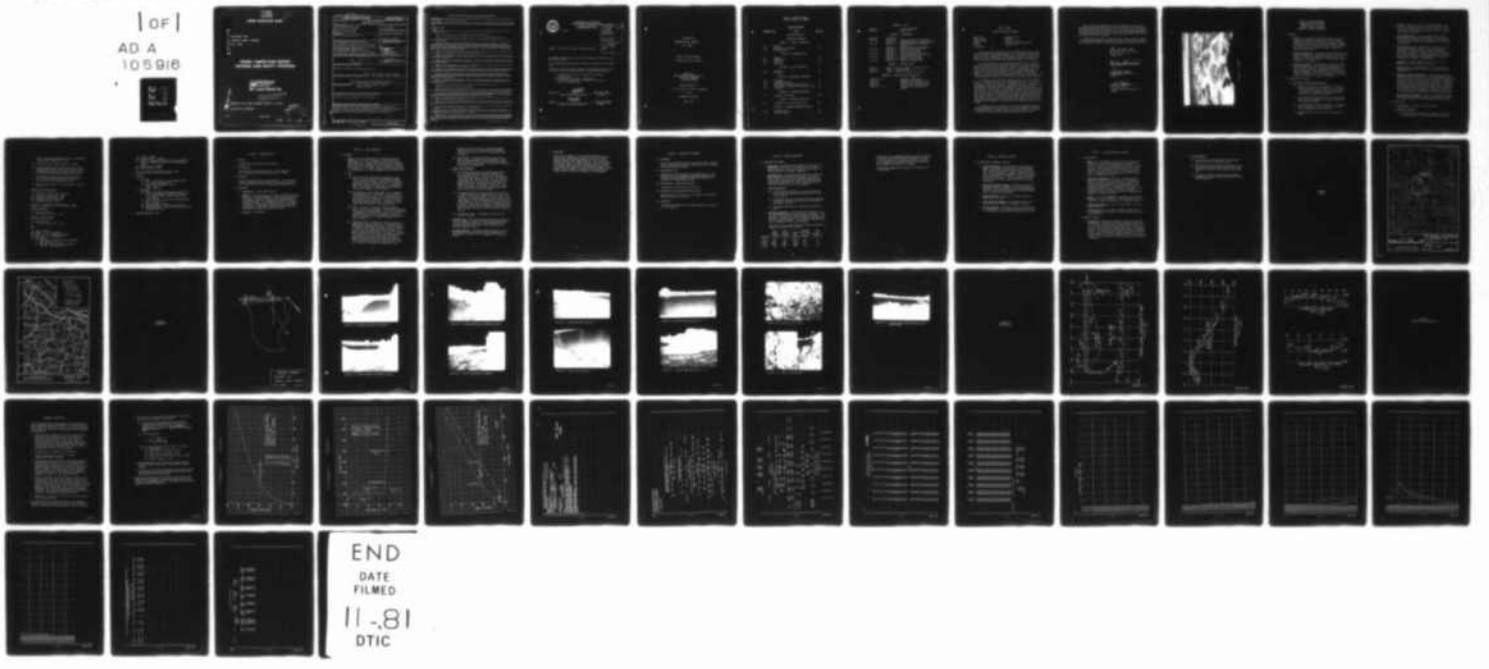
AD-A105 916 HOSKINS-WESTERN-SONDEREGGER INC LINCOLN NE F/G 13/13
NATIONAL DAM SAFETY PROGRAM. SELLENRIEK DAM (MO 31048), OSAGE-G--ETC(U)
JUN 79 R S DECKER, G JAMISON, G ULMER DACW43-79-C-0046

UNCLASSIFIED NL

1 OF 1
AD A 105916



END
DATE FILMED
11-81
DTIC


A
5916
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

OSAGE-GASCONADE BASIN

SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

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

FOR: STATE OF MISSOURI

JUNE, 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105 91
3. RECIPIENT'S CATALOG NUMBER	6
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Sellenriek Dam (MO 31048) Franklin County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hoskins-Western-Sonderegger, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0046
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
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 June 1979
	13. NUMBER OF PAGES Approximately 55
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 12 57	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for release; distribution unlimited.

10 Rey S. /Decker Gordon /Jamison Garold /Ulmer Harold P. /Hoskins

17. DISTRIBUTION STATEMENT (of the abstract entered in Block

6 National Dam Safety Program. Sellenriek Dam (MO 31048), Osage-Gasconade Basin, Franklin County, Missouri. Phase I Inspection 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.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

394131

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

INSTRUCTIONS FOR PREPARATION OF REPORT DOCUMENTATION PAGE

RESPONSIBILITY. The controlling DoD office will be responsible for completion of the Report Documentation Page, DD Form 1473, in all technical reports prepared by or for DoD organizations.

CLASSIFICATION. Since this Report Documentation Page, DD Form 1473, is used in preparing announcements, bibliographies, and data banks, it should be unclassified if possible. If a classification is required, identify the classified items on the page by the appropriate symbol.

COMPLETION GUIDE

General. Make Blocks 1, 4, 5, 6, 7, 11, 13, 15, and 16 agree with the corresponding information on the report cover. Leave Blocks 2 and 3 blank.

Block 1. Report Number. Enter the unique alphanumeric report number shown on the cover.

Block 2. Government Accession No. Leave Blank. This space is for use by the Defense Documentation Center.

Block 3. Recipient's Catalog Number. Leave blank. This space is for the use of the report recipient to assist in future retrieval of the document.

Block 4. Title and Subtitle. Enter the title in all capital letters exactly as it appears on the publication. Titles should be unclassified whenever possible. Write out the English equivalent for Greek letters and mathematical symbols in the title *(see "Abstracting Scientific and Technical Reports of Defense-sponsored RDT/E," AD-667 000)*. If the report has a subtitle, this subtitle should follow the main title, be separated by a comma or semicolon if appropriate, and be initially capitalized. If a publication has a title in a foreign language, translate the title into English and follow the English translation with the title in the original language. Make every effort to simplify the title before publication.

Block 5. Type of Report and Period Covered. Indicate here whether report is interim, final, etc., and, if applicable, inclusive dates of period covered, such as the life of a contract covered in a final contractor report.

Block 6. Performing Organization Report Number. Only numbers other than the official report number shown in Block 1, such as series numbers for in-house reports or a contractor/grantee number assigned by him, will be placed in this space. If no such numbers are used, leave this space blank.

Block 7. Author*(s)*. Include corresponding information from the report cover. Give the name*(s)* of the author*(s)* in conventional order *(for example, John R. Doe or, if author prefers, J. Robert Doe)*. In addition, list the affiliation of an author if it differs from that of the performing organization.

Block 8. Contract or Grant Number*(s)*. For a contractor or grantee report, enter the complete contract or grant number*(s)* under which the work reported was accomplished. Leave blank in in-house reports.

Block 9. Performing Organization Name and Address. For in-house reports enter the name and address, including office symbol, of the performing activity. For contractor or grantee reports enter the name and address of the contractor or grantee who prepared the report and identify the appropriate corporate division, school, laboratory, etc., of the author. List city, state, and ZIP Code.

Block 10. Program Element, Project, Task Area, and Work Unit Numbers. Enter here the number code from the applicable Department of Defense form, such as the DD Form 1498, "Research and Technology Work Unit Summary" or the DD Form 1634, "Research and Development Planning Summary," which identifies the program element, project, task area, and work unit or equivalent under which the work was authorized.

Block 11. Controlling Office Name and Address. Enter the full, official name and address, including office symbol, of the controlling office. *(Equates to funding/sponsoring agency. For definition see DoD Directive 5200.20, "Distribution Statements on Technical Documents.")*

Block 12. Report Date. Enter here the day, month, and year or month and year as shown on the cover.

Block 13. Number of Pages. Enter the total number of pages.

Block 14. Monitoring Agency Name and Address *(if different from Controlling Office)*. For use when the controlling or funding office does not directly administer a project, contract, or grant, but delegates the administrative responsibility to another organization.

Blocks 15 & 15a. Security Classification of the Report: Declassification/Downgrading Schedule of the Report. Enter in 15 the highest classification of the report. If appropriate, enter in 15a the declassification/downgrading schedule of the report, using the abbreviations for declassification/downgrading schedules listed in paragraph 4-207 of DoD 5200.1-R.

Block 16. Distribution Statement of the Report. Insert here the applicable distribution statement of the report from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 17. Distribution Statement *(of the abstract entered in Block 20, if different from the distribution statement of the report)*. Insert here the applicable distribution statement of the abstract from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 18. Supplementary Notes. Enter information not included elsewhere but useful, such as: Prepared in cooperation with . . . Translation of *(or by)* . . . Presented at conference of . . . To be published in . . .

Block 19. Key Words. Select terms or short phrases that identify the principal subjects covered in the report, and are sufficiently specific and precise to be used as index entries for cataloging, conforming to standard terminology. The DoD "Thesaurus of Engineering and Scientific Terms" *(TEST)*, AD-672 000, can be helpful.

Block 20. Abstract. The abstract should be a brief *(not to exceed 200 words)* factual summary of the most significant information contained in the report. If possible, the abstract of a classified report should be unclassified and the abstract to an unclassified report should consist of publicly- releasable information. If the report contains a significant bibliography or literature survey, mention it here. For information on preparing abstracts see "Abstracting Scientific and Technical Reports of Defense-Sponsored RDT&E," AD-667 000.

☆ U.S. G.P.O. 1980-665-141/1299

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

IN REPLY REFER TO

SUBJECT: Sellenriek Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Sellenriek Dam:

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

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

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

SUBMITTED BY: SIGNED
Chief, Engineering Division — 21 SEP 1979 Date

APPROVED: SIGNED
Colonel, CE, District Engineer — 21 SEP 1979 Date

SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

JUNE, 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

TABLE OF CONTENTS

APPENDIX A - MAPS

APPENDIX B - PHOTOGRAPHS

APPENDIX C - PROJECT PLATES

APPENDIX D - HYDRAULIC AND HYDROLOGIC DATA

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Sellenriek Dam
State Located	Missouri
County Located	Franklin County
Stream	Tributary to Big Berger Creek
Date of Inspection	June 27, 1979

Sellenriek Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends approximately three miles downstream of the dam. Within the damage zone are three or more dwellings and associated structures.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the recommended guidelines for a small dam having a high hazard potential. Considering the small volume of water impounded and the large floodplain downstream of the dam, one-half of the Probable Maximum Flood is the appropriate spillway design flood. The spillways will not pass 50% of the probable maximum flood without overtopping the dam. The spillways will pass the 100-year flood (flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillways will pass 40% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meterologic and hydrologic conditions that are reasonably possible in the region.

No design data were available for this dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Other deficiencies observed during the inspection are small trees and brush growing along the water line, considerable erosion of upstream face, muskrat burrows along the water line, a few small cedar trees growing on the downstream slope, scour hole at end of principal spillway outlet is overgrown with brambles and brush and the channel downstream from the dam is overgrown with trees and brush.

Maintenance of this dam is generally good. Several items of preventive maintenance addressed to the minor deficiencies listed above need to be initiated by the owner. These are described in the body of the report.

Rey S. Decker
E-3703

Gordon Jamison

Garold Ulmer
E-4777

H. P. Hoskins
Harold P. Hoskins
Chairman of Board
Hoskins-Western-Sonderegger, Inc.
E-8696

PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SELLENRIEK DAM - MO 31048
FRANKLIN COUNTY, MISSOURI
SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Sellenriek Dam be made.

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

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth fill approximately 730 feet in length and about 32 feet in height. It is located in rolling hills covered with a loess soil mantle 5 to 10 feet in thickness overlying limestone and residual soils derived from limestone.

(2) The principal spillway consists of a 12 inch welded steel pipe with a hooded inlet passing through the base of the embankment.

(3) A vegetated earth emergency spillway is cut through the left abutment. It is trapezoidal in section with a bottom width of about 20 feet.

(4) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the northwestern corner of Franklin County, Missouri, as shown on Plate A-2. The dam is shown on Plate A-1 in the NE¼ of Section 11, T44N, R4W. The lake formed behind the dam is shown in the NE¼ of Section 11, T44N, R4W.

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

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends approximately three miles downstream where three or more dwellings with associated structures are located in the floodplain.

e. Ownership. The dam is owned by Mrs. Helen Sellenriek, 849 White Road, Chesterfield, Mo. 63017.

f. Purpose of Dam. The dam impounds a reservoir containing about 90 acre-feet which is used for recreation and flood retardation.

g. Design and Construction History. The dam was constructed in 1963 by Mr. Sellenriek who was in the land grading and excavation business. Mr. Thorpe, the man who supervised construction of the dam, reported that local S.C.S. personnel assisted in laying out the dam and inspected the core trench. Information from the local S.C.S. office was not available. Mr. Thorpe also reported that material for the dam was good clay borrowed from the valley bottom and adjacent slopes. A core trench was excavated along the centerline. Compaction of the fill was accomplished with the rubber-tired earth moving equipment.

h. Normal Operating Procedure. There are no controlled outlets for this dam. The reservoir level is controlled by rainfall and runoff, evaporation, and the capacity of the spillways.

1.3 PERTINENT DATA

a. Drainage Area. 122 acres (0.19 square miles).

b. Discharge at Damsite.

(1) All discharges at the damsite are through a principal spillway consisting of a 12 inch diameter welded steel

pipe spillway with a hooded inlet and a grassed earth channel ungated emergency spillway.

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

(3) The principal spillway capacity varies from 0 cfs at elevation 652.0 feet to 14 cfs at the crest of the emergency spillway (elevation 654.0 feet) to 15 cfs at the minimum top of dam (elevation 656.9 feet).

(4) The emergency spillway capacity varies from 0 cfs at its crest elevation 654.0 feet to 442 cfs at elevation 656.9 feet (minimum top of dam).

(5) Total spillway capacity at the minimum top of dam is 457 cfs ±.

c. Elevations (feet above MSL).

(1) Top of dam - 657.5+ (656.9 Minimum)
(2) Principal spillway crest - 652±
(3) Emergency spillway crest - 654±
(4) Streambed at centerline - 625±
(5) Maximum tailwater - unknown

d. Reservoir. Length (feet) of maximum pool - 1300 ±

e. Storage (Acre-feet).

(1) Top of dam - 152±
(2) Principal spillway crest - 90±

f. Reservoir Surface (Acres).

(1) Top of dam - 17±
(2) Principal spillway crest - 10±

g. Dam.

(1) Type - earthfill
(2) Length - 730 ft.± (measured)
(3) Height - 34 ft.± (measured, maximum)
(4) Top width - 18 ft.± (measured)
(5) Side slopes.
  (a) Downstream - 3H on 1V (overall, measured) some section 4H on 1V
  (b) Upstream - 3H on 1V (overall, measured) 1H on 1V at high water line

(6) Zoning - unknown
(7) Impervious core - unknown
(8) Cutoff - reported that foundation cutoff bottomed in good clay. Deeper on left end to intercept gravel strata
(9) Grout curtain - unknown
(10) Wave protection - none

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

(1) Principal
(a) Type - uncontrolled, 12 inch diameter welded steel pipe with hooded inlet
(b) Crest (invert) elevation - 652 ft.
Outlet - 623.5 ft.
(c) Length - 161 ft.±
(2) Emergency
(a) Type - uncontrolled vegetated earth channel cut through left abutment, trapezoidal section, 20 ft.± bottom width with side slopes of 9H on 1V or flatter.
(b) Control section - vegetated earth approximately 80 ft. in length
(c) Crest elevation - 654 ft.
(d) Upstream Channel - open and clean, grassed
(e) Downstream Channel - open, well grassed, parallels downstream toe of dam

j. Regulating Outlets. None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mrs. Sellenriek that the dam was constructed in 1963.

2.3 OPERATION

No data were available on spillway operation. It was reported by Mrs. Sellenriek that the reservoir level drops as much as 4 or 5 feet below the principal spillway during drought periods.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusion of this report. 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. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Sellenriek Dam was made on June 27, 1979. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska, making the inspection were: R.S. Decker, Geotechnical; Gordon Jamison, Hydrology; Garold Ulmer, Civil Engineer. Mrs. Sellenriek was present at the dam site. Mr. Everett Thorpe, the man who supervised the construction of the dam, accompanied the inspection team.

b. Dam.

(1) Geology and Soils (Abutment and embankment). Upland soils in the area are CL loessial material probably overlying cherty limestone. Valley slopes (abutments) are silty clay (CL) with cherty gravel. No limestone bedrock was exposed at the site or in the immediate area. Auger holes on the embankment produced plastic CL-CH soil to depths of 2 to 2.5 feet.

(2) Upstream Slope. The upstream slope is well vegetated with adapted grasses. A few small trees and shrubs are growing along the water line. Considerable erosion of the face has occurred at or just above the normal pool elevation (elev. 652-653). A few muskrat burrows were noted along the water line. No slumps or other deformations were noted on the upstream slope.

(3) Crest. The crest is plated with cherty limestone gravel and serves as a roadway. The crest also supports a fair cover of adapted grasses. No cracks or indications of deformation were noted on the crest. The crest is remarkably level for a non-engineered dam with one small swag at elevation 657 ft. and the remainder of the crest at 657.5 ft.

(4) Downstream Slope. The downstream slope is very well vegetated with adapted grasses. A few small cedar trees were observed growing on the slope. A definite bulge is apparent in the downstream slope from about ℄ station 4 + 00 to near the right (east) end of the dam. The man who supervised construction of the dam (Mr. Everett Thorpe) reported that the bulge was caused by overfilling that section due to a mix-up in slope staking during construction. No cracks, rodent holes or signs of abnormal deformation (other than the constructed overfill) were noted on the slope or along the toe of the dam. There was no indication of emergence of the

phreatic line on the slope nor any sign of seepage along the toe or in the stream channel downstream from the pipe outlet. Soils in the downstream slope are good CL.

(5) Miscellaneous. The good vegetative cover and the plastic materials apparent in the embankment indicate that this structure could withstand significant overtopping without serious damage. There was no indication or evidence of overtopping.

c. Appurtenant Structures.

(1) The principal spillway is uncontrolled and consists of a 12 inch welded steel pipe with hooded inlet passing through the dam. The inlet is covered with a wire mesh trash guard which was open. No deterioration of the steel pipe was noted. The scour hole and surrounding area at the outlet end is overgrown with brambles and brush. The reservoir level was 0.7 ft. below the inlet of the spillway at the time of inspection. The bottom of the outlet scour hole and downstream channel were dry when inspected.

(2) The emergency spillway is uncontrolled and consists of a vegetated channel cut through cherty clay on the left abutment. The approach channel is clear and open. The exit channel is clear and open and outlets downstream and roughly parallel with the downstream toe of the dam. All of the emergency spillway is very well vegetated and free of erosion. There was no indication of flow through the emergency spillway nor any evidence of overtopping of the dam. Discharge through the spillway should not endanger the dam.

(3) Drawdown Facilities. No drawdown facilities exist for this structure.

d. Reservoir Area. The area surrounding the reservoir appears to be well grassed. Some erosion was noted around the shoreline but nothing significant. A gravel armored beaching slope has developed in portions of the shoreline. The reservoir water was clear.

e. Downstream Channel. The channel downstream from the principal spillway is armor plated with cherty limestone gravel and appears to be stable. It is overgrown with trees and brush.

3.2 EVALUATION

There does not appear to be any serious potential of failure of this dam. Sideslopes and materials in the dam should provide adequate safety against shear failure. No sign of seepage was noted in the downstream area. Overtopping should not seriously impair the safety of the structure. The minor deficiencies noted (few trees on backslope and wave erosion on upslope) do not appear to require immediate remedial action. However, measures should be initiated in the near future to curtail the activities of the muskrats on the embankment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

Maintenance of this dam appears to be generally good. The muskrats should be eliminated and measures taken to remove the trees from the embankment slopes and to protect the upstream face from continued erosion.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

Upon checking with the owner, we are unaware of any warning system in effect for this dam.

4.5 EVALUATION

There does not appear to be any serious potential of failure of this structure.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam. All computations are based on field inspection and surveys by the consultant. The plan, profiles, and cross sections from the survey are attached in Appendix C.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Dissen, Missouri 7 1/2 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The spillway pipe appeared to be in good condition. A trash rack was located on the hooded inlet and was clear of debris.

(2) The emergency spillway is located in the left abutment of the dam. Spillway releases should not endanger the integrity of the dam.

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

d. Overtopping Potential. The spillways are too small to pass 50% of the probable maximum flood without overtopping. The spillways will pass 40% of the PMF without overtopping. The 100-year (1 percent) peak outflow discharge is approximately 5% of the spillway capacity. This dam could withstand significant overtopping without serious damage.

The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Peak Inflow Discharge cfs	Peak Outflow Discharge cfs	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 656.9	Time Dam Overtopping Hr.
100 Yr.	470	20	654.3	+2.6	0
1/2 PMF	1100	580	657.2	-0.3	1±
PMF	2200	2000	658.0	-1.1	2±
0.4 PMF	890	400	656.7	+0.2	0

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the 1/2 PMF to the PMF is the test for the adequancy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. The dam appears to be structurally stable. The embankment slopes should provide adequate safety factors against shear failures for a dam of this size. There were no seeps, slides or abnormal deformations in the embankment or abutments. Additional studies would be required to determine the effect of overtopping on structural stability. However, it appears that the safety of the dam would not be impaired by significant overtopping.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

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

d. Post Construction Changes. The inspection team is not aware of any post-construction changes on this dam.

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

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. This dam appears to have only a slight potential of failure. Using the approximate data available for analysis, the dam will be overtopped 0.3 foot for a period of 1± hour by one-half the Probable Maximum Flood. The effect of such overtopping on the structural or erosional stability of the dam is not known,but is believed to be minimal. Seepage and stability analyses were unavailable and is considered a deficiency.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. 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 as a matter of record.

c. Urgency. The item recommended in paragraph 7.2a should be pursued on a high priority basis. The curtailment of muskrat activities on the dam should be done in the near future.

d. Necessity for Phase II. Phase II investigation is not considered necessary.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazard-out to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives. Additional information should be obtained on the effects of overtopping and on the topographic characteristics of the reservoir area to determine the increase in the height of dam or the size of the spillway that is necessary to pass one half the Probable Maximum Flood without overtopping the dam. The services of an engineer experienced in the design of dams should be obtained to evaluate the present reservoir storage capacity, to provide seepage, erosional, and stability analyses of the present dam, and to design protective measures, if required.

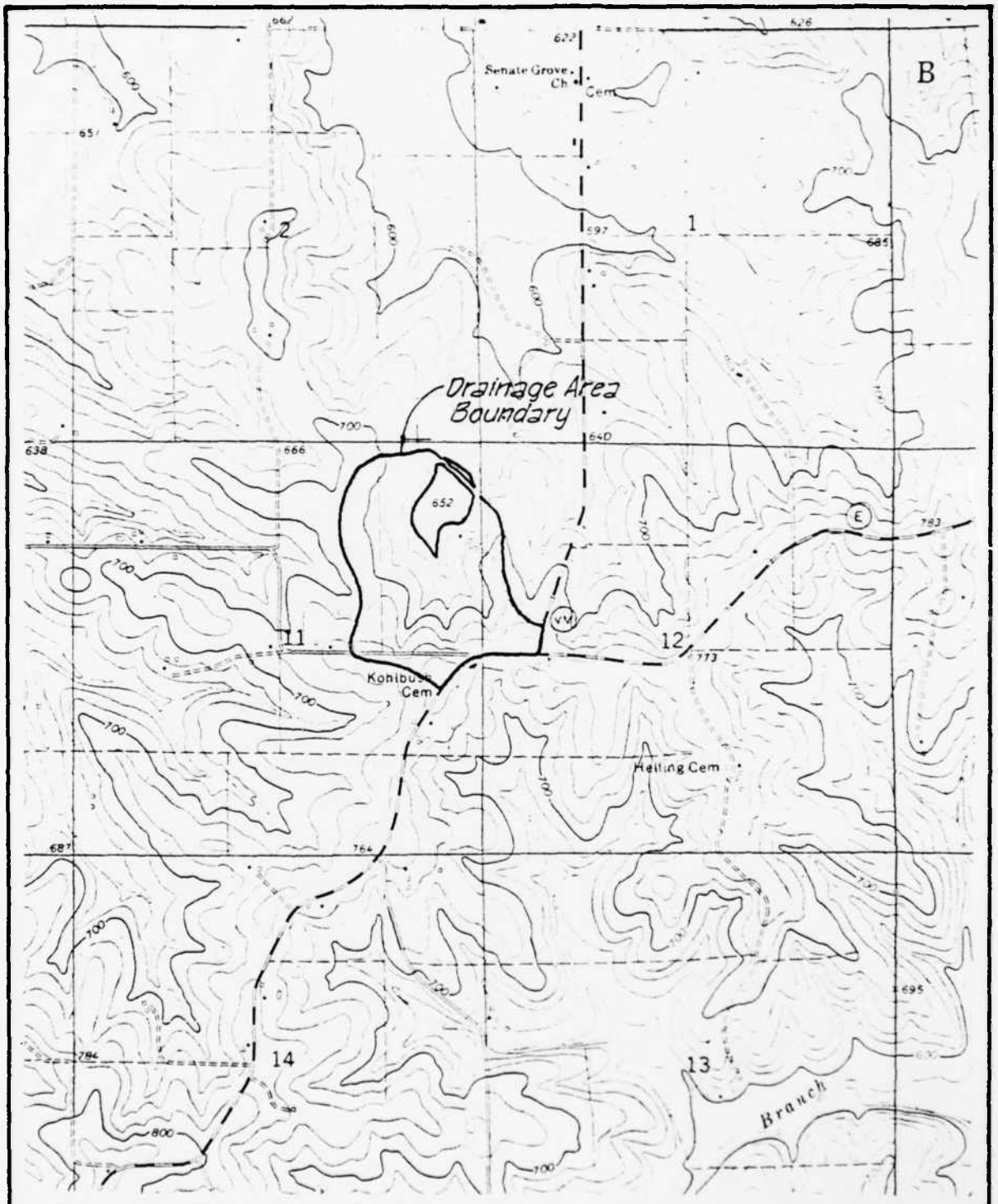
b. O & M Procedures

(1) The activities of the muskrats on the embankment should be curtailed in the near future.

(2) Trees should be removed from the embankment slopes and measures taken to prevent their recurrence and to control the erosion on the upstream face of the dam.

(3) A program of periodic inspection and maintenance implementation should be initiated to control these minor deficiencies.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval 20 Feet

N

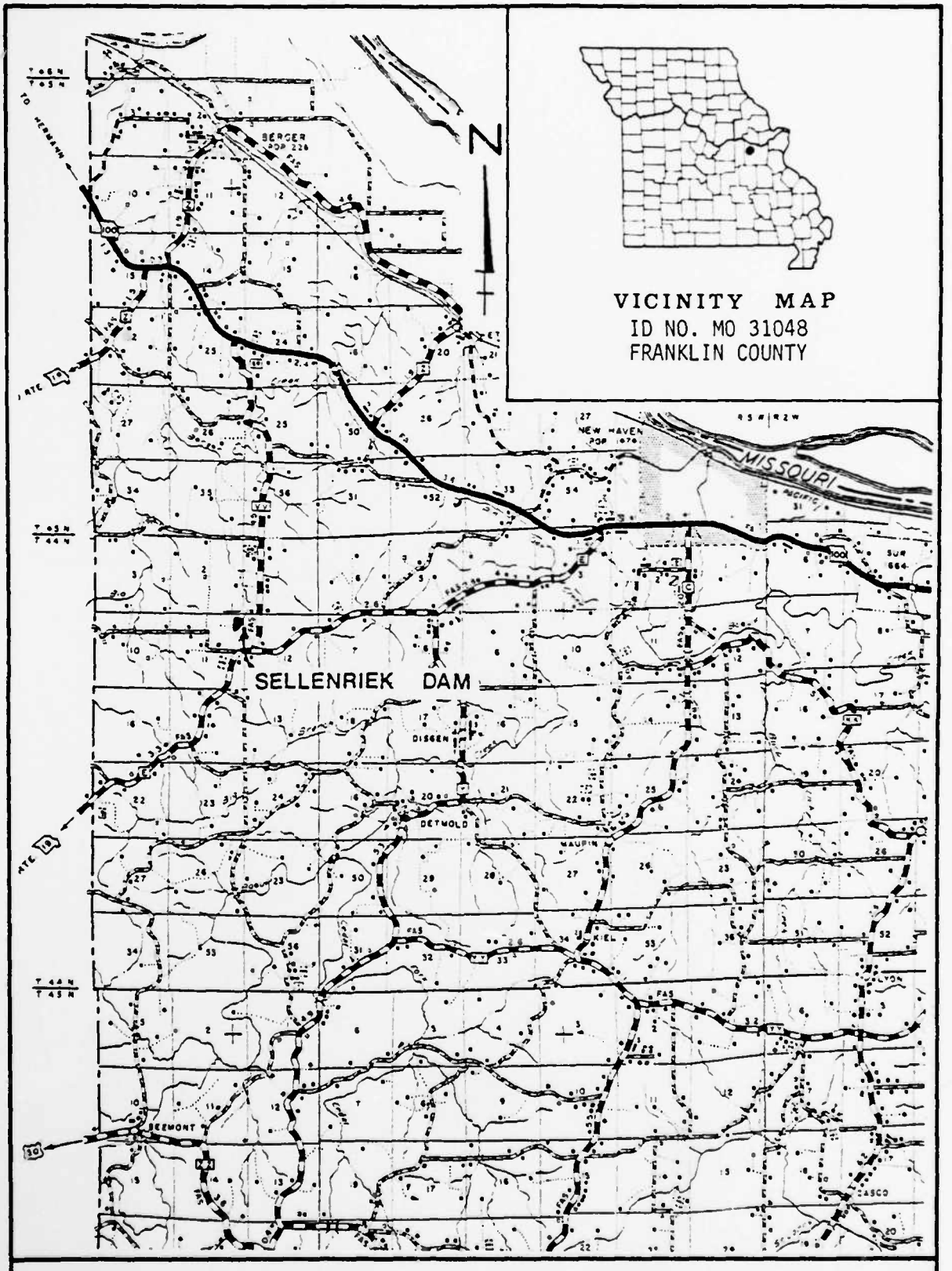
VICINITY TOPOGRAPHY

SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

PLATE A-1


VICINITY MAP
ID NO. MO 31048
FRANKLIN COUNTY
SELLENRIEK DAM
MISSOURI
NEW HAVEN
BERGER
DETMOLD
MAUPIN
DISSEN
SEEMONT
CASCO
N
Scale in miles
0 1 2 3 4 5
LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

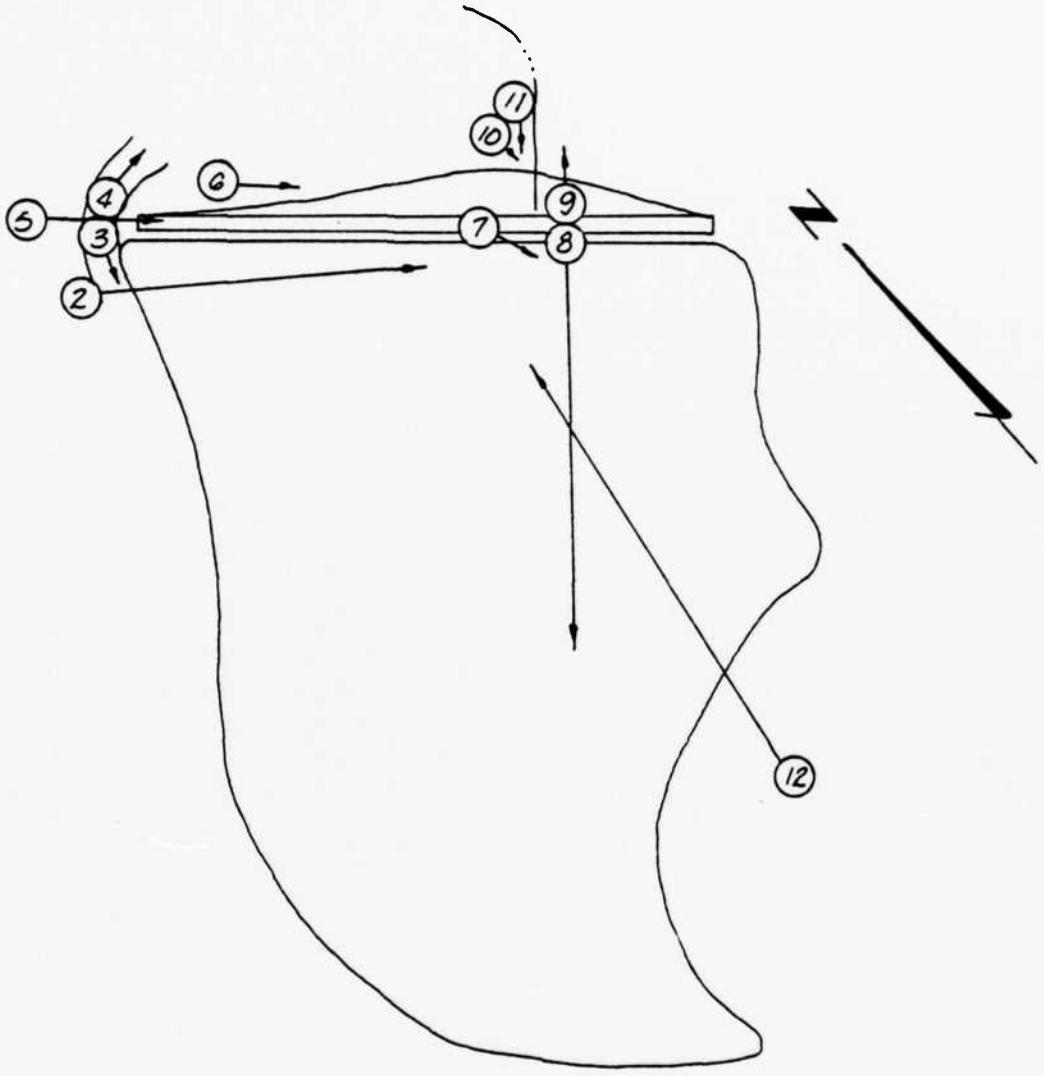


PHOTO INDEX

SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

PLATE B-1

PHOTO NO. 2 - UPSTREAM SLOPE FROM LEFT ABUTMENT

PHOTO NO. 3 - LOOKING UPSTREAM IN EMERGENCY SPILLWAY

PHOTO NO. 4 - LOOKING DOWNSTREAM IN EMERGENCY SPILLWAY

PHOTO NO. 5 - CREST OF DAM FROM LEFT ABUTMENT

PHOTO NO. 6 - DOWNSTREAM SLOPE FROM LEFT

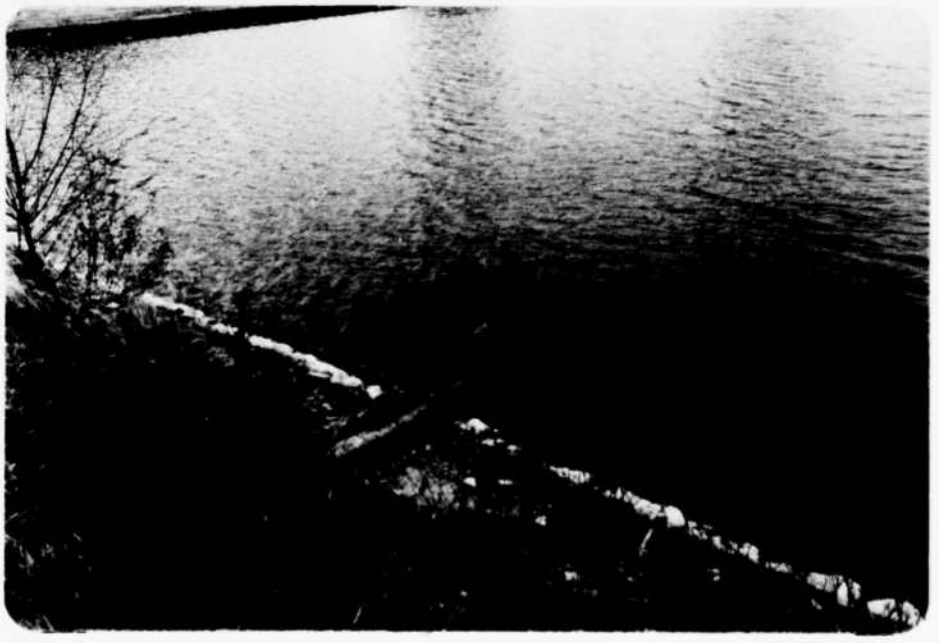


PHOTO NO. 7 - INLET OF PIPE SPILLWAY

PHOTO NO. 8 - LOOKING UPSTREAM ACROSS LAKE

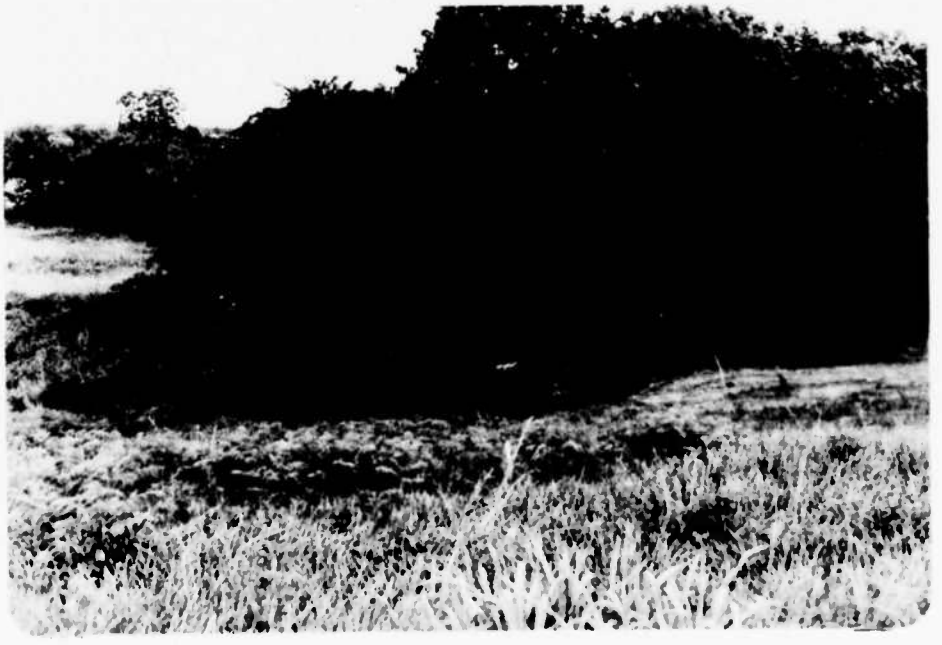


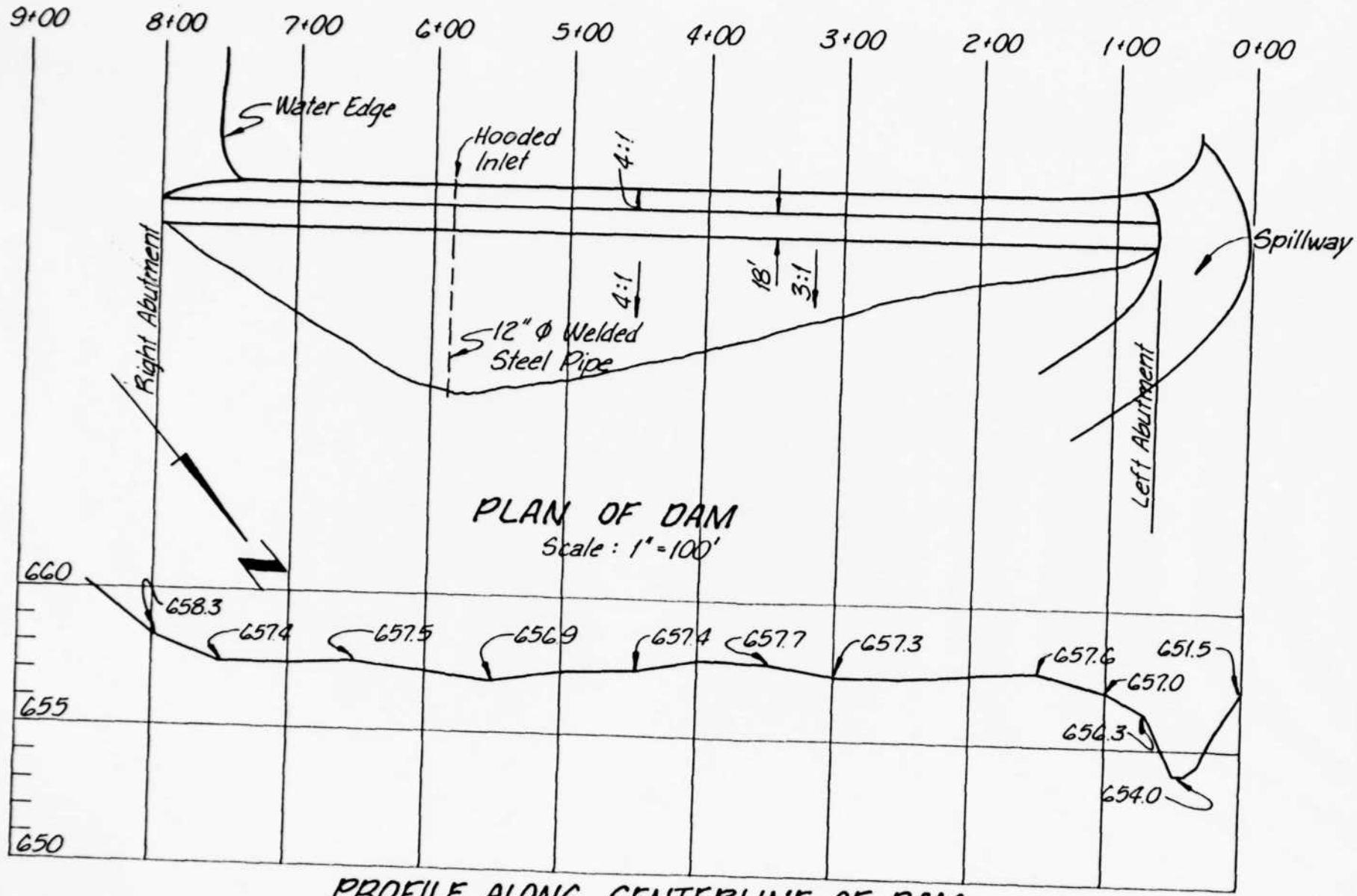
PHOTO NO. 9 - LOOKING DOWNSTREAM FROM STA. 6 + 75

PHOTO NO. 10 - OUTLET OF PIPE SPILLWAY

PHOTO NO. 11 - OUTLET OF PIPE SPILLWAY

PHOTO NO. 12 - OVERVIEW TAKEN FROM HIGH ON RIGHT SIDE.
DAM IN CENTER

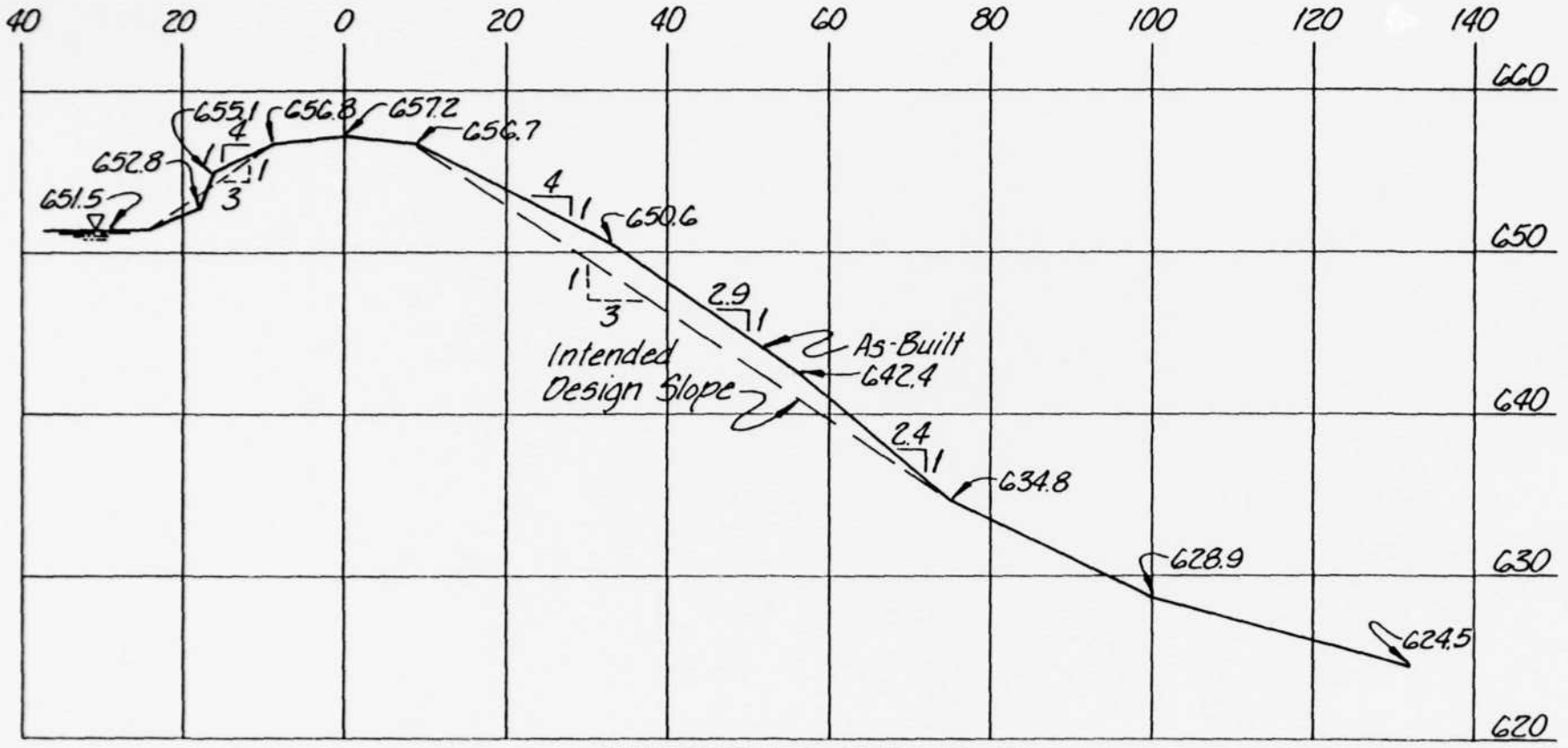
APPENDIX C
PROJECT PLATES



PLAN OF DAM
Scale : 1" = 100'

PROFILE ALONG CENTERLINE OF DAM
Scale : 1" = 100' H.
1" = 5' V.

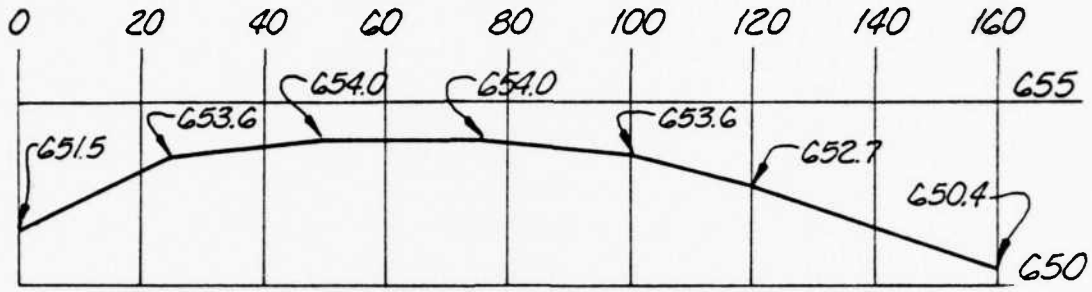
PLATE C-1



SECTION @ STA. 6+00

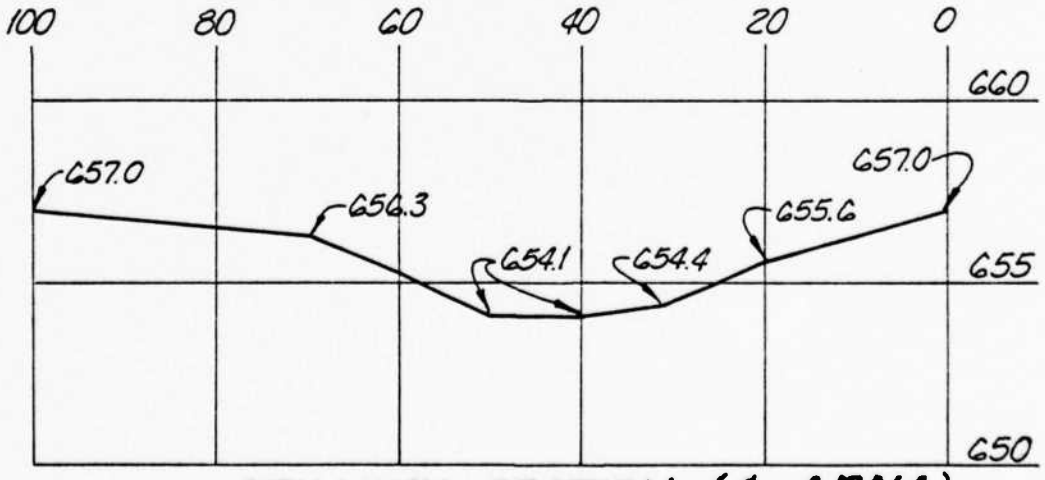
Scale: 1" = 20' H.
1" = 10' V.

PLATE C-2



℄ PROFILE OF SPILLWAY

Scale : 1" = 30' H.
1" = 5' V.



SPILLWAY SECTION (℄ of DAM)

Scale : 1" = 20' H.
1" = 5' V.

PLATE C-3

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See Appendix D).

   a. Twenty-four hour, 100-year rainfall for the dam location were taken from the data for the rainfall station at Sullivan, MO. as supplied by the St. Louis District Corps of Engineers per their letter dated 6 March 1979. The twenty-four hour probable maximum precipitation was taken from the curves of the Hydrometerological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.19 square miles (122 acres).

   c. Time of concentration of runoff = 12 minutes (computed from Kirpich formula).

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the 100-year precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the invert of the principal spillway.

   e. The total twenty-four hour storm duration losses for the 100-year storm were 3.33 inches. The total losses for the PMF storm were 1.88 inches. These data are based on SCS runoff curve No. 86 and 71 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed is composed of SCS soil groups B, C, and D (Peridge-Gasconade-Gross-Union) with 50% of watershed being of soil group B (Peridge). Land usage consisted primary of cultivated land with some of the watershed in woods and pasture.

   f. Average soil loss rates = 0.08 inch per hour approximately (for PMF storm, AMC III).

2. The combined discharge rating consisted of three components: the flow through the principal spillway, the flow through the emergency spillway and the flow going over the top of the dam.

a. The principal spillway rating was developed by using weir flow and the full conduit flow equation:

(1) The weir flows were developed using Table 21-37- "Upstream Head and Discharge Ratios for Pipes Flowing Partly Full" from V. T. Chow's Handbook of Applied Hydrology (New York: McGraw-Hill Book Company, 1964).

(2) Full Flow Equation.

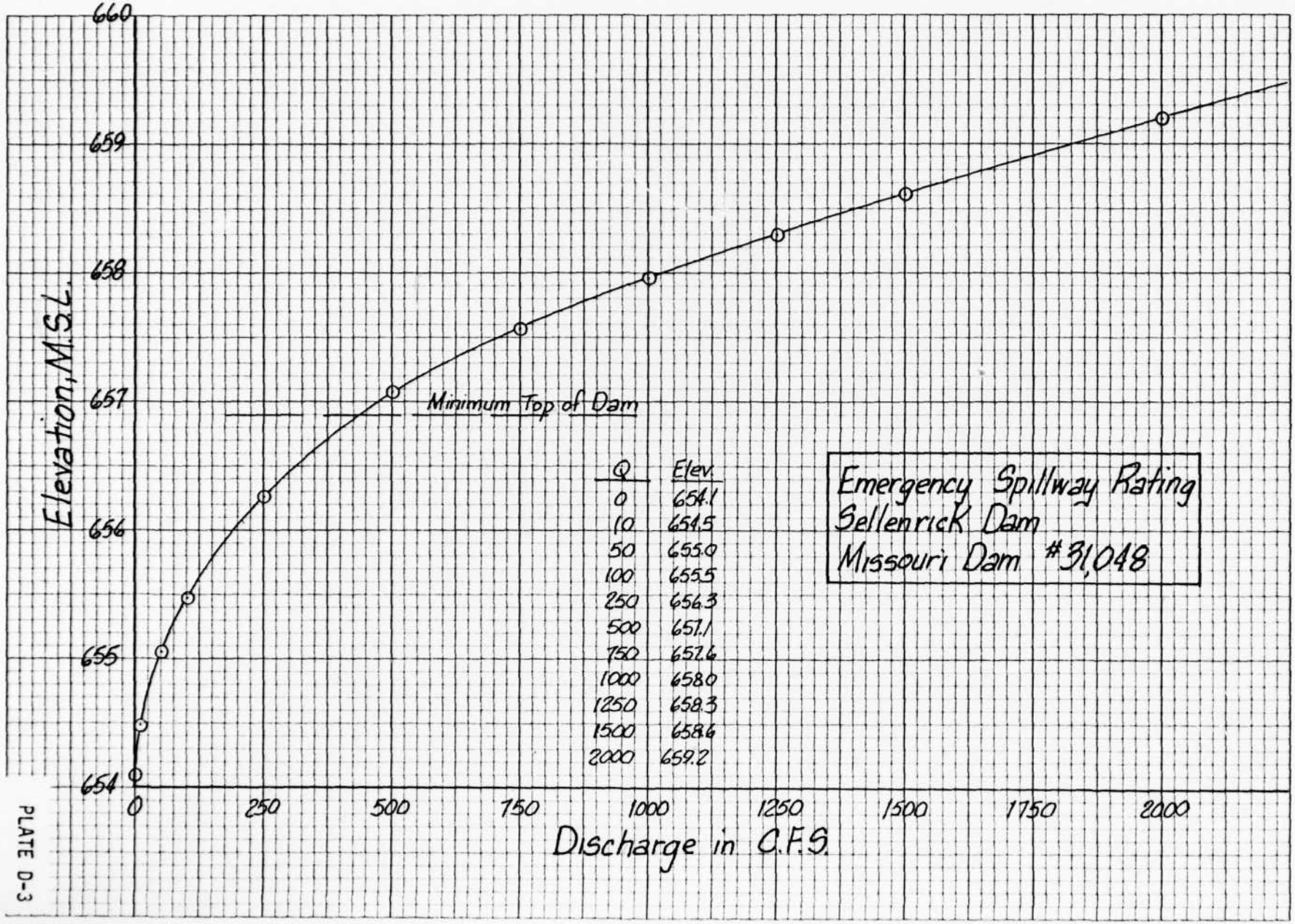
$$Q = a\sqrt{\frac{2gH}{1 + K_e + K_b + K_pL}}$$

where a = cross-sectional area of pipe, ft^2 = 0.785
H = total head, ft.
K_e = coefficient for entrance loss = 0.5
K_b = coefficient for bend loss = 0.024
K_p = coefficient for pipe friction loss = 0.02673
L = length of pipe, ft. = 161

b. The emergency spillway ratings were developed using the Corps of Engineers Surface Water Profile HEC-2 computer program.

c. The flows over the dam were developed using the dam overtopping analysis (Flow over non-level dam crest) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The output and plotted hydrographs are attached as Appendix D.



Q	Elev.
0	654.1
10	654.5
50	655.0
100	655.5
250	656.3
500	657.1
750	657.6
1000	658.0
1250	658.3
1500	658.6
2000	659.2

Emergency Spillway Rating
Sellenrick Dam
Missouri Dam #31,048

PLATE D-3

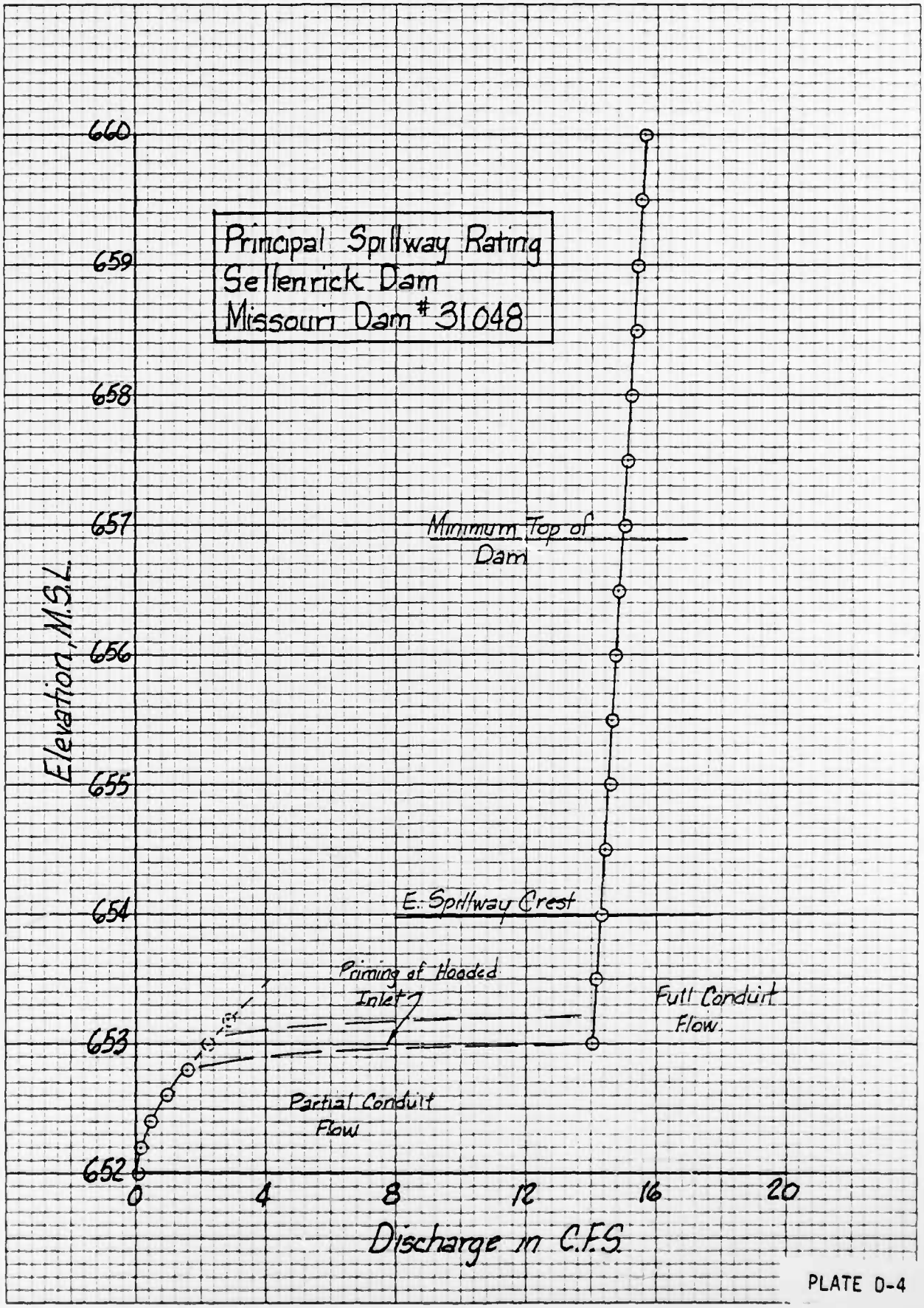


PLATE D-4

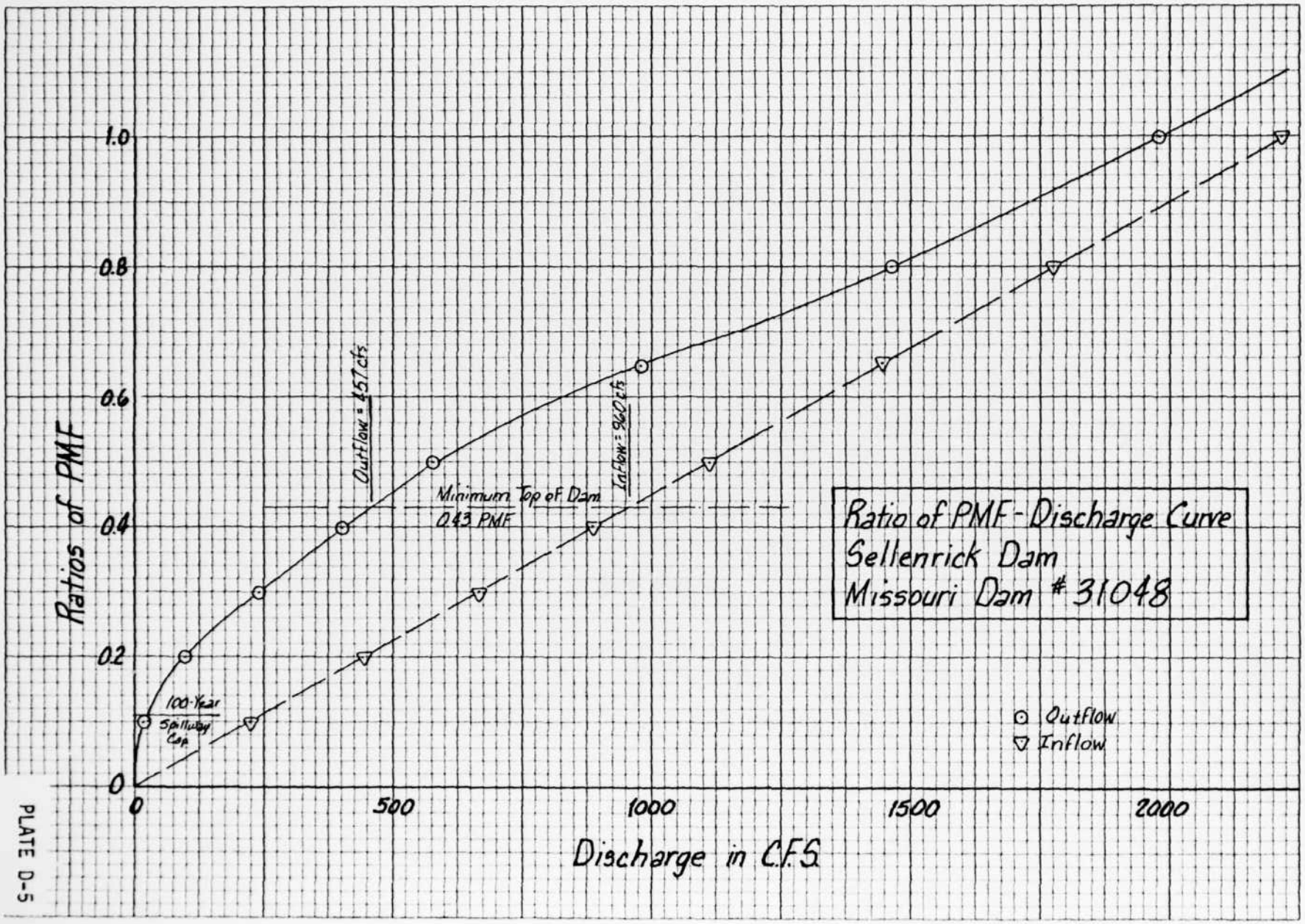


PLATE D-5

```
A1       ANALYSIS OF OAM OVERTOPPING USING RATIOS OF PMF
A2       HYOROLOGIC-HYORAULIC ANALYSIS OF SAFETY OF SELLENRICK OAM 31048
A3       RATIOS OF PMF ROUTED THRU THE RESERVOIR
B 000288000000000000005                              00000000000000000000003
B1000005
J 000001000000800060001
J1000.1000003.2000000.3000000.4000000.5000000.6500000.80000001.0
K 00000000000001                  00000000          00000001
K1       CALCULATION OF INFLOW HYOROGRAPH TO 31048 RESERVOIR
M 0300010000300200000.19          00000.19000001.0                    00000001
P        005325.3000001020000012100000130
T                                                    -1.0    -86.
M2       00000.17
X 000000     -.0100000031
K 00000100000032                  00000002          00000001
K1       ROUTED FLOWS THRU 31048 RESERVOIR
Y                        0000000100000001
Y1000001                                            -652.0      -1
Y4J652.0000652.4000652.8000653.0000653.5000654.0000654.5000655.0000655.5000656.0
Y4G656.5000657.0000657.5000658.0000658.5000659.0000659.5000660.0
Y5000000000000.5000001.6000014.0000014.1000014.3000024.4000064.5000119.0000203.0
Y50325.0000490.00000715.0001040.0001415.0001840.0002291.0002716.
$A000000000000100000002000000031800000042
$E000625000306520000066000000670000006B0
$$0652.0
$05656.9000003.0000001.500000844
$L000000000000270000010200000140000004790000059800000677000007000000071800000844
$V0656.9000657.0000657.2000657.3000657.5000657.7000657.9000658.3000659.0000660.0
K 000099
A
A
A
A
A
```

PMF Input Data

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

RUN  DATE= 79/07/25.
     TIME= 15.44.30.


                ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
                HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF SELLENRICK DAM 31048
                RATIOS OF PMF ROUTED THRU THE RESERVOIR

                                JOB SPECIFICATION
          NO     NHR    NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         288       0       5       0      0       0       0       0       3       0
                                JOPER     NWT   LROPT   TRACE
                                    5       0       0       0


                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 8 LRTIO= 1
              RTIOS=    .10    .20    .30    .40    .50    .65    .80   1.00


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

                          SUB-AREA RUNOFF COMPUTATION

                CALCULATION OF INFLOW HYDROGRAPH TO 31048 RESERVOIR

                     ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    000001       0       0       0       0       0       1       0       0

                                HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       2     .19    0.00     .19    1.00   0.000       0       1       0

                                PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   25.30  102.00  121.00  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  -86.00    0.00    0.00

          CURVE NO =  -86.00  WETNESS =   -1.00  EFFECT CN =   86.00

                              UNIT HYDROGRAPH DATA
                          TC=  0.00   LAG=   .17

                              RECESSION DATA
                        STRTQ=    0.00   QRCSN=    -.01   RTIOR= 1.00

          UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=    .17  VOL= 1.00
          132.     399.     410.     257.     129.      69.      36.      19.      10.       5.
            3.       1.

0                               END-OF-PERIOD FLOW
```

PLATE D-7

CMS	63.	15.	4.	4.	1289.
INCHES		25.28	30.96	30.96	30.96
MM		641.99	786.41	786.41	786.41
AC-FT		256.	314.	314.	314.
THOUS CU M		316.	387.	387.	387.

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

HYDROGRAPH ROUTING

ROUTEO FLOWS THRU 31048 RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	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	-652.	-1

STAGE	652.00	652.40	652.80	653.00	653.50	654.00	654.50	655.00	655.50	656.00
	656.50	657.00	657.50	658.00	658.50	659.00	659.50	660.00		
FLOW	0.00	.50	1.60	14.00	14.10	14.30	24.40	64.50	119.00	203.00
	325.00	490.00	715.00	1040.00	1415.00	1840.00	2291.00	2716.00		

SURFACE AREA=	0.	10.	20.	31.	42.
CAPACITY=	0.	90.	208.	461.	824.
ELEVATION=	625.	652.	660.	670.	680.

CREL	SPWIO	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
652.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
656.9	3.0	1.5	844.

CREST LENGTH	0.	27.	102.	140.	479.	598.	677.	700.	718.	844.
AT OR BELOW ELEVATION	656.9	657.0	657.2	657.3	657.5	657.7	657.9	658.3	659.0	660.0

STATION 000002, 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.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

UVN

STATION 000002, PLAN 1, RATIO 5 0.5PMF

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.	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.	2.	2.	3.	4.	6.	7.
8.	10.	11.	12.	13.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	16.	17.	19.	20.	22.	23.	26.	33.
39.	45.	51.	56.	61.	67.	73.	80.	85.	91.
98.	104.	111.	117.	125.	134.	141.	149.	155.	162.
167.	171.	175.	180.	189.	205.	250.	323.	430.	515.
571.	576.	551.	514.	478.	449.	421.	396.	372.	352.
334.	320.	310.	300.	292.	283.	274.	265.	256.	247.
240.	233.	226.	221.	215.	211.	206.	200.	192.	182.
170.	159.	148.	138.	128.	119.	114.	109.	104.	99.
94.	90.	86.	82.	78.	75.	72.	68.	65.	63.
61.	59.	57.	56.	54.	52.	51.	49.	48.	46.
45.	44.	42.	41.	40.	39.	38.	37.	36.	35.
34.	33.	33.	32.	31.	30.	30.	29.	28.	28.
27.	27.	26.	26.	25.	25.	24.	24.	24.	24.
24.	24.	24.	24.	23.	23.	23.	23.		

STORAGE

90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	92.	92.
92.	92.	92.	93.	93.	93.	93.	93.	94.	94.
94.	94.	95.	95.	95.	96.	96.	96.	96.	97.
97.	97.	97.	98.	98.	98.	98.	99.	99.	99.
100.	100.	100.	100.	100.	101.	101.	101.	101.	101.
102.	102.	102.	102.	102.	103.	103.	103.	103.	104.
104.	104.	104.	104.	105.	105.	105.	105.	106.	106.
106.	106.	106.	107.	107.	107.	108.	109.	109.	110.
111.	112.	113.	114.	115.	116.	117.	118.	119.	120.
121.	122.	123.	123.	124.	125.	126.	127.	127.	128.
129.	130.	131.	131.	132.	133.	134.	134.	135.	135.
136.	136.	136.	137.	138.	139.	142.	146.	151.	155.
157.	157.	156.	155.	153.	152.	151.	150.	148.	148.
147.	146.	145.	145.	144.	144.	143.	143.	142.	142.
141.	141.	140.	140.	140.	139.	139.	139.	138.	137.
136.	135.	134.	133.	133.	132.	131.	130.	130.	129.
129.	128.	128.	127.	127.	126.	126.	125.	125.	125.

124.	124.	124.	123.	123.	123.	123.	122.	122.	122.
122.	121.	121.	121.	121.	121.	121.	120.	120.	120.
120.	120.	120.	120.	119.	119.	119.	119.	119.	119.
119.	119.	119.	119.	118.	118.	118.	118.	118.	118.
118.	118.	118.	118.	118.	118.	118.	118.		

STAGE

652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0	652.0
652.0	652.0	652.0	652.0	652.1	652.1	652.1	652.1	652.1	652.1
652.1	652.1	652.1	652.1	652.1	652.1	652.1	652.1	652.2	652.2
652.2	652.2	652.2	652.3	652.3	652.3	652.3	652.3	652.4	652.4
652.4	652.4	652.5	652.5	652.5	652.5	652.6	652.6	652.6	652.6
652.7	652.7	652.7	652.7	652.8	652.8	652.8	652.8	652.9	652.9
652.9	652.9	653.0	653.0	653.0	653.0	653.0	653.0	653.1	653.1
653.1	653.1	653.1	653.2	653.2	653.2	653.2	653.2	653.3	653.3
653.3	653.3	653.3	653.3	653.4	653.4	653.4	653.4	653.4	653.5
653.5	653.5	653.5	653.5	653.6	653.6	653.6	653.7	653.8	653.8
653.9	654.0	654.1	654.2	654.2	654.3	654.4	654.4	654.5	654.6
654.7	654.8	654.8	654.9	655.0	655.0	655.1	655.1	655.2	655.2
655.3	655.4	655.4	655.5	655.5	655.6	655.6	655.7	655.7	655.8
655.8	655.8	655.8	655.9	655.9	656.0	656.2	656.5	656.8	657.0
657.2	657.2	657.1	657.0	657.0	656.9	656.8	656.7	656.6	656.6
656.5	656.5	656.4	656.4	656.4	656.3	656.3	656.3	656.2	656.2
656.1	656.1	656.1	656.1	656.1	656.0	656.0	656.0	655.9	655.9
655.8	655.7	655.7	655.6	655.6	655.5	655.5	655.4	655.4	655.3
655.3	655.2	655.2	655.2	655.1	655.1	655.1	655.0	655.0	655.0
655.0	654.9	654.9	654.9	654.9	654.8	654.8	654.8	654.8	654.8
654.8	654.7	654.7	654.7	654.7	654.7	654.7	654.7	654.6	654.6
654.6	654.6	654.6	654.6	654.6	654.6	654.6	654.6	654.5	654.5
654.5	654.5	654.5	654.5	654.5	654.5	654.5	654.5	654.5	654.5
654.5	654.5	654.5	654.5	654.5	654.4	654.4	654.4		

PEAK OUTFLOW IS 576. AT TIME 16.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	576.	220.	65.	65.	18758.
CMS	16.	6.	2.	2.	531.
INCHES		10.78	12.76	12.76	12.76
MM		273.72	323.98	323.98	323.98
AC-FT		109.	129.	129.	129.
THOUS CU M		135.	159.	159.	159.

DVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	200.	400.	600.	800.	1000.	1200.	0.	0.	0.	0.	0.	0.
.05	1I												
.10	2I												
.15	3I												
.20	4I												
.25	5I												
.30	6I												
.35	7I												
.40	8I												
.45	9I												
.50	10I												
.55	11I												
1.00	12I												
1.05	13I												
1.10	14I												
1.15	15I												
1.20	16I												
1.25	17I												
1.30	18I												
1.35	19I												
1.40	20I												
1.45	21I												
1.50	22I												
1.55	23I												
2.00	24I												
2.05	25I												
2.10	26I												
2.15	27I												
2.20	28I												
2.25	29I												
2.30	30I												
2.35	31I												
2.40	32I												
2.45	33I												
2.50	34I												
2.55	35I												
3.00	36I												
3.05	37I												
3.10	38I												
3.15	39I												
3.20	40I												
3.25	41I												
3.30	42I												
3.35	43I												
3.40	44I												
3.45	45I												
3.50	46I												
3.55	47I												
4.00	48I												
4.05	49I												
4.10	50I												
4.15	51I												
4.20	52I												
4.25	53I												
4.30	54I												
4.35	55I												
4.40	56I												

PLATE D-11

4.45 571
4.50 581
4.55 591
5.00 601
5.05 611
5.10 621
5.15 631
5.20 641
5.25 651
5.30 661
5.35 671
5.40 681
5.45 691
5.50 701
5.55 711
6.00 721
6.05 731
6.10 740I
6.15 750I
6.20 760I
6.25 770I
6.30 780I
6.35 730I
6.40 800I
6.45 810 I
6.50 820 I
6.55 830 I
7.00 840 I
7.05 850 I
7.10 860 I
7.15 870 I
7.20 880 I
7.25 890 I
7.30 900 I
7.35 910 I
7.40 920 I
7.45 930 I
7.50 940 I
7.55 950 I
8.00 960 I
8.05 970 I
8.10 980 I
8.15 990 I
8.201000 I
8.251010 I
8.301020 I
8.351030 I
8.401040 I
8.451050 I
8.501060 I
8.551070 I
9.001080 I
9.051090 I
9.101100 I
9.151110 I
9.201120 I
9.25113.01
9.30114.01
9.35115.01
9.40116.01
9.45117.01
9.50118.01

PLATE D-12

9.55119.01
10.00120.01
10.05121.01
10.10122.01
10.15123.01
10.20124.01
10.25125.01
10.30126.01
10.35127.01
10.40128.01
10.45129.01
10.50130.01
10.55131.01
11.00132.01
11.05133.01
11.10134.01
11.15135.01
11.20136.01
11.25137.01
11.30138.01
11.35139.01
11.40140.01
11.45141.01
11.50142.01
11.55143.01
12.00144.01
12.05145.0
12.10146.0
12.15147.0
12.20148.0
12.25149.0
12.30150.0
12.35151.0
12.40152.0
12.45153.0
12.50154.0
12.55155.0
13.00156.0
13.05157.0
13.10158.0
13.15159.0
13.20160.0
13.25161. 0
13.30162. 0
13.35163.
13.40164.
13.45165.
13.50166.
13.55167.
14.00168.
14.05169.
14.10170.
14.15171.
14.20172.
14.25173.
14.30174.
14.35175.
14.40176.
14.45177.
14.50178.
14.55179.
15.00180.
Data Documents, Inc. 82

PLATE D-13

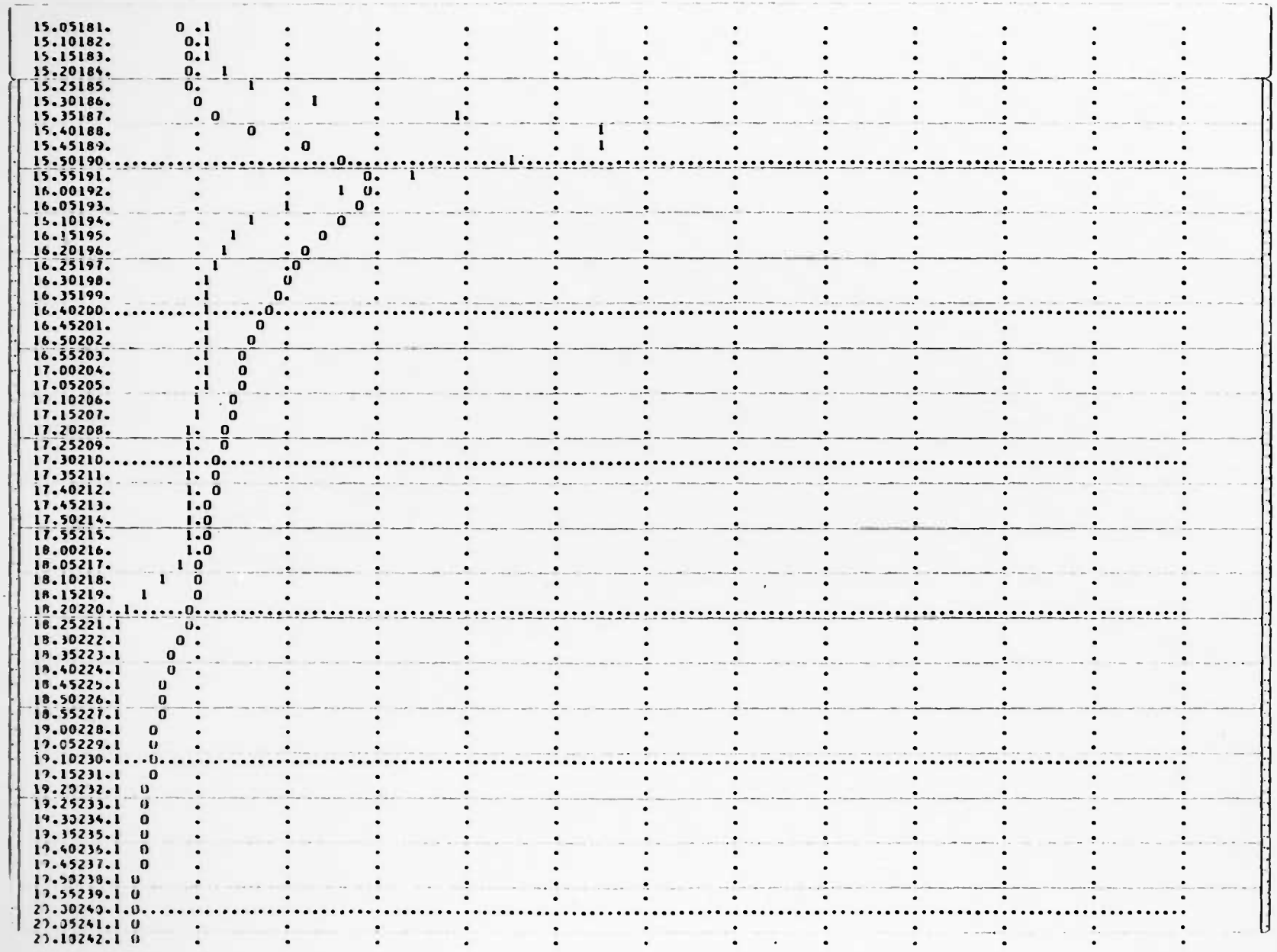


PLATE D-14

```
20.15243.1 0
23.20244.1 0
20.25245.1 0
20.30246.1 0
20.35247.1 0
20.40248.10
20.45249.10
20.50250.10
20.55251.10
21.00252.10
21.05253.10
21.10254.10
21.15255.10
21.20256.10
21.25257.10
21.30258.10
21.35259.10
21.40260.10
21.45261.10
21.50262.10
21.55263.10
22.00264.10
22.05265.10
22.10266.10
22.15267.1
22.20268.1
22.25269.1
22.30270.1
22.35271.1
22.40272.1
22.45273.1
22.50274.1
22.55275.1
23.00276.1
23.05277.1
23.10278.1
23.15279.1
23.20280.1
23.25281.1
23.30282.1
23.35283.1
23.40284.1
23.45285.1
23.50286.1
23.55287.1
0.00288.1
```


PLATE D-15

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 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .65	RATIO 7 .80	RATIO 8 1.00
HYDROGRAPH AT	000001	.19	1	222.	444.	665.	887.	1109.	1442.	1774.	2218.
		(.49)		(6.28)I	(12.56)I	(18.84)I	(25.12)I	(31.40)I	(40.82)I	(50.24)I	(62.80)I
ROUTED TO	000002	.19	1	18.	97.	239.	400.	576.	976.	1462.	1976.
		(.49)		I .52)I	2.75)I	6.76)I	11.32)I	16.31)I	27.63)I	41.39)I	55.94)I

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	652.00	652.00	656.90
STORAGE	90.	90.	152.
OUTFLOW	0.	0.	457.

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	654.20	0.00	115.	18.	0.00	18.25	0.00
.20	655.30	0.00	129.	97.	0.00	16.42	0.00
.30	656.15	0.00	141.	239.	0.00	16.08	0.00
.40	656.73	0.00	150.	400.	0.00	16.00	0.00
.50	657.16	.26	157.	576.	.50	16.00	0.00
.65	657.57	.67	163.	976.	.92	15.92	0.00
.80	657.80	.90	167.	1462.	1.25	15.83	0.00
1.00	657.99	1.09	170.	1976.	1.92	15.83	0.00

PLATE D-17


DAT
FILM

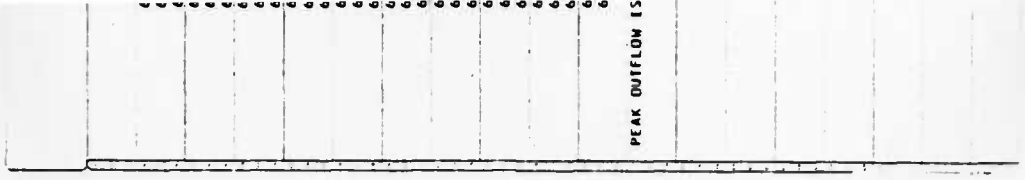


PLATE D-10

20	0.	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	271	281	291	301	311	321	331	341	351	361	371	381	391	401	411	421	431	441	451	461	471	481	491	501	511	521	531	541	551	561
•OVF•	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	4.00	4.05	4.10	4.15	4.20	4.25	4.30	4.35	4.40

PLATE D-11

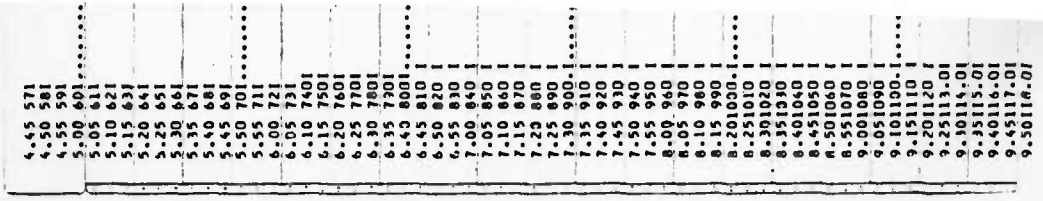

4.45 571
4.50 581
4.55 591
5.00 601
5.05 611
5.10 621
5.15 631
5.20 641
5.25 651
5.30 661
5.35 671
5.40 681
5.45 691
5.50 701
5.55 711
6.00 721
6.05 731
6.10 7401
6.15 7501
6.20 7601
6.25 7701
6.30 7801
6.35 7901
6.40 8001
6.45 810
6.50 820
6.55 830
7.00 840
7.05 850
7.10 860
7.15 870
7.20 880
7.25 890
7.30 900
7.35 910
7.40 920
7.45 930
7.50 940
7.55 950
8.00 960
8.05 970
8.10 980
8.15 990
8.201000
8.251010
8.301020
8.351030
8.401040
8.451050
8.501060
8.551070
9.001080
9.051090
9.101100
9.151110
9.201120
9.25113-01
9.30114-01
9.35115-01
9.40116-01
9.45117-01
9.50118-01

PLATE D-12

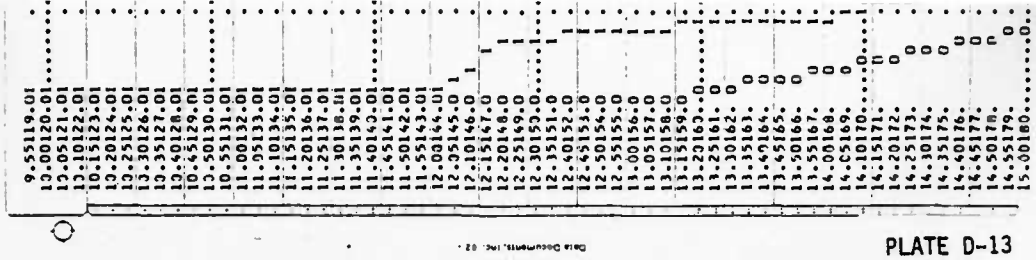


PLATE D-13

PLATE D-14