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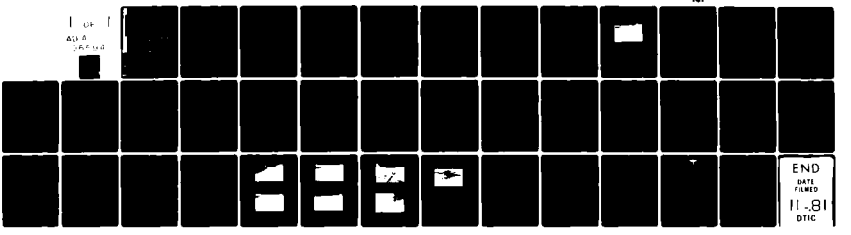

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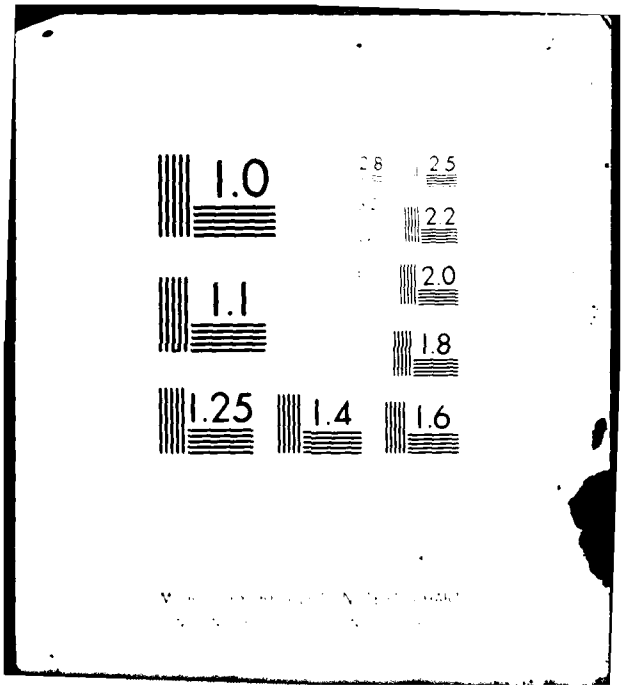
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# MISSOURI-KANSAS CITY BASIN

LEVEL (1)

REED AREA NO. 3
JACKSON COUNTY, MISSOURI
MO 20032



# PHASE 1 INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM





PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI



AUGUST 1978

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

# REPORT DOCUMENTATION PAGE

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| | |
|---|---|
| 1. REPORT NUMBER | 2. GOVT ACCESSION NO. AD-A106594 / 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Reed Area No. 3 Dam (MO 20032) Jackson County, Missouri | 5. TYPE OF REPORT & PERIOD COVERED Final Report. / 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) Black & Veatch, Consulting Engineers | 8. CONTRACT OR GRANT NUMBER(s) DACW43-78-C-0148 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 12. REPORT DATE Aug[illegible]978 / 13. NUMBER OF PAGES Approximately 30 |
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18. SUPPLEMENTARY NOTES

National Dam Safety Program. Reed Area Number 3 (MO 20032), Missouri - Kansas City Basin, Jackson County, Missouri. Phase I Inspection Report.

Paul R. /Zaman Bruce A. /Ainsworth
Harry L. /Callahan

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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# MISSOURI-KANSAS CITY BASIN

REED AREA NO. 3
JACKSON COUNTY, MISSOURI
MO 20032



# PHASE 1 INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

AUGUST 1978

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Reed Area No. 3 (Coot Lake) Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Reed Area No. 3 (Coot Lake) Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED — Chief, Engineering Division — 28 FEB 1979 — Date

APPROVED BY: SIGNED — Colonel, CE, District Engineer — 28 FEB 1979 — Date

# REED AREA NO. 3
# (COOT LAKE DAM)

JACKSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20032

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

*PREPARED BY:*

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

AUGUST 1978

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

| | |
|---|---|
| Name of Dam | Reed Area No. 3 (Coot Lake) Dam |
| State Located | Missouri |
| County Located | Jackson County |
| Stream | Tributary to Big Creek |
| Date of Inspection | 18 August 1978 |

Reed Area No. 3 (Coot Lake) Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers failure would threaten the life and property of approximately four families downstream of the dam and would potentially cause appreciable damage to one improved road, two railroad crossings, and two smaller lakes within the estimated damage zone which extends 3 miles downstream of the dam.

Our inspection and evaluation indicates the spillway does meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass the probable maximum flood without overtopping but will pass 50 percent of the probable maximum flood, which is greater than the estimated 100-year flood. Considering the small watershed, the small volume of water impounded, the four houses, one road and railroad downstream from the dam, 50 percent of the probable maximum flood is the appropriate spillway design flood.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to maintain this structure in good condition. Seepage and stability analyses of the existing dam are required to satisfy the guidelines. A detailed report discussing the results of the inspection is attached.

Paul R. Zaman, PE
Illinois 62-29261

Bruce A. Ainsworth, PE
Missouri E-18023

Harry L. Callahan, Partner
Black & Veatch

Overview of Lake and Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
REED AREA NO. 3 (COOT LAKE) DAM

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES



LIST OF PHOTOGRAPHS



APPENDIX

## SECTION 1 - PROJECT INFORMATION

### 1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the Reed Area No. 3 (Coot Lake) Dam be made. Throughout the remainder of this report Reed Area No. 3 Dam will be referred to by its common name of Coot Lake Dam.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

### 1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the valley of a tributary to Big Creek in south central Jackson County, Missouri (Plate 1). Topography of the contributing watershed is characterized by rolling hills. The watershed lies within the James A. Reed Wildlife Area. Topography in the vicinity of the dam is shown on Plate 2.

(2) There are two spillways at this dam which shall be designated in this report as the principal spillway and the emergency spillway. The principal spillway is located approximately 30 feet upstream from the centerline of the dam near the center of the structure. The principal spillway is a 54-inch corrugated metal pipe (CMP) drop inlet spillway connected with a 36-inch CMP acting as the discharge pipe. The 36-inch CMP runs under the embankment to the discharge point. The pipe discharges to the natural stream bed.

(3) Located at the upstream side of the drop inlet is an operating stem for a valve in a 12-inch steel drain pipe. This 12-inch pipe connects to the 36-inch pipe that runs under the embankment. This 12-inch pipe could be used to evacuate the pool.

(4) The emergency spillway is located at the left abutment. The spillway is constructed exclusively of earth. The approach channel leads to the axis of the dam at an adverse slope. Near the axis of the dam the slope of the channel flattens. This area would be the control section and acts as a broad-crested weir. The discharge channel then runs from this control section to the natural channel at a fairly steep slope. A good stand of grass serves to protect the soil from erosion.

(5) A 6-inch steel pipe runs through the embankment to a fish hatchery at the downstream toe of the dam. The pipe is located approximately 100 feet to the right of the principal spillway.

(6) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in south central Jackson County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Pleasant Hill, Missouri in Section 22 of T47N, R31W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the small size category.

d. Hazard Classification. The hazard classification assigned by the St. Louis District, Corps of Engineers for this dam is as follows: The Coot Lake Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, extensive agricultural, industrial and commercial facilities, and to important public utilities, main highways or railroads. For the Coot Lake Dam the flood damage zone extends downstream for 3 miles. Within the damage zone are four homes, two smaller lakes, one fish hatchery, one improved road crossing, and two railroads.

e. Ownership. The dam is owned by the Missouri Department of Conservation, 2901 N. Ten Mile Drive, Jefferson City, Missouri 65101.

f. Purpose of Dam. The dam forms a 23-acre recreational lake and also serves as a water supply to a fish hatchery downstream of the dam.

g. Design and Construction History. The dam was designed by the Missouri Department of Conservation. Construction history was not available.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation. Water is drawn from the lake intermittently to supply the fish hatchery downstream.

1.3 PERTINENT DATA

a. Drainage Area - 225 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through the uncontrolled principal spillway. The water level could be lowered below normal pool elevation by use of the controlled outlet works.

(2) Estimated experienced maximum flood at damsite - unknown.

(3) Estimated ungated combined spillway capacity at maximum pool elevation (Top of dam) - 700 cfs.

(4) The estimated capacity of the 12-inch pipe assuming normal pool elevation is 10 cfs. No estimate of the capacity of the 6-inch pipe to the fish hatchery was made since information was limited.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 976.0 ± (see Plate 4)

(2) Principal spillway crest - 972.0

(3) Emergency spillway crest - 973.4

(4) Streambed at centerline of dam - 945 ±

(5) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 1,800 feet ±

(2) Length of normal pool - 1450 feet ±

e. Storage (Acre-feet).

(1) Top of dam - 248

(2) Principal spillway crest - 119 (from 1973 inventory)

(3) Design surcharge - Not available

f. Reservoir Surface (Acres).

(1) Top of dam - 32

(2) Principal spillway crest - 23

g. Dam.

(1) Type - Earth embankment

(2) Length - 900 feet

(3) Height - 34 feet ±

(4) Top width - 12 feet

(5) Side slopes - upstream face 3H to 1V, downstream face 2.5H to 1V (see Plate 4)

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel - None.

i. Emergency Spillway.

(1) Type - Grass open channel.

(2) Width of spillway - 50 feet.

(3) Crest elevation - 973.4 feet m.s.l.

(4) Gates - None.

(5) Upstream channel - Grass.

(6) Downstrean channel - Grass channel into natural streambed.

j. Principal Spillway.

(1) Type - Shaft.

(2) Size of orifice - 54 inch.

(3) Crest elevation - 972.0 feet m.s.l.

(4) Upstream channel - Not applicable.

(5) Downstream channel - Earth channel leading to natural stream.

k. Regulating Outlets - A 12-inch steel drain pipe with an inlet invert elevation of 956.3 feet (m.s.l.) is a regulating outlet. The discharge is regulated by a valve with a manual operating stem located on the upstream side of the intake shaft. This 12-inch steel drain pipe was probably used as the diversion during construction. A 6-inch steel pipe also runs through the embankment, its purpose is to supply water to the fish hatchery ponds on the downstream side of the dam. The discharge is regulated by a valve with manual operating stem located at the dam.

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

Design data was available in the form of as-built drawings from the Missouri Department of Conservation.

### 2.2 CONSTRUCTION

Construction records were unavailable, however the dam was reportedly built circa 1958.

### 2.3 OPERATION

The maximum recorded loading on the dam is unknown.

### 2.4 EVALUATION

a. Availability. The only engineering data available were the as-built drawings.

b. Adequacy. The engineering data available were inadequate to make a detailed assessment of design, construction, and operation. Detailed seepage and stability analyses should be performed for this dam to satisfy inspection program requirements.

c. Validity. The engineering data available were insufficient to determine the validity of the design, construction, and operation.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

a. General. A visual inspection of Coot Lake Dam was made on 18 August 1978. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and geotechnical engineering. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following items at the dam. No surface cracks or unusual movement of the embankment was found. There was no problem of sloughing or erosion of the embankment or abutment slopes. The riprap on the upstream face is small but no problem of erosion was sighted. There was no noticeable seepage in the embankment or at the toe of the dam. The lake level at the time of the inspection was four feet below normal pool elevation which is probably due to the prolonged period of drought preceding the inspection.

c. Appurtenant Structures. The inspection team observed the following items pertaining to appurtenant structures. The corrugated metal pipe of the principal spillway appeared in good condition. This pipe discharges to the natural channel at the toe of the dam. No water was discharging through the principal spillway at the time of inspection. The operating valve and stem guide of the 12-inch steel pipe are located on the upstream side of the drop inlet. The valve was not tested for operation at the time of the inspection.

The emergency spillway channel was in good condition with no evidence of erosion of either the bottom or the side slopes of the channel. There was a good stand of grass in the channel to help prevent erosion.

At the time of the inspection the 6-inch steel pipe that services the fish hatchery ponds was in operation.

d. Reservoir Area. No slides or excessive erosion due to wave action were observed along the shore of the reservoir.

e. Downstream Channel. Heavy vegetation along the banks and mild channel slopes typical of streams in the area characterize the channel downstream of the spillways.

### 3.2 EVALUATION

None of the conditions observed are significant enough to indicate a need for immediate remedial action. The inspection team observed no deficiencies at the dam at the time of the inspecton.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

Controlled outlet works exist, but are apparently not used, except to supply water to the fish hatchery. The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the emergency and principal spillways.

### 4.2 MAINTENANCE OF DAM

Maintenance performed was unknown.

### 4.3 MAINTENANCE OF OPERATING FACILITIES

Maintenance of operating facilities is unknown.

### 4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

### 4.5 EVALUATION

At the time of the inspection no deficiencies were observed.

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

a. Design Data. The Missouri Department of Conservation supplied as-built drawings of the dam which showed the elevation, location and design of the principal and emergency spillways. Design data pertaining to hydrology was unavailable.

b. Experience Data. The drainage area and lake surface area are developed from USGS Pleasant Hill and Lake Jacomo Quadrangle Maps. The spillway and dam layouts are from surveys made during the inspection and the as-built drawings supplied by the Missouri Department of Conservation.

c. Visual Observations.

(1) The 54-inch CMP of the principal spillway is in good condition. The outlet of the discharge pipe of the principal spillway is also in good condition.

(2) The emergency spillway channel is in good condition with no evidence of erosion at the time of the inspection.

(3) The pipe that was used as a diversion during construction of the dam could serve to evacuate the pool if the gate valve on the upstream side of the principal spillway was opened. The 6-inch steel pipe could also be used to help draw down the pool.

(4) Spillway releases would not endanger the integrity of the dam.

d. Overtopping Potential. The spillway will pass 50 to 100 percent of the probable maximum flood, which is the spillway design flood recommended by the guidelines, without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass 50 percent of the probable maximum flood without overtopping. This flood is greater than the 100-year estimated to be 470 cfs according to the methodology outlined by the USGS in "Technique for Estimating the Magnitude and Frequency of Missouri Floods". According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of small size should pass 50 to 100 percent of the probable maximum flood. Considering the small watershed, the small volume of water impounded, and the downstream hazard, 50 percent of the probable maximum flood is the appropriate spillway design flood. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 2,400 cfs of the total discharge from the reservoir of 3,400 cfs. The estimated duration of overtopping is 2.1 hours. Failure of upstream water impoundments shown on the 1975 revised USGS map would not have a significant impact on the hydrologic or hydraulic analysis.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately 3 miles downstream of the dam. There are four inhabited homes, one improved road, and two railroad crossings downstream of the dam which could be severely damaged and lives could be lost should failure of the dam occur.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found.

c. Operating Records. No operational records exist.

d. Post Construction Changes. No post construction changes are known to exist.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

The seismic stability of an earth dam is dependent upon a number of factors: The important factors being embankment and foundation materials and shear strengths; abutment material classification, conditions, and strength; embankment zoning; and embankment geometry. Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability.

## SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

a. Safety. Items noted during the visual inspection by the inspection team indicate no dificiencies were observed.

b. Adequacy of Information. Due to the unavailability of engineering design data, the conclusions in this report were based only on performance history and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Due to the lack of data, detailed seepage and stability analyses comparable in scope to the requirements of the Recommended Guidelines should be performed.

c. Urgency. No programs of urgency need be developed as a result of this visual inspection.

d. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analyses required by the guidelines.

### 7.2 REMEDIAL MEASURES

a. Alternatives. No alternatives are recommended by the inspection team.

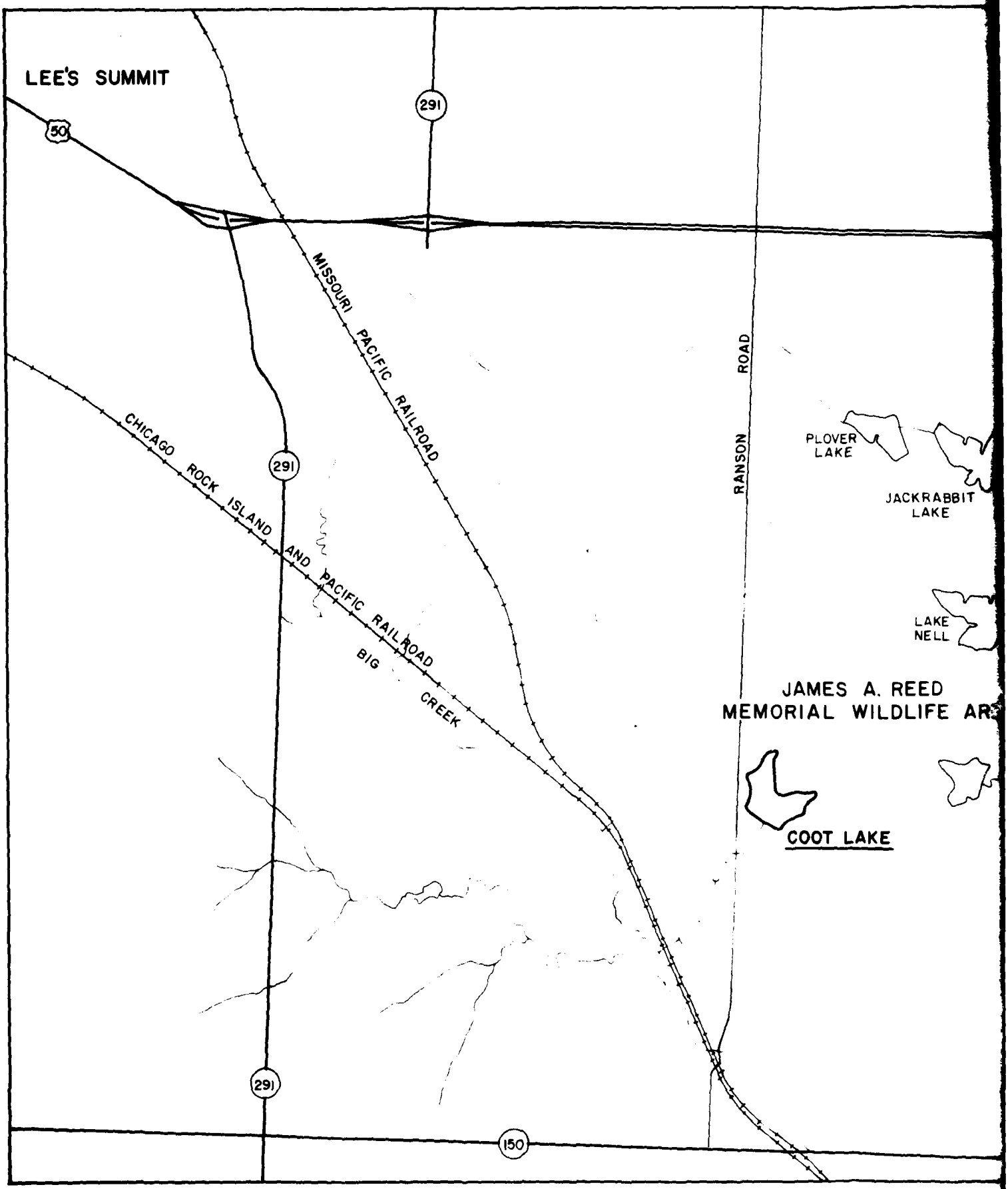
b. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

(1) Check the downstream face of the dam periodically for seepage and stability problems. If seepage flows are observed or sloughing on the embankment slopes are noted, the dam should be inspected and the condition evaluated by an engineer experienced in design and construction of earthen dams.

(2) The 12-inch value of the steel drain pipe should be tested periodically to insure that the pool could be evacuated.

(3) A regular maintenance program should be continued to control the growth on downstream and upstream slopes of the dam.

(4) A detailed inspection of the dam should be made at least every year by an engineer experienced in design and construction of dams.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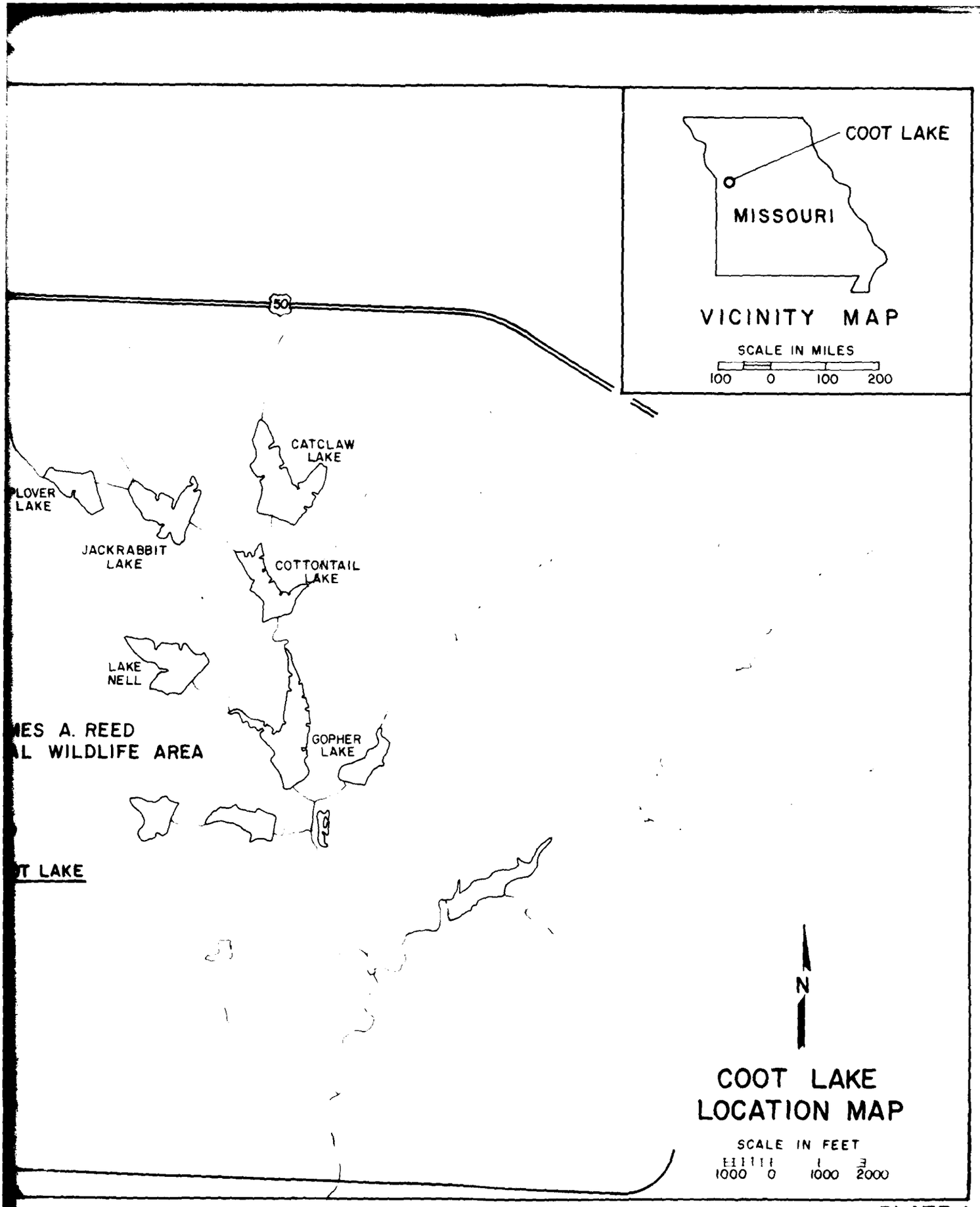
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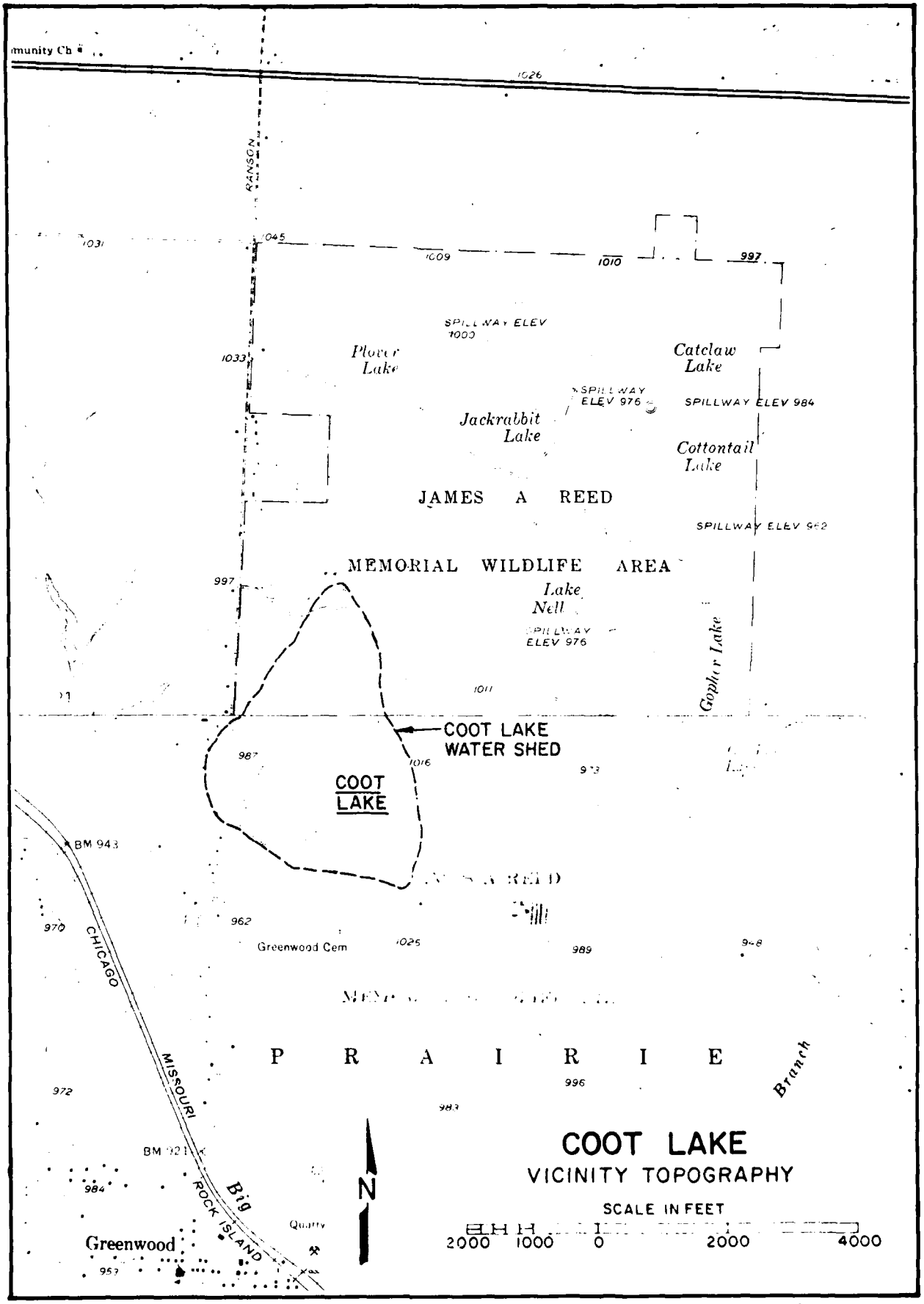
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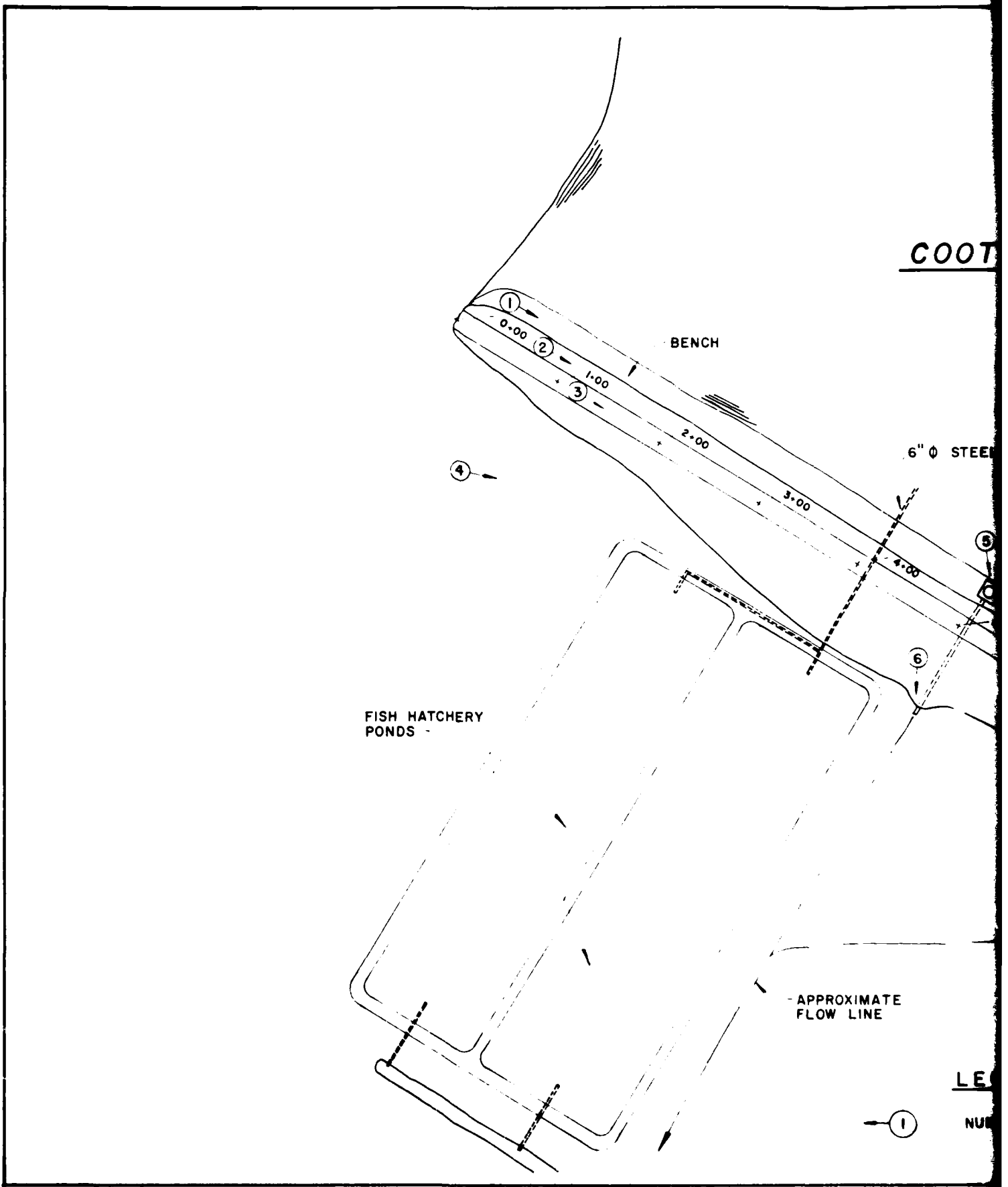
PLATE 2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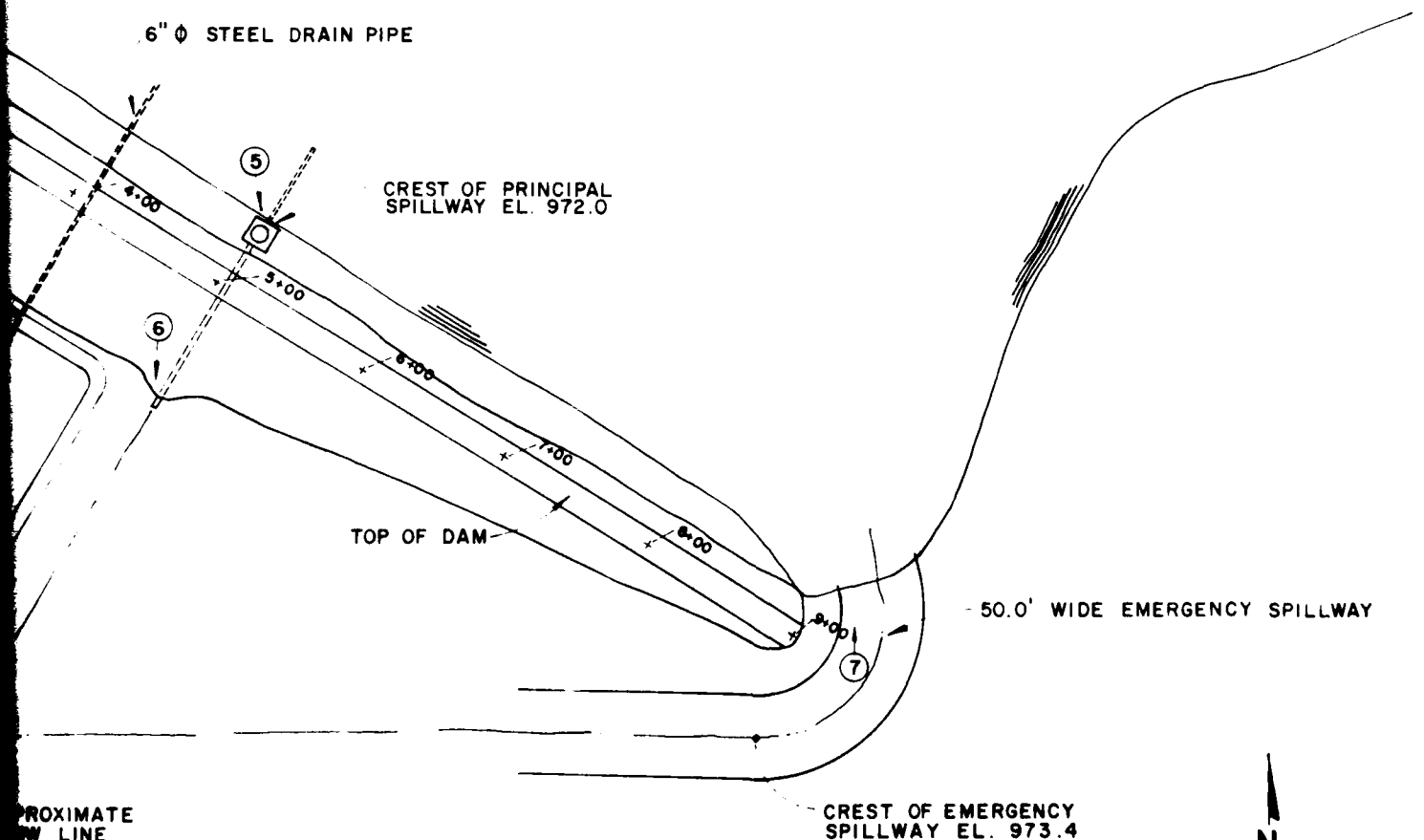


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## COOT LAKE PLAN

PLATE 3

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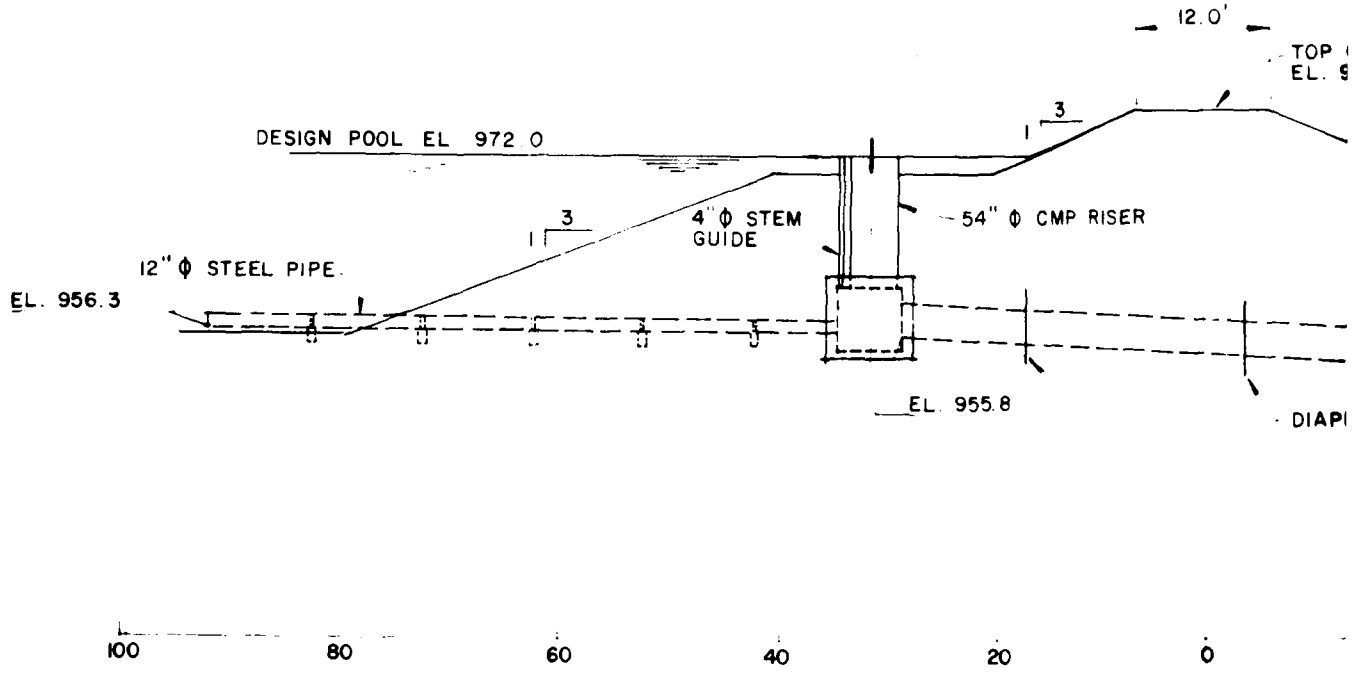


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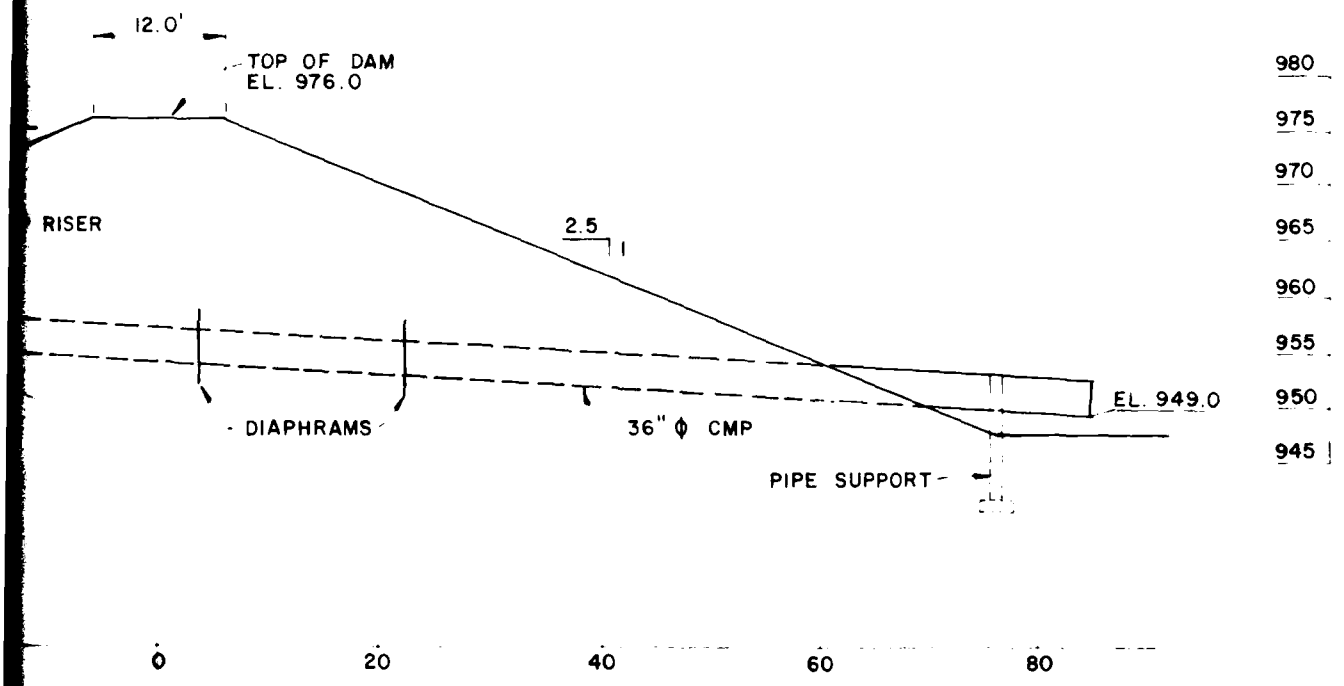



AT PRINCIPAL SPILLWAY

# COOT LAKE
# CROSS SECTION

PLATE 4

12

Photo 1: Upstream Face of Dam (Looking East)

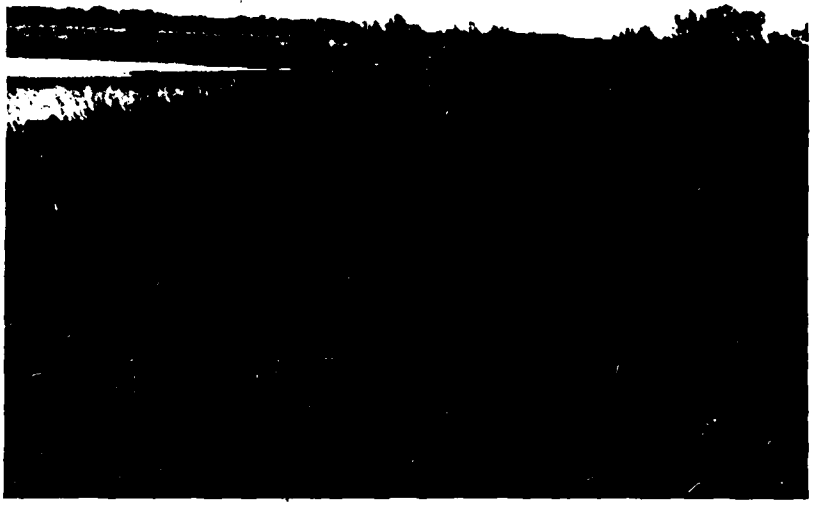


Photo 2: Bench on Upstream Face of Dam (Looking East)

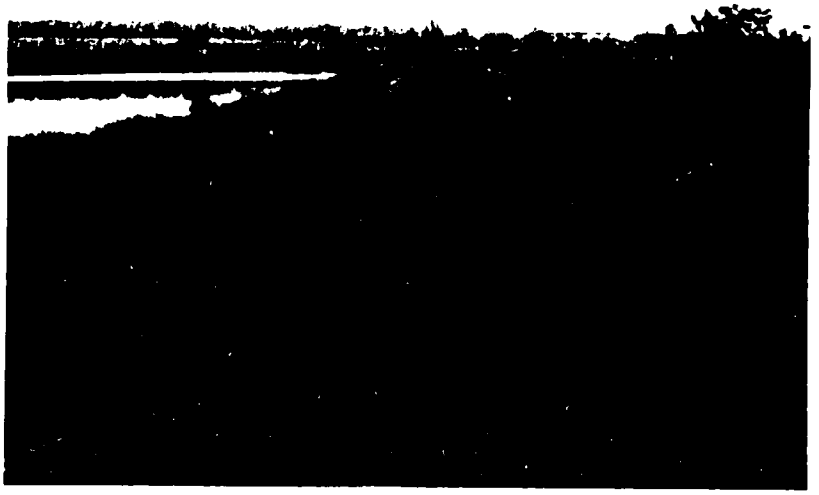


Photo 3: Crest of Dam (Looking East)

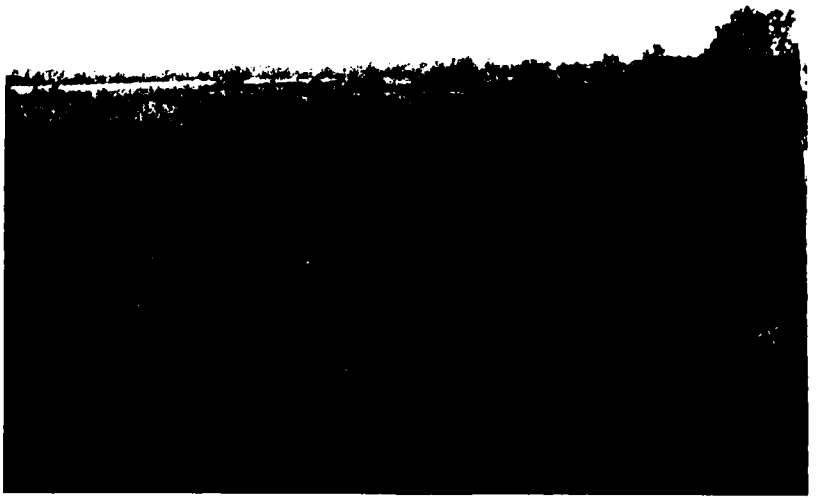


Photo 4: Downstream Face of Dam (Looking East)

Photo 5: Principal Spillway Inlet

Photo 6: Principal Spillway Outlet Pipe

Photo 7: Emergency Spillway Channel (Looking Upstream)

# APPENDIX A

# HYDROLOGIC COMPUTATIONS

## HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrograph (see Plate A-1 and A-2). Hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33:

| | |
|---|---|
| 200 square mile, 24 hour rainfall | - 24.8 inches |
| 10 square mile, 6 hour percent of 24 hour 200 square mile rainfall | - 101% |
| 10 square mile, 12 hour percent of 24 hour 200 square mile rainfall | - 120% |
| 10 square mile, 24 hour percent of 24 hour 200 square mile rainfall | - 130% |

b. Drainage area = 225 acres.

c. Time of concentration: $Tc = (11.9 \times L^3/H)^{0.385} = 0.27$ hours = 16 minutes (L = length of longest watercourse in miles, H = elevation difference in feet) (2)

d. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 85 and antecedent moisture condition III. The hydrologic soil groups in this area are B and D.

2. Spillway release rates are based on the broad-crested weir equation and a combination of both the broad-crested weir equation and the orifice equation.

Broad-crested weir equation:

$Q = CLH^{1.5}$ (C = 2.7, L = 50 feet for emergency spillway, H is the head on weir).

Combined broad-crested weir and orifice equation:

$Q = C_o (2 R_s) H_o^{3/2}$ ($C_o$ = 3.9 to 1.3, $R_s$ = 2.25 feet for the principal spillway, $H_o$ is the head on the shaft)

Discharge rates over the top of the dam are based on the broad-crested weir equation:

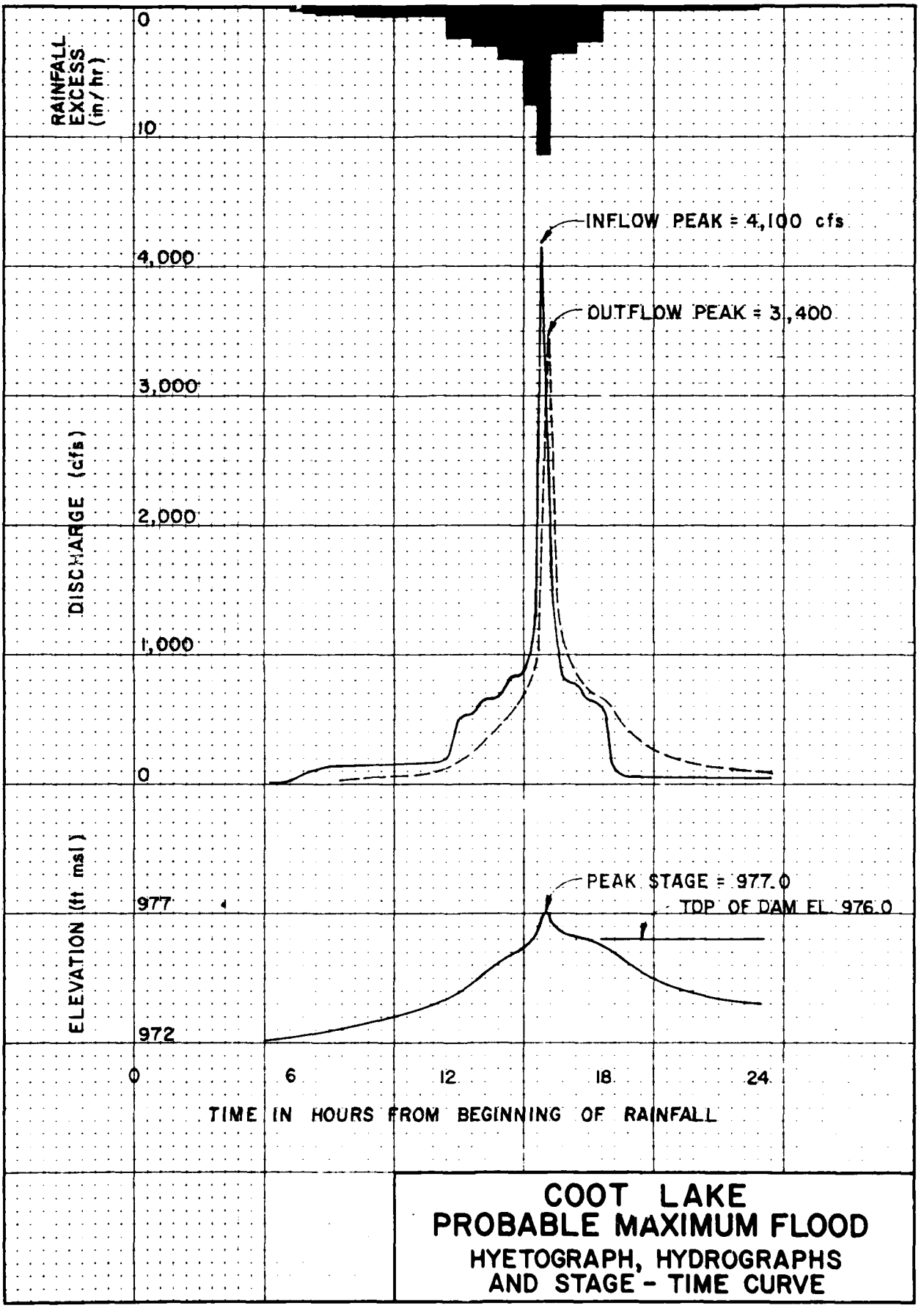
$Q = CLH^{1.5}$ (C = 2.6, L = 900 feet).

3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

4. Floods are routed through the spillways using HEC-1, with the modified Puls routing method, to determine the capacity of the spillways. Inflow and outflow hydrographs are shown on Plates A-1 and A-2.

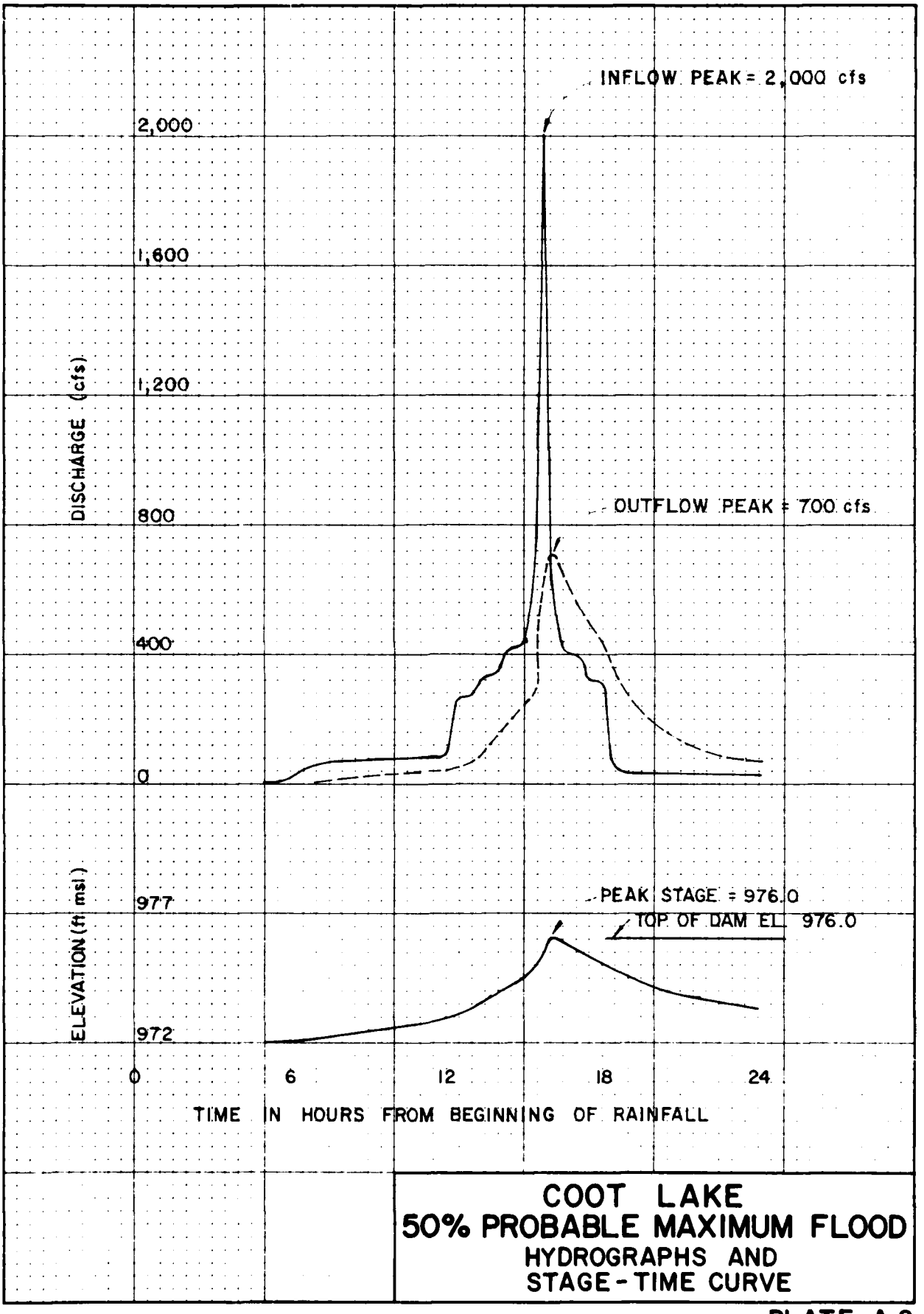
(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Dam Safety Verson, July, 1978, Davis, California

(2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.




# COOT LAKE
# PROBABLE MAXIMUM FLOOD
## HYETOGRAPH, HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-1




# COOT LAKE
## 50% PROBABLE MAXIMUM FLOOD
## HYDROGRAPHS AND STAGE-TIME CURVE

PLATE A-2


DATE
ILME