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NATIONAL DAM SAFETY PROGRAM. SHATTO DAM (MO 10068), MISSOURI - --ETC(U)
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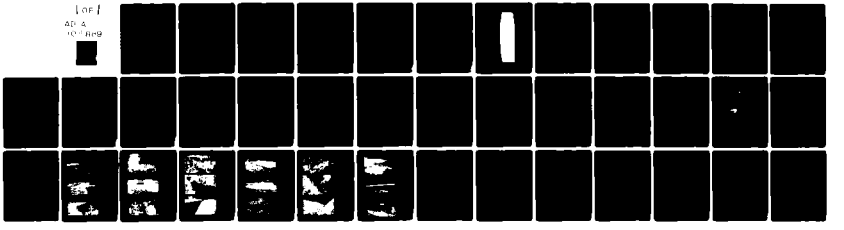

MISSOURI
MISSOURI-GRAND-CHARITON BASIN

LEVEL

SHATTO DAM

SULLIVAN COUNTY, MISSOURI

MO 10068

AD A105889

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Shatto Dam (MO 10068),
Missouri - Grand - Chariton Basin,
Sullivan County, Missouri. Phase I Inspection
Report.

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9 Final rept.

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10 Harold P. /Hoskins

PREPARED BY: HOSKINS-WESTERN-SONDEREGGER, INC.

FOR: STATE OF MISSOURI

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

IN REPLY REFER TO

SUBJECT: Shatto Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Shatto Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED — 28 SEP 1978
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 29 SEP 1978
Colonel, CE, District Engineer — Date

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Shatto Dam
State Located	Missouri
County Located	Sullivan County
Stream	Tributary to East Locust Creek
Date of Inspection	July 21, 1978

Shatto Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. 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 an intermediate size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends eight miles downstream of the dam. Within the first mile downstream of the dam are two homes with outbuildings, a large industrial complex, a drive-in theater, two highway crossings and one railroad crossing. The flood plain is farmed.

Our inspection and evaluation indicates that the spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillways will pass 36% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Additional deficiencies, in accordance with the guidelines, are the lack of seepage and stability analysis. These analyses should be obtained in the future.

Other deficiencies visually observed by the inspection team were small trees growing on the upstream embankment slope and some small willows growing around the spillway inlet.

The item of preventive maintenance in regard to tree growth needs to be initiated by the owner. This is described in detail in the body of the report. Copies of the report have been furnished the dam owner and the Governor of Missouri.

H. P. Hoskins E8696

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

SUBMITTED BY SIGNED — 28 SEP 1978
Chief, Engineering Division — Date

APPROVED BY SIGNED — 29 SEP 1978
Colonel, CE, District Engineer — Date

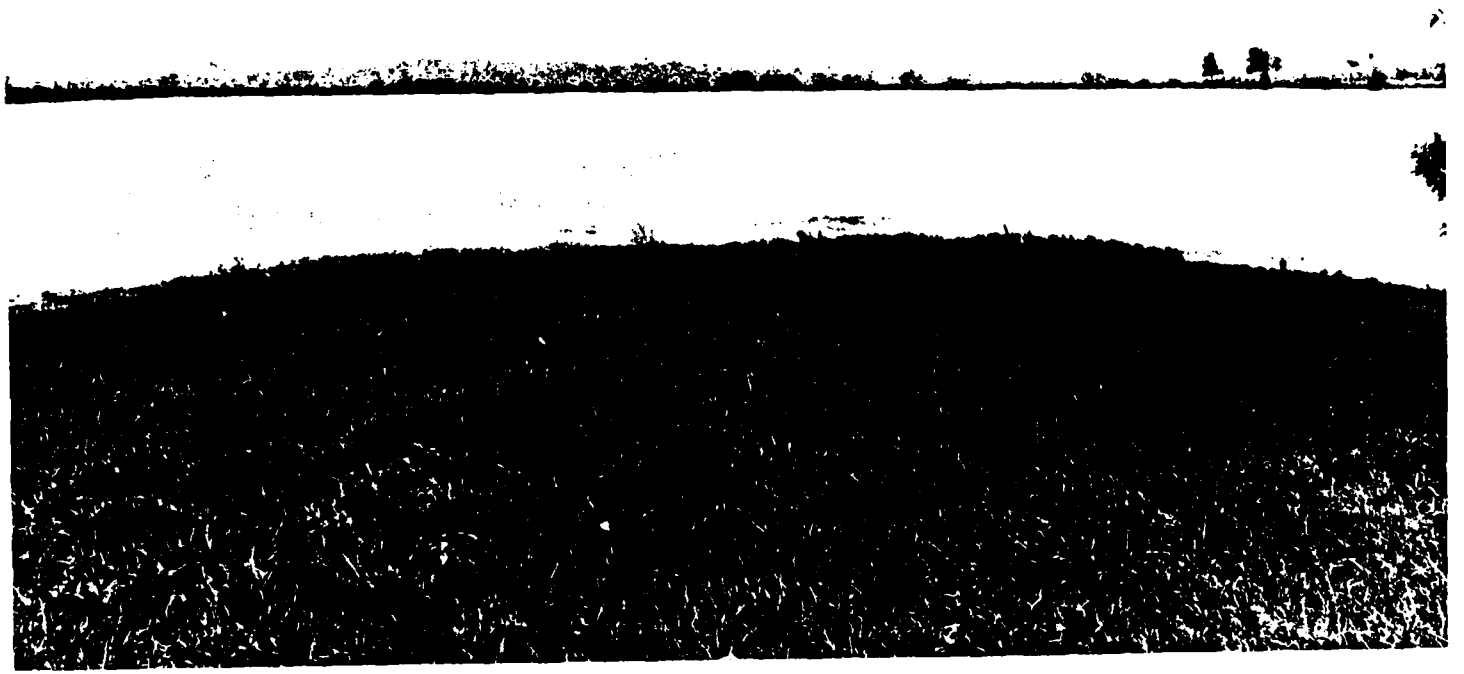

PHOTO. NO. 1
OVERVIEW OF RESERVOIR
AND DAM TAKEN FROM
WEST LOOKING EAST
DAM IN BACKGROUND

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SHATTO DAM - MO 10068

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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 St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Shatto Dam be made.

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 fill oriented about north and south and located just downstream from an abandoned limestone rock quarry. Slopes adjacent to the project area are gently rolling. Soils on the slopes are derived from fine grained plastic glacial till.

(2) An old railroad fill impounds the North side of the reservoir.

(3) An old railroad cut through the North (left) abutment about 400 feet upstream (west) of the dam serves as the emergency spillway.

(4) The principal spillway is located on the right (south) end of the dam and consists of a corrugated metal pipe riser (48 inch diameter) with a 12 inch diameter CMP outlet conduit.

(5) An old sewage lagoon, now used for fishing is located about 100 feet downstream from the toe of the dam at about centerline station 6+00 (see plan in Appendix C). Pertinent physical data are given in Paragraph 1.3 below.

b. Location. The dam is located in the central portion of Sullivan County, Missouri, as shown on Plate 2. The lake formed by the dam is located in the S½ of Sec. 10, T62N, R20W as shown on Plate 1.

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, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends eight miles downstream of the dam. Within the first mile downstream of the dam are two homes with outbuildings, a large industrial complex, a drive-in theater, two highway crossings and one railroad crossing. The floodplain is farmed.

e. Ownership. The dam is owned by John Shatto, Milan, Missouri 63556.

f. Purpose. The dam forms a 31± acre recreational lake.

g. Design and Construction History. No design data or plans were available for this dam. However, it was reported hydrology and hydraulic analyses were performed by an engineer at the University of Missouri and that Soil Conservation Service personnel assisted in laying out the dam. The owner reported that construction of the dam took 15 months and was completed in 1965.

The dam was constructed by the owner and neighbors. Silty clay and clay from the reservoir area was used for the embankment. Materials were spread in lifts of 8 to 10 inches thick and compacted by routing the rubber tired earth moving equipment (3 were used) over the entire fill. It was reported that personnel from the Corps of Engineers visited the project 2 or 3 times during the construction, performed density tests, and indicated that embankment compaction was over 100 percent of standard density. The embankment was constructed using selective placement of clay materials in the upstream and center sections and random fill in the downstream section. In 1965 or 1966, seepage from a natural spring (elevation of spring was above lake level) in the south (right) abutment caused a slip in the downstream slope of the dam in the area around centerline station 10+00. This area was excavated to a depth of 15 to 18 feet where the source of the seepage was intercepted with a perforated pipe/gravel drainage system. The spring which produced the seepage originates in the hill south of the highway. Construction of the dam blocked the natural drainageway that had previously served as an outfall for the discharge from the spring. The drain from the spring outlets into the lagoon downstream from the toe of the dam. The area has remained dry and no problems have been encountered since the drainage system was installed.

h. Normal Operating Procedure. There are no controlled operating facilities for this dam. It was reported that the maximum reservoir level occurred in 1969 when water discharged through the emergency spillway to a maximum depth of 6 inches for a period of 4 days. SCS engineers estimated that this flood resulted from a 60 year ± frequency rainfall.

1.3 PERTINENT DATA

a. Drainage Area - 173 Acres

b. Discharge at Damsite

(1) All discharge at the damsite is through an uncontrolled corrugated metal pipe drop inlet principal spillway and a grassed earth channel ungated emergency spillway, which is formed from an abandoned railroad cut.

(2) Estimated maximum flood at damsite - 100 c.f.s. estimated maximum emergency spillway outflow (see paragraph 1.2g).

(3) The principal spillway capacity varies from 0 c.f.s. at elevation (887.9) to 4 c.f.s. at the invert of the emergency crest (889.5).

(4) The principal spillway capacity at maximum pool elevation (891.1 min. dam crest) is 4 c.f.s.

(5) The emergency spillway capacity at maximum pool elevation is 166 c.f.s.

(6) The total spillway capacity at maximum pool elevation is 170 c.f.s.

c. Elevation (Feet above M.S.L. estimated from U.S.G.S. Quad Sheets.)

(1) Top of dam - 892 ±.

(2) Principal spillway crest - 888 ±.

(3) Emergency spillway crest - 889.5 ± (measured).

(4) Streambed at centerline of dam - 837 ±.

(5) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 2200 feet ±.

e. Storage (Acre-feet). Top of dam - 206.

f. Reservoir Surface (Acres).

(1) Top of dam - 33.0 ±.

(2) Spillway crest - 29.3 ±.

g. Dam

(1) Type - earth embankment.

(2) Length - 1050 ± feet.

(3) Height - 55 ± feet (maximum).

(4) Top width - 30 feet (measured).

(5) Side slopes.

(a) Downstream - 3H on 1V in upper one third, 5.7 H on 1V in lower section (measured with abney hand level and stadia board).

(b) Upstream - 3H on 1V (measured).

(6) Zoning - Selective placement of silty and sandy clay in the upstream and center sections.

(7) Impervious core - yes.

(8) Cutoff - Reported to be compacted earth to depths of 16 to 18 feet below ground surface.

(9) Grout curtain - no.

(10) Wave protection - Riprap extending from top of dam down slope to 10 to 12 feet below normal pool elevation.

(11) Foundation/Embankment Drains - no.

h. Diversion and Regulating Tunnel. None.

i. Spillway.

(1) Principal

(a) Type - 48 diameter corrugated metal pipe inlet riser (See Photo No. 5) with wire mesh screen on crest and a 12 inch corrugated metal pipe conduit.

(b) Length of weir (circular) - 12.6 feet

(c) Crest elevation - 887.9 feet M.S.L.

(2) Emergency

(a) Type - abandoned railroad cut modified to grassed earth channel.

(b) Control section - 26 foot bottom width with 2:1 side slope (station 2+00).

(c) Crest elevation - varies from 889.5 feet M.S.L. invert to 890.0 at edges.

(d) Upstream channel - clear and well grassed.

(e) Downstream channel - constricted by abandoned railroad grade culvert and heavy brush but would not cause backwater effects on spillway discharge.

j. Regulating Outlets

(1) Principal spillway - None

(2) Emergency spillway - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data, other than that reported by the owner and discussed in Section 1.2g, were available for this dam. Topographic data for reservoir stage - volume relationships were taken from U.S.G.S. 15 Min. Quad sheets with 20 foot contour intervals.

2.2 CONSTRUCTION

No construction data, other than that reported by the owner, were available.

2.3 OPERATION

The maximum loading on the dam reported by the owner was a storm in 1969 which produced about 0.5 feet of water passing over the uncontrolled emergency spillway. Lake levels remain fairly stable as evidenced by the permanent boat docks around the shoreline.

2.4 EVALUATION

a. Availability. No engineering data were available other than as reported by the owner.

b. Adequacy. The information on embankment design and construction that was available seems adequate to evaluate the stability of the dam. The topographic data for reservoir volume relationships and flood routings are approximate.

c. Validity. Discussions with the owner indicated that he had a good working knowledge about earth dam design and embankment construction.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Shatto Dam was conducted on July 21, 1978. The inspection team consisted of Rey Decker and Steve Nickel, geology and soil engineering; Garold Ulmer, Civil engineer, and Richard Walker, hydrology, all from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska. The owner, Mr. Shatto, spent several hours with the inspection team during the inspection.

b. Dam. The riprap on the upstream face consists of durable limestone and looks good. There was no evidence of significant erosion or slips on the upstream slope. A couple of elm saplings, near the waterline, were observed toward the left (north) end of the dam. Some small willows were also observed around the principal spillway inlet area.

Rough measurement along the crest of the dam (see Appendix C) showed little variance in crest elevation. Materials on the surface of the dam consist of lean to fat clays (CL or CH) with occasional gravel. No cracks or deformations were noted on the crest.

The downstream slope is well vegetated with clover, alfalfa and brome grass and had been recently mowed.

The surface of the lower one half ± of the downstream slope was wet with some free water accumulated in mower tracks extending transversely (north-south) across the slope. However, it was reported that this area had 1 to 2 inches of rain the day before the inspection. All of the free water observed on the slope was ponded and was clear, with no indication of boils or piping. There was no indication of slips or deformations on the downstream slope. The measured section (Appendix C) shows a bump in the slope. The owner reported that the dam was built "that way". Water was ponded along the toe of the dam downstream from centerline stations 3+00 to 4+00. This could be the result of recent rainfall. The owner reported that this area dries out.

The drain from the spring on the right abutment was discharging into the lagoon at the rate of 1 gal/min.±. The water level in the lagoon was at elevation 839± or about 3 feet lower than the toe of the dam. A road culvert drains the south side of the road into the lagoon at the toe of the dam. The lower end of the outlet channel from this culvert is eroded to a depth of 2 to 3 feet.

Abutments for the dam consist of glacial till which apparently overlies limestone (stone was quarried in the bottom of the valley which now comprises a portion of the reservoir bottom). No slides were evident in the abutments. A seepy area was observed in the left (north) abutment adjacent to the embankment-abutment through about halfway between the crest and the toe of the dam. No boils were observed and the discharge from this seep area was clear. Discharge was estimated to be 0.1± gal/min. This seep could be the result of a natural spring in the left abutment as discovered and remedied on the right abutment.

c. Appurtenant Structures. The principal spillway consists of a corrugated metal pipe riser, 4 feet in diameter and 4 feet in height, connected to a 12 inch diameter CMP outlet passing through the dam. The inlet pipe is covered with wire mesh. The outlet discharges into the natural drainageway about 1200 feet downstream from the dam (see plan view in Appendix C). Water to a depth of about 2 inches was flowing over the crest of the spillway at the time of the inspection. There was no visual evidence of deterioration of the principal spillway.

An old railroad cut is utilized as an emergency spillway (see Appendix C). The spillway crest is about 34 feet from the shoreline of the lake. It has an elevation of 889.5± feet and a bottom width of 33± feet. The outlet channel has a bottom width of 26± feet and side slopes of 2.1 to 2.5 H on 1V. The emergency spillway is well grassed and maintained. No obstructions, slides, or deformations were noted in the spillway.

An old railroad embankment forms an auxilary dike across a small arm of the lake just west of the emergency spillway. This dike has a crest width of 15± feet and crest elevation of 892± to 894± feet. The stability of this dike has no affect upon the stability or operation of the dam and reservoir.

e. Downstream Channel. The principal spillway discharges through a pipe into the natural drainageway some 1200 feet below the dam. No operational problems were noted at the outlet of this spillway. The emergency spillway discharges into an adjacent watershed over the hill that forms the north abutment of the dam.

3.2 EVALUATION

None of the conditions observed are significant enough to indicate a need for remedial action or serious potential of failure. The few small trees on the upstream face could ultimately lead to potential of failure if left uncontrolled. Additional studies would be required to assess the nature of and the potential adverse affects of seepage on the downstream side of the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam.

4.2 MAINTENANCE OF DAM

Maintenance procedures include regular mowing of the dam, controlling the moss and cattails in the lake and keeping the inlet to the principal spillway unobstructed.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist for this dam.

4.4 DESCRIPTION OF WARNING SYSTEM

No warning system is in effect for this dam.

4.5 EVALUATION

Observations indicate that maintenance of this dam is very good.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No hydraulic and hydrologic data were furnished by the owner. Therefore, all computations are based on field inspection and surveys by the consultant. The plan, profiles and cross sections from the survey are attached in Appendix C.

b. Experience. The drainage area and contour surface areas are developed from the U.S.G.S. Milan West Quadrangle sheet. The spillway and dam layout are from surveys made during inspection.

c. Visual Observations.

(1) Principal and emergency spillways are in good condition except as noted.

(2) The emergency spillway has been used as described in paragraph 1.2g Normal Operating Procedure.

(3) The emergency spillway and exit channel are in the left hillside abutment well away from the dam. Spillway releases will not endanger the integrity of the dam.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. One-half the PMF will overtop the dam by 0.62' for a period of 3.4 hours. The spillways will pass 36% of the PMF without overtopping. The existing spillways will pass the 100-year frequency flood without overtopping. The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 891.1	Time Dam Overtopping Hr.
100 Yr.	300	100	890.3	+0.8	0
1/2 PMF	800	600	891.7	-0.6	3.25
PMF	1700	1600	892.	-1.3	5.5
0.36 PMF	600	200	891.1	0	0

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and an intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillways.

The St. Louis District Corps of Engineers, in a letter dated 13 July, 1978 has estimated the damage zone as extending eight miles downstream of the dam. Within the first mile downstream of the dam are two homes with outbuildings, a large industrial complex, a drive-in theater, two highway crossings and one railroad crossing. The flood plain is farmed.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations which could adversely affect the structural stability of this dam are discussed in Section 3.

b. Design and Construction Data. No design or construction data were available, other than as reported by the owner and discussed in Section 1.2 g. The lack of seepage and stability analysis is a deficiency that should be corrected.

c. Operating Records. There are no operating facilities for this dam.

d. Post Construction Changes. The discharge from a natural spring in the south (right) abutment was intercepted and controlled and the slip on the downstream slope of the dam caused by the uncontrolled seepage from spring was repaired a couple of years after the dam was constructed.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The few small trees on the upstream face of the dam should be removed. Additional studies should be made to determine the source and affects on structural stability of seepage conditions observed on the downstream slope and toe of the dam. The probable maximum flood will overtop the dam. The spillways will pass the 0.36 PMF without overtopping.

b. Adequacy of Information. No design or construction data were available. However, the visual observations, performance history and information provided by the owner are considered sufficient to support the conclusion reported herein. Topographic data used for reservoir storage relationships and subsequent flood routings are approximate. Neither seepage nor stability analysis were found which is a deficiency that should be corrected in the future.

c. Urgency. There doesn't appear to be an immediate urgency to perform the remedial or maintenance features recommended in paragraph 7.2 below.

d. Necessity for Phase II. Phase II investigation is not called for. Additional engineering data should be obtained, at the owner's expense, to determine the source of the seepage water observed on the downstream slope and toe of the dam and the possible affects that the seepage may have upon the structural stability of the dam. The engineering investigations should be done by a professional engineer who is experienced and competent in earth dam design.

e. Seismic Stability. The magnitude of an earthquake in Seismic Zone 1, where this dam is located, is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives

(1) Additional studies and analyses should be performed to assess the affects of seepage on the structural stability of the downstream slope of the dam.

(2) The spillway size and/or the height of the dam should be increased to pass the maximum design flood without overtopping the dam.

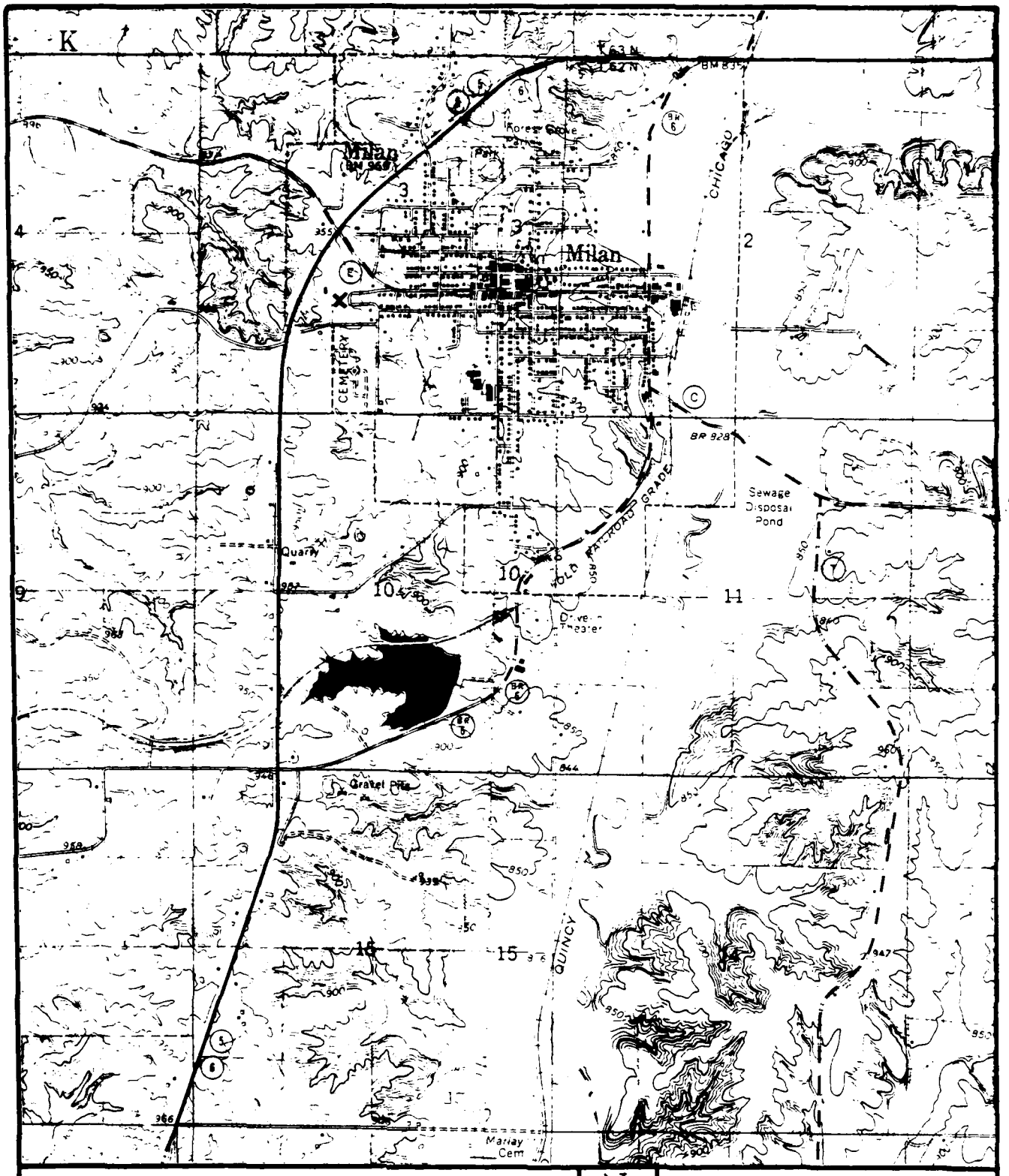
(3) Remedial measures should be performed by a professional engineer who is experienced and competent in earth dam design.

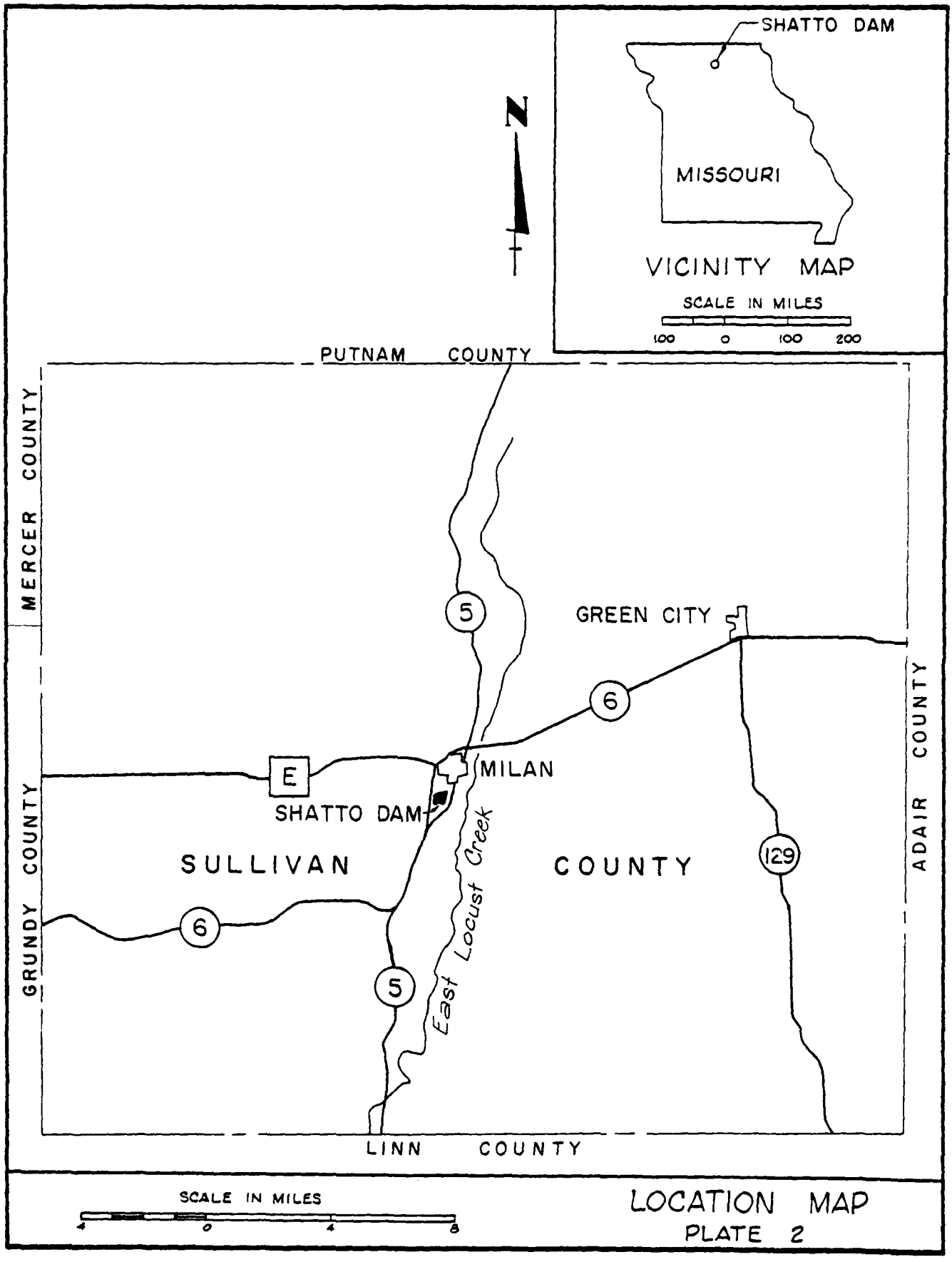
b. O & M Maintenance and Procedures

(1) The few small trees should be removed from the upstream face of the dam and measures initiated to prevent their recurrence.

(2) Present maintenance procedures, other than as noted above, seem to be adequate.

APPENDIX A
MAPS


K
Milan
BM 969
Milan
CHICAGO
CEMETERY
BR 928
Sewage
Disposal
Pond
OLD RAILROAD GRADE
Quarry
Drive-in
Theater
Gravel Pits
QUINCY
Marlay
Cem
SCALE IN FEET
2000 1000 0 2000 4000
1000 500 0 1000
SCALE IN METERS
N
SHATTO
LAKE DAM
VICINITY TOPOGRAPHY
PLATE 1


SHATTO DAM
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
N
PUTNAM COUNTY
MERCER COUNTY
GRUNDY COUNTY
ADAIR COUNTY
LINN COUNTY
GREEN CITY
MILAN
SHATTO DAM
SULLIVAN COUNTY
East Locust Creek
5
6
E
129
SCALE IN MILES
4 0 4 8
LOCATION MAP
PLATE 2

APPENDIX B
PHOTOGRAPHS

PHOTO. NO. 2
DOWNSTREAM SLOPE
TAKEN FROM EAST
LOOKING WEST

PHOTO. NO. 3
DOWNSTREAM SLOPE
TAKEN FROM NORTH
LOOKING SOUTH

PHOTO. NO. 4
UPSTREAM SLOPE
TAKEN FROM NORTH
LOOKING SOUTH

PHOTO. NO. 5
48" DIAMETER CMP
SPILLWAY ENTRANCE

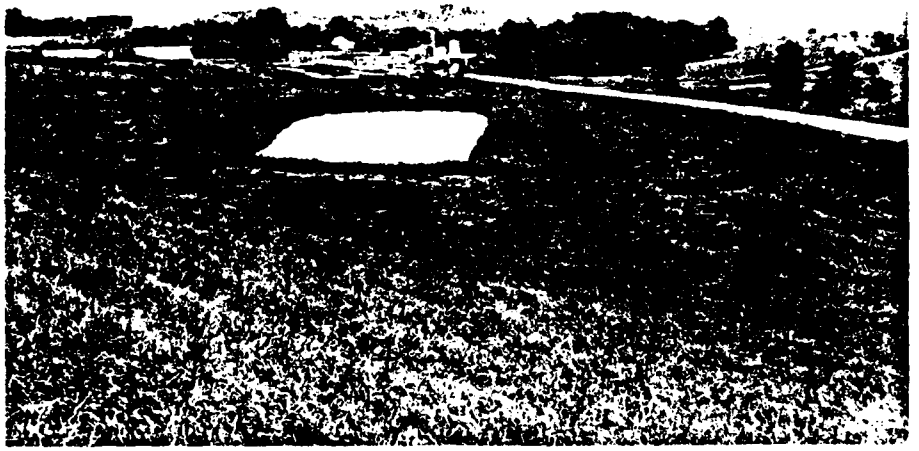


PHOTO. NO. 6
FORMER SEWAGE
LAGOON DOWNSTREAM
FROM DAM. PHOTO.
TAKEN FROM SOUTH
END OF DAM.

PHOTO. NO. 7
DRAINAGE OUTLET
FOR SPRING - SOUTH
ABUTMENT

PHOTO. NO. 8
PRINCIPAL SPILLWAY
OUTLET

PHOTO. NO. 9
PRINCIPAL SPILLWAY
OUTLET

PHOTO. NO. 10
DOWNSTREAM SLOPE
TAKEN FROM HIGHWAY
LOOKING NORTHWEST

PHOTO. NO. 11
DOWNSTREAM SLOPE
TAKEN FROM HIGHWAY
LOOKING NORTHWEST

PHOTO. NO. 12
DOWNSTREAM SLOPE
OF DAM. TAKEN
FROM HIGHWAY
LOOKING NORTH.

PHOTO. NO. 13
SEEP AREA ON
NORTH ABUTMENT

PHOTO. NO. 14
SEEP AREA ON
NORTH ABUTMENT

PHOTO. NO. 15
LOOKING UPSTREAM
IN EMERGENCY
SPILLWAY

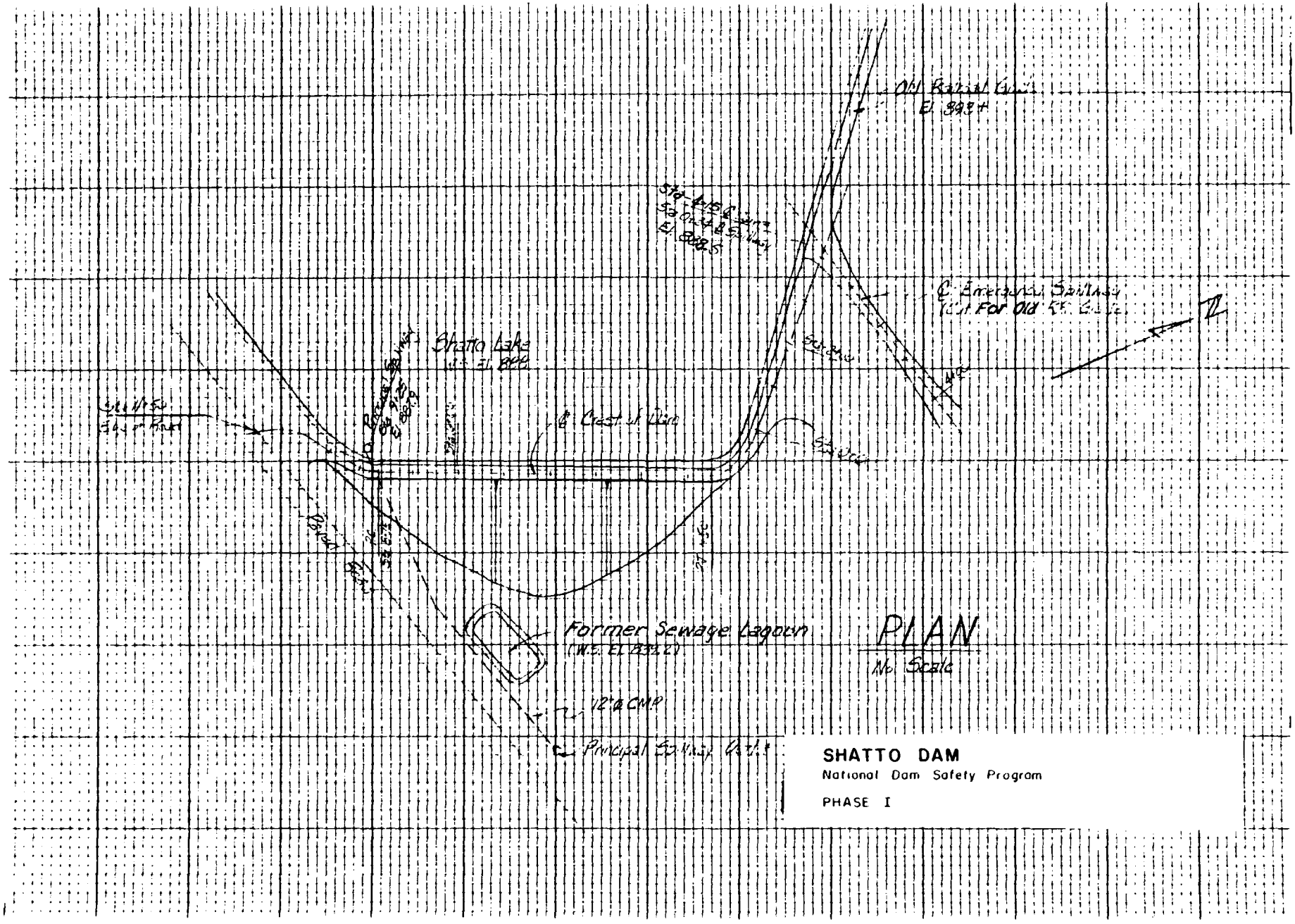
PHOTO. NO. 16
LOOKING UPSTREAM
IN EMERGENCY
SPILLWAY. ROD
AT CONTROL SECTION.

PHOTO. NO. 17
OLD RAILROAD
GRADE TAKEN
FROM WEST

PHOTO. NO. 18
UPSTREAM FACE OF
DAM LOOKING SOUTH-
EAST

PHOTO. NO. 19
LOOKING UPSTREAM
FROM CENTER LINE
OF DAM

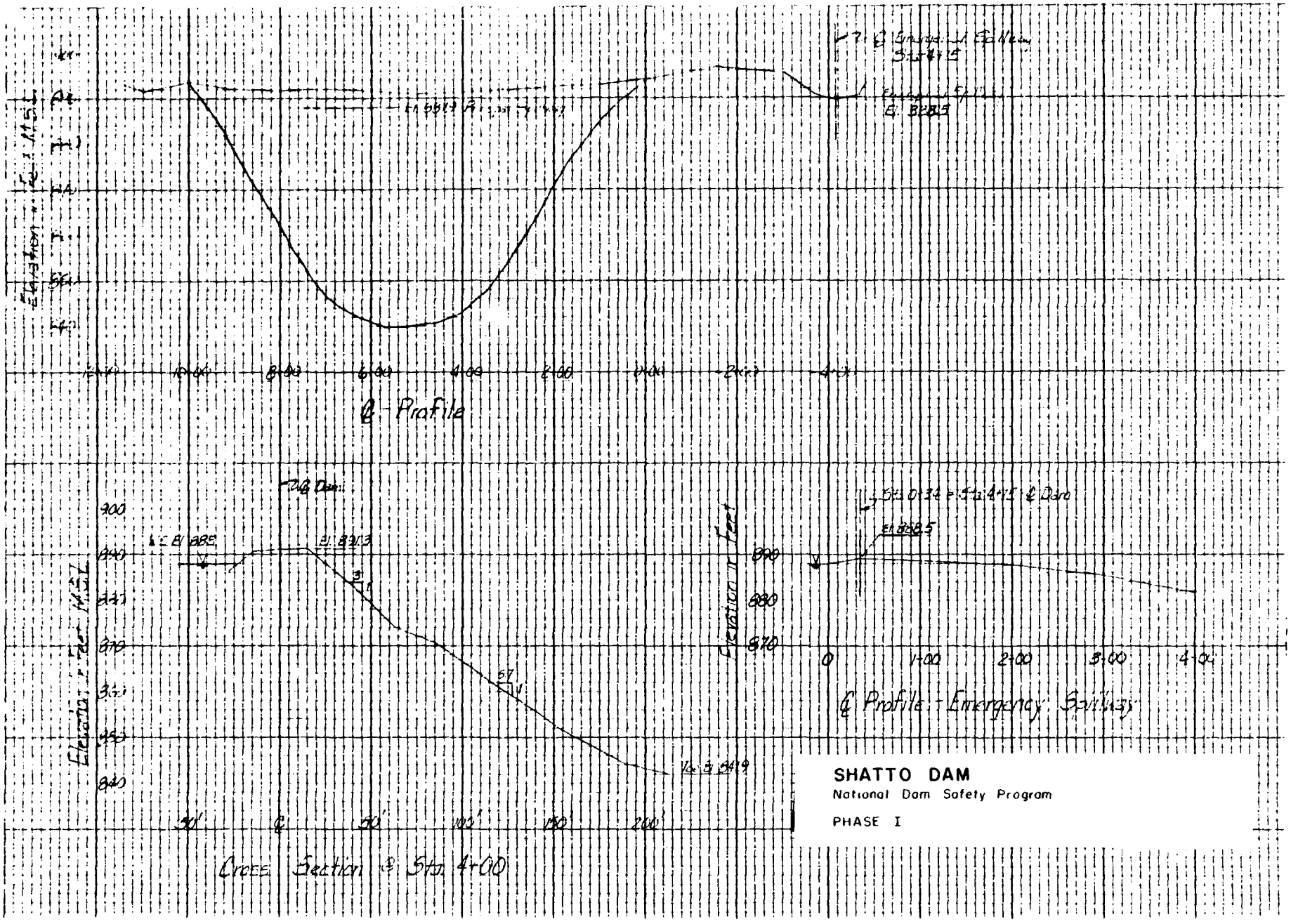
APPENDIX C
PLANS AND REPORTS



SHATTO DAM

National Dam Safety Program

PHASE I


℄ - Profile
℄ Profile - Emergency Spillway
Creek Section @ Sta. 4+00
SHATTO DAM
National Dam Safety Program
PHASE I

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvalinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1).

a. Twenty four-hour, 12-hour, and 6-hour 100-year rainfalls for the dam location were taken from NWS Technical Paper 40. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current OCE directives furnished 4 August 1978 and formally stated in a letter dated 21 August 1978.

b. Drainage area = 0.27 square miles.

c. Time of concentration of runoff = 19 minutes.

d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMCIII). The initial pool elevation was assumed at the crest of the principal spillway.

e. The total 24-hour storm duration losses (interception, infiltration and evapotranspiration) for the 100-year storm were 0.67 inches which is a 0.22 PMF storm. The total losses for the 24-hour duration 1/2 PMF storm were 0.70 inches. The total losses for the PMF storm were 0.72 inches. These data are based on SCS runoff curve No. 86 and antecedent moisture conditions from SCS AMCIII.

f. Average soil loss rates = 0.02 inches per hour approximately. These low loss rates are due, again, to the large part of the reservoir occupying the drainage area.

2. A combined spillway discharge and dam overtopping rating was computed from the given field data. The principal pipe spillway rating was computed using the procedures and data given in "Hydraulic Characteristics of Reservoir Outlet Works" furnished by the St. Louis District. This small relative change in head gives almost constant discharge. The discharge rating for the emergency spillway is based on the broad crested weir equation ($Q = CLH^{3/2}$) for flows equal to or less than 60 CFS at the spillway entrance. (See Plan - Sta. 0+34 - Appendix C). H is the head on the crest, L is the effective crest length, and the coefficient C varies with the head and is taken from the USGS publication "Measurement of Peak Discharge at Dams by Indirect Methods: Book 3, Chapter 5, TWRI". Hydraulic analysis of the spillway channel shows the control section shifting from Sta. 0+34 to Sta. 2+00 at flows greater than 60 CFS. (See Appendix C). At Sta. 2+00 the flow rating is extended on upwards by assuming critical depth at the control section (Sta. 2+00) and then computing an M2 water surface profile back to the reservoir. The flows over the dam crest are based again on the broad crested weir equation and USGS criteria for road or dam embankments with an unpaved surface.

3. Floods were routed through the spillway using the TR-20 program, which uses the "modified puls" method to determine capability of the spillway and dam embankment crest. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are given on Plate D1.

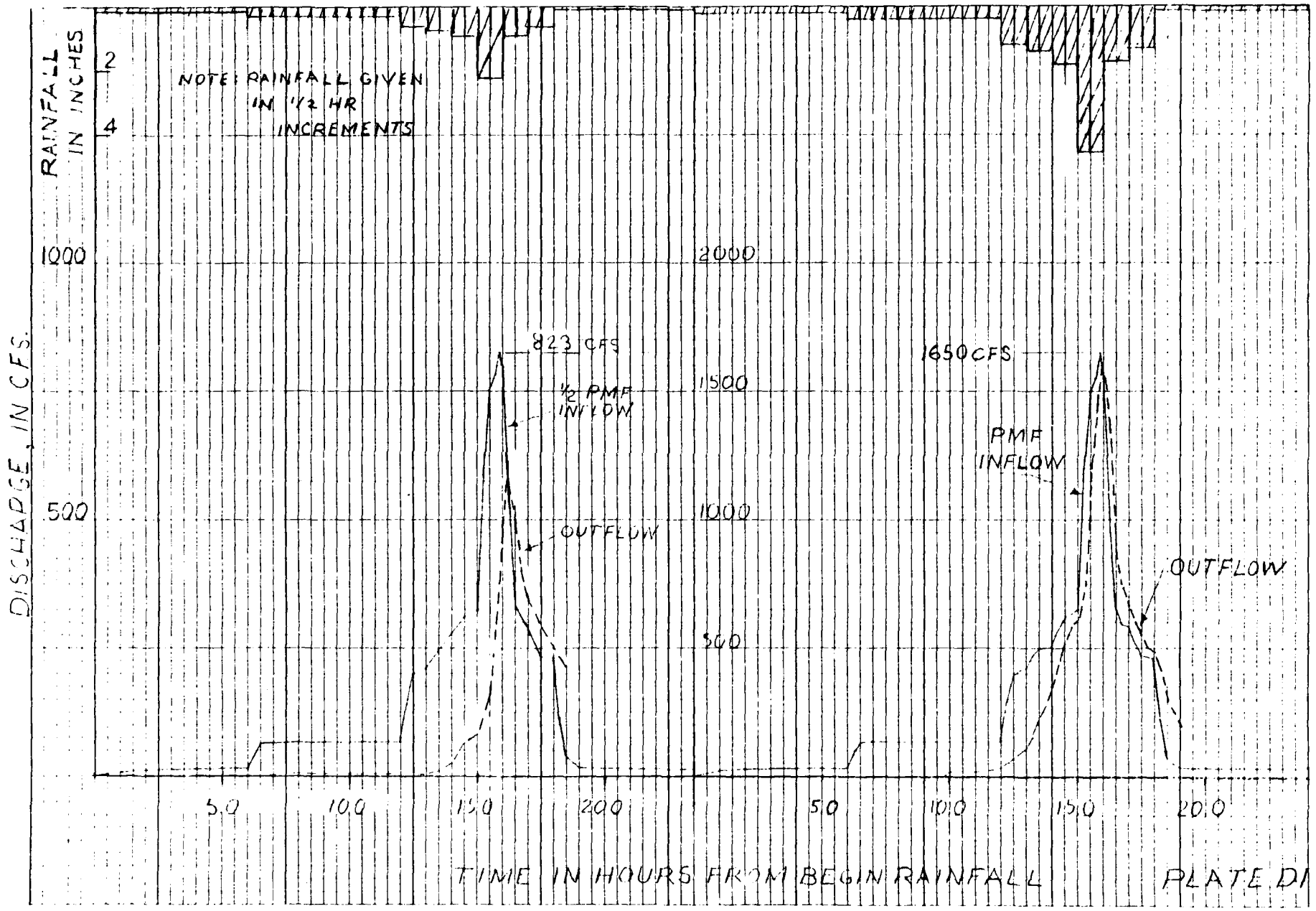

RAINFALL IN INCHES
2
4
NOTE: RAINFALL GIVEN IN 1/2 HR INCREMENTS
DISCHARGE, IN CFS.
1000
500
2000
1500
1000
500
823 CFS
1/2 PMF INFLOW
OUTFLOW
1650 CFS
PMF INFLOW
OUTFLOW
5.0
10.0
15.0
20.0
5.0
10.0
15.0
TIME IN HOURS FROM BEGIN RAINFALL

PLATE D1