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NATIONAL DAM SAFETY PROGRAM. NISHISAKWICK CREEK DAM (NJ-00/129)--ETC(U)
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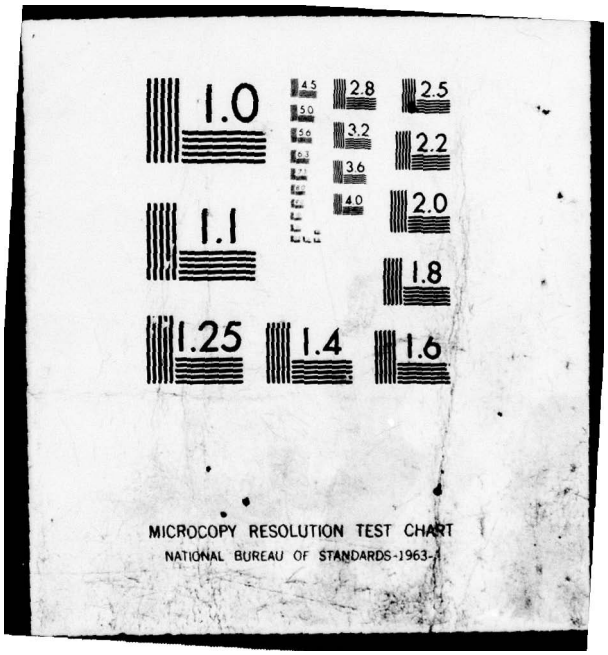
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DELAWARE RIVER BASIN
NISHISAKWICK CREEK
HUNTERDON COUNTY
NEW JERSEY

LEVEL II

NISHISAKWICK CREEK DAM
NJ 00129

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

August, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

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Dams
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Nishisakwick Creek Dam, NJ
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Structural Analysis
National Dam Inspection Act Report

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

25 SEP 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Nishisakwick Creek Dam in Hunterdon County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Nishisakwick Creek Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate since 27 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following remedial actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The existing dam plans and drawings should be annotated and updated to form a coherent as-built set.

(2) All trees and brush should be removed from the dam embankment to avoid problems which may develop from their roots. The grass covering should be maintained for surface erosion protection.

(3) Replacement of small quantities of eroded fill and riprap, and repair of minor cracks should be undertaken during routine maintenance.

(4) Remove the concrete stop-gate at the left of the dam.

(5) Provide additional low-level outlet facilities. Since the existing outlet pipe is pressurized, a control valve should be provided at the upstream end.

(6) A formalized program of annual inspections of the dam should be initiated, utilizing the standard visual check list in this report. Headwater and tailwater gages should be read during severe rainstorms and at routine operating and maintenance visits to the dam. A permanent log should be kept of all maintenance visits to the dam, the lake and the outlet passages. Movement and settlement of the embankments should be monitored regularly by means of surveying monuments, and any change in seepage rates should be noted.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James A. Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

NISHISAKWICK CREEK DAM (NJ00129)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 2 May 1979 by Frederic R. Harris, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Nishisakwick Creek Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate since 27 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following remedial actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The existing dam plans and drawings should be annotated and updated to form a coherent as-built set.

(2) All trees and brush should be removed from the dam embankment to avoid problems which may develop from their roots. The grass covering should be maintained for surface erosion protection.

(3) Replacement of small quantities of eroded fill and riprap, and repair of minor cracks should be undertaken during routine maintenance.

(4) Remove the concrete stop-gate at the left of the dam.

(5) Provide additional low-level outlet facilities. Since the existing outlet pipe is pressurized, a control valve should be provided at the upstream end.

(6) A formalized program of annual inspections of the dam should be initiated, utilizing the standard visual check list in this report. Headwater and tailwater gages should be read during severe rainstorms and at routine operating and maintenance visits to the dam. A permanent log should be kept of all maintenance visits to the dam, the lake and the outlet passages. Movement and settlement of the embankments should be monitored regularly by means of surveying monuments, and any change in seepage rates should be noted.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 22 Sep 1979

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: Nishisakwick Creek Dam, I.D. NJ00129

State Located: New Jersey

County Located: Hunterdon

Stream: Nishisakwick Creek

Date of Inspection: May 2, 1979

Assessment of General Condition

Nishisakwick Creek Dam is an earth embankment with a concrete core into extending glacial till. The dam has a straight axis with an overall length of approximately 603 feet, and a structural height of about 23 feet. The core wall is completely covered by the earthfill. Nishisakwick Creek Dam is in good condition with wet areas evident along the toe. Slow, discolored seepages were found. The downstream and upstream slopes support a medium to heavy brush growth. The hazard potential is rated as "high."

The adequacy of Nishisakwick Creek Dam is considered questionable in view of its lack of spillway capacity to pass the spillway design flood (1/2 PMF) without overtopping the dam. The spillway is capable of passing a flood equal to 13% of the PMF, and is assessed "inadequate."

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam.

The following remedial action therefore is suggested along with a timetable for completion.

1. Carry out a more precise hydrologic and hydraulic analysis of the dam within six months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out in the near future.

1. All brush and trees should be removed from the downstream slope to avoid problems which may develop from their roots.

2. A program should be developed to monitor seepage through the embankment.

3. Existing plans and drawings of the dam should be annotated and updated to form a coherent as-built set.

4. Remove the concrete stop-gate at the left of the dam.

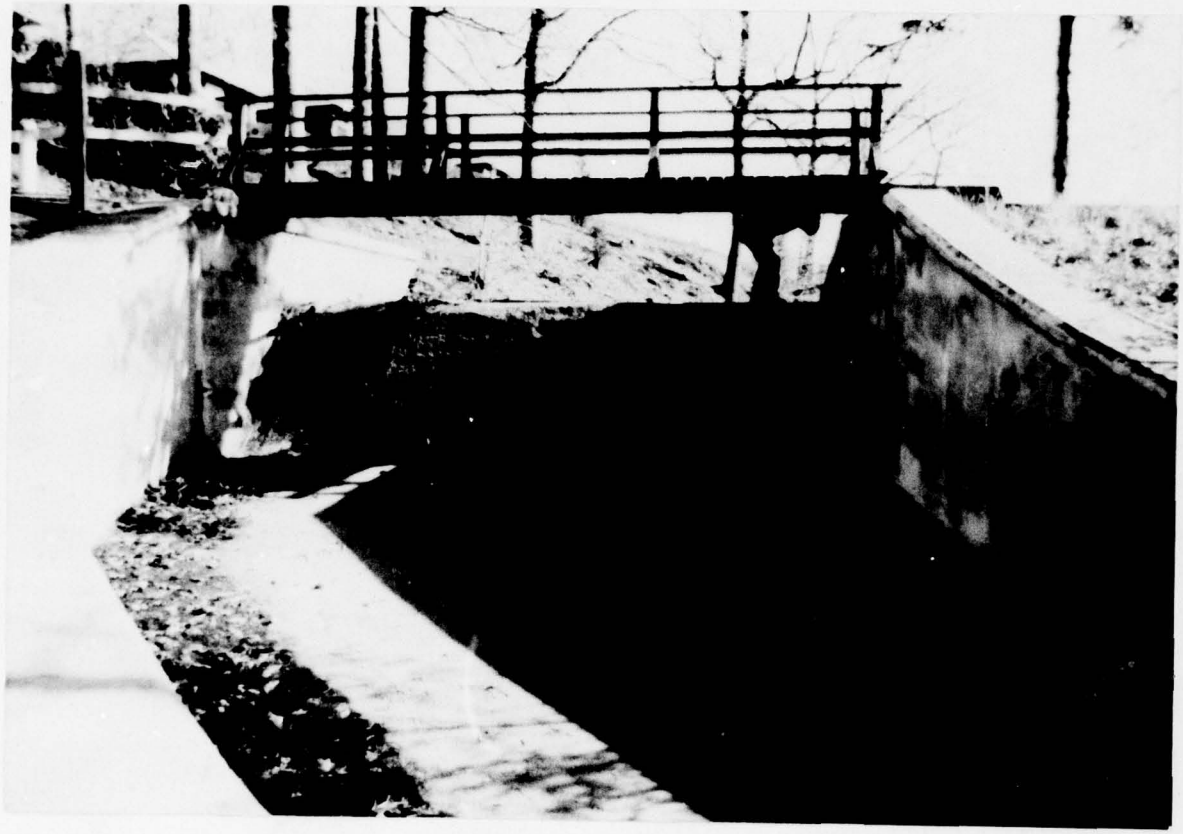
5. A program of annual inspection and maintenance should be initiated. This should include lowering the lake and updating the operation and maintenance log, and performing minor repairs as necessary.

6. Additional emergency drain-down facilities should be provided. Since the existing outlet pipe is pressurised, a control valve should be provided at the upstream end.

A. G. Posch

Anthony G. Posch, P.E.

AGP/REJ/ak



Nishisakwick Creek Dam
Overall view of spillway structure from downstream.

May 2, 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface 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.

In reviewing this report, 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 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 unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NISHISAKWICK CREEK DAM, I.D. NJ00129

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Nishisakwick Creek Dam was made on May 2, 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 inspecton, an evaluation of hydrologic and hydraulic conditions at the site, an evaluation as to the structural adequacy of the various project features, and assesses the general condition of the dam with respect to safety.

d. Description of Project

1.2 Description of Dam and Appurtenances

Nishisakwick Creek Dam is an earth embankment with a concrete core extending into glacial till. The dam has a straight axis with an overall length of approximately 603 feet, and a maximum embankment height of about 23 feet. The core wall is completely covered by the earthfill. The crest of the dam is 8 feet wide and supports a paved walkway. The upstream and downstream slopes both are 3 horizontal to 1 vertical.

An uncontrolled concrete ogee spillway, 20! long, is located on the extreme right of the dam, and a curved concrete channel carries

the flow from the spillway to the downstream channel. A footbridge has been provided over the spillway.

A secondary unregulated outlet exists on the left side of the dam, consisting of a 12 inch diameter concrete culvert which discharges at high reservoir levels only. About 10' downstream of the culvert is a 4 foot square concrete gate, with a 4" opening at the bottom.

The low-level outlet to the dam is a 16 inch diameter cast-iron pipe, with its intake at lake bottom. The pipe discharges approximately 100 feet downstream of the dam, through a concrete and masonry outlet into a stream which joins the main stream. The control valve is located at the downstream end of the pipe.

b. Location

Nishisakwick Creek Dam is located at Camp Tecumseh, Township of Alexandria, Hunterdon Coutny, New Jersey and is accessible by way of Route 513 and Mechlin Corner Road.

c. Size and Hazard Classification

Nishisakwick Creek Dam has a structural height of 23 feet and a reservoir storage of 141 acre-feet. Since its storage is less than 1,000 acre-feet and its height is less than 40 feet, it is classififed in the dam size category as being "small." Since failure of the dam could cause loss of life and extensive property damage, a hazard potential classifications of "high" has been assigned to the project. The likely loss of life is based on the existence of a recreation house 100 feet downstream of the dam, which is frequently occupied in the summer by up to 30 people.

d. Ownership

Nishisakwick Creek Dam is owned by the Salvation Army. Correspondence should be addressed to: RD No. 1, Pittstown, NJ 08867.

e. Purpose of the Dam

Nishisakwick Creek Dam is presently used for recreational purposes only.

f. Design and Construction History

The dam was designed and constructed in 1930. No computations for the design of the embankment or structures are available for review. The original low-level outlet valve was located at the end of a 30 foot pier extending into the lake from the middle point of the dam. Eight years ago the pier was removed and the valve located in its present position. Following extensive deterioration at the spillway, the concrete core was extended by 20 feet to the right of the spillway, and the spillway was rebuilt, within the last 5 years. An artificial island has

recently been built in the lake.

g. Normal Operational Procedures

The normal discharge from the lake is over the unregulated spillway, and it is allowed to naturally balance with inflow to the lake. The lake is not lowered on a regular basis.

1.3 Pertinent Data

a. Drainage Area	0.83 square miles
b. Discharge at Damsite	
Maximum known flood at damsite:	No records.
Ungated spillway capacity at elevation of top of dam:	407 cfs (el. 600' MSL)
Total spillway capacity at maximum pool elevation:	1,748 cfs (el. 600.81' MSL)
c. Elevation (feet above MSL)	
Top of dam:	600
Maximum pool-design surcharge (SDF):	600.81
Spillway crest:	597
Streambed at centerline of dam:	577 (est.)
Maximum tailwater:	580 (estimate)
d. Reservoir	
Length of maximum pool:	5,400 feet
e. Storage (acre-feet)	
Design surcharge (SDF):	148
Top of dam:	141
Spillway crest:	118
f. Reservoir Surface (acres)	
Top of dam:	8.48
Maximum pool:	8.6 (est.)

Spillway crest:	7.35

g. Dam

Type:	Earth embankment with concrete core wall.
Length:	603'
Height:	23'
Top width:	8'
Side slopes:	3 horizontal to 1 vertical
Zoning:	Core wall with earthfill
Impervious core:	Core wall
Cutoff:	Core wall
Grout curtain:	None

h. Diversional Regulating Tunnel

N/A

i. Spillway

Type:	Unregulated concrete ogee.
Length:	19' 10"
Crest elevation:	597'
Gates:	N/A
Upstream channel:	Camp Tecumseh Lake
Downstream channel:	Curved concrete channel with sidewalls to Nishisakwick Creek.

j. Regulating Outlets

Low-level outlet:	16" ø pipe (Invert el. 577' MSL)
Control:	Gate valve, 100' downstream

Emergency gate:	N/A
Outlet:	12" ø concrete culvert (invert 1' higher than spillway crest).

SECTION 2: ENGINEERING DATA

2.1 Design

Drawings for the dam and spillway structures were available in the files of the New Jersey Department of Environmental Protection. No design computations were available, but some basic dimensions, flow capacities and characteristics are available on the dam permit application.

2.2 Construction

The dam was constructed in 1930. The spillway structure was rebuilt approximately 5 years ago. Brief engineering data on the construction of the dam is available in the form of photographs and progress sheets.

2.3 Operation

No records of daily flows and reservoir levels are kept.

2.4 Evaluation

a. Availability

The availability of engineering data is fair. The drawings illustrating the plan, sections and topography of the dam, can be obtained from the New Jersey Department of Environmental Protection. Correspondence and basic engineering data are on microfiche, also at the NJDEP.

b. Adequacy

The available engineering data is not sufficient to perform a comprehensive, definitive stability analysis of the embankment. Data needed to fully assess the stability of the dam include:

1. Subsurface information at the damsite, including engineering properties and parameters of the bedrock.
2. Soil properties of the embankment.
3. Location of the phreatic line within the dam section at several cross section lines including the maximum section.
4. Verification of, and the vertical extent of the core wall.
5. Rainfall and water-level records.

A check list of engineering construction and maintenance data is

included in Appendix A.

c. Validity

With the exception of the modifications made, data on the drawings were found to correspond well to the structure as observed.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Nishisakwick Creek Dam did not reveal any signs of distress in the dam or appurtenances. The spillways and outlet channel are in good alignment and have not settled. The embankment is periodically maintained, but seepage was observed in places. The water level at the time of inspection was below the spillway crest.

b. Dam

Nishisakwick Creek Dam is an earth embankment with a concrete core extending into glacial till. Both the upstream and downstream faces have 3 to 1 slopes. The downstream slope was covered with medium to heavy brush and trees. The upstream slope also supports a growth of brush and weeds. A concrete walkway lies along the crest. No vertical or horizontal movement of the dam was detected. No evidence of burrowing by animal in the downstream face was found. Some rip-rap protection exists downstream of the spillway channel.

Slow (less than 1/2 gpm) discolored seepage was observed along the toe of the downstream slope. There is a large pool approximately 160 feet to the left of the auxiliary spillway. Apart from local softening, there was no major sloughing. Minor erosion has occurred on the upstream face near the spillway, where some rip-rap has been disloged.

c. Appurtenant Structures

1. Spillway

The lake level at the time of inspection was below the spillway crest. The concrete ogee and discharge channel were found to be in satisfactory condition. Minor cracks in the channel wall and across the ogee were noted, from which water was seeping at a rate not exceeding 1/2 gpm. The secondary oulet gate on the left side appeared to be susceptible to blockage with debris.

2. Outlet Works

The low-level outlet is a 16 inch diameter pipe with its intake on lake bottom at the middle of the dam. The pipe and the gate valve controlling the flow appear to be well maintained and in good condition. The concrete and masonry pipe outfall is in good condition and contains some debris.

3. Bridges

The two foot bridges on the dam are in good condition.

d. Reservoir Area

The reservoir rim is gently sloped and no indications of instability were readily apparent. The slopes above the reservoir are sparsely wooded. There are many dwellings near the shoreline on the right side. Sedimentation was apparent at the lake intake.

e. Downstream Channel

Below the concrete channel, the natural channel is obstructed by numerous cobbles and boulders. The side slopes are moderately flat and support trees and brush. Minor erosion and undercutting of the banks was observed. The low-level discharge runs into the downstream channel approximately 150 feet downstream of the dam. A footbridge near this point has collapsed into the stream. Adjacent to the low-level discharge channel there is a two-story house which is reported to be used as a camp recreation building.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Nishisakwick Creek Dam is used to impound water for recreation activities. The policy is to maintain a nearly constant lake level close to the elevation of the spillway crest. The lake level is maintained by unregulated discharge over the spillway.

The lake is not lowered on a regular basis.

4.2 Maintenance of the Dam

The dam is well maintained by an experienced contractor, but there is no formal program of regular inspection and maintenance of the dam. Records of work done at the dam and lake are kept in the files of the contractor. The lake was dredged of sediment 5 years ago.

4.3 Maintenance of Operating Facilities

The operating facilities consist of an operable low-level outlet, with a gate valve at the discharge end. Sufficient maintenance has been carried out to insure its present operability, and the valve is set deep enough into the ground to protect it from freezing.

4.4 Evaluation

The dam and reservoir appear to be well maintained. Current operational procedures are satisfactory.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Nishisakwick Creek Dam is approximately 0.83 square miles. A drainage map of the watershed of the dam site is presented on plate 1, Appendix D.

The topography within the basin is moderately sloped. Elevations range from approximately 800 feet above MSL at the north end of the watershed to about 600 feet at the dam site. Land use patterns within the watershed are mostly forest, with several residential buildings scattered around the lake.

The evaluation of the hydraulic and hydrologic features of the Lake was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Spillway Design Flood for the dam falls in a range of 1/2 PMF to PMF. In this case the low end of the range, 1/2 PMF, is chosen as the SDF since the factors used to select size and hazard classification are on the low-side of their respective ranges.
The probable maximum flood (PMF) was calculated from the probable maximum precipatation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC1-DB Flood Hydrograph Computer program.

Initial and infiltration loss rates were applied to the Probable Maximum Storm rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC1-DB.

THE SDF peak inflow calculated for Nishisakwick Creek Dam is 1748 cfs which results in overtopping of the dam.

The stage-outflow relation for the spillway was determined utilizing HEC1-DB program from the known spillway length and elevation and the assumed discharge coefficient (see computer printout).

The reservoir storage capacity curve can be computed directly by the conic method, utilizing the HEC1-DB program. The conic method assumes that the reservoir capacity resembles a series

of vertically stacked cones. The reservoir surface areas at various elevations were measured by planimeters from U.S.G.S. Quadrangle topographic maps. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing.

A breach analysis indicates that the hazard potential for loss of life downstream, due to dam failure from overtopping, is not significantly greater than that which exists without failure.

Drawdown calculations indicate that to empty the lake to an elevation of 577' MSL through the low-level outlet, would take 2 days 13 hours, assuming a 2 cfs/square mile inflow. This is considered inadequate for emergency draindown.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, it is known that the dam has not been overtopped in its history.

c. Visual Observation

The valley below the dam is heavily wooded, and there is a house immediately downstream of the dam. The slopes around the lake are approixmately 3 on 1. The majority of the drainage area is densely wooded.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of .81 feet. Computations indicate that the dam can pass approximately 13% of the PMF without overtopping the dam crest. Since one half the PMF is the minimum Spillway Design Flood (SDF) for this dam, and since the hazard potential for loss of life downstream, due to dam failure from overtopping, is not significantly greater than that which exists without failure, the spillway of the Nashisakwick Creek Dam is assessed as "inadequate."

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The dam structure shows no signs of major seepage, cracking, settlement or differential movement that would suggest instability. The spillway and wingwalls appear by visual inspection to be in satisfactory condition with regard to stability. The large trees near the spillway and on the downstream face pose a possible threat to stability and should be removed.

b. Design and Construction Data

No design computations concerning structural stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

Brief records on microfiche are available, outlining qualitatively the post-construction settlement, cracking and seepage. The dam has served satisfactorily since its construction in 1930.

d. Post-Construction Changes

Approximately 5 years ago, the spillway structure was reconstructed due to severe deterioration. The corewall was also extended by 20 feet to the right of the spillway.

From the visual inspection, the new structure appeared to be in good condition.

e. Static Stability

A static stability analysis was not performed for Nishisakwick Creek Dam because the lack of data on which to base assumptions of material properties might produce misleading results. The static stability is considered, by inspection only, to be satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0,

1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since the last two conditions are considered to be satisfactory, seismic stability is not regarded as a problem on this dam. A Geological Map is presented in Plate 2.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The safety of Nishisakwick Creek Dam is in question because the dam does not have adequate spillway capacity to pass one-half the PMF without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the dam or spillway. The dam's spillway can pass only about 13% of the PMF, and is inadequate.

The approximate static stability analysis performed for this dam indicates that factors of safety against movement are adequate.

b. Adequacy of Information

The information and data uncovered is not adequate to perform a comprehensive, definitive evaluation of the dam's stability. Nevertheless, in view of the past performance of the dam, and its present condition, it is not judged that additional information on the engineering properties of the embankment and foundation materials is necessary at this time.

c. Urgency

Carry out a more precise hydrologic and hydraulic analysis of the dam within six months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The studies should be performed by an engineer experienced in the design and construction of dams.

The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within a reasonable period of time.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are as follows:

1. Increase the dam height, thus permitting a higher discharge to pass over the spillway and reduce possible overtopping.

2. Lower the weir crest elevation.

3. Widen the weir structure.

4. Modify the dam to withstand overtopping.

b. Other Remedial Measures

1. All trees and brush should be removed from the dam embankment to avoid problems which may develop from their roots. The grass covering should be maintained for surface erosion protection.

2. Replacement of small quantities of eroded fill and rip-rap, and repair of minor cracks should be undertaken during routine maintenance.

c. Recommendations

The following additional action is recommended:

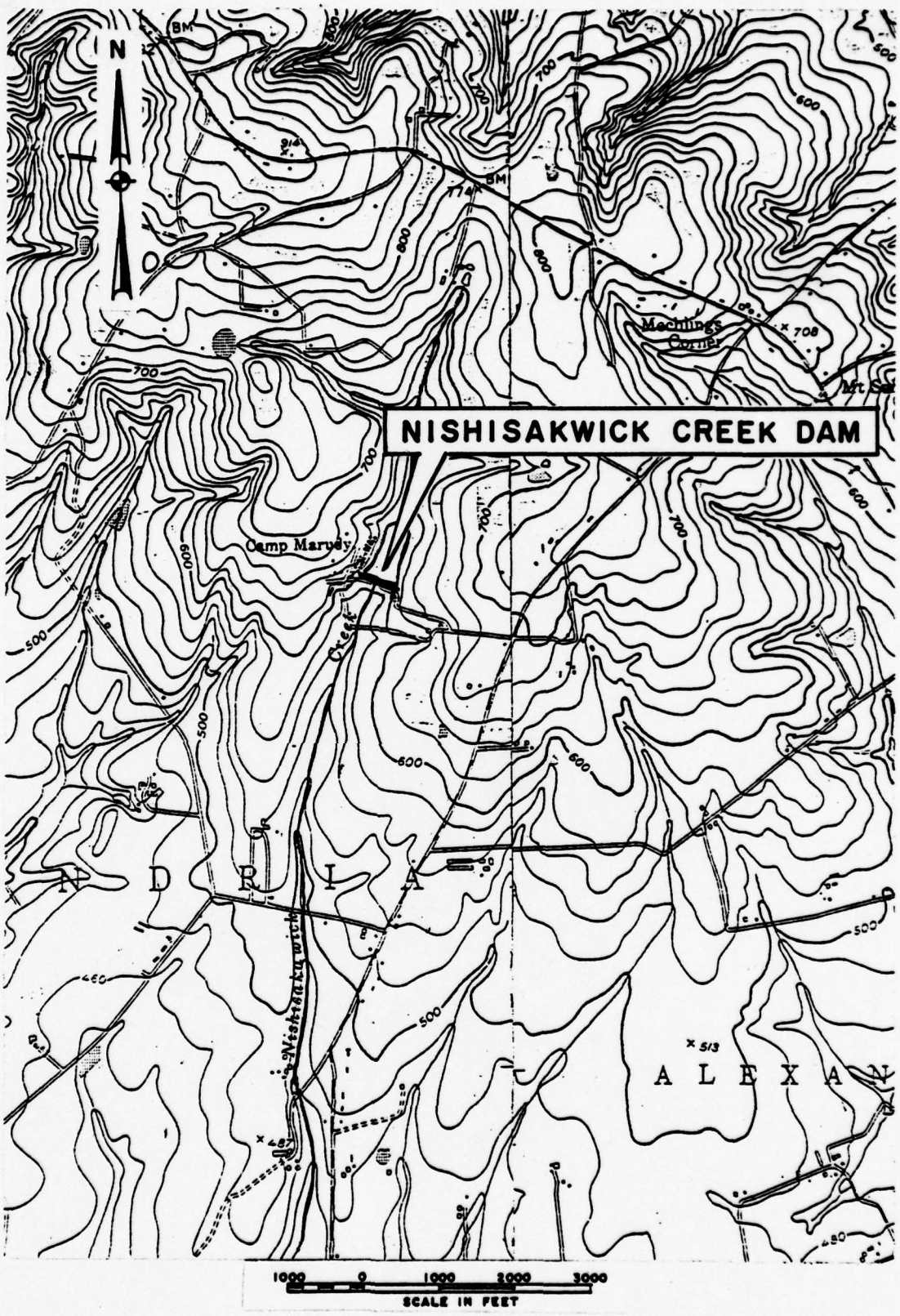
1. Remove the concrete stop-gate at the left of the dam.

2. Provide additional low-level outlet facilities. Since the existing outlet pipe is pressurized, a control valve should be provided at the upstream end.

d. O & M Procedures

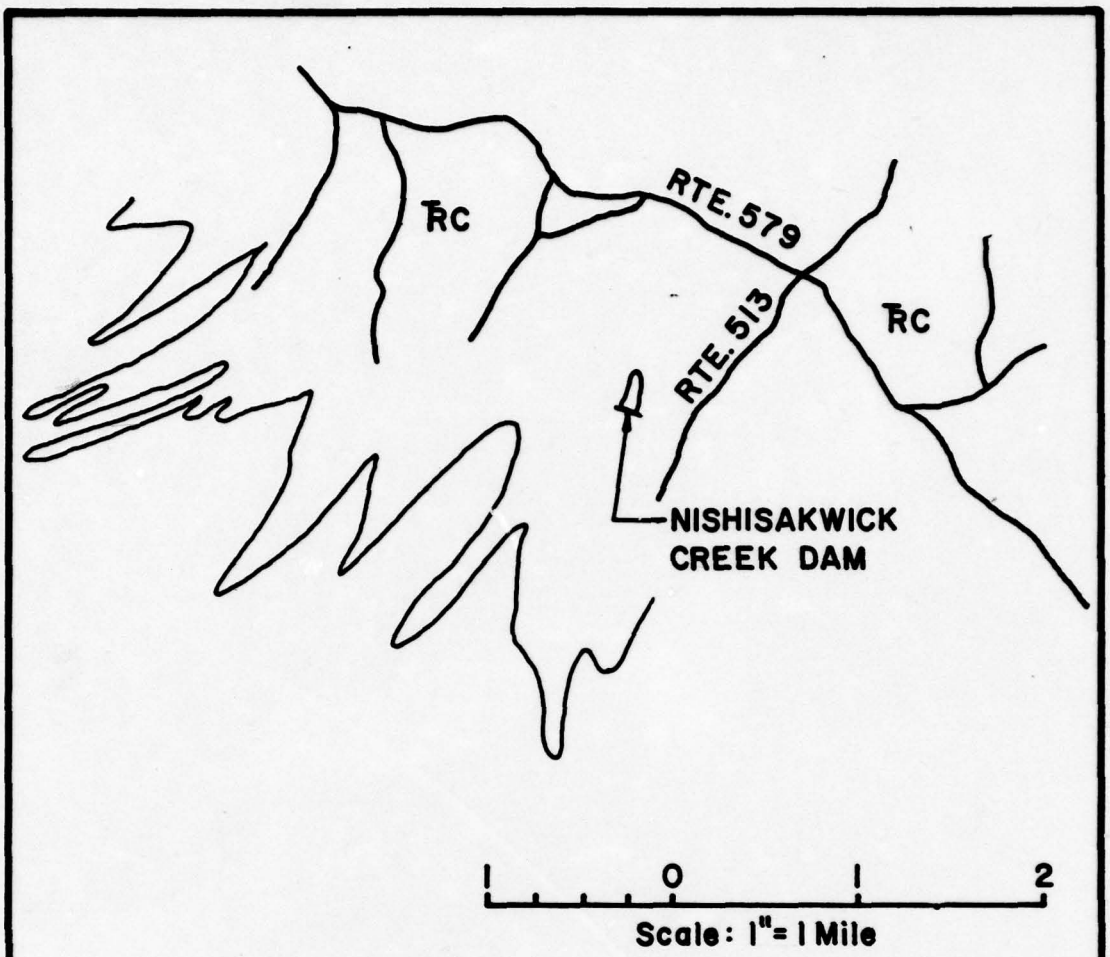
A formalized program of annual inspections of the dam by an experienced party should be initiated, utilizing the standard visual check list in this report. A headwater gage should be installed in the dam, and read out during severe rain storms and at routine operating and maintenance visits to the dam. A permanent log should be kept of all maintenance and operating events of the dam and the lake. Movement and settlement of the embankment should be monitored regularly by means of surveying monuments, and any change in seepage rates should be noted.

PLATES



VICINITY MAP

PLATE I



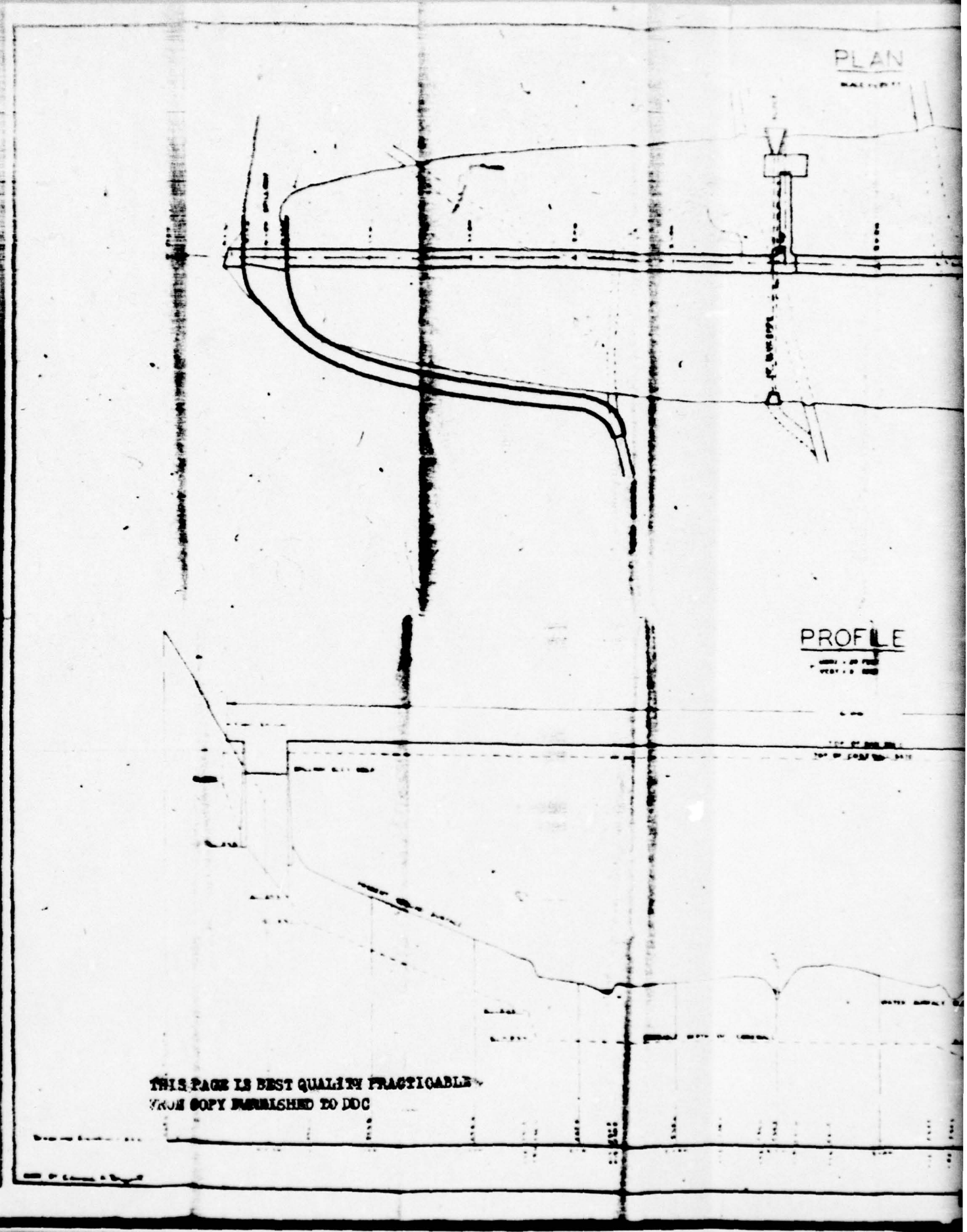
LEGEND

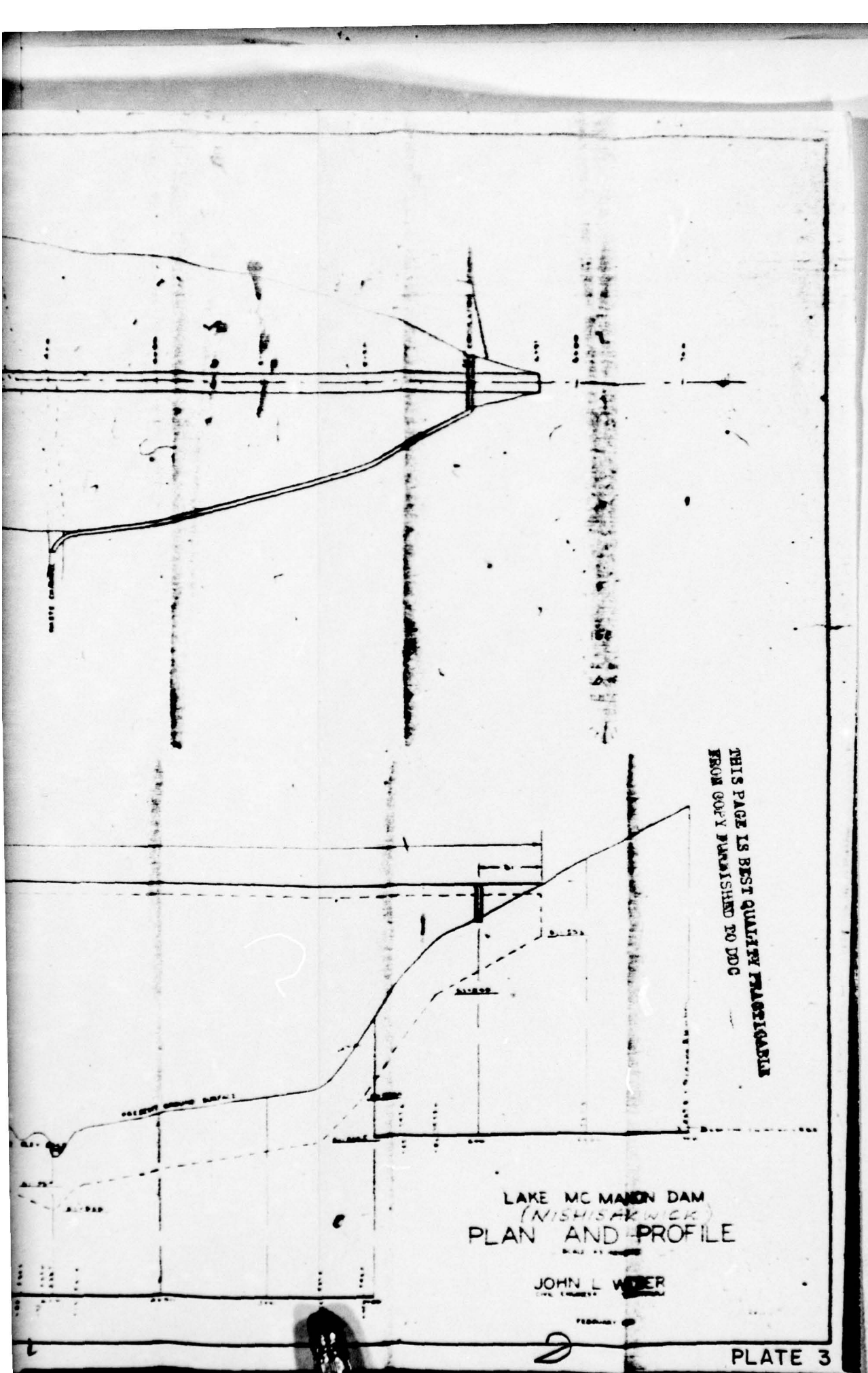
TRIASSIC

TRC — Brunswick Formation
Border Conglomerate

GEOLOGIC MAP
NISHISAKWICK CREEK DAM

PLATE 2

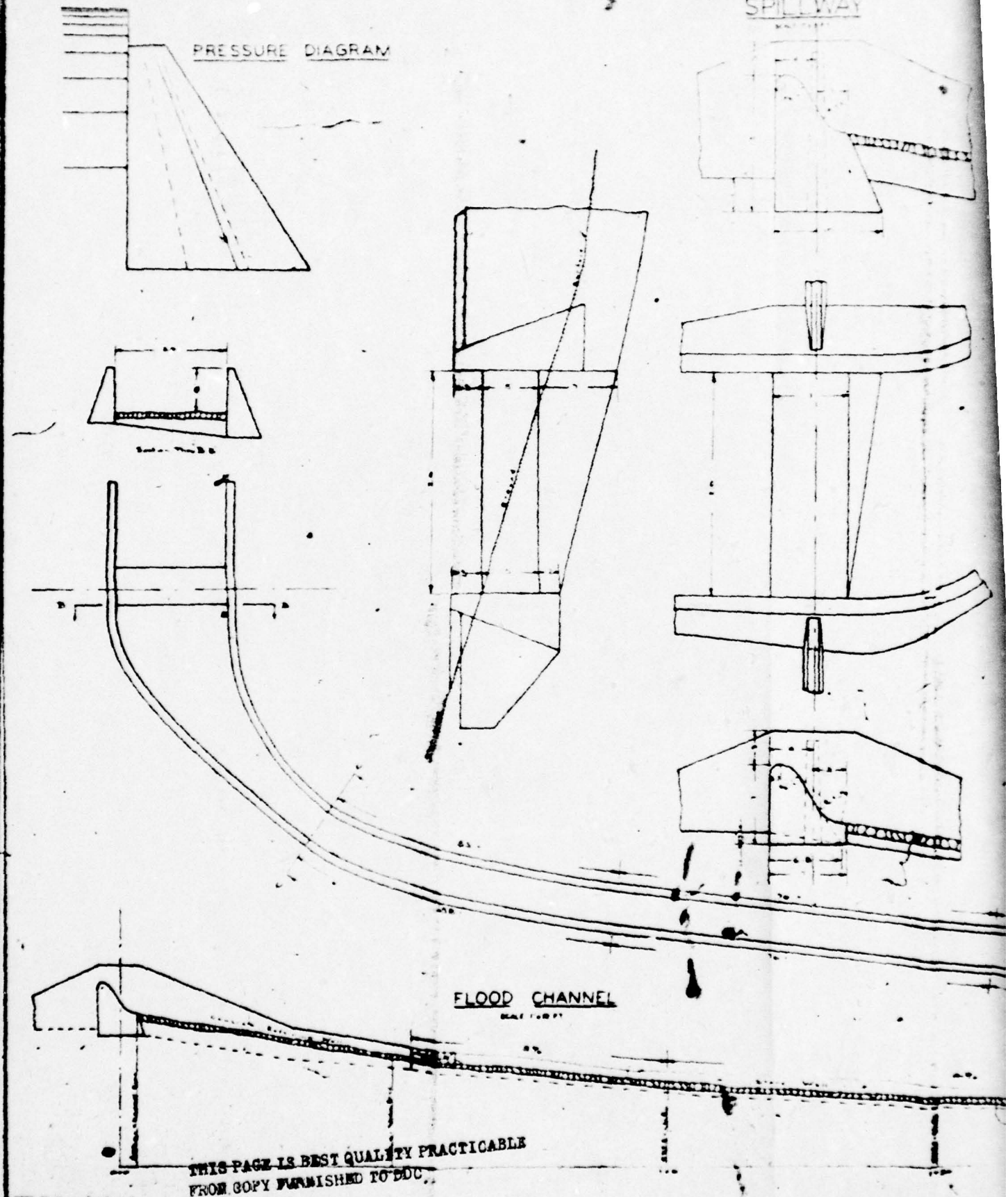




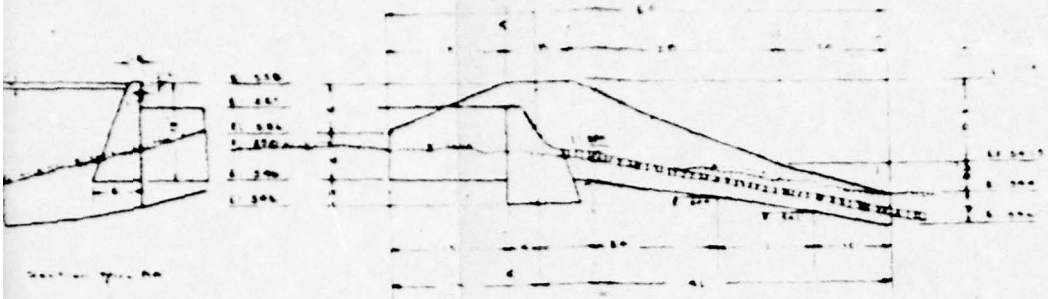
LAKE MC MAHON DAM
(NISHISAKAWICK)
PLAN AND PROFILE

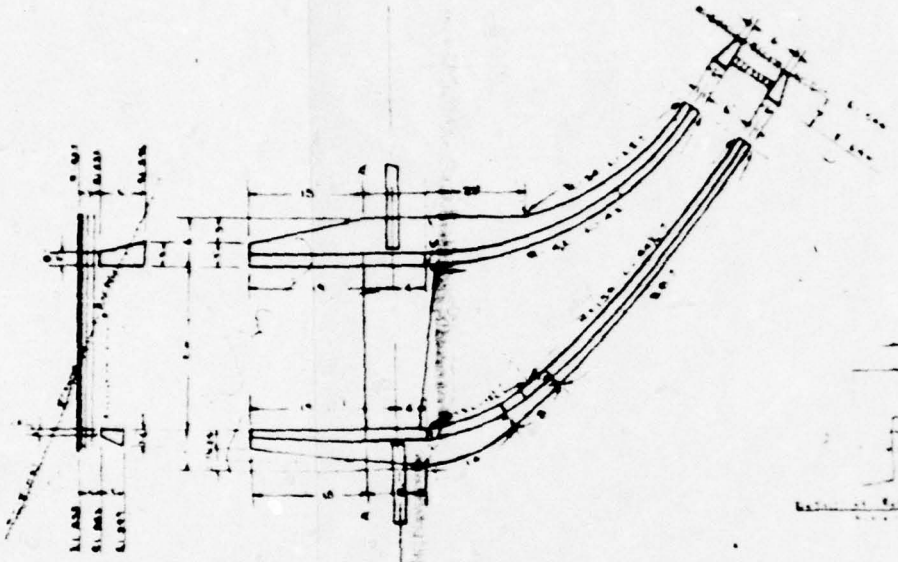
JOHN L WEBER

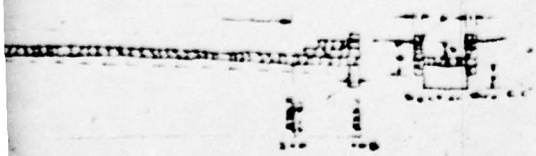
PLATE 3



RETAINING WALLS



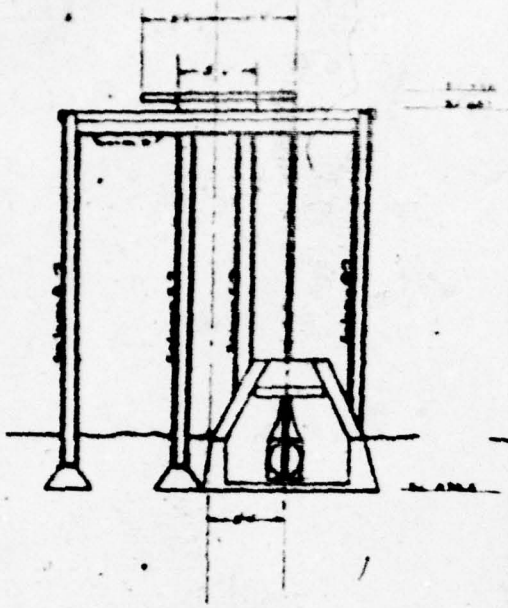




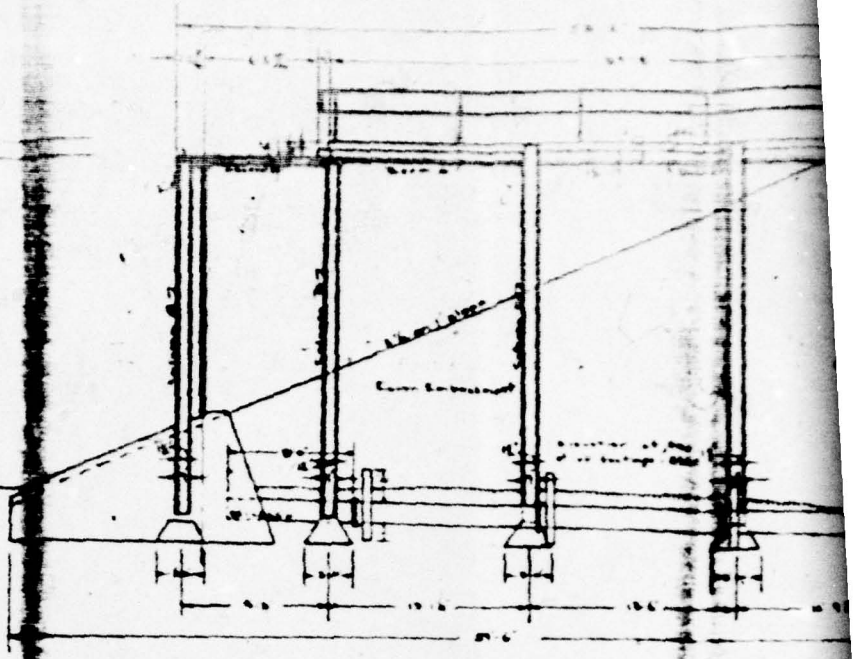
LAKE MC MAHON DAM
(NISHNABOTNA)
SPILLWAY AND RETAINING WALLS

JOHN L WEBER

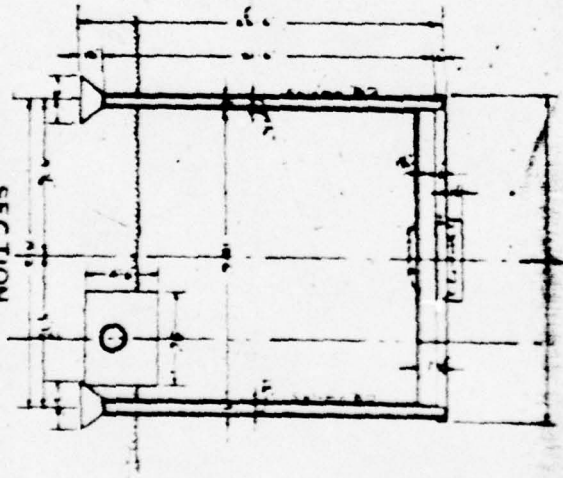
PLATE 4



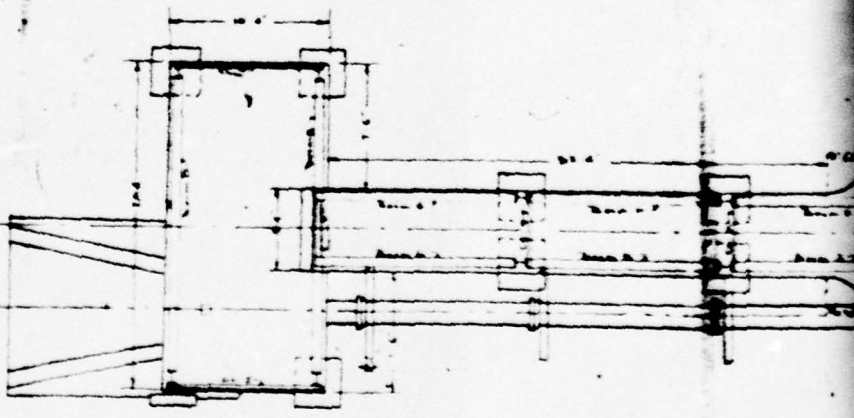
END VIEW



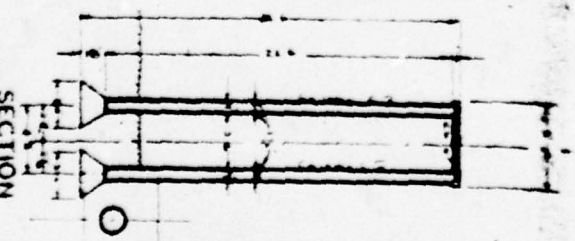
PROFILE



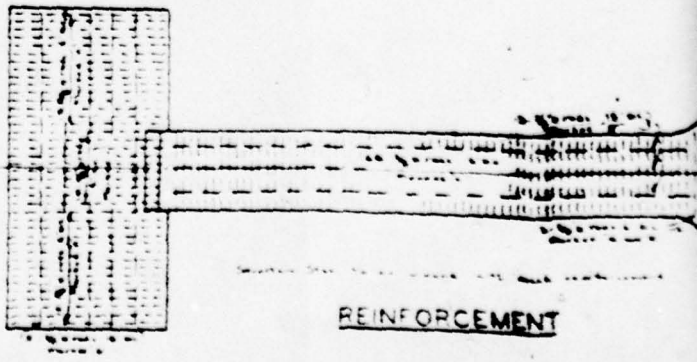
SECTION



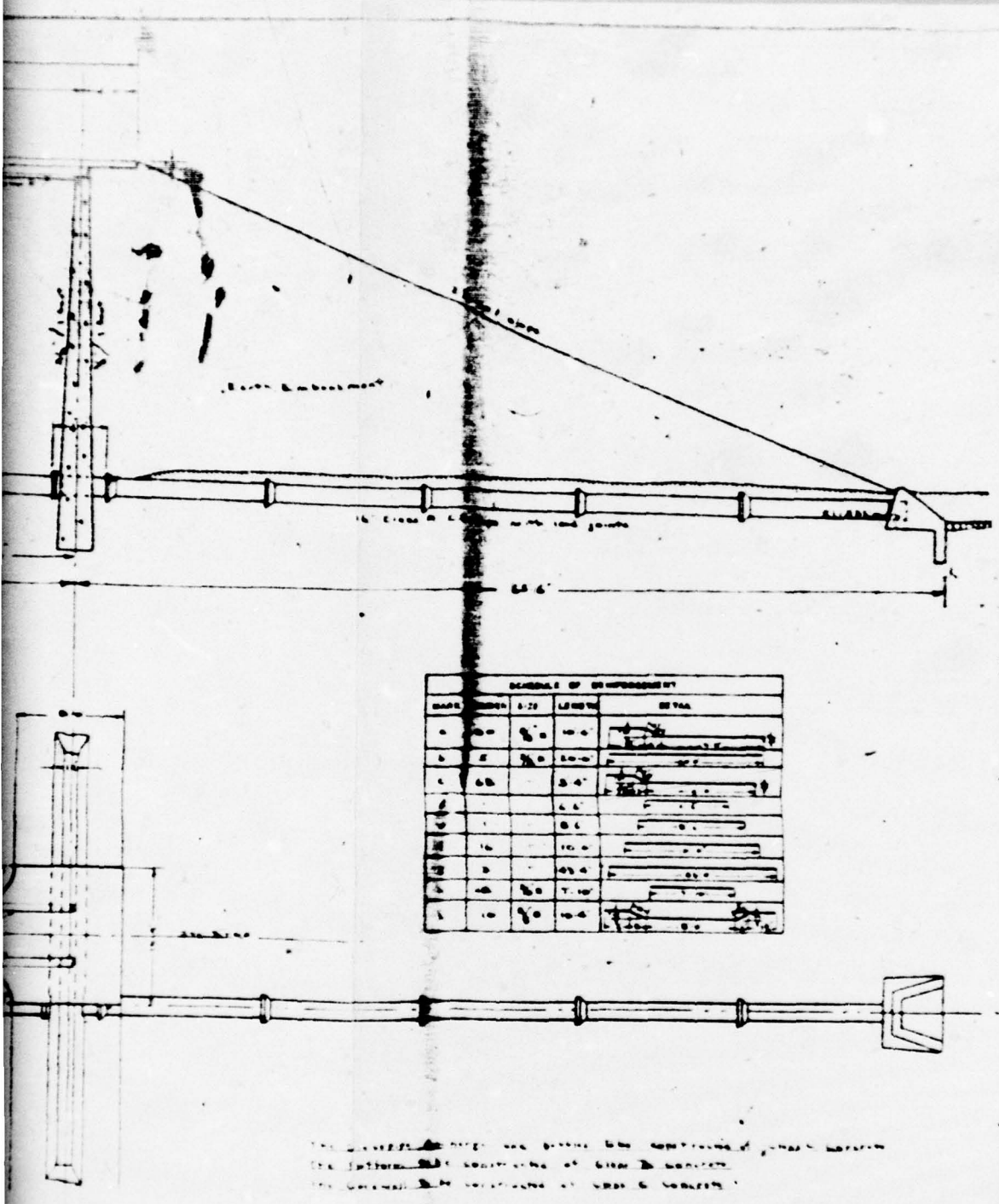
PLAN



SECTION



REINFORCEMENT



LAKE MC MAHON DAM
(NISHISAKNICK)
SLUICEPIPE AND CONTROL PLATFORM

JOHN L. WEBER

PLATE 5

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION

PHASE I

Name of Dam Nishisakwick Creek County Hunterdon State New Jersey Coordinators NJDEP

Date(s) Inspection May 2, 1979 Weather Sunny Temperature 80° F

Pool elevation at Time of Inspection 594' M.S.L. Tailwater at time of Inspection 577' M.S.L.

Inspection Personnel:

Eugene Koo
Henry King
Chuck Chin

Owner's Representatives present at inspection:

T.A. Stryker (Maintenance Contractor - (201) 735-5058)
R. Seiler
G. Cervenka

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	No visible surface cracks.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No evidence of movement or cracking at toe.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No significant sloughing or erosion. Small amounts of silt have been washed out of the fill with the seepage. Minor erosion of u/s face near spillway.	Replace lost fill as part of routine maintenance. Provide rip-rap on upstream face near spillway.
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	The axis of the dam is straight. No major deviations from line or grade in the horizontal or vertical planes were noted.	
RIPRAP FAILURES	No failures of the small areas of rip-rap protection were found.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
VEGETATION	Trees are growing on upstream and downstream faces. Brush growth is moderate.	Cut down trees on the embankment faces, and adjacent to spillway.
JUNCTION OF EMBANKMENT AND ABTUMENT, SPILLWAY AND DAM	The concrete core has been extended by 20' feet to the right of the spillway. No erosion of the embankment was noted adjacent to the spillway on the downstream face. Erosion has taken place adjacent to the left abutment on the upstream face.	Replace lost fill as part of routine maintenance.
ANY NOTICEABLE SEEPAGE	Seepage was visible at the left end on the downstream face of the embankment below the auxiliary spillway, where a standing pool has formed. Minor seepage next to main spillway.	Stability of dam is not jeopardized by the present level of seepage. Seepage should be regularly monitored.
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	A unregulated concrete ogee weir, 20 feet wide, forms the crest of the spillway. No horizontal misalignment was noted. Water level was below the crest at the inspection. Horizontal crack, 2 feet from bottom, runs across the full width. Minor seepage; otherwise good condition.	Crack appears to be a construction joint. No action required.
APPROACH CHANNEL	No formal channel. Insufficient rip-rap near weir.	Provide additional rip-rap at weir entrance.
DISCHARGE CHANNEL	A sloping, curved concrete discharge channel leads from the ogee to the stream. Minor cracks in the concrete were noted, and a small amount of seepage was flowing through the cracks.	Repair concrete cracks with epoxy grout as part of routine maintenance.
BRIDGE AND PIERS	Four-foot wide footbridges over main (right) and auxiliary (left) spillways are in good condition.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	N/A	
INTAKE STRUCTURE (Low-Level Outlet)	No intake structure as such. The 16" ø low-level outlet pipe intake is at the level of the lake bottom. There is a trash rack provided at the inlet end of the pipe. The pipe is of cast iron.	
OUTLET STRUCTURE (Low-Level Outlet)	The low-level outlet pipe discharges approximately 100 feet downstream of the dam, through a short concrete and masonry channel into a stream which joins the main stream. The control valve is at the outlet structure and is operable.	
OUTLET FACILITIES	An auxiliary outlet facility is provided on the left side of the dam by an 12 inch diameter concrete unregulated culvert. Beyond the culvertis a 4 by 4 foot concrete block with a 4 inch opening at the bottom. The opening is easily blocked by debris.	Recommend that concrete block is removed.
EMERGENCY GATE	None	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS		
None		Install a nearby benchmark.
OBSERVATION WELLS		
None		
WEIRS		
None		
PIEZOMETERS		
None		
OTHERS		
None		Install gages to measure lake and tailwater elevations.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	The slope on the lake rim is approximately 3 to 1. No signs of instability. Slight undercutting in places. Vegetation is mainly sparse. Deciduous trees at intake end.	
SEDIMENTATION	Visible at the upstream dam face and at the inlet to the lake.	
USE	Recreation.	
SHORELINE BUILDINGS	Many camp buildings on the right bank, a few on the left. Some small-boat stages and swimming facilities.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Below the main spillway channel, the stream bed is eroded and the stream banks are undermined. Flow downstream is obstructed by collapsed footbridge. Below the confluence with the 16 inch pipe outlet channel, the over bank becomes flat.	Place rip-rap on channel banks near spillway. Reinstate downstream footbridge.
SLOPES	Steep slopes immediately downstream of the concrete channel, moderate slopes near the footbridge and flat ground along the natural channel.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	One house is located near the downstream footbridge and no other homes are in the immediate downstream reach. It is estimated that there are more than 20 homes within 2 miles downstream.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available.
REGIONAL VICINITY MAP	Available. U.S.G.S. Quadrangle Map - Frenchtown.
CONSTRUCTION HISTORY	The dam was constructed in 1930 and contains a concrete core.
TYPICAL SECTIONS OF DAM	Available.
HYDROLOGIC/HYDRAULIC DATA	Original spillway and outlet capacity on dam application No. 158. No hydrologic data.
OUTLETS - PLAN	Available. Included herein.
- DETAILS	Available. Included herein.
- CONSTRAINTS	Available. Included herein.
- DISCHARGE RATINGS	Available. Included herein.
RAINFALL/RESERVOIR RECORDS	None available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	U.S.G.S. Quadrangle: Geological overlay sheet. Rutgers University Report for Hunterdon County.
DESIGN COMPUTATIONS	None available.
HYDROLOGY & HYDRAULICS	Spillway capacity given on dam application (original spillway).
DAM STABILITY	None available.
SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS	None available.
BORING RECORDS	1930 test-holes revealed that the foundation is hardpan.
LABORATORY	None available.
FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	1968 inspection report on microfiche. NJDEP.
BORROW SOURCES	Not known.
SPILLWAY PLAN - SECTIONS	Available. Included herein.
- DETAILS	Available. Included herein.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None.
MODIFICATIONS	Approximately 5 years ago silt was dredged from the lake. Spillway and walkway rebuilt, and the low-level outlet valve was relocated.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION	None.
- REPORTS	None.
MAINTENANCE OPERATION RECORDS	In the files of T. A. Stryker Co., Maintenance Contractor.

APPENDIX B

PHOTOGRAPHS

(Taken on May 2, 1979)

Photo No. 1 - Overall view of spillway and bridge structure from downstream. Note crack at joint of vertical and sloped right wing-wall, also seepage at the base of the spillway.

Photo No. 2 - Overall view of upstream face of spillway. Note build-up of stones and silt at the spillway inlet.

Photo No. 3 - View of concrete walkway along the crest and the emergency spillway. Note outlet pipe from the lake.

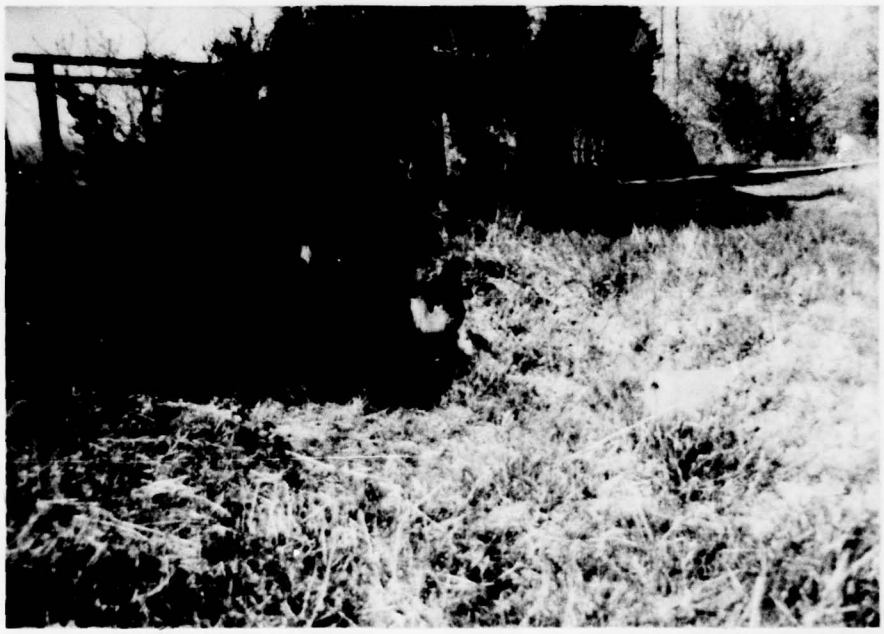


Photo No. 4 - View of the emergency spillway and bridge. Note the four inch opening at the bottom is clogged with debris.

Photo No. 5 - View of low level outlet. Note valve key behind the concrete wall.

Photo No. 6 - View looking upstream at the intersection of the spillway channel and the low level outlet channel.

Photo No. 7 - Overall view of reservoir from spillway bridge, looking upstream.

Photo No. 8 - View of downstream channel - Nishisakwick Creek. Note slight cracks and spalling of the left wingwall on the spillway outlet.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: Nishisakwick Creek Dam

Drainage Area Characteristics: Forest, light residential near lake.

Elevation Top Normal Pool (Storage Capacity): 597' (118 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: (SDF) 600.81' (148 acre-feet)

Elevation Top Dam: 600' (141 acre-feet)

SPILLWAY CREST

a. Elevation 597'

b. Type Dropped ogee.

c. Width 2'

d. Length 19' 10"

e. Location Spillover Right side of dam.

f. No. and Type of Gates None.

OUTLET WORK: (Auxiliary)

a. Type Concrete culvert.

b. Location Left side of dam.

c. Entrance Inverts 598' MSL

d. Exit Inverts 598' MSL

e. Emergency Draindown Facilities 16" diameter low-level outlet. (el. 577' MSL)

HYDROMETEOROLOGICAL GAGES

a. Type N/A

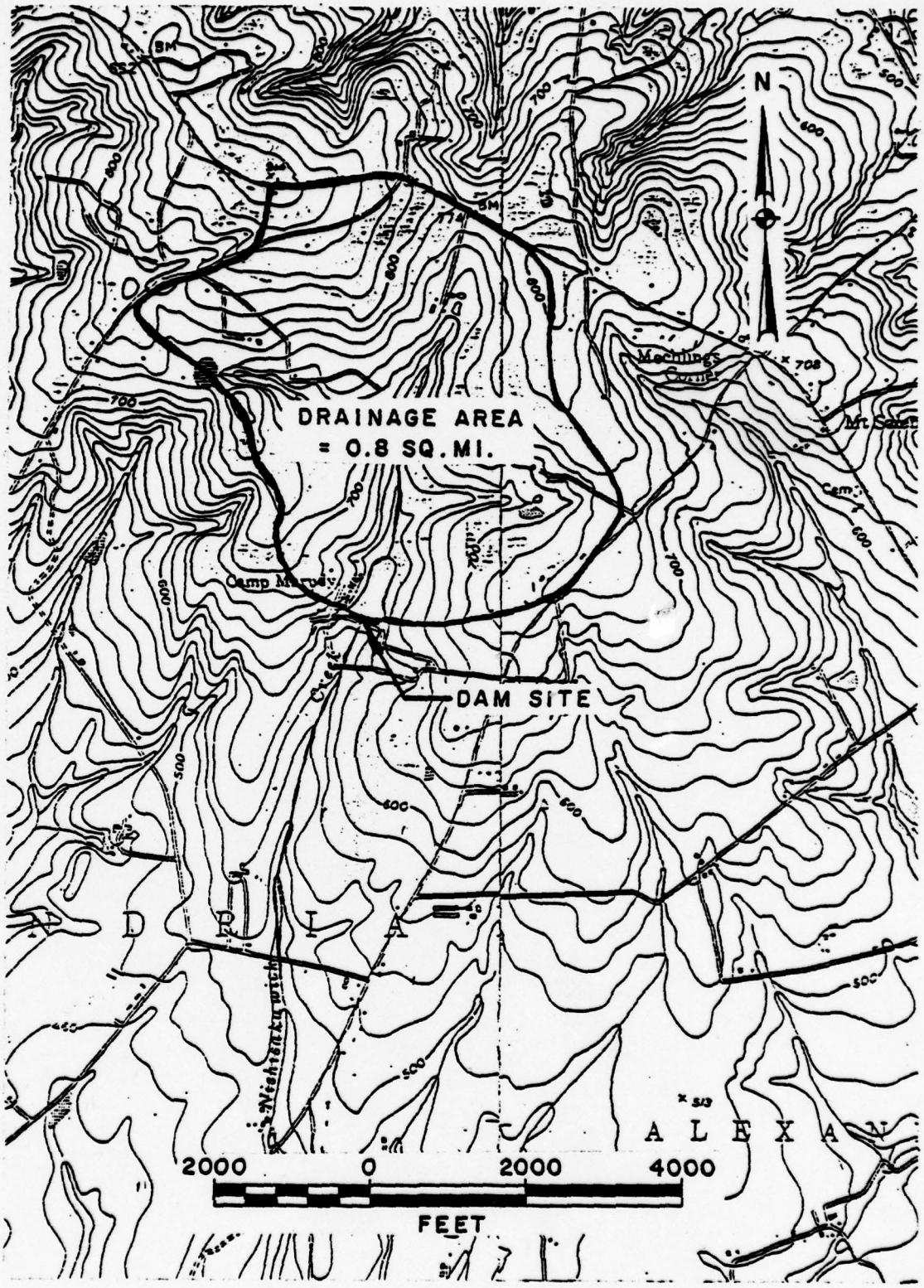
b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE 407 cfs

APPENDIX D

HYDROLOGIC COMPUTATIONS



NISHISAKWICK CREEK DAM
DRAINAGE BASIN

Size & Hazard Classification

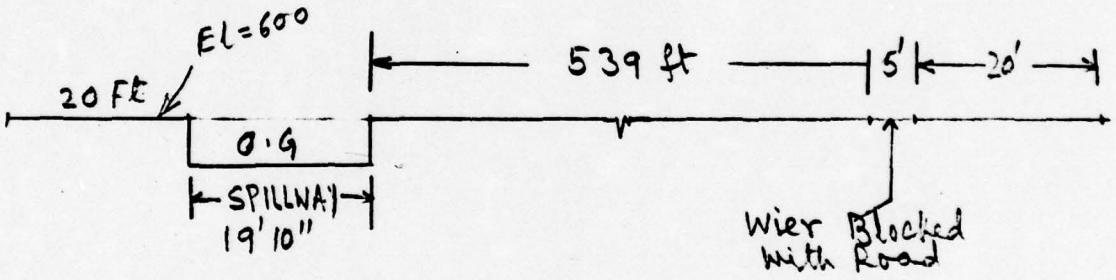
Surface area of Lake = 7.35 Acres

Small Dam, High Hazard

S.D.F = $\frac{1}{2}$ PMF

Hydrologic Analysis : D.A = 0.83 Sq mi

Inflow hydrograph at Dam was determined using HEC 1 DB program. The inflow routed through the reservoir.

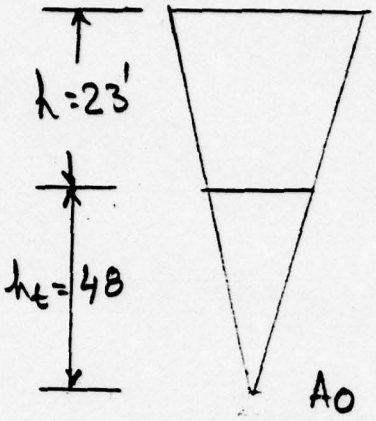


Elevation of Road = 600'
Elevation of Spillway Crest = 597'

Reservoir Stage Area Relation :

Pool level (597') = 7.35 Ac

At elevation 620 = 16 AC



$$h_t = h / \left(\sqrt{\frac{A_2}{A_1}} - 1\right) = \frac{23}{.475} = 48$$

PMS = 23" 200 sq miles 24 hrs.
For Zone 6 The all season envelope

6 hr - 112 %.
12 hr - 123 %.
24 hr - 132 %.
48 hr - 143 %.

Estimation of T_c

1) Estimating T_c from velocity estimate and watercourse length

		Slope	Vel*	
Overland flow	$\frac{914-774}{2900}$	= 4.8%	3.0	Pasture upper portion of watershed
Reach 1	$\frac{774-640}{3200}$	= 4.2%	3.0	Natural Channel
Reach 2	$\frac{640-597}{1700}$	= 2.5%	1.0	Natural Ch. not well defined

* From Figure 13, Engineering for Small Dams.

$$T_c = \frac{2900+3200}{3\times 3600} + \frac{1700}{1\times 3600} = 1.03 \text{ hrs.}$$

2) Estimating T_c assuming same velocity $= \frac{7800}{1.5\times 3600} = 1.4$ hrs

3) (S.C.S Guide) - Same as Kirpich

$$T_c = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

$L = 7800 \text{ Ft} = 1.48 \text{ Miles}$

$H = 317 \text{ Ft}$

$$= \left(\frac{11.9\times(1.48)^3}{317}\right)^{.385}$$

$$= .45 \text{ hrs.}$$

Assume $T_c = 1.40$ hrs.

Lag $= 0.6\ T_c = .84$ hrs.

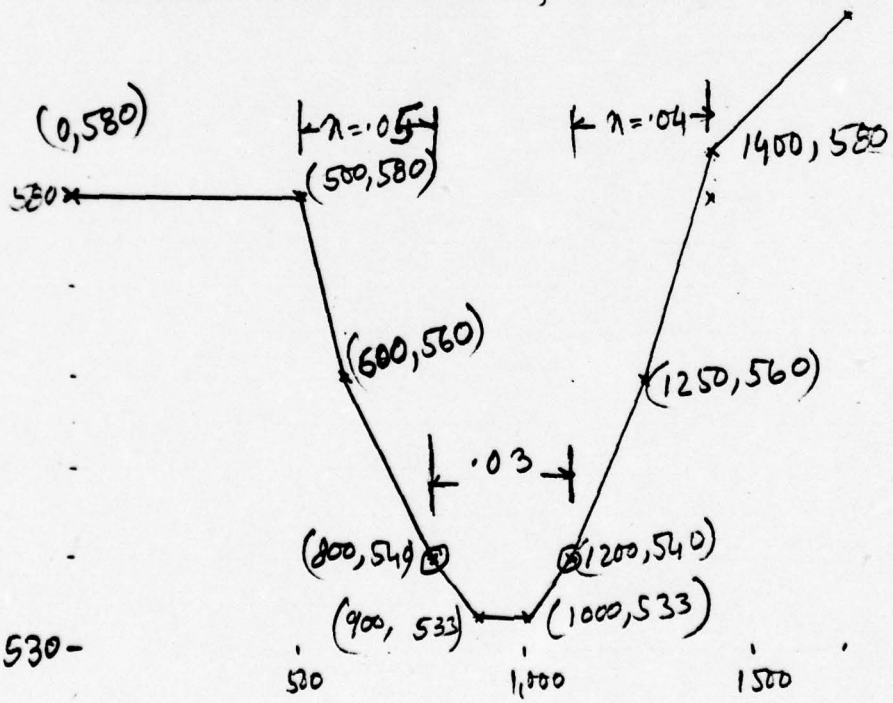
Invert of the channel at Dam Site 23' below the top of the dam.

$\therefore$ El = 600 - 23 = 577 ft

The Downstream Slope estimated from U.S.G.S $\approx \frac{100}{3600} = .0277$ ft

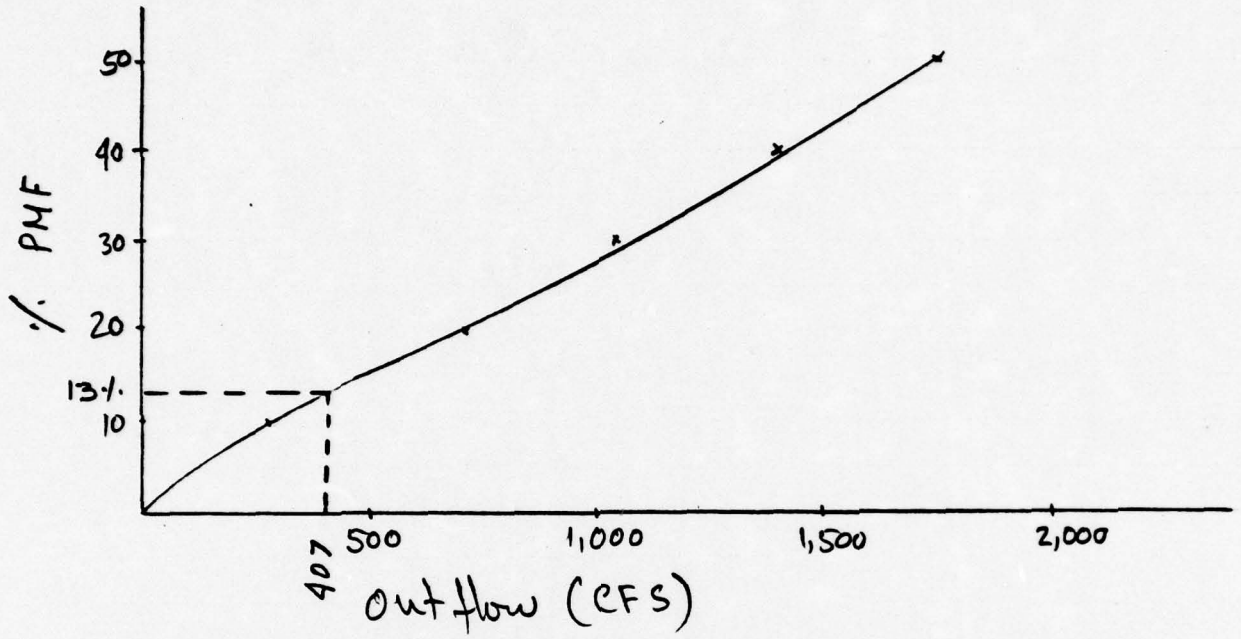
At 2000 ft D/S

Section Plotted from U.S.G.S Quad



Slope = $\frac{20'}{1350}$ at this location .01538

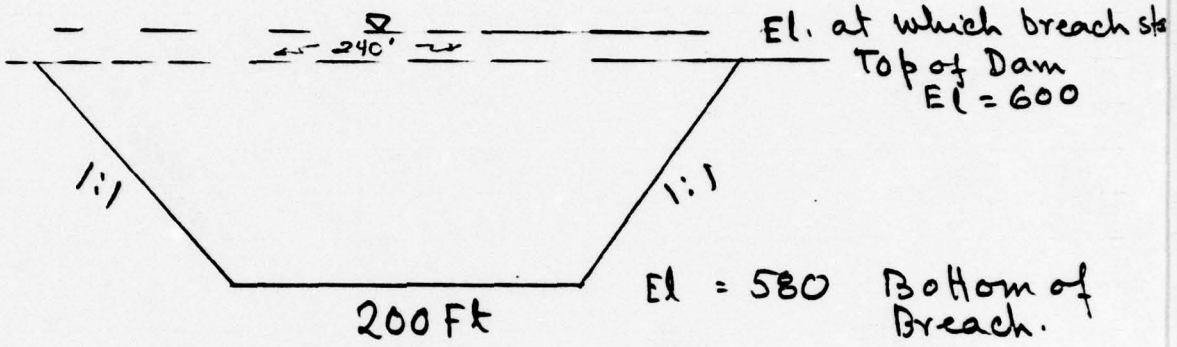
Overtopping Potential



Overtopping of Dam occurs at Ele 600 with Q = 407 cfs (≈ 13.1% of PMF)

Breach Analysis

Assume breach begins to develop when Reservoir stage reaches ele = 600.3 Ft ie, 0.3 Ft above dam.



Effect of breach was analyzed at 2000 Ft downstream of breach.

Maximum stage without dam break = 533.1

Maximum stage after dam break = 535.2

No serious damage at 2000' downstream is expected due to Dam break, but the frequently occupied house 100' downstream would be washed away, possibly causing the loss of more than a few lives.

Reservoir Evaluation

a) $16''\phi$ Pipe area $= \frac{\pi}{4} \times \left(\frac{16}{12}\right)^2 = 1.39$

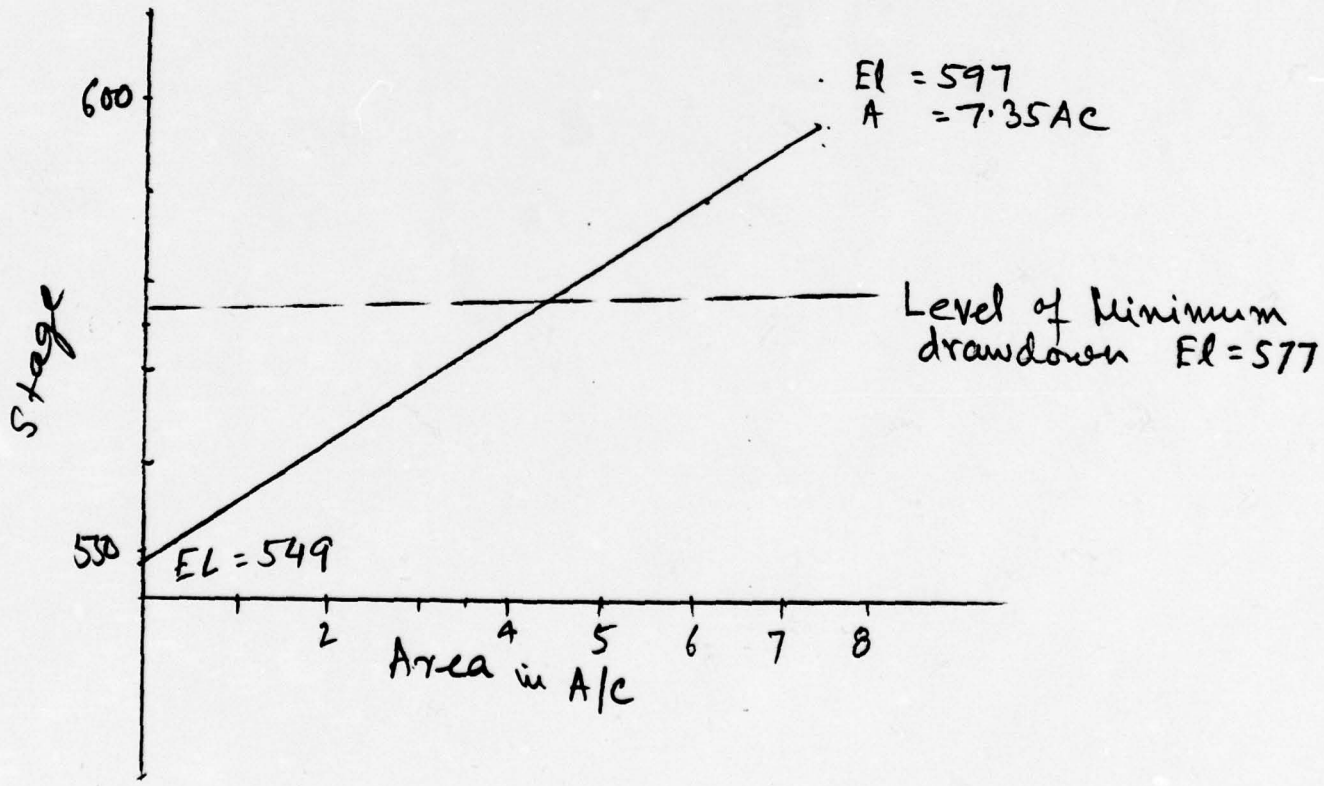
Tailwater $= 577'$ MSL

ΣK assumed $= 1.5$ (See HEC 2 Manual)

$$Q = A \times \sqrt{\frac{29H}{K}}$$

$$= 1.39 \times \sqrt{\frac{64.4}{1.5}}\sqrt{H} = 9.1\sqrt{H}$$

b) Stage Vs. Area



© Drainage area = 0.83 sq mi

Assuming 2 cfs/SM flow

Inflow = 1.66 cfs.

El	Area (AC)	Av. Area (Ac)	Vol (AF)	Head on outlet H	Outlet $Q = 9.10\sqrt{H}$	Time to draw $t_1 = \frac{Vol \times 24}{1.98Q}$	Time to draw 1.66 cfs $\frac{1.66 \times t_1}{Q}$	Total time $t_1 + t_2$
597	7.35							
		7	28	18	38.6	8.8	.4	9.2
593	6.6							
		6.4	25.6	14	34.0	9.1	.4	9.5
589	6.2							
		5.8	23.2	10	28.8	9.8	.6	10.4
585	5.5							
		5.2	20.8	6	22.3	11.3	.8	12.1
581	4.9							
		4.6	18.4	2	12.9	17.3	2.2	19.5
577	4.4							
						56.3		60.7

Time of Drawdown with no inflow
= 56 hrs = 2 days 8 hrs.

Time of Drawdown with Const. inflow of 2 cfs/SM
= 61 hr = 2 days 13 hrs.

HEC1-DB

Computer Print-out.

MULTIRATIO PMF ROUTING.

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
     1              A1       N.J. DAM INSPECTION
     2              A2       N.J. 00129 NISHISAKWICK CREEK
     3              A3       MULTI RATIO PMF ROUTING
     4              B    100       0      15       0       0       0       0       0       0       0
     5              B1     5
     6              J      1       5       1
     7              J1   .5      .4      .3      .2      .1
     8              K      0     DAM                                       1
     9              K1       LOCAL INFLOW
    10              M      1       2     .83                     .83
    11              P      0      23     112     123     132
    12              T                                                 1    .10             .02
    13              W2             .84
    14              X     -1   -0.05       2
    15              K      1     DAM                                       1
    16              K1       ROUTING THROUGH DAM
    17              Y                                      1       1
    18              Y1                                                -597.
    19              $A     0    7.35      16
    20              $E   549     597     620
    21              $S   597   19.83    3.95     1.5
    22              $D   600    2.75     1.5     584
    23              K      1 REACH 1                                       1
    24              K1       CHANNEL ROUTING MOD. PULS. REACH 1
    25              Y                                      1       1
    26              Y1     1
    27              Y6   .05     .03     .05     533     570    2000 .015385
    28              Y7   500     580     600     560     800     540     900     533    1000     533
    29              Y7  1200     540    1250     560    1400     580
    30              K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT DAM
ROUTE HYDROGRAPH TO DAM
ROUTE HYDROGRAPH TO EACH 1
END OF NETWORK

```
RUN  DATE 79/07/09.
     TIME 14.18.30.

                    N.J. DAM INSPECTION
                    N.J. 00129 NISHISAKWICK CREEK
                    MULTI RATIO PMF ROUTING

                                JOB SPECIFICATION
      NQ     NHR     NMIN     IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
     100       0       15        0       0        0        0        0        0        0
                              JOPER      NWT   LROPT   TRACE
                                  5        0       0       0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1 NRTIO= 5 LRTIO= 1
          RTIOS=    .50     .40     .30     .20     .10

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

                          SUB-AREA RUNOFF COMPUTATION

     LOCAL INFLOW

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

                                HYDROGRAPH DATA
      IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
          1       2     .83    0.00     .83    0.00   0.000       0       0       0

                                PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   23.00  112.00  123.00  132.00    0.00    0.00    0.00
 TRSPC COMPUTED BY THE PROGRAM IS  .800

                                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     .10    0.00     .02

                              UNIT HYDROGRAPH DATA
                          TC=  0.00    LAG=   .84

                                RECESSION DATA
                        STRTQ=   -1.00    QRCSN=   -.05    RTIOR= 2.00

     UNIT HYDROGRAPH 19 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=    .84  VOL= 1.00
        64.     210.     376.     414.     359.     256.     159.     105.      70.      45.
        30.      19.      13.       8.       6.       4.       3.       1.       0.

 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    .15       1    .03    .00    .03       1.      1.01  12.45      51    .52    .49    .02    408.
 1.01    .30       2    .03    .00    .03       1.      1.01  13.00      52    .52    .49    .02    587.
```

1	.45	3	.03	.00	.03	1.	1.01	13.15	53	.62	.59	.02	748.
1.01	1.00	4	.03	.00	.03	1.	1.01	13.30	54	.62	.59	.02	879.
1.01	1.15	5	.03	.00	.03	1.	1.01	13.45	55	.62	.59	.02	987.
1.01	1.30	6	.03	.00	.03	1.	1.01	14.00	56	.62	.59	.02	1075.
1.01	1.45	7	.03	.00	.03	2.	1.01	14.15	57	.77	.75	.02	1152.
1.01	2.00	8	.03	.00	.03	2.	1.01	14.30	58	.77	.75	.02	1230.
1.01	2.15	9	.03	.00	.03	2.	1.01	14.45	59	.77	.75	.02	1317.
1.01	2.30	10	.03	.00	.03	2.	1.01	15.00	60	.77	.75	.02	1400.
1.01	2.45	11	.03	.00	.03	2.	1.01	15.15	61	.78	.76	.02	1469.
1.01	3.00	12	.03	.00	.03	2.	1.01	15.30	62	1.57	1.54	.02	1569.
1.01	3.15	13	.03	.00	.03	2.	1.01	15.45	63	4.39	4.36	.02	1947.
1.01	3.30	14	.03	.00	.03	1.	1.01	16.00	64	1.10	1.07	.02	2647.
1.01	3.45	15	.03	.00	.03	1.	1.01	16.15	65	.72	.70	.02	3335.
1.01	4.00	16	.03	.00	.03	1.	1.01	16.30	66	.72	.70	.02	3479.
1.01	4.15	17	.03	.00	.03	1.	1.01	16.45	67	.72	.70	.02	3195.
1.01	4.30	18	.03	.00	.03	1.	1.01	17.00	68	.72	.70	.02	2708.
1.01	4.45	19	.03	.00	.03	1.	1.01	17.15	69	.57	.54	.02	2256.
1.01	5.00	20	.03	.00	.03	1.	1.01	17.30	70	.57	.54	.02	1959.
1.01	5.15	21	.03	.00	.03	1.	1.01	17.45	71	.57	.54	.02	1728.
1.01	5.30	22	.03	.00	.03	1.	1.01	18.00	72	.57	.54	.02	1547.
1.01	5.45	23	.03	.00	.03	1.	1.01	18.15	73	.04	.02	.02	1383.
1.01	6.00	24	.03	.00	.03	1.	1.01	18.30	74	.04	.02	.02	1184.
1.01	6.15	25	.08	.00	.08	1.	1.01	18.45	75	.04	.02	.02	929.
1.01	6.30	26	.08	.00	.08	2.	1.01	19.00	76	.04	.02	.02	674.
1.01	6.45	27	.08	.00	.08	2.	1.01	19.15	77	.04	.02	.02	461.
1.01	7.00	28	.08	.00	.08	3.	1.01	19.30	78	.04	.02	.02	311.
1.01	7.15	29	.08	.06	.02	7.	1.01	19.45	79	.04	.02	.02	216.
1.01	7.30	30	.08	.06	.02	19.	1.01	20.00	80	.04	.02	.02	170.
1.01	7.45	31	.08	.06	.02	41.	1.01	20.15	81	.04	.02	.02	159.
1.01	8.00	32	.08	.06	.02	65.	1.01	20.30	82	.04	.02	.02	148.
1.01	8.15	33	.08	.06	.02	86.	1.01	20.45	83	.04	.02	.02	138.
1.01	8.30	34	.08	.06	.02	101.	1.01	21.00	84	.04	.02	.02	129.
1.01	8.45	35	.08	.06	.02	110.	1.01	21.15	85	.04	.02	.02	120.
1.01	9.00	36	.08	.06	.02	117.	1.01	21.30	86	.04	.02	.02	112.
1.01	9.15	37	.08	.06	.02	121.	1.01	21.45	87	.04	.02	.02	105.
1.01	9.30	38	.08	.06	.02	123.	1.01	22.00	88	.04	.02	.02	98.
1.01	9.45	39	.08	.06	.02	125.	1.01	22.15	89	.04	.02	.02	91.
1.01	10.00	40	.08	.06	.02	126.	1.01	22.30	90	.04	.02	.02	85.
1.01	10.15	41	.08	.06	.02	127.	1.01	22.45	91	.04	.02	.02	79.
1.01	10.30	42	.08	.06	.02	127.	1.01	23.00	92	.04	.02	.02	74.
1.01	10.45	43	.08	.06	.02	128.	1.01	23.15	93	.04	.02	.02	69.
1.01	11.00	44	.08	.06	.02	128.	1.01	23.30	94	.04	.02	.02	64.
1.01	11.15	45	.08	.06	.02	128.	1.01	23.45	95	.04	.02	.02	60.
1.01	11.30	46	.08	.06	.02	128.	1.02	0.00	96	.04	.02	.02	56.
1.01	11.45	47	.08	.06	.02	128.	1.02	.15	97	0.00	0.00	0.00	52.
1.01	12.00	48	.08	.06	.02	128.	1.02	.30	98	0.00	0.00	0.00	49.
1.01	12.15	49	.52	.49	.02	156.	1.02	.45	99	0.00	0.00	0.00	46.
1.01	12.30	50	.52	.49	.02	246.	1.02	1.00	100	0.00	0.00	0.00	43.
									SUM	24.29	21.64	2.65	47231.
										(617.)	(550.)	(67.)	(1337.43)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3479.	1698.	492.	472.	47210.
CMS	99.	48.	14.	13.	1337.
INCHES		19.03	22.05	22.05	22.05
MM		483.39	559.95	559.98	559.98
AC-FT		842.	975.	975.	975.
THOUS CU M		1039.	1203.	1203.	1203.

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 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	DAM	.83 (2.15)	1	1740. (49.26)	1392. (39.41)	1044. (29.56)	696. (19.70)	348. (9.85)
ROUTED TO	DAM	.83 (2.15)	1	1748. (49.50)	1398. (39.59)	1048. (29.67)	718. (20.32)	290. (8.23)
ROUTED TO	EACH 1	.83 (2.15)	1	1729. (48.96)	1381. (39.12)	1034. (29.28)	690. (19.54)	291. (8.25)

533.0 533.0 533.0 533.0 533.0 533.0 533.0 533.0 533.0 533.0

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	597.00	597.00	600.00
STORAGE	118.	118.	141.
OUTFLOW	0.	0.	407.

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
.50	600.81	.81	148.	1748.	5.00	16.50	0.00
.40	600.65	.65	147.	1398.	4.50	16.50	0.00
.30	600.48	.48	145.	1048.	3.00	16.50	0.00
.20	600.29	.29	143.	718.	1.50	16.50	0.00
.10	599.40	0.00	136.	290.	0.00	17.00	0.00

PLAN 1 STATION EACH 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1729.	534.5	16.50
.40	1381.	534.2	16.50
.30	1034.	533.9	16.50
.20	690.	533.6	16.75
.10	291.	533.3	17.00

DAM BREACH

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**********  ********************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********  ********************
    1              A1       N.J. DAM INSPECTION
    2              A2       N.J. 00129 NISHISAKWICK CREEK
    3              A3       MULTI RATIO PMF ROUTING
    4              B    100       0      15       0       0       0       0       0       0       0
    5              B1     5
    6              J      1       1       1
    7              J1    .5
    8              K      0     DAM                                               1
    9              K1       LOCAL INFLOW
   10              M      1       2     .83               .83
   11              P      0      23     112     123     132
   12              T                                                        1     .10             .02
   13              W2            .84
   14              X     -1   -0.05       2
   15              K      1     DAM                                               1
   16              K1       ROUTING THROUGH DAM
   17              Y                                       1       1
   18              Y1                                                    -597.
   19              SA     0    7.35      16
   20              SE   549     597     620
   21              SS   597   19.83    3.95     1.5
   22              SD   600    2.75     1.5     584
   23              SB   200       1     580       1     597   600.3
   24              K      1 REACH 1                                         1
   25              K1       CHANNEL ROUTING MOD. PULS. REACH 1
   26              Y                                       1       1
   27              Y1     1
   28              Y6    .05     .03     .05     533     570    2000 .015385
   29              Y7   500     580     600     560     800     540     900     533    1000     533
   30              Y7  1200     540    1250     560    1400     580
   31              K     99
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PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT DAM
ROUTE HYDROGRAPH TO DAM
ROUTE HYDROGRAPH TO EACH 1
END OF NETWORK

LAST MODIFICATION 26 FEB 79
****

RUN DATE 79/07/09.
TIME# 15.10.26.

N.J. DAM INSPECTION
N.J. 00129 NISHISAKWICK CREEK
MULTI RATIO PMF ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	.0	0	0

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

RTIOS= .50

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

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.83	0.00	.83	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	112.00	123.00	132.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

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	.10	0.00	.02

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .84

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 19 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .84 VOL= 1.00

64.	210.	376.	414.	359.	256.	159.	105.	70.	45.
30.	19.	13.	8.	6.	4.	3.	1.	0.	

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.03	.00	.03	1.	1.01	12.45	51	.52	.49	.02	408.
1.01	.30	2	.03	.00	.03	1.	1.01	13.00	52	.52	.49	.02	587.

1.01	.45	3	.03	.00	.03	1.	1.01	13.15	53	.62	.59	.02	[illegible]
1.01	1.00	4	.03	.00	.03	1.	1.01	13.30	54	.62	.59	.02	879.
1.01	1.15	5	.03	.00	.03	1.	1.01	13.45	55	.62	.59	.02	987.
1.01	1.30	6	.03	.00	.03	1.	1.01	14.00	56	.62	.59	.02	1075.
1.01	1.45	7	.03	.00	.03	2.	1.01	14.15	57	.77	.75	.02	1152.
1.01	2.00	8	.03	.00	.03	2.	1.01	14.30	58	.77	.75	.02	1230.
1.01	2.15	9	.03	.00	.03	2.	1.01	14.45	59	.77	.75	.02	1317.
1.01	2.30	10	.03	.00	.03	2.	1.01	15.00	60	.77	.75	.02	1400.
1.01	2.45	11	.03	.00	.03	2.	1.01	15.15	61	.78	.76	.02	1469.
1.01	3.00	12	.03	.00	.03	2.	1.01	15.30	62	1.57	1.54	.02	1569.
1.01	3.15	13	.03	.00	.03	2.	1.01	15.45	63	4.39	4.36	.02	1947.
1.01	3.30	14	.03	.00	.03	1.	1.01	16.00	64	1.10	1.07	.02	2647.
1.01	3.45	15	.03	.00	.03	1.	1.01	16.15	65	.72	.70	.02	3335.
1.01	4.00	16	.03	.00	.03	1.	1.01	16.30	66	.72	.70	.02	3479.
1.01	4.15	17	.03	.00	.03	1.	1.01	16.45	67	.72	.70	.02	3195.
1.01	4.30	18	.03	.00	.03	1.	1.01	17.00	68	.72	.70	.02	2708.
1.01	4.45	19	.03	.00	.03	1.	1.01	17.15	69	.57	.54	.02	2256.
1.01	5.00	20	.03	.00	.03	1.	1.01	17.30	70	.57	.54	.02	1959.
1.01	5.15	21	.03	.00	.03	1.	1.01	17.45	71	.57	.54	.02	1728.
1.01	5.30	22	.03	.00	.03	1.	1.01	18.00	72	.57	.54	.02	1547.
1.01	5.45	23	.03	.00	.03	1.	1.01	18.15	73	.04	.02	.02	1383.
1.01	6.00	24	.03	.00	.03	1.	1.01	18.30	74	.04	.02	.02	1184.
1.01	6.15	25	.08	.00	.08	1.	1.01	18.45	75	.04	.02	.02	929.
1.01	6.30	26	.08	.00	.08	2.	1.01	19.00	76	.04	.02	.02	674.
1.01	6.45	27	.08	.00	.08	2.	1.01	19.15	77	.04	.02	.02	461.
1.01	7.00	28	.08	.00	.08	3.	1.01	19.30	78	.04	.02	.02	311.
1.01	7.15	29	.08	.06	.02	7.	1.01	19.45	79	.04	.02	.02	216.
1.01	7.30	30	.08	.06	.02	19.	1.01	20.00	80	.04	.02	.02	170.
1.01	7.45	31	.08	.06	.02	41.	1.01	20.15	81	.04	.02	.02	159.
1.01	8.00	32	.08	.06	.02	65.	1.01	20.30	82	.04	.02	.02	148.
1.01	8.15	33	.08	.06	.02	86.	1.01	20.45	83	.04	.02	.02	138.
1.01	8.30	34	.08	.06	.02	101.	1.01	21.00	84	.04	.02	.02	129.
1.01	8.45	35	.08	.06	.02	110.	1.01	21.15	85	.04	.02	.02	120.
1.01	9.00	36	.08	.06	.02	117.	1.01	21.30	86	.04	.02	.02	112.
1.01	9.15	37	.08	.06	.02	121.	1.01	21.45	87	.04	.02	.02	105.
1.01	9.30	38	.08	.06	.02	123.	1.01	22.00	88	.04	.02	.02	98.
1.01	9.45	39	.08	.06	.02	125.	1.01	22.15	89	.04	.02	.02	91.
1.01	10.00	40	.08	.06	.02	126.	1.01	22.30	90	.04	.02	.02	85.
1.01	10.15	41	.08	.06	.02	127.	1.01	22.45	91	.04	.02	.02	79.
1.01	10.30	42	.08	.06	.02	127.	1.01	23.00	92	.04	.02	.02	74.
1.01	10.45	43	.08	.06	.02	128.	1.01	23.15	93	.04	.02	.02	69.
1.01	11.00	44	.08	.06	.02	128.	1.01	23.30	94	.04	.02	.02	64.
1.01	11.15	45	.08	.06	.02	128.	1.01	23.45	95	.04	.02	.02	60.
1.01	11.30	46	.08	.06	.02	128.	1.02	0.00	96	.04	.02	.02	56.
1.01	11.45	47	.08	.06	.02	128.	1.02	.15	97	0.00	0.00	0.00	52.
1.01	12.00	48	.08	.06	.02	128.	1.02	.30	98	0.00	0.00	0.00	49.
1.01	12.15	49	.52	.49	.02	156.	1.02	.45	99	0.00	0.00	0.00	46.
1.01	12.30	50	.52	.49	.02	246.	1.02	1.00	100	0.00	0.00	0.00	43.
									SUM	24.29	21.64	2.65	47231.
										(617.)	(550.)	(67.)	(1337.43)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3479.	1698.	492.	472.	47210.
CMS	99.	48.	14.	13.	1337.
INCHES		19.03	22.05	22.05	22.05
MM		483.39	559.95	559.98	559.98
AC-FT		842.	975.	975.	975.
THOUS CU M		1039.	1203.	1203.	1203.

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .021 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .250 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

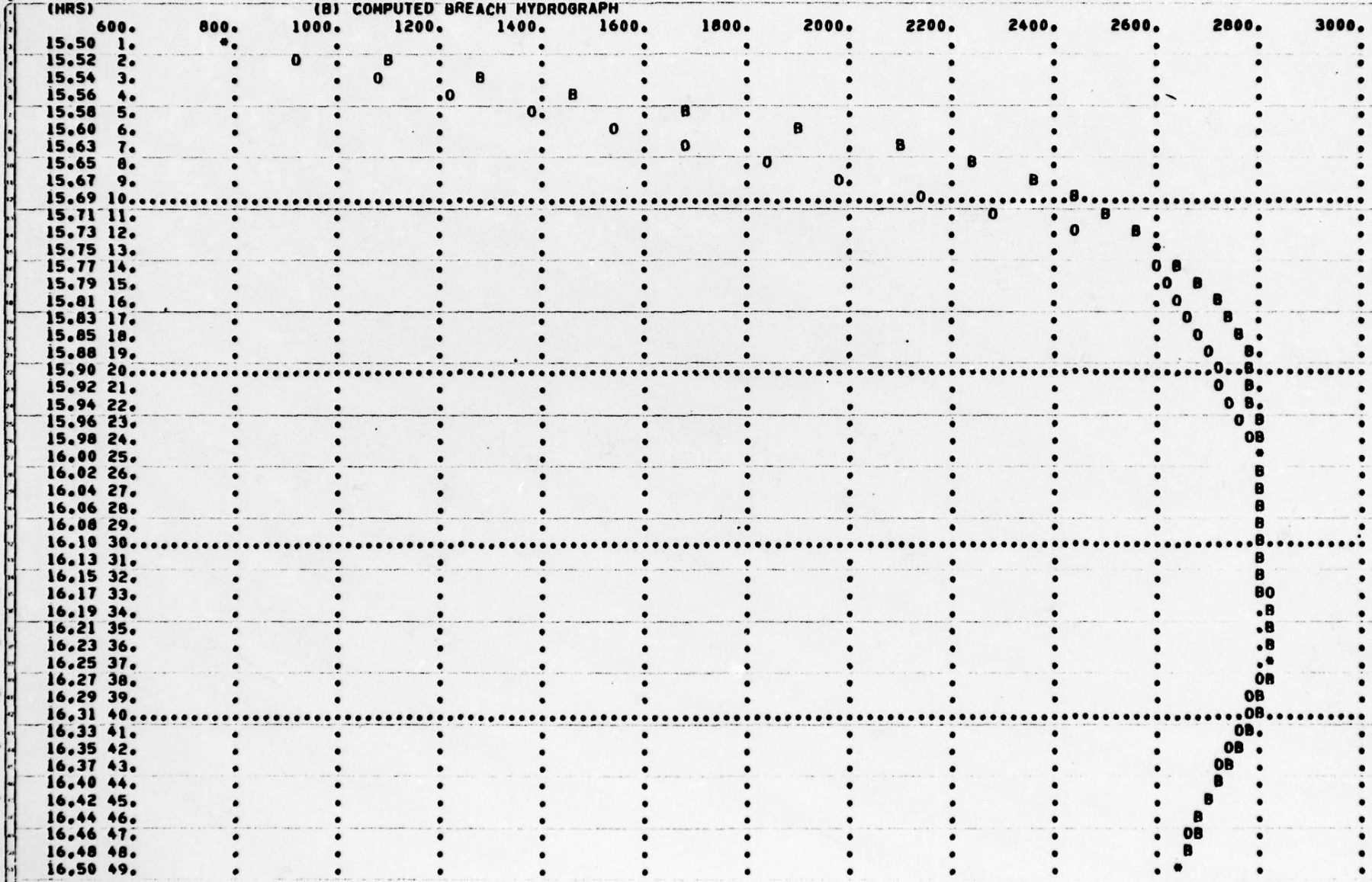
TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	- COMPUTED BREACH HYDROGRAPH (CFS)	= ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
15.500	0.000	771.	771.	0.	0.	0.
15.521	.021	923.	1095.	-172.	-172.	-0.
15.542	.042	1075.	1279.	-204.	-376.	-1.
15.563	.063	1226.	1458.	-231.	-608.	-1.
15.583	.083	1378.	1676.	-297.	-905.	-2.
15.604	.104	1530.	1908.	-378.	-1283.	-2.
15.625	.125	1682.	2095.	-413.	-1696.	-3.
15.646	.146	1834.	2241.	-407.	-2103.	-4.
15.667	.167	1986.	2353.	-367.	-2470.	-4.
15.688	.188	2137.	2438.	-300.	-2770.	-5.
15.708	.208	2289.	2503.	-214.	-2984.	-5.
15.729	.229	2441.	2553.	-112.	-3096.	-5.
15.750	.250	2593.	2593.	-0.	-3096.	-5.
15.771	.271	2610.	2630.	-20.	-3116.	-5.
15.792	.292	2627.	2675.	-48.	-3164.	-5.
15.813	.313	2644.	2712.	-69.	-3232.	-6.
15.833	.333	2661.	2739.	-78.	-3310.	-6.
15.854	.354	2677.	2757.	-80.	-3390.	-6.
15.875	.375	2694.	2770.	-76.	-3466.	-6.
15.896	.396	2711.	2779.	-68.	-3533.	-6.
15.917	.417	2728.	2785.	-57.	-3590.	-6.
15.938	.437	2745.	2789.	-44.	-3634.	-6.
15.958	.458	2762.	2792.	-30.	-3664.	-6.
15.979	.479	2779.	2794.	-15.	-3679.	-6.
16.000	.500	2796.	2796.	0.	-3679.	-6.
16.021	.521	2798.	2797.	1.	-3678.	-6.
16.042	.542	2800.	2798.	1.	-3677.	-6.
16.063	.562	2802.	2800.	2.	-3675.	-6.
16.083	.583	2804.	2801.	3.	-3672.	-6.
16.104	.604	2806.	2802.	3.	-3669.	-6.
16.125	.625	2808.	2804.	4.	-3665.	-6.
16.146	.646	2810.	2806.	4.	-3661.	-6.
16.167	.667	2812.	2808.	4.	-3658.	-6.
16.188	.687	2814.	2811.	3.	-3655.	-6.
16.208	.708	2816.	2814.	2.	-3652.	-6.
16.229	.729	2818.	2817.	1.	-3651.	-6.
16.250	.750	2820.	2820.	0.	-3651.	-6.
16.271	.771	2805.	2818.	-14.	-3665.	-6.
16.292	.792	2789.	2809.	-20.	-3685.	-6.
16.313	.812	2774.	2795.	-22.	-3707.	-6.
16.333	.833	2759.	2779.	-21.	-3727.	-6.
16.354	.854	2743.	2762.	-18.	-3746.	-6.
16.375	.875	2728.	2744.	-16.	-3761.	-6.
16.396	.896	2713.	2725.	-13.	-3774.	-6.
16.417	.917	2697.	2707.	-10.	-3784.	-7.
16.438	.937	2682.	2689.	-7.	-3791.	-7.
16.458	.958	2666.	2671.	-4.	-3795.	-7.
16.479	.979	2651.	2653.	-2.	-3797.	-7.
16.500	1.000	2636.	2636.	0.	-3797.	-7.

OVF

STATION DAM

TIME (HRS)

(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH
(*) POINTS AT NORMAL TIME INTERVAL



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 1 .50
HYDROGRAPH AT	DAM	.83 (2.15)	1	1740. (49.26) (
ROUTED TO	DAM	.83 (2.15)	1	2820. (79.85) (
ROUTED TO	EACH 1	.83 (2.15)	1	3034. (85.90) (

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	597.00	597.00	600.00
STORAGE	118.	118.	141.
OUTFLOW	0.	0.	407.

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
.50	600.32	.32	144.	2820.	1.81	16.25	15.50

PLAN 1 STATION EACH 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3034.	535.2	16.00