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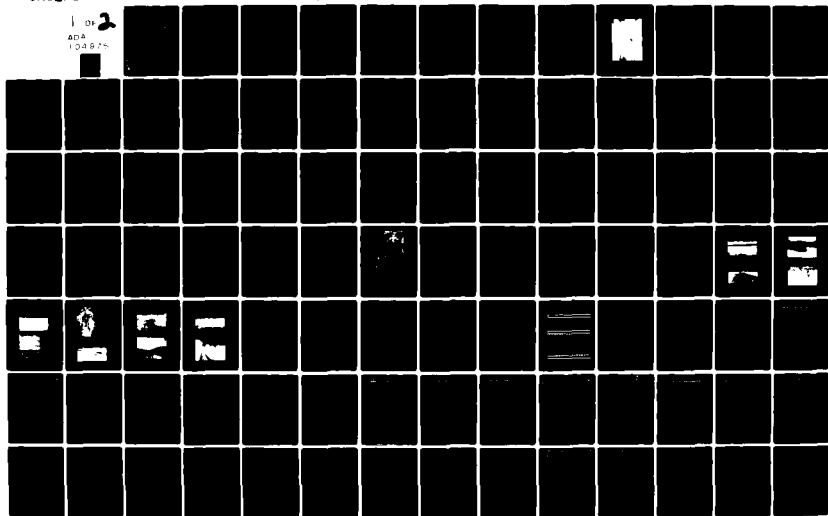
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KOHL IRRIGATION LAKE SOUTH DAM
AUDRAIN COUNTY, MISSOURI
MO. 11208

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



**United States Army
Corps of Engineers**
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St. Louis District

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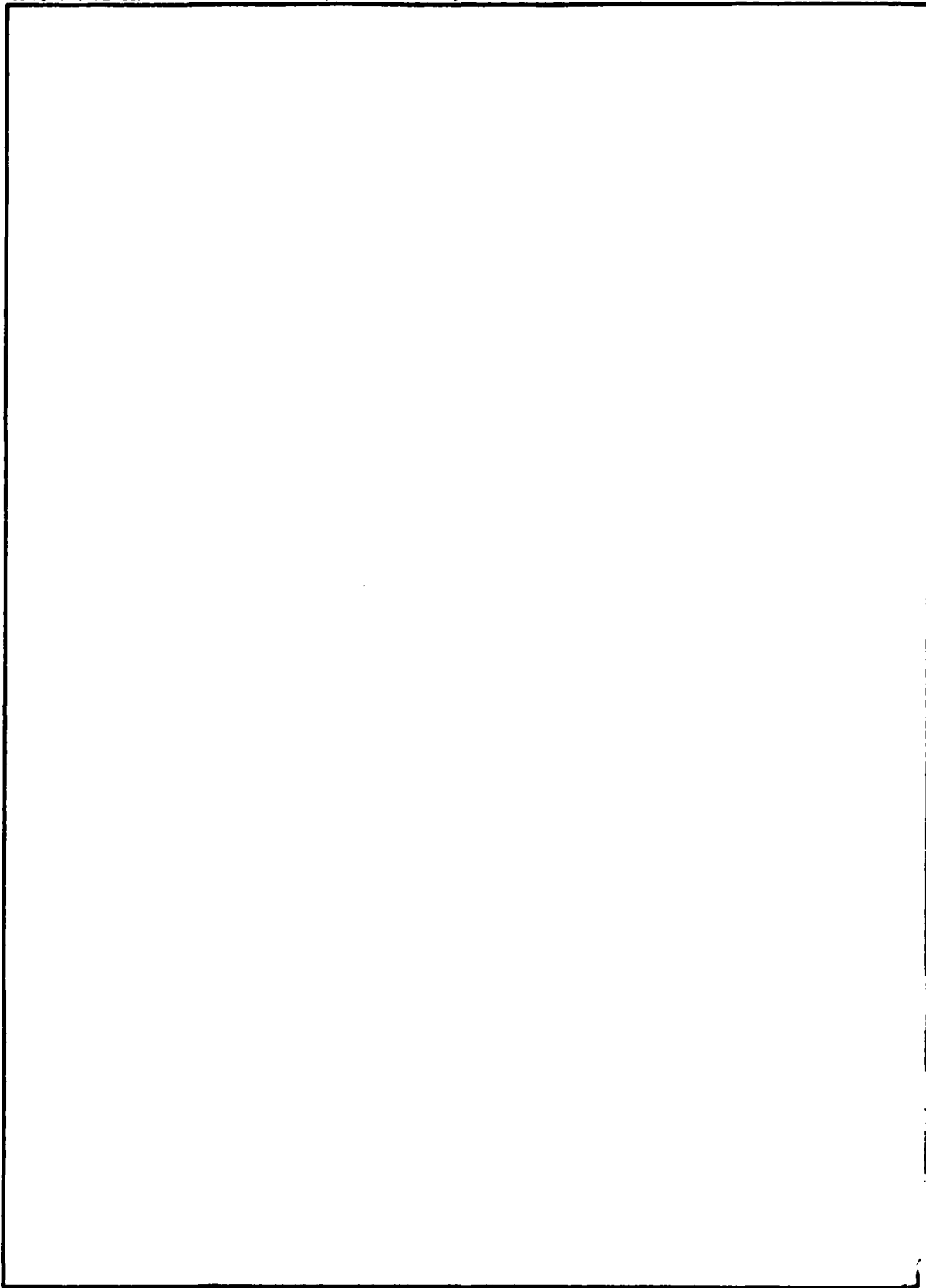
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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Kohl Irrigation Lake South Dam (MO 11208) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Kohl Irrigation Lake South Dam (MO 11208).

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

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

- 1) The combined capacity of the principal and the emergency spillways will not pass a 10-year frequency flood without overtopping the dam. The spillway capacity is, therefore, considered to be unusually small and seriously inadequate.
- 2) Overtopping could result in dam failure.
- 3) Dam failure significantly increases the hazard to life and property downstream

SUBMITTED BY: Chief, Engineering Division

12 JAN 1981

Date

APPROVED BY: Colonel, CE, District Engineer

14 JAN 1981

Date

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KOHL IRRIGATION LAKE SOUTH DAM
AUDRAIN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 11208

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM .

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES, LTD.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

DECEMBER 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Kohl Irrigation Lake South Dam,
Missouri Inv. No. 11208
State Located: Missouri
County Located: Audrain
Stream: An unnamed tributary of the Shady Creek
Date of Inspection: July 9, 1980

Assessment of General Condition

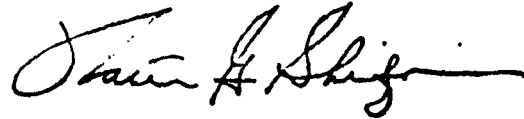
Kohl Irrigation Lake South Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. of St. Louis, Missouri and PRC Engineering Consultants, Inc. of Englewood, Colorado (A Joint Venture) according to the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Within the estimated damage zone of one mile downstream of the dam are two houses, one highway, one building, one barn, and a shed which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Kohl Irrigation Lake South Dam is in the small size classification since it is 14 feet high, and impounds more than 50 acre-feet but less than 1,000 acre-feet of water.

The inspection and evaluation by the consultant's inspection team indicate that the spillway of Kohl Irrigation Lake South Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Kohl Irrigation Lake South Dam being a small size dam with a high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Considering a major highway being located immediately below the dam and the number of inhabited dwellings located downstream of the dam, the PMF is considered the appropriate spillway design flood for Kohl Irrigation Lake South Dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. It was determined that the reservoir/spillway system can accommodate approximately 8 percent of the Probable Maximum Flood without overtopping the dam. The evaluation also indicates that the reservoir/spillway system cannot accommodate the ten-percent chance flood (10-year flood) without overtopping.

There is a significant dam upstream of Kohl Irrigation Lake South Dam. The upstream dam is named as Talbert Lake Dam (MO. 11209). Talbert Lake Dam is located immediately upstream of Kohl Irrigation Lake South and has been included in the hydrologic and hydraulic evaluation of Kohl Irrigation Lake South Dam.

Other deficiencies noted by the inspection team were: the erosion on the upstream slope due to wave action, the tall vegetation on the top of dam and the downstream slope, the separation of the construction joint in the principal spillway, the vegetation at the entrance to the principal spillway, a need for periodic inspection by a qualified engineer, and a lack of maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.



Walter G. Shifrin, P.E.



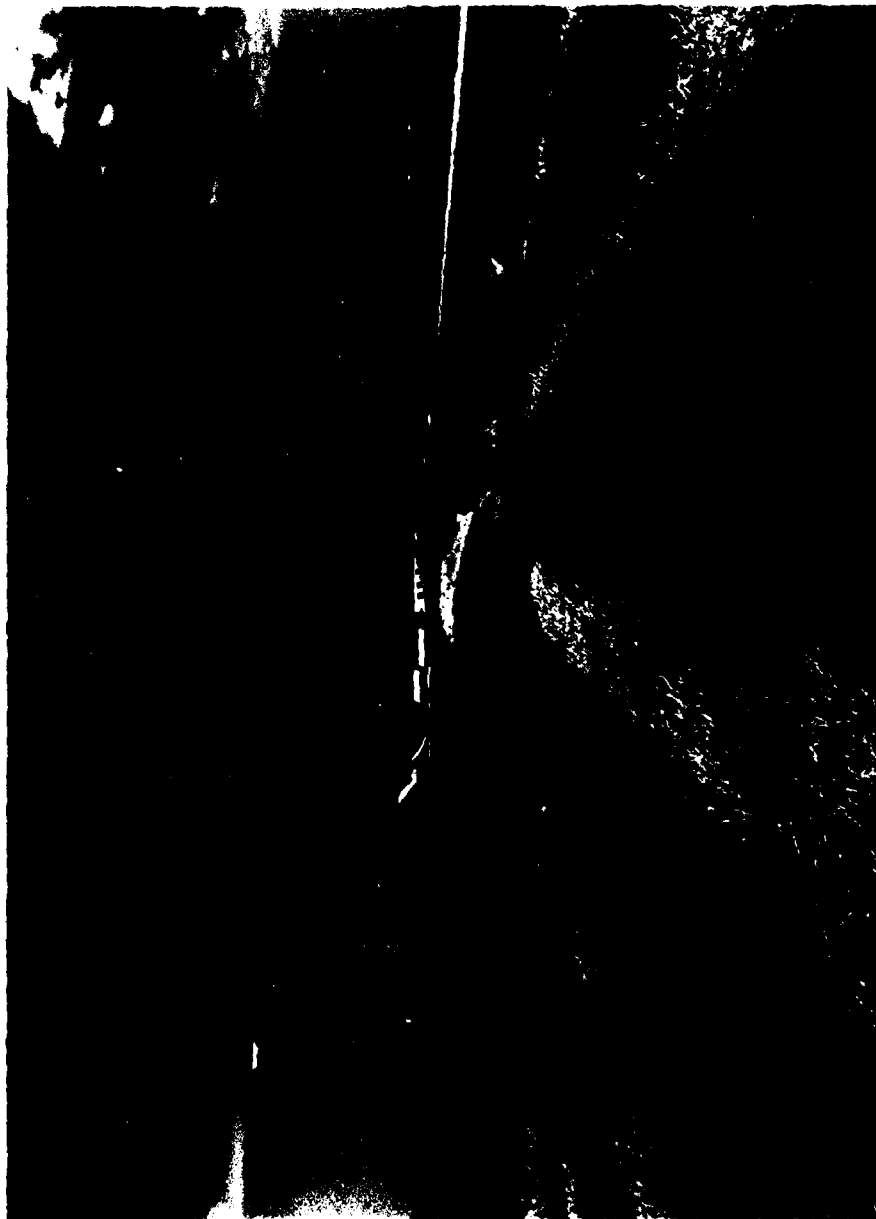


Figure 1. A. Field photograph of the specimen. B. Microphotograph of the specimen.

NATIONAL DAM SAFETY PROGRAM

KOHL IRRIGATION LAKE SOUTH DAM, I.D. No. 11208

TABLE OF CONTENTS

<u>Sect. No.</u>	<u>Title</u>	<u>Page</u>
SECTION 1	PROJECT INFORMATION	1
	1.1 General	1
	1.2 Description of Project	2
	1.3 Pertinent Data	7
SECTION 2	ENGINEERING DATA	10
	2.1 Design	10
	2.2 Construction	10
	2.3 Operation	10
	2.4 Evaluation	11
SECTION 3	VISUAL INSPECTION	12
	3.1 Findings	12
	3.2 Evaluation	18

TABLE OF CONTENTS

(Continued)

<u>Sect. No.</u>	<u>Title</u>	<u>Page</u>
SECTION 4	OPERATION PROCEDURES	20
	4.1 Procedures	20
	4.2 Maintenance of Dam	20
	4.3 Maintenance of Operating Facilities	20
	4.4 Description of Any Warning System in Effect	20
	4.5 Evaluation	21
SECTION 5	HYDRAULIC/HYDROLOGIC	22
	5.1 Evaluation of Features	22
SECTION 6	STRUCTURAL STABILITY.	24
	6.1 Evaluation of Structural Stability.	24
SECTION 7	ASSESSMENT/REMEDIAL MEASURES.	26
	7.1 Dam Assessment	26
	7.2 Remedial Measures.	28

TABLE OF CONTENTS

(Continued)

LIST OF PLATES

	<u>Plate No.</u>
LOCATION MAP	1
DRAINAGE BASIN AND DOWNSTREAM HAZARD ZONE.	1A
PLAN AND SECTIONS OF DAM	2-3
GEOLOGIC MAPS.	4-5

APPENDICES

APPENDIX A	-	PHOTOGRAPHS
APPENDIX B	-	HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

KOHL IRRIGATION LAKE SOUTH DAM, Missouri Inv. No. 11208

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Kohl Irrigation Lake South Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., and PRC Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Kohl Irrigation Lake South Dam was made on July 9, 1980. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site, and the structural adequacy of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based on the observations and measurements made during the visual inspection and conversations with Mr. Fred Kohl, the owner. Original design drawings for the dam and appurtenant structures were available; however, the dam and

appurtenant structures were not constructed in accordance with these drawings. No final design drawings or "as-built" drawings were available.

According to Mr. Kohl, the dam is a zoned, rolled, earthfill structure with a straight alignment between earth abutments. A plan and elevation of the dam are shown on Plate 2 and Photos 1 through 3 show views of the embankment. According to Mr. Kohl, a 12-foot wide clay core trench with nearly vertical side slopes was excavated to a maximum depth of 10 feet into a gray and red mottled clay foundation soil. The core, which was constructed of a select clay soil, extends all the way up through the embankment. The upstream and downstream shells were constructed of a lesser quality clay material.

The top of the dam is 16 feet wide and appeared to be level except the area near the principal spillway. The crest length of the dam, excluding the centrally located, concrete-lined spillway, is 732 feet. A 3- to 4-foot high training berm for the emergency spillway extends for 115 feet at a right angle off the left end of the embankment in the upstream direction. The major portion of the dam has a crest elevation of 763 feet above mean sea level (M.S.L.). The minimum top of dam elevation, however, was placed at 761 feet above M.S.L. for hydraulic evaluation due to the fact that the dam embankment at the principal spillway is unprotected at this elevation (see Plate 2). Thus, this is considered to be the point at which the dam embankment would be overtopped. The maximum structural height of the embankment was measured to be 14 feet at a point 10 feet to the left of the principal spillway.

The upstream slope above the water surface and the downstream slope of the dam were measured as 1 vertical to 2.75 horizontal (1V to 2.75H), though some difficulty was encountered in obtaining these measurements. Tall grasses obstructed accurate slope measurements in the downstream direction, and wave-eroded slopes and a near horizontal berm at the water's edge hampered

measurements on the upstream slope. However, it is assumed that measurements obtained are representative. No riprap was placed on the upstream slope. The entire embankment is protected by vegetative cover.

A principal and an emergency spillway were constructed for this dam. The principal spillway is a concrete-lined, trapezoidal-shaped, chute spillway cut into the embankment 328 feet to the left of the right abutment (see Photos 5 and 6). The first 26 feet of the channel has a bottom width of 12 feet with side slopes of 1V to 1.75H and is level (see Plate 3). The channel, at the end of the 26-foot long section, has a transition within a 30-foot length in which the bottom width tapers from 12 feet to 8 feet, the side slopes flatten out to 1V to 3H, and the channel slopes downward on a 42 percent grade. The channel then begins to flatten out from about a 32 percent grade to an 18 percent grade before entering a 5-foot high by 8-foot wide concrete box culvert that passes under Highway W, located approximately 50 feet downstream of the dam. The crest elevation of the spillway is assumed to be at 759 feet above M.S.L. A 2-foot high metal trashrack was provided for the spillway and is located at the entrance to the spillway (see Photo 11). According to Mr. Kohl, the concrete of the spillway is reinforced.

The emergency spillway is a grass-lined, trapezoidal, open channel cut into the left abutment. The spillway has a bottom width of 23 feet, a top width of 50 feet with side slopes of about 1V to 4.5H, and is located about 115 feet upstream of the embankment (see Plate 2). The flows through the spillway are directed by a 115-foot long training berm back towards the embankment. The flows, once past the embankment, will flow through a natural channel created by the dam and highway embankments and in the direction of the box culvert under the highway. The crest elevation of the spillway is 760 feet above M.S.L., assuming the crest of the principal spillway is at 759 feet above M.S.L. The spillway channel has a slope of about a half of a percent for a distance of about 200 feet at which point the channel steepens.

No low-level outlets or outlet works were provided for this dam. However, a portable, diesel-powered, centrifugal pump is used at the damsite to pump water from the reservoir to be used to irrigate row crops on the reservoir rim. According to Mr. Kohl, the pump has an 1,000 gallons per minute (gpm) capacity and the capability to drain the reservoir. The pump is also, reportedly, operable; however, on the day of the inspection, the pump was not at the damsite. The pump is generally operated each year during the summer months.

b. Location

Kohl Irrigation Lake South Dam is located in Audrain County in the State of Missouri, and crosses an unnamed tributary of Shady Creek. The small community of Vandalia is about 1-1/2 miles to the north. The Kohl Irrigation Lake South Dam location on the 7.5 minute series of the U.S. Geological Survey maps is found in Section 17 of Township 52 North, Range 5 West, of the Vandalia, Missouri Quadrangle Sheet.

c. Size Classification

The impoundment of Kohl Irrigation Lake South Dam is less than 1,000 acre-feet but more than 50 acre-feet, and the height is 14 feet. Therefore, the size is determined to fall in the "small" category, according to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with this classifi-

cation. Within the estimated damage zone, extending one mile downstream of the dam, are two houses, one highway immediately below the dam, one building, one barn and a shed.

e. Ownership

Kohl Irrigation Lake South Dam and Reservoir is privately owned by Mr. Fred Kohl. His mailing address is as follows: Route 1, Vandalia, Missouri, 63302.

f. Purpose of Dam

As the name of the dam implies, the water impounded by the dam is used for crop irrigation.

g. Design and Construction History

Kohl Irrigation Lake South Dam was designed by the Department of Agriculture, Soil Conservation Service, in the Mexico, Missouri Office. According to Mr. Kohl, the design drawings were not completely followed during the construction of the dam. Mr. Kohl also stated that he had the height of the dam increased by about one foot in 1975. The original construction was done by Mr. Paul Goodman of Vandalia, Missouri, in 1973.

h. Normal Operational Procedures

Normal operational procedure is to allow the reservoir to remain as full as possible while the water level below the principal spillway crest is controlled by rainfall, runoff, evaporation, and the rate at which water is pumped out of the reservoir for agricultural use.

1.3 Pertinent Data

a. Drainage Area (square miles):. 0.64

b. Discharge at Damsite

Estimated experienced maximum flood (cfs): 10

Estimated ungated spillway capacity with
reservoir at top of dam elevation (cfs): 198

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

Top of dam (minimum):. 761

Spillway crest:

Principal Spillway * * 759

Emergency Spillway 760

Normal Pool: 759

Maximum Experienced Pool:. 760.7

Observed Pool: 754.3

d. Reservoir

Length of pool with water surface
at top of dam elevation (feet):. 930

e. Storage (Acre-Feet)

Top of dam (minimum):. 111

Spillway crest:

Principal Spillway 75

Emergency Spillway 91

Normal Pool: 75

Maximum Experienced Pool:. 104

Observed Pool: 25

f. Reservoir Surfaces (Acres)

Top of dam (minimum):. 21.1

Spillway crest:

Principal Spillway 15.4

Emergency Spillway	18.2
Normal Pool:	15.4
Maximum Experienced Pool:	20.2
Observed Pool:	7.5

g. Dam

Type:	Rolled, Earthfill
Length:	732 feet (excluding the principal spillway)
Structural Height:	14 feet
Hydraulic Height:	14 feet*
Top width:	16 feet
Side slopes:	
Downstream.	1V to 2.75H
Upstream.	1V to 2.75H (Above the water surface)
Zoning:	Three zones, (1) Impervious select clay core, (2) Upstream and (3) down- stream shells of poorer clay. (According to Mr. Kohl)
Impervious core:	Clay core
Cutoff:	A 12-foot wide and 10-foot deep core trench (According to Mr. Kohl)
Grout curtain:	None
Volume:	16,000 cu. yds. (Estimated)

h. Diversion and Regulating Tunnel. None

i. Spillway

Type:	
Principal Spillway	Concrete chute channel, uncontrolled
Emergency Spillway	Earthcut channel, uncontrolled

Length of crest:

Principal Spillway 12 feet

Emergency Spillway 23 feet

Crest Elevation (feet above M.S.L.):

Principal Spillway 759

Emergency Spillway 760

j. Regulating Outlets

Type: Portable, centrifugal pump

Location: Northwest corner of reservoir.

(However, the pump was not at
the dam site on the day of the
inspection)

Maximum Capacity: 1,000 gallons per minute

(According to Mr. Kohl)

* The hydraulic height of the dam is the vertical distance from
the lowest point on the downstream toe to the top of dam
or the maximum water surface, if below the top of dam.

** The elevation of the crest of the principal spillway was
assumed from the U.S.G.S. topo map, and the elevations of
other features of the dam were determined using this eleva-
tion and field measurements.

SECTION 2: ENGINEERING DATA

2.1 Design

Original design sketches and calculations were made available from the Soil Conservation Service and the owner, Mr. Fred Kohl. The design notes from the SCS are dated July of 1972; however, as mentioned before, the original design was not used. Final design drawings or "as-built" drawings were not available.

2.2 Construction

No documented data concerning the construction of the dam was available for this report. However, information concerning the construction of the dam was obtained through conversations with Mr. Kohl. Mr. Kohl stated that the compaction of the embankment was achieved by the activity of the earthmoving equipment across the embankment. No compaction control of the material was employed. A 12-foot wide and 10-foot deep core trench with vertical side slopes was excavated parallel to the dam axis and into the clay foundation.

2.3 Operation

No operational records are available for Kohl Irrigation Lake South Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is fair and consists of the original design sketches, engineering computations, State Geological Maps, a general soil map of the State of Missouri published by the Soil Conservation Service, and U.S.G.S. Quadrangle Sheets.

b. Adequacy

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. The available data and the field measurements are adequate enough to evaluate the hydraulic and hydrologic capabilities of the dam. 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 (including earthquake loads) and made a matter of record.

c. Validity

Original design sketches and computations were available for review. However, the original design sketches were not used during the construction. Final design drawings were not available for review. The only engineering data which were felt to be valid were the area-capacity data for the reservoir and are presented in this report in Appendix B.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Kohl Irrigation Lake South Dam was made on July 9, 1980. The following persons were present during the inspection:

<u>Name</u>	<u>Affiliation</u>	<u>Disciplines</u>
Dr. M.A. Samad	PRC Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Civil and Mechanical
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
Zoran Batchko	PRC Engineering Consultants, Inc.	Soils
Kevin J. Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Fred Kohl	Owner	

Specific observations are discussed below.

b. Dam

The crest and the downstream slope of the dam have a tall, dense grass cover, which adequately protects the embankment material from surface runoff erosion. However, the upstream slope has a sparse vegetative cover, and surface runoff has eroded small drainage rivulets on the order of 1 to 3 inches on the upstream face. The upstream slope also has no riprap protection and, consequently, has been eroded by wave action. Nearly vertical faces up to 2 feet high were exposed near the crest of the dam and smaller scallops were also exposed along the reservoir rim. The dam material underlying the grayish-brown topsoil cover was revealed to be a mottled red, brown, and gray, moderately plastic clay with some silt and sand.

There was no evidence of seepage or leakage through or below the dam. No signs of past or present instability were seen on the embankment except for the wave eroded upstream slope. According to Mr. Kohl, the dam has never been overtopped and no evidence indicating the contrary was observed.

Both abutments slope gently upward from the top of dam. No instabilities, seepage, or erosion were observed on either abutment.

No evidence of burrowing animals was apparent on either the embankment or abutments. According to Mr. Kohl, muskrats have been present in the reservoir in the past.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of Shady Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The topography at the damsite is flat to rolling with U-shaped valleys. Elevations of the ground surface range from 750 feet above M.S.L. at the damsite to 780 feet above M.S.L. approximately one mile south of the damsite. The reservoir slopes are in the range of 8° to 12° from the horizontal and free of any potential slide activity. The area near the damsite is covered with slope wash deposits of glacial-fluvial and loess in origin consisting of mottled reddish brown to gray silty clay.

The regional bedrock geology beneath the glacial outwash deposits in the damsite area as shown on Geologic Map of Missouri (1977) (see Plate 4) consist of Pennsylvanian Pleasanton-Marmaton-Cherokee Group, Mississippian Burlington Formation and Chouteau Group rocks, Silurian Bowling Green Limestone, and Ordovician rocks consisting of Noix Limestone and Decorah Formation.

No outcropping of bedrock was observed at the site. The predominant bedrock in the site vicinity underlying the glacial-fluvial deposits are the Pennsylvanian Marmaton-Cherokee Group consisting of cyclic deposits of shale, limestone and sandstone. The outlet and inlet areas of the unnamed tributary of the Shady Creek contain Quaternary alluvium.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the Cap Au Gres faulted flexure nearly 12 miles east of the damsite. The Cap Au Gres faulted flexure had its last movement in post-Pennsylvanian, pre-Pleistocene time. Thus the fault has no effect on the damsite.

Kohl Irrigation Lake South Dam consists of a zoned earthfill embankment, a concrete lined principal spillway located at approximately the mid-point of the embankment, and an emergency spillway located at the northern end of the dam.

No boring logs or construction reports were available which would indicate foundation conditions encountered during the construction. Based upon the visual inspection and conversations with Mr. Fred Kohl, the embankment probably rests on the glacial-fluvial deposits (mottled reddish brown to gray silty clay) with a core trench excavated into the glacial-fluvial deposits. The concrete lined principal spillway rests on the compacted embankment fill (mottled reddish brown to gray, medium plastic clay). The emergency spillway was cut into the left abutment.

(2) Project Soils

According to the "Missouri General Soil Map and Soil Association Descriptions" published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Putnam-Mexico in the Central-Claypan area family. The soils are basically formed from loess. These soils are mostly a very slowly permeable silty clay.

Materials were removed from both slopes of the embankment from below the vegetative cover. The embankment soils samples obtained were observed to be mottled red, brown, and gray, moderately plastic clay with some silt and sand. Based upon the Unified Soil Classification system, the soil would probably be classified as CL-CH. This soil type generally has the following character-

istics: impervious with a coefficient of permeability less than 1.0 foot per year, medium shear strength, and a high resistance to piping.

d. Appurtenant Structures

(1) Principal Spillway

No major problems were observed in the spillway. No major cracks were found in the concrete; however, some minor shrinkage cracks were observed. The construction joint between the slab and the side wall on the left side of the spillway and only along the upper portion of the channel was observed to be up to 1/2 of an inch wide with no joint filler present (see Photo 7). The separation of the joint extended the full thickness of the slab. However, separation of the joint between the slab and the side walls in the rest of the spillway channel was apparent. No undermining of the spillway was apparent. The trashrack was securely attached to the spillway and appeared to be able to function as intended. Some vegetation was observed growing around the entrance to the spillway. No instabilities or obstructions were observed in the spillway and the spillway appears to be able to function properly.

(2) Emergency Spillway

The spillway has, for the most part, a good vegetative cover; however, some areas near the inlet section of the spillway were sparsely covered. It is felt, however, due to the location in the channel of these areas, erosion of the channel in these areas would have little or no effect on the safety of the dam or the operation of the spillway. No erosion or instabilities were observed in the spillway channel. The spillway was unobstructed and appeared to be able to operate properly.

(3) Outlet Works

There are no low level outlets or outlet works provided for this dam. However, a portable, centrifugal pump is used at the damsite. Reportedly, the pump is operable and is also capable of draining the reservoir. The pump is generally used during the summer months each year.

(4) Upstream Dam

There is a significant dam upstream of Kohl Irrigation Lake South Dam. The upstream dam is identified as Talbert Lake Dam (MO. 11209). This dam is located immediately upstream of Kohl Irrigation Lake South and is included in the hydrologic and hydraulic evaluation of Kohl Irrigation Lake South Dam.

e. Reservoir Area

The reservoir water surface elevation at the time of inspection was 754.3 feet above M.S.L.

The surface area of the reservoir at normal water level is about 15.4 acres. The rim seems to be stable as no severely eroded areas were observed. The land around the reservoir slopes gently to the rim and is grass covered. There are no homes built in close proximity to the reservoir; however, there is a dam located at the upper end of this reservoir (see Photo 11), and a 2- to 4-foot high perimeter dike extending along the left side of the reservoir. With the exception of small, localized, undercut slopes in the perimeter dike, there was no evidence of instability. No evidence of excessive siltation was observed in the reservoir.

f. Downstream Channel

The flows from the principal and the emergency spillway will converge at the culvert which passes under Highway W, which is located approximately 50 feet downstream of the dam. The downstream channel beyond the culvert is a well defined channel, which is

approximately 5 feet wide, 3 feet deep and has variable side slopes. The channel is obstructed by heavy vegetation and trees, which will affect the hydraulic efficiency of the channel (see Photo 10).

3.2 Evaluation

The visual inspection did not reveal any items that are sufficiently significant to indicate a need for immediate remedial action. The following problems were observed that could affect the safety of the dam and which will require maintenance within a reasonable period of time.

1. The erosion due to wave action and minor surface runoff erosion on the upstream slope do not appear to affect the structural stability of the dam in their present condition. Continual erosion, however, of the slope can only be detrimental to the stability of the dam.
2. The growth of vegetation on the top of dam and downstream slope should be properly maintained. A tall, dense growth of vegetation on the embankment hinders a comprehensive inspection of the dam and potential problems could go undetected.
3. The separation of the construction joint does not appear to affect the stability of the principal spillway in its present condition nor does it indicate an instability of the spillway. Nevertheless, if the condition is left unchecked, water can be forced down through the joint and under the slab during flows through the spillway. This could cause undermining of the spillway slab, which could lead to an eventual failure of the slab.

4. The vegetative growth at the entrance to the principal spillway does not appear to restrict the hydraulic capabilities of the spillway in its present condition. Nevertheless, the condition does exist and if the vegetation is allowed to continue to grow, it could affect the hydraulic capacity of the spillway.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Kohl Irrigation Lake South Dam is used to impound water from rainfall and runoff for crop irrigation. There are no specific procedures which are followed for the operation of the reservoir. The water level in the reservoir is controlled by rainfall, runoff, evaporation, the elevation of the crest of the principal spillway, and irrigation usage of the reservoir.

4.2 Maintenance of Dam

The dam is maintained by the owner, Mr. Fred Kohl. The grass on the slopes and the dam crest is mowed periodically. Mr. Kohl mentioned that in 1974 he stopped the erosion near the water surface on the upstream slope by adding soil in several places. The owner also periodically checks for seepage and rodent activity.

4.3 Maintenance of Operating Facilities

There are no operating facilities at the damsite which require maintenance except for the portable centrifugal pump. On the day of the inspection, the pump was not at the damsite.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the damsite.

4.5

Evaluation

The maintenance at Kohl Irrigation Lake South Dam appears to be adequate, however, the remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No hydrologic and hydraulic design data, except a computation sheet showing elevation-area-capacity data supplied by the owner, is available for Kohl Irrigation Lake South Dam and the upstream dam. The sizes of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dams were prepared from field notes and sketches prepared during the field inspection. The reservoir elevation-capacity data were based on the computation sheet supplied by the owner and the U.S.G.S. Vandalia, Missouri Quadrangle topographic map (7.5 minute series). The spillway and overtop release rates and the reservoir elevation capacity data are presented in Appendix B.

The hydrologic soil groups of the two watersheds, one above the upstream dam and the other between the upstream dam and Kohl Irrigation Lake South Dam were determined from information available in the U.S.D.A. Soil Conservation Service publication "Missouri General Soil Map and Soil Association Descriptions", 1979. The Probable Maximum Precipitation (PMP) used to determine the Probable Maximum Flood (PMF) was determined by using the U.S. Weather Bureau publication, "Hydrometeorological Report No. 33" (April, 1956).

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, according to Mr. Fred Kohl, the maximum reservoir level was about 20 inches above the crest of the principal spillway.

c. Visual Observations

Observations made of the spillways during the visual inspection are discussed in Section 3.1d.(1) and (2) and evaluated in Section 3.2.

d. Overtopping Potential

Both the Probable Maximum Flood, and one-half of the Probable Maximum Flood when routed through the reservoir, resulted in overtopping of the dam. The peak inflows for the PMF and one-half of the PMF are 4372 cfs and 1933 cfs respectively. The peak outflow discharges for the PMF and one-half of the PMF are 4,247 and 1,518 cfs, respectively. The combined maximum capacity of the spillways just before overtopping the dam is 198 cfs. The PMF overtopped the dam by 3.02 feet and one-half of the PMF overtopped the dam by 2.28 feet. The total duration of overflow over the top of dam is 13.58 hours during the PMF and 9 hours during one-half of the PMF. The spillway/reservoir system of Kohl Irrigation Lake South Dam is capable of accommodating a flood equal to approximately 8 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Kohl Irrigation Lake South Dam will not accommodate the ten-percent chance flood without overtopping the dam. The Talbert Lake Dam (MO. 11209) mentioned in Section 3.1d has been included in determining the overtopping potential of Kohl Irrigation Lake South Dam. The Kohl Irrigation Lake South Dam may be susceptible to erosion due to high velocity flow on its downstream slope, due to overtopping of the dam. The emergency spillway will not probably be subject to excessive erosion because it has a good cover of grass.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately one mile downstream of the dam. Within the damage zone are one highway approximately 50 feet downstream of the dam, two houses, one building, one barn and a shed.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement observed on the embankment or foundation during the visual inspection. There were no signs of distress on the embankment other than the erosion due to wave action on the upstream face. The upstream slope does not have a protective riprap layer and, consequently, has undergone erosion. The top of dam and downstream slope are protected by a vegetative cover. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made. The spillways appeared to be structurally stable on the day of the inspection.

b. Design and Construction Data

Design computations pertaining to the embankment were not available during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records were available relating to the dam or appurtenant structures. The water level on the day of the visual inspection was 4 feet 8 inches below the crest of the principal spillway. The water level in the reservoir has apparently been 20 inches above the crest of the principal spillway at its highest point in recent years, according to Mr. Kohl. The reservoir surface elevation is normally controlled by the crest of the principal spillway.

d. Post Construction Changes

It is unknown what affect the changes in the original design had on the stability of the dam, if any. However, the only modification, which has been completed since the dam was constructed, was the addition of one foot of soil to the crest to level off the dam approximately one year after completion of the embankment. This did not appear to affect the structural stability of the dam; however, this could have a positive effect on the safety of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1, as defined in "Recommended Guidelines for Safety Inspection of Dams" prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude which would be expected in Seismic Zone 1 will not cause distress to a well designed and constructed earth dam. Available literature indicates no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed 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.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Kohl Irrigation Lake South Dam is found to be "Seriously Inadequate". The spillway/reservoir system will accommodate approximately 8 percent of the PMF without overtopping the dam. The surface soils in the embankment and the emergency spillway appears to be clay with some silt and sand. The emergency spillway has a good cover of grass and the embankment supports a dense growth of tall vegetation. The dam is overtopped by over 3 feet during the occurrence of the PMF. The maximum velocity of flow in the emergency spillway during PMF will be about

6 ft/sec. The emergency spillway channel will probably not be subject to excessive erosion at this velocity of flow during the PMF. However, the dam may be susceptible to erosion due to high velocity of flow on its downstream slope, due to overtopping of the dam during the PMF.

A quantitative evaluation of the safety of the embankment could not be made in view of the absence of seepage and stability analyses. The dam, however, appears to be in generally good condition except for the erosion due to wave action observed on the upstream face. The present embankment and appurtenant structures, however, according to Mr. Kohl, have performed satisfactorily since their construction; there have been no failures or evidence of instability. According to Mr. Kohl, the dam has never been overtopped and no evidence indicating the contrary was observed. The safety of the dam can be improved if the deficiencies described in Section 3.2 and 6.1a are properly corrected as described in Section 7.2.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurement, past performance and the present condition of the dam. Some information on the design hydrology and hydraulic design of the dam was available; however, the dam was not built according to the original design. For example, the design calls for a drop inlet spillway, but a chute type spillway has been provided instead. 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.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time, and the item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

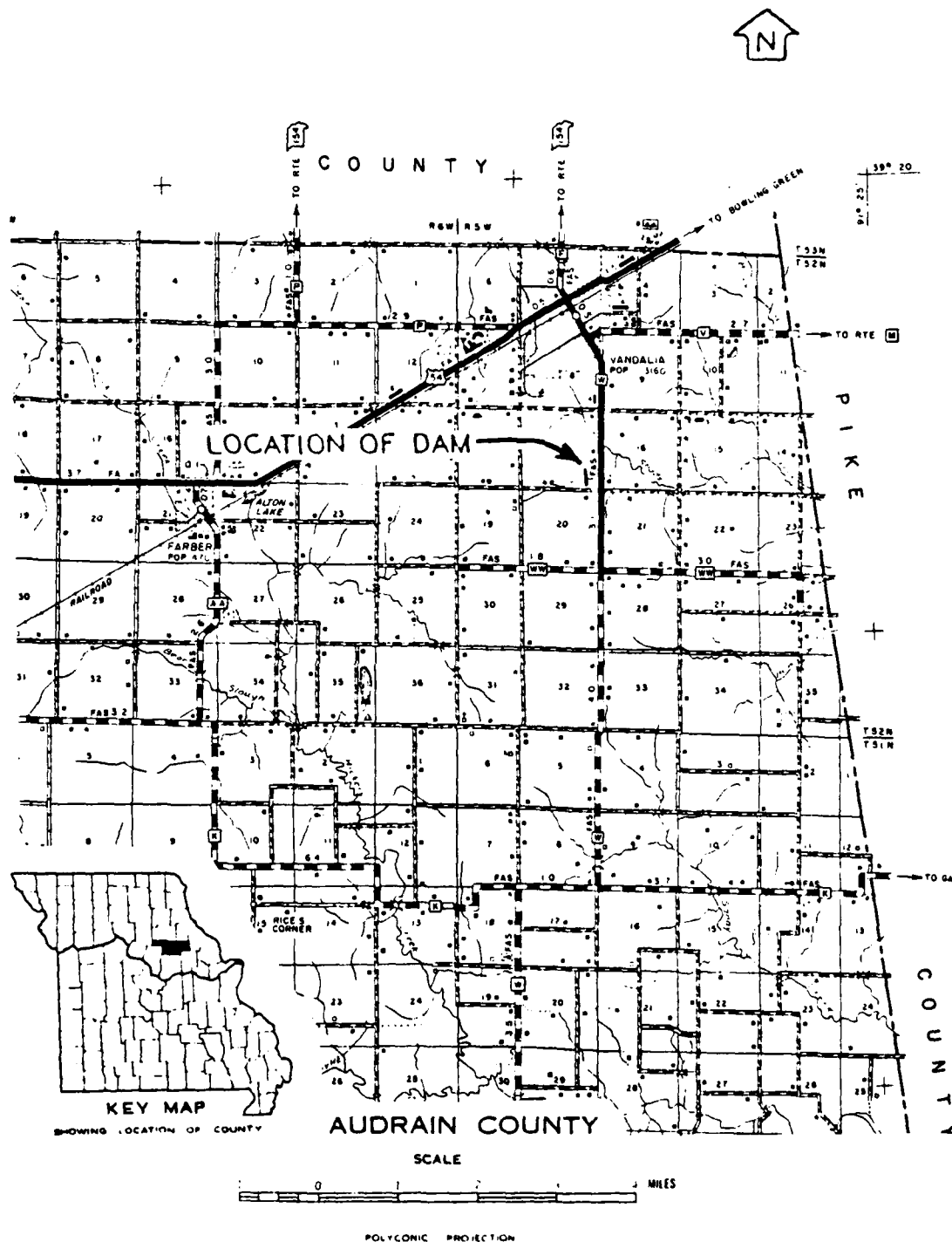
One of the following mitigation measures should be undertaken to avoid severe consequences of dam failure from overtopping.

1. Increase the capacity of the spillways to pass the Probable Maximum Flood without overtopping the dam.
2. Increase the height of the dam enough to pass the PMF without overtopping the dam; an investigation also should be done that includes studying the effects on the structural stability of the existing embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.
3. A combination of 1 and 2 above.

b. O & M Procedures

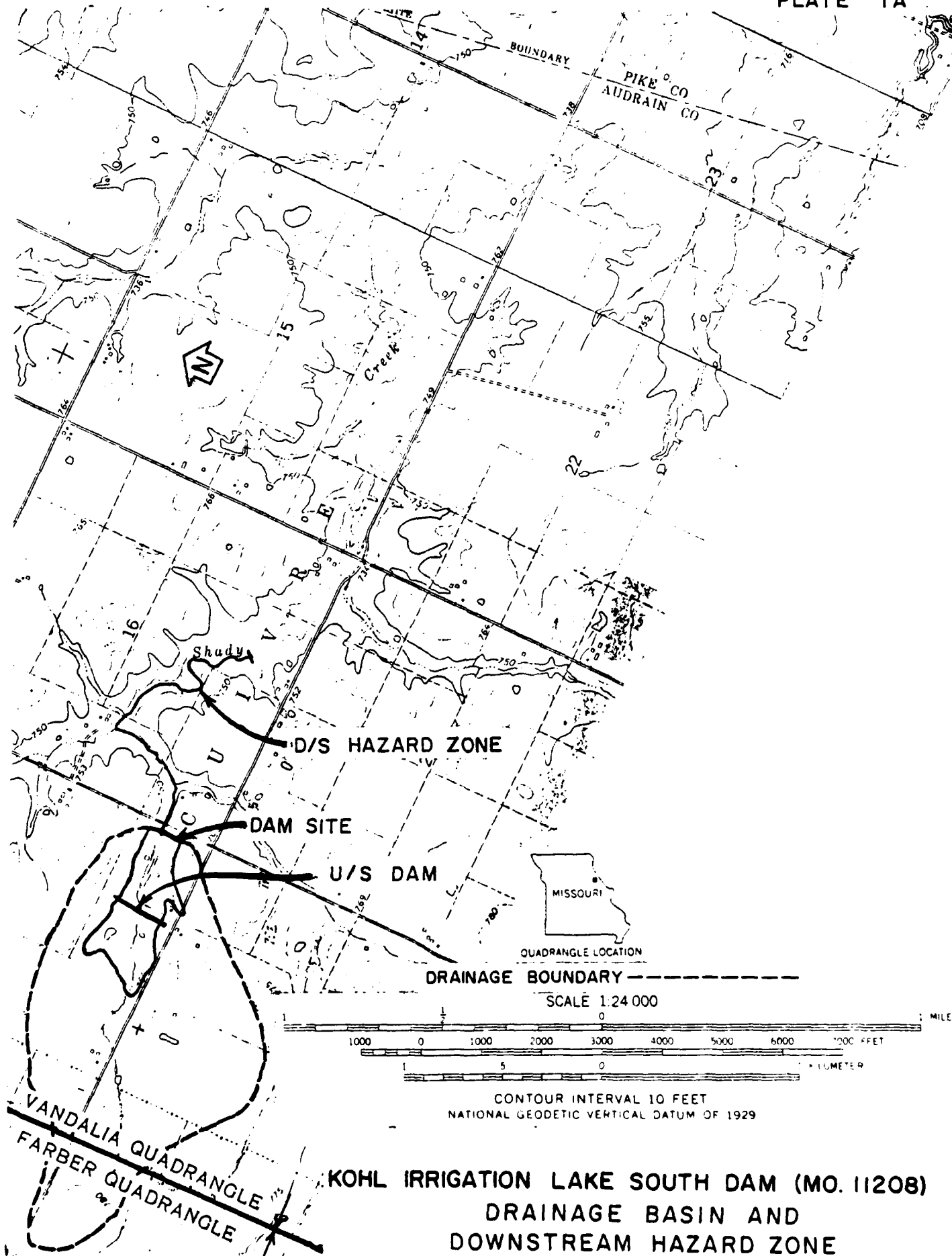
1. The erosion on the upstream slope due to wave action and surface runoff should be properly repaired and the upstream slope adequately protected against future erosion due to wave action and surface runoff.
2. The vegetation on the embankment, especially the vegetation on the top of dam and the downstream slope, should be properly maintained and an adequate vegetative cover retained on the embankment to protect it from surface erosion. Large vegetation, such as bushes and trees, should be prevented from growing on the embankment.
3. The separation of the construction joint in the principal spillway should be properly repaired.
4. The vegetation at the entrance to the principal spillway should be removed and further growth of vegetation in the spillway prevented.
5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.
6. The owner should initiate the following programs:
 - (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.
 - (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs, and maintenance.

PLATES

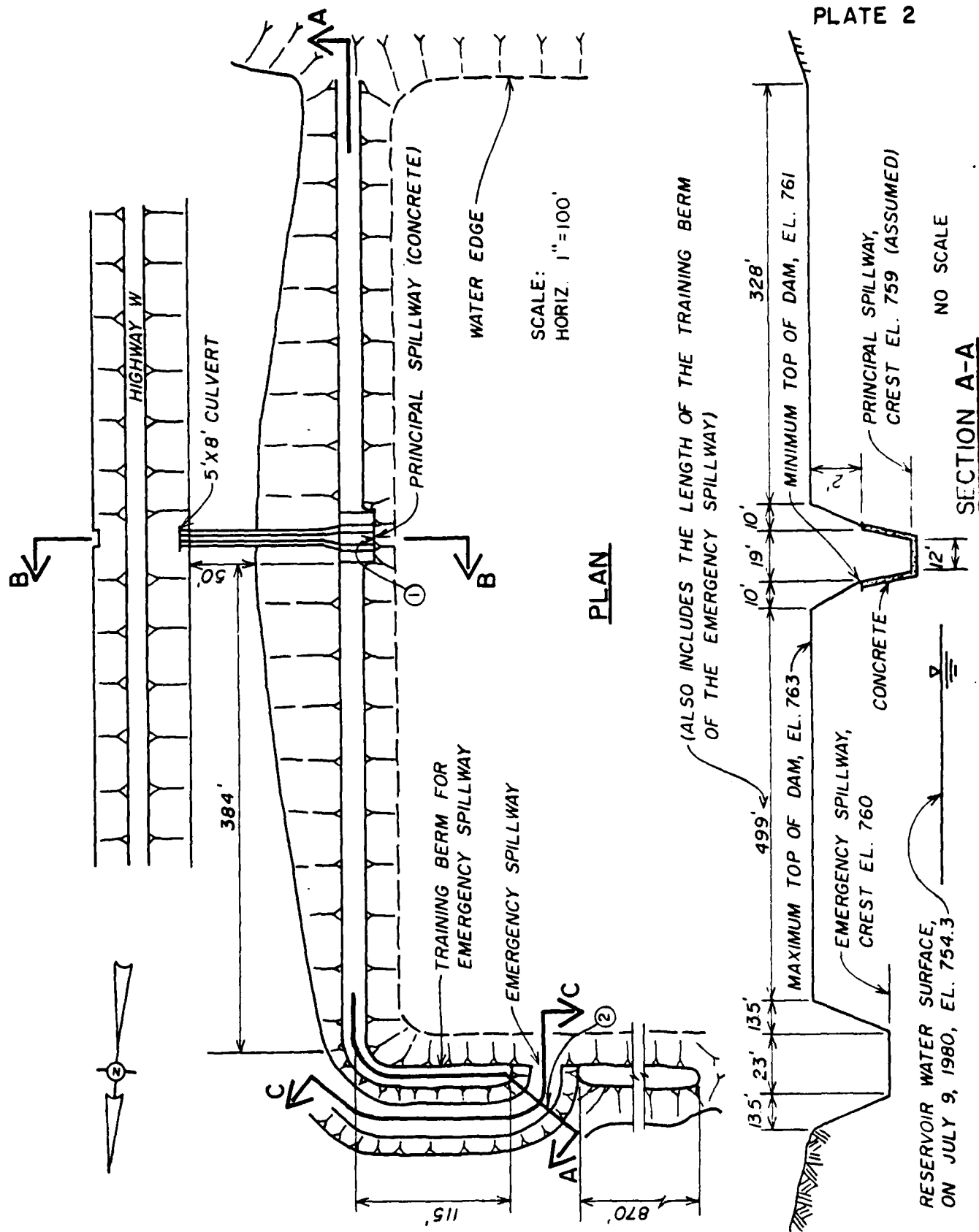


LOCATION MAP - KOHL IRRIGATION LAKE SOUTH DAM

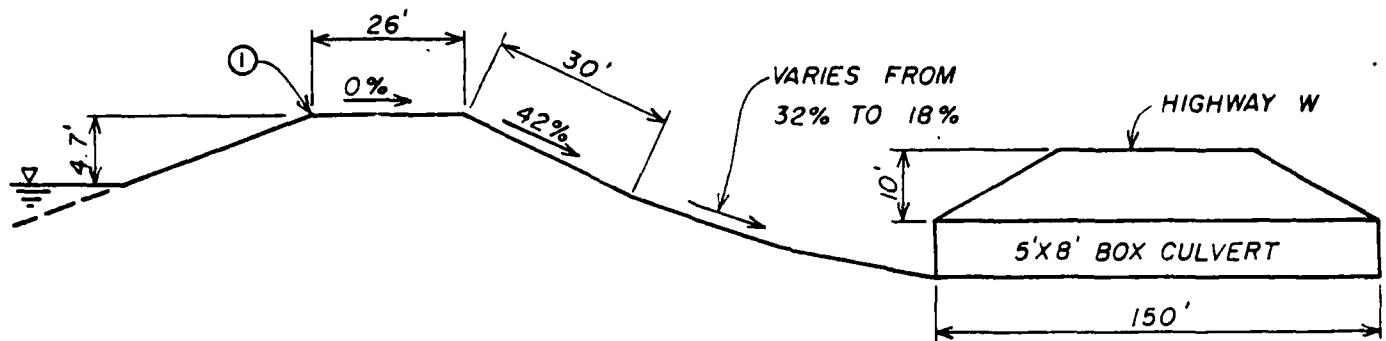
MO-11208



KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE

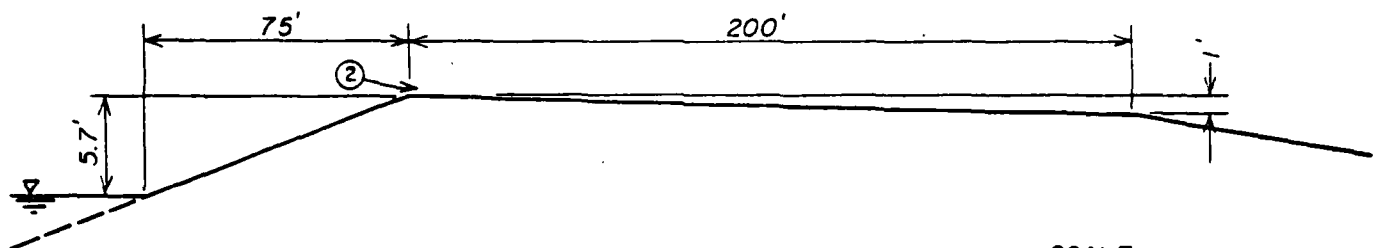


KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
PLAN & ELEVATION



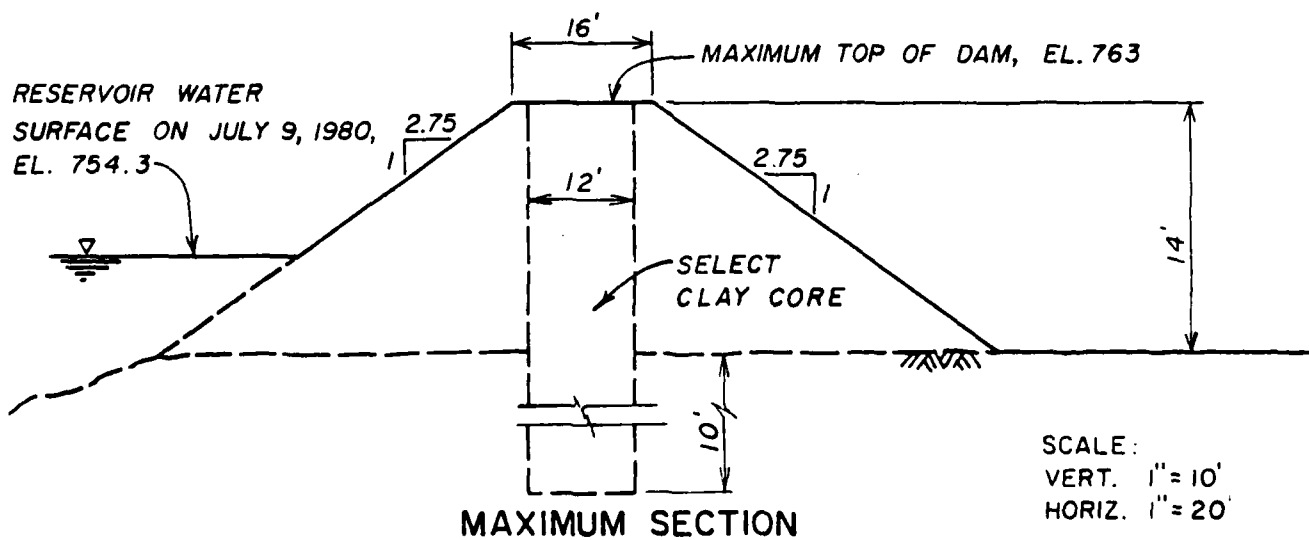
SECTION B-B
PRINCIPAL SPILLWAY PROFILE

NO SCALE



SECTION C-C
EMERGENCY SPILLWAY PROFILE

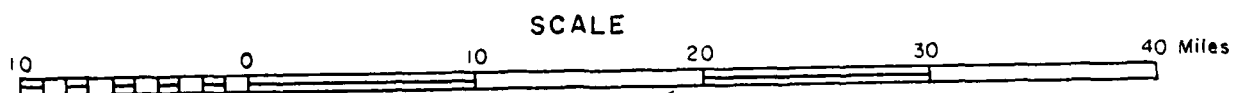
SCALE:
VERT. 1"=10'
HORIZ. 1"=50'



MAXIMUM SECTION

SCALE:
VERT. 1"=10'
HORIZ. 1"=20'

KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
PROFILES
PRINCIPAL & EMERGENCY SPILLWAYS,
MAXIMUM SECTION



⊕ LOCATION OF DAM

NOTE: LEGEND OF THIS DAM IS ON PLATE 5

REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP
OF
KOHL IRRIGATION LAKE S DAM

LEGEND

<u>PERIOD</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	{ PPwm	PLEASANTON GROUP: CYCLIC DEPOSITS OF SANDSTONE SHALE AND LIMESTONE
	{ Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	{ Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	{ Mo	KEOKUK - BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	{ Mk	CHOUTEAU GROUP: HANNIBAL AND BACHELOR FORMATION (SANDSTONE, SHALE, CHERTY LIMESTONE, DOLOMITE)
SILURIAN	S	BOWLING GREEN LIMESTONE
ORDOVICIAN	{ Ou	NOIX LIMESTONE
	{ Odp	DECORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE

APPENDIX A

PHOTOGRAPHS

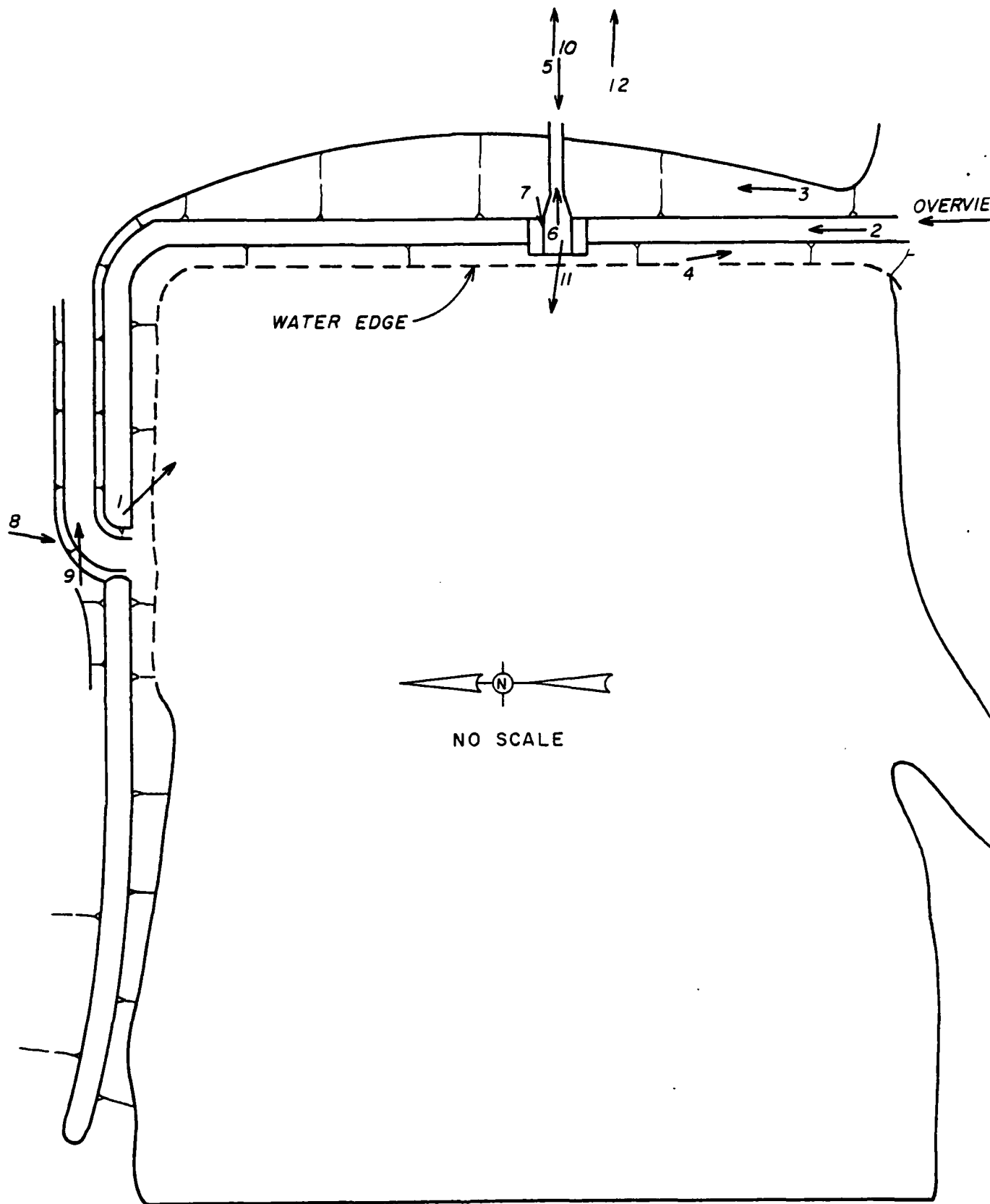


PHOTO INDEX
FOR
KOHL IRRIGATION LAKE
SOUTH DAM

Kohl Irrigation Lake South Dam
Photographs

- Photo 1 - Overview of the upstream slope showing vegetative cover and location of the principal spillway.
- Photo 2 - View of the top of dam showing the dense vegetative cover.
- Photo 3 - View of the downstream slope showing the dense vegetative cover.
- Photo 4 - View of the scarp due to wave erosion on the upstream slope.
- Photo 5 - View of the principal spillway from Highway W looking back toward the reservoir.
- Photo 6 - View of the principal spillway discharge channel and box culvert that passes under Highway W.
- Photo 7 - Close-up view of the separation of the joint between the slab and side walls of the principal spillway.
- Photo 8 - View of the emergency spillway.
- Photo 9 - View of the emergency spillway channel with the training berm on the right side of the photo.
- Photo 10 - View of the downstream channel just beyond the Highway W embankment.

Photo 11 - View of the reservoir and rim showing the upstream dam embankment and the entrance to the principal spillway with the trashrack and vegetative growth shown.

Photo 12 - View of a dwelling from Highway W that appears to be in the downstream hazard zone.

Rebel Irrigation Lake South Dam



Photo 1



Photo 2

Kohl Irrigation Lake South Dam



Photo 3



Photo 4

Field Investigation, Lake County, Pa.



Photo 5



Photo 6

Kohl Irrigation Lake South Dam



Photo 7



Photo 8

Roh! Irrigation Lake South Dam



Photo 9



Photo 10

Kohl Irrigation Lake South Dam



Photo 11



Photo 12

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

KOHL IRRIGATION LAKE SOUTH DAM

HYDROLOGIC AND HYDRAULIC DATA, ASSUMPTIONS AND METHODOLOGY

1. SCS Unit Hydrograph and HEC-1DB are used to develop the inflow hydrographs, and the hydrologic inputs are as follows:

- (a) Twenty-four hour probable maximum precipitation from Hydro-meteorological Report No. 33, 24-hour 100-year rainfall and 24-hour 10-year rainfall of Hannibal, Missouri.

- (b) Drainage area:

Drainage area above upstream (U/S) dam = 0.48 sq. mi.

Drainage area between U/S dam and Kohl Irrigation Lake South Dam = 0.16 sq. mi.

- (c) Lag time:

Lag time for U/S dam watershed = 0.43 hr.

Lag time for Kohl Irrigation Lake South Dam watershed = 0.25 hr.

- (d) Hydrologic Soil Group:

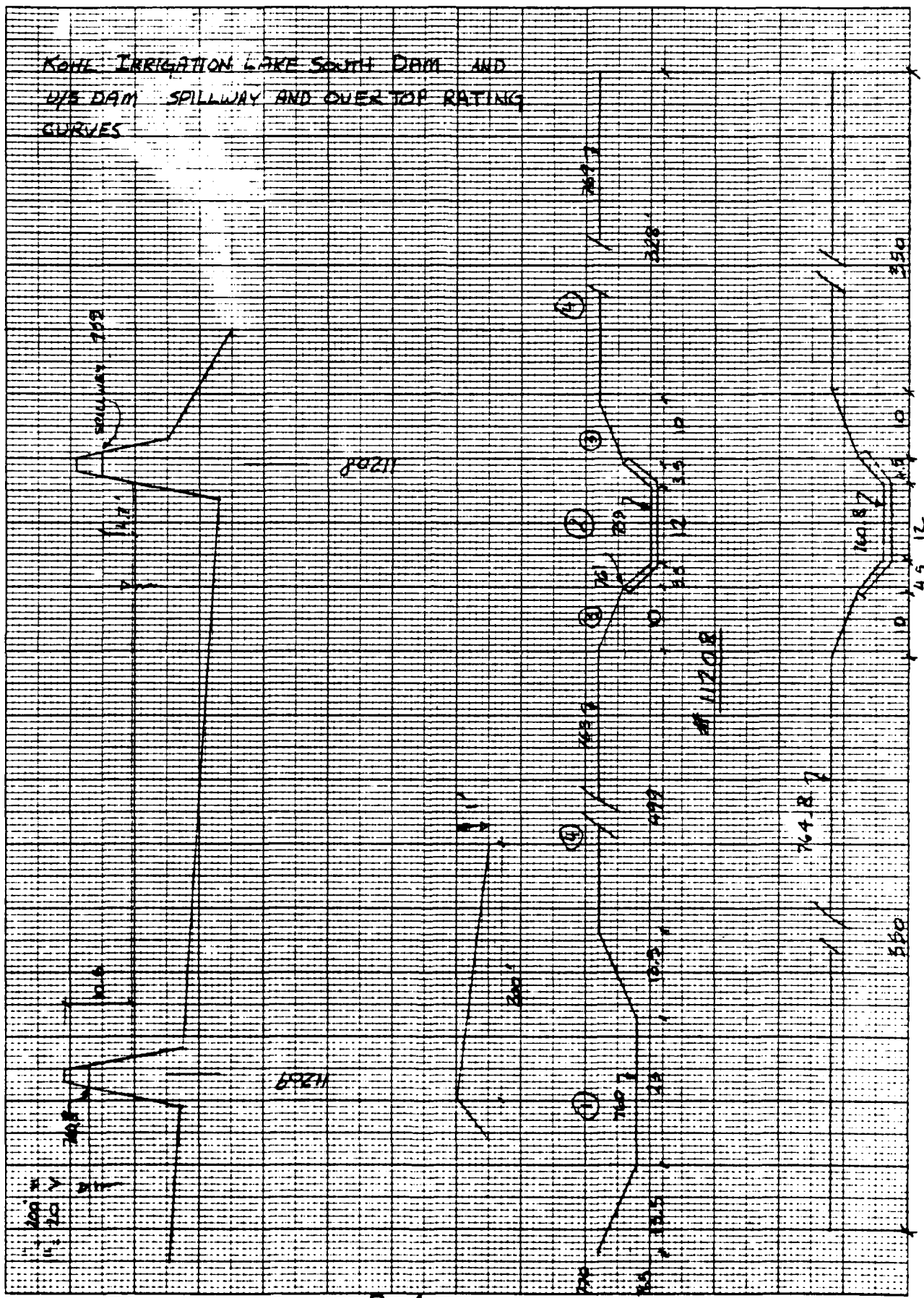
Soil Group "D" for both U/S dam and Kohl Irrigation Lake South Dam

- (e) Runoff curve number:

CN = 84 for AMC II and CN = 93 for AMC III for both U/S dam and Kohl Irrigation South Lake Dam.

2. Emergency spillway release rates are based on HEC-2 run assuming Manning's $n = 0.03$. Principal spillway release rates are determined by assuming critical flow. Flow rates over the dam are based on broad crested weir equation $Q = CLH^{3/2}$.
3. Floods are routed through the upstream reservoir and then through Kohl Irrigation Lake South to determine the capability of its spillways.

KOHL IRRIGATION LAKE SOUTH DAM AND
DYE DAM SPILLWAY AND OVERTOP RATING
CURVES



DAM SAFETY INSPECTION / MISSOURI - 1980

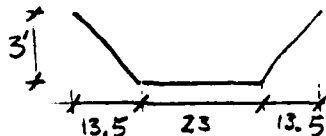
JOB NO. 1263

KOHL IRR. LAKE SOUTH DAM #11208

BY PZ DATE JUL 80

① EMERGENCY SPILLWAY

$$S = \frac{1}{200}$$



$$y < 3 \quad A = y(4.5y + 23)$$

$$P = 9.2y + 23$$

$$T = 9.0y + 23$$

$$y > 3 \quad A = 50y - 40.5$$

$$P = 50.7$$

$$T = 50$$

$$Q = \sqrt{\frac{A^3 g}{T}}$$

y_c	Q	y_n	Regime
1	144.7	1.34	Subcritical
2	453.7	2.50	
3	919.5	3.52	
4	1616.5	4.62	
5	2433.4	5.68	
6	3354.7	6.71	

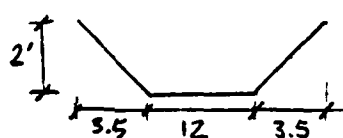
② SPILLWAY assumed critical depth.

$$y < 2 \quad A = y(1.75y_c + 12)$$

$$T = 12 + 3.5y_c$$

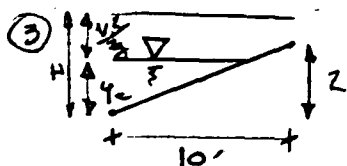
$$y > 2 \quad A = 19y_c - 7$$

$$T = 19$$



$$H_2 = \text{WSEL} - 759$$

$$Q = \sqrt{\frac{A^3 g}{T}}$$



$$y_c < 2 \quad y_c = \frac{4}{5}H \quad A = 2.5y_c^2$$

$$T = 5y_c$$

$$y_c > 2 \quad y_c = \frac{2}{3}(H + 0.9) \quad A = 10(y_c - 1)$$

$$T = 10$$

$$Q = \sqrt{\frac{A^3 g}{T}}$$

④ WEIR FLOW

$$Q_4 = CLH^{3/2}$$

$$L = 827$$

$$H = \text{WSEL} - 763$$

$$Q_{\text{TOTAL}} = Q_1 + Q_2 + 2 \times Q_3 + Q_4$$

SHEET NO. 3 OF 4

DAM SAFETY INSPECTION / MISSOURI - 1988

JOB NO. 1263

KOHLE IRR. LAKE SOUTH DAM # 11208

BY FZ DATE JUL 90

① * See HEC 2 Section #3				WSEL	② * by iteration							③			Sub					
Y ₁	A ₁	T ₁	V ₁	Q ₁	V ₁ /g	H ₁	H ₂	V ₀₂	A ₂	T ₂	V ₂	Q ₂	V ₂ /g	H ₃	V ₀₃	A ₃	T ₃	Q ₃	Total 9.9.203	
0	0	0	0	0	0	0	759	0	0	0	0	0	0	0						0
0.46	11.5	27.1	2.2	25	.07	0.53	760	1.00	9.06	14.4	4.5	41	0.31							41
0.71	18.4	24.3	2.7	50	.11	0.82	760.53	1.53	14.7	15.7	5.5	81	0.47							106
1.08	29.9	32.7	3.3	100	.17	1.25	760.82	1.82	18.1	16.4	5.9	108	0.55							158
1.61	48.8	37.5	4.1	200	.26	1.87	761.25	2.25	23.4	17.5	6.6	153	0.67	0.25	0.20	0.1	1	0.	0.	253
2.02	64.9	41.2	4.6	300	.33	2.35	761.87	2.87	31.7	19.0	7.3	232	0.83	0.87	0.70	1.2	3.5	4	4	440
2.35	74.3	44.2	5.0	400	.39	2.75	762.35	3.35	37.8	"	8.0	302	0.99	1.35	1.08	2.9	5.4	12	12	626
2.65	82.8	46.4	5.4	500	.45	3.10	762.75	3.75	42.8	"	8.5	365	1.13	1.75	1.40	4.9	7.0	23	23	811
2.90	104.7	49.1	5.7	600	.51	3.41	763.10	4.10	47.5	"	8.9	423	1.24	2.10	1.68	7.0	8.4	37	37	997
3.13	116.6	50.0	6.0	700	.56	3.69	763.41	4.41	51.2	"	9.3	477	1.35	2.41	1.93	9.3	9.6	52	52	1181
3.53	136.3	"	6.6	900	.68	4.21	763.69	4.91	54.8	"	9.6	527	1.44	2.69	2.13	11.3	10	58	58	1363
4.06	162.8	"	7.4	200	.84	4.90	764.21	5.21	61.3	"	10.2	625	1.61	3.21	2.47	14.7	"	01	01	1727
4.54	186.6	"	8.0	500	1.00	5.54	764.90	5.90	70.1	"	10.9	764	1.84	3.90	2.93	19.3	"	53	53	2270
4.98	209.0	"	8.6	800	1.15	6.14	765.54	6.54	78.2	"	11.5	900	2.06	4.54	3.36	23.6	"	206	206	2812
5.41	230.4	"	9.1	1100	1.29	6.70	766.14	7.14	85.8	"	12.1	1034	2.26	5.14	3.76	27.6	"	260	260	3354
							766.70	7.70	92.9	"	12.5	165	2.44	5.70	4.13	31.3	"	315	315	3895

SHEET NO. 4 OF 4DAM SAFETY INSPECTION / MISSOURI - 1990JOB NO. 1263KOHLE TRR. LAKE SOUTH DAM #11208BY FE DATE JUL 80

				Q	WSEL
		H ₄	C ₄	Q ₄	Total
SUB TOTAL					
0					759
41					760
106					760.53
158					760.82
253					761.25
440					761.87
626					762.35
811		0	0	0	762.75
997		0.10	2.93	77	763.10
1181		0.41	3.01	653	763.41
1363		0.69	3.03	1436	763.69
1727		1.21	3.04	3344	764.21
2270		1.90	3.04	6595	764.90
2812		2.54	3.05	10226	765.54
3354		3.14	3.07	14119	766.14
3895		3.70	3.08	18122	766.70

HEC-2 INPUT AND SUMMARY TABLE

.....
 HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
 ERROR CORR - 01-02-03
 MODIFICATION - 50-11-32-95

T1 DAM SAFETY INSPECTION
 T2 KDHLL IRRIGATION SOUTH LAKE DAM 11208
 T3 EMERGENCY SPILLWAY RATING CURVE

J1	ICHECK	INQ	MINV	IGIN	STRT	METRIC	WV103	U	WSEL	PQ
0.	0.	0.	0.	0.	-1.000000	0.00	0.0	0.	769.000	0.000

J2	NPROF	IPLOT	PRFVS	NSECV	NSECH	FN	ALLDC	10V	CHNIM	ITRACE
1.000	0.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

30.000	0.000	25.000	4.000	26.000	10.000	42.000	3.000	5.000	17.000
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J5 LPRINT MUMSEC *****REQUESTED SECTION NUMBERS*****

MC	-10.000	-10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	14.000	25.000	50.000	100.000	200.000	400.000	800.000	1600.000	3200.000	6400.000
QT	900.000	1200.000	1500.000	1800.000	2100.000	2400.000	2700.000	3000.000	3300.000	3600.000

X1	1.000	4.000	0.000	50.000	0.000	0.000	0.000	0.000	0.000	0.000
AR	762.000	0.000	159.000	15.500	759.000	36.500	762.000	50.000	0.000	0.000

X1	2.000	0.000	0.000	0.000	100.000	100.000	100.000	0.000	0.000	0.000
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X1	3.000	0.000	0.000	0.000	100.000	100.000	100.000	0.000	0.000	0.000
FJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

 HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
 ERROR CORR - 31.02.03
 MODIFICATION - 30.61.12.83

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EMERGENCY SPILLWAY RAYIN

SUMMARY PRINTOUT

SECTNO	DEPTH	AREA	TOPWID	VCH	HW	D	EO	10K+S	K-MNCH
1.000	3.32	7.92	25.92	3.16	.15	26.00	779.48	197.84	30.00
1.000	3.51	12.84	27.37	3.40	.24	60.00	759.74	172.27	30.00
1.000	3.74	20.98	30.11	4.77	.35	100.00	760.14	150.99	30.00
1.000	1.22	34.76	33.98	5.75	.51	200.00	760.73	132.28	30.00
1.000	1.56	56.74	37.02	6.42	.64	300.00	761.20	124.55	30.00
1.000	1.55	58.83	39.67	6.89	.74	400.00	761.59	118.23	30.00
1.000	2.11	60.50	41.94	7.30	.83	500.00	761.94	114.69	30.00
1.000	2.14	78.64	44.19	7.63	.90	600.00	762.25	111.41	30.00
1.000	2.56	84.52	46.05	7.32	.97	700.00	762.53	108.77	30.00
1.000	2.39	107.27	49.60	8.39	1.09	900.00	763.05	104.37	30.00
1.000	3.41	129.91	50.00	9.24	1.32	1200.00	763.73	101.21	30.00
1.000	3.33	150.90	50.00	9.94	1.53	1500.00	764.36	98.07	30.00
1.000	4.22	170.36	50.00	10.57	1.73	1800.00	764.75	96.14	30.00
1.000	4.59	184.84	50.00	11.12	1.92	2100.00	765.51	94.55	30.00
2.000	3.17	14.28	28.34	1.73	.05	25.00	760.11	30.39	30.00
2.000	3.43	21.70	30.32	2.38	.08	50.00	760.40	34.09	30.00
2.000	1.17	33.31	33.35	3.00	.14	100.00	760.41	37.55	30.00
2.000	1.64	51.51	34.16	3.84	.23	200.00	761.82	41.71	30.00
2.000	2.34	67.09	41.57	4.47	.31	300.00	761.89	43.83	30.00
2.000	2.40	81.25	44.63	4.92	.38	400.00	762.28	45.19	30.00
2.000	2.59	94.48	47.22	5.29	.43	500.00	762.63	46.03	30.00
2.000	2.93	107.15	49.57	6.60	.49	600.00	762.93	46.53	30.00
2.000	3.17	118.04	50.00	5.93	.55	700.00	763.22	46.68	30.00
2.000	3.36	137.53	50.00	6.54	.67	900.00	763.73	47.45	30.00
2.000	4.04	163.54	50.00	7.35	.94	1200.00	764.41	48.82	30.00
2.000	4.54	186.81	50.00	8.03	1.00	1500.00	765.04	49.71	30.00
2.000	4.98	208.84	50.00	8.62	1.13	1800.00	765.63	50.65	30.00
2.000	5.38	228.59	50.00	9.19	1.31	2100.00	766.19	52.01	30.00

SECTO	DEPTH	AREA	TOTAL	VC	HW	G	EG	10+5	K-ANCH
3-000	4.6	11.34	77.14	7.17	.27	25.00	760.33	60.15	30.00
3-000	.71	14.64	29.80	8.68	.11	50.00	760.93	59.27	30.00
3-000	1.24	23.94	33.64	3.14	.17	100.00	761.25	51.57	30.00
3-000	1.61	44.75	57.50	9.18	.26	200.00	761.17	48.95	30.00
3-000	2.02	64.98	41.20	4.62	.33	300.00	762.35	48.19	30.00
3-000	2.73	79.30	44.21	5.04	.47	400.00	762.75	49.36	30.00
3-000	2.65	92.77	45.29	5.39	.45	500.00	761.11	49.46	30.00
3-000	2.71	104.46	49.15	5.72	.51	600.00	763.41	49.43	30.00
3-000	3.13	116.55	50.23	6.01	.56	700.00	763.69	49.76	30.00
3-000	3.43	136.30	50.00	6.60	.68	800.00	764.21	49.33	30.00
3-000	4.55	152.80	50.33	7.37	.44	1200.00	764.30	49.13	30.00
3-000	4.54	186.75	50.00	8.93	1.00	1500.00	765.54	49.97	30.00
3-000	4.78	208.96	50.00	9.51	1.15	1800.00	766.14	51.56	30.00
3-000	5.42	230.55	50.00	9.11	1.27	2100.00	766.71	53.03	30.00

SUMMARY OF ERROR

CAUTION	SECTION	1-000	PROFILE 1	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 2	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 3	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 4	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 5	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 6	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 7	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 8	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 9	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 10	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 11	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 12	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 13	CRITICAL DEPTH ASSUMED
CAUTION	SECTION	1-000	PROFILE 14	CRITICAL DEPTH ASSUMED

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI

 SHEET NO. 1 OF 1
DAM NAME: JOE TRIG LAKE SOUTH / ID NO.: 11209

 JOB NO. 163
RESERVOIR ELEVATION - AREA DATA

 BY JEK DATE 9/9/80

ELEV. (M.S.L.) (Ft.)	RESERVOIR SURFACE AREA (Acres)	CUMULATIVE STORAGE (Ac - Ft)	REMARKS
745	0	0	From Survey Notes, Estimated Streambed
749	1.1	2.2	" "
751	2.9	6.2	" "
753	6.0	15.1	" "
755	8.2	29.3	" "
757	10.8	48.3	" "
759	15.4	74.5	Principal Spillway Crest
760	18.2	91.3	Emergency Spillway Crest
761	21.1	111	Top of Dam
770	45	408.5	Measured from U.S.G.S. Quad

Terry Hill D.C.

2

7-10-72

Fred Kohl & Ralph Talbert
W. Res.

W. Drakey C.E.T.

MESSAGE

Part on Kohl			Part on Talbert			Total		
El.	Ar.	Sto.	Ar.	Sto.		Ar.	Sto.	
30	0.0	0.0	0.0	0.0		0.0	0.0	
24	1.1	2.2	0.0	0.0		1.1	2.2	
16	2.9	6.2	0.2	0.1		3.1	6.3	
8	6.0	15.1	0.8	1.1		6.8	16.2	
2	8.2	27.3	1.5	3.4		9.7	31.6	
2	10.8	48.3	2.3	7.2		13.1	55.5	
7	15.4	74.5	4.3	13.8		19.7	88.3	
6	21.1	111.0	9.2	27.3		30.3	138.5	

Top of road west Culvert 100.0 Fl. West Culvert 93.8

Fl. of east Culvert 92.9 & ditch @ 85.0

Fl. of ditch @ Kohl dam 80.2 TBM El. 93.2 Top of Ry marker @ South end of Kohl dam. Advise if you need more info.

REPLY

Buck Blakely

11202

KOHL IRRIGATION LAKE SOUTH
DAM AND UPSTREAM DAM
RESERVOIR AREA & STORAGE
(SUPPLIED BY OWNER)

B-13

DAM SAFETY INSPECTION / MISSOURI

SHEET NO. 1 OF 1

DAM NAME: KOHL IRR. LAKE SOUTH DAM 11208

JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS

BY FZ DATE JUL 80

1) DRAINAGE AREA, $A = 0.160$ sq. mi. = (102 acres)2) LENGTH OF STREAM, $L = (1.45 \times 2000' = 2900') = 0.53$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$$H_1 = 779$$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 759$ 5) ELEVATION OF CHANNEL BED AT $0.85L$, $E_{85} = 778$ 6) ELEVATION OF CHANNEL BED AT $0.10L$, $E_{10} = 768$ 7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10}) / 0.75L = 0.005$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3) / (H_1 - H_2)]^{0.385} = 0.41 \text{ hr.}$$

B) BY VELOCITY ESTIMATE,

$$\text{SLOPE} = 0.5\% \Rightarrow \text{AVG. VELOCITY} = 2 \text{ fps}$$

$$t_c = L / V = \frac{2900}{2} \times \frac{1}{3600} = 0.4 \text{ hr.}$$

USE $t_c = 0.41$ 9) LAG TIME, $t_l = 0.6 t_c = 0.25$ hr.10) UNIT DURATION, $D \leq t_l / 3 = 0.082$ hr.

< 0.083 hr.

USE $D = 0.083$ hr.11) TIME TO PEAK, $T_p = D/2 + t_l = 0.29$ hr.

12) PEAK DISCHARGE,

$$q_p = (484 \times A) / T_p = 266 \text{ cfs}$$

[illegible]

.....
 A FLOOD HYDROGRAPH PACKAGE INDC-17
 DAM SAFETY VERIFICATION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE=80080726
 TIME=101222Z8.

DAM SAFETY INSPECTION 7 MISSOURI
 MOHL IRRIGATION SOUTH LAKE DAM TWO-11209
 PMP

JOB SPECIFICATION

NO	NHR	NMIN	IOAY	IMR	IMIN	METRC	IPLT	IPRT	INSTAN
100	0	5	0	0	0	0	0	0	0
			JOPER	MUT	LHOPT	THACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLANE=1 NUNIT=1 LUNIT=1

NTLOSS 1.00

SUB-AREA RUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM TWO-11209

ISTRJ	ICOMP	TECON	ITAPT	JPLT	JURT	INAME	ISTAGE	LAUTO
209DAM	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

INVOG	IUNG	STAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.45	0.00	.48	1.00	0.00	0	1	0

PRECIP DATA

SPEE	PM1	R6	K12	R24	W48	R72	R96
0.00	24.60	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LHOPT	STARR	OLTR	RTIOL	ERAIN	SIRKS	RTIOW	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00	0.00

CURVE NO = -93.00 WTRFSS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA

10= 0.00 LAG= .43

STATION= 0.00 RECEPTION DATA
 ORCSN= 0.00 RTIOW= 1.00

UNIT HYDROGRAPH 20 END OF PERIOD ORIGINATES, TCS
 41. 120. 257. 480. 978. 1465. 2190. 2790. 3740. 4410. 5000. 5500. 6000. 6500. 7000. 7500. 8000. 8500. 9000. 9500. 10000. 10500. 11000. 11500. 12000. 12500. 13000. 13500. 14000. 14500. 15000. 15500. 16000. 16500. 17000. 17500. 18000. 18500. 19000. 19500. 20000. 20500. 21000. 21500. 22000. 22500. 23000. 23500. 24000. 24500. 25000. 25500. 26000. 26500. 27000. 27500. 28000. 28500. 29000. 29500. 30000. 30500. 31000. 31500. 32000. 32500. 33000. 33500. 34000. 34500. 35000. 35500. 36000. 36500. 37000. 37500. 38000. 38500. 39000. 39500. 40000. 40500. 41000. 41500. 42000. 42500. 43000. 43500. 44000. 44500. 45000. 45500. 46000. 46500. 47000. 47500. 48000. 48500. 49000. 49500. 50000. 50500. 51000. 51500. 52000. 52500. 53000. 53500. 54000. 54500. 55000. 55500. 56000. 56500. 57000. 57500. 58000. 58500. 59000. 59500. 60000. 60500. 61000. 61500. 62000. 62500. 63000. 63500. 64000. 64500. 65000. 65500. 66000. 66500. 67000. 67500. 68000. 68500. 69000. 69500. 70000. 70500. 71000. 71500. 72000. 72500. 73000. 73500. 74000. 74500. 75000. 75500. 76000. 76500. 77000. 77500. 78000. 78500. 79000. 79500. 80000. 80500. 81000. 81500. 82000. 82500. 83000. 83500. 84000. 84500. 85000. 85500. 86000. 86500. 87000. 87500. 88000. 88500. 89000. 89500. 90000. 90500. 91000. 91500. 92000. 92500. 93000. 93500. 94000. 94500. 95000. 95500. 96000. 96500. 97000. 97500. 98000. 98500. 99000. 99500. 100000. 100500. 101000. 101500. 102000. 102500. 103000. 103500. 104000. 104500. 105000. 105500. 106000. 106500. 107000. 107500. 108000. 108500. 109000. 109500. 110000. 110500. 111000. 111500. 112000. 112500. 113000. 113500. 114000. 114500. 115000. 115500. 116000. 116500. 117000. 117500. 118000. 118500. 119000. 119500. 120000. 120500. 121000. 121500. 122000. 122500. 123000. 123500. 124000. 124500. 125000. 125500. 126000. 126500. 127000. 127500. 128000. 128500. 129000. 129500. 130000. 130500. 131000. 131500. 132000. 132500. 133000. 133500. 134000. 134500. 135000. 135500. 136000. 136500. 137000. 137500. 138000. 138500. 139000. 139500. 140000. 140500. 141000. 141500. 142000. 142500. 143000. 143500. 144000. 144500. 145000. 145500. 146000. 146500. 147000. 147500. 148000. 148500. 149000. 149500. 150000. 150500. 151000. 151500. 152000. 152500. 153000. 153500. 154000. 154500. 155000. 155500. 156000. 156500. 157000. 157500. 158000. 158500. 159000. 159500. 160000. 160500. 161000. 161500. 162000. 162500. 163000. 163500. 164000. 164500. 165000. 165500. 166000. 166500. 167000. 167500. 168000. 168500. 169000. 169500. 170000. 170500. 171000. 171500. 172000. 172500. 173000. 173500. 174000. 174500. 175000. 175500. 176000. 176500. 177000. 177500. 178000. 178500. 179000. 179500. 180000. 180500. 181000. 181500. 182000. 182500. 183000. 183500. 184000. 184500. 185000. 185500. 186000. 186500. 187000. 187500. 188000. 188500. 189000. 189500. 190000. 190500. 191000. 191500. 192000. 192500. 193000. 193500. 194000. 194500. 195000. 195500. 196000. 196500. 197000. 197500. 198000. 198500. 199000. 199500. 200000. 200500. 201000. 201500. 202000. 202500. 203000. 203500. 204000. 204500. 205000. 205500. 206000. 206500. 207000. 207500. 208000. 208500. 209000. 209500. 210000. 210500. 211000. 211500. 212000. 212500. 213000. 213500. 214000. 214500. 215000. 215500. 216000. 216500. 217000. 217500. 218000. 218500. 219000. 219500. 220000. 220500. 221000. 221500. 222000. 222500. 223000. 223500. 224000. 224500. 225000. 225500. 226000. 226500. 227000. 227500. 228000. 228500. 229000. 229500. 230000. 230500. 231000. 231500. 232000. 232500. 233000. 233500. 234000. 234500. 235000. 235500. 236000. 236500. 237000. 237500. 238000. 238500. 239000. 239500. 240000. 240500. 241000. 241500. 242000. 242500. 243000. 243500. 244000. 244500. 245000. 245500. 246000. 246500. 247000. 247500. 248000. 248500. 249000. 249500. 250000. 250500. 251000. 251500. 252000. 252500. 253000. 253500. 254000. 254500. 255000. 255500. 256000. 256500. 257000. 257500. 258000. 258500. 259000. 259500. 260000. 260500. 261000. 261500. 262000. 262500. 263000. 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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 1188

STAG 759.09 760.00 760.55 760.82 761.26 761.47 762.35 763.10 763.41

FLOW 0.00 41.00 106.00 154.00 253.00 440.00 626.00 811.00 1074.00 1325.00

CAPACITY 0. 2. 6. 15. 20. 48. 76. 91. 111. 409.

ELEVATION 745. 749.2 751. 753. 754. 757. 759. 761. 770.

CHSL MPAD 759.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

COOL CATA EXPL 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

TOPEL COOL EXPL DAMVID 761.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

STATION 2080M, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

PERIOD HOURS INFLOW OUTFLOW STORAGE STAGE

NO. DA HR. MN

1 0.01 7.05 1.00 0.08 0. 0. 75. 759.0

2 0.01 7.10 1.00 1.17 0. 0. 75. 759.0

3 0.01 7.15 1.00 2.35 0. 0. 75. 759.0

4 0.01 7.20 1.00 3.53 0. 0. 75. 759.0

5 0.01 7.25 1.00 4.71 0. 0. 75. 759.0

6 0.01 7.30 1.00 5.89 0. 0. 75. 759.0

7 0.01 7.35 1.00 7.07 0. 0. 75. 759.0

8 0.01 7.40 1.00 8.25 0. 0. 75. 759.0

9 0.01 7.45 1.00 9.43 0. 0. 75. 759.0

10 0.01 7.50 1.00 10.61 0. 0. 75. 759.0

11 0.01 7.55 1.00 11.79 0. 0. 75. 759.0

12 0.01 8.00 1.00 12.97 0. 0. 75. 759.0

13 0.01 8.05 1.00 14.15 0. 0. 75. 759.0

14 0.01 8.10 1.00 15.33 0. 0. 75. 759.0

15 0.01 8.15 1.00 16.51 0. 0. 75. 759.0

16 0.01 8.20 1.00 17.69 0. 0. 75. 759.0

17 0.01 8.25 1.00 18.87 0. 0. 75. 759.0

18 0.01 8.30 1.00 20.05 0. 0. 75. 759.0

19 0.01 8.35 1.00 21.23 0. 0. 75. 759.0

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)

RATIOS APPLIED TO FLOWS

OPERATION STATION AREA PLAN RATIO 1.00

HYDROGRAPH AT 2000AM 1 3587.
 101.5811

ROUTED TO 2000AM 1 3597.
 99.0211

HYDROGRAPH AT 2000AM 1 15394
 43.5911

COMBINED 2000AM 1 4172.
 121.8011

ROUTED TO 2000AM 1 4247.
 120.2511

U/S DAM

SUMMARY OF KIN. DATA ANALYSIS

PLAN 1	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	TIME OF FAILURE
760.80	760.80	760.80	762.80	16.00
26.	26.	26.	26.	16.00
0.	0.	0.	0.	16.00

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS									
PLAN 1	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM					
	STORAGE	789.00	759.00	761.00					
	OUTFLOW	75	75	111					
				198					
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF			
OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX	MAX			
ONE	3-STEP	OVER DAM	AC-F	HOURS	OUTFLOW	FAILURE			
1.00	764.02	3.02	211	13.58	16.08	0.00			
				9847					

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

DAM SAFETY INSPECTION - MISSOURI									
KOHL IRRIGATION SOUTH LAKE DAM (MO.11208)									
FIFTY PERCENT PMF									
	100	0	5	0	0	0	0	0	0
1	5								
2	1								
3	1								
4	5								
5	1								
6	1								
7	1								
8	1								
9	1								
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11200DAM									
RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11200									
1	2	.16	1						1
	24.5	100	120						
	.25								
21120-DAM									
COMBINE HYDROGRAPHS									
11120-DAM									
ROUTE HYDROGRAPH THROUGH DAM 11203									
1	759	760	760.53	760.52	761.25	761.87	762.35	762.75	-1
14763.69	764.21	764.90							763.1
0	41	106	158	253	440	611	826	1074	1834
2799	5071	8365							
0	2.2	6.2	15.1	29.3	48.3	71.5	91.3	111	408.5
745	745	751	753	755	757	759	760	761	770
759									
761									
99									

DATE: 08/08/86
TIME: 10:24:00

MOHL IRRIGATION SOUTH LAKE DAM (MO.1208)
DAM SAFETY INSPECTION - MISSOURI
FIFTY PERCENT PMF

JOB SPECIFICATION								
NO	MHR	NMIN	IDAY	IHR	IMIN	MLTRC	PLPT	INSTAN
000	0	5	0	0	0	0	0	0
			JOPER	NUT	LAPPI	TRACE		
			5	0	0	0		

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN# 1 NCTID# 1 LRTIO# 1

050114

SUB-AREA MUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11209

ISTAD	ICOMP	IECON	ITAPE	JFLT	JNVL	ISTACE	IAUTO
09DAM	0	0	0	0	0	0	0

HYDROGRAPH DATA

PRICIP. DATA		R4B		R72		R96	
SPFC	IMS	K6	R12	K24			
0.00	0.50	100.00	120.00	130.00	3.00	0.00	0.00

LOSS DATA

CMPT	STARR	CLANK	HTIOL	EMAIN	STRKS	RTIOK	STRTL	CNCTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-1.00	0.00	0.00

CURVE NO. = -93.00 WEIRNESS = -.1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA

C = 0.00 LAG = .03 ONLY MICROGRAPH LAB

RECESSION DATA

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STATIQ= 0.00  QRC$N= 0.00
RECESSION DATA

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UTILITY HYDROGRAPH 2ND END OF PERIOD ORIGINATES, TC=				0.00 HOURS, LAG=	.03	VOL= 1.00
91.	124.	237.	408.	491.	370.	202.
100.	125.	87.	65.	27.	20.	10.

1911 571 654 36 20 31

MO,DA	HR,MM	PERIOD	RAIN	CHD	LOSS	COMP	PERIOD	RAIN	EQS	LOSS	COMP
1.01	0.0	1	0.0	0.00	0.0	0.0	12.35	151	.21	.00	530.
1.01	1.0	2	0.0	0.00	0.0	0.0	12.40	152	.21	.00	531.
1.01	2.0	3	0.0	0.00	0.0	0.0	12.45	153	.21	.00	532.
1.01	3.0	4	0.0	0.00	0.0	0.0	12.50	154	.21	.00	533.
1.01	4.0	5	0.0	0.00	0.0	0.0	12.55	155	.21	.00	534.
1.01	5.0	6	0.0	0.00	0.0	0.0	13.00	156	.21	.00	535.
1.01	6.0	7	0.0	0.00	0.0	0.0	13.05	157	.21	.00	536.
1.01	7.0	8	0.0	0.00	0.0	0.0	13.10	158	.21	.00	537.
1.01	8.0	9	0.0	0.00	0.0	0.0	13.15	159	.21	.00	538.
1.01	9.0	10	0.0	0.00	0.0	0.0	13.20	160	.21	.00	539.
1.01	10.0	11	0.0	0.00	0.0	0.0	13.25	161	.21	.00	540.
1.01	11.0	12	0.0	0.00	0.0	0.0	13.30	162	.21	.00	541.
1.01	12.0	13	0.0	0.00	0.0	0.0	13.35	163	.21	.00	542.
1.01	13.0	14	0.0	0.00	0.0	0.0	13.40	164	.21	.00	543.
1.01	14.0	15	0.0	0.00	0.0	0.0	13.45	165	.21	.00	544.
1.01	15.0	16	0.0	0.00	0.0	0.0	13.50	166	.21	.00	545.
1.01	16.0	17	0.0	0.00	0.0	0.0	13.55	167	.21	.00	546.
1.01	17.0	18	0.0	0.00	0.0	0.0	14.00	168	.21	.00	547.
1.01	18.0	19	0.0	0.00	0.0	0.0	14.05	169	.21	.00	548.
1.01	19.0	20	0.0	0.00	0.0	0.0	14.10	170	.21	.00	549.
1.01	20.0	21	0.0	0.00	0.0	0.0	14.15	171	.21	.00	550.
1.01	21.0	22	0.0	0.00	0.0	0.0	14.20	172	.21	.00	551.
1.01	22.0	23	0.0	0.00	0.0	0.0	14.25	173	.21	.00	552.
1.01	23.0	24	0.0	0.00	0.0	0.0	14.30	174	.21	.00	553.
1.01	24.0	25	0.0	0.00	0.0	0.0	14.35	175	.21	.00	554.
1.01	25.0	26	0.0	0.00	0.0	0.0	14.40	176	.21	.00	555.
1.01	26.0	27	0.0	0.00	0.0	0.0	14.45	177	.21	.00	556.
1.01	27.0	28	0.0	0.00	0.0	0.0	14.50	178	.21	.00	557.
1.01	28.0	29	0.0	0.00	0.0	0.0	14.55	179	.21	.00	558.
1.01	29.0	30	0.0	0.00	0.0	0.0	15.00	180	.21	.00	559.
1.01	30.0	31	0.0	0.00	0.0	0.0	15.05	181	.21	.00	560.
1.01	31.0	32	0.0	0.00	0.0	0.0	15.10	182	.21	.00	561.
1.01	32.0	33	0.0	0.00	0.0	0.0	15.15	183	.21	.00	562.
1.01	33.0	34	0.0	0.00	0.0	0.0	15.20	184	.21	.00	563.
1.01	34.0	35	0.0	0.00	0.0	0.0	15.25	185	.21	.00	564.
1.01	35.0	36	0.0	0.00	0.0	0.0	15.30	186	.21	.00	565.
1.01	36.0	37	0.0	0.00	0.0	0.0	15.35	187	.21	.00	566.
1.01	37.0	38	0.0	0.00	0.0	0.0	15.40	188	.21	.00	567.
1.01	38.0	39	0.0	0.00	0.0	0.0	15.45	189	.21	.00	568.
1.01	39.0	40	0.0	0.00	0.0	0.0	15.50	190	.21	.00	569.
1.01	40.0	41	0.0	0.00	0.0	0.0	15.55	191	.21	.00	570.
1.01	41.0	42	0.0	0.00	0.0	0.0	16.00	192	.21	.00	571.
1.01	42.0	43	0.0	0.00	0.0	0.0	16.05	193	.21	.00	572.
1.01	43.0	44	0.0	0.00	0.0	0.0	16.10	194	.21	.00	573.
1.01	44.0	45	0.0	0.00	0.0	0.0	16.15	195	.21	.00	574.
1.01	45.0	46	0.0	0.00	0.0	0.0	16.20	196	.21	.00	575.
1.01	46.0	47	0.0	0.00	0.0	0.0	16.25	197	.21	.00	576.
1.01	47.0	48	0.0	0.00	0.0	0.0	16.30	198	.21	.00	577.
1.01	48.0	49	0.0	0.00	0.0	0.0	16.35	199	.21	.00	578.
1.01	49.0	50	0.0	0.00	0.0	0.0	16.40	200	.21	.00	579.
1.01	50.0	51	0.0	0.00	0.0	0.0	16.45	201	.21	.00	580.
1.01	51.0	52	0.0	0.00	0.0	0.0	16.50	202	.21	.00	581.
1.01	52.0	53	0.0	0.00	0.0	0.0	16.55	203	.21	.00	582.
1.01	53.0	54	0.0	0.00	0.0	0.0	17.00	204	.21	.00	583.
1.01	54.0	55	0.0	0.00	0.0	0.0	17.05	205	.21	.00	584.
1.01	55.0	56	0.0	0.00	0.0	0.0	17.10	206	.21	.00	585.

114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1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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)

RATIOS APPLIED TO FLOWS

OPERATION STATION AREA PLAN RATIO 1

HYDROGRAPH AT 2000AM .08 1 1794
 (1.24) (88.78)

ROUTED TO 2000AM .48 1 1576
 (1.24) (88.78)

HYDROGRAPH AT 2000AM .16 1 770
 (.41) (81.00)

2 COMBINED 2000AM .64 1 1933
 (1.65) (89.78)

ROUTED TO 2000AM .64 1 1518
 (1.65) (87.40)

U/S DAM

SUMMARY OF DAM SAFETY ANALYSIS									
PLAN 1		ELEVATION		INITIAL VALUE		SPILLWAY CREST		TOP OF DAM	
		STORAGE		760.00		760.00		762.80	
		OUTFLOW		26.		26.		50.	
				0.		0.		148.	
RATIO OF PMF	MAXIMUM RESERVOIR DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS			
0.0	2.50	139.	1078.	6.67	16.19	16.00			

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS									
PLAY 1	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM					
	STORAGE	789.00	759.00	761.00					
	OUTFLOW	79	79	111					
				198					
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF				
OF)	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	FAILURE			
PMF	W.S.ELEV	OVER DAM	AC-FT	HOURS	HOURS	HOURS			
80	743.26	18.09	1069	9.00	16.02	0.00			

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

RUN DATE: 08/08/2006
 TIME: 10:01:10

DAM SAFETY INSPECTION - MISSOURI
 KOKIL IRRIGATION SOUTH LAKE DAM (NO. 11208)
 PERCENT PMF

JOB SPECIFICATION

NO	HR	MIN	DAY	HR	MIN	SEC	PLT	IPRT	INSTAN
300	0	5	0	0	0	0	0	0	0
			JUMP	NUT	LPNT	THACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLANE 1 RTIOE 5 LRTIOE 1
 .06 .01 .00 .05

RTIOE .05

SUB-AREA RUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAP 11209

ESTAG	ICOMP	TECON	ITAPE	JPT	JRT	INAME	ISTAGE	IAUTO
PRDAM	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

INVOG	JUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.48	0.00	.48	1.00	0.000	0	1	0

PRECIP DATA

SPEE	PMS	RL	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STPMN	DLTKR	RTIOL	FMATN	STKRS	RTIOW	STIRL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO 1 -53.00 WIFNESS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA

ICE 0.00 LAGE .43

RECESSION DATA

STRTOE 0.00 DRCSNS 0.00 RTIOE 1.00

END-OF-PERIOD FLOW

MO-DA	HR-MN	PERIOD	RAIN	EXCS	LOSS	RAIN	EXCS	LOSS	COMP
0	0	0	0	0	0	0	0	0	0

AD-A104 975

PRC CONSOER TOWNSEND INC ST LOUIS MO

NATIONAL DAM SAFETY PROGRAM, KOHL IRRIGATION LAKE SOUTH DAM (MO--ETC(U)

DEC 80 W G SHIFRIN

F/6 13/13

DACW43-80-C-0094

NL

UNCLASSIFIED

2 OF 2

AD-A
104975



END

DATA

FORM

10-81

DTIC

ISTAG	ICONF	LECON	ITAME	JPT	JPM1	INAME	ISTAG	IAURO
12ABAN	0	0	0	0	0	1	0	0

[illegible]

SPT	PM3	R6	R12	R24	R49	R72	R96
0.00	29.60	100.00	100.00	100.00	0.00	0.00	0.00

[illegible]

000.6 = NO 12744J 80.1. 001.6 = 537417N 001.6 = ON 12744J 80.1. 000.6 = NO 12744J 80.1. 001.6 = 537417N 001.6 = ON 12744J 80.1.

UNIT HYDROGRAPH DATA
IC= 0.00 LAG= 0.25

STRTIME	0.00	RECESSION DATA		WTORS	1.00
		GRCSE	0.00		

[illegible]

MS	31.58	31.07	30.89
1	112.14	790.1	23.11
			1989.89

COMPTON HYDROGRAPHIS

THE JOURNAL OF DOCUMENTATION

ISTAG	ICOMP	RECON	STAGE	JPLY	JPRI	INAME	ISTAGL	IAUTO
000000	0	0	0	0	0	1	0	0

...YUQAN HOPKINS INC

	RECEIVED	DATE	TIME	FROM	TO	BY	REMARKS
1	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
2	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
3	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
4	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
5	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
6	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
7	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
8	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
9	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
10	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
11	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
12	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
13	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
14	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
15	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
16	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
17	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
18	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
19	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
20	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
21	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
22	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
23	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
24	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
25	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
26	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
27	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
28	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
29	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
30	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
31	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
32	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
33	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
34	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
35	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
36	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
37	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
38	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
39	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
40	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
41	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
42	10/10/50	10:00	10:00	10:00	10:00	10:00	10:00
43	10/10/50	10:00					

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

OPERATION STATION SHEET PLAN RATIO 1 RATIO 2 RATIO 3 RATIO 4 RATIO 5
 RATIOS APPLIED TO FLOWS
 RATIO 1 RATIO 2 RATIO 3 RATIO 4 RATIO 5

HYDROGRAPH AT 2090AM	1.40	1.70	2.10	2.51	2.87	3.23
	1.20	1.50	1.80	2.10	2.40	2.70
ROUTED TO 2090AM	1.40	1.70	2.10	2.51	2.87	3.23
	1.20	1.50	1.80	2.10	2.40	2.70
HYDROGRAPH AT 2090AM	1.40	1.70	2.10	2.51	2.87	3.23
	1.20	1.50	1.80	2.10	2.40	2.70
2 COMBINED 2090AM	1.40	1.70	2.10	2.51	2.87	3.23
	1.20	1.50	1.80	2.10	2.40	2.70
ROUTED TO 2090AM	1.40	1.70	2.10	2.51	2.87	3.23
	1.20	1.50	1.80	2.10	2.40	2.70

U/S DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM		
		STORAGE	740.00	760.00	762.00		
		OUTFLOW	24	26	28		
			0	0	145		
RATED OF PHE	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
.95	762.17	0.00	02	71	0.00	16.79	0.00
.90	762.36	0.00	44	91	0.00	16.67	0.00
.87	762.57	0.00	47	111	0.00	16.58	0.00
.80	762.75	0.00	49	139	0.00	16.50	0.00
.72	762.85	.05	91	290	.60	17.29	16.29

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS									
PLAN	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM					
	STORAGE	760.48	759.80	761.00					
	OUTFLOW	107.	75.	111.					
		154.	0.	158.					
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF			
OF	RESERVOIR	DEPTH	STORAGE	OVER TOP	MAX OUTFLOW	MAX OUTFLOW			
PMF	USABLE	OVER DAM	AS-FI	HOURS	HOURS	HOURS			
0.00	760.75	0.00	107.	0.00	0.00	0.00			
0.05	760.75	0.00	107.	0.00	0.00	0.00			
0.07	760.75	0.00	107.	0.00	0.00	0.00			
0.08	760.75	0.00	107.	0.00	0.00	0.00			
0.09	761.07	.07	113.	1.33	17.43	0.00			