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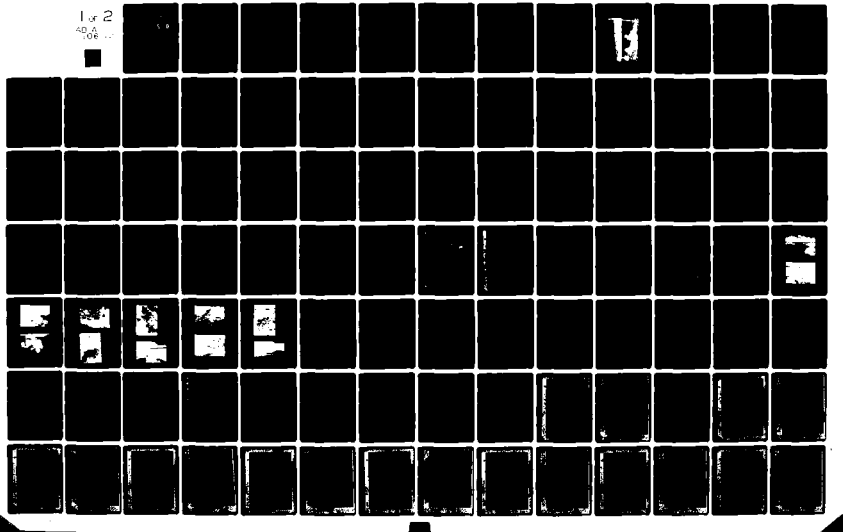

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HUELIN McDANIELS DAM
WARREN COUNTY, MISSOURI
MO 30508

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A106	3. RECIPIENT'S CATALOG NUMBER 112
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program McDaniels, Huelin Dam (MO 30508) Warren County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.		8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0075
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE September 1979
		13. NUMBER OF PAGES Approximately 75
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) National Dam Safety Program. Huelin McDaniels Dam (MO 30508), Mississippi - Kaskaskia - St. Louis Basin, Warren County, Missouri. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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

IN REPLY REFER TO

SUBJECT: Huelin McDaniels Dam (Mo. 30508) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Huelin McDaniels Dam (Mo. 30508).

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 — 26 SEP 19.. — Date

APPROVED BY: SIGNED — Colonel, CE, District Engineer — 26 SEP 19.. — Date

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HUELIN McDANIELS DAM
WARREN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30508

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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

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

SEPTEMBER 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Huelin McDaniels Dam
Missouri Inv. No. 30508
State Located: Missouri
County Located: Warren
Stream: Lost Creek
Date of Inspection: May 18, 1979

Assessment of General Condition

Huelin McDaniels Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. and Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on 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. The estimated damage zone extends approximately 5 miles downstream of the dam. Within the damage zone are

six houses, seven buildings, and one road crossing which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Huelin McDaniels Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Huelin McDaniels Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Huelin McDaniels 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. Since there is high hazard potential downstream of the dam, the appropriate spillway design flood for this dam is the Probable Maximum Flood. It was determined that the reservoir/spillway system can accommodate 15 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the reservoir/spillway system will accommodate the 10-year flood without overtopping. However, the dam will be overtopped during the occurrence of the 100-year flood.

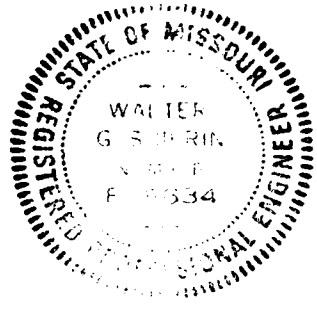
The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. The 100-year and the 10-year floods are defined as the floods having a 1 percent and a 10 percent chance, respectively, of being equalled or exceeded during any given year.

Other deficiencies noted by the inspection team were: the rust colored seepage exiting from the embankment in the vicinity of the service spillway discharge pipe; the erosion of the embankment near the service spillway pipe and to the adjacent hillside; the growth of trees on the downstream embankment slope;

rodent activity on the embankment; questionable stability of the right cut bank of the emergency spillway channel; sloughing and erosion of the upstream embankment slope due to wave action, a need for periodic inspection by a qualified engineer and a lack of maintenance schedule. The lack of stability and seepage 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.



Overview of Huelin McDaniels Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HUELIN McDANIELS DAM, I.D. No. 30508

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HUELIN McDANIELS DAM, Missouri Inv. No. 30508

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 Huelin McDaniels Dam was carried out under Contract DACW 43-79-C-0075 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates, Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Huelin McDaniels Dam was made on May 18, 1979. 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; presents an assessment as to 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. The conclusions drawn herein, therefore, are based on the presence of, or absence of, obvious signs of distress. 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 reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to north abutment or side, and right to the south abutment or side.

d. 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 the Project

a. Description of Dam and Appurtenances

It should be noted that design drawings are not available for the dam or appurtenant structures. The following description is based exclusively on observations and measurements made during the visual inspection.

The dam embankment is a compacted earthfill structure. The crest is 30 feet wide on the left fifth of the dam and 35 feet wide on the remainder of the dam. The total crest length is 400 feet. The crest elevation is approximately 839.5 feet above MSL, and the maximum height of the embankment was measured to be 25.0 feet.

The downstream slope of the embankment was measured as 1V to 3H. It was not possible to accurately measure the upstream slope because of high reservoir level, a wave eroded upstream slope and a near horizontal berm just under water level. No riprap was placed on the upstream slope. The entire exposed embankment has a grass cover.

The dam site is situated on the border between the Dissected Till Plain Section of Central Lowlands Physiographic Province which extends to the north and the Ozark Plateau Province to the south. Although the area in which the dam and reservoir are located was glaciated during Pleistocene time, the till and loess which characterize the uplands of the Till Plains have been largely removed by erosion since the end of the Pleistocene. The area is characterized by wooded hills which have gentle to steep slopes.

The bedrock geology of the area typically consists of gently northeastwardly dipping (ca. 30-50 feet/mile) sediments of Palezoic age. To the north of Warren County these beds are often capped by young (Pleistocene) deposits of glacial drift and wind blown loess. In the southern areas of the county the bedrock is generally covered by residual soil, colluvium, or alluvium. The rocks underlying the area are predominately carbonates (limestones and dolomites) although beds of sandstone and shale are not infrequent.

The bedrock in Warren County contains some minor folding. The largest known geologic structure in the area is a gentle anticline centered about 2 1/2 miles northwesterly of the town of Warrenton. It is not known if the beds beneath the dam site are affected by the folding.

According to the Soil Conservation Service (Soil Survey of Montgomery and Warren Counties, Missouri, 1978), the soil in the bottom lands at the site consists of silt loam and silty clay loam (CL-ML, CL) of the Dockery series. Upslope of these materials is predominantly lindley loam (CL, CL-ML) and silt loam, clay and clay loam (CL, CL-ML, CH, MH) of the Keswick series. Some silt loam (ML) and cherty clay loam (GC) of the Cedargap series are shown to be located in the channel bottom upstream of the damsite.

The dam is constructed with two spillways. The service spillway is a 22 inch diameter steel pipe located at the right side of the embankment. The inlet end of the steel pipe daylights into the reservoir, with an elevation difference of 4.5 feet from the invert of the pipe to the crest of the dam. A wire mesh trashrack is provided at the inlet. From the inlet the steel pipe extends through the embankment and discharges near the downstream toe of the embankment into

a small pool. The drop from the downstream end of the pipe to the pool is approximately 6 feet. The pipe extends approximately 5 feet out of the embankment and daylights at the downstream end.

The emergency spillway is grass-lined open channel at the right side of the embankment. The channel has a 12 foot bottom width and an elevation difference from crest of the spillway to the crest of the dam of 10 inches. The right bank of the spillway crest is a very steep hillside, while the left slope is 1V to 4&H. The spillway channel is grass-lined and flows along the hillside to a point approximately 100 feet from the reservoir where it flows down a steep hillside into the pool located downstream of the service spillway pipe. From this point spillway discharges are carried away from the dam in a stream channel.

There is no low level drain or outlet pipe at the damsite.

b. Location

The dam is located about 1 mile downstream of the extreme headwaters of Lost Creek. From the dam, Lost Creek runs southeasterly for about one mile, then southerly for about 2 1/2 miles and then southwesterly about 11 miles where it flows into the Missouri River near the village of Gore. The upper part of Lost Creek is intermittant but it becomes perennial about 4 miles below the dam.

The main access to the dam from Warrenton, Missouri, is west on the Interstate Highway No. 70 frontage road approximately 4 miles to a gravel road heading south, thence south on this road 1/4 mile to a private road to the

west. The damsite is located at the end of this private road, approximately 1000 feet from the beginning of the road. The dam and reservoir are shown on the Warrenton Quadrangle Sheet (7.5 minute series) in Section 23, Township 47 North, Range 3 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam height category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "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 the classification. The estimated damage zone extends approximately 5 miles downstream of the dam. Within the damage zone are six houses, seven buildings, and one road crossing.

e. Ownership

The dam is owned by a private owner, Huelin McDaniels. The mailing address is Huelin McDaniels, 7733 Forsyth Road, Room 1840, Clayton, Missouri, 63105.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use as a private lake.

g. Design and Construction History

Huelin McDaniels Dam was designed in 1970 by Mr. H. McDaniels of Stolwyk, McDaniel, and Ferrenbach of 7733 Forsyth in Clayton, MO., a local engineering firm.

The dam was constructed by Mr. Lee Moorman of Wentzville, MO.

h. Normal Operational Procedures

There are no normal operational procedures for the lake which is used soley for recreational purposes. The water level in the lake is controlled by rainfall, runoff, evaporation and the elevation of the 22 inch steel pipe spillway.

There is no low level outlet pipe for the lake.

1.3 Pertinent Data *

a. Drainage Area (square miles):	0.69 (0.61+.08)
b. Discharge at Damsite	
Estimated experienced maximum flood (cfs):	NA
Estimated ungated spillway capacity at maximum pool elevation (cfs):	120
c. Elevation (Feet above MSL)	
Top of dam:	839.5
Spillway crest:	
Service Spillway	835.0 (Assumed)
Emergency Spillway	838.7
Normal Pool	835.0
Maximum Pool (PMF):	841.92
d. Reservoir	
Length of maximum pool: (Feet)	2850
e. Storage (Acre-Feet)	
Top of dam:	216
Spillway crest:	107
Normal Pool:	107
Maximum Pool(PMF):	344
f. Reservoir Surface (Acres)	
Top of dam:	33.5
Spillway crest:	16.0
Normal Pool:	16.0
Maximum Pool: (PMF)	43 ±
g. Dam	
Type:	Rolled Earthfill

Length:	400 feet
Structural Height:	25 feet
Hydraulic Height:	25 feet
Top width:	30 to 35 feet
Side slopes:	
Downstream	1V to 3H
Upstream	Unknown
Zoning:	Unknown
Impervious core:	Unknown
Cutoff:	Unknown
Grout curtain:	Unknown

h. Diversion and Regulating Tunnel None

i. Spillway

Type:	
Service Spillway	22 inch diameter iron pipe, uncontrolled
Emergency Spillway	Earth channel, uncontrolled
Length of weir:	
Service Spillway	22 inch diameter iron pipe
Emergency Spillway	12 feet
Crest Elevation (feet above MSL):	
Service Spillway	835.0
Emergency Spillway	838.7

j. Regulating Outlets None

Type:

Length:

Closure:

Maximum Capacity:

* The term "maximum pool" used in this section refers to pool at top of dam elevation unless otherwise specified.

SECTION 2 : ENGINEERING DATA

2.1 Design

No design data is available for this report. Most of the design information was obtained verbally from Mr. McDaniels. He mentioned that there are two anti-seep collars welded to the 22 inch steel spillway pipe (exact position unknown).

2.2 Construction

According to Mr. McDaniels, the dam was built by Mr. Moorman of Wentzville, a local contractor at that time. Efforts to contact Moorman regarding the construction were futile.

2.3 Operation

There is no data available concerning operation for this lake and dam.

2.4 Evaluation

a. Availability

No design drawings, design computations, construction data, or operation data is available.

In addition, no pertinent data was available for review of hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, slope stability, seepage analysis, or foundation conditions.

b. Adequacy

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

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

No valid engineering data are available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Huelin McDaniels Dam was made on May 18, 1979. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Jon Diebel	Engineering Consultants, Inc.	Structural and Mechanical
Peter Strauss	Engineering Consultants, Inc.	Soils
Peter Howard	Engineering Consultants, Inc.	Geology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural

Specific observations are discussed below.

b. Dam

The crest and downstream slope of the dam have a grass cover which appears to be adequately protecting the embankment material.

The upstream slope has no riprap protection and has consequently been eroded by wave action. Nearly vertical faces up to 4 feet high are exposed. The dam material where exposed is a low plasticity clay with some silt. There are gravel size pieces of various rock types indicating glacial drift material as well as residual soils.

The downstream embankment slope has some small trees growing on the lower portion near the right abutment. Also, some rodent activity was observed on the upstream slope of the embankment.

There is no evidence of seepage or leakage through or below the dam. There is a small dry natural drainage gulley in natural ground from the left abutment contact and following the downstream toe of the dam at the left half of the embankment. This is believed to be a collector ditch for local runoff and does not affect the dam.

No signs of past or present instability were seen on the embankment or in the foundation except for the wave eroded upstream slope near the crest and an eroded area in the lower part of the downstream slope near the right abutment and above the pipe outlet. This is discussed in the following sections of the report.

There are no outcrops in the vicinity of the dam but, based on a knowledge of the geology of the area from Missouri Geological Survey and Geologic Map of Missouri (1979), one deduces the area is underlain by the Burlington Limestone (Osgean Series, Mississippian). This formation is predominately composed of cherty, crinoidal limestone (Geological Map of Missouri, 1979) dipping northeasterly at about 30 feet per mile.

Near the right abutment there is a cut bank which exposes drift and residual soil. The drift is composed of a mixture of fine grained and frequent glacial erratics from 6-18 inches in diameter and with smaller cobbles and gravels. The rock in the erratics is predominately carbonates but andesite and other rocks can be noted.

Above the emergency spillway by the right abutment, there is a cut bank about 20 feet high with a very steep slope. This and the wooded area above it appear to be unstable. If it were to slide it would block the emergency spillway. The spillway is not founded on rock.

c. Appurtenant Structures

(1) Spillway

The trashrack at the upstream end of the service spillway pipe appears to be doing a satisfactory job of preventing trash from entering and plugging the service spillway pipe. The trashrack was slightly plugged on the day of the inspection. The embankment material at the downstream end of the pipe is sloughing and eroding. This slope erosion has exposed a length of approximately 6 feet of the steel pipe. The erosion is due mostly to surface runoff.

A small seep was observed several feet to the right (looking downstream) and below the spillway pipe. The water at this seep was rust in color, indicating the possibility of flow along the steel spillway pipe. The seep was not a measurable amount of water.

The emergency spillway is located in a slight swale cut into the natural ground next to the right abutment of the dam. The spillway channel is poorly channelized, grass covered and is blocked by a large tree stump which fell from the unstable slope above the channel. This slope is very steep and about 20 feet high. Residual soils, including some glacial drift, undercut trees and some bushes are moving downslope toward the spillway channel. The channel forces a diversion of the spillway flow down a steep side slope adjacent to the right abutment contact of the dam. This area is also adjacent to the outlet end of the pipe spillway. It is believed that this diverted spillway flow eroded some of the material above the spillway pipe in the lower part of the downstream slope.

d. Reservoir Area

The water surface elevation was approximately 835.0 feet above M.S.L. at the time of inspection. The reservoir rim is gently sloping with trees and woods near the shore. With the exception of a small localized undercut slope about 500 feet upstream of the right abutment there was no evidence of instability. This existing area will not significantly affect the capacity of the reservoir.

e. Downstream Channel

The downstream channel is well defined with vegetative and tree growth immediately downstream from the pool created by discharges from the service spillway. The vegetative growth and the trees may affect the hydraulic efficiency of the channel. Some minor erosion could be observed in a few areas in the channel.

3.2 Evaluation

The following items were observed which could affect the stability of the dam, or which will require maintenance within a reasonable period of time.

1. Wave action on the upstream embankment slope causing erosion and sloughing of embankment materials.

2. Trees growing on the downstream embankment slope at the right side of the dam.

3. The eroded material around the discharge end of the service spillway pipe.

4. The rust colored seepage exiting near the service spillway pipe.

5. The poorly channelized emergency spillway causing discharges to flow down the slope at right abutment of the dam, eroding the material at this abutment.

6. Rodent activity on the upstream slope of the embankment.

7. An unstable right bank of the emergency spillway channel.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Huelin McDaniels Dam impounds water for recreational purposes only and normal procedure is to allow it to remain as full as possible at all times. There is no periodic procedures for operation of the lake and dam.

4.2 Maintenance of Dam

The dam is maintained by the few owners that live in the immediate area. The maintenance of the dam seems to be somewhat lacking. There are some trees growing on the downstream slope. The grass on the slopes and crest is kept low. Some minor rodent activity was detected on the upstream slope, and sloughing due to wave activity was also observed on the upstream slope of the embankment.

The trashrack structure is made up of several heavy gauge close meshed screens which forms a wall around the inlet of the spillway. The trashrack and spillway entrance were slightly plugged on the day of the inspection.

At the outlet end of the spillway pipe and on the adjacent hillside there was a region of erosion. Some remedial measures will be required to repair this area and prevent future problems.

4.3 Maintenance of Operating Facilities

There is no low level outlet facility for this lake and dam, and the service spillway is a self-functioning pipe which requires no operation.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in effect.

4.5 Evaluation

It appears that the maintenance of Huelin McDaniels Dam is somewhat lacking. There are several deficiencies which were noticed by the inspection team which should be corrected within a reasonable period of time. The deficiencies are described in Sec. 7.1.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of Huelin McDaniels Dam upstream from the dam axis consists of approximately 440 acres. There is a dam located upstream of Huelin McDaniels Dam. The watershed area between the upstream dam and Huelin McDaniels Dam investigated in this report is about 390 acres. Most of the watershed area is wooded and covered with grass. Land gradients in the higher regions of the watershed average roughly 10 percent, and in the lower areas surrounding the reservoir average about 5 percent. Huelin McDaniels Dam is located on the headwaters of Lost Creek. The reservoir is about one mile downstream from the extreme headwaters of Lost Creek. At its longest arm the watershed is approximately one mile long. A drainage map showing the watershed area is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Huelin McDaniels Dam was based on criteria set forth in the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM

1110-2-1411 (Standard Project Storm). The SCS method was used for deriving the unit hydrogaphs, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). Two unit hydrographs were derived. One unit hydrograph was for the drainage area above the upstream dam; another unit hydrograph was for the drainage area between the upstream dam and Huelin McDaniels Dam. The parameters of the unit hydrographs are presented in Appendix B. The SCS method was used for determining loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are also presented in Appendix B. The curve number, unit hydrograph parameters, PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak discharges of the PMF and one-half of the PMF at the upstream reservoir are 1,042 cfs and 521 cfs respectively. The peak discharges of the PMF and one-half of the PMF between the upstream dam and Huelin McDaniels Dam are 5,830 cfs and 2,915 cfs respectively.

Both the PMF and one-half of the PMF inflow hydrographs at the upstream dam were routed through the upstream reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF at the upstream dam are 864 cfs and 381 cfs, respectively. These outflow hydrographs were combined with the PMF and one-half of the PMF for Huelin McDaniels Dam. The combined hydrographs for both the PMF and one-half of the PMF, were then routed through Huelin McDaniels Dam reservoir. The peak outflow discharges for the PMF and one-half of the PMF at Huelin McDaniels Dam are 4,860 cfs and 2,233 cfs respectively. Both the PMF and one-half of the PMF, when routed through the reservoir re-

sulted in overtopping of the dam.

The stage-outflow relations for the spillways were prepared from field notes, and sketches, prepared during the field inspection. The reservoir stage-capacity data was based on the U.S.G.S. Warrenton Quandrangle topographic map (7.5 minutes series). The spillway and overtop rating curve and the reservoir capacity curve for Huelin McDaniels Dam are presented in Plates 2 & 3 respectively in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest can erode the dam embankment and release the all the stored water into the downstream floodplain. The safe hydrologic design of a dam calls for a spillway discharge capability in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineers designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. According to the Corps criteria, the hydrologic requirement for safety for this dam is the capability to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping.

b. Experience Data

It is believed that no records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1c(1) and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1-a, 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 outflow discharges for the PMF and one-half of the PMF at Huelin McDaniels are 4,860 cfs and 2,233 cfs respectively. The PMF overtopped the dam crest by 2.42 feet, and one-half of the PMF overtopped the dam crest by 1.39 feet. The total duration of embankment overflow is 8.83 hours during the PMF, and 5.67 hours during one-half of the PMF. The spillways for Huelin McDaniels Dam are capable of passing approximately 15 percent of the PMF just before overtopping the dam.

The computed one percent and ten percent chance floods using 100-year and 10-year, 24 hour rainfall data, respectively, were routed through the reservoir. The routing results indicate the spillway/reservoir system will accomodate the 10-year flood without overtopping the dam and the dam will be overtopped by 0.28 feet during the occurence of the 100-year flood.

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 5 miles downstream of the dam. Within the damage zone are six houses, seven buildings and one road crossing.

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. The erosion and sloughing of embankment materials on the upstream slope of the embankment is fairly significant. However, the wide crest of the embankment reduces the seriousness of the erosion. The condition should be watched and the slope stabilized if the erosion continues. The trees on the downstream slope of the embankment present a hazard to the structural stability of the embankment, and should be cut in the near future. The rodents should be eliminated from the embankment.

The seepage exiting near the service spillway pipe should be investigated. The rust color of the seepage indicates the water is flowing near the spillway pipe, which is an undesirable condition. The recommended seepage and stability study should address in detail this condition.

The eroded embankment material around the service spillway pipe and on the hillside adjacent to this pipe will decrease the structural stability of the embankment.

The emergency spillway channel should be reworked to force discharges to flow to the downstream edge of the ledge above the streambed prior to flowing into the streambed. This will prevent further erosion to the embankment material and the adjacent hillside. The eroded areas will have to be repaired by compacting earthfill into the void areas. A headwall may be required to properly stabilize the embankment material surrounding the service spillway pipe.

The right bank of the spillway channel appears to be unstable as well. Prolonged flows through the spillway may cause a failure of this slope, which would block the spillway channel. This slope should be stabilized to prevent a failure from occuring.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam or appurtenant structures were found. No seepage and stability analyses were available for review.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. Water levels have not been recorded, however, the reservoir was full on the day of inspection, and is assumed to be close to full at all times.

d. Post Construction Changes

No post construction changes are known to exist which will effect the structural stability of the dam.

e. Seismic Stability

According to the Seismic Zone Map of Contiguous States, Form TM 5-809-10/NAVFAC P-355/AFM 88-3 Chapter 13; April 1973 the portion of Missouri in which Huelin McDaniels Dam is located is in Seismic Zone 2. This means there is only moderate damage probability. A detailed seismic analysis is not felt to be necessary for this embankment under present conditions.

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 inspections. 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 on 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 on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Huelin McDaniels Dam was found to be "Seriously Inadequate". The spillway/reservoir system will accommodate only 15 percent of the PMF without overtopping the dam.

The surface soils on the embankment are silty soils. The dam is overtopped by over 2 feet during the PMF and the duration of embankment overflow is about 9 hours. If the body of the dam is made up of silty soils, the dam would be susceptible to erosion and failure during overtopping.

The embankment is in need of some maintenance to improve its safety. The erosion of embankment materials on the upstream slope of the dam is not serious at this time, but should be monitored, and repairs made as required. The trees growing on the downstream embankment slope should be cut, and future growth prevented. The rodents should be eliminated from the embankment.

The embankment in the vicinity of the service spillway discharge pipe is in questionable condition. The rust colored seepage exiting from the embankment near the steel spillway pipe indicates a potentially hazardous condition and should be investigated. The substantial erosion from flows through the emergency spillway should be repaired, and the spillway channel reworked to prevent discharges from continuing to erode the embankment and adjacent hillside. The right bank of the emergency spillway should be stabilized to prevent a slope failure which would block the spillway channel.

No seepage and stability analyses were available for review. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed.

b. Adequacy of Information

Adequate information concerning the dam and appurtenant structures is not available. No seepage and stability analyses were available for review.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future. The items recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken as specified in Sec. 7.1c, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives:

Spillway capacity and/or height of dam should be increased to pass the PMF without overtopping the dam.

b. O & M Procedures:

1. Reroute discharges through the emergency spillway channel to prevent further erosion of the embankment near the service spillway pipe and to the adjacent hillside.

2. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams. This study should concentrate on the area exhibiting seepage on the downstream slope near the service spillway pipe.

3. Remove all trees and brush from the embankment slopes under guidance of an engineer experienced in the design and construction of earthen dams.

4. Eliminate rodents from the embankment.

5. Stabilize the right cut bank of the emergency spillway channel.

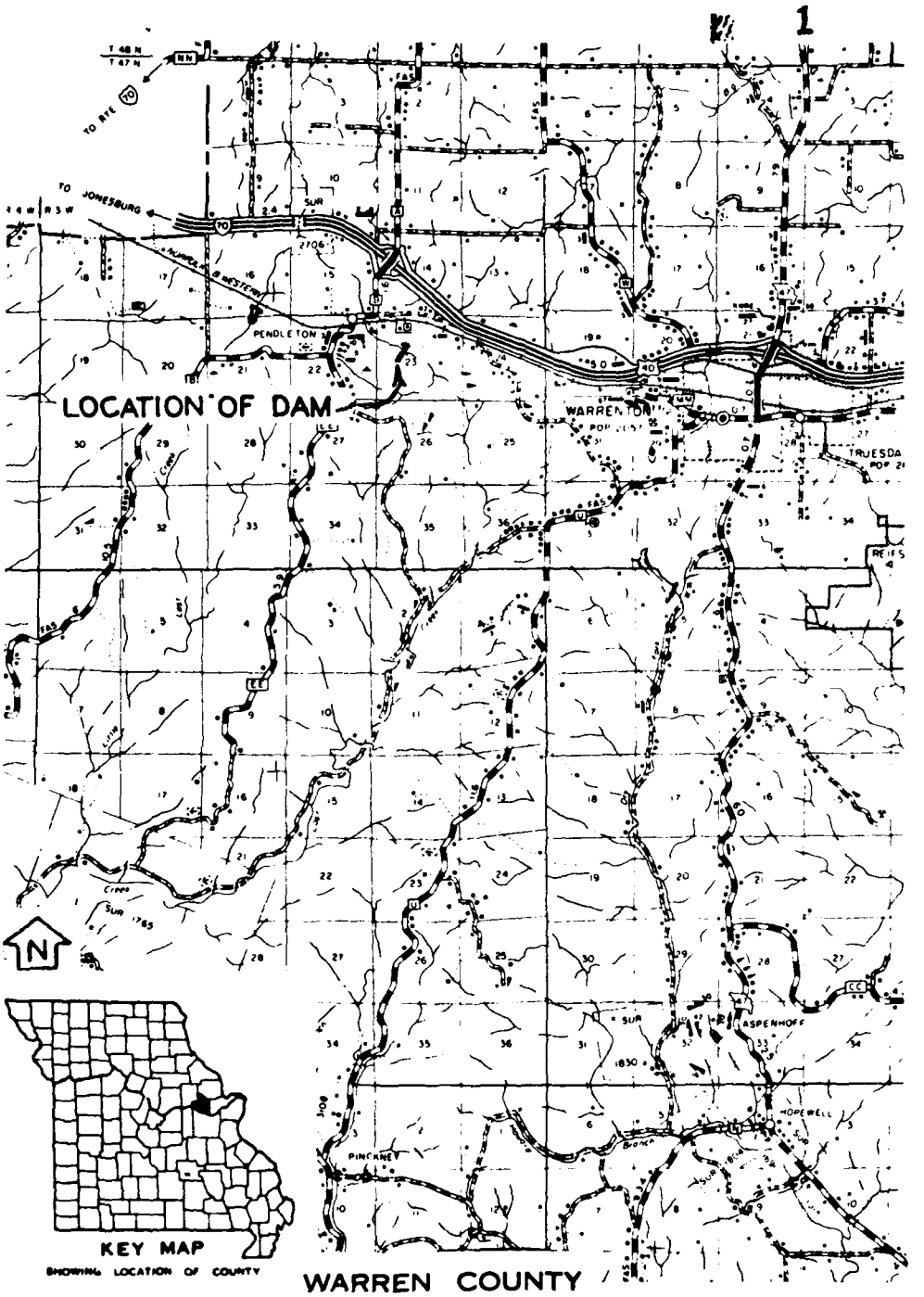
6. Monitor the condition of the upstream slope which is sloughing and eroding due to wave action, and make required repairs.

7. The owner should initiate the following programs.

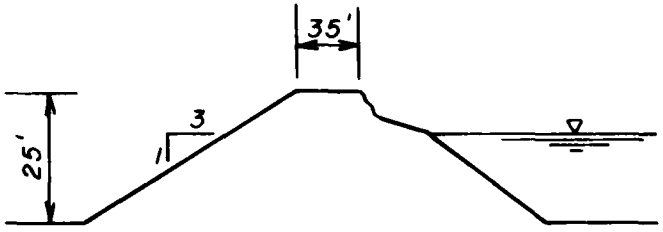
   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

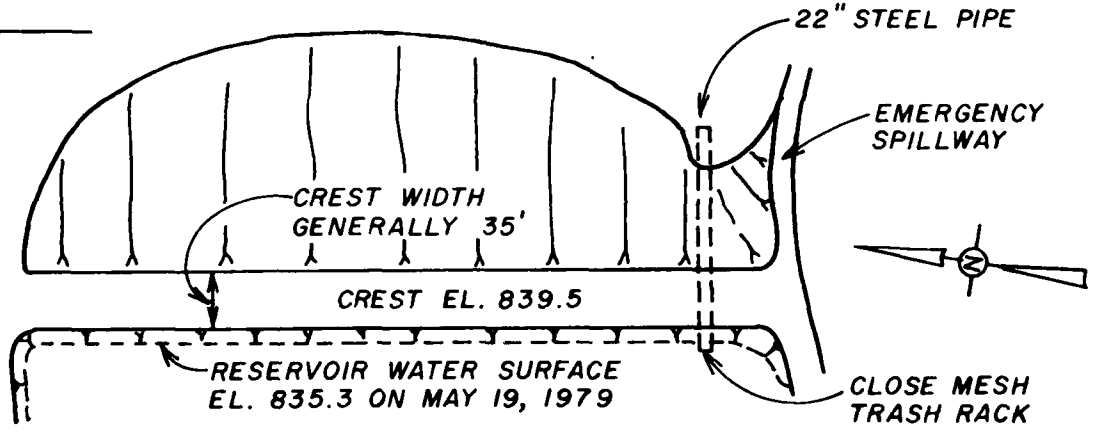
PLATES



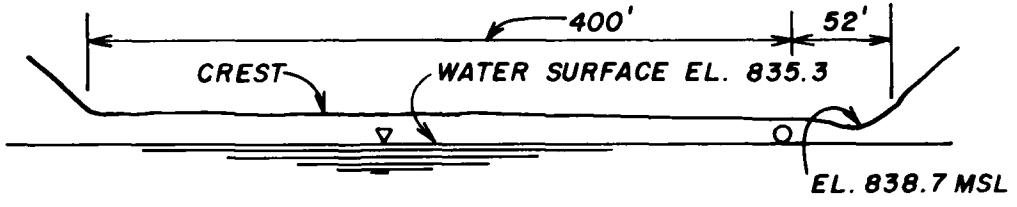
LOCATION MAP - HUELIN McDANIELS DAM



SECTION



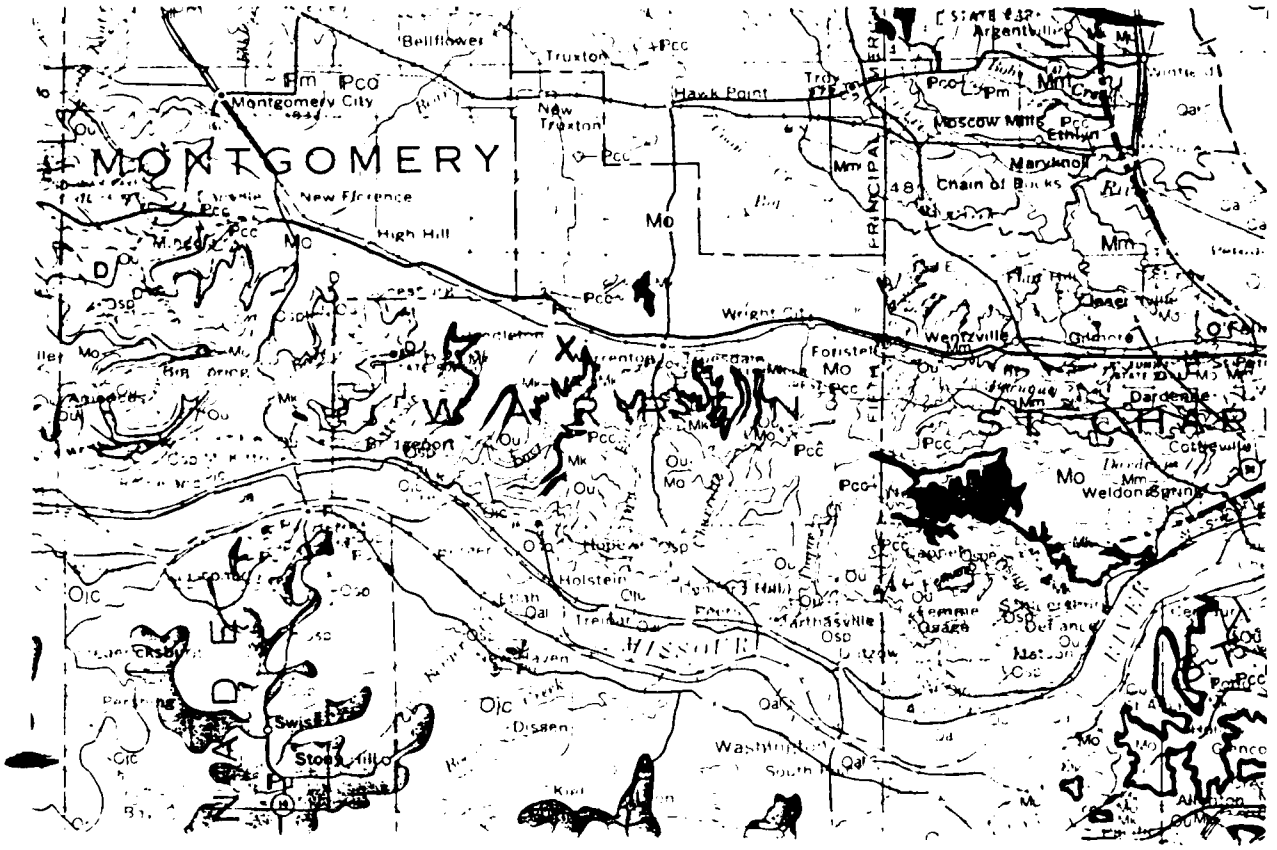
PLAN



ELEVATION

SCALE:
1" = 100' (HORIZONTAL)
VERTICAL NOT TO SCALE

HUELIN McDANIELS DAM (MO. 30508)
PLAN, ELEVATION & SECTION



QUARTERNARY { Qal - ALLUVIUM

PENNSYLVANIAN { Pm - MARMATON GROUP
Pcc - CHEROKEE GROUP

MISSISSIPPIAN { Mm - ST. LOUIS LIMESTONE
SALEM FORMATION
WARSAW FORMATION
Mo - BURLINGTON-KEOKUK FORMATION
Mk - CHOTEAU GROUP

ORDOVICIAN { Ou - NOIX LIMESTONE
MAQUOKETA SHALE
CAPE LIMESTONE
KIMMSWICK FORMATION
DECORAH FORMATION
PLATTIN FORMATION
JOACHIM DOLOMITE

Osp-ST. PETER SANDSTONE

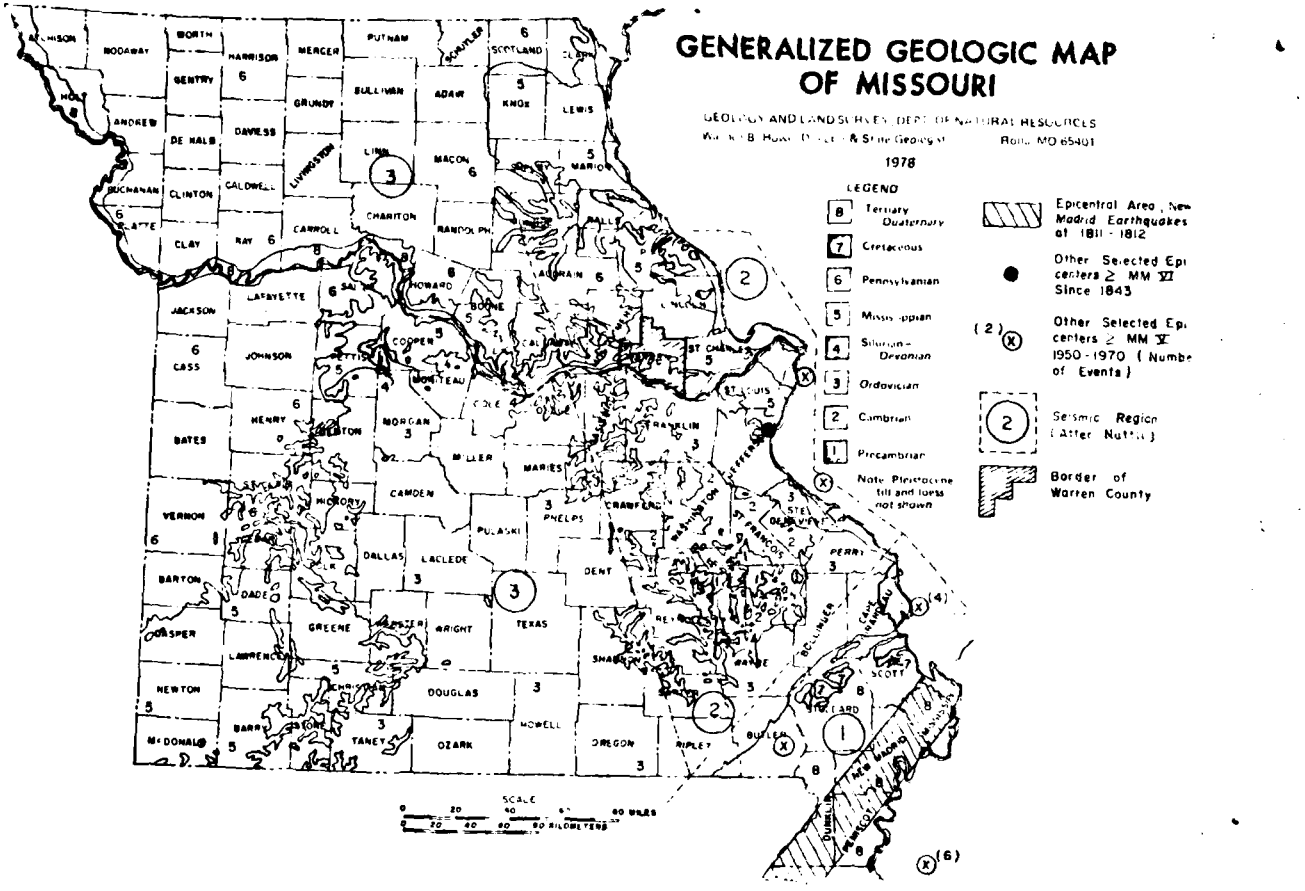
Ojc-COTTER-POWELL FORMATION
JEFFERSON CITY DOLOMITE

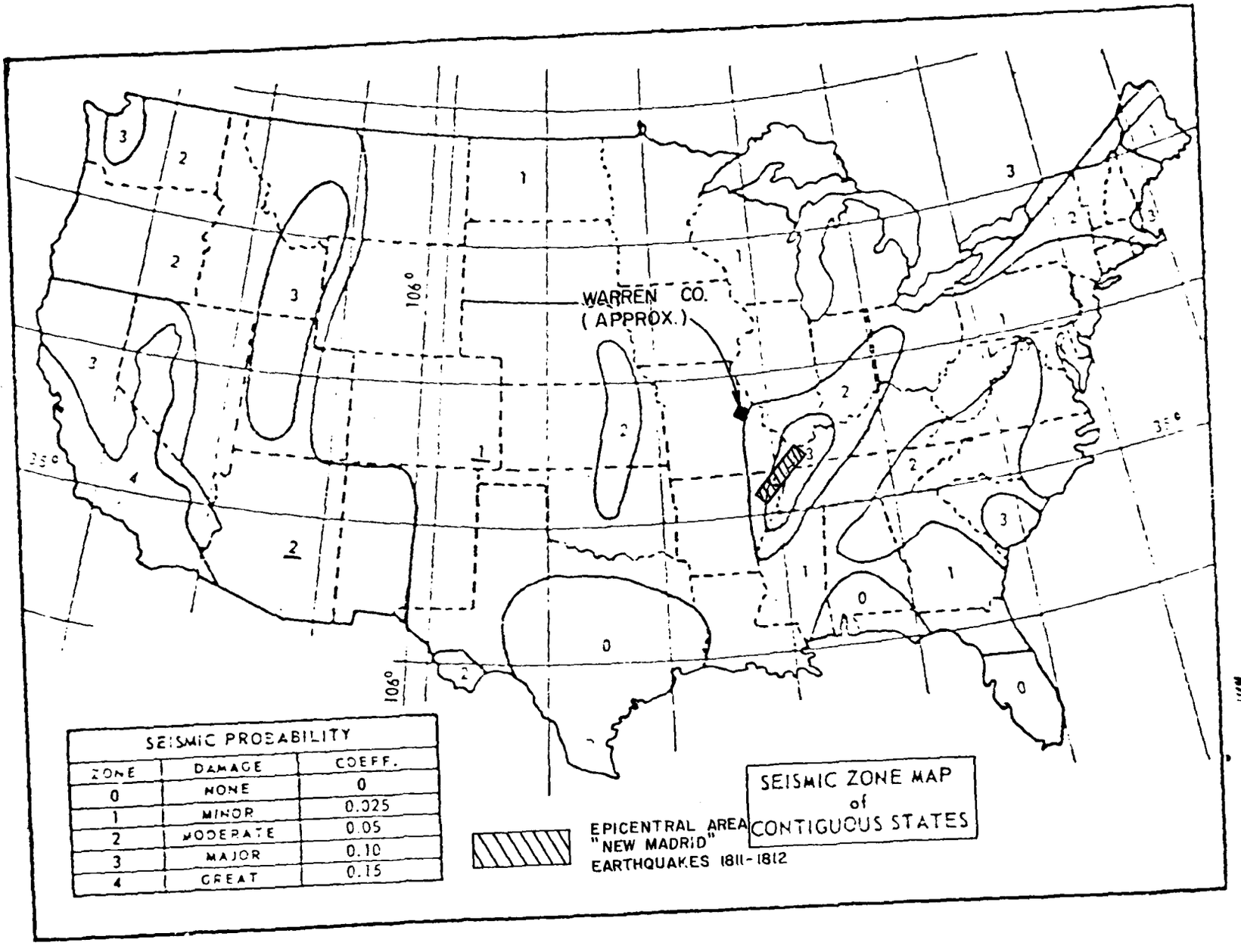
X LOCATION OF DAM MO 30508

REFERENCE:
GEOLOGIC MAP OF MISSOURI, MISSOURI GEOLOGIC SURVEY, 1979.

10 0 10
SCALE OF MILES

GEOLOGIC MAP OF WARREN COUNTY AND ADJACENT AREA


GENERALIZED GEOLOGIC MAP OF MISSOURI
GEOLOGY AND LAND SURVEY, DEPT. OF NATURAL RESOURCES
Rolla, MO 65401
1978
LEGEND
8 Tertiary Quaternary
7 Cretaceous
6 Pennsylvanian
5 Mississippian
4 Silurian-Devonian
3 Ordovician
2 Cambrian
1 Precambrian
Note: Pleistocene till and loess not shown
Epicentral Area, New Madrid Earthquakes of 1811 - 1812
Other Selected Epicenters ≥ MM VI Since 1843
(2) Other Selected Epicenters ≥ MM V 1950 - 1970 (Number of Events)
2 Seismic Region (After Nuttli)
Border of Warren County
SCALE
0 20 40 60 80 MILES
0 20 40 60 80 KILOMETERS


WARREN CO.
(APPROX.)
106°
35°
SEISMIC PROBABILITY
ZONE | DAMAGE | COEFF.
0 | NONE | 0
1 | MINOR | 0.025
2 | MODERATE | 0.05
3 | MAJOR | 0.10
4 | GREAT | 0.15
EPICENTRAL AREA "NEW MADRID" EARTHQUAKES 1811-1812
SEISMIC ZONE MAP of CONTIGUOUS STATES

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

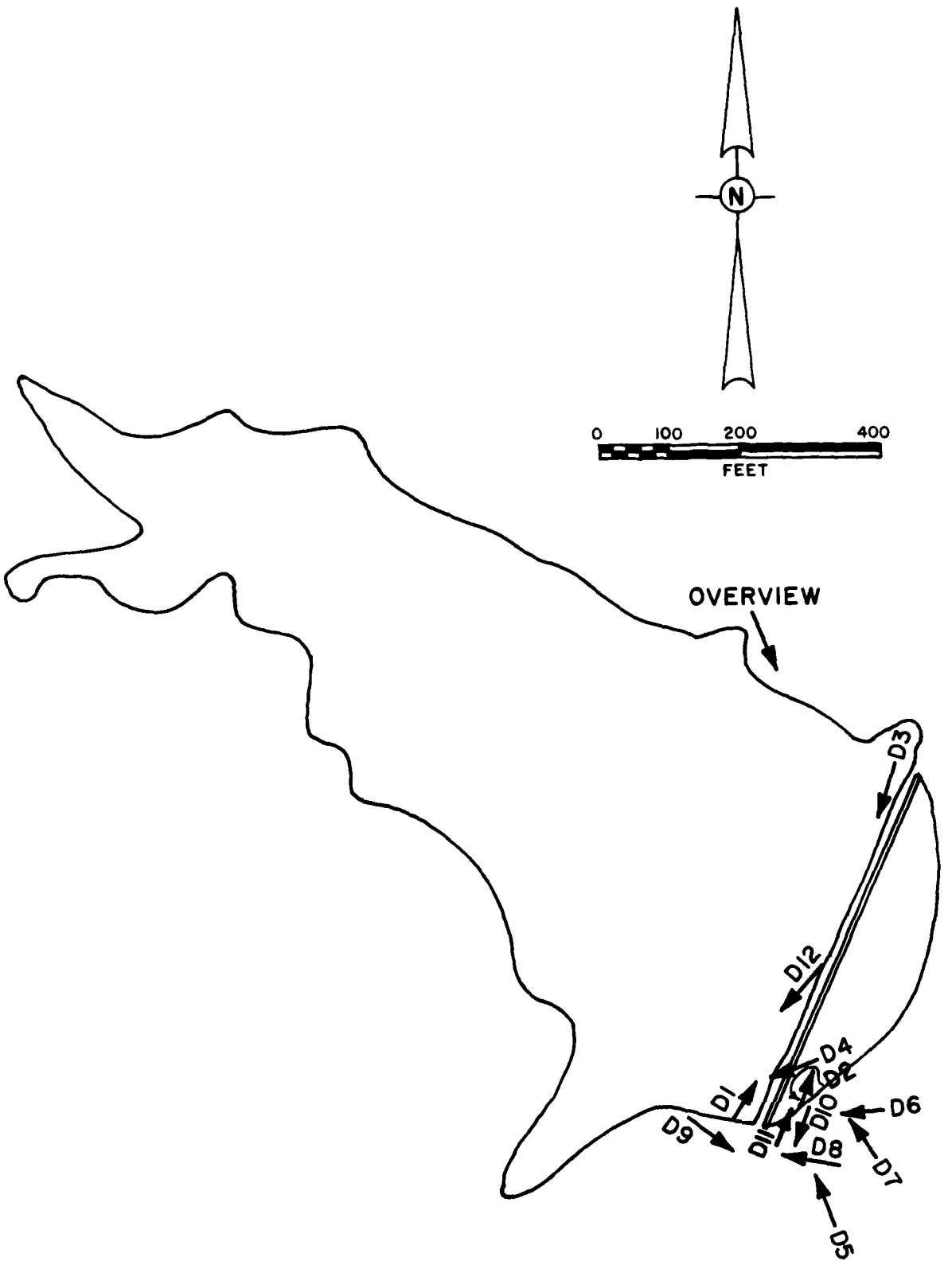


PHOTO INDEX
FOR
HUELIN McDANIELS DAM

Huelin McDaniels Dam

D1 - Upstream embankment slope

D2 - Downstream embankment slope

D3 - Sloughing on upstream embankment slope

D4 - Service spillway intake

D5 - Service spillway discharge

D6 - Sloughed material near service spillway pipe

D7 - Rust-colored seepage near service spillway pipe

D8 - Emergency spillway

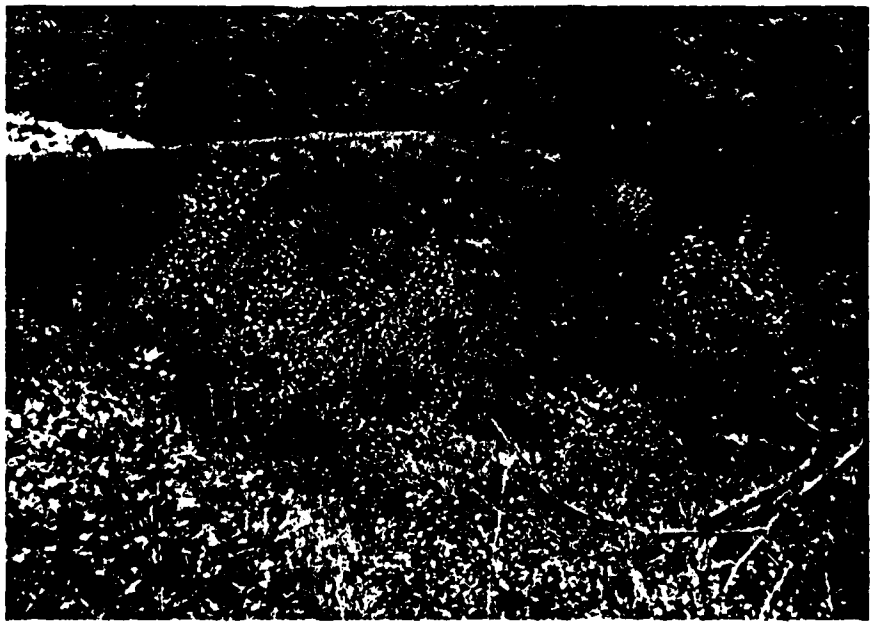
D9 - Emergency spillway channel

D10- Eroded hillside near spillway channel

D11- Eroded hillside near spillway channel

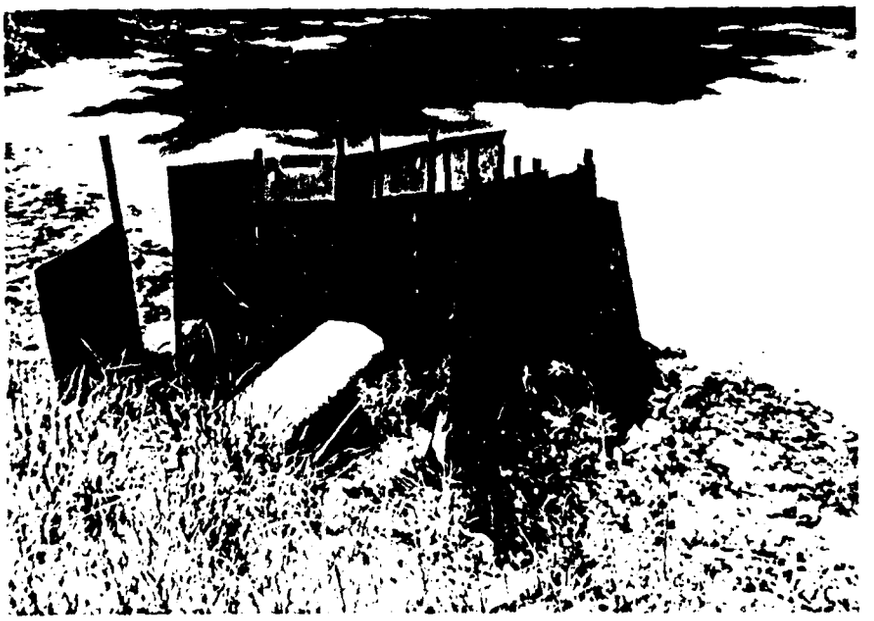
D12- Unstable bank in reservoir rim

D1



D2

D3



D4

D5

D6

D7

D8

D9

D10

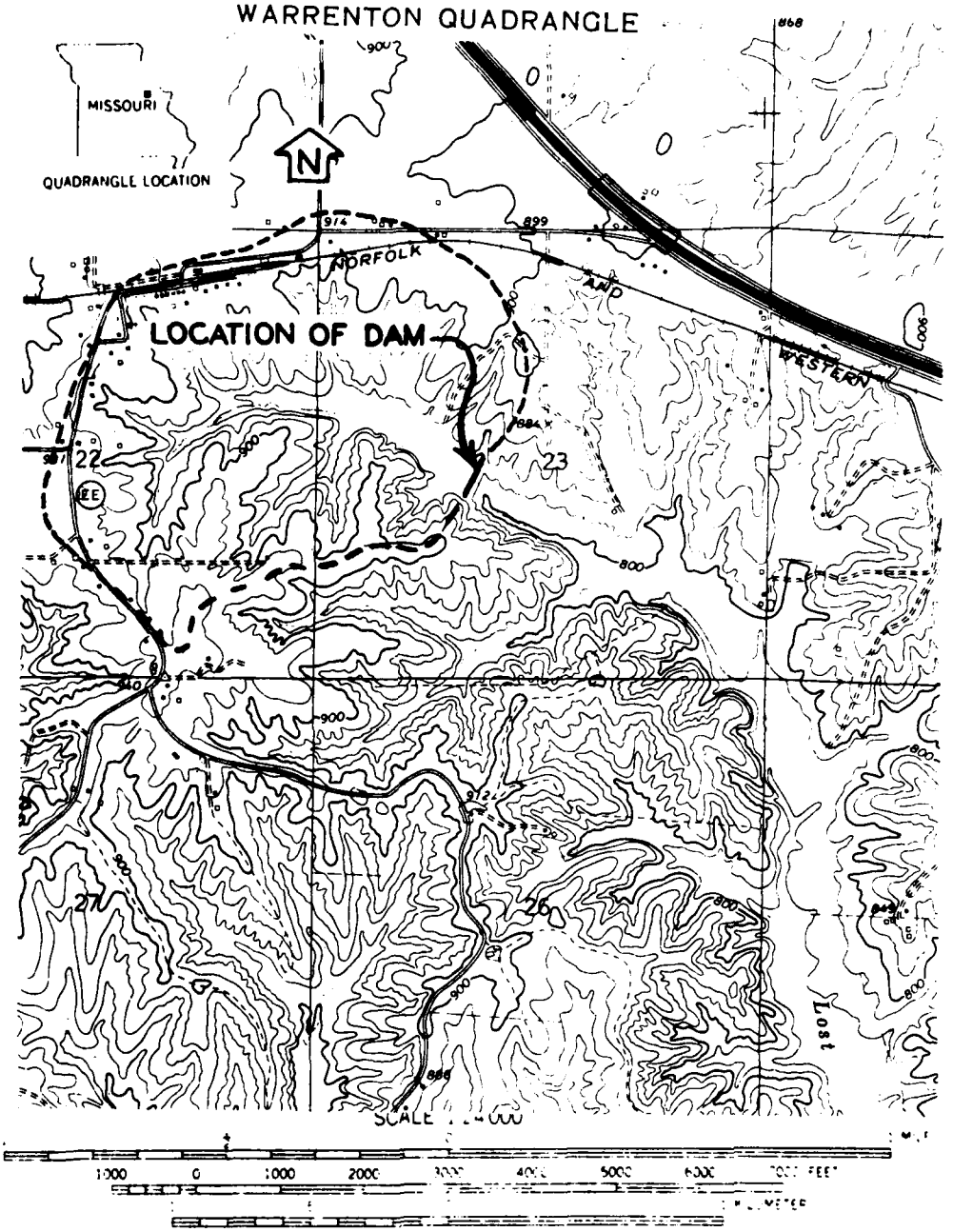
D11

D12

APPENDIX B

HYDROLOGIC COMPUTATIONS

PLATE-1, APPENDIX-B



HUELIN McDANIELS DAM (MO. 30508)
DRAINAGE BASIN

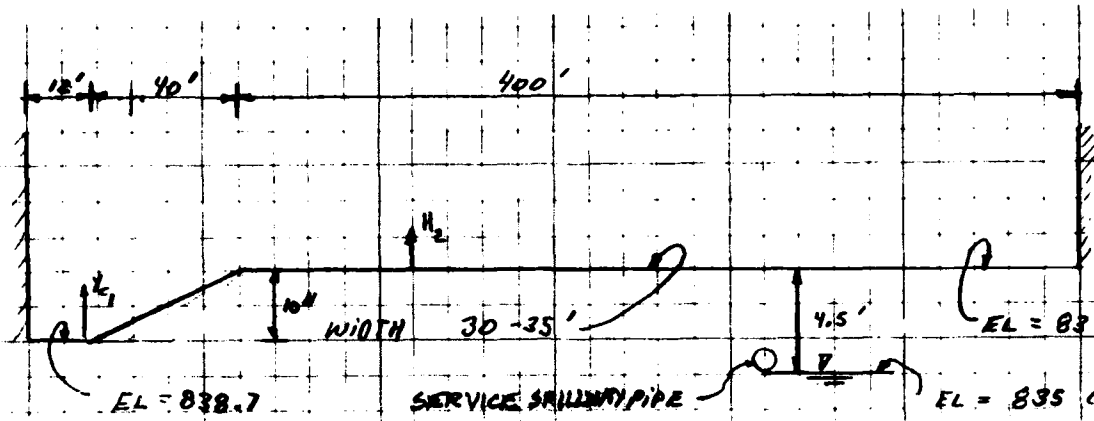
ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

MISSOURI DAM 30508 JOB NO. 1240-001-1

EMERGENCY SPILLWAY AND OVERTOP DISCHARGE RATING CURVE BY MLH DATE 5-2-17

EC1-4



Y_{c_1} (FT)	A_{c_1} (FT)	T_{c_1} (Ft.)	$V_{c_1} = 5.67\sqrt{\frac{A_{c_1}}{T_{c_1}}}$	$\frac{V_{c_1}^2}{2g}$	$Q_1 = A_{c_1} \cdot V_{c_1}$	U/S ELEV. = 838.7 + $\frac{H_2^2}{2g} + V_{c_1}$	H_2	C_2	L_2	$Q_2 = C_2 L_2 H_2^{3/2}$	$Q_T = Q_{c_1} + Q_2$
0	0	12	0	0	0	838.7	—	—	—	—	0
.5	12	36	3.27	0.17	39.24	839.37	—	—	—	—	39.24
.83	26.6	52	4.06	0.26	108.0	839.79	.29	2.68	400	167.4	275.4
1	35.44	52	4.68	0.34	165.85	840.04	.54	2.70	400	428.56	594.41
1.5	61.44	52	6.16	0.59	378.5	840.79	1.29	2.64	400	1547.2	1925.7
2.0	87.44	52	7.35	0.84	642.68	841.54	2.04	2.63	400	3065.2	3707.9
2.5	113.4	52	8.37	1.09	949.16	842.29	2.79	2.63	400	4902.5	5851.7
3.0	139.4	52	9.28	1.34	1293.63	843.04	3.54	2.63	400	7006.8	8300.4

EC1-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

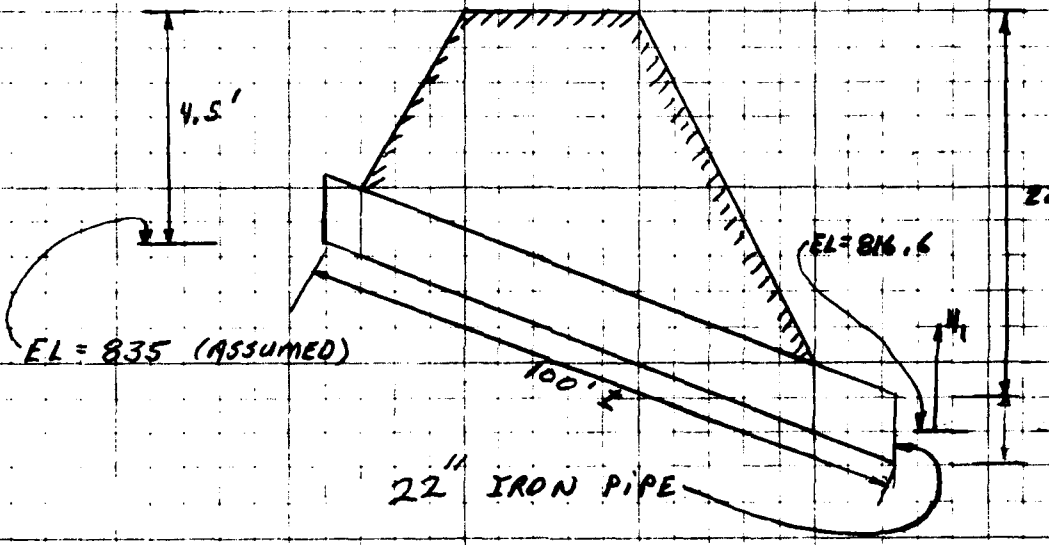
MISSOURI DAM 30.508 JOB NO. 1240-001-1

SPILLWAY RATING CURVE. BY KLB DATE 5-24-79

M.R.A.V

SPILLWAY RATING CURVE

ASSUME NO TAIL WATER EFFECTS AND PRESSURE FLOW CONTROL ABOVE ELEV. 837.



ASSUME $\epsilon = 0.00085'$ $\Rightarrow \frac{\epsilon}{D} = \frac{0.00085}{22/12} = 0.00046$

Assume $K = 0.5$ $f = .0153$

$$H_1 = \left(1 + K_e + f\frac{L}{D}\right)\frac{V^2}{2g}$$

$$H_1 = \left(1.5 + 0.0153\frac{100}{1.83}\right)\frac{V^2}{2g}$$

$$H_1 = 2.87\,\frac{V^2}{2g}$$

$$V = \sqrt{\frac{2g\,H_1}{2.87}} = 4.74\sqrt{H_1}$$

$$Q = A \cdot V = \frac{\pi}{4}(1.83^2) \cdot 4.74\sqrt{H_1} \Rightarrow \boxed{Q = 12.46\sqrt{H_1}}$$

ECI-4 ENGINEERING CONSULTANTS, INC.

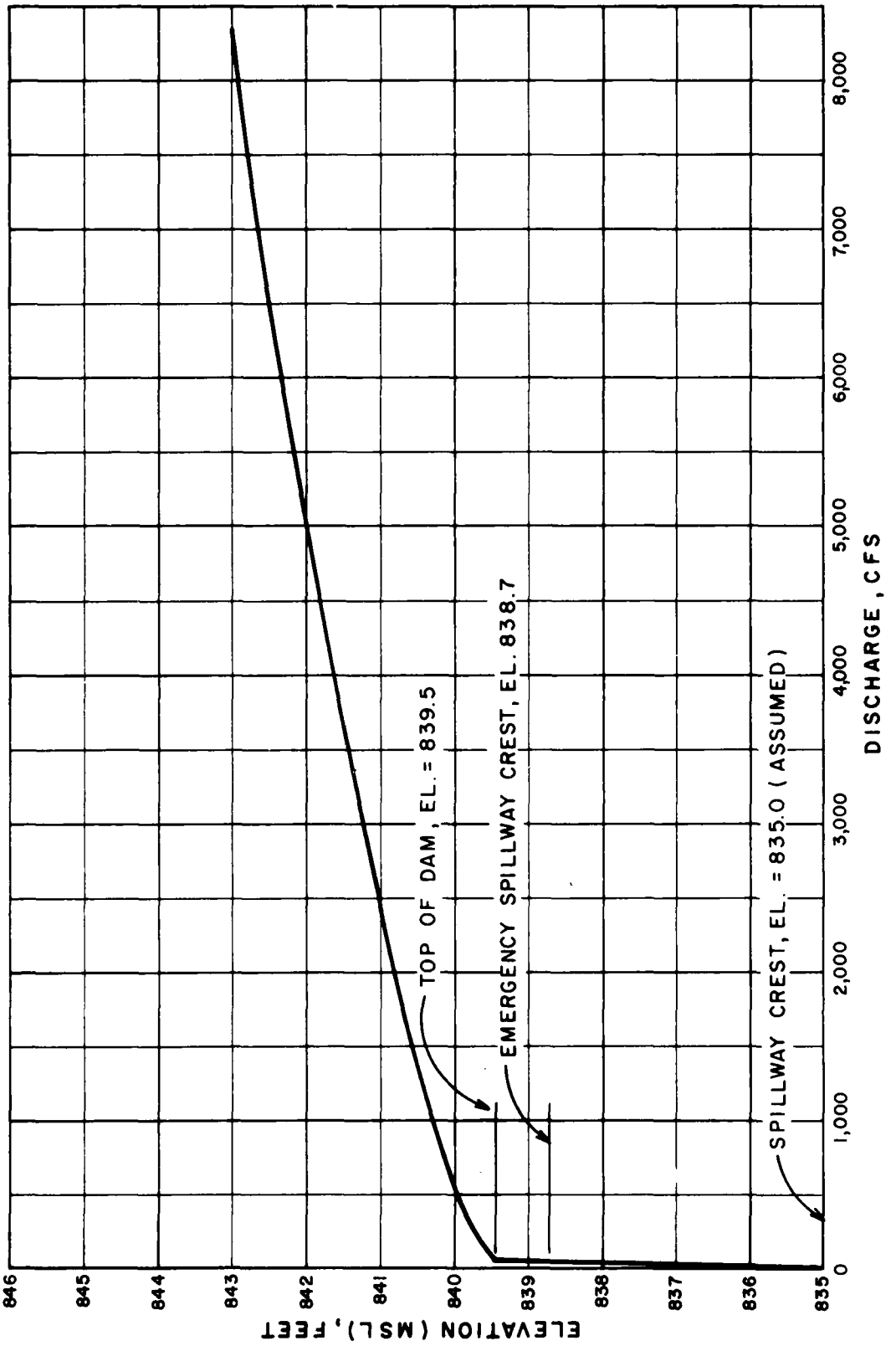
DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

MISSOURI DAM 30508 JOB NO. 1240-001-1

COMBINED SPILLWAY AND OVERTOP RATING CURVE BY KLB M.E.H.✓ DATE 5-24-7.

RESERVOIR WATER SURFACE ELEV.	HEAD ON SPILLWAY (Ft) H_1	SPILLWAY DISCHARGE $Q = 3.24 H_1 \sqrt{H_1}$	EMERGENCY SPILLWAY DISCHARGE (CFS)	OVERTOP DISCHARGE (CFS)	COMBINED DISCHARGE (CFS)
835.0	—	0	—	—	0
837.0	20.4	56	—	—	56
838.7	22.1	59	0	—	59
839.37	22.77	60	39.74	—	99
839.79	23.19	60	108.0	167.40	335
840.04	23.44	60	165.85	428.56	654
840.79	24.19	61	378.50	1547.2	1987
841.54	24.94	62	642.68	3065.2	3770
842.29	25.69	63	949.16	4902.5	5915
843.04	26.44	64	1293.63	7006.8	8364

PLATE-2, APPENDIX-B



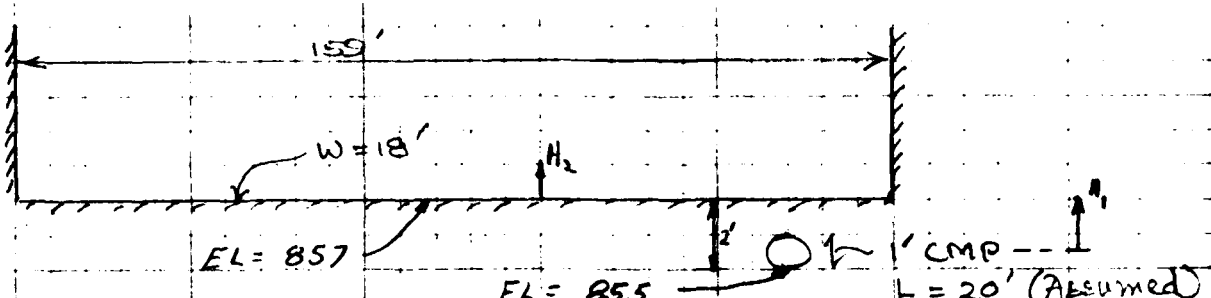
HUELIN McDANIELS DAM (MO. 30508)
SPILLWAY & OVERTOP RATING CURVE

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI SHEET NO. 1 OF

UPSTREAM DAM TO DAM # 30509 JOB NO. 1240-001

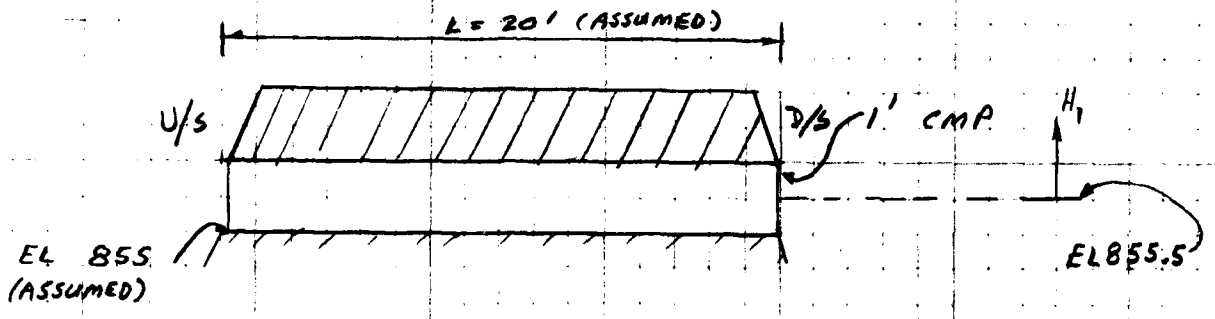
SPILLWAY & OVERTOP RATING CURVE BY MAS DATE 5/22/



RESERVOIR WATER SURFACE ELEV. (FT)	H_1 = (WSEL - 855.5)	$Q_1 = 5.11\sqrt{H_1}$	C_2	L_2	H_2 = (WSEL - 857)	$Q_2 = C_2 L_2 H_2^{3/2}$	$Q_T = Q_1 + Q_2$
855	–	0	–	–	–	–	0
856.0	0.5	3.61	–	–	–	–	4
857.0	1.5	6.26	2.64	159	0	0	6
858.0	2.5	8.08	2.63	159	1	418.17	426
859.0	3.5	9.56	2.63	159	2	1182.76	1192
861.0	5.5	11.98	2.63	159	4	3345.36	3,357
863.0	7.5	13.99	2.63	159	6	6145.82	6160

ASSUME PRESSURE FLOW CONTROLS

CULVERT FLOWS



ASSUME $n = 0.013$, $K_e = 0.1$

AND $f = 0.021$

$$H_1 = \left(1.1 + K_e + f\frac{L}{D}\right)\frac{V^2}{2g}$$

$$H_1 = \left(1.1 + 0.021\,\frac{20}{1}\right)\frac{V^2}{2g}$$

$$H_1 = 1.52\,\frac{V^2}{2g}$$

$$V = \sqrt{\frac{2g\,H_T}{1.52}} = 6.51\sqrt{H_1}$$

$$Q = A \cdot V = \frac{\pi}{4}(1)^2 \times 6.51\sqrt{H_1}$$

$$Q = 5.11\sqrt{H_1}$$

ECI-4 ENGINEERING CONSULTANTS, INC.

Dam Safety Inspection - Missouri SHEET NO. 1 OF

Missouri Dam # 30508 JOB NO. 1204

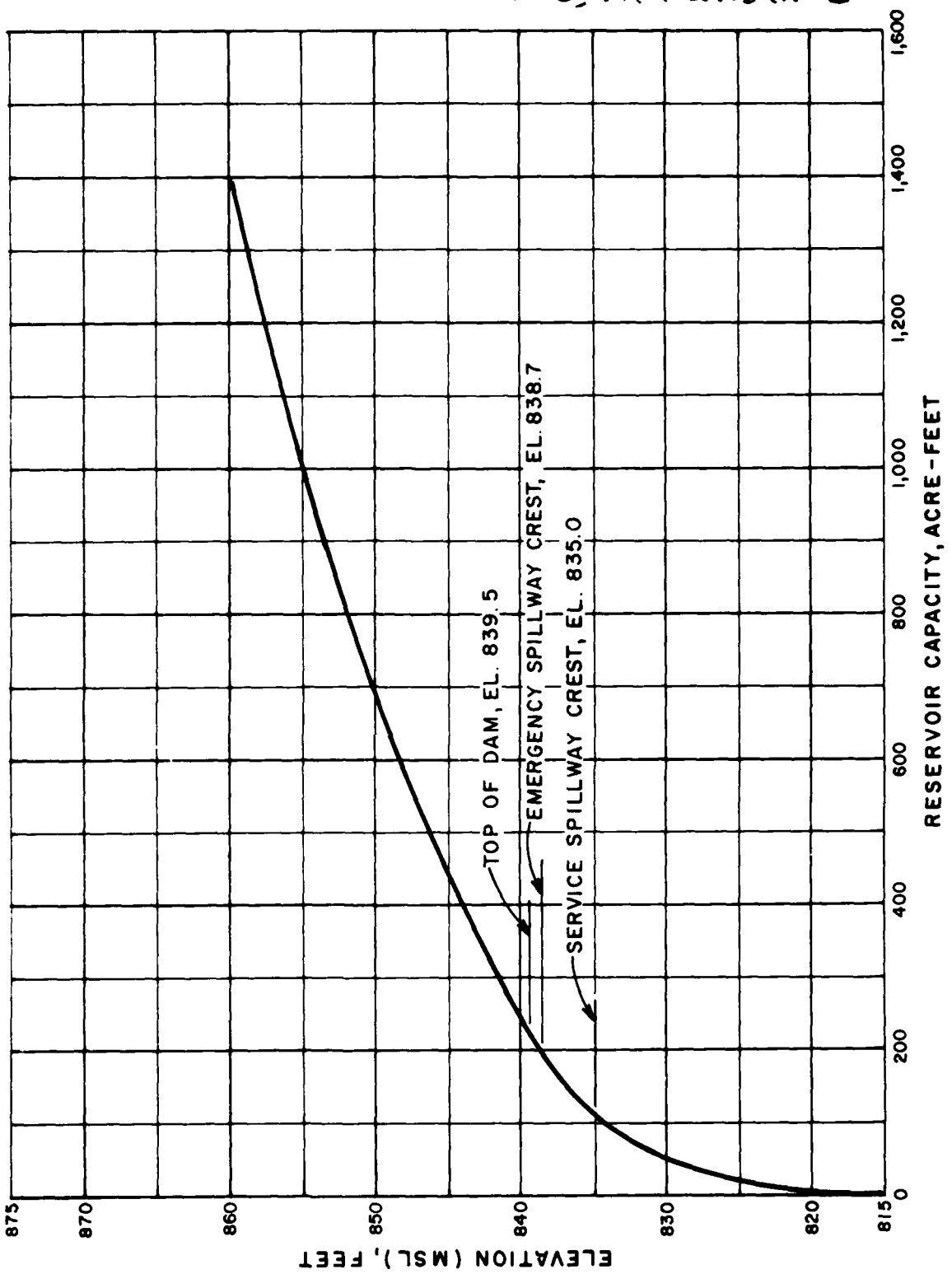
Reservoir Area Capacity BY M.R.H. DATE 5-15-79

Mononame #315

Reservoir Area Capacity

Elev. M.S.L. (Ft.)	Reservoir Surface Area (Acres)	Incremental Volume (Ac.-Ft.)	Total Volume (Ac.-Ft.)	Remarks
815	0	—	0	Est. Streambed at Center of Dam
835	16	107	107	Water Surface as shown on Quadrangle Elev. Est.
838.7	30	84	191	EMERGENCY SPILLWAY CREST ELEVATION
839.5	33.5	25.	216	TOP OF DAM ELEVATION
840	36	17	233	AREA MEASURED ON USGS. MAP.
860	83	1158	1391	AREA MEASURED ON USGS MAP

PLATE-3, APPENDIX-B



HUELIN McDANIELS DAM (MO. 30508)
RESERVOIR CAPACITY CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF
UPSTREAM DAM TO MO. #30508 — JOB NO. 1240-001-1
RESERVOIR AREA CAPACITY — BY MLB DATE 5-29-7;

RESERVOIR AREA CAPACITY

ELEV. M.S.L. (Ft)	RESERVOIR SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-FT)	TOTAL VOLUME (AC-FT)	REMARKS
837	0	-	0	ESTIMATED BOTTOM OF RESERVOIR ELEV.
855	4.35	26.1	26.1	ASSUMED SPILLWAY CREST ELEV.
857	5.25	9.6	35.7	TOP OF DAM
860	6.14	17.1	52.8	AREA MEASURED ON USGS MAP.
880	12.57	183.3	236.1	AREA MEASURED ON USGS MAP.

DAM NO MO 30508

DETERMINATION OF PMP

1. Determine drainage area of the basin

   D.A. = 440 (390+50) Acres

2. Determine PMP Index Rainfall

   Location of centroid of basin:

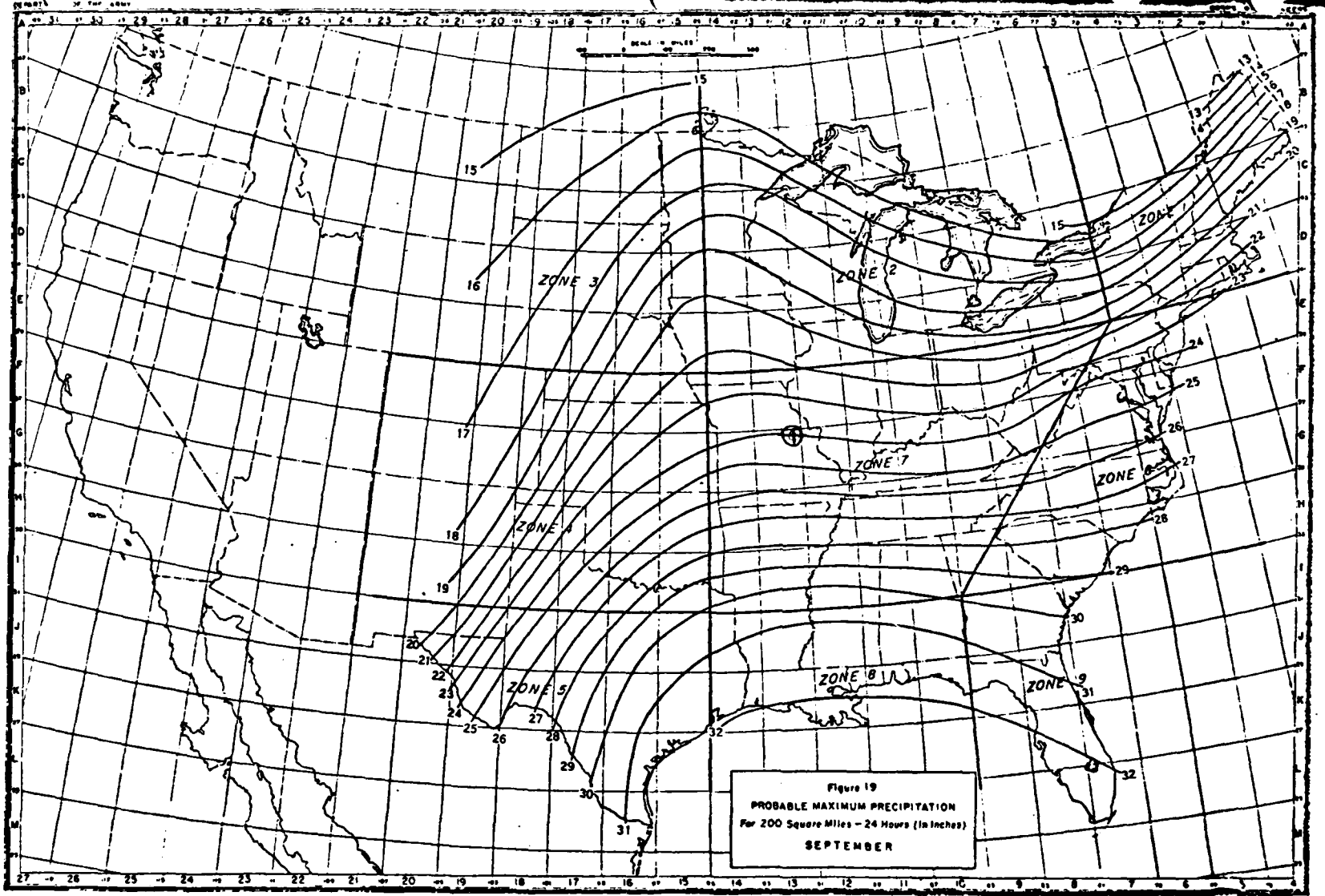
   Long. = 91°13'46", Lat. = 38°49'24" ⇒ PMP = 24"

3. Determine basin rainfall in terms of percentage of PMP Index Rainfall for various durations;

   Location: Long. = 91°13'46", Lat. = 38°49'24"

   ⇒ Zone 7

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (inches)	Rainfall Increments (inches)	Duration of Increment (Hrs.)
6	100	24	24	6
12	120	28.8	4.8	6
24	130	31.2	2.4	12



PMP FOR 200 SQ. MI. · 24 HOURS
DURATION = 24"

HUELIN McDANIELS DAM (MO. 30508)
LOCATION OF CENTROID OF WATERSHED
LAT. = 38°49'24", LONG. = 91°13'46"

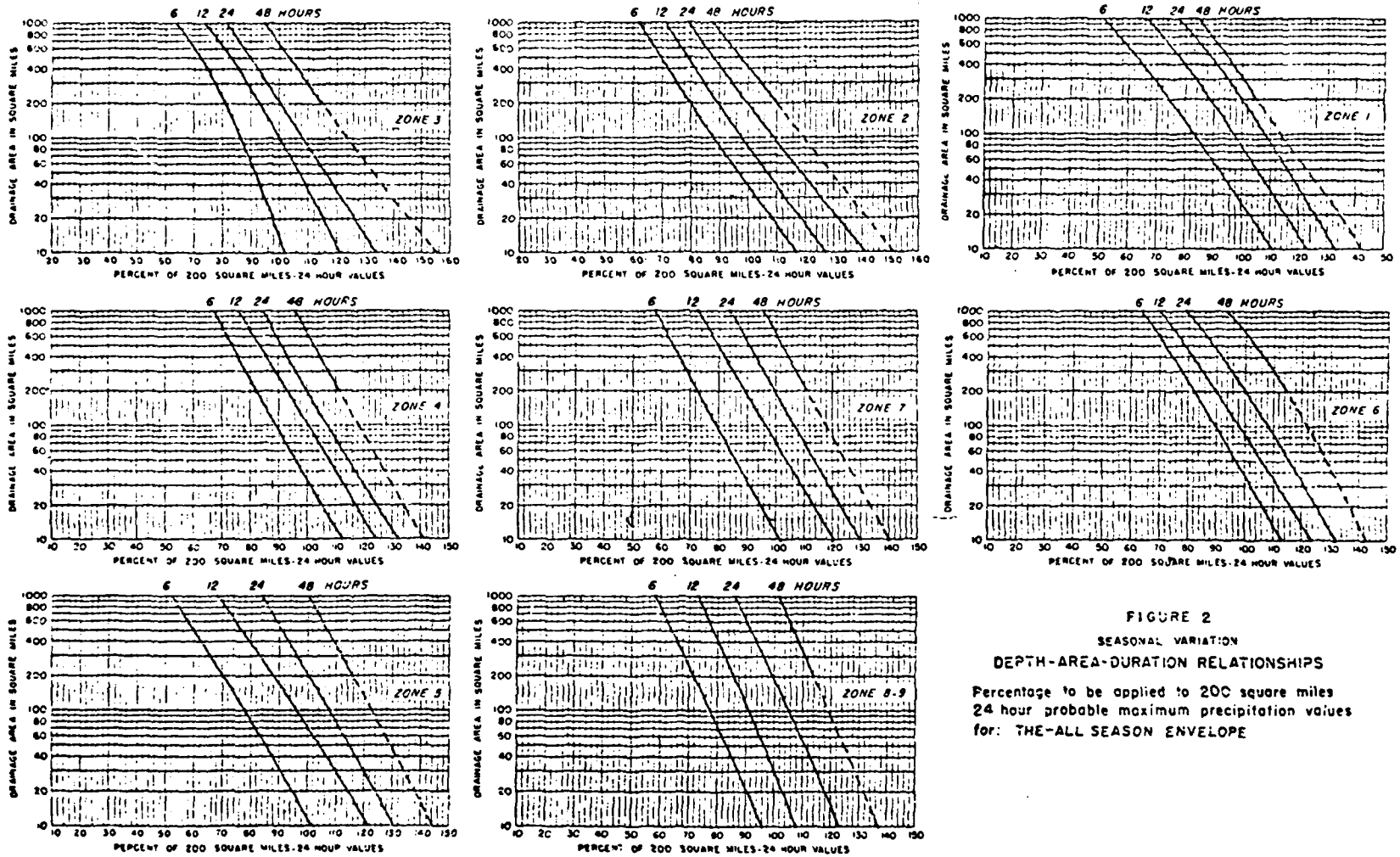


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE-ALL SEASON ENVELOPE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF
DAM # MO. 30508 — JOB NO. 1240-001
Unit Hydrograph Parameters — BY MAS DATE 5-23-7

1. Drainage Area, $A = 390\ Ac = 0.61$ Sq. mi.
2. Length of Stream = $(2.25" \times 2000'/5280) = 0.85$ mi
3. Elevation at drainage divide along the the longest stream, $H_1 = 950$ ft
4. Reservoir elevation at Spillway Crest, $H_2 = 835'$
5. Difference in Elevation, $\Delta H = 950 - 835 = 115$ ft
6. Average slope of stream $= \frac{\Delta H}{L} = \frac{115}{.85 \times 5280} = 2.6\%$
7. Time of concentration:
   a) By Kirpich formula:
   $$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times .85^3}{115}\right)^{0.385} = 0.35 \text{ hr.}$$
   b) By velocity estimate:
   Slope = 2.6% $\Rightarrow$ Avg Velocity = 3 ft/sec
   $$\therefore T_c = \frac{0.85 \times 5280}{3 \times 60 \times 60} = 0.42 \text{ hrs.}$$
   Say $\underline{T_c = 0.40 \text{ hr.}}$
8. Lag time, $L_t = 0.6 \times 0.40 \simeq 0.24$ hr.
9. Unit duration $D \leq \frac{L_t}{3} = \frac{0.24}{3} = 0.08 < 0.083$
   Use $D = 0.083$ hr = 5 min.
10. Time to Peak, $T_p = D/2 + L_t = \frac{0.083}{2} + 0.24 = 0.28$ hr.
11. Peak Discharge, $q_p = \frac{484 \times A}{T_p} = \frac{484 \times 0.61}{0.28} = \underline{1054 \text{ cfs}}$

ECI-4 ENGINEERING CONSULTANTS, INC.

Dam SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 1

Dam upstream of Dam # MO. 30508 — JOB NO. 1240-001

UNIT HYDROGRAPH PARAMETERS — BY PRW DATE 5-23-79

1. DRAINAGE AREA, A = 50 AC = 0.08 Sq mi

2. LENGTH OF STREAM = (1.0" x 2000' / 5280) = 0.38 mi

3. ELEVATION OF DRAINAGE DIVIDE ALONG THE LONGEST STREAM, H_1 = 914'

4. RESERVOIR ELEVATION AT SPILLWAY CREST H_2 = 850'

5. DIFFERENCE IN ELEVATION, ΔH = 914' − 850' = 64'

6. AVERAGE SLOPE OF STREAM = $\frac{\Delta H}{L} = \frac{64'}{0.38 \times 5280} = 3.2\%$

7. TIME OF CONCENTRATION:

a) BY KIRPICH FORMULA

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times .38^3}{64}\right)^{0.385} = 0.17 \text{ hr}$$

b) BY VELOCITY ESTIMATE

SLOPE = 3.2% ⇒ AVG VELOCITY = 3 ft./sec

$$T_c = \frac{0.38 \times 5280}{3 \times 60 \times 60} = 0.19 \text{ hr}$$

USE T_c = 0.18 hr.

8. LAG TIME, L_t = 0.6 × 0.18 = 0.11 hr

9. UNIT DURATION $D \leq \frac{L_t}{3} = \frac{0.11}{3} = 0.04 < 0.083$

USE D = 0.083 hr = 5 min

10. TIME TO PEAK, $T_p = D/2 + L_t = \frac{0.083}{2} + 0.11 \text{ hr} = 0.15 \text{ hr}$

11. PEAK DISCHARGE, $Q_p = \frac{484 \times A}{T_p} = \frac{484 \times .08}{0.15} = 218 \text{ CFS}$

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI SHEET NO. 1 OF
DAM # MO. 30508 JOB NO. 1240-001
DETERMINATION OF SOIL GROUP & CURVE NUMBER BY MAS DATE 5/21/7.

MISSOURI DAM # MO 30508

DETERMINATION OF HYDROLOGIC SOIL GROUP & SCS CURVE NUMBER

1. The soils in the waterrhed consist of B, C and D group soils. The predominent soil group seems to be 'C'
   Assume soil group 'C' for the entire watershed.

2. The waterrhed is mostly wooded and covered with grass. Assume 'Fair' hydrologic condition for infiltration
   Thus CN = 73 for soil group C & AMC II

   $\Rightarrow$ CN = 87 for AMC-III

HEC1DB INPUT DATA

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

A                   DAM SAFETY INSPECTION - MISSOURI
A                  HUELIN McDANIELS DAM (30508)
A                 PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
B     300      0      5      0      0      0      0      0      0      0
B1      5
J       1      2      1
J1    1.0    0.5
K     0U/S30508                                       1
K1 INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS, FOR UPSTREAM DAM
M       1      2   0.18                0.08    1.0
P            24.0    100    120    130
T                                                     -1    -87
W2           0.11
X       0      0      1
K     10/S30508                                       1
K1 ROUTE HYDROGRAPH THROUGH UPSTREAM DAM TO NO. 30508 DAM
Y                                1      1
Y1      1                                         -855.     -1
Y4  855.0  856.0  857.0  858.0  859.0  861.0  863.0
Y5    0.0      4  [illegible]  42  [illegible]  3357   6160
$S    0.0   26.1   35.7   52.8  256.[illegible]
$E  837.   855.   857.   860.   880.
$$  855.
$D  857.
K       0  [illegible]                                1
K1 INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS FOR NO. 30508 DAM
M       1      2   0.61                0.61    1.0
P            24.0    100    120    130
T                                                     -1    -87
W2           0.24
X       0      0      1
K       2  30508                                      1
K1 COMBINE HYDROGRAPHS BEFORE ROUTING
K       1  30508                        2             1
K1 ROUTE COMBINED HYUDROGRAPH THROUGH               DAM 30508
Y                                1      1
Y1      1                                        -835.00     -1
Y4  835.0  837.0  838.7  839.37  839.5  839.79  840.04  840.79  841.54  842.29
Y4 843.04
Y5      0     56     59     99    120    335    654   1907   3770   5915
Y5  6364
$S    0.0   107.   191.   215.   233.  1391.
$E   815.   835.  838.7  839.5   840.   860.
$$ 835.00
$D 839.5
K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT S30502
ROUTE HYDROGRAPH TO S30502
RUNOFF HYDROGRAPH AT S30504
COMBINE 2 HYDROGRAPHS AT S30504
ROUTE HYDROGRAPH TO S30504
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 FEB 79
**********

RUN  DATE= 79/06/26.
     TIME= 11.41.05.
```

DAM SAFETY INSPECTION - MISSOURI
HUELIN McDANIELS DAM (MO50)
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

IT	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

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

RTIOS= 1.00 .50

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

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS, FOR UPSTREAM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
933508	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.08	0.03	.08	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-87.00	0.00	0.00

CURVE NO = -87.00 WETNESS = -1.00 EFFECTIVN = 87.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .11

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

TIME INCREMENT TOO LARGE--(DTHG IS GT LAG/2)

UNIT HYDROGRAPH 1 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .11 VOL= 1.00

		446.	254.	151.	53.	32.	9.	4.	2.	0.					
							END-OF-PERIOD FLOW								
	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	
	1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.20	.19	.01	118.	
	1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.19	.01	119.	
	1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.19	.01	120.	
	1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.19	.01	120.	
	1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.20	.19	.01	120.	
	1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.19	.01	120.	
	1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.23	.01	126.	
	1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.23	.01	136.	
	1.01	.45		.01	0.00	.01	0.	1.01	13.15	159	.24	.23	.01	142.	
	1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.23	.01	144.	
	1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.24	.00	145.	
	1.01	1.00	12	.01	0.00	.01	0.	1.01	13.30	162	.24	.24	.00	145.	
	1.01	1.05	13	.01	0.00	.01	0.	1.01	13.35	163	.24	.24	.00	146.	
	1.01	1.10	14	.01	0.00	.01	0.	1.01	13.40	164	.24	.24	.00	146.	
	1.01	1.15	15	.01	0.00	.01	0.	1.01	13.45	165	.24	.24	.00	146.	
	1.01	1.20	16	.01	0.00	.01	0.	1.01	13.50	166	.24	.24	.00	146.	
	1.01	1.25	17	.01	0.00	.01	0.	1.01	13.55	167	.24	.24	.00	146.	
	1.01	1.30	18	.01	0.00	.01	0.	1.01	14.00	168	.24	.24	.00	146.	
	1.01	1.35	19	.01	0.00	.01	0.	1.01	14.05	169	.30	.30	.00	165.	
	1.01	1.40	20	.01	0.00	.01	0.	1.01	14.10	170	.30	.30	.00	170.	
	1.01	1.45	21	.01	0.00	.01	0.	1.01	14.15	171	.30	.30	.00	178.	
	1.01	1.50	22	.01	0.00	.01	0.	1.01	14.20	172	.30	.30	.00	181.	
	1.01	1.55	23	.01	.00	.01	0.	1.01	14.25	173	.30	.30	.00	183.	
	1.01	2.00	24	.01	.00	.01	0.	1.01	14.30	174	.30	.30	.00	183.	
	1.01	2.05	25	.01	.00	.01	0.	1.01	14.35	175	.30	.30	.00	183.	
	1.01	2.10	26	.01	.00	.01	0.	1.01	14.40	176	.30	.30	.00	184.	
	1.01	2.15	27	.01	.00	.01	0.	1.01	14.45	177	.30	.30	.00	184.	
	1.01	2.20	28	.01	.00	.01	1.	1.01	14.50	178	.30	.30	.00	184.	
	1.01	2.25	29	.01	.00	.01	1.	1.01	14.55	179	.30	.30	.00	184.	
	1.01	2.30	30	.01	.00	.01	1.	1.01	15.00	180	.30	.30	.00	184.	
	1.01	2.35	31	.01	.30	.01	1.	1.01	15.05	181	.18	.18	.00	167.	
	1.01	2.40	32	.01	.00	.01	1.	1.01	15.10	182	.36	.36	.00	164.	
	1.01	2.45	33	.01	.00	.01	1.	1.01	15.15	183	.36	.36	.00	194.	
	1.01	2.50	34	.01	.30	.01	1.	1.01	15.20	184	.55	.54	.00	238.	
	1.01	2.55	35	.01	.00	.01	1.	1.01	15.25	185	.64	.63	.00	305.	
	1.01	3.00	36	.01	.00	.01	1.	1.01	15.30	186	1.55	1.54	.01	485.	
	1.01	3.05	37	.01	.00	.01	2.	1.01	15.35	187	2.55	2.54	.01	803.	
	1.01	3.10	38	.01	.00	.01	2.	1.01	15.40	188	1.00	1.00	.00	1042.	
	1.01	3.15	39	.01	.00	.01	2.	1.01	15.45	189	.64	.64	.00	782.	
	1.01	3.20	40	.01	.55	.01	2.	1.01	15.50	190	.55	.55	.00	549.	
	1.01	3.25	41	.01	.00	.01	2.	1.01	15.55	191	.36	.36	.00	400.	
	1.01	3.30	42	.01	.00	.01	2.	1.01	16.00	192	.36	.36	.00	301.	
	1.01	3.35	43	.01	.00	.01	2.	1.01	16.05	193	.28	.28	.00	244.	
	1.01	3.40	44	.01	.00	.01	2.	1.01	16.10	194	.28	.28	.00	204.	
	1.01	3.45	45	.01	.00	.01	2.	1.01	16.15	195	.28	.28	.00	184.	
	1.01	3.50	46	.01	.00	.01	2.	1.01	16.20	196	.28	.28	.00	177.	
	1.01	3.55	47	.01	.00	.01	3.	1.01	16.25	197	.28	.28	.00	174.	
	1.01	4.00	48	.01	.30	.01	3.	1.01	16.30	198	.28	.28	.00	173.	
	1.01	4.05	49	.01	.00	.01	3.	1.01	16.35	199	.28	.28	.00	173.	
	1.01	4.10	50	.01	.00	.01	3.	1.01	16.40	200	.28	.28	.00	173.	
	1.01	4.15	51	.01	.00	.01	3.	1.01	16.45	201	.28	.28	.00	173.	
	1.01	4.20	52	.01	.30	.01	3.	1.01	16.50	202	.28	.28	.00	173.	
	1.01	4.25	53	.01	.01	.01	3.	1.01	16.55	203	.28	.28	.00	173.	
	1.01	4.30	54	.01	.01	.01	3.	1.01	17.00	204	.28	.28	.00	173.	
	1.01	4.35	55	.01	.01	.01	3.	1.01	17.05	205	.22	.22	.00	164.	

1.01	4.40	56	.01	.01	.01	8.	1.01	17.11	206	.22	.22	.00	149.
1.01	4.45	57	.01	.01	.01	36.	1.01	17.15	207	.22	.22	.00	141.
1.01	4.50	58	.01	.01	.01	36.	1.01	17.20	208	.22	.22	.00	138.
1.01	4.55	59	.01	.01	.01	36.	1.01	17.25	209	.22	.22	.00	139.
1.01	5.00	60	.01	.01	.01	4.	1.01	17.30	210	.22	.22	.00	136.
1.01	5.05	61	.01	.01	.01	4.	1.01	17.35	211	.22	.22	.00	136.
1.01	5.10	62	.01	.01	.01	4.	1.01	17.40	212	.22	.22	.00	136.
1.01	5.15	63	.01	.01	.01	4.	1.01	17.45	213	.22	.22	.00	136.
1.01	5.20	64	.01	.01	.01	4.	1.01	17.50	214	.22	.22	.00	136.
1.01	5.25	65	.01	.01	.01	4.	1.01	17.55	215	.22	.22	.00	136.
1.01	5.30	66	.01	.01	.01	4.	1.01	18.00	216	.22	.22	.00	136.
1.01	5.35	67	.01	.01	.01	4.	1.01	18.05	217	.02	.02	.00	107.
1.01	5.40	68	.01	.01	.01	4.	1.01	18.10	218	.02	.02	.00	96.
1.01	5.45	69	.01	.01	.01	4.	1.01	18.15	219	.02	.02	.00	30.
1.01	5.50	70	.01	.01	.01	4.	1.01	18.20	220	.02	.02	.00	20.
1.01	5.55	71	.01	.01	.01	4.	1.01	18.25	221	.02	.02	.00	19.
1.01	6.00	72	.01	.01	.01	4.	1.01	18.30	222	.02	.02	.00	13.
1.01	6.05	73	.07	.04	.03	4.	1.01	18.35	223	.02	.02	.00	13.
1.01	6.10	74	.07	.04	.03	16.	1.01	18.40	224	.02	.02	.00	12.
1.01	6.15	75	.07	.04	.03	20.	1.01	18.45	225	.02	.02	.00	12.
1.01	6.20	76	.07	.04	.03	25.	1.01	18.50	226	.02	.02	.00	12.
1.01	6.25	77	.07	.04	.02	24.	1.01	18.55	227	.02	.02	.00	12.
1.01	6.30	78	.07	.04	.03	25.	1.01	19.00	228	.02	.02	.00	12.
1.01	6.35	79	.07	.04	.03	25.	1.01	19.05	229	.02	.02	.00	12.
1.01	6.40	80	.07	.05	.02	27.	1.01	19.10	230	.02	.02	.00	12.
1.01	6.45	81	.07	.05	.02	24.	1.01	19.15	231	.02	.02	.00	12.
1.01	6.50	82	.07	.05	.02	24.	1.01	19.20	232	.02	.02	.00	12.
1.01	6.55	83	.07	.05	.02	24.	1.01	19.25	233	.02	.02	.00	12.
1.01	7.00	84	.07	.05	.02	30.	1.01	19.30	234	.02	.02	.00	12.
1.01	7.05	85	.07	.05	.02	33.	1.01	19.35	235	.02	.02	.00	12.
1.01	7.10	86	.07	.05	.02	31.	1.01	19.40	236	.02	.02	.00	12.
1.01	7.15	87	.07	.05	.02	31.	1.01	19.45	237	.02	.02	.00	12.
1.01	7.20	88	.07	.05	.01	32.	1.01	19.50	238	.02	.02	.00	12.
1.01	7.25	89	.07	.05	.01	32.	1.01	19.55	239	.02	.02	.00	12.
1.01	7.30	90	.07	.05	.01	32.	1.01	20.00	240	.02	.02	.00	12.
1.01	7.35	91	.07	.05	.01	33.	1.01	20.05	241	.02	.02	.00	12.
1.01	7.40	92	.07	.05	.01	33.	1.01	20.10	242	.02	.02	.00	12.
1.01	7.45	93	.07	.05	.01	33.	1.01	20.15	243	.02	.02	.00	12.
1.01	7.50	94	.07	.06	.01	34.	1.01	20.20	244	.02	.02	.00	12.
1.01	7.55	95	.07	.06	.01	34.	1.01	20.25	245	.02	.02	.00	12.
1.01	8.00	96	.07	.06	.01	34.	1.01	20.30	246	.02	.02	.00	12.
1.01	8.05	97	.07	.06	.01	35.	1.01	20.35	247	.02	.02	.00	12.
1.01	8.10	98	.07	.06	.01	35.	1.01	20.40	248	.02	.02	.00	12.
1.01	8.15	99	.07	.06	.01	35.	1.01	20.45	249	.02	.02	.00	12.
1.01	8.20	100	.07	.06	.01	35.	1.01	20.50	250	.02	.02	.00	12.
1.01	8.25	101	.07	.06	.01	35.	1.01	20.55	251	.02	.02	.00	12.
1.01	8.30	102	.07	.06	.01	36.	1.01	21.00	252	.02	.02	.00	12.
1.01	8.35	103	.07	.06	.01	36.	1.01	21.05	253	.02	.02	.00	12.
1.01	8.40	104	.07	.06	.01	36.	1.01	21.10	254	.02	.02	.00	12.
1.01	8.45	105	.07	.06	.01	36.	1.01	21.15	255	.02	.02	.00	12.
1.01	8.50	106	.07	.06	.01	36.	1.01	21.20	256	.02	.02	.00	12.
1.01	8.55	107	.07	.06	.01	36.	1.01	21.25	257	.02	.02	.00	12.
1.01	9.00	108	.07	.06	.01	37.	1.01	21.30	258	.02	.02	.00	12.
1.01	9.05	109	.07	.06	.01	37.	1.01	21.35	259	.02	.02	.00	12.
1.01	9.10	110	.07	.06	.01	37.	1.01	21.40	260	.02	.02	.00	12.
1.01	9.15	111	.07	.06	.01	37.	1.01	21.45	261	.02	.02	.00	12.
1.01	9.20	112	.07	.06	.01	37.	1.01	21.50	262	.02	.02	.00	12.
1.01	9.25	113	.07	.06	.01	37.	1.01	21.55	263	.02	.02	.00	12.
1.01	9.30	114	.07	.06	.01	37.	1.01	22.00	264	.02	.02	.00	12.
1.01	9.35	115	.07	.06	.01	37.	1.01	22.05	265	.02	.02	.00	12.

1.01	9.40	116	.07	.06	.01	38.	1.01	22.10	266	.02	.02	.00	12.
1.01	9.45	117	.07	.06	.01	38.	1.01	22.15	267	.02	.02	.00	12.
1.01	9.50	118	.07	.06	.01	38.	1.01	22.20	268	.02	.02	.00	12.
1.01	9.55	119	.07	.06	.01	38.	1.01	22.25	269	.02	.02	.00	12.
1.01	10.00	120	.07	.06	.01	38.	1.01	22.30	270	.02	.02	.00	12.
1.01	10.05	121	.07	.06	.01	38.	1.01	22.35	271	.02	.02	.00	12.
1.01	10.10	122	.07	.06	.01	38.	1.01	22.40	272	.02	.02	.00	12.
1.01	10.15	123	.07	.06	.00	38.	1.01	22.45	273	.02	.02	.00	12.
1.01	10.20	124	.07	.06	.00	38.	1.01	22.50	274	.02	.02	.00	12.
1.01	10.25	125	.07	.06	.00	38.	1.01	22.55	275	.02	.02	.00	12.
1.01	10.30	126	.07	.06	.00	38.	1.01	23.00	276	.02	.02	.00	12.
1.01	10.35	127	.07	.06	.00	38.	1.01	23.05	277	.02	.02	.00	12.
1.01	10.40	128	.07	.06	.00	38.	1.01	23.10	278	.02	.02	.00	12.
1.01	10.45	129	.07	.06	.00	38.	1.01	23.15	279	.02	.02	.00	12.
1.01	10.50	130	.07	.06	.00	38.	1.01	23.20	280	.02	.02	.00	12.
1.01	10.55	131	.07	.06	.00	39.	1.01	23.25	281	.02	.02	.00	12.
1.01	11.00	132	.07	.06	.00	39.	1.01	23.30	282	.02	.02	.00	12.
1.01	11.05	133	.07	.06	.00	39.	1.01	23.35	283	.02	.02	.00	12.
1.01	11.10	134	.07	.06	.00	39.	1.01	23.40	284	.02	.02	.00	12.
1.01	11.15	135	.07	.06	.00	39.	1.01	23.45	285	.02	.02	.00	12.
1.01	11.20	136	.07	.06	.00	39.	1.01	23.50	286	.02	.02	.00	12.
1.01	11.25	137	.07	.06	.00	39.	1.01	23.55	287	.02	.02	.00	12.
1.01	11.30	138	.07	.06	.00	39.	1.02	0.00	288	.02	.02	.00	12.
1.01	11.35	139	.07	.06	.00	39.	1.02	.05	289	0.00	0.00	0.00	9.
1.01	11.40	140	.07	.06	.00	39.	1.02	.10	290	0.00	0.00	0.00	4.
1.01	11.45	141	.07	.06	.00	39.	1.02	.15	291	0.00	0.00	0.00	2.
1.01	11.50	142	.07	.06	.00	39.	1.02	.20	292	0.00	0.00	0.00	1.
1.01	11.55	143	.07	.06	.00	39.	1.02	.25	293	0.00	0.00	0.00	0.
1.01	12.00	144	.07	.06	.00	39.	1.02	.30	294	0.00	0.00	0.00	0.
1.01	12.05	145	.07	.19	.01	58.	1.02	.35	295	0.00	0.00	0.00	0.
1.01	12.10	146	.20	.19	.01	93.	1.02	.40	296	0.00	0.00	0.00	0.
1.01	12.15	147	.20	.19	.01	107.	1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.20	.19	.01	114.	1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.20	.19	.01	117.	1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.20	.19	.01	119.	1.02	1.00	300	0.00	0.00	0.00	0.
									SUM	31.20	29.48	1.72	18226.
										(792.)	(748.)	(44.)	(516.10)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1042.	203.	63.	61.	18251.
CMS	30.	6.	2.	2.	517.
INCHES		23.59	29.48	29.48	29.48
MM		599.22	748.69	748.69	748.69
AC-FT		101.	126.	126.	126.
THOUS CU M		124.	155.	155.	155.

HYDROGRAPH AT STA 10508 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	8.	16.	20.	23.	24.	25.	26.	27.	28.	29.
29.	29.	29.	30.	30.	31.	31.	32.	33.	33.	33.	33.
33.	33.	33.	34.	34.	34.	35.	35.	35.	35.		

35.	36.	36.	36.	36.	36.	36.	37.	37.	37.	
37.	37.	37.	37.	37.	38.	38.	38.	38.	38.	
38.	38.	38.	38.	38.	38.	38.	39.	39.	39.	
39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	
39.	39.	39.	39.	58.	90.	107.	114.	117.	119.	
119.	120.	120.	120.	120.	120.	120.	126.	136.	142.	
145.	145.	146.	146.	146.	146.	146.	146.	155.	178.	
178.	181.	183.	183.	183.	184.	184.	184.	184.	184.	
187.	194.	194.	238.	305.	485.	985.	1042.	782.	549.	
400.	221.	248.	204.	184.	177.	174.	173.	173.	173.	
173.	173.	173.	173.	164.	149.	141.	138.	137.	136.	
136.	136.	136.	136.	136.	136.	137.	56.	30.	20.	
15.	13.	13.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	
12.	12.	12.	12.	12.	12.	12.	12.	9.	6.	
2.	1.	0.	0.	0.	0.	0.	0.	0.	0.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1042.	203.	53.	61.	18251.
CMS	30.	6.	2.	2.	517.
INCHES		23.59	29.48	29.48	29.48
MM		599.22	748.69	748.69	748.69
AC-FT		101.	126.	126.	126.
THOUS CU M		124.	155.	155.	155.

HYDROGRAPH AT STA 5950 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	4.	6.	10.	11.	12.	13.	13.	14.
14.	14.	15.	15.	15.	15.	16.	16.	16.	16.
16.	17.	17.	17.	17.	17.	17.	17.	17.	18.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	19.	19.	19.	19.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	20.	20.	20.	20.
20.	20.	20.	20.	29.	45.	54.	57.	59.	59.
60.	60.	60.	60.	60.	60.	63.	68.	71.	72.
72.	73.	73.	73.	73.	73.	73.	73.	77.	85.
89.	91.	91.	92.	92.	92.	92.	92.	92.	92.
94.	82.	97.	119.	152.	245.	442.	521.	391.	274.
200.	151.	122.	102.	92.	89.	87.	87.	86.	86.
86.	86.	86.	86.	82.	75.	71.	69.	68.	68.
68.	68.	68.	68.	68.	68.	54.	28.	15.	10.
8.	7.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.

6.	6.	6.	6.	6.	6.	6.	6.	0.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	521.	101.	12.	30.	9126.
CMS	15.	3.	1.	1.	258.
INCHES		11.80	14.74	14.74	14.74
MM		299.61	374.54	374.54	374.54
AC-FT		60.	63.	63.	63.
THOUS CU M		62.	78.	78.	78.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH UPSTREAM DAM TO NO. 30503 DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
S30508	1	0	0	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-855.	-1

STAGE	855.00	856.00	857.00	858.00	859.00	861.00	863.00
FLOW	0.00	4.00	6.00	426.00	1192.00	3357.00	6160.00

CAPACITY=	0.	2.	36.	51.	236.
ELEVATION=	837.	855.	857.	869.	883.

CREL	SPWID	COQW	EXPW	ELLVL	COOL	CAREA	EXPL
855.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
857.0	3.0	0.0	0.

STATION S30508, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	2.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	4.	4.	4.	4.

4.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	6.	6.	6.	6.	6.	10.	21.	28.
32.	34.	36.	37.	37.	38.	38.	38.	38.	38.
39.	39.	39.	39.	39.	39.	39.	39.	39.	39.
39.	39.	39.	39.	43.	56.	73.	88.	99.	107.
112.	115.	117.	118.	119.	120.	121.	125.	131.	136.
139.	141.	143.	144.	145.	145.	146.	146.	148.	154.
159.	162.	174.	178.	180.	181.	182.	183.	183.	184.
180.	174.	176.	192.	224.	293.	466.	780.	864.	738.
571.	432.	365.	308.	262.	229.	208.	194.	186.	180.
177.	175.	174.	174.	172.	166.	157.	150.	145.	148.
137.	138.	137.	137.	136.	136.	130.	111.	85.	60.
43.	31.	24.	15.	16.	15.	14.	13.	13.	13.
13.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	10.
7.	6.	6.	6.	6.	6.	6.	6.	6.	8.

STORAGE

26.	25.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	25.	26.	26.	25.	26.	25.	26.	26.	26.
26.	25.	25.	26.	26.	26.	25.	26.	26.	26.
26.	25.	25.	26.	26.	26.	26.	27.	27.	27.
27.	27.	27.	27.	27.	27.	27.	27.	27.	27.
27.	27.	27.	27.	27.	27.	27.	28.	29.	28.
28.	28.	28.	29.	29.	29.	29.	29.	30.	30.
30.	30.	30.	31.	31.	31.	31.	31.	32.	32.
32.	32.	33.	33.	33.	33.	33.	34.	34.	34.
34.	34.	35.	35.	35.	35.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.
38.	38.	38.	38.	39.	40.	42.	44.	45.	44.
42.	41.	41.	40.	39.	39.	39.	38.	38.	38.
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.
38.	37.	37.	37.	37.	37.	37.	37.	37.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	35.	35.	35.

STAGE

855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0
855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0
855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0
855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0
855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.0	855.1	855.1
855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1

855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1	855.1
855.1	855.2	855.2	855.2	855.2	855.2	855.3	855.3	855.3	855.4
855.4	855.4	855.5	855.5	855.6	855.6	855.6	855.7	855.7	855.8
855.8	855.9	855.9	855.9	856.0	856.0	856.1	856.1	856.2	856.2
856.2	856.3	856.3	856.4	856.4	856.5	856.5	856.6	856.6	856.6
856.7	856.7	856.8	856.8	856.9	856.9	857.0	857.0	857.0	857.1
857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1
857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1
857.1	857.1	857.1	857.1	857.1	857.1	857.2	857.2	857.2	857.2
857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.3
857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.4
857.4	857.4	857.4	857.4	857.4	857.4	857.4	857.4	857.4	857.4
857.4	857.4	857.4	857.4	857.5	857.7	858.1	858.5	858.6	858.4
858.2	858.0	857.9	857.7	857.6	857.5	857.5	857.4	857.4	857.4
857.4	857.4	857.4	857.4	857.4	857.4	857.4	857.3	857.3	857.3
857.3	857.3	857.3	857.3	857.3	857.3	857.3	857.2	857.2	857.1
857.1	857.1	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	856.9	856.9

PEAK OUTFLOW IS 864. AT TIME 1[illegible].75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	864.	202.	59.	56.	16906.
CMS	24.	6.	2.	2.	479.
INCHES		23.47	27.30	27.30	27.30
MM		596.11	693.51	693.51	693.51
AC-FT		100.	115.	116.	116.
THOUS CU M		123.	144.	144.	144.

STATION S3050R, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
5.	5.	5.	5.	6.	6.	6.	6.	6.	6.
6.	6.	6.	5.	6.	5.	6.	5.	6.	6.
6.	19.	36.	46.	61.	65.	58.	61.	64.	67.
69.	71.	71.	72.	72.	73.	73.	73.	74.	77.

STORAGE

STAGE

856.3	856.3	856.3	856.3	856.4	856.4	856.4	856.4	856.4	[illegible]
856.5	856.5	856.5	856.5	856.6	856.6	856.7	856.7	856.8	856.9
857.0	857.0	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1
857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2
857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.3	857.2
857.2	857.2	857.2	857.[illegible]	857.3	857.3	857.5	857.8	857.9	857.8
857.7	857.6	857.5	857.4	857.3	857.3	857.2	857.2	857.2	857.2
857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2	857.2
857.2	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1	857.1
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0	857.0
857.0	857.0	857.0	857.0	857.0	857.0	856.9	856.9	856.9	856.9

PEAK OUTFLOW IS 381, AT TIME 15.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	381.	96.	27.	26.	7785.
CMS	11.	3.	1.	1.	220.
INCHES		11.38	12.57	12.57	12.57
MM		289.17	319.34	319.34	319.34
AC-FT		49.	54.	54.	54.
THOUS CU M		60.	66.	66.	66.

****

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS FOR NO. 30508 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30508	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.61	0.00	.61	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-87.00	0.00	0.00

CURVE NO = -87.00 WETNESS = -1.00 EFFECT CN = 87.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= 1.24

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 15 END OF PERIOD ORDINATES, TC= 8.00 HOURS, LAG= 4.80 MDL= 1.00

195. 673. 1026. 992. 732. 485. 265. 164. 108. 66.
39. 24. 15. 10. 6. 3.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.20	.19	.01	854.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.19	.01	876.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.19	.01	891.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.19	.01	900.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.20	.19	.01	907.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.19	.01	911.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.23	.01	922.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.23	.01	951.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.24	.23	.01	993.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.23	.01	1033.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.24	.00	1068.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.30	162	.24	.24	.00	1080.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.35	163	.24	.24	.00	1092.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.40	164	.24	.24	.00	1099.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.45	165	.24	.24	.00	1104.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.50	166	.24	.24	.00	1108.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.55	167	.24	.24	.00	1110.
1.01	1.30	18	.01	0.00	.01	0.	1.01	14.00	168	.24	.24	.00	1112.
1.01	1.35	19	.01	0.00	.01	0.	1.01	14.05	169	.30	.30	.00	1120.
1.01	1.40	20	.01	0.00	.01	0.	1.01	14.10	170	.30	.30	.00	1166.
1.01	1.45	21	.01	0.00	.01	0.	1.01	14.15	171	.30	.30	.00	1227.
1.01	1.50	22	.01	0.00	.01	0.	1.01	14.20	172	.30	.30	.00	1286.
1.01	1.55	23	.01	.00	.01	0.	1.01	14.25	173	.30	.30	.00	1331.
1.01	2.00	24	.01	.00	.01	0.	1.01	14.30	174	.30	.30	.00	1357.
1.01	2.05	25	.01	.00	.01	0.	1.01	14.35	175	.30	.30	.00	1373.
1.01	2.10	26	.01	.00	.01	1.	1.01	14.40	176	.30	.30	.00	1384.
1.01	2.15	27	.01	.00	.01	1.	1.01	14.45	177	.30	.30	.00	1390.
1.01	2.20	28	.01	.00	.01	2.	1.01	14.50	178	.30	.30	.00	1395.
1.01	2.25	29	.01	.00	.01	3.	1.01	14.55	179	.30	.30	.00	1398.
1.01	2.30	30	.01	.00	.01	4.	1.01	15.00	180	.30	.30	.00	1400.
1.01	2.35	31	.01	.00	.01	5.	1.01	15.05	181	.18	.18	.00	1378.
1.01	2.40	32	.01	.00	.01	6.	1.01	15.10	182	.36	.36	.00	1336.
1.01	2.45	33	.01	.00	.01	7.	1.01	15.15	183	.36	.36	.00	1339.
1.01	2.50	34	.01	.00	.01	8.	1.01	15.20	184	.55	.54	.00	1446.
1.01	2.55	35	.01	.00	.01	9.	1.01	15.25	185	.64	.63	.00	1678.
1.01	3.00	36	.01	.00	.01	10.	1.01	15.30	186	1.55	1.54	.01	2185.
1.01	3.05	37	.01	.00	.01	10.	1.01	15.35	187	2.55	2.54	.01	3308.
1.01	3.10	38	.01	.00	.01	11.	1.01	15.40	188	1.00	1.00	.00	4868.
1.01	3.15	39	.01	.00	.01	12.	1.01	15.45	189	.64	.64	.00	5830.
1.01	3.20	40	.01	.00	.01	13.	1.01	15.50	190	.55	.55	.00	5729.
1.01	3.25	41	.01	.00	.01	14.	1.01	15.55	191	.36	.36	.00	5529.
1.01	3.30	42	.01	.00	.01	14.	1.01	16.00	192	.36	.36	.00	5029.
1.01	3.35	43	.01	.00	.01	15.	1.01	16.05	193	.28	.28	.00	3193.
1.01	3.40	44	.01	.00	.01	16.	1.01	16.10	194	.28	.28	.00	2558.
1.01	3.45	45	.01	.00	.01	17.	1.01	16.15	195	.28	.28	.00	2118.
1.01	3.50	46	.01	.00	.01	17.	1.01	16.20	196	.28	.28	.00	1820.
1.01	3.55	47	.01	.00	.01	18.	1.01	16.25	197	.28	.28	.00	1627.
1.01	4.00	48	.01	.00	.01	19.	1.01	16.30	198	.28	.28	.00	1509.
1.01	4.05	49	.01	.00	.01	19.	1.01	16.35	199	.28	.28	.00	1438.
1.01	4.10	50	.01	.00	.01	20.	1.01	16.40	200	.28	.28	.00	1391.
1.01	4.15	51	.01	.00	.01	21.	1.01	16.45	201	.28	.28	.00	1362.

1.01	4.20	52	.01	.00	.01	21.	1.01	16.50	202	.20	.20	.00	1341.	
1.01	4.25	53	.01	.01	.01	22.	1.01	16.55	203	.20	.20	.00	1328.	
1.01	4.30	54	.01	.01	.01	22.	1.01	17.00	204	.20	.20	.00	1323.	
1.01	4.35	56	.01	.01	.01	23.	1.01	17.05	205	.22	.22	.00	1309.	
1.01	4.40	56	.01	.01	.01	24.	1.01	17.10	206	.22	.22	.00	1267.	
1.01	4.45	57	.01	.01	.01	24.	1.01	17.15	207	.22	.22	.00	1205.	
1.01	4.50	58	.01	.01	.01	25.	1.01	17.20	208	.22	.22	.00	1146.	
1.01	4.55	59	.01	.01	.01	25.	1.01	17.25	209	.22	.22	.00	1103.	
1.01	5.00	60	.01	.01	.01	26.	1.01	17.30	210	.22	.22	.00	1077.	
1.01	5.05	61	.01	.01	.01	26.	1.01	17.35	211	.22	.22	.00	1061.	
1.01	5.10	62	.01	.01	.01	27.	1.01	17.40	212	.22	.22	.00	1052.	
1.01	5.15	63	.01	.01	.01	27.	1.01	17.45	213	.22	.22	.00	1045.	
1.01	5.20	64	.01	.01	.01	28.	1.01	17.50	214	.22	.22	.00	1042.	
1.01	5.25	65	.01	.01	.01	28.	1.01	17.55	215	.22	.22	.00	1040.	
1.01	5.30	66	.01	.01	.01	29.	1.01	18.00	216	.22	.22	.00	1038.	
1.01	5.35	67	.01	.01	.01	29.	1.01	18.05	217	.02	.02	.00	998.	
1.01	5.40	68	.01	.01	.01	30.	1.01	18.10	218	.02	.02	.00	860.	
1.01	5.45	69	.01	.01	.01	30.	1.01	18.15	219	.02	.02	.00	659.	
1.01	5.50	70	.01	.01	.01	30.	1.01	18.20	220	.02	.02	.00	463.	
1.01	5.55	71	.01	.01	.01	31.	1.01	18.25	221	.02	.02	.00	317.	
1.01	6.00	72	.01	.01	.01	31.	1.01	18.30	222	.02	.02	.00	232.	
1.01	6.06	73	.07	.04	.03	37.	1.01	18.35	223	.02	.02	.00	179.	
1.01	6.10	74	.07	.04	.04	57.	1.01	18.40	224	.02	.02	.00	146.	
1.01	6.15	75	.07	.04	.03	88.	1.01	18.45	225	.02	.02	.00	126.	
1.01	6.20	76	.07	.04	.03	120.	1.01	18.50	226	.02	.02	.00	113.	
1.01	6.25	77	.07	.04	.02	146.	1.01	18.55	227	.02	.02	.00	106.	
1.01	6.30	78	.07	.04	.02	164.	1.01	19.00	228	.02	.02	.00	101.	
1.01	6.35	79	.07	.04	.02	177.	1.01	19.05	229	.02	.02	.00	98.	
1.01	6.40	80	.07	.05	.02	188.	1.01	19.10	230	.02	.02	.00	96.	
1.01	6.45	81	.07	.05	.02	197.	1.01	19.15	231	.02	.02	.00	95.	
1.01	6.50	82	.07	.05	.02	204.	1.01	19.20	232	.02	.02	.00	94.	
1.01	6.55	83	.07	.05	.02	211.	1.01	19.25	233	.02	.02	.00	94.	
1.01	7.00	84	.07	.05	.02	216.	1.01	19.30	234	.02	.02	.00	94.	
1.01	7.05	85	.07	.05	.02	221.	1.01	19.35	235	.02	.02	.00	94.	
1.01	7.10	86	.07	.05	.02	226.	1.01	19.40	236	.02	.02	.00	94.	
1.01	7.15	87	.07	.05	.02	230.	1.01	19.45	237	.02	.02	.00	94.	
1.01	7.20	88	.07	.05	.01	234.	1.01	19.50	238	.02	.02	.00	94.	
1.01	7.25	89	.07	.05	.01	238.	1.01	19.55	239	.02	.02	.00	94.	
1.01	7.30	90	.07	.05	.01	241.	1.01	20.00	240	.02	.02	.00	94.	
1.01	7.35	91	.07	.05	.01	244.	1.01	20.05	241	.02	.02	.00	94.	
1.01	7.40	92	.07	.05	.01	247.	1.01	20.10	242	.02	.02	.00	94.	
1.01	7.45	93	.07	.05	.01	250.	1.01	20.15	243	.02	.02	.00	94.	
1.01	7.50	94	.07	.06	.01	252.	1.01	20.20	244	.02	.02	.00	94.	
1.01	7.55	95	.07	.06	.01	255.	1.01	20.25	245	.02	.02	.00	94.	
1.01	8.00	96	.07	.06	.01	257.	1.01	20.30	246	.02	.02	.00	94.	
1.01	8.05	97	.07	.06	.01	259.	1.01	20.35	247	.02	.02	.00	94.	
1.01	8.10	98	.07	.06	.01	261.	1.01	20.40	248	.02	.02	.00	94.	
1.01	8.15	99	.07	.06	.01	263.	1.01	20.45	249	.02	.02	.00	94.	
1.01	8.20	100	.07	.06	.01	265.	1.01	20.50	250	.02	.02	.00	94.	
1.01	8.25	101	.07	.06	.01	267.	1.01	20.55	251	.02	.02	.00	94.	
1.01	8.30	102	.07	.06	.01	268.	1.01	21.00	252	.02	.02	.00	94.	
1.01	8.35	103	.07	.06	.01	270.	1.01	21.05	253	.02	.02	.00	94.	
1.01	8.40	104	.07	.06	.01	271.	1.01	21.10	254	.02	.02	.00	94.	
1.01	8.45	105	.07	.06	.01	273.	1.01	21.15	255	.02	.02	.00	94.	
1.01	8.50	106	.07	.06	.01	274.	1.01	21.20	256	.02	.02	.00	94.	
1.01	8.55	107	.07	.06	.01	275.	1.01	21.25	257	.02	.02	.00	94.	
1.01	9.00	108	.07	.06	.01	277.	1.01	21.30	258	.02	.02	.00	94.	
1.01	9.05	109	.07	.06	.01	278.	1.01	21.35	259	.02	.02	.00	94.	
1.01	9.10	110	.07	.06	.01	279.	1.01	21.40	260	.02	.02	.00	94.	
1.01	9.15	111	.07	.06	.01	280.	1.01	21.45	261	.02	.02	.00	94.	

1.01	9.20	118	.07	.06	.01	881.	1.01	21.80	268	.02	.02	.00	94.
1.01	9.25	119	.07	.06	.01	882.	1.01	21.55	269	.02	.02	.00	94.
1.01	9.30	114	.07	.06	.01	283.	1.01	22.00	264	.02	.02	.00	94.
1.01	9.35	115	.07	.06	.01	284.	1.01	22.05	266	.02	.02	.00	94.
1.01	9.40	116	.07	.06	.01	285.	1.01	22.10	266	.02	.02	.00	94.
1.01	9.45	117	.07	.06	.01	285.	1.01	22.15	267	.02	.02	.00	94.
1.01	9.50	118	.07	.06	.01	886.	1.01	22.20	268	.02	.02	.00	94.
1.01	9.55	119	.07	.06	.01	287.	1.01	22.25	269	.02	.02	.00	94.
1.01	10.00	120	.07	.06	.01	288.	1.01	22.30	270	.02	.02	.00	94.
1.01	10.05	121	.07	.06	.01	288.	1.01	22.35	271	.02	.02	.00	94.
1.01	10.10	122	.07	.06	.01	289.	1.01	22.40	272	.02	.02	.00	94.
1.01	10.15	123	.07	.06	.00	290.	1.01	22.45	273	.02	.02	.00	94.
1.01	10.20	124	.07	.06	.00	290.	1.01	22.50	274	.02	.02	.00	94.
1.01	10.25	125	.07	.06	.00	291.	1.01	22.55	275	.02	.02	.00	94.
1.01	10.30	126	.07	.06	.00	291.	1.01	23.00	276	.02	.02	.00	94.
1.01	10.35	127	.07	.06	.00	292.	1.01	23.05	277	.02	.02	.00	94.
1.01	10.40	128	.07	.06	.00	293.	1.01	23.10	278	.02	.02	.00	94.
1.01	10.45	129	.07	.06	.00	293.	1.01	23.15	279	.02	.02	.00	94.
1.01	10.50	130	.07	.06	.00	294.	1.01	23.20	280	.02	.02	.00	94.
1.01	10.55	131	.07	.06	.00	294.	1.01	23.25	281	.02	.02	.00	94.
1.01	11.00	132	.07	.06	.00	295.	1.01	23.30	282	.02	.02	.00	94.
1.01	11.05	133	.07	.06	.00	295.	1.01	23.35	283	.02	.02	.00	94.
1.01	11.10	134	.07	.06	.00	295.	1.01	23.40	284	.02	.02	.00	94.
1.01	11.15	135	.07	.06	.00	296.	1.01	23.45	285	.02	.02	.00	94.
1.01	11.20	136	.07	.06	.00	296.	1.01	23.50	286	.02	.02	.00	94.
1.01	11.25	137	.07	.06	.00	297.	1.01	23.55	287	.02	.02	.00	94.
1.01	11.30	138	.07	.06	.00	297.	1.02	0.00	288	.02	.02	.00	94.
1.01	11.35	139	.07	.06	.00	297.	1.02	.05	289	0.00	0.00	0.00	90.
1.01	11.40	140	.07	.06	.00	298.	1.02	.10	290	0.00	0.00	0.00	77.
1.01	11.45	141	.07	.06	.00	298.	1.02	.15	291	0.00	0.00	0.00	56.
1.01	11.50	142	.07	.06	.00	298.	1.02	.20	292	0.00	0.00	0.00	37.
1.01	11.55	143	.07	.06	.00	299.	1.02	.25	293	0.00	0.00	0.00	22.
1.01	12.00	144	.07	.06	.00	299.	1.02	.30	294	0.00	0.00	0.00	14.
1.01	12.05	145	.20	.19	.01	324.	1.02	.35	295	0.00	0.00	0.00	8.
1.01	12.10	146	.20	.19	.01	410.	1.02	.40	296	0.00	0.00	0.00	5.
1.01	12.15	147	.20	.19	.01	542.	1.02	.45	297	0.00	0.00	0.00	3.
1.01	12.20	148	.20	.19	.01	668.	1.02	.50	298	0.00	0.00	0.00	2.
1.01	12.25	149	.20	.19	.01	762.	1.02	.55	299	0.00	0.00	0.00	1.
1.01	12.30	150	.20	.19	.01	818.	1.02	1.00	300	0.00	0.00	0.00	1.
									SUM	31.20	29.48	1.72	1391554.
										(792.)(749.)(44.)(3940.43)			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5830.	1539.	983.	464.	1391664.
CMS	165.	44.	28.	13.	3941.
INCHES		23.48	29.48	29.48	29.48
MM		596.29	748.68	748.68	748.68
AC-FT		763.	958.	958.	958.
THOUS CU M		942.	1182.	1182.	1182.

HYDROGRAPH AT STA 30508 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	2.	3.	4.
5.	6.	7.	8.	9.	10.	10.	11.	12.	13.
14.	14.	15.	16.	17.	17.	18.	19.	19.	20.
21.	21.	22.	22.	23.	24.	24.	25.	25.	26.

26.	27.	27.	28.	24.	29.	29.	29.	30.	30.	
31.	31.	32.	57.	48.	120.	146.	169.	177.	188.	
197.	204.	211.	216.	221.	226.	230.	234.	238.	241.	
244.	247.	250.	252.	255.	257.	259.	261.	263.	265.	
267.	268.	270.	271.	273.	274.	275.	277.	278.	279.	
280.	281.	282.	283.	284.	285.	285.	286.	287.	288.	
288.	289.	290.	290.	291.	291.	292.	293.	293.	294.	
294.	295.	295.	295.	296.	296.	297.	297.	297.	298.	
298.	298.	299.	299.	324.	410.	542.	668.	762.	818.	
854.	876.	891.	903.	907.	911.	922.	951.	993.	1033.	
1062.	1080.	1092.	1099.	1104.	1104.	1110.	1112.	1125.	1166.	
1227.	1286.	1331.	1357.	1375.	1384.	1390.	1395.	1398.	1400.	
1376.	1336.	1339.	1446.	1678.	2185.	3306.	4860.	5830.	5729.	
4925.	3929.	3153.	2558.	2115.	1820.	1627.	1509.	1436.	1391.	
1362.	1341.	1328.	1323.	1309.	1267.	1208.	1146.	1103.	1077.	
1061.	1052.	1045.	1042.	1040.	1038.	998.	864.	669.	463.	
317.	232.	179.	146.	124.	113.	106.	101.	98.	96.	
95.	94.	94.	94.	94.	94.	94.	94.	94.	94.	
94.	94.	94.	94.	94.	94.	94.	94.	94.	94.	
94.	94.	94.	94.	94.	94.	94.	94.	94.	94.	
94.	94.	94.	94.	94.	94.	94.	94.	94.	94.	
94.	94.	94.	94.	94.	94.	94.	94.	94.	94.	
94.	94.	94.	94.	94.	94.	94.	94.	98.	77.	
56.	37.	22.	14.	8.	5.	3.	2.	1.	1.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3430.	1533.	483.	464.	139166.
CMS	165.	44.	14.	13.	3941.
INCHES		23.48	29.48	29.48	29.48
MM		596.29	748.68	748.68	748.68
AC-FT		763.	958.	958.	958.
THOUS CU M		942.	1182.	1182.	1182.

HYDROGRAPH AT STA 30508 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	1.	1.	2.	2.	
3.	3.	3.	4.	4.	5.	5.	6.	6.	6.	
7.	7.	8.	8.	8.	9.	9.	9.	10.	10.	
10.	11.	11.	11.	12.	12.	12.	12.	13.	13.	
13.	13.	14.	14.	14.	14.	15.	15.	15.	15.	
15.	16.	19.	29.	44.	60.	73.	82.	89.	94.	
98.	102.	105.	108.	111.	113.	115.	117.	119.	120.	
122.	123.	125.	126.	127.	128.	130.	131.	132.	132.	
133.	134.	135.	136.	136.	137.	138.	138.	139.	139.	
140.	140.	141.	141.	142.	142.	143.	143.	143.	144.	
144.	145.	145.	145.	145.	146.	146.	146.	147.	147.	
147.	147.	147.	148.	148.	148.	148.	149.	149.	149.	
149.	149.	149.	150.	162.	205.	271.	334.	381.	409.	
427.	438.	445.	450.	453.	456.	461.	475.	496.	516.	
531.	540.	546.	550.	552.	554.	555.	556.	862.	883.	
614.	643.	665.	678.	687.	692.	695.	697.	699.	700.	
689.	668.	670.	723.	839.	1092.	1693.	2430.	2915.	2885.	
2863.	1964.	1376.	1279.	1019.	910.	813.	754.	718.	696.	
681.	671.	660.	661.	654.	634.	603.	573.	551.	539.	
531.	526.	523.	521.	520.	510.	489.	432.	389.	351.	
158.	116.	89.	73.	63.	57.	53.	50.	49.	48.	
47.	47.	47.	47.	47.	47.	47.	47.	47.	47.	

47.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	45.	38.
21.	18.	11.	7.	4.	3.	2.	1.	1.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2915.	770.	242.	232.	69587.
CMS	83.	22.	7.	7.	1970.
INCHES		11.74	14.74	14.74	14.74
MM		298.14	374.34	374.34	374.34
AC-FT		582.	479.	479.	479.
THOUS CU M		471.	591.	591.	591.

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS BEFORE ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5050	2	0	0	0	2	1	0	0

SUM OF 2 HYDROGRAPHS AT 5050 PLAN 1 RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	2.	3.	4.
5.	6.	7.	8.	9.	10.	11.	11.	12.	13.
14.	15.	15.	16.	17.	18.	18.	19.	20.	20.
21.	22.	23.	23.	24.	24.	24.	25.	26.	26.
27.	27.	28.	28.	29.	29.	30.	30.	30.	31.
31.	32.	39.	58.	89.	121.	147.	165.	179.	190.
199.	206.	215.	214.	224.	228.	233.	237.	241.	244.
247.	250.	253.	256.	259.	261.	263.	265.	267.	269.
271.	273.	274.	276.	278.	279.	280.	282.	283.	284.
285.	286.	287.	288.	289.	290.	291.	296.	308.	315.
320.	328.	326.	324.	328.	329.	330.	331.	331.	332.
333.	333.	334.	334.	335.	335.	336.	336.	336.	337.
337.	338.	338.	338.	367.	466.	615.	756.	862.	925.
965.	991.	1008.	1018.	1026.	1031.	1045.	1076.	1123.	1166.
1201.	1222.	1235.	1243.	1249.	1253.	1256.	1258.	1273.	1319.
1389.	1455.	1505.	1534.	1553.	1565.	1573.	1578.	1581.	1583.
1559.	1511.	1516.	1659.	1903.	2478.	3772.	5641.	6693.	6867.
5496.	4361.	3518.	2866.	2360.	2049.	1834.	1703.	1622.	1572.
1539.	1517.	1502.	1496.	1480.	1455.	1363.	1296.	1248.	1219.
1201.	1190.	1183.	1178.	1176.	1174.	1129.	974.	792.	628.
550.	263.	205.	165.	142.	128.	119.	114.	111.	109.
107.	107.	107.	107.	107.	107.	107.	107.	107.	107.
107.	107.	107.	107.	107.	107.	107.	107.	107.	107.
107.	107.	107.	107.	107.	107.	107.	107.	107.	107.
107.	107.	107.	107.	107.	107.	107.	107.	107.	107.
107.	107.	107.	107.	107.	107.	107.	107.	107.	107.
107.	107.	107.	107.	107.	107.	107.	107.	102.	87.
60.	43.	28.	20.	14.	11.	9.	8.	7.	7.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6693.	1741.	542.	520.	156072.
CMS	190.	49.	15.	15.	4419.
INCHES		23.48	29.22	29.22	29.22
MM		596.27	742.28	742.28	742.28
AC-FT		863.	1075.	1075.	1075.
THOUS CU M		1065.	1326.	1326.	1326.

SUM OF 2 HYDROGRAPHS AT 30506 PLAN 1 RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	2.	2.
3.	3.	3.	4.	4.	5.	5.	6.	6.	7.
7.	7.	8.	8.	8.	9.	9.	9.	10.	10.
10.	11.	11.	11.	12.	12.	12.	13.	13.	13.
13.	14.	14.	14.	14.	15.	15.	15.	15.	15.
16.	17.	19.	29.	45.	60.	73.	82.	89.	95.
99.	103.	106.	109.	112.	114.	116.	118.	120.	122.
124.	125.	127.	128.	129.	131.	132.	133.	134.	135.
136.	137.	138.	139.	139.	140.	141.	141.	142.	143.
143.	144.	144.	145.	146.	146.	147.	147.	147.	148.
148.	149.	149.	149.	150.	150.	150.	151.	151.	151.
152.	152.	152.	152.	153.	153.	153.	153.	154.	154.
154.	154.	154.	155.	167.	217.	276.	339.	387.	416.
433.	447.	461.	495.	505.	511.	519.	536.	561.	583.
602.	611.	617.	622.	624.	626.	625.	629.	636.	660.
695.	726.	752.	767.	777.	782.	786.	789.	790.	792.
779.	765.	758.	819.	951.	1279.	1879.	2759.	3295.	3226.
2773.	2220.	1784.	1445.	1199.	1030.	920.	853.	812.	787.
770.	759.	751.	745.	740.	716.	681.	648.	624.	609.
600.	595.	591.	589.	554.	587.	564.	437.	371.	261.
180.	131.	101.	83.	71.	64.	60.	57.	55.	54.
54.	53.	54.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	53.	53.	53.	53.
53.	53.	53.	53.	53.	53.	53.	53.	51.	44.
34.	24.	17.	13.	10.	9.	7.	7.	6.	6.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3295.	867.	269.	258.	77368.
CMS	93.	25.	8.	7.	2191.
INCHES		11.68	14.49	14.49	14.49
MM		296.79	367.96	367.96	367.96
AC-FT		430.	533.	533.	533.
THOUS CU M		530.	657.	657.	657.

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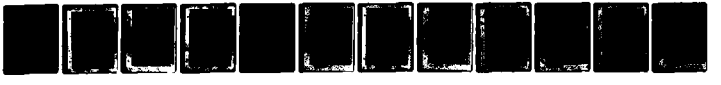
HYDROGRAPH ROUTING

AD-A106 112 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. HUELIN MCDANIELS DAM (MO 30508), M--ETC(U)
SEP 79 W G SHIFRIN DACW43-79-C-0075
UNCLASSIFIED NL

2 ± 2



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SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

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

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	S3050H	.08	1	1042.	521.
		(.21)		(29.51)	(14.75)
ROUTED TO	S3050H	.08	1	468.	381.
		(.21)		(24.45)	(10.78)
HYDROGRAPH AT	30507	.61	1	5830.	2915.
		(1.58)		(165.08)	(82.54)
2 COMBINED	3050G	.69	1	6695.	3295.
		(1.79)		(189.54)	(93.32)
ROUTED TO	3050G	.69	1	4960.	2237.
		(1.79)		(137.63)	(63.32)

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	855.00	885.00	857.00
STORAGE	26.	26.	56.
OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	858.57	1.57	85.	864.	14.50	15.75	0.00
.53	857.89	.89	41.	381.	11.42	15.75	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	835.00	835.00	859.50
STORAGE	107.	107.	2154.
OUTFLOW	0.	0.	120.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	891.92	2.42	344.	4860.	8.83	16.00	0.00
.50	890.39	1.39	285.	2253.	5.67	16.00	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

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

RUN DATE* 79/06/26.
    TIME* 11.46.59.

                    DAM SAFETY INSPECTION - MISSOURI
                    HUELLN McDANIELS DAM (30508)
                    PERCENT OF PMF DETERMINATION AND ROUTING

                              JOB SPECIFICATION
        NQ    NHR    NMIN    IDAY    IHR    IMIN    METRC    IPLT    IPRT    NSTAN
       300      0       5       0      0       0        0       0       4        0
                             JOPER    NWT   LROPT    TRACE
                                 5      0       0        0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                       NPLAN= 1 NRTIO= 9 LRTIO= 1
        RTIOS=   .10   .11   .12   .13   .14   .15   .16   .17   .18

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

                    SUB-AREA RUNOFF COMPUTATION

   INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS, FOR UPSTREAM DAM

             ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME  ISTAGE  IAUTO
            S30508       0       0       0      0      0       1       0      0

                              HYDROGRAPH DATA
    IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
        1      2     .08   -0.00     .08    1.00   0.000       0       0       0

                                PRECIP DATA
          SPFE     PMS      R6     R12     R24     R48     R72     R96
          0.00   24.00  100.00  120.00  130.00    0.00    0.00    0.00

                                 LOSS DATA
  LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
      0   0.00   0.00   1.00   0.00   0.00   1.00  -1.00 -87.00   0.00   0.00

       CURVE NO = -87.00  WETNESS =  -1.00  EFFECT CN =  87.00

                          UNIT HYDROGRAPH DATA
                       TC= 0.00     LAG=  .11

                             RECESSION DATA
                STRTQ=  -1.00    QRCSN=  0.00    RTIOR= 1.00

                          END-OF-PERIOD FLOW
  MO.DA HR.MN PERIOD  RAIN  EXCS  LOSS  COMP Q     MO.DA HR.MN PERIOD  RAIN  EXCS  LOSS  COMP Q
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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH UPSTREAM DAM TO MD. 30508 DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30508	1	0	0	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0		0.000	0.000	0.000	-855.	-1

STAGE	855.00	856.00	857.00	858.00	859.00	861.00	863.00
FLOW	0.00	0.00	0.00	926.00	1192.00	3357.00	5160.00
CAPACITY=	0.	26.	36.	53.	236.		
ELEVATION=	857.	855.	857.	860.	880.		

CREL	SPWID	COOL	EXPW	ELEVL	COOL	CAREA	EXPL
855.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
857.0	0.0	0.0	0.

PEAK OUTFLOW IS 5. AT TIME 14.17 HOURS

PEAK OUTFLOW IS 16. AT TIME 17.17 HOURS

PEAK OUTFLOW IS 21. AT TIME 17.00 HOURS

PEAK OUTFLOW IS 34. AT TIME 14.08 HOURS

PEAK OUTFLOW IS 53. AT TIME 15.92 HOURS

PEAK OUTFLOW IS 78. AT TIME 15.83 HOURS

PEAK OUTFLOW IS 824. AT TIME 15.83 HOURS

PEAK OUTFLOW IS 1884. AT TIME 15.83 HOURS

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PEAK OUTFLOW IS     886. AT TIME  15.75 HOURS

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                        SUB-AREA RUNOFF COMPUTATION

      INPUT PRECIPITATION, RATIOS, UNIT HYDROGRAPH PARAMETERS FOR NO. 30508 DAM

            ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME  ISTAGE  IAUTO
            30508     0       0       0       0      0      1       0      0

                              HYDROGRAPH DATA
     IHYDG   IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
       1       2     .61    0.00    .61    1.00    0.000     0       0       0

                               PRECIP DATA
          SPFE    PMS     R6      R12     R24     R48     R72     R96
          0.00   24.00  110.00  120.00  130.00   0.00    0.00    0.00

                                LOSS DATA
   LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
     0     0.00   0.00   1.00   0.00   0.00   1.00  -1.00  -87.00  0.00   0.00

    CURVE NO = -87.00  WETNESS =   -1.00  EFFECT CN =   87.00

                          UNIT HYDROGRAPH DATA
                     TC=  0.00   LAG=   .24

                             RECESSION DATA
              STRTQ=   0.00   QRCSN=   0.00   RTIOR= 1.00

                          END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS   COMP Q    MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS  COMP Q

                                                         SUM  31.20  29.48  1.72  139165.
                                                            ( 792.)( 749.)( 44.)( 3940.43)

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

                           COMBINE HYDROGRAPHS

      COMBINE HYDROGRAPHS BEFORE ROUTING

            ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME  ISTAGE  IAUTO
            30508     2       0       0       0      0      1       0      0

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

                           HYDROGRAPH ROUTING

      ROUTE COMBINED HYDROGRAPH THROUGH NO.        DAM  30608
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ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3850	1	0	0	0	1	1	0	0

ROUTING DATA

AMSKK	ELOSS	AVG	NRES	ISAME	IOPT	IRMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.0000	0.000	-835.	-1

STAGE =	835.00 843.34	837.38	838.78	839.37	839.53	839.79	840.04	840.79	843.54	852.29
FLOW =	0.00 8304.00	50.00	99.00	99.00	120.00	335.00	654.00	1987.00	3778.00	5915.00

CAPACITY=	0.	107.	191.	219.	253.	1391.
ELEVATION =	835.	835.	839.	840.	840.	860.

CSEL	SPILD	COQ	EXPW	ELEVL	COQL	CAREA	EXPL
835.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

4M DATA

TOPEL	COQD	EXPD	DAMWID
839.5	0.0	0.0	0.

PEAK OUTFLOW IS 56. AT TIME 18.33 HOURS

PEAK OUTFLOW IS 79. AT TIME 18.33 HOURS

PEAK OUTFLOW IS 65. AT TIME 18.33 HOURS

PEAK OUTFLOW IS 79. AT TIME 18.33 HOURS

PEAK OUTFLOW IS 93. AT TIME 18.25 HOURS

PEAK OUTFLOW IS 114. AT TIME 18.25 HOURS

PEAK OUTFLOW IS 175. AT TIME 18.08 HOURS

PEAK OUTFLOW IS 210. AT TIME 17.92 HOURS

PEAK OUTFLOW IS 252. AT TIME 17.17 HOURS

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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)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 .10	RATIO 2 .11	RATIO 3 .12	RATIO 4 .13	RATIO 5 .14	RATIO 6 .15	RATIO 7 .16	RATIO 8 .17	RATIO 9 .18
HYDROGRAPH AT	530508	.08 (.21)	1	104. (2.95)	115. (3.26)	125. (3.54)	135. (3.84)	146. (4.13)	156. (4.43)	167. (4.72)	177. (5.02)	188. (5.31)
ROUTED TO	530509	.08 (.21)	1	6. (.17)	16. (.46)	21. (.59)	34. (.97)	53. (1.51)	72. (2.03)	92. (2.60)	109. (3.10)	186. (3.55)
HYDROGRAPH AT	30508	.61 (1.58)	1	535. (15.15)	641. (18.16)	700. (19.81)	758. (21.46)	816. (23.11)	874. (24.76)	933. (26.41)	991. (28.06)	1049. (29.71)
8 COMBINED	30508	.69 (1.79)	1	588. (16.65)	696. (19.71)	725. (19.96)	764. (21.62)	846. (23.97)	931. (26.37)	1015. (28.73)	1098. (31.09)	1175. (33.27)
ROUTED TO	30508	.69 (1.79)	1	58. (1.64)	59. (1.66)	65. (1.83)	79. (2.25)	93. (2.62)	114. (3.23)	175. (4.96)	210. (5.96)	852. (7.13)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	855.00	898.00	897.00
STORAGE	20.	26.	36.
OUTFLOW	0.	0.	6.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	856.95	0.00	35.	6.	0.00	18.17	0.00
.11	857.02	.02	36.	15.	1.50	17.17	0.00
.12	857.05	.04	36.	21.	2.25	17.00	0.00
.13	857.07	.07	36.	34.	2.50	16.08	0.00
.14	857.11	.11	36.	53.	2.67	15.92	0.00
.15	857.16	.16	37.	72.	2.75	15.83	0.00
.16	857.20	.20	37.	92.	2.83	15.83	0.00
.17	857.25	.25	37.	109.	2.92	15.83	0.00
.18	857.29	.29	37.	125.	2.92	15.75	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	835.00	835.00	839.68
STORAGE	10%	10%	21%
OUTFLOW	0.	0.	120.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	838.04	0.00	176.	36.	0.00	18.33	0.00
.11	838.[illegible]	0.00	1[illegible].	59.	0.00	18.33	0.00
.12	838.80	0.00	1[illegible].	65.	0.00	18.33	0.00
.13	839.04	0.00	2[illegible].	79.	0.00	18.33	0.00
.14	839.26	0.00	2[illegible].	93.	0.00	18.25	0.00
.15	839.46	0.00	21[illegible].	114.	0.00	18.25	0.00
.16	839.57	.07	21[illegible].	175.	1.42	18.08	0.00
.17	839.62	.12	[illegible].	210.	[illegible].08	17.42	0.00
.18	839.68	.18	222.	252.	[illegible].58	17.17	0.00