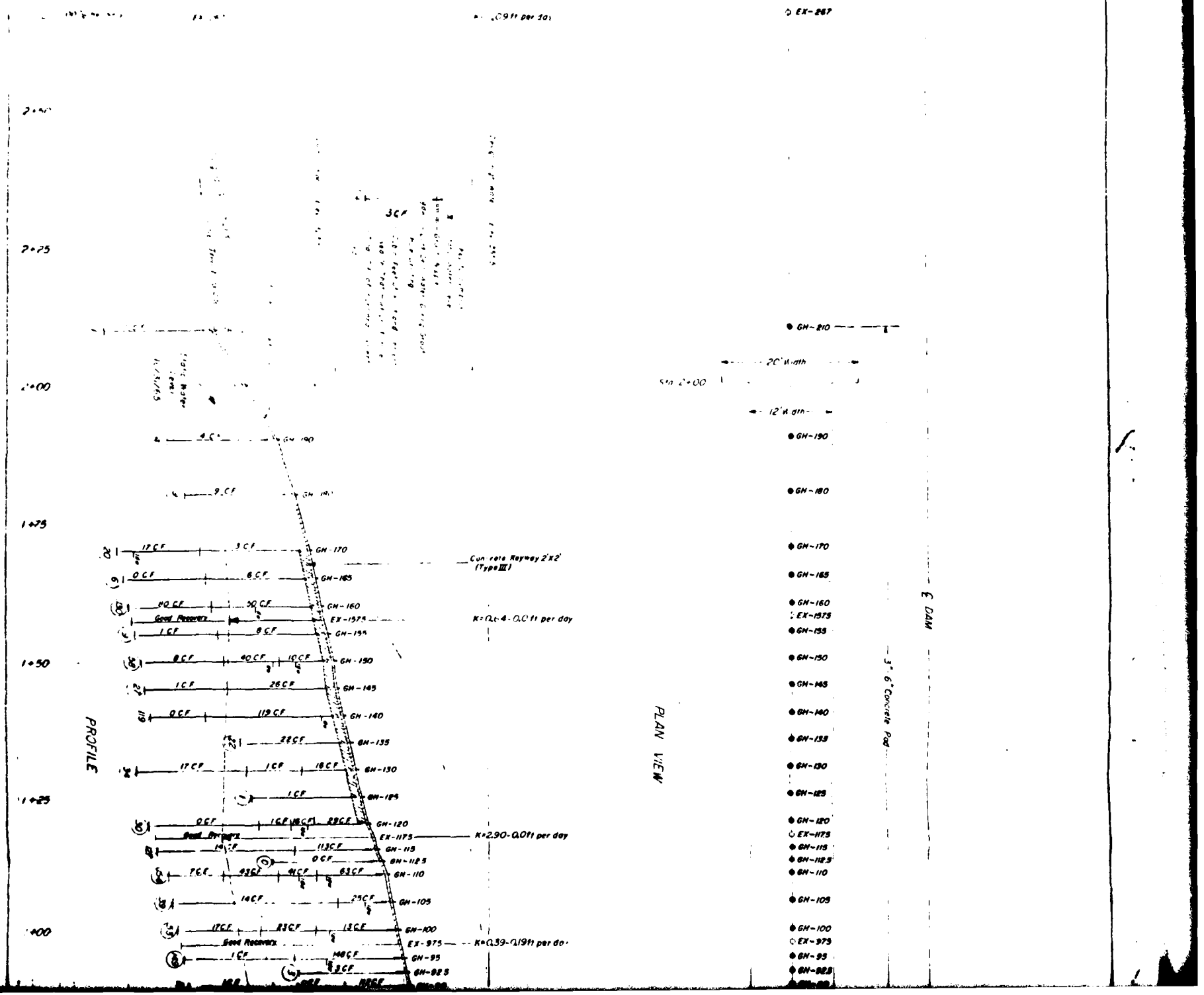
AS BUILT

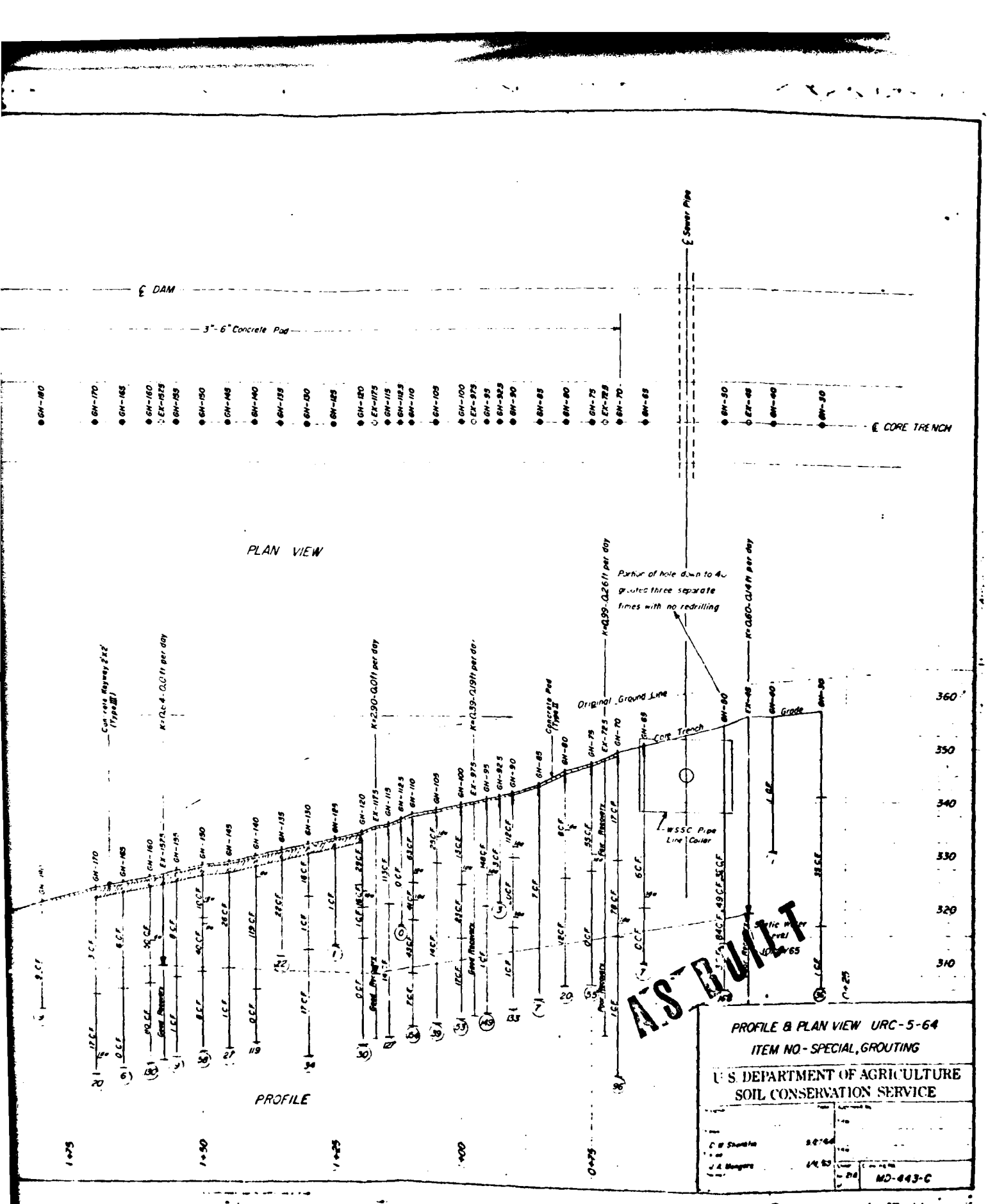
FOUNDATION GROUTING DETAILS
UPPER ROCK CREEK WATERSHED
MONTGOMERY COUNTY, MARYLAND
MULTIPLE PURPOSE DAM, SITE NO 5
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WHITMAN, REQUARDT & ASSOC
MD 443-P

C10

2


PROFILE
PLAN VIEW
2+50
2+25
2+00
1+75
1+50
1+25
1+00
GN-210
20' Width
Sta 2+00
12' Width
GN-190
GN-180
GN-170
GN-165
GN-160
EX-157.5
GN-155
GN-150
GN-145
GN-140
GN-135
GN-130
GN-125
GN-120
EX-117.5
GN-115
GN-112.5
GN-110
GN-105
GN-100
EX-97.5
GN-95
GN-92.5
Concrete Roadway 2'X2' (Type III)
K=0.64-0.01 ft per day
K=2.90-0.01 ft per day
K=0.39-0.19 ft per day
E DAM
3' 6" Concrete Pad
Good Recovery
EX-267


℄ DAM
3"-6" Concrete Pad
℄ Sewer Pipe
℄ CORE TRENCH
PLAN VIEW
Portion of hole down to 40' grouted three separate times with no redrilling
K=0.99-0.261 ft per day
K=0.60-0.141 ft per day
K=0.39-0.191 ft per day
K=2.90-0.011 ft per day
K=1.26-4.0.011 per day
Original Ground Line
Grade
Core Trench
WSSC Pipe Line Cover
Concrete Pad (Type II)
Concrete Keyway 2'x2' (Type III)
AS BUILT
PROFILE
PROFILE & PLAN VIEW URC-5-64
ITEM NO - SPECIAL, GROUTING
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MD-443-C

APPENDIX D

PHOTOGRAPHS

APPENDIX E

ANALYSES

Contents

Snyder's Unit Hydrograph and HEC 1 Dam Safety Version

from Baltimore District Data

Zone 33 → Ct = Plate K

$C_p = 1.25$

use: $t_p = 2.5(L L_{CA})^{0.3}$

$t_p = 2.5(7.8 \times 3.5)^{0.3} = 6.74$ hrs.

where: $L = 7.8$ miles

$L_{CA} = 3.5$ miles

W Card input $t_p = 6.74$ $C_p = 1.25$ into program

From Hydromet 33, Precip. PMP Index = 24.3 inch, Zone 6

read P Card R_6 112% R_{12} 122% R_{24} 130%

from Baltimore District, Loss Data use 1" and 0.05 in/hr.

T Card

from Baltimore District, Recession Data use -1.0, -0.05, 2.0

X Card

From Design Report Review

D.A. = 12.77 mi^2 = 8173 ACRES

Tc = 5.3 hrs.

RCN (AMC II) = 82

Emergency spillway

width – 180 feet

side slope – 2½ : 1

level section – 20 feet

exit slope – 2%, 150 feet → .25%, 427 feet

entrance slope – 1%, length 243 feet

Stage - Storage Data

	(MSL) Stage	Surface Area, Ac.	Cumm. Storage Ac.-Ft.
Sediment Pool	318.8	48	303
Recreation/Normal Pool	323.5	74	600
Riser Crest	335.5	121	1155+600* = 1755
Emerg. Spillway Crest	351.0	214	3700+600* = 4300
Design High Water	355.5	248	4500+600* = 5100
Top of Dam	363.6	317	6720+600* = 7320

#E ← CARDS → #S

*600 is storage allocated to sediment and recreation, see sheet 3 of Section I and sheet 4 of Section 3 of Design Report

Emergency Spillway Rating Curve [1]

Stage	Discharge
351.0	0
352.0	250
353.0	690
354.0	1540
355.0	2950
356.0	4720
357.0	6800
358.0	9010
360.0	14180
362.0	20260
364.0	27000
↑	↑
Y^4 CARD	Y^5 CARD

from Emerg. Spillway Rating Curve - Discharge @ top of dam

elev. 363.6 = 25,500 cfs

neglecting approx. 300 cfs thru riser (principal spillway)

Elev. 10 days after 100 yr. 6 hour storm is 336.4 which is starting elevation for S.C.S. Freeboard Hydrograph

2.5 x 6 hr. pt. rainfall = 32 inches

Areal rainfall = 27.12 inches

Peak inflow = 32,148 cfs

Peak outflow = 25,800 cfs

1. Ref: Design Report, U.S. Department of Agriculture Soil Conservation Service Sec. H & H, p. 22-23

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                A1       SNYDER UNIT HYDROGRAPH,FLOOD ROUTING,AND DAM OVERTOPPING ANALYSIS
    2                A2       UPPER ROCK CREEK SITE=5,MONTGOMERY CO.,MD. N.D.I. MD00046
    3                A3       FOR 50% AND 100% PMF
    4                B      58        0       30        0        0        0        0        0       -4        0
    5                B1      5
    6                J       1        2        1
    7                J1    .50     1.00
    8                K       0        1                                          1
    9                K1       CALCULATION OF PMF RATIOS TO LAKE NEEDWOOD
   10                M       1        1    12.77             12.77                                    1
   11                P                24.3      112      122      130
   12                T                                                          1      .05
   13                W     6.74     1.25
   14                X    -1.0    -0.05      2.0
   15                K       1        2                                          1
   16                K1        ROUTED FLOWS THROUGH LAKE NEEDWOOD
   17                Y                                        1        1
   18                Y1      1                                                 600       -1
   19                Y4    351      352      353      354      355      356      357      358      360      362
   20                Y4    364
   21                Y5      0      250      690     1540     2950     4720     6800     9010    14180    20260
   22                Y5  27000
   23                $S    303      600     1755     4300     5100     7320
   24                $E  318.8    323.5    335.5    351.0    355.5    363.6
   25                $$  351.0
   26                $D  363.6      3.1      1.5      426
   27                K      99
```

SNYDER UNIT HYDROGRAPH,FLOOD ROUTING,AND DAM OVERTOPPING ANALYSIS
UPPER ROCK CREEK SITE=5,MONTGOMERY CO.,MD. N.D.I. MD00046
FOR 50% AND 100% PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
58	0	30	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF PMF RATIOS TO LAKE NEEDWOOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	12.77	0.00	12.77	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.30	112.00	122.00	130.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .808

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 6.74 CP=1.25 NTA= 0

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 26 END-OF-PERIOD ORDINATES, LAG= 6.70 HOURS, CP= .76 VOL= 1.00

92.	261.	388.	478.	553.	619.	678.	733.	783.	831.
876.	919.	956.	959.	925.	882.	838.	790.	740.	686.
628.	563.	489.	402.	285.	113.				

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.54	23.70	1.84	385353.
										(649.)(602.)(47.)(10911.98)			

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THROUGH LAKE NEEDWOOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	600.	-1

STAGE	351.00	352.00	353.00	354.00	355.00	356.00	357.00	358.00	360.00	362.00
	364.00									
FLOW	0.00	250.00	690.00	1540.00	2950.00	4720.00	6800.00	9010.00	14180.00	20260.00
	27000.00									

CAPACITY=	303.	600.	1755.	4300.	5100.	7320.
ELEVATION=	319.	324.	336.	351.	356.	364.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
351.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
363.6	3.1	1.5	426.

PEAK OUTFLOW IS 7553. AT TIME 25.00 HOURS

PEAK OUTFLOW IS 18570. AT TIME 23.00 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 1.00
HYDROGRAPH AT	1	12.77	1	9856.	19713.
		(33.07)		(279.10)(	558.21)(
ROUTED TO	2	12.77	1	7553.	18570.
		(33.07)		(213.87)(	525.86)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	323.50	351.00	363.60
STORAGE	600.	4300.	7320.
OUTFLOW	0.	0.	25652.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	357.34	0.00	5604.	7553.	0.00	25.00	0.00
1.00	361.44	0.00	6729.	18570.	0.00	23.00	0.00

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

APPENDIX F

GEOLOGY REPORT

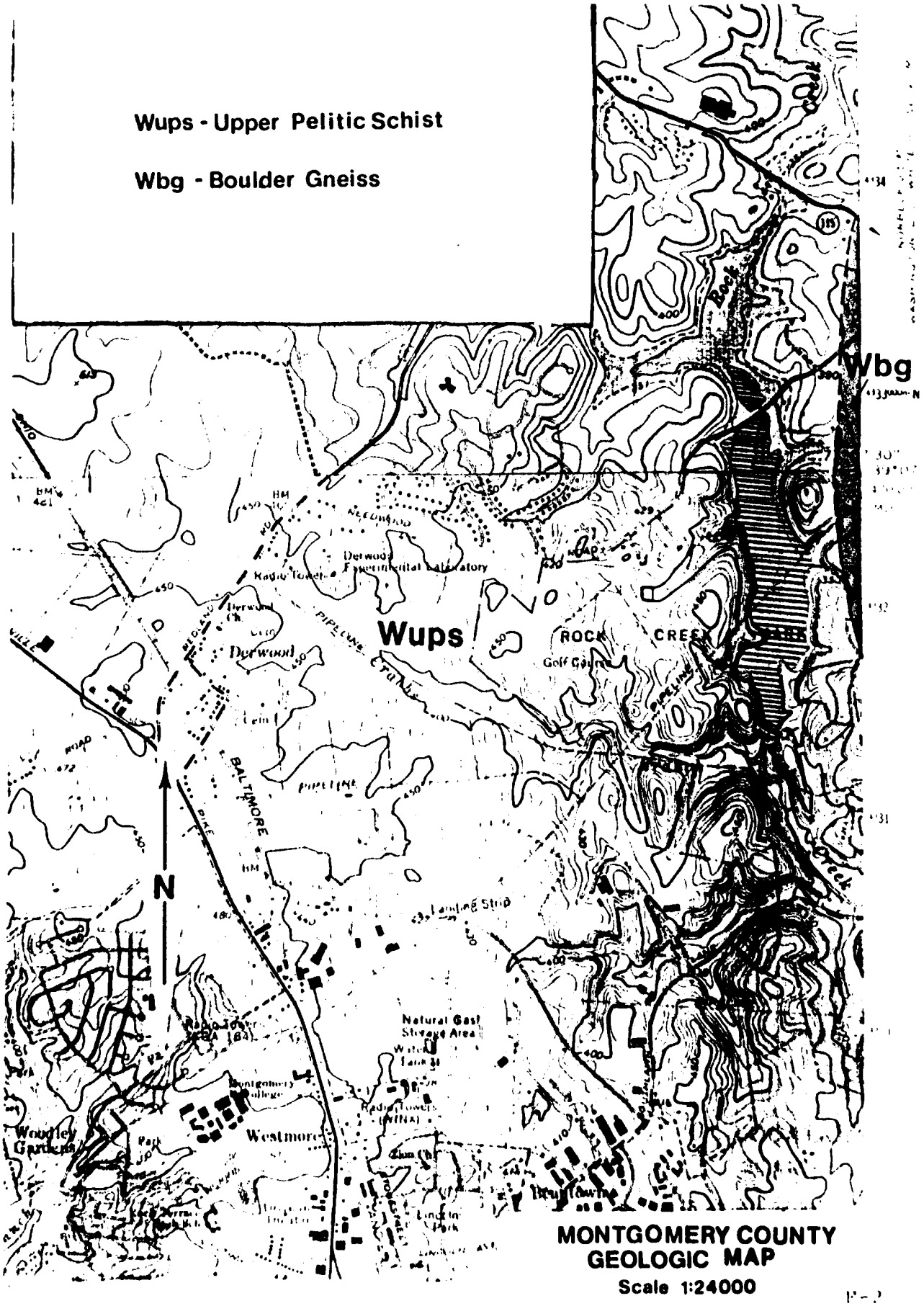
GEOLOGY REPORT

UPPER ROCK CREEK WATERSHED SITE No. 5

(LAKE NEEDWOOD DAM)

Lake Needwood Dam is situated within the rolling hills of the Piedmont Physiographic Province and is entirely underlain by the upper pelitic schist of the Wissahickon formation of late Precambrian age. This material consists of albite-chlorite-muscovite schist with quartzite beds and sandstone occurring locally. The formation weathers primarily to micaceous silt with some occurrence of clay and silty clay. Less weathered layers of schist and weathered quartzite may be disaggregated into silty sands. Rock and soils derived from rock of this formation generally provide competent foundation materials.

Groundwater occurrence and movement through the formation is predicated primarily upon secondary porosity imparted by hydraulically open joint and fracture systems, as the massive crystalline rock itself is relatively impervious. Rock cores obtained for the design of Lake Needwood Dam indicate that the upper 10 to 30 feet of rock underlying the dam is highly fractured and water pressure tests suggest moderately pervious conditions. Apparently the designers interpreted the subsurface data at the right side of the dam to indicate potential seepage problems as provisions were made for a grout curtain. However, the original interpretation is not available and review of the subsurface data does not reveal any marked difference in the geo-hydrologic characteristics of the formation underlying the dam.


Wups - Upper Pelitic Schist
Wbg - Boulder Gneiss
Wbg
Wups
ROCK CREEK
Derwood
Derwood Experimental Laboratory
Radio Tower
PIPELINE
BALTIMORE
Golf Course
Landing Strip
Natural Gas Storage Area
Westmore
Woodley Gardens
N
MONTGOMERY COUNTY
GEOLOGIC MAP
Scale 1:24000

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