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BLACK AND VEATCH KANSAS CITY MO  
NATIONAL DAM SAFETY PROGRAM. RHODEN INVESTMENT DAM - NO NAME 91--ETC(U)  
AUG 78 D P GUPTA, B A AINSWORTH, H L CALLAHAN

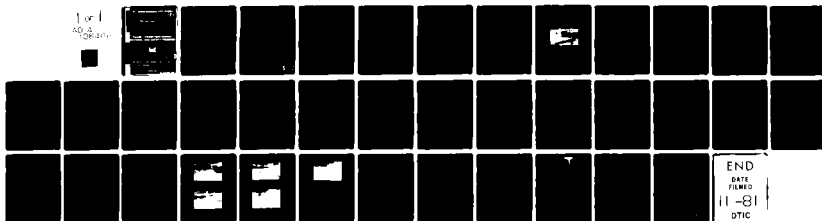
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PHASE I INSPECTION REPORT

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18. SUPPLEMENTARY NOTES		
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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

NONAME 91  
JACKSON COUNTY, MISSOURI  
MO 20144

## PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



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

FOR: STATE OF MISSOURI

AUGUST 1978

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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: Nonaime 91 Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Nonaime 91 dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

- 1) Spillway will not pass 50 percent of the Probable Maximum Flood;
- 2) Overtopping could result in dam failure;
- 3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: \_\_\_\_\_

**SIGNED**  
Chief, Engineering Division

**9 FEB 1970**  
Date

APPROVED BY: \_\_\_\_\_

**SIGNED**  
Colonel, CE, District Engineer

**12 FEB 1970**  
Date

NO NAME 91

JACKSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20144

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	No Name 91 Dam
State Located	Missouri
County Located	Jackson County
Stream	Tributary to Blue River
Date of Inspection	29 August 1978

No Name 91 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 two improved roads within the first 2 miles of the estimated damage zone which extends 3 miles downstream of the dam.

Our inspection and evaluation indicates the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The criteria for a spillway on a small dam in the high hazard category is that the spillway pass 50 to 100 percent of the probable maximum flood without overtopping the dam. The spillway will not pass the probable maximum flood without overtopping but will pass 15 percent of the probable maximum flood which is less than the 100-year flood. Due to the small volume of water impounded, the large flood plain downstream and the potential hazard to life and property, the spillway should be designed to pass 50 percent of the probable maximum flood. 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 only deficiency visually observed by the inspection team was some minor erosion on the downstream embankment slope. Seepage and stability analyses were not available which is considered a deficiency.

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 prevent additional erosion on the embankment which could lead to the development of potential safety hazards. A detailed report discussing this deficiency is attached.

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Missouri E-17479

Bruce A. Ainsworth  
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Harry L. Callahan  
Harry L. Callahan, Partner  
Black & Veatch





OVERVIEW OF DAM

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
NO NAME 91 DAM

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APPENDIX

Appendix A - Hydrologic Computations

## 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 No Name 91 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, Appendix D". 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 southwestern Jackson County, Missouri (see Plate 1). Topography of the contributing watershed is characterized by rolling hills. The watershed comprises privately owned farm land. Topography in the vicinity of the dam is shown on Plate 2.

(2) A spillway channel was excavated in the limestone strata in the south abutment. A concrete broad-crested weir and spillway was constructed at the left abutment from which the water flows into a natural limestone discharge channel.

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

b. Location. The dam is located in the southwestern portion of 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 Belton, Missouri, in the NE 1/4 of Section 33, T47N, R33W.

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 No Name 91 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 No Name 91 Dam the flood damage zone extends downstream for 3 miles. Within the damage zone downstream of the dam are four houses, and two improved roads.

e. Ownership. The dam is owned by Rhoden Investment Company of Kansas City, Missouri, 3600 Broadway, Kansas City, Missouri 64111.

f. Purpose of Dam. The dam forms a 7-acre recreational lake.

g. Design and Construction History. The inspection team was unable to locate design data for the dam. The dam reportedly was constructed in 1965.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation.

### 1.3 PERTINENT DATA

a. Drainage Area - 392 acres.

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through an uncontrolled spillway.

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

(3) Estimated ungated spillway capacity at maximum pool elevation - 820 cfs (top of dam).

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

(1) Top of dam - 1,000  $\pm$  (see Plate 3)

(2) Spillway crest - 996.2

(3) Streambed at centerline of dam - 965  $\pm$

(4) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 1,000 feet  $\pm$

e. Storage (Acre-feet).

- (1) Top of dam - 82
- (2) Design Surcharge - not available

f. Reservoir Surface (Acres).

- (1) Top of dam - 10
- (2) Spillway crest - 7

g. Dam.

- (1) Type - earth embankment
- (2) Length - 560 feet
- (3) Height - 35 feet maximum (from 1973 inventory)
- (4) Top width - 29 feet  $\pm$
- (5) Side Slopes - varies, front face approximately 2.6H to 1V, back slope 2 to 3.5H 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. Spillway.

- (1) Type - concrete and rock (see paragraph 3.1c)
- (2) Length of weir - 27 feet (see paragraph 3.1c)
- (3) Crest elevation - 996.2 feet m.s.l.
- (4) Gates - none
- (5) Upstream Channel - none

(6) Downstream Channel - Broken limestone and shale. Side slopes one-quarter mile downstream of dam are typical of streams in the area.

j. Regulating Outlets - none

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

No design data were found to be readily available.

### 2.2 CONSTRUCTION

The dam was constructed in 1965. No additional construction data are available.

### 2.3 OPERATION

The maximum recorded loading on the dam is unknown.

### 2.4 EVALUATION

a. Availability. No engineering data were found.

b. Adequacy. No engineering data were available to make a detailed assessment of design, construction, and operation. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record.

c. Validity. No engineering data were available to determine the validity of the design, construction, and operation.



## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

a. General. A visual inspection of No Name 91 Dam was made on 29 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. Some erosion was noted near the right abutment on the downstream embankment. The upstream slope has no slope protection other than vegetation; however, there was very little erosion evident. Soil types in the area are predominantly clays. Observations of the spillway discharge channel indicate the dam foundation may be comprised of limestone and shale. No animal burrows, sliding, cracking, settlement, or sinkholes were observed. The crest of the dam sloped irregularly from the upstream to the downstream face. This sloping probably resulted from the operation of farm equipment during wet periods and/or the failure of the crest to be initially constructed to uniform grades. No evidence of sliding or sloughing was observed.

c. Appurtenant Structures. The spillway is a concrete broad-crested weir, 27 feet long which spills into a limestone and shale discharge channel. There is some minor cracking and spalling of the concrete in the walls and slab of the spillway.

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

e. Downstream Channel. Spillway discharge flows over the concrete, broad-crested weir to a limestone and shale channel, then to a natural streambed channel. Heavy vegetation and mild channel slopes typical of streams in the area characterize the area downstream of the spillway.

### 3.2 EVALUATION

None of the conditions observed are significant enough to indicate a need for immediate remedial action or a serious potential of failure.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

No controlled outlet works exist. The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled spillway.

### 4.2 MAINTENANCE OF DAM

Maintenance performed was unknown.

### 4.3 MAINTENANCE OF OPERATING FACILITIES

No controlled outlet works exist.

### 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

Existing erosion observed on the downstream side of the dam, although minor, increases the potential for failure and warrants regular monitoring and control.

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

a. Design Data. No as-built drawings or design calculations were available.

b. Experience Data. The drainage area and lake surface area are developed from the USGS Belton Quadrangle Map. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations.

(1) The spillway discharge channel is in good condition. The concrete weir spillway has some minor cracking and spalling of the walls and slab.

(2) No drawdown facilities are available to evacuate the pool.

(3) The spillway and exit channel are located at the left abutment. Spillway releases will not endanger the integrity of the dam.

d. Overtopping Potential. The spillway will not 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 15 percent of the probable maximum flood without overtopping. This flood is less than the 100-year flood estimated 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. The portion of the estimated peak discharge of 50 percent of the probable maximum flood overtopping the dam would be 1,800 cfs of the total discharge from the reservoir of 2,880 cfs. The estimated depth of flow over the dam would be 1.3 feet. The estimated duration of overtopping is 1.2 hours. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 4,100 cfs of the total discharge from the reservoir of 5,780 cfs. The estimated depth of flow over the dam would be 2.3 feet. The estimated duration of overtopping is 5.4 hours. Flow overtopping the dam can erode the embankment and lead to failure of the dam.

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 downstream of the dam which could be severely damaged and lives of the inhabitants 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. Seepage and stability analyses conforming to the requirements of the guidelines were not available which is considered a deficiency.

c. Operating Records. No operational records exist.

d. Post Construction Changes. No post construction changes exist which will affect the structural stability of the dam.

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 materials, 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. The only item of concern that was noted during the visual inspection which should be monitored or controlled was the presence of some minor erosion on the downstream embankment.

b. Adequacy of Information. Due to the lack of engineering design data and drawings, 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. However seepage and stability analyses are needed to satisfy the requirements of the guidelines.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiency described in this report. The remedial measures recommended in paragraph 7.2 could be accomplished now or delayed until observations of this monitoring program and/or the recommendation of a qualified engineer indicate the necessity of action. If the safety deficiency listed in paragraph 7.1a is not corrected, it will continue to deteriorate and lead to a serious potential of failure. Presently, immediate action is not considered necessary.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam or identify any serious dangers that would require a Phase II investigation.

e. Seismic Stability. This dam is located in Seismic Zone 1. Because stability analyses are not available, the seismic stability of the dam cannot be assessed. An assessment of the seismic stability should be included as part of the stability analyses required by the guidelines.

### 7.2 REMEDIAL MEASURES

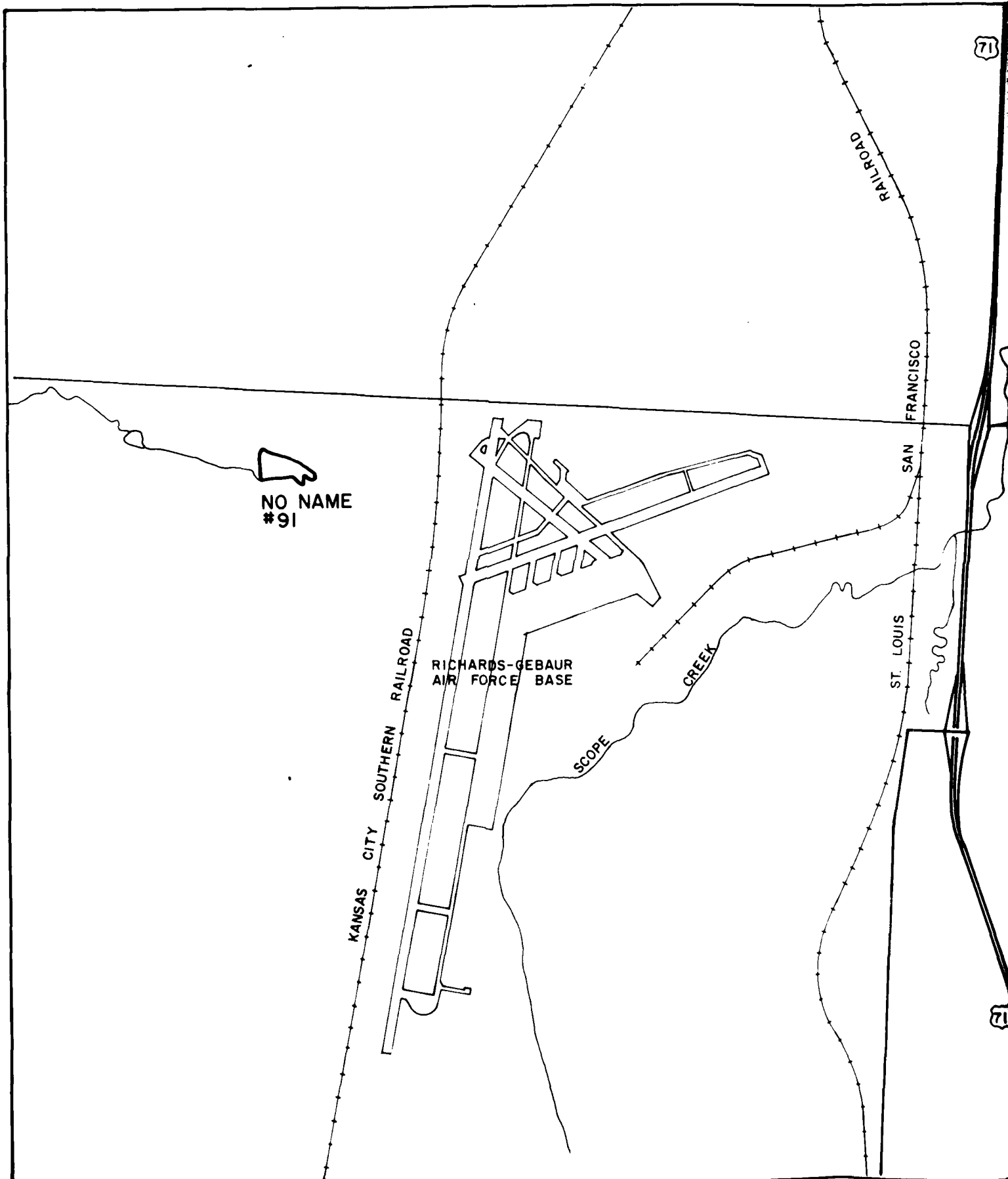
a. Alternatives. The spillway size and/or the height of dam should be increased to pass 50 percent of the probable maximum flood. In either case, the spillway should be protected to prevent erosion of the dam embankment.

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 further erosion problems. If increased erosion is observed, the dam should be inspected and the pending condition evaluated by an engineer experienced in design and construction of earthen dams.

(2) A detailed inspection of the dam should be made at least every year by an engineer experienced in design and construction of dams. More frequent inspections may be required if items of distress are observed other than those already mentioned.

(3) Seepage and stability analyses should be preformed by a professional engineer experienced in the design and construction of earth dams.



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MISSOURI

VICINITY MAP

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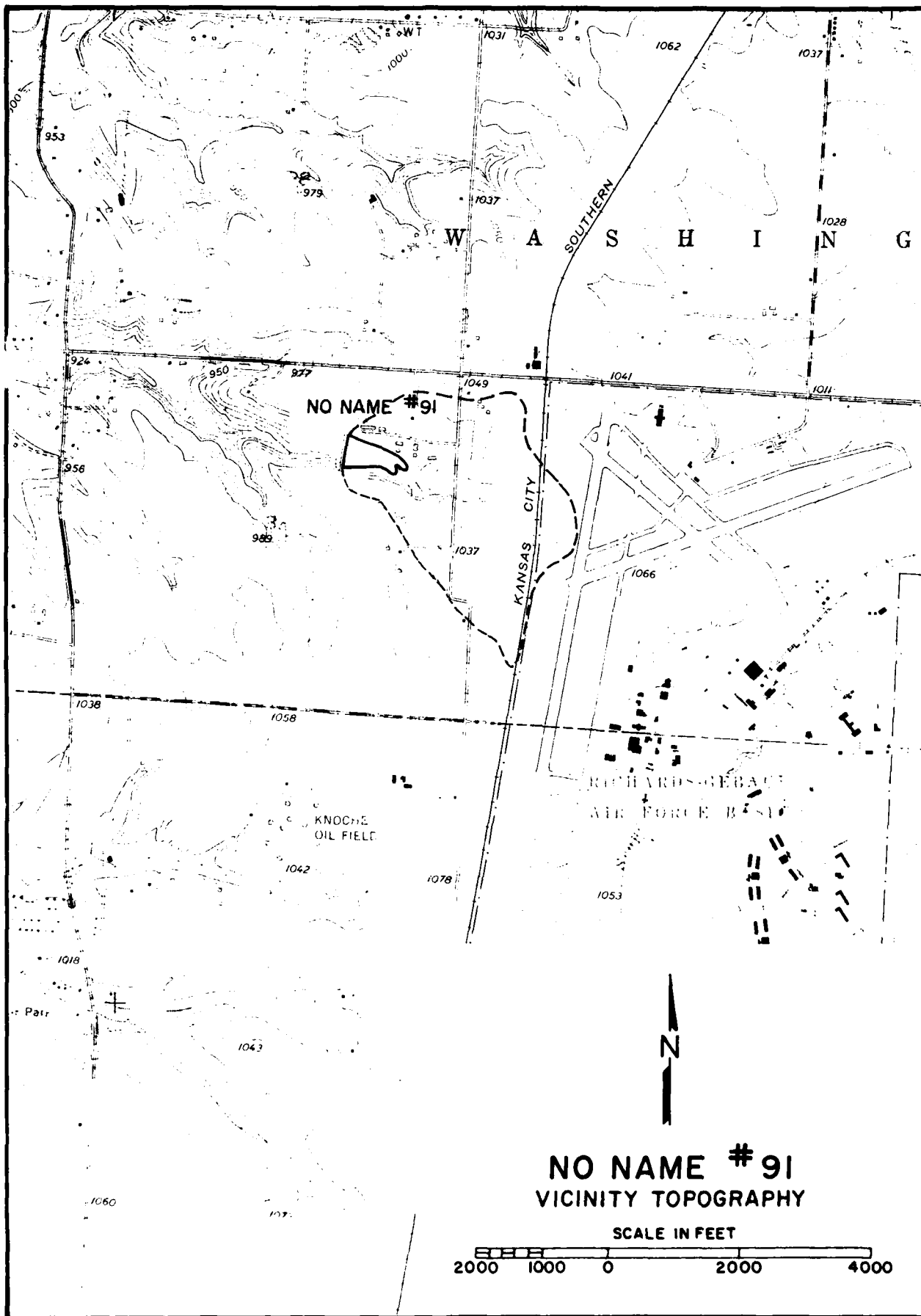
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LOCATION MAP

SCALE IN FEET

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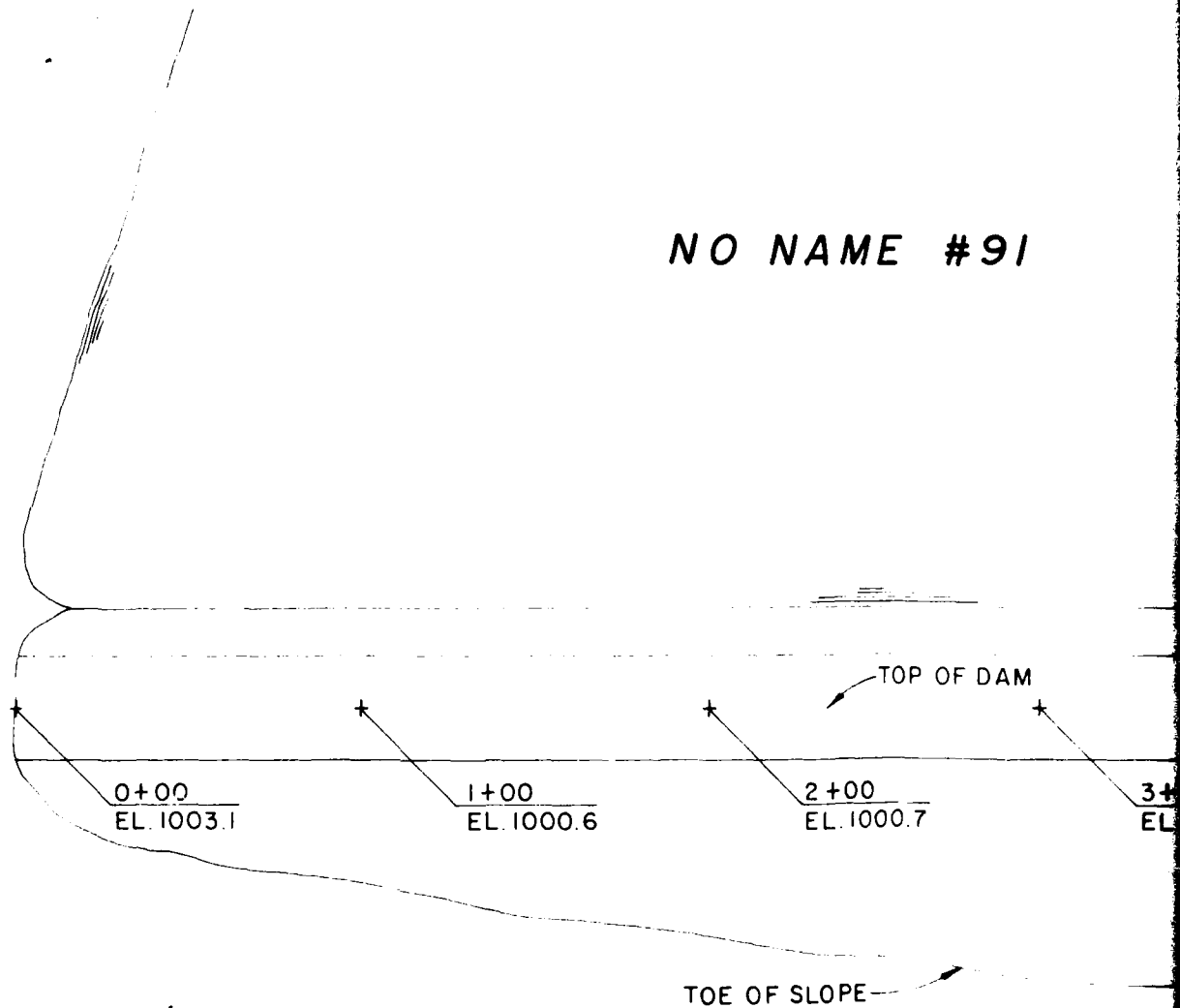
PLATE 1





NO NAME #91

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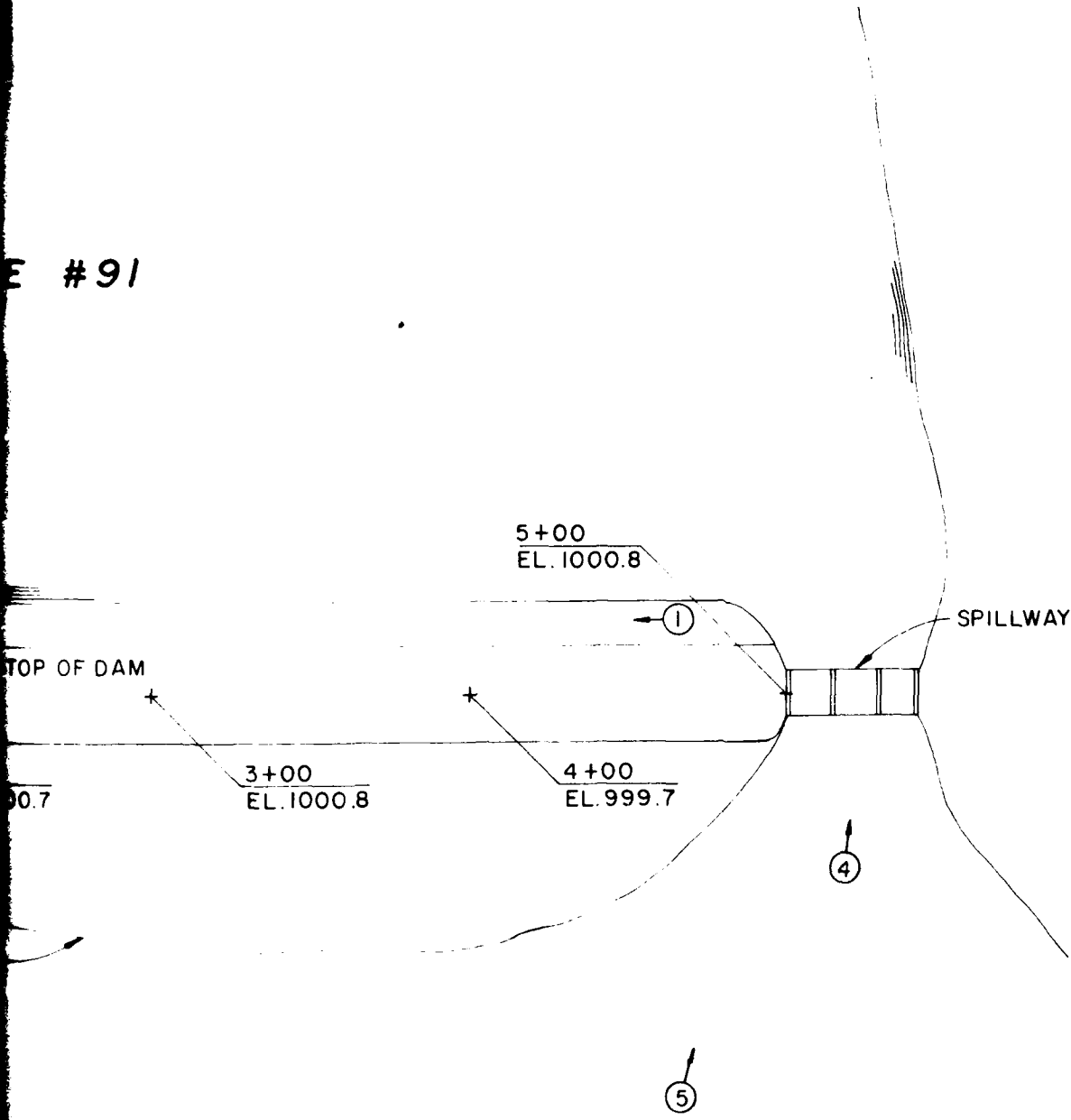
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TOP OF DAM

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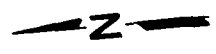
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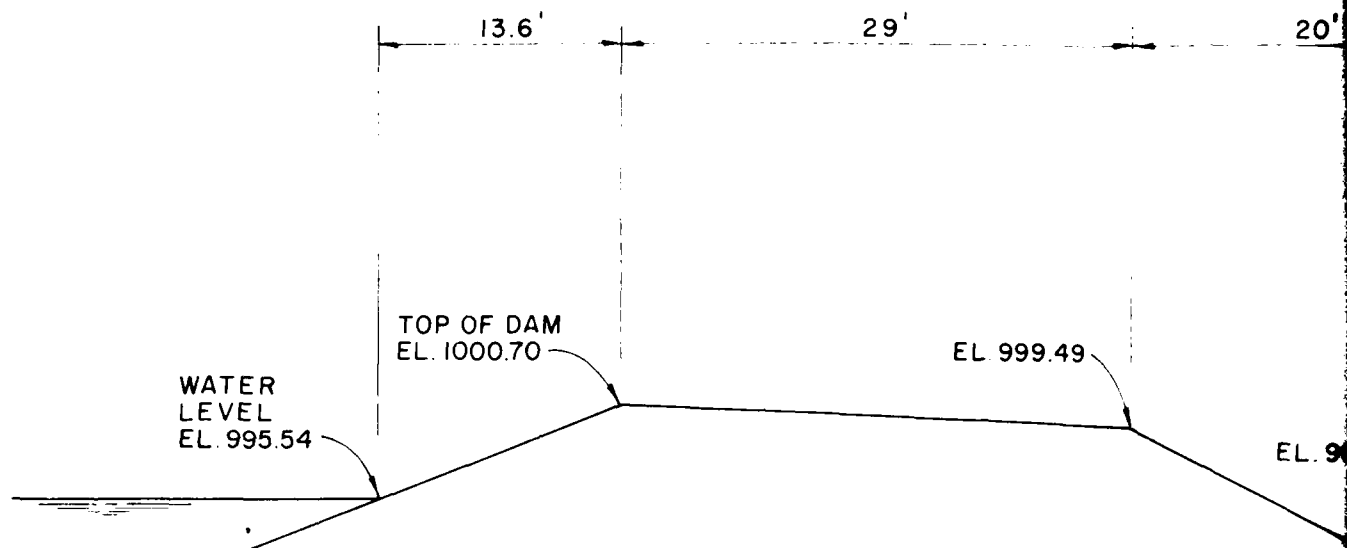


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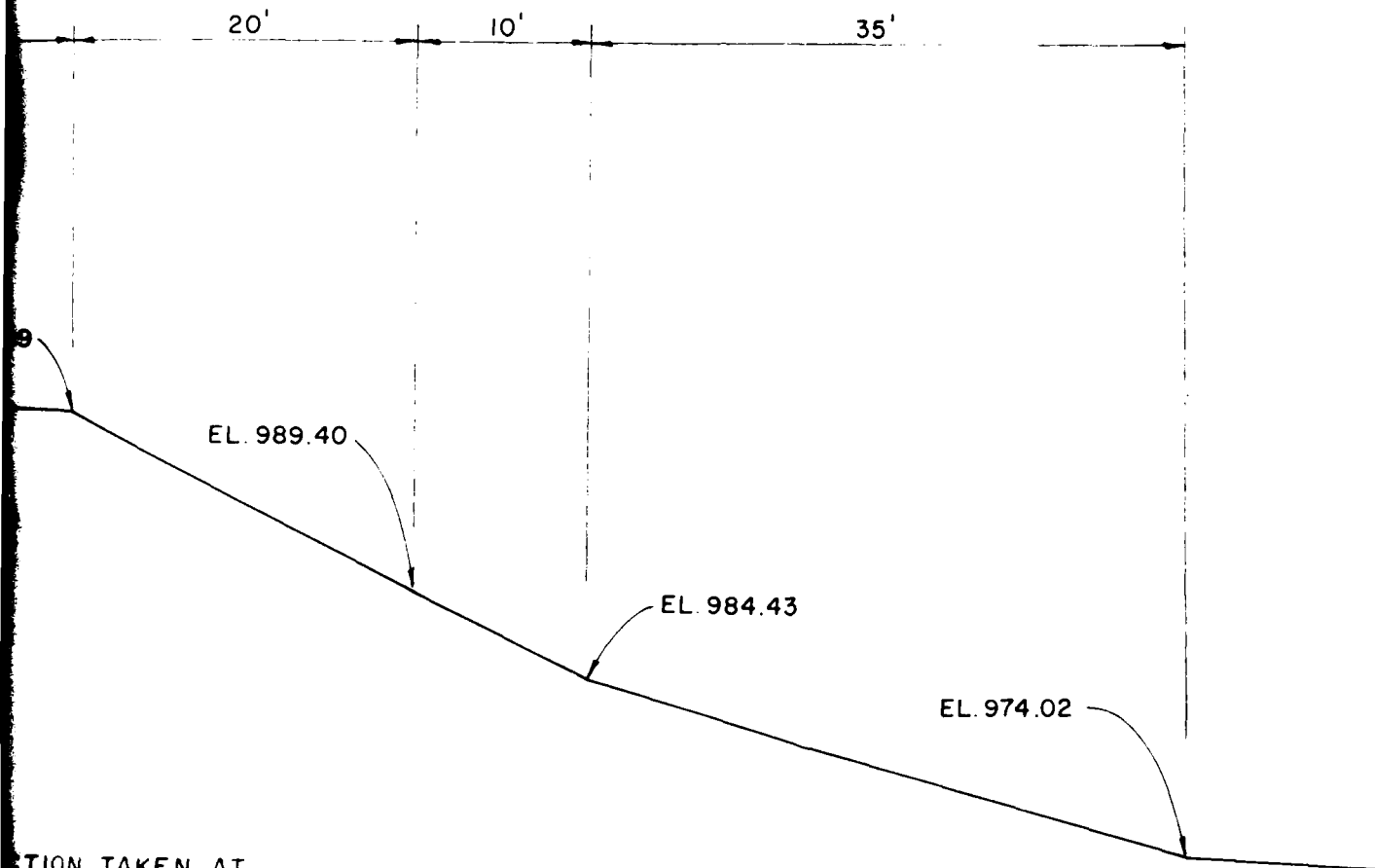
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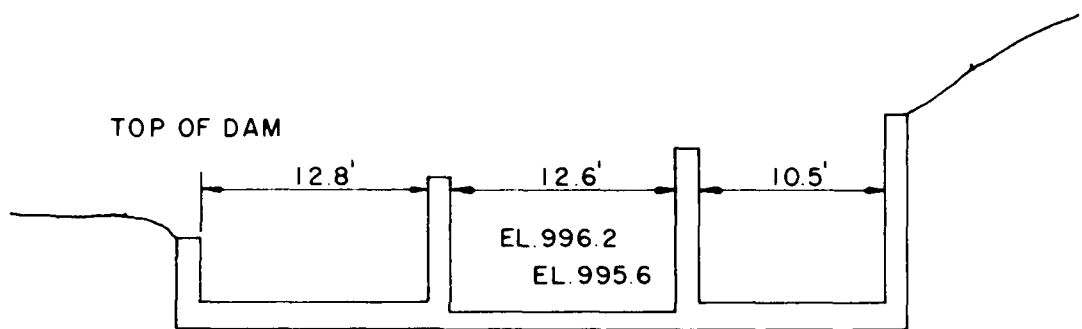


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SECTION TAKEN AT  
STATION 2+50.

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TYPICAL SECTION



NO NAME # 91  
SPILLWAY SECTION

PLATE 5



PHOTO 1: UPSTREAM FACE OF DAM (LOOKING NORTH)



PHOTO 2: DOWNSTREAM FACE OF DAM (LOOKING SOUTH)



PHOTO 3: DOWNSTREAM FACE OF DAM (LOOKING EAST)



PHOTO 4: SPILLWAY CHUTES (LOOKING UPSTREAM)





PHOTO 5: DISCHARGE CHANNEL (LOOKING UPSTREAM)

APPENDIX A  
HYDROLOGIC COMPUTATIONS

## HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1<sub>1</sub> were used to develop the inflow hydrograph (see Plate A-1) and 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 = 392 acres.

c. Time of concentration ( $T_c$ ) =  $(11.9 \times L^3/H)^{0.385} = 27$  minutes  
( $L$  = length of longest watercourse in miles,  $H$  = elevation difference in feet)<sub>2</sub>

d. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 82 and antecedent moisture condition III.

2. Spillway release rates are based on the broadcrested weir equation:

$$Q = CLH^{1.5}$$

$$C = 3.13$$

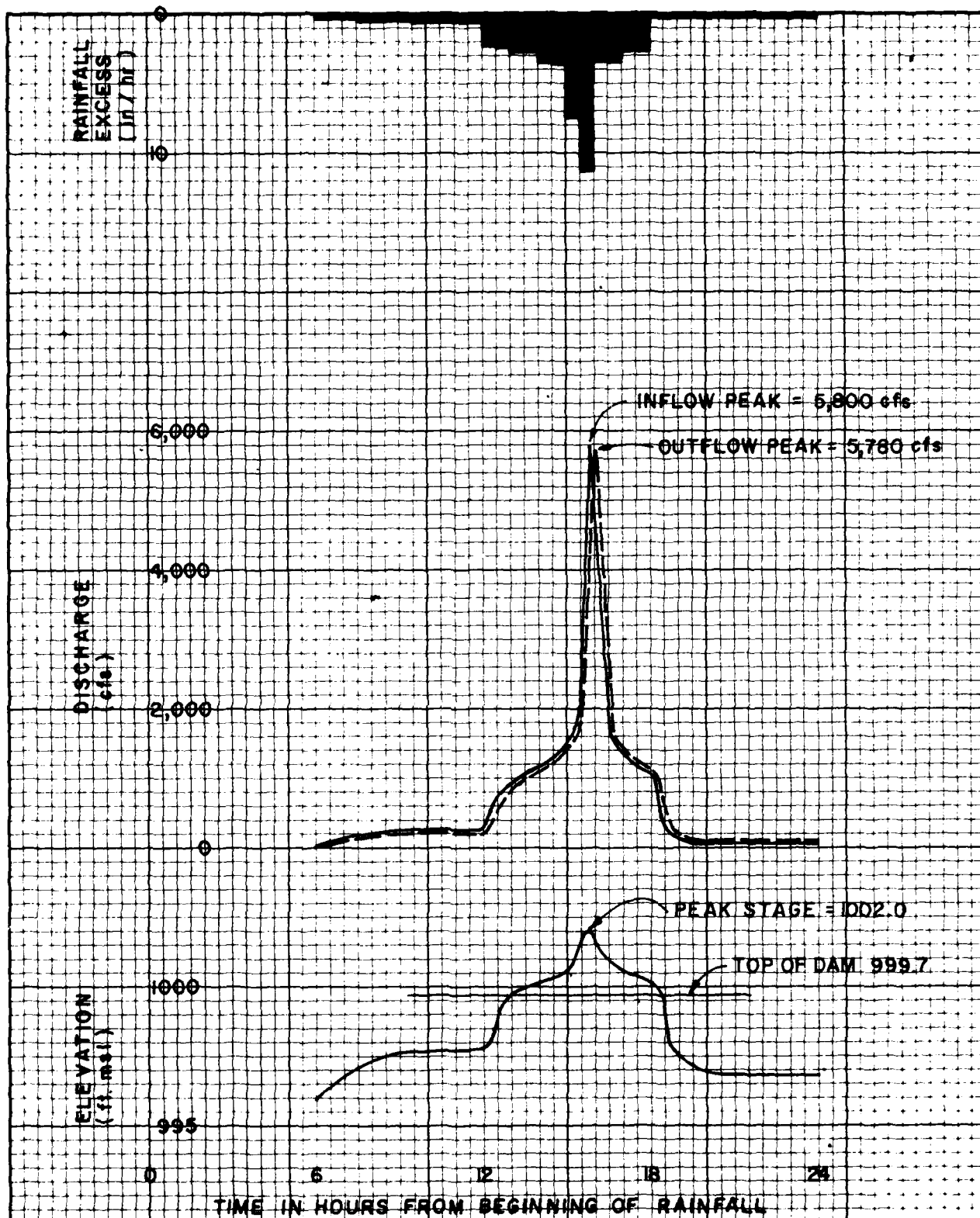
$$L = 27 \text{ feet (length of weir)}$$

$$H = \text{head on weir}$$

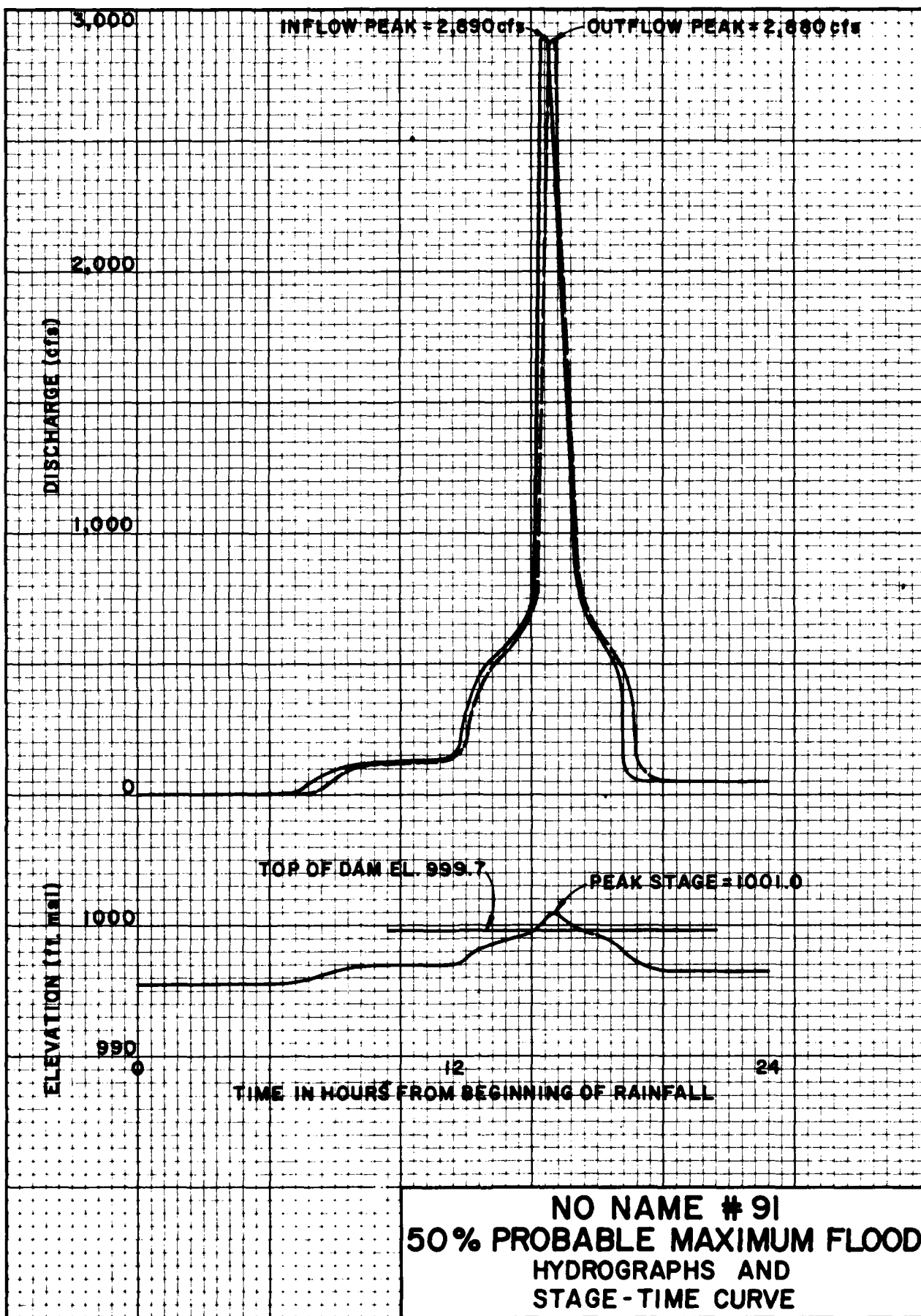
3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation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

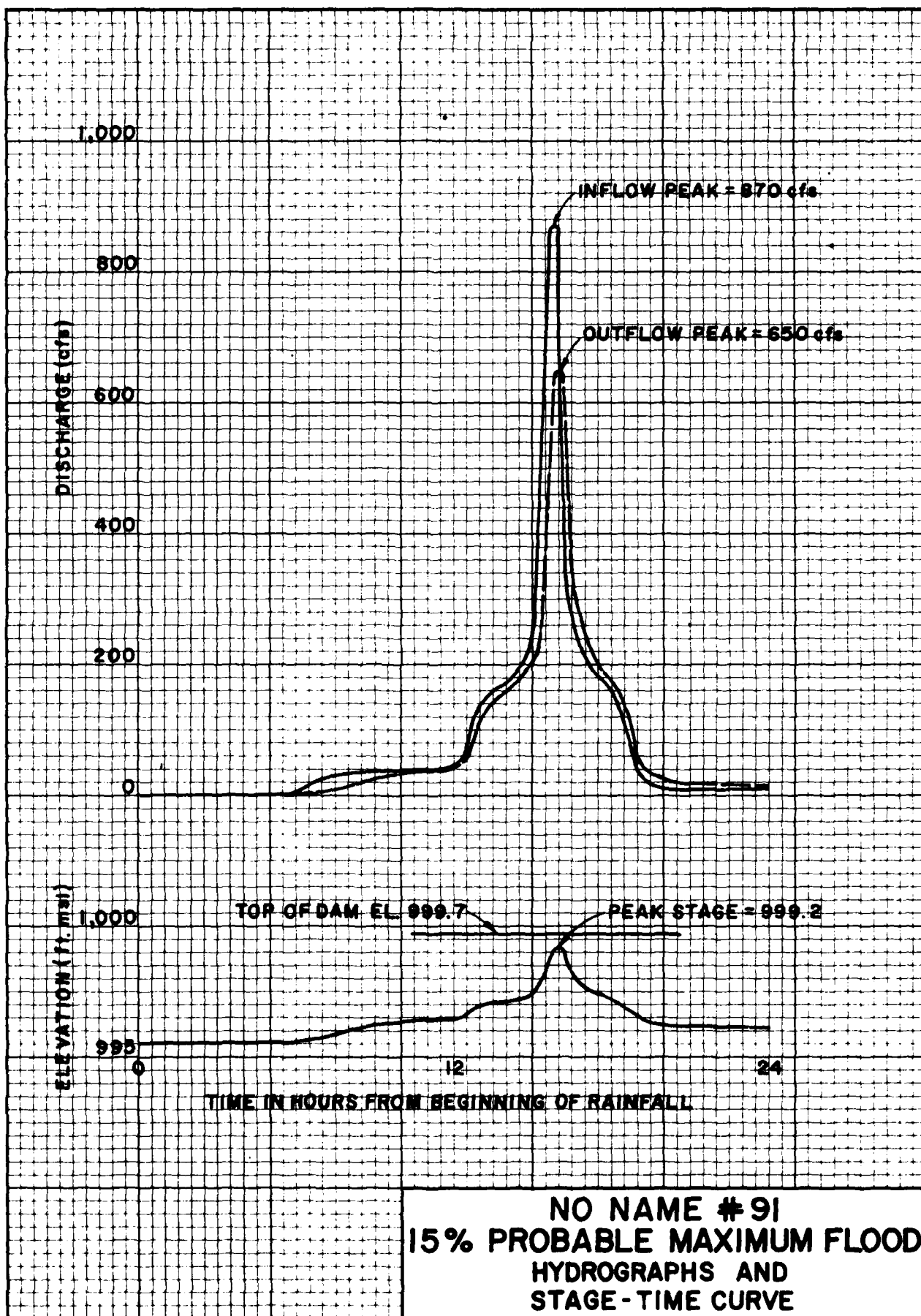
4. Floods are routed through the spillway using HEC-1, modified Puls to determine the capability of the spillway. Inflow and outflow hydrographs are shown on Plates A-1, A-2, and A-3.

- (1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July, 1978, Davis, California.
- (2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.



NO NAME #91  
PROBABLE MAXIMUM FLOOD  
HYETOGRAPH, HYDROGRAPHS  
AND STAGE - TIME CURVE





**DAT  
FILM**