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NATIONAL DAM SAFETY PROGRAM. GARNERVILLE DAM (INVENTORY NUMBER --ETC(U)
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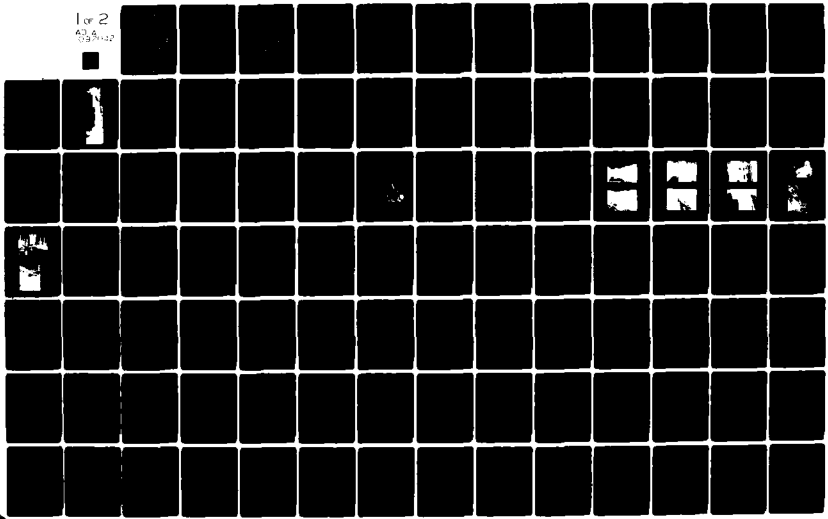

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Granerville Dam
Rockland County
Minisceongo
Hudson River

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

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Examination of available documents and a visual inspection of the dam and the appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Using Corps of Engineers screening criteria, it has been determined that the dam would be overtopped for all storms exceeding approximately 19 percent of Probable Maximum Flood (PMF). The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate spillway" is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

It is, therefore, recommended that within 3 months of notification to the owner, detailed hydrological hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. At the same time further analysis of the structural stability of the overflow and non-overflow section should be performed. The results of these investigations analysis will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the 1/2 PMF. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

On the basis of Stability Analysis performed during the investigation, the structural stability of the non-overflow section of the dam against overturning was determined to be adequate for all cases except the Extreme Loading: PMF. The structural stability of the non-overflow section of the dam against sliding was determined to be adequate for all cases except Unusual Loading: one-half PMF, and Extreme Loading: PMF.

On the basis of Structural Stability performed during the investigation, the structural stability of the overflow section of the dam against overturning was determined to be adequate for all cases except Normal Loading condition with ice load and Extreme Loading: PMF. The stability of the overflow section of the dam against sliding was determined to be adequate for all cases except Normal Loading condition with ice load, Unusual Loading: one-half PMF, and Extreme Loading: PMF.

The following remedial measures must be completed within 1 year:

- Backfill the low saddle in the right abutment to an elevation equal to that of the top of the dam.
- Monitor the seepage of the downstream of the right abutment and through the masonry on the downstream face of the dam at bi-weekly intervals with aid of weirs. In addition determine the source of the seepage in the right abutment.
- Remove all trees on the backfill at the upstream face of the dam. Provide a program of periodic cutting and brushing of the backfill.
- Remove and haul away debris from the spillway crest.
- Remove and haul away debris and boulders from the tailrace area of the spillway immediately downstream of the dam.
- Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

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HUDSON RIVER BASIN

GARNERVILLE DAM

ROCKLAND COUNTY, NEW YORK
INVENTORY NO. N.Y. 744

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1980

CONTRACT NO. DACW-51-79-C0001

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~~HUDSON RIVER BASIN~~

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GARNERVILLE DAM

~~ROCKLAND COUNTY~~, ~~NEW YORK~~

(INVENTORY ~~NO.~~ Nine N.Y. 744),

Hudson River Basin,
Rockland County, New York.

PHASE I INSPECTION REPORT,
NATIONAL DAM SAFETY PROGRAM

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PREFACE

This report is prepared under guidance containted 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 investigations, 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. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

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 frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. 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
GARNERVILLE DAM
I.D. NO. N.Y. 744
DEC No. 337 B
HUDSON RIVER BASIN
ROCKLAND COUNTY, NEW YORK

CONTENTS

APPENDIX

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Garnerville Dam (I.D. No. 744)
State Located:	New York
County Located:	Rockland
Stream:	Minisceongo
Basin:	Hudson River
Date of Inspection:	April 24, 1980

ASSESSMENT

Examination of available documents and a visual inspection of the dam and the appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property.

Using Corps of Engineers screening criteria, it has been determined that the dam would be overtopped for all storms exceeding approximately 19 percent of Probable Maximum Flood (PMF). The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate spillway" is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

It is, therefore, recommended that within 3 months of notification to the owner, detailed hydrological hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. At the same time further analysis of the structural stability of the overflow and non-overflow section should be performed. The results of these investigations analysis will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the 1/2 PMF. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

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The following remedial measures must be completed within 1 year:

- Backfill the low saddle in the right abutment to an elevation equal to that of the top of the dam.
- Monitor the seepage of the downstream of the right abutment and through the masonry on the downstream face of the dam at bi-weekly intervals with aid of weirs. In addition determine the source of the seepage in the right abutment.
- Remove all trees on the backfill at the upstream face of the dam. Provide a program of periodic cutting and brushing of the backfill.
- Remove and haul away debris from the spillway crest.
- Remove and haul away debris and boulders from the tailrace area of the spillway immediately downstream of the dam.

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- Remove all trees on the backfill at the upstream face of the dam. Provide a program of periodic cutting and brushing of the backfill.

- Remove and haul away debris from the spillway crest.

- Remove and haul away debris and boulders from the tailrace area of the spillway immediately downstream of the dam.

- Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

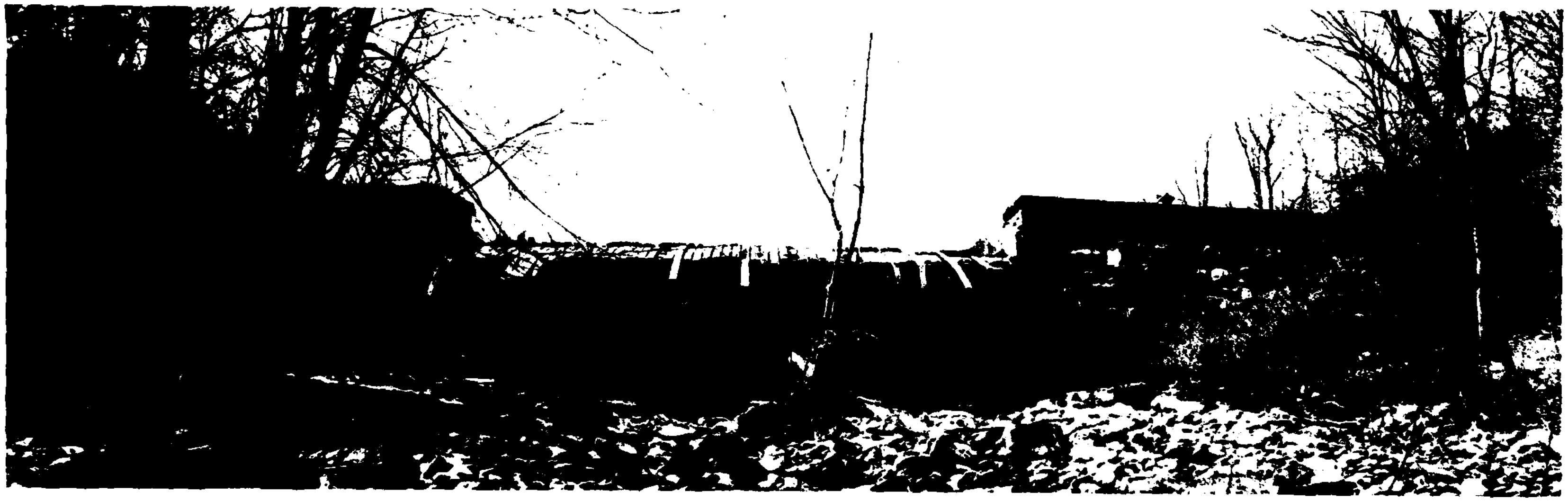
Eugene O'Brien

Eugene O'Brien, P.E.
New York, No. 29823

Approved By:

W. M. Smith, Jr.
New York District Engineer

Date: 11 Sep 80



1. GENERAL OVERVIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GARNERVILLE DAM
I. D. NO. N.Y. 744
DEC No. 337 B
HUDSON RIVER BASIN
ROCKLAND COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the State of New York, Department of Environmental Conservation, by letter dated 7 January 1980, in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, 8 August 1972.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF THE PROJECT

a. Description of the Dam and Appurtenant Structure

The Garnerville Dam is composed of a 330 foot long masonry structure that includes a 69 foot long overflow section, serving as a spillway. There are two reservoir drains, one 30-inches in diameter and one 8-inch, both are controlled by gate valves.

The crest of the embankment is 13 feet wide and the upstream and downstream slopes are 1H to 4.5V. The maximum height of the structure above the stream is 28 feet. The spillway opening, which is 6.9 feet deep, is located slightly to the left of the center of the dam and has a slightly rounded overflow crest. The 30-inch reservoir drain passes beneath the dam just to the left of the left side of the spillway and exists about 10 feet downstream of the toe. It is controlled by a gate valve located about 6 feet upstream of the dam. The 8-inch low level outlet passes slightly to the left of the 30-inch outlet and continues downstream to the town of Garnerville. It is controlled by a valve located near the toe of the dam.

The upstream slope of the masonry structure is covered with impervious clay fill and stone paving.

It is also reported and observations further indicated that the entire reservoir is lined with an impervious clay layer covered by cobblestone.

b. Location

Garnerville Dam is located on Minisceongo Creek, a tributary of the Hudson River in West Haverstraw, New York about 1-1/2 miles west of Garnerville, New York, approximately 0.75 miles north of State Route 202. The dam is in a sparsely populated residential area and directly upstream of the village of Garnerville.

c. Size Classification

The dam is 29 feet high and has a reservoir (29 feet high) with a storage capacity of 198 acre-feet and, therefore, is classified as a small dam.

d. Hazard Classification

The dam is in the "high" hazard potential category because of the close proximity of the dam to residences and its location within the town of Garnerville.

e. Ownership

Garnerville Dam is owned by the Garnerville Holding Company, 55 Railroad Avenue, Garnerville, New York 10923, Tel. (914) 947-1155, and operation and maintenance is carried out by the owner. The person to contact at the company is Mr. David Lipman.

f. Purpose of Dam

The dam was originally constructed as the uppermost of a series of dams to provide water for an industrial facility, located in Garnerville. The water is for the most part no longer used for this purpose with the exception of the 8-inch outlet which is still utilized at the company plant. Otherwise, the dam is used for recreational purpose.

g. Design and Construction History

There are no design drawings or records of the construction of the dam. The construction of the dam was completed in 1875.

h. Normal Operating Procedure

Water is continuously released from the reservoir through the 8-inch pipeline; and over the spillway through most of the year depending on the inflow. The 30-inch reservoir drain is operated periodically to check its operability and as required to lower the reservoir below spillway crest.

1.3 PERTINENT DATA

a.	Drainage Area (sq. mile)	17.5
b.	Discharge at Dam Site (CFS)	
	Ungated spillway at maximum pool	3,890
	Maximum capacity of low level outlets	150
	Total discharge, Maxi. Pool (El. 216.9)	4,040
c.	Elevation (feet above MSL USGS Datum)	
	Top of Dam	216.9
	Maximum Design Pool	210.0
	Spillway Crest	210.0
	Invert low level outlets	188.0
d.	Reservoir	
	Length of Maximum Pool (feet)	1,150
	Length of Shoreline at Spillway Crest (feet)	3,200
	Surface Area Acre	10.2
e.	Storage (acre-feet)	
	Reservoir at Spillway Crest	100.0
	Reservoir at Maximum Pool (Top of Dam)	198.0
f.	Dam	
	Type	Masonry Gravity Dam
	Length (feet)	328.5
	Upstream Slope	1H to 4.5V
	Downstream Slope	1H to 4.5V - (Covered with fill and stone paving to $\pm$ 30° slope)
	Crest Elevation	216.9
	Crest Width (feet)	13
	Grout Curtain	None
g.	Spillway	
	Type	Broadcrested overflow section of dam
	Length (feet)	69 feet
	Crest Elevation (MSL)	210
	Upstream Channel	None
	Downstream Channel	100 feet wide (boulders and debris in stream)

h. Reservoir Drain and Pipeline

Upstream: A dual intake structure is located 11.5 feet to the left of the overflow section, included is a gate valve for the 30-inch pipe, and a screen type structure. It was not possible to ascertain exact invert levels of intakes.

Downstream: The outlet for 30-inch cast iron pipe is located in a channel about 10 feet from downstream toe just left of overflow section. Control for the 8-inch pipe is near the toe of the dam 85-feet left from the center of the overflow section.

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

a. Geology

The records of the owner contain no data on site geology. However, there is data available in the literature on the general geology of the area. The rock in the area is the Brunswick Formation of the Newark Group of the upper Triassic. Generally, the rocks of this formation are sandstone, red shale conglomerate and limestone. No outcrops existed at the dam site to confirm the existence of this type of rock.

2.2 SUBSURFACE INVESTIGATIONS

No subsurface investigation could be located for the dam. However, the General Soil Map of New York State prepared by the Cornell University Experiment Station (1968) indicates that the surficial soils around Garnerville Dam are of the Rockaway-Chatfield Association. This association is dominated by well drained, moderately coarse textured sandy loams and loams on glacial till derived from granitic rocks.

2.3 DAM AND APPURTENANT STRUCTURES

There are virtually no records or drawings with regard to the original construction of the dam or low level outlet structures. There are a few sketches of the outlet works in the records of the owner.

2.4 CONSTRUCTION RECORDS

No information has been located in relation to the construction of the project. The completion is assumed to be 1875 from a Marble Plaque located on the dam. The name of the contractor is unknown.

2.5 OPERATION RECORD

In recent years there has been no regular operation of the dam and no records were kept of the reservoir operation. The dam is inspected on occasion by the maintenance staff of the owner but no regular maintenance is carried out, and no systematic monitoring of the performance of the dam is in effect.

2.6 EVALUATION OF DATA

There is little data available about the design or construction of the dam. There are reportedly some drawings with regard to the construction of the outlet works available in the records of the owner, but these, although reported, were not made available to us. Although the data is not adequate for an in-depth evaluation, estimates, field observations, measurements and discussions regarding past history and performance of the dam, supports sufficient data for Phase I evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Garnerville Dam was made on April 24, 1980. The weather was fair and the temperature was 60^{o} to 65^{o}F. The reservoir had been lowered about 1 to 2 feet to allow inspection of the spillway crest and downstream face.

b. Main Dam

The main dam which was completed in 1875 shows no signs of major distress or structural problems. The vertical and horizontal alignment of the crest appears to be unchanged. There are no major cracks in the masonry joints on the dam or spillway sections. However, the following adverse conditions were noted.

(1) There is minor seepage through small cracks in the masonry near the toe of the dam on the left non-overflow section.

(2) There is a low saddle on the right abutment which appears to be the result of construction activities in the area. Seepage of about 5 gpm eminates from the ground about 1,000 feet directly downstream from this point. There is no indication of fines being washed.

(3) There is a large amount of tree growth on the right non-overflow section of the dam immediately upstream of the crest of the dam.

(4) There is a zone of ice damage in the masonry wherever it is exposed to the reservoir.

c. Spillway and Tailrace

The downstream face at the spillway appears to be in good condition. It was difficult to observe the condition of the crest of the spillway due to the remains of the flashboard structure, which was constructed to increase the storage capacity of the reservoir. At the time of the flashboard construction, a large stair step like overflow crib structure was constructed downstream of the spillway. Both structures have since been demolished by a flood (reportedly in 1956). The spillway crest has the general appearance, therefore, of being in much poorer condition. However, between the remains of the flashboards the crest appears to be in good condition.

The tailrace channel of the spillway is full of debris from the flashboard structure, overflow crib structure, and boulders. The channel is also choked intermittently for a substantial distance downstream with fallen trees and the abutments of several old bridges.

d. Reservoir Drain and Pipeline

The regulating gates for the 30-inch reservoir drain and the 8-inch pipeline are in good operating condition and appear to be well maintained.

e. Reservoir Area

There are neither slides, rockfalls, sloughing or other signs of instability in the vicinity of the dam. There are, however, small earth slides at the eastern end of the reservoir 0.5 mile from dam. The slides are likely the result of vandals breaking apart a number of stone retaining walls built around the dam. These do not appear to present a hazardous condition. There were no objectionable amounts of floating debris in the reservoir.

3.2 EVALUATION OF OBSERVATIONS

Although deficiencies were observed there is no indication that the dam is in imminent danger. A number of the deficiencies observed in the previous paragraphs are minor and should be corrected by the maintenance forces. Other conditions described above, however, represent conditions which may have potential for further deterioration for this reason, these conditions need to be further investigated.

Significant conditions which were observed which require immediate investigation to determine the extent of corrective action necessary to determine the stability of the dam and appurtenances. The following is a summary of the problem areas encountered, in order of importance, with the appropriate recommended action:

1. Backfill the low saddle in the right abutment to an elevation equal to that of the top of the dam.

2. Monitor the seepage at the downstream of the right abutment and through the masonry on the downstream face of the dam at bi-weekly intervals with aid of weirs. In addition determine the source of the seepage in the right abutment.

3. Remove all trees on backfill at the upstream face of the dam.

4. Remove and haul away debris from the spillway crest.

5. Remove and haul away debris and boulders from the tailrace area for the spillway immediately downstream of the dam.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The Garnerville reservoir discharges continuously through the 8-inch cast iron pipe and over the spillway throughout most of the year. Flow through the 8-inch pipeline goes directly to the manufacturing facility downstream and could be controlled through a valve at the downstream toe of the dam. Flow over the spillway is uncontrolled above spillway crest elevation 210. The 30-inch outlet is opened to lower the reservoir or check the operating mechanism.

4.2 MAINTENANCE OF DAM

There is no regular maintenance schedule for the dam. The dam is checked periodically by the maintenance staff of the owner and in particular the operating mechanisms are checked. Repair programs have been carried out, as required in the past, particularly in attempts to repair seepage in the masonry of the dam. The reservoir drain and pipeline are in good operating condition and appear to be maintained regularly. It is reported that due to vandalism the operation of the controls for the reservoir drains are checked regularly. The gate valves for the reservoir drain and pipeline are in good operating condition.

4.3 WARNING SYSTEM IN EFFECT

There are no warning systems in effect or in preparation.

4.4. EVALUATION

The overall maintenance of the Garnerville Dam is considered to be less than inadequate in the following area.

(a) Control of vegetation and tree growth on upstream backfill.

(b) Maintenance of the spillway crest and downstream tailrace area.

(c) No formal operation and maintenance manuals exist in the project.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE BASIN CHARACTERISTICS

Garnerville Dam is located on Minisceongo Creek in West Haverstraw, Rockland County, New York. The watershed contributing to the reservoir is 17.5 square miles and is drained by Minisceongo Creek and its tributary, South Branch. Landcover varies from thickly wooded slopes through orchards, pastures, urban areas and several ponds and swamps. The longest watercourse is approximately 9.5 miles and falls over 1,000 feet to the normal lake elevation 210. The tributary, South Branch, flows northward and enters Minisceongo Creek about 2.4 miles upstream of the dam, falling from an elevation of 675 feet at its southern divide to about 370 feet at its confluence, a distance of approximately 5.7 miles.

5.2 ANALYSIS CRITERIA

The analysis of the Garnerville Dam was performed using the Corps of Engineers HEC-1 computer program[1/]. Because of the number of tributaries and the shape of the watershed contributing to the reservoir, it was necessary to divide the basin into three subareas. Snyder synthetic unit hydrographs were derived for each subarea and the reservoir inflow was simulated from this complex watershed. In accordance with the recommended guidelines of the Corps of Engineers[7/], the adequacy of the spillway was analyzed using the Probable Maximum Flood (PMF) and one-half the PMF.

5.3 SPILLWAY CAPACITY

The principal spillway of Garnerville Dam is centrally located, 69 feet in length and 6.9 feet in depth. The crest is triangular in shape and is estimated to be at El 210. The computed maximum spillway discharge with the lake surface at El 216.9 is 3,890 cfs.

5.4 RESERVOIR CAPACITY

There was no data available on the normal capacity of Garnerville reservoir. However, for the purpose of this analysis, it has been estimated that normal capacity is 100 acre-feet, surcharge storage between spillway crest (El 210) and top of dam (El 216.9) is 98 acre-feet, which is equivalent to 0.1 inches of runoff over the entire basin. Maximum or total capacity of the reservoir is 198± acre-feet.

5.5 FLOODS OF RECORD

There are no available records of the floods or maximum reservoir elevations. Maximum discharge at the Minisceongo Creek gage at Thiells (1959-1963) was 747 cfs on August 10, 1960.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated on the basis of the spillway capacity and the available surcharge storage to meet the selected design flood inflows. The Probable Maximum Precipitation (PMP)for the Garnerville Dam area was obtained from Hydrometeorological Report No. 33[4/]. The 24-hour index rainfall for each subarea was 21.9 inches. The initial rainfall loss for subareas A and B was estimated to be 2.0 inches in order to reflect the available surface storage, while subarea C with little basin storage had an initial loss of 1.0 inch. The constant loss for the entire basin was assumed to be 0.1 inches per hour. The combination of the hydrographs resulted in a peak inflow of 20,120 cfs. (1,000 CSM).

The PMF routed through the reservoir resulted in a peak outflow of 20,080 cfs and a corresponding water surface elevation of 222.87, 5.97 feet about the top of the dam. One-half the PMF overtops the dam by 2.84 feet with a peak discharge of 10,000 cfs. The spillway is capable of passing 19.4% of the PMF without overtopping the dam.

5.7 EVALUATION

The Garnerville Dam does not have sufficient spillway capacity to pass either the PMF or one-half the PMF. As a result of the spillways insufficient capacity and the condition as previously reported, which exists on the right abutment, the dam is assessed as seriously inadequate.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations did not indicate existing problems with the structure of the dams. The observed seepage on the downstream left wing of the dam is not considered to represent an unstable or otherwise dangerous condition. A potential stability problem does exist, however, because of the low point in the right abutment and the resulting higher potential for erosion.

b. Design and Construction Data

There exists no design computation or other data regarding the structural stability of the dam and the spillway. There are no documents or drawings showing the as-built section or details of the dam.

c. Stability Analysis

Since there are no contract drawings or documents available showing the full geometry or details of the dam, spillway, and foundation condition.

The primary source of structural and subsurface information used in stability analysis were: geometry observed and measures during the inspection visit and sketches supplied by the state from earlier inspections.

The following tables show the results of the structural stability analysis for spillway and non-overflow sections. The computations of analysis are given in Appendix E.

	Non-Overflow Section	Overturning	Sliding Stability
I)	Normal Loading Condition with Reservoir level at Spillway Crest; no ice load	Inside Middle third	1.92
II)	Normal Loading Condition with Reservoir level at Spillway Crest; with ice load	Inside Middle third	1.64
III)	Unusual Loading: One-half PMF, Water overtopping Dam by 2.84 feet	Inside Middle half	1.03
IV)	Extreme Loading: PMF, Water overtopping the Dam by 5.97 feet	Outside Middle half	0.95
V)	Unusual Loading: Reservoir level at Spillway Crest; 0.05 g earthquake force	Inside Middle half	1.51

	Spillway	Overturning	Sliding Capacity
I)	Normal Loading Condition with Reservoir level at Spillway Crest; no ice load	Inside Middle third	1.53
II)	Normal Loading Condition with Reservoir level at Spillway Crest; with ice load	Outside Middle third	1.3
III)	Unusual Loading: One-half PMF, Water overtopping Dam by 2.84 feet	Inside Middle half	0.90
IV)	Extreme Loading: PMF, Water overtopping the Dam by 5.97 feet	Outside Middle half	0.78
V)	Unusual Loading: Reservoir level at Spillway Crest; 0.05 g earthquake force	Inside Middle half	1.28

On the basis of Stability Analysis performed during the investigation, the structural stability of the non-overflow section of the dam against overturning was determined to be adequate for all cases except the Extreme Loading: PMF. The structural stability of the non-overflow section of the dam against the sliding was determined to be adequate for all cases except Unusual Loading: one-half PMF, and Extreme Loading: PMF.

On the basis of Structural Stability performed during the investigation, the structural stability of the overflow section of the dam against overturning was determined to be adequate for all cases except Normal Loading condition with ice load and Extreme Loading: PMF. The stability of the overflow section of the dam against sliding was determined to be adequate for all cases except Normal Loading condition with ice load, Unusual Loading: one-half PMF, and Extreme Loading: PMF.

Since exact geometry, foundation conditions, upstream backfill characteristics and extent, as well as the extent and magnitude of the uplift pressure are unknown, it is therefore, recommended that with the spillway adequacy studies a more detailed structural stability analysis be performed. Field investigations, should be done to obtain more information regarding the extent and characteristics of the backfill and foundation materials; as well as the quality and condition of the non-exposed masonry of the structure. Based on the results of the analysis, modification of the dam should be recommended as required.

d. Operation Records

There are no records of the regulating gates operations. No major operational problems, which would affect the stability of the dam were reported.

e. Post Construction Changes

Several post construction changes have been carried out on or near the dam which would have an affect on the stability of the dam. The flashboard structure has been constructed across the spillway to raise the reservoir level and, therefore, increase the normal hydrostatic load, but this structure was destroyed during a flood and never rebuilt. A second post construction change which still poses a potential stability problem is the addition of runoff drain to the reservoir near the right abutment. Observations indicate that a low point which exists on the abutment is probably a result of this construction. This creates an area of greater erosion potential.

f. Seismic Stability

The dam is located in Zone 2, therefore, a stability analysis was carried out using a normal reservoir loading (water level at spillway crest) and a 0.05g earthquake factor with Zangers method. The results of this analysis showed the dam to be safe under both overturning and sliding.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Examination of the available documents and visual inspections of the Garnerville Dam and appurtenant structures did not reveal conditions which constitute a hazard to human life or property.

Using the Corps of Engineers Screening Criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 19.4 percent of the PMF. The overtopping of the dam could cause erosion of the right abutment and near the toe of the dam. This could result in possible instability due to undermining leading to dam failure and thus increasing the hazard to loss of life downstream. The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency in spillway computations, that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

On the basis of Stability Analysis performed during the investigation, the structural stability of the non-overflow section of the dam against overturning was determined to be adequate for all cases except the Extreme Loading: PMF. The structural stability of the non-overflow section of the dam against sliding was determined to be adequate for all cases except Unusual Loading: one-half PMF, and Extreme Loading: PMF.

On the basis of Structural Stability performed during the investigation,the structural stability of the overflow section of the dam against overturning was determined to be adequate for all cases except Normal Loading condition with ice load and Extreme Loading: PMF. The stability of the overflow section of the dam against sliding was determined to be adequate for all cases except Normal Loading condition with ice load, Unusual Loading: one-half PMF, and Extreme Loading: PMF.

A more detailed structural stability analysis is required. Field investigations are required to obtain more information regarding the extent and magnitude of uplift pressures under the base of the dam and spillway, quality of the masonry and concrete and the extent and characteristics of the backfill and foundation materials. This information should then be incorporated into a detailed structural stability evaluation.

b. Adequacy of Information

The information and data available were adequate for performance of this investigation.

c. Need for Additional Investigations

Since the spillway is considered to be "seriously inadequate", additional hydrologic/hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed. After the in-depth hydrologic/hydraulic investigations have been completed, remedial measures must be initiated to provide spillway capacity sufficient to discharge the outflow from the 1/2 PMF event. In addition, an investigation of the structural stability of the spillway and non-overflow portions of the dam are required.

d. Urgency

The additional hydrologic/hydraulic investigations and the stability investigation which are required must be initiated within 3 months from the date of notification. Within 1 year of notification, remedial measures as a result of these investigations must be initiated, with completion of these measures during the following year. In the interim, develop an emergency action plan for the notification of downstream residents and proper governmental authorities in the event of overtopping and provide round-the-clock surveillance of the dam during periods of extreme run-off. The other problem areas listed below must be corrected within 1 year from notification.

7.2 RECOMMENDED MEASURES

The following are the recommended measures.

1. Backfill the low saddle in the right abutment to an elevation equal to that of the top of the dam.

2. Monitor the seepages at the downstream of the right abutment and through the masonry on the downstream face of the dam at bi-weekly intervals with aid of weirs. In addition, determine the source of the seepage in the right abutment.

3. Remove all trees on the backfill at the upstream face of the dam. Provide a program of periodic cutting and brushing of the backfill.

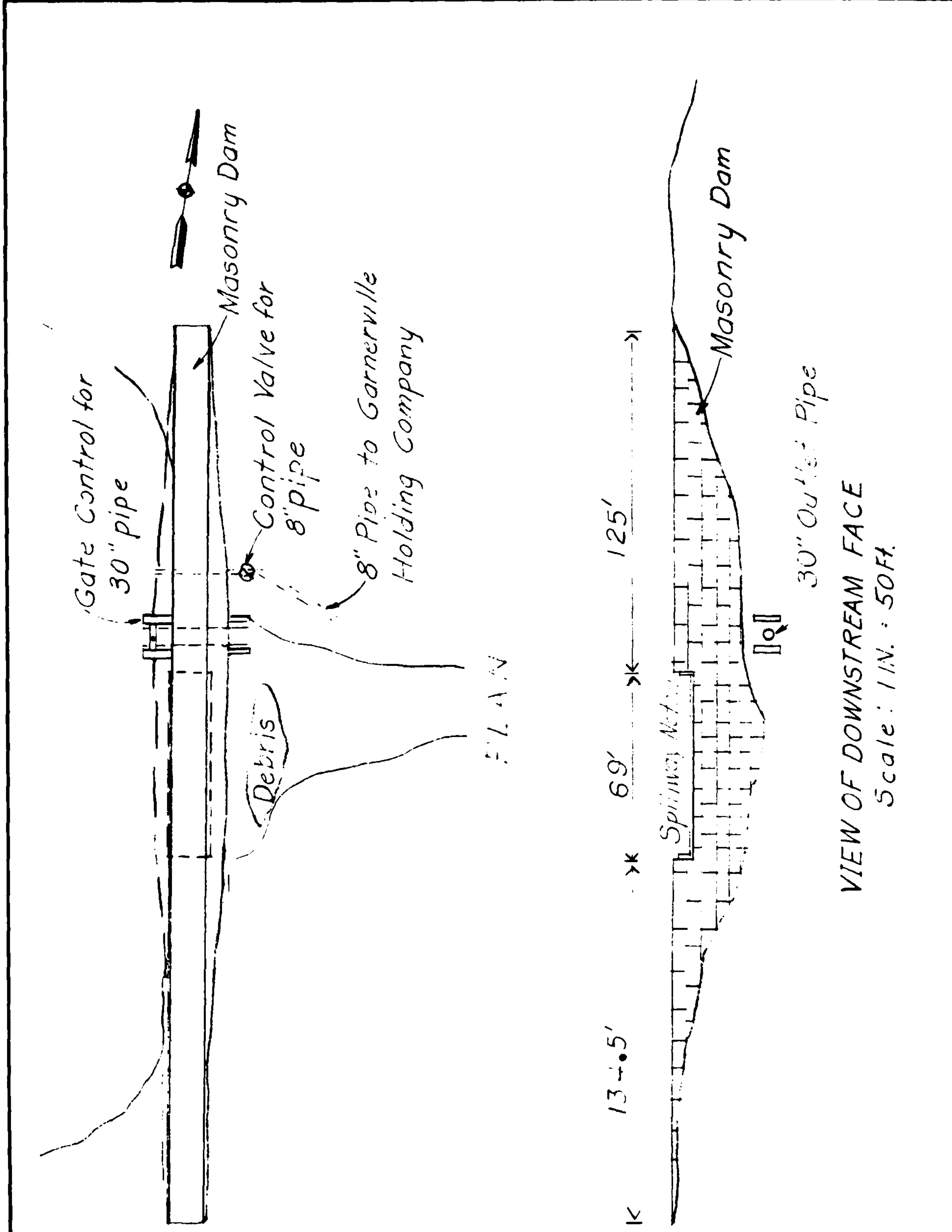
4. Remove and haul away debris from the spillway crest.

5. Remove and haul away debris and boulders from the tailrace area for the spillway immediately downstream of the dam.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

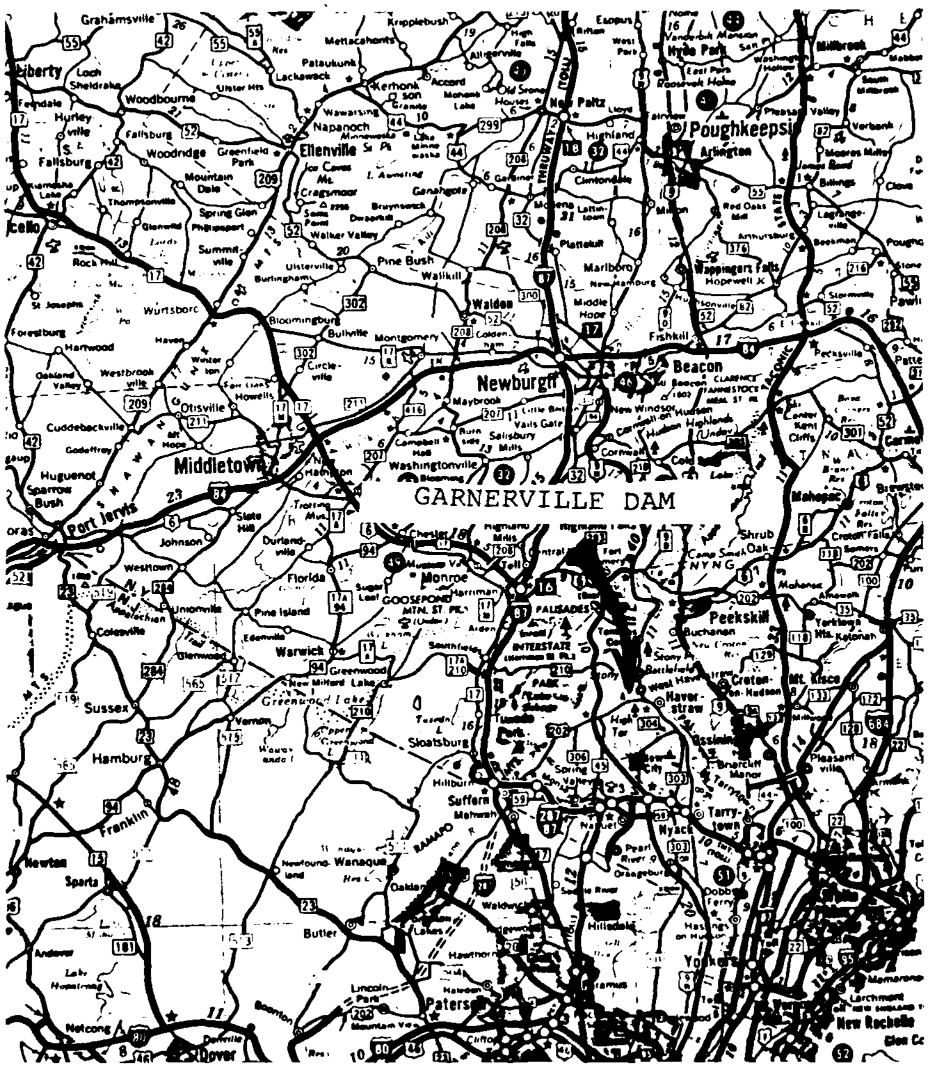
DRAWINGS

APPENDIX A



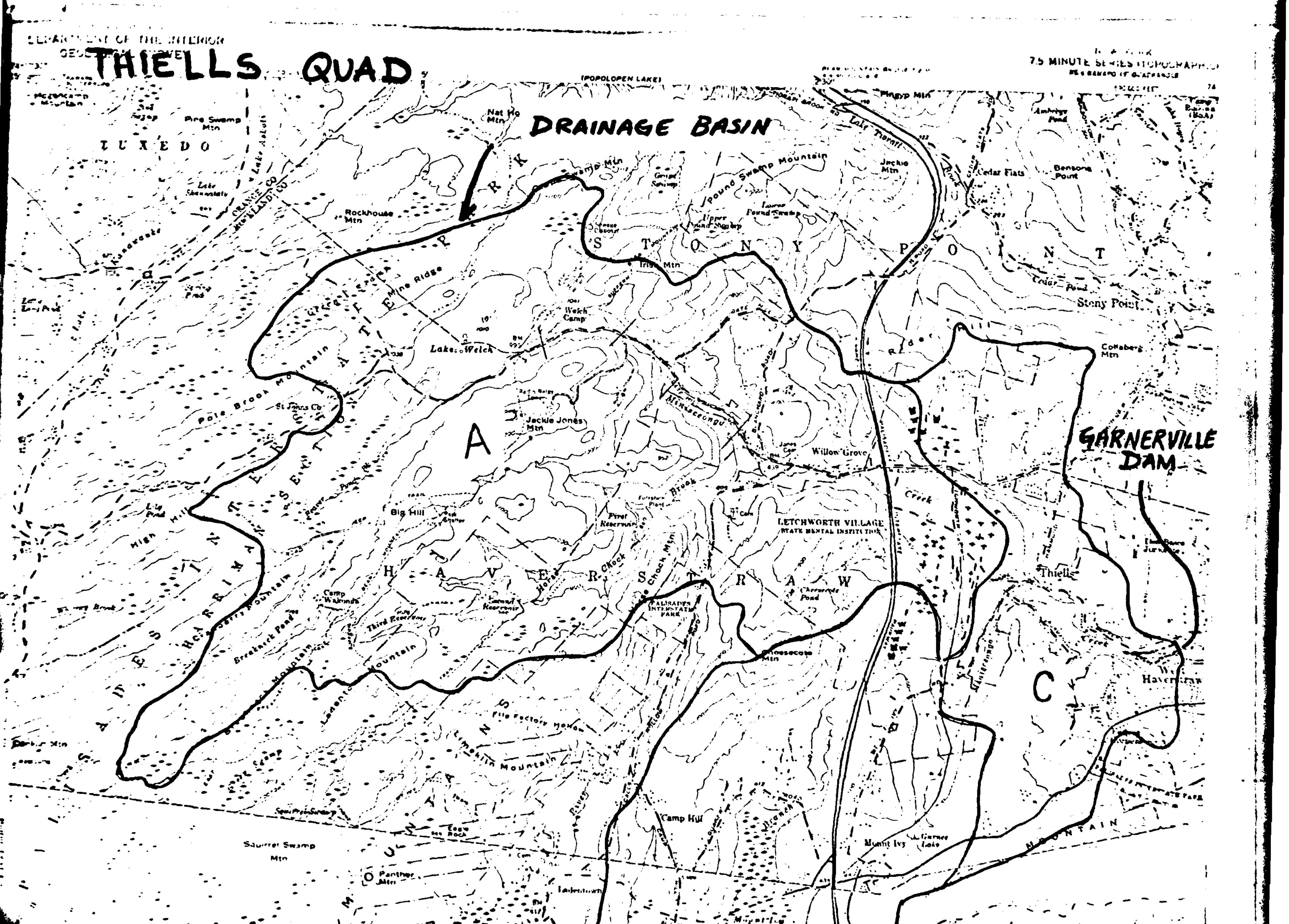
TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS and ARCHITECTS **NEW YORK**

	GARNERVILLE DAM PLAN & SECTION	BY: JF DATE: 6/11/80 DRAWING NUMBER:

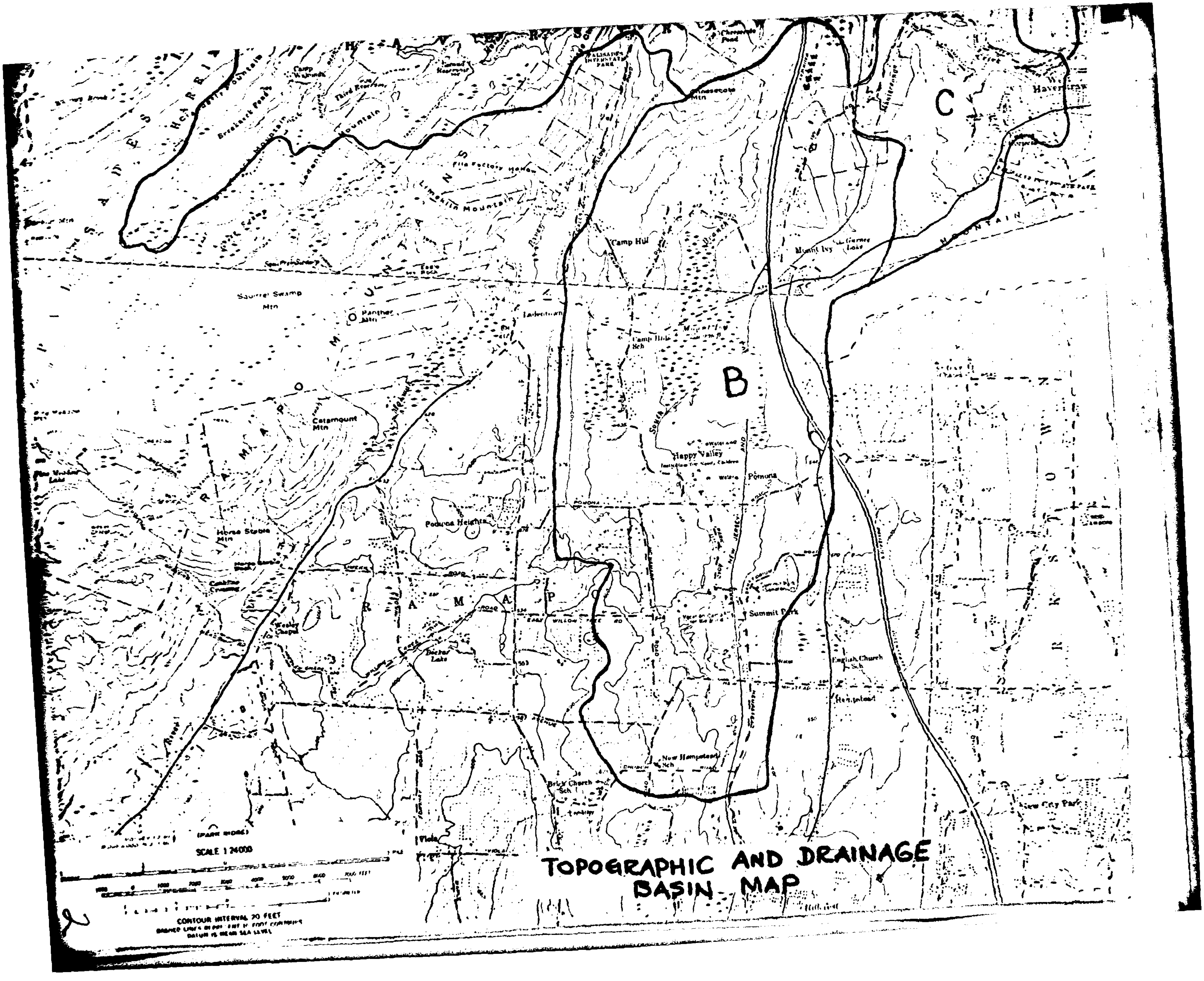


SCALE: 1 inch = 11.2 Miles

VICINITY MAP



THIELLS QUAD
DRAINAGE BASIN
GARNERVILLE DAM
A
C
7.5 MINUTE SERIES (TOPOGRAPHIC)
TUXEDO
STONY POINT
HAVERSTRAW
LETCHWORTH VILLAGE
STATE MENTAL INSTITUTION
Willow Grove
Thiells
Stony Point
Lake Welch
Jackie Jones Mtn
Big Hill
Limekiln Mountain
Pound Swamp Mountain
Cedar Flats
Camp Hill
Mount Ivy



TOPOGRAPHIC AND DRAINAGE BASIN MAP

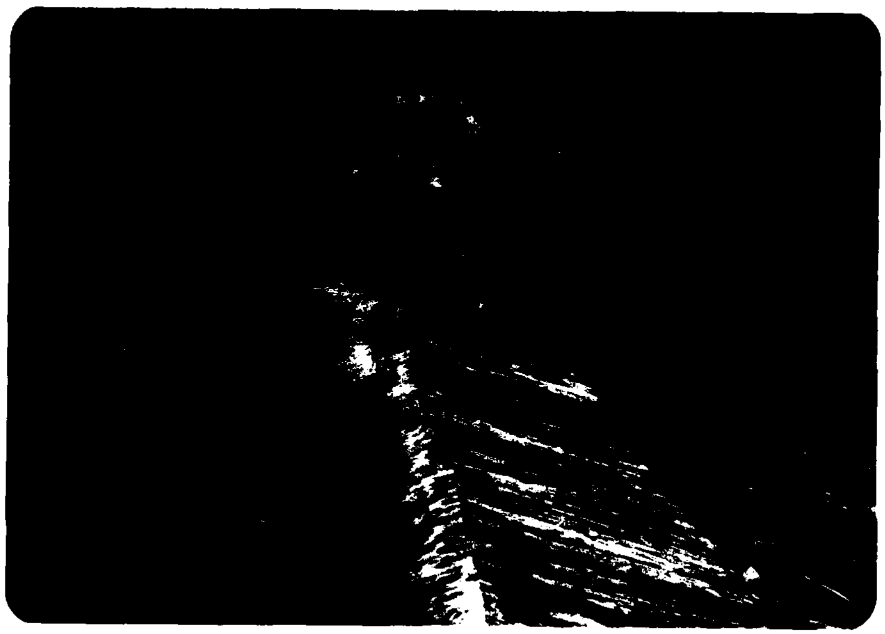
PHOTOGRAPHS

APPENDIX B

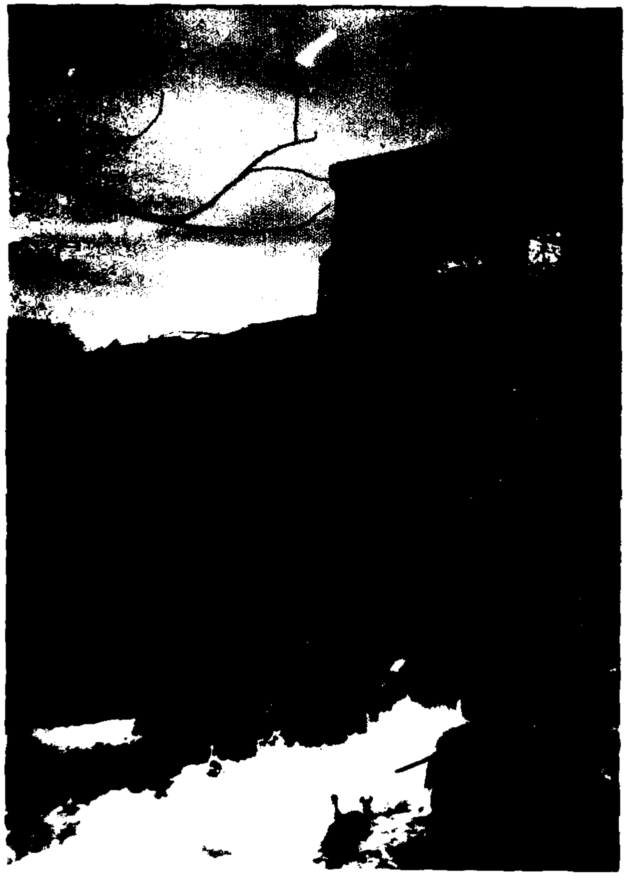
2. VIEW OF UPSTREAM FACE OF DAM.

3. VIEW OF DOWNSTREAM CHANNEL.

4. VIEW OF SPILLWAY AND CREST OF RIGHT NON-OVER FLOW SECTION OF DAM. NOTE: CONDITION OF BOARDS, VEGETATION ON UPSTREAM FACE.



5. VIEW LOOKING TOWARDS LEFT NON-OVER FLOW SECTION OF DAM. NOTE: UPSTREAM VEGETATION, CONTROL FOR RESERVOIR DRAIN, DETERIORATION OF CONCRETE DUE TO FROST ACTION.



6. VIEW OF DOWNSTREAM OF RESERVOIR DRAIN.

7. VIEW OF OPERATING MECHANISM FOR RESERVOIR DRAIN

8. VIEW OF CONTROL VALVE FOR 8-INCH WATER SUPPLY PIPE.

9. VIEW OF SEEPAGE ON DOWNSTREAM FACE OF LEFT NON-OVERFLOW SECTION OF DAM.

10. VIEW OF DEPRESSION IN RIGHT ABUTMENT IMMEDIATELY ADJACENT TO DAM (LOOKING UPSTREAM).

11. VIEW OF SEEPAGE DOWNSTREAM OF RIGHT ABUTMENT DEPRESSION.

VISUAL INSPECTION CHECKLIST

APPENDIX C

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam GARNERVille DAM

Fed. I.D. # NY 744 DEC Dam No. 196B - 337B

River Basin Lower Hudson

Location: Town GARNERville County Rockland

Stream Name Minisceongo Creek

Tributary of Hudson River

Latitude (N) 41° 12' Longitude (W) 74° 00'

Type of Dam MASONRY - Gravity

Hazard Category High

Date(s) of Inspection April 24, 1980

Weather Conditions Fair 60°-65° F

Reservoir Level at Time of Inspection El. 210. (During inspection lowered 1 to 2 feet)

b. Inspection Personnel Kalman Szalay - Principal Geotechnical Engr
Joseph Fiten Jr. - Geotechnical Engr

c. Persons Contacted (Including Address & Phone No.) MR William Daker
GARNERville Holding Company, 55 Railroad Ave Garnerville
NY 1094? (914) 947-1155 MR DAVID Lipman
Same as above

d. History:

Date Constructed 1875 Date(s) Reconstructed

Designer Not Known

Constructed By Not Known

Owner GARNERville Holding Company.

2) Embankment NONE

a. Characteristics

(1) Embankment Material NA

(2) Cutoff Type NA

(3) Impervious Core NA

(4) Internal Drainage System NA

(5) Miscellaneous NA

b. Crest

(1) Vertical Alignment NA

(2) Horizontal Alignment NA

(3) Surface Cracks NA

(4) Miscellaneous NA

c. Upstream Slope

(1) Slope (Estimate) (V:H)

(2) Undesirable Growth or Debris, Animal Burrows

(3) Sloughing, Subsidence or Depressions

(4) Slope Protection ____________________

____

____

(5) Surface Cracks or Movement at Toe ____________________

____

d. Downstream Slope

(1) Slope (Estimate - V:H) ____________________

(2) Undesirable Growth or Debris, Animal Burrows ____________________

____

(3) Sloughing, Subsidence or Depressions ____________________

____

____

(4) Surface Cracks or Movement at Toe ____________________

____

(5) Seepage ____________________

____

____

(6) External Drainage System (Ditches, Trenches; Blanket) ____________________

____

____

(7) Condition Around Outlet Structure ____________________

____

(8) Seepage Beyond Toe ____________________

____

e. Abutments - Embankment Contact

____

____

(1) Erosion at Contact ______________________________

____

(2) Seepage Along Contact ______________________________

____

____

____

3) Drainage System

a. Description of System None in existence

____

____

____

b. Condition of System ______________________________

____

c. Discharge from Drainage System ______________________________

____

____

4) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) None

____

____

____

____

____

____

____

____

5) Reservoir

a. Slopes Generally Stable - Some retaining walls in place

b. Sedimentation NO EVIDENCE OF EXCESSIVE SEDIMENTATION OBSERVED; NO FLOATING DEBRIS

c. Unusual Conditions Which Affect Dam None

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) Several Highway Bridges, Dense Building, Homes AND Business

b. Seepage, Unusual Growth Through face of Dam and also ≈300 feet D/S on left abutment

c. Evidence of Movement Beyond Toe of Dam None

d. Condition of Downstream Channel Some blockage by Trees and remains of old Railroad bridges

7) Spillway(s) (Including Discharge Conveyance Channel)

Over flow section in center portion of Dam

a. General Attempts have been made at various times to modify or repair the spillway. The result is that the original spillway has been covered by concrete and wood, both of which have now deteriorated.

b. Condition of Service Spillway Dificult to judge due to remnants of previous Repairs.

c. Condition of Auxiliary Spillway None

d. Condition of Discharge Conveyance Channel None

8) Reservoir Drain/Outlet

Type: Pipe 30" and 8" Conduit ______ Other ______

Material: Concrete ______ Metal Cast Iron Other ______

Size: 30" and 8" Length 30" ± 25', 8" ± 1 mile

Invert Elevations: Entrance ______ Exit ______

Physical Condition (Describe): Unobservable ✓

Material: ______

Joints: ______ Alignment ______

Structural Integrity: Appears to be intact

Hydraulic Capability: ______

Means of Control: Gate ______ Valve ✓ Uncontrolled ______

Operation: Operable ✓ Inoperable ______ Other ______

Present Condition (Describe): Good working order

9) Structural

a. Concrete Surfaces generally good. Some Spalling near line of ice contact.

b. Structural Cracking None evident

c. Movement - Horizontal & Vertical Alignment (Settlement) None evident

d. Junctions with Abutments or Embankments left Abutment good - low saddle in Rt abutment near contact.

e. Drains - Foundation, Joint, Face None existent

f. Water Passages, Conduits, Sluices appear to be good.

g. Seepage or Leakage Small seepage from several "cracks" in masonry on left Non-overflow section. Flow ranges from 1 to 3 gpm. No fines in flow

h. Joints - Construction, etc. Masonry joints are generally in good condition. Some pointing has been done in recent years

i. Foundation Hardpan- generally sound

j. Abutments Rt abutment has low saddle

k. Control Gates operable

l. Approach & Outlet Channels Approach not visible, reported to be good. Outlet-good condition

m. Energy Dissipators (Plunge Pool, etc.) None

n. Intake Structures Appears to be good- upstream screen structure somewhat dillapidated

o. Stability Appears stable

p. Miscellaneous

HYDROLOGIC DATA AND COMPUTATION

APPENDIX D

TAMS

Job No. 1551-10 Sheet 1 of 6

Project GARNERVILLE DAM PHASE 1 INSPECTION Date MAY 15 1980

Subject HYDROLOGIC/HYDRAULIC COMPUTATIONS By D.L.C.

SUB AREA A

Ch'k. by

$$T_p = C_T (L L_{ca})^{0.3}$$

$$= 2.525 [(7.1)(3.2)]^{0.3}$$

$$= (2.525)(2.55)$$

$$= 6.44$$

$L = 7.1$ mi

$L_{ca} = 3.2$ mi

$C_T = 2.525$

$C_p = 0.625$

$A = 8.2$ sq mi

use $t_r = 1$ hour

$$q_p = \frac{640 C_p}{T_p}$$

$$= \frac{400}{6.44}$$

$$= 62.1 \text{ cfs/sq mile}$$

$$Q_p = 509.2 \text{ cfs.}$$

Initial loss 2"

Constant loss 0.1 inch/hour

TAMS

Job No. 1551-10 | Sheet 2 of 6

Project: GARNERVILLE DAM PHASE 1 INSPECTION | Date: MAY 16 1980

Subject: HYDROLOGIC / HYDRAULIC COMPUTATIONS | By: D.L.C

SUB BASIN B | Ch'k. by

$$T_p = C_T (L L_{CA})^{0.3}$$
$$= 2.67[(5.7)(2.6)]^{0.3}$$
$$= 2.67 \times 2.245$$
$$= 6.0 \text{ hours}$$

$L = 5.7$ mi

$L_{CA} = 2.6$ mi

$C_T = 2.67$

$C_p = 0.625$

$A = 6.9$ mi^2

Use $T_R = 1.0$ hour

$$q_p = \frac{640 C_p}{T_p} = \frac{640 \times 0.625}{6.00}$$
$$= 66.7$$

$$Q_p = 66.7 \times 6.9$$
$$= 460 \text{ cfs.}$$

Initial loss 2.0"

Constant loss 0.1 in/hour.

TAMS

Job No. 1551-10 | Sheet 3 of 6
Project Garnerville Dam | Date May 16 1980
Subject Hydrologic / Hydraulic Computations Sub Area C | By D.L.C.
Ch'k. by

$T_p = C_T\,(L\,L_{CA})^{0.3}$

$= 2[(2.4)(1.3)]^{0.3} = 2 \times 1.407$

$= 2.8$ hrs

$L = 2.4$ Mi.
$L_{CA} = 1.3$ Mi.
$A = 2.4$ SQ MI.

$T_r = 2.8/T_p = 0.5$ hours. use $t_R = 1.0$

$T_{PR} = t_p + 0.25(T_R - t_r)$
$= 2.8 + .25(.5)$
$= 2.925$ hrs

$q_p = \dfrac{640\,C_p}{T_p} = \dfrac{400}{2.8}$

$= 142.9$ cfs/sq mile

$q_{PR} = 136.7$ cfs/sq m.

$Q_p = 142.9 \times 2.4$
$= 342.8$ cfs.

$Q_{PR} = 328$ cfs

Cross sections for routing combined hydrographs from Sub Areas A & B through Sub Area C

36+00		54+00		76+00		96+00		114+00	
Station	Elevation	Station	Elevation	STN	EL	STN	EL	STN	EL
				6[illegible]	320				
7450	380			7460	300	5350	300	7290	[illegible]
8130	360	6710	360	7[illegible]	[illegible]	5520	[illegible]	[illegible]	260
8220	340	6750	300	7710	2[illegible]	[illegible]	260	7400	[illegible]
8250	325 ℄	6610	320	8[illegible]	270 ℄	5800	240	[illegible]	230
8300	328 ℄	6820	315	8020	28[illegible]	6000	228	75[illegible]	216
8500	340	7000	300	8130	350	6100	2[illegible]	7550	220
8600	360	7050	310	8200	370	6100	260	[illegible]	232
8[illegible]	380	[illegible]	340			6150	270	[illegible]	2[illegible]
		7410	300			6150	271	[illegible]	[illegible]
						6200	2[illegible]	7820	2[illegible]
						6450	300	7970	[illegible]

TAMS

Job No. 1551 - 10
Project: GARNERVILLE DAM PHASE 1 INSPECTION
Subject: HYDROLOGIC / HYDRAULIC COMPUTATION
SPILLWAY RATING $C \approx 3.46$

Sheet 4 of 6
Date MAY 28 1980
By DLC
Ch'k. by

Assume Coef C reduced 10% due to poor condition of spillway surface

Use $C' = 3.114$ $Q = C' L H^{3/2}$

Flow over Dam
$L = 260$ $C' = 2.778$

$L = 690'$

EL	H	$L \times C'$	Q		
210	0	214.87	0		
211	1		215		
212	2		608		
214	4		1720		
216	6		3160.		
216.9	6.9		3890.	TOP OF DAM	
218	8		4860.	830	5690
220	10		6790.	3940	10730

P [illegible] 24 HR 200 [illegible] (I [illegible]) 24.5%

	6 HR	12 HR	24 HR	48 HOUR	72 HR
% Point PMP	1[illegible].1	122.4	134.7	151.0	157.1

TAMS

Job No. 1551-10

Project Gardnerville Dam Phase 1 Inspection

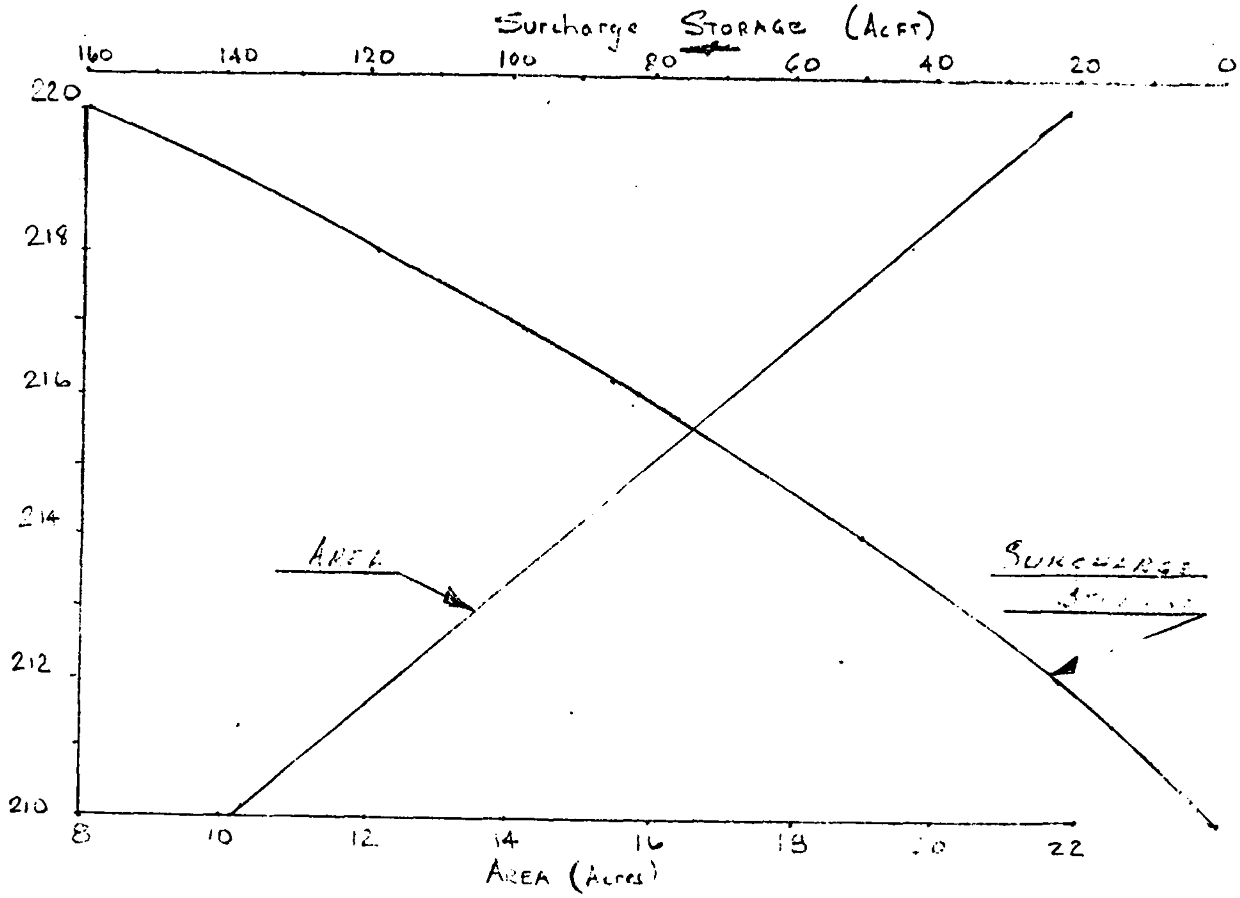
Subject El/Area/Surcharge Storage.

Sheet 5 of 6

Date May 30 19

By DLC

Ch'k. by



El	ΔH (Ft)	Area (Ac)	Mean Area (Ac)	Δ Vol. Ac Ft	Surcharge Storage (Ac Ft)
210		10.2			0
	2		11.35	22.7	
212		12.5			22.7
	2		13.65	27.3	
214		14.8			50
	2		16.	32.0	
216		17.2			82
	2		18.35	36.7	
218		19.5			118.7
	2		20.65	41.3	
220		21.8			160.

Assume Vol of Lake at El 210 (Normal Pool) = 100 Ac ft.

TAMS

Job No. 1551-10

Sheet 6 of 6

Project GARNERVILLE DAM PHASE I INSPECTION

Date JUNE 4 1980

Subject HYDROLOGIC/HYDRAULIC COMPUTATIONS

By DLC

Ch'k. by

CROSS SECTIONS - from USGS QUADRANGLE MAP below DAM

STN 2+00

STATION	ELEV
1500	220
1590	200
1690	195
1730	194
1960	180
2000	175
2040	180
2140	200
2200	220

STN 22+00

STN	ELEVATION
6900	170
7300	160
7860	152
7900	151
7930	150
8000	140
8040	150
8180	160
8200	170

STN 54+00

6920	150
6940	140
6970	130
6980	120
7000	115
7030	120
7070	130
7100	140
7750	150

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
A1      PHASE 1 INSPECTION GARNERVILLE DAM  ROCKLAND COUNTY N.Y.        1551-10
A2               TAMS ENGINEERS AND ARCHITECTS
A3                          MAY 1980
B     100       1       0       0       0       0       0       0       0       0
B1      5
J       1       2       1
J1      1     0.5
K         A                             1               1
K1      SUBBASIN A RUNOFF
M       1       1     8.2                                                1
P            21.9   110.5     122     132     142
T                                                2.     0.1             .05
W    6.44    .625
X      -1    -0.5       3
K             B
K1      SUB BASIN B RUNOFF
M       1       1     6.9                                                1
P            21.9   110.5     122     132     142
T                                                2.     0.1             .03
W       6    .625
X      -1    -0.5       3
K       2     A B                       1               1
K1      COMBINE RUNOFF FROM SUBBASINS A & B
K       1   15+00
K1      MINISCEONGO CREEK CHANNEL ROUTING
Y                               1       1
Y1      1
Y6.04   .04     .04     328.    380.    3600.   0.005
Y77950. 360.    8130.   360.    8220.   340.    8250.   335.    8500.   328.
Y78540. 340.    8600.   360.    8630.   380.
K       1   76+00
K1      CHANNEL ROUTING MINISCEONGO CREEK
Y                               1       1
Y1      1
Y6.04   .04     .04     270.    320.    4000.   0.014
Y76300. 320.    7460.   300.    7640.   290.    7710.   280.    8000.   270.
Y78320. 280.    8150.   300.    8300.   320.
K       1  114+00
K1      CHANNEL ROUTING AT UPSTREAM END OF RESERVOIR
Y                               1       1
Y1      1
Y6.04   .04     .04     210.    260.    3800.   0.016
Y77330. 260.    7400.   240.    7430.   220.    7500.   210.    7550.   220.
Y77680. 232.    7720.   233.    7750.   240.    7820.   260.
K             C
K1      SUB-BASIN C RUNOFF
M       1       1     2.4                                                1
P            21.9   110.5     122     132     142
T                                               1    0.1                 .01
W 2.93   .625
```

```
K     -1      .5      3
K      2  INFLOW                                     2       1       1
K1        COMBINE CHANNEL FLOW & SUBBASIN RUNOFF AT STN 114+00.
K      1      100                                    1               1
K1        RESERVOIR ROUTING    GARNERVILLE DAM
Y                                           1        1
Y1     1                                                         100       -1
Y4195.  210.     212.     214.     216.     218.     220.
Y50.    0.       608.     1720.    3160.    4860.    6790.
SS0.    100.     123.     150.     182.     219.     260.
SE195.  210.     212.     214.     216.     218.     220.
SS 210.
SD216.9 2.779    1.5      260.
K      1    2+00
K1        MINISCEONGO CREEK D/S OF DAM
Y                                           1        1
Y1     1
Y6   .04       .04      .04      175      220      200    0.021
Y7  1500       220      1590     200      1690     195    1730     194     1960     180
Y7  2000       175      2040     180      2140     200    2200     220
K      1    21+00
K1        MINISCEONGO CREEK D/S HIGH TENSION WIRES
Y                                           1        1
Y1     1
Y6   .03       .04      .03      140      170      1900   .018
Y7  6900       170      7300     160      7360     152    7900     151     7930     150
Y7  8000       140      8040     150      8180     160    8200     170
K      1   30+00
K1        MINISCEONGO CREEK U/S OF CEMETARY
Y                                           1        1
Y1     1
Y6   .03       .04      .03      115      150      1800   0.011
Y7  6920       150      6940     140      6970     130    6980     120     7000     115
Y7  7030       120      7070     130      7100     140    7750     150
K      99
```

```
FW (     QUEN      STR     JETWI     ALCU     NS

     RUNOFF HYDROGRAPH AT          A
     RUNOFF HYDROGRAPH AT              B
     COMBINE  2 HYDROGRAPHS AT     A B
     ROUTE HYDROGRAPH TO          18+00
     ROUTE HYDROGRAPH TO          76+00
     ROUTE HYDROGRAPH TO          114+0
     RUNOFF HYDROGRAPH AT              C
     COMBINE  2 HYDROGRAPHS AT INFLOW
     ROUTE HYDROGRAPH TO            100
     ROUTE HYDROGRAPH TO           2+00
     ROUTE HYDROGRAPH TO .        39+00
     END OF NETWORK
```

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

RUN  DATE= 80/ 7/23.
     TIME= 16.02.07.

              PHASE 1 INSPECTION GARNERVILLE DAM  ROCKLAND COUNTY N.Y.        1551-10
                       TAMS ENGINEERS AND ARCHITECTS
                                 MAY 1980

                                    JOB SPECIFICATION
        NO      NHR     NMIN    IDAY     IHR     IMIN   METRC     IPLT     IPRT    NSTAN
       100        1        0       0       0        0       0        0        0        0
                                JOPER     NWT    LROPT   TRACE
                                    5       0        0       0

                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                  NPLAN= 1 NRTIO= 2 LRTIO= 1
         RTIOS=    1.00     .50

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

                                  SUB-AREA RUNOFF COMPUTATION

              SUBBASIN A RUNOFF

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

                                           HYDROGRAPH DATA
        IHYDG    IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
            1       1     8.20     0.00     8.20     0.00    0.000        0        1        0

                                             PRECIP DATA
                   SPFE     PMS       R6      R12      R24      R48      R72      R96
                   0.00    21.90  110.50   122.00   132.00   142.00     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    2.00     .10    0.00     .05

                                        UNIT HYDROGRAPH DATA
                                  TP=  6.44     CP= .63      NTA=  0

                                            RECESSION DATA
                              STRTQ=   -1.00     QRCSN=    -.50     RTIOR= 3.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 7.50 AND R= 5.92 INTERVALS

        UNIT HYDROGRAPH 36 END-OF-PERIOD ORDINATES, LAG=   6.50 HOURS, CP=  .63  VOL= 1.00
      20.      134.      207.      321.      423.      491.      516.      488.      422.      356.
     301.      254.      214.      181.      153.      129.      109.       92.       78.       66.
      55.       47.       39.       33.       28.       24.       20.       17.       14.       12.
      10.        9.        7.        6.        5.        4.

                                  END-OF-PERIOD FLOW
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1.01	1.00	1	.01	.00	.01	7.	1.03	3.00	51	0.00	0.00	0.00	4988.
1.01	2.00	2	.01	.00	.01	7.	1.03	4.00	52	0.00	0.00	0.00	4375.
1.01	3.00	3	.01	.00	.01	6.	1.03	5.00	53	0.00	0.00	0.00	3920.
1.01	4.00	4	.01	.00	.01	6.	1.03	6.00	54	0.00	0.00	0.00	3512.
1.01	5.00	5	.01	.00	.01	5.	1.03	7.00	55	0.00	0.00	0.00	3147.
1.01	6.00	6	.01	.00	.01	5.	1.03	8.00	56	0.00	0.00	0.00	2819.
1.01	7.00	7	.02	.00	.02	5.	1.03	9.00	57	0.00	0.00	0.00	2526.
1.01	8.00	8	.03	.00	.02	5.	1.03	10.00	58	0.00	0.00	0.00	2263.
1.01	9.00	9	.03	.00	.02	5.	1.03	11.00	59	0.00	0.00	0.00	2028.
1.01	10.00	10	.03	.00	.02	5.	1.03	12.00	60	0.00	0.00	0.00	1817.
1.01	11.00	11	.03	.00	.02	5.	1.03	13.00	61	0.00	0.00	0.00	1628.
1.01	12.00	12	.03	.00	.02	5.	1.03	14.00	62	0.00	0.00	0.00	1458.
1.01	13.00	13	.15	.01	.14	6.	1.03	15.00	63	0.00	0.00	0.00	1307.
1.01	14.00	14	.18	.01	.17	7.	1.03	16.00	64	0.00	0.00	0.00	1171.
1.01	15.00	15	.22	.01	.21	8.	1.03	17.00	65	0.00	0.00	0.00	1049.
1.01	16.00	16	.56	.03	.53	11.	1.03	18.00	66	0.00	0.00	0.00	940.
1.01	17.00	17	.21	.01	.20	16.	1.03	19.00	67	0.00	0.00	0.00	842.
1.01	18.00	18	.16	.01	.15	22.	1.03	20.00	68	0.00	0.00	0.00	754.
1.01	19.00	19	.01	.00	.01	29.	1.03	21.00	69	0.00	0.00	0.00	676.
1.01	20.00	20	.01	.00	.01	34.	1.03	22.00	70	0.00	0.00	0.00	606.
1.01	21.00	21	.01	.00	.01	37.	1.03	23.00	71	0.00	0.00	0.00	543.
1.01	22.00	22	.01	.00	.01	37.	1.04	0.00	72	0.00	0.00	0.00	486.
1.01	23.00	23	.01	.00	.01	36.	1.04	1.00	73	0.00	0.00	0.00	436.
1.02	0.00	24	.01	.00	.01	32.	1.04	2.00	74	0.00	0.00	0.00	390.
1.02	1.00	25	.12	.01	.11	28.	1.04	3.00	75	0.00	0.00	0.00	350.
1.02	2.00	26	.12	.01	.11	25.	1.04	4.00	76	0.00	0.00	0.00	313.
1.02	3.00	27	.12	.02	.10	23.	1.04	5.00	77	0.00	0.00	0.00	281.
1.02	4.00	28	.12	.02	.10	24.	1.04	6.00	78	0.00	0.00	0.00	251.
1.02	5.00	29	.12	.02	.10	27.	1.04	7.00	79	0.00	0.00	0.00	225.
1.02	6.00	30	.12	.02	.10	32.	1.04	8.00	80	0.00	0.00	0.00	202.
1.02	7.00	31	.34	.24	.10	46.	1.04	9.00	81	0.00	0.00	0.00	181.
1.02	8.00	32	.34	.24	.10	78.	1.04	10.00	82	0.00	0.00	0.00	162.
1.02	9.00	33	.34	.24	.10	132.	1.04	11.00	83	0.00	0.00	0.00	145.
1.02	10.00	34	.34	.24	.10	211.	1.04	12.00	84	0.00	0.00	0.00	130.
1.02	11.00	35	.34	.24	.10	311.	1.04	13.00	85	0.00	0.00	0.00	117.
1.02	12.00	36	.34	.24	.10	425.	1.04	14.00	86	0.00	0.00	0.00	104.
1.02	13.00	37	1.94	1.84	.10	589.	1.04	15.00	87	0.00	0.00	0.00	94.
1.02	14.00	38	2.32	2.23	.10	878.	1.04	16.00	88	0.00	0.00	0.00	84.
1.02	15.00	39	2.90	2.81	.10	1363.	1.04	17.00	89	0.00	0.00	0.00	75.
1.02	16.00	40	7.36	7.26	.10	2224.	1.04	18.00	90	0.00	0.00	0.00	67.
1.02	17.00	41	2.71	2.62	.10	3547.	1.04	19.00	91	0.00	0.00	0.00	60.
1.02	18.00	42	2.13	2.03	.10	5161.	1.04	20.00	92	0.00	0.00	0.00	54.
1.02	19.00	43	.18	.08	.10	6823.	1.04	21.00	93	0.00	0.00	0.00	48.
1.02	20.00	44	.18	.08	.10	8201.	1.04	22.00	94	0.00	0.00	0.00	43.
1.02	21.00	45	.18	.08	.10	9029.	1.04	23.00	95	0.00	0.00	0.00	39.
1.02	22.00	46	.18	.08	.10	9221.	1.05	0.00	96	0.00	0.00	0.00	35.
1.02	23.00	47	.18	.08	.10	8772.	1.05	1.00	97	0.00	0.00	0.00	31.
1.03	0.00	48	.18	.08	.10	7875.	1.05	2.00	98	0.00	0.00	0.00	28.
1.03	1.00	49	0.00	0.00	0.00	6839.	1.05	3.00	99	0.00	0.00	0.00	25.
1.03	2.00	50	0.00	0.00	0.00	5851.	1.05	4.00	100	0.00	0.00	0.00	22.
									SUM	24.88	20.90	3.98	124923.
										(632.)	(531.)	(101.)	(3537.43)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9221.	8322.	4557.	1729.	124909.
CMS	261.	236.	129.	49.	3537.
INCHES		9.44	20.68	23.54	23.62
MM		239.78	525.18	597.82	599.86
AC-FT		4126.	9038.	10288.	10323.
THOUS CU M		5090.	11148.	12690.	12733.

HYDROGRAPH AT STAA FOR PLAN 1, RTIO 1

7.	7.	6.	6.	5.	5.	5.	5.	5.	5.
5.	5.	6.	7.	8.	11.	16.	22.	29.	34.
37.	37.	36.	32.	28.	25.	23.	24.	27.	32.
46.	79.	132.	211.	311.	425.	589.	878.	1363.	2224.
2547.	5161.	6623.	8201.	9029.	9221.	8772.	7875.	6839.	5851.
[illegible]	4375.	3920.	3512.	3147.	2819.	2526.	2263.	2028.	1817.
1665.	1458.	1307.	1171.	1049.	940.	842.	754.	676.	606.
543.	486.	436.	390.	350.	313.	281.	251.	225.	202.
181.	162.	145.	130.	117.	104.	94.	84.	75.	67.
60.	54.	48.	43.	39.	35.	31.	28.	25.	22.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9221.	8322.	4557.	1729.	124909.
CMS	261.	236.	129.	49.	3537.
INCHES		9.44	20.68	23.54	23.62
MM		239.78	525.18	597.82	599.86
AC-FT		4126.	9038.	10288.	10323.
THOUS CU M		5090.	11148.	12690.	12733.

HYDROGRAPH AT STAA FOR PLAN 1, RTIO 2

4.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	3.	3.	3.	4.	6.	8.	11.	14.	17.
13.	19.	15.	16.	14.	13.	12.	12.	13.	16.
23.	39.	66.	106.	156.	213.	295.	439.	681.	1112.
1773.	2581.	3412.	4100.	4514.	4611.	4386.	3937.	3420.	2925.
2494.	2155.	1570.	1756.	1573.	1410.	1263.	1132.	1014.	908.
914.	729.	653.	585.	524.	470.	421.	377.	338.	303.
271.	243.	218.	195.	175.	157.	140.	126.	113.	101.
90.	81.	73.	65.	58.	52.	47.	42.	38.	34.
30.	27.	24.	22.	19.	17.	16.	14.	13.	11.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4611.	4161.	2278.	864.	62454.
CMS	131.	118.	65.	24.	1769.
INCHES		4.72	10.34	11.77	11.81
MM		119.89	262.59	298.91	299.93
AC-FT		2063.	4519.	5144.	5162.
THOUS CU M		2545.	5574.	6345.	6367.

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SUB-AREA RUNOFF COMPUTATION

SUB BASIN B RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
B	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.90	0.00	6.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.90	110.50	122.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT STRKR DLTKR RTIOL ERAIN STRKS RTIOK STRTL CNSTL ALSMX RTIMP

UNIT HYDROGRAPH DATA
TP= 6.00 CP= .63 NTA= 0

RECESSION DATA
STRTQ= -1.00 QRCSN= -.50 RTIOR= 3.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.26 AND R= 5.37 INTERVALS

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 5.98 HOURS, CP= .63 VOL= 1.00

30.	109.	216.	330.	422.	471.	466.	410.	340.	282.
234.	194.	161.	134.	111.	92.	76.	63.	53.	44.
36.	30.	25.	21.	17.	14.	12.	10.	8.	7.
6.	5.	4.							

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	1.00	1	.01	.00	.01	6.	1.03	3.00	51	0.00	0.00	0.00	3970.
1.01	2.00	2	.01	.00	.01	6.	1.03	4.00	52	0.00	0.00	0.00	3557.
1.01	3.00	3	.01	.00	.01	5.	1.03	5.00	53	0.00	0.00	0.00	3187.
1.01	4.00	4	.01	.00	.01	5.	1.03	6.00	54	0.00	0.00	0.00	2855.
1.01	5.00	5	.01	.00	.01	4.	1.03	7.00	55	0.00	0.00	0.00	2558.
1.01	6.00	6	.01	.00	.01	4.	1.03	8.00	56	0.00	0.00	0.00	2292.
1.01	7.00	7	.03	.00	.02	4.	1.03	9.00	57	0.00	0.00	0.00	2053.
1.01	8.00	8	.03	.00	.02	4.	1.03	10.00	58	0.00	0.00	0.00	1840.
1.01	9.00	9	.03	.00	.02	3.	1.03	11.00	59	0.00	0.00	0.00	1648.
1.01	10.00	10	.03	.00	.02	3.	1.03	12.00	60	0.00	0.00	0.00	1477.
1.01	11.00	11	.03	.00	.02	3.	1.03	13.00	61	0.00	0.00	0.00	1323.
1.01	12.00	12	.03	.00	.02	4.	1.03	14.00	62	0.00	0.00	0.00	1186.
1.01	13.00	13	.15	.00	.14	4.	1.03	15.00	63	0.00	0.00	0.00	1062.
1.01	14.00	14	.18	.01	.17	4.	1.03	16.00	64	0.00	0.00	0.00	952.
1.01	15.00	15	.22	.01	.21	5.	1.03	17.00	65	0.00	0.00	0.00	853.
1.01	16.00	16	.56	.02	.54	7.	1.03	18.00	66	0.00	0.00	0.00	764.
1.01	17.00	17	.21	.01	.20	10.	1.03	19.00	67	0.00	0.00	0.00	684.
1.01	18.00	18	.16	.00	.16	13.	1.03	20.00	68	0.00	0.00	0.00	613.
1.01	19.00	19	.01	.00	.01	17.	1.03	21.00	69	0.00	0.00	0.00	549.
1.01	20.00	20	.01	.00	.01	19.	1.03	22.00	70	0.00	0.00	0.00	492.
1.01	21.00	21	.01	.00	.01	21.	1.03	23.00	71	0.00	0.00	0.00	441.
1.01	22.00	22	.01	.00	.01	20.	1.04	0.00	72	0.00	0.00	0.00	395.
1.01	23.00	23	.01	.00	.01	18.	1.04	1.00	73	0.00	0.00	0.00	354.
1.02	0.00	24	.01	.00	.01	16.	1.04	2.00	74	0.00	0.00	0.00	317.
1.02	1.00	25	.12	.00	.11	14.	1.04	3.00	75	0.00	0.00	0.00	284.
1.02	2.00	26	.12	.00	.11	12.	1.04	4.00	76	0.00	0.00	0.00	255.
1.02	3.00	27	.12	.02	.10	12.	1.04	5.00	77	0.00	0.00	0.00	228.
1.02	4.00	28	.12	.02	.10	13.	1.04	6.00	78	0.00	0.00	0.00	204.
1.02	5.00	29	.12	.02	.10	16.	1.04	7.00	79	0.00	0.00	0.00	183.
1.02	6.00	30	.12	.02	.10	22.	1.04	8.00	80	0.00	0.00	0.00	164.
1.02	7.00	31	.34	.24	.10	36.	1.04	9.00	81	0.00	0.00	0.00	147.
1.02	8.00	32	.34	.24	.10	68.	1.04	10.00	82	0.00	0.00	0.00	132.
1.02	9.00	33	.34	.24	.10	123.	1.04	11.00	83	0.00	0.00	0.00	118.
1.02	10.00	34	.34	.24	.10	203.	1.04	12.00	84	0.00	0.00	0.00	106.
1.02	11.00	35	.34	.24	.10	301.	1.04	13.00	85	0.00	0.00	0.00	95.
1.02	12.00	36	.34	.24	.10	409.	1.04	14.00	86	0.00	0.00	0.00	85.
1.02	13.00	37	1.94	1.84	.10	563.	1.04	15.00	87	0.00	0.00	0.00	76.
1.02	14.00	38	2.32	2.23	.10	843.	1.04	16.00	88	0.00	0.00	0.00	68.
1.02	15.00	39	2.90	2.81	.10	1325.	1.04	17.00	89	0.00	0.00	0.00	61.
1.02	16.00	40	7.36	7.26	.10	2197.	1.04	18.00	90	0.00	0.00	0.00	55.
1.02	17.00	41	2.71	2.61	.10	3526.	1.04	19.00	91	0.00	0.00	0.00	49.
1.02	18.00	42	2.13	2.03	.10	5114.	1.04	20.00	92	0.00	0.00	0.00	44.
1.02	19.00	43	.18	.08	.10	6666.	1.04	21.00	93	0.00	0.00	0.00	39.
1.02	20.00	44	.18	.08	.10	7815.	1.04	22.00	94	0.00	0.00	0.00	35.
1.02	21.00	45	.18	.08	.10	8336.	1.04	23.00	95	0.00	0.00	0.00	32.
1.02	22.00	46	.18	.08	.10	8178.	1.05	0.00	96	0.00	0.00	0.00	28.
1.02	23.00	47	.18	.08	.10	7442.	1.05	1.00	97	0.00	0.00	0.00	25.
1.03	0.00	48	.18	.08	.10	6441.	1.05	2.00	98	0.00	0.00	0.00	23.

```
                                                    100   0.1   0.00   .00        20.
                                                          0.00  0.00   0.00       18.

                                                    SUM  24.88  20.82  4.06   107891.
                                                       ( 632.)( 529.)( 103.)( 3055.13)
```

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8336.	7378.	3953.	1495.	107883.
CMS	236.	209.	112.	42.	3055.
INCHES		9.95	21.32	24.19	24.24
MM		252.65	541.44	614.30	615.71
AC-FT		3659.	7840.	8596.	8916.
THOUS CU M		4513.	9671.	10972.	10998.

HYDROGRAPH AT STA B FOR PLAN 1, RTIO 1

6.	6.	5.	5.	4.	4.	4.	4.	3.	3.
3.	4.	4.	4.	5.	7.	10.	13.	17.	19.
21.	20.	18.	16.	14.	12.	12.	13.	16.	22.
36.	66.	123.	203.	301.	409.	563.	843.	1325.	2197.
3526.	5114.	6676.	7815.	8336.	8178.	7442.	6441.	5446.	4569.
3970.	3557.	3187.	2655.	2558.	2292.	2053.	1840.	1648.	1477.
1323.	1186.	1062.	952.	853.	764.	684.	613.	549.	492.
441.	395.	354.	317.	284.	255.	228.	204.	183.	164.
147.	132.	118.	106.	95.	85.	76.	68.	61.	55.
49.	44.	39.	35.	32.	28.	25.	23.	20.	18.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8336.	7378.	3953.	1495.	107883.
CMS	236.	209.	112.	42.	3055.
INCHES		9.95	21.32	24.19	24.24
MM		252.65	541.44	614.30	615.71
AC-FT		3659.	7840.	8896.	8916.
THOUS CU M		4513.	9671.	10972.	10998.

HYDROGRAPH AT STA B FOR PLAN 1, RTIO 2

3.	3.	3.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	3.	4.	5.	7.	8.	10.
10.	10.	9.	8.	7.	6.	6.	6.	8.	11.
18.	34.	62.	101.	151.	205.	282.	421.	663.	1098.
1763.	2557.	3333.	3908.	4168.	4089.	3721.	3220.	2723.	2284.
1985.	1778.	1593.	1428.	1279.	1146.	1027.	920.	824.	738.
662.	593.	531.	476.	426.	382.	342.	307.	275.	246.
221.	198.	177.	159.	142.	127.	114.	102.	92.	82.
74.	66.	59.	53.	47.	42.	38.	34.	31.	27.
25.	22.	20.	18.	16.	14.	13.	11.	10.	9.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4168.	3689.	1976.	747.	53942.
CMS	118.	104.	56.	21.	1527.
INCHES		4.97	10.66	12.09	12.12
MM		126.32	270.72	307.15	307.86
AC-FT		1829.	3920.	4448.	4458.
THOUS CU M		2256.	4836.	5486.	5499.

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

COMBINE HYDROGRAPHS

COMBINE RUNOFF FROM SUBBASINS A & B

COMP RUNOF ... INS

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

SUM OF 2 HYDROGRAPHS AT A B PLAN 1 RTIO 1

14.	12.	11.	10.	9.	9.	9.	8.	8.	8.
9.	9.	9.	11.	14.	19.	26.	36.	46.	53.
57.	56.	54.	48.	42.	37.	35.	37.	43.	54.
82.	146.	256.	414.	613.	835.	1152.	1721.	2688.	4421.
7772.	10276.	13489.	16016.	17365.	17400.	16214.	14316.	12286.	10420.
8057.	7932.	7107.	6367.	5705.	5111.	4579.	4103.	3676.	3294.
2951.	2644.	2379.	2122.	1902.	1704.	1526.	1368.	1225.	1098.
984.	881.	790.	707.	634.	565.	509.	456.	408.	366.
322.	294.	263.	236.	211.	189.	170.	152.	136.	122.
109.	98.	88.	79.	70.	63.	57.	51.	45.	41.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17400.	15700.	8509.	3224.	232792.
CMS	493.	445.	241.	91.	6592.
INCHES		9.67	20.97	23.83	23.90
MM		245.66	532.61	605.35	607.11
AC-FT		7785.	16878.	19187.	19239.
THOUS CU M		9603.	20819.	23662.	23731.

SUM OF 2 HYDROGRAPHS AT A B PLAN 1 RTIO 2

7.	6.	6.	5.	5.	4.	4.	4.	4.	4.
4.	4.	5.	5.	7.	9.	13.	18.	23.	27.
29.	29.	27.	24.	21.	19.	18.	18.	22.	27.
41.	73.	128.	207.	306.	417.	576.	861.	1344.	2211.
3536.	5133.	6745.	8008.	8682.	8700.	8107.	7158.	6143.	5210.
4479.	3966.	3553.	3184.	2852.	2556.	2290.	2051.	1838.	1647.
1475.	1322.	1184.	1061.	951.	852.	763.	684.	613.	549.
492.	441.	395.	354.	317.	284.	254.	228.	204.	183.
164.	147.	132.	118.	106.	95.	85.	76.	68.	61.
55.	49.	44.	39.	35.	32.	28.	25.	23.	20.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8700.	7850.	4255.	1612.	116396.
CMS	246.	222.	120.	46.	3296.
INCHES		4.84	10.48	11.92	11.95
MM		122.83	266.31	302.68	303.55
AC-FT		3892.	8439.	9592.	9620.
THOUS CU M		4801.	10410.	11831.	11865.

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HYDROGRAPH ROUTING

MINICEONGO CREEK CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
18+00	1	0	0	0	0	0	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0400	.0400	.0400	328.0	380.0	3600.	.00500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
7950.00 380.00 7930.00 360.00 8220.00 340.00 8250.00 335.00 8500.00 328.00
8540.00 340.00 8600.00 360.00 8630.00 380.00

STORAGE	0.00	12.09	48.34	104.97	174.24	247.07	324.63	406.83	493.67	585.16
	681.29	782.06	887.56	999.12	1117.18	1241.73	1372.79	1510.35	1654.40	1804.96
OUTFLOW	0.00	473.49	3006.39	9327.59	19840.24	34583.84	53423.05	75854.78	101884.25	131535.43
	164145.87	201862.66	242449.67	286652.73	335068.86	387785.53	444912.05	506566.45	572870.16	643945.72
STAGE	328.00	330.74	333.47	336.21	338.95	341.68	344.42	347.16	349.89	352.63
	355.37	358.11	360.84	363.58	366.32	369.05	371.79	374.53	377.26	380.00
FLOW	0.00	473.49	3006.39	9327.59	19840.24	34583.84	53423.05	75854.78	101884.25	131535.43
	164145.87	201862.66	242449.67	286652.73	335068.86	387785.53	444912.05	506566.45	572870.16	643945.72

STATION 18+00, PLAN 1, RTIO 1

OUTFLOW

17.	12.	12.	10.	10.	9.	9.	8.	8.	8.
8.	9.	9.	10.	13.	17.	24.	33.	43.	51.
56.	55.	55.	50.	44.	39.	36.	36.	41.	51.
72.	174.	419.	362.	564.	801.	1087.	1607.	2495.	4175.
4742.	9972.	13710.	15909.	17336.	17416.	16361.	14463.	12450.	10549.
9174.	8046.	7185.	6453.	5772.	5177.	4635.	4155.	3721.	3335.
2999.	2704.	2410.	2166.	1937.	1737.	1556.	1394.	1249.	1119.
1000.	898.	805.	721.	646.	579.	519.	466.	424.	378.
339.	304.	272.	244.	219.	196.	176.	157.	141.	126.
113.	101.	91.	81.	73.	65.	59.	52.	47.	42.

STOR

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.	3.	6.	9.	13.	17.	21.	28.	41.	59.
33.	111.	132.	148.	158.	159.	152.	140.	127.	115.
105.	95.	87.	80.	74.	68.	63.	59.	55.	51.
49.	44.	40.	36.	33.	30.	28.	25.	23.	21.
20.	18.	17.	16.	15.	14.	13.	12.	11.	10.
9.	8.	7.	6.	6.	5.	4.	4.	4.	3.
3.	3.	2.	2.	2.	2.	1.	1.	1.	1.

STAGE

328.1	328.1	328.1	328.1	328.1	328.1	328.0	328.0	328.0	328.0
328.0	328.1	328.1	328.1	328.1	328.1	328.1	328.2	328.2	328.3
328.3	328.3	328.3	328.3	328.3	328.2	328.2	328.2	328.2	328.3
328.4	328.7	329.3	330.1	330.8	331.1	331.4	332.0	332.9	334.0
335.1	336.4	337.2	337.9	338.3	338.3	338.0	337.5	337.0	336.5
336.1	335.7	335.3	335.0	334.7	334.4	334.2	334.0	333.8	333.6
333.5	333.1	332.9	332.6	332.3	332.1	331.9	331.7	331.6	331.4
331.3	331.2	331.1	331.0	330.9	330.9	330.8	330.7	330.5	330.2
330.0	329.8	329.6	329.4	329.3	329.1	329.0	328.9	328.8	328.7
[illegible]	329.7	329.5	329.5	329.4	329.4	328.3	328.3	328.3	328.2

TOTAL VOLUME

[illegible]	[illegible]	329.6	329.4	329.7	329.1	329.0	328.9	328.8	328.7
328.7	328.6	328.5	328.5	328.4	328.4	328.3	328.3	328.3	328.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17416.	15711.	8510.	3224.	232784.
CMS	493.	445.	241.	91.	6592.
INCHES		9.68	20.97	23.83	23.90
MM		245.83	532.65	605.35	607.09
AC-FT		7790.	16880.	19183.	19238.
THOUS CU M		9609.	20821.	23662.	23730.

MAXIMUM STORAGE = 159.

MAXIMUM STAGE IS 339.3

STATION 18+00, PLAN 1, RTIO 2

OUTFLOW

5.	6.	6.	5.	5.	5.	4.	4.	4.	4.
4.	4.	5.	5.	6.	8.	12.	16.	21.	25.
26.	29.	28.	25.	22.	19.	18.	18.	20.	25.
36.	62.	109.	181.	274.	382.	534.	808.	1245.	2036.
2307.	4049.	6544.	7903.	8625.	8733.	8195.	7276.	6254.	5310.
4544.	4015.	3598.	3223.	2899.	2609.	2332.	2092.	1873.	1679.
1594.	1348.	1237.	1092.	969.	868.	778.	697.	625.	560.
531.	453.	409.	366.	328.	294.	263.	236.	211.	189.
170.	152.	136.	122.	109.	98.	88.	79.	70.	63.
57.	51.	45.	41.	36.	33.	29.	26.	23.	21.

STOR

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.	0.	0.	0.	1.	1.
1.	2.	3.	5.	7.	10.	13.	17.	23.	34.
71.	67.	81.	94.	100.	101.	96.	88.	78.	70.
63.	53.	54.	50.	47.	43.	39.	35.	32.	29.
27.	25.	23.	21.	19.	18.	16.	15.	14.	13.
12.	12.	10.	9.	8.	8.	7.	6.	5.	5.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

328.0	328.0	328.0	328.0	328.0	328.0	328.0	328.0	328.0	328.0
328.0	328.0	328.0	328.0	328.0	328.0	328.1	328.1	328.1	328.1
328.2	328.2	328.2	328.1	328.1	328.1	328.1	328.1	328.1	328.1
328.2	328.4	328.6	329.0	329.6	330.2	330.8	331.1	331.6	332.4
333.6	334.3	335.0	335.6	335.9	336.0	335.7	335.3	334.9	334.5
334.1	333.9	333.7	333.6	333.4	333.0	332.7	332.5	332.2	332.0
331.9	331.7	331.5	331.4	331.3	331.2	331.1	331.0	330.9	330.8
330.6	330.6	330.4	330.1	329.9	329.7	329.5	329.4	329.2	329.1
329.0	328.9	328.8	328.7	328.6	328.6	328.5	328.5	328.4	328.4
328.3	328.3	328.3	328.2	328.2	328.2	328.2	328.2	328.1	328.1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8733.	7855.	4255.	1612.	116392.
CMS	247.	222.	120.	46.	3296.
INCHES		4.84	10.49	11.92	11.95
MM		122.92	266.32	302.67	303.54
AC-FT		3895.	8440.	9592.	9619.
THOUS CU M		4805.	10410.	11831.	11865.

MAXIMUM STORAGE = 101.

```
                                      4549.        1.05    4.00     100   0.00   0.00   0.00      18.
                                                                    SUM  24.88  20.82   4.06  107891.

 MAXIMUM STAGE IS     336.0


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

                                             HYDROGRAPH ROUTING

                     CHANNEL ROUTING MINISCEONGO CREEK

                             ISTAQ    ICOMP    IECON    ITAPE    JPLT     JPRT    INAME  ISTAGE   IAUTO
                             76+00       1        0        0        0        0        0       0       0
                                                    ROUTING DATA
                    QLOSS    CLOSS      AVG     IRES    ISAME     IOPT     IPMP             LSTR
                      0.0    0.000     0.00        1        1        0        0                0

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


NORMAL DEPTH CHANNEL ROUTING
----------------------------


        QN(1)    QN(2)    QN(3)    ELNVT    ELMAX    RLNTH      SEL
        .0400    .0400    .0400    270.0    320.0    4000.   .01400


        CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
        4500.00  320.00 7460.00  300.00 7640.00  290.00 7710.00  280.00 8000.00  270.00
        8020.00  280.00 8150.00  300.00 8300.00  320.00

STORAGE      0.00      9.86     39.47     88.71    157.49    238.41    327.91    426.01    533.24    654.80
           791.97    944.65   1114.78   1309.85   1530.67   1777.25   2049.59   2347.68   2671.52   3021.12

OUTFLOW      0.00    565.01   3587.59  10577.42  23313.15  44089.06  70819.29 103620.53 144300.70 194692.67
        253473.39 321418.99 398231.41 486165.25 587216.55 702519.20 833175.49 980244.38 1144744.37 1327658.38

STAGE      270.00    272.63    275.26    277.89    280.53    283.16    285.79    288.42    291.05    293.68
           296.32    298.95    301.58    304.21    306.84    309.47    312.11    314.74    317.37    320.00

FLOW         0.00    565.01   3587.59  10577.42  23313.15  44089.06  70819.29 103620.53 144300.70 194692.67
        253473.39 321418.99 398231.41 486165.25 587216.55 702519.20 833175.49 980244.38 1144744.37 1327658.38

                                  STATION    76+00, PLAN 1, RTIO 1

                                                OUTFLOW
           24.       11.       12.       11.       10.        9.        9.        8.        8.        8.
            5.        9.        9.       10.       12.       16.       22.       31.       41.       49.
           55.       56.       56.       51.       45.       40.       36.       36.       40.       48.
           67.      111.      196.      329.      518.      777.     1047.     1532.     2371.     3949.
         4536.     9619.    13126.    15661.    17273.    17455.    16452.    14611.    12569.    10678.
         9194.     8111.     7265.     6503.     5836.     5219.     4685.     4190.     3760.     3376.
         3030.     2734.     2449.     2189.     1967.     1757.     1578.     1411.     1266.     1133.
         1015.      910.      816.      731.      655.      587.      531.      477.      432.      389.
          347.      312.      279.      250.      224.      201.      180.      161.      144.      129.
          116.      104.       93.       83.       75.       67.       60.       54.       48.       43.

                                                  STOR
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        1.        1.        1.
```

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	35.	65.	55.	[illegible]	[illegible]	[illegible]	21.	37.
34.	31.	28.	26.	24.	22.	20.	18.	17.	15.
14.	13.	12.	11.	11.	10.	9.	8.	8.	7.
6.	5.	5.	4.	4.	3.	3.	3.	3.	2.
2.	2.	2.	1.	1.	1.	1.	1.	1.	1.

STAGE

270.1	270.0	270.1	270.0	270.0	270.0	270.0	270.0	270.0	270.0
270.0	270.0	270.0	270.0	270.1	270.1	270.1	270.1	270.2	270.2
270.3	270.3	270.3	270.2	270.2	270.2	270.2	270.2	270.2	270.2
271.3	270.5	270.9	271.5	272.4	272.8	273.1	273.5	274.2	275.4
276.4	277.5	278.4	278.9	279.3	279.3	279.1	278.7	278.3	277.9
277.4	277.0	276.6	276.4	276.1	275.9	275.7	275.5	275.3	275.1
274.9	274.5	274.3	274.0	273.9	273.7	273.5	273.4	273.2	273.1
273.0	272.9	272.8	272.8	272.7	272.7	272.5	272.2	272.0	271.8
271.6	271.5	271.3	271.2	271.0	270.9	270.8	270.7	270.7	270.6
270.5	270.5	270.4	270.4	270.3	270.3	270.3	270.2	270.2	270.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17455.	15717.	8510.	3224.	232780.
CMS	494.	445.	241.	91.	6592.
INCHES		9.68	20.97	23.83	23.90
MM		245.93	532.63	605.34	607.08
AC-FT		7793.	16879.	19183.	19238.
THOUS CU M		9613.	20820.	23662.	23730.

MAXIMUM STORAGE = 126.

MAXIMUM STAGE IS 279.3

STATION 76+00, PLAN 1, RTIO 2

OUTFLOW

12.	5.	6.	5.	5.	5.	4.	4.	4.	4.
4.	4.	5.	5.	6.	8.	11.	15.	20.	25.
22.	29.	28.	26.	23.	20.	18.	18.	20.	24.
33.	55.	92.	164.	253.	359.	498.	767.	1187.	1920.
3135.	4841.	6423.	7791.	8599.	8735.	8271.	7356.	6347.	5382.
4609.	4051.	3674.	3270.	2932.	2644.	2364.	2119.	1899.	1700.
1524.	1365.	1223.	1096.	982.	880.	788.	706.	633.	567.
515.	442.	419.	375.	336.	301.	270.	242.	216.	194.
174.	156.	139.	125.	112.	100.	90.	81.	72.	65.
58.	52.	46.	42.	37.	33.	30.	27.	24.	22.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	2.	3.	4.	6.	9.	12.	16.	23.
35.	48.	59.	69.	75.	76.	72.	66.	59.	52.
47.	43.	40.	36.	33.	30.	27.	25.	23.	21.
19.	18.	16.	15.	14.	13.	12.	11.	11.	10.
9.	8.	7.	7.	6.	5.	5.	4.	4.	3.
3.	3.	2.	2.	2.	2.	2.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	0.	0.	0.

STAGE

270.1	270.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0
270.0	270.0	270.0	270.0	270.0	270.0	270.1	270.1	270.1	270.1
270.1	270.1	270.1	270.1	270.1	270.1	270.1	270.1	270.1	270.1
270.2	270.3	270.5	270.8	271.2	271.7	272.3	272.8	273.2	273.8
274.9	275.7	276.3	276.8	277.1	277.2	277.0	276.7	276.3	275.9
[illegible]	[illegible]	275.3	275.0	274.7	274.4	274.2	274.0	273.8	273.6

```
  [illegible]  [illegible]  [illegible]  [illegible]   274.7   274.4   274.2   274.0   273.8   273.6
  272.5   272.3   272.2   273.1   273.0   272.9   272.8   272.8   272.7   272.6
  272.4   272.2   272.0   271.7   271.6   271.4   271.3   271.1   271.0   270.9
  270.8   270.7   270.6   270.6   270.5   270.5   270.4   270.4   270.3   270.3
  270.3   270.2   270.2   270.2   270.2   270.2   270.1   270.1   270.1   270.1

                  PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
         CFS      8775.    7856.     4255.     1612.       116390.
         CMS       247.     222.      120.       46.         3296.
      INCHES                4.84     10.48     11.92         11.95
          MM              122.93    266.31    302.67        303.54
       AC-FT               3896.     8439.     9592.         9619.
   THOUS CU M              4805.    10410.    11831.        11865.

                    MAXIMUM STORAGE =       76.

MAXIMUM STAGE IS     277.2

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

                                HYDROGRAPH ROUTING

              CHANNEL ROUTING AT UPSTREAM END OF RESERVOIR

                 ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                 114+0        1        0        0        0        0        0        0        0
                                       ROUTING DATA
        QLOSS    CLOSS      AVG     IRES    ISAME     IOPT     IPMP             LSTR
          0.0    0.000     0.00        1        1        0        0                0

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

NORMAL DEPTH CHANNEL ROUTING
----------------------------

      QN(1)    QN(2)    QN(3)    ELNVT    ELMAX    RLNTH      SEL
      .0400    .0400    .0400    210.0    260.0    3800.   .01600

      CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
       7730.00  260.00 7400.00  240.00 7430.00  220.00 7500.00  210.00 7550.00  220.00
       7650.00  232.00 7720.00  233.00 7750.00  240.00

STORAGE        0.00       3.62      14.50      32.62      58.00      90.76     130.98     178.64     233.76     299.21
             372.92     450.12     535.57     613.24     698.03     784.94     873.95     965.09    1058.33    1153.70

OUTFLOW        0.00     232.59    1478.77    4359.90    9419.46   17200.52   28021.69   42291.76   60393.34   86129.42
          119177.06  157468.29  201055.11  250041.83  304218.99  363478.85  427755.76  497009.46  571216.58  650365.73

STAGE        210.00     212.67     215.26     217.89     220.53     223.16     225.79     228.42     231.05     233.68
             236.32     238.95     241.58     244.21     246.84     249.47     252.11     254.74     257.37     260.00

FLOW           0.00     232.59    1478.77    4359.90    9419.46   17200.52   28021.69   42291.76   60393.34   86129.42
          119177.06  157468.29  201055.11  250041.83  304218.99  363478.85  427755.76  497009.46  571216.58  650365.73

                        STATION   114+0, PLAN 1, RTIO 1
```

OW

[illegible]4.	9.	12.	11.	10.	9.	9.	8.	8.	8.
5.	9.	9.	10.	12.	15.	21.	29.	39.	48.
54.	55.	57.	53.	47.	41.	37.	36.	39.	46.
63.	101.	177.	310.	497.	746.	1020.	1465.	2309.	3786.
[illegible]	9415.	12963.	15556.	17209.	17493.	16511.	14734.	12658.	10780.
9251.	[illegible]	7300.	6558.	5864.	5263.	4708.	4229.	3788.	3406.
[illegible]54.	2755.	2470.	2207.	1983.	1773.	1590.	1427.	1281.	1147.
1123.	921.	825.	739.	662.	593.	536.	483.	436.	394.
351.	315.	282.	253.	227.	205.	183.	165.	147.	132.
116.	106.	95.	85.	76.	68.	61.	55.	49.	44.

STOR

1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	2.	3.	4.	6.	8.	10.	14.	20.	29.
43.	58.	73.	84.	91.	92.	88.	80.	72.	64.
57.	52.	47.	44.	40.	37.	34.	32.	29.	27.
24.	23.	21.	19.	18.	16.	15.	14.	13.	12.
11.	10.	9.	8.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	4.	3.	3.	3.	2.	2.
2.	2.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

210.4	210.1	210.1	210.1	210.1	210.1	210.1	210.1	210.1	210.1
210.1	210.1	210.1	210.1	210.1	210.2	210.2	210.3	210.4	210.5
210.6	210.7	210.6	210.6	210.5	210.5	210.4	210.4	210.4	210.5
210.7	211.1	212.0	212.8	213.2	213.7	214.3	215.2	216.0	217.4
218.9	220.5	221.7	222.6	223.2	223.2	222.9	222.3	221.6	221.0
220.4	219.9	219.4	219.0	218.7	218.4	218.1	217.8	217.4	217.0
216.7	216.4	216.2	215.9	215.7	215.5	215.4	215.2	214.8	214.6
214.3	214.1	213.9	213.7	213.5	213.4	213.3	213.2	213.1	213.0
212.9	212.8	212.7	212.7	212.6	212.3	212.1	211.9	211.7	211.5
211.3	211.2	211.1	211.0	210.9	210.8	210.7	210.6	210.6	210.5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17493.	15719.	8509.	3224.	232778.
CMS	495.	445.	241.	91.	6592.
INCHES		9.68	20.97	23.83	23.90
MM		245.97	532.59	605.34	607.07
AC-FT		7795.	16878.	19183.	19238.
THOUS CU M		9615.	20818.	23662.	23730.

MAXIMUM STORAGE = 92.

STATION 114+0, PLAN 1, RTIO 2

OUTFLOW

17.	5.	6.	5.	5.	5.	4.	4.	4.	4.
4.	4.	4.	5.	6.	8.	10.	15.	19.	24.
27.	29.	28.	26.	23.	20.	18.	18.	19.	23.
31.	50.	89.	151.	236.	352.	479.	733.	1136.	1843.
[illegible]	4751.	6361.	7691.	8590.	8729.	8327.	7411.	6413.	5435.
4651.	4025.	3663.	3297.	2957.	2664.	2386.	2134.	1916.	1714.
1532.	1361.	1238.	1109.	993.	890.	797.	715.	640.	574.
[illegible]	466.	422.	380.	339.	305.	272.	245.	221.	198.
177.	159.	142.	128.	114.	102.	92.	82.	74.	66.
[illegible]	53.	47.	43.	38.	34.	31.	27.	25.	22.

STOR

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.

```
                                     .        54.
   15.      14.      12.     26.      24.                         19.       3.      38.
    6.       6.       5.     11.      10.      9.       9.         8.      17.      16.
    3.       2.       2.      5.       5.      4.       4.         4.       7.       7.
    1.       1.       1.      2.       2.      2.       1.         1.       3.       3.
                              1.       1.      1.       0.         0.       1.       1.
                                                                            0.       0.

                                      STAGE
  210.2    210.1    210.1    210.1    210.1   210.1    210.0     210.0
  210.0    210.0    210.1    210.1    210.1   210.1    210.1     210.2    210.0    210.0
  210.3    210.3    210.3    210.3    210.3   210.2    210.2     210.2    210.2    210.3
  210.4    210.6    211.0    211.7    212.6   212.9    213.2     213.7    210.2    210.3
  216.7    218.1    218.9    219.6    220.1   220.2    220.0     219.5    214.5    215.6
  218.0    217.6    217.3    216.9    216.6   216.3    216.1     215.9    219.0    218.5
  215.3    215.1    214.8    214.5    214.2   214.0    213.8     213.6    215.7    215.5
  213.2    213.1    213.0    212.9    212.9   212.8    212.7     212.7    213.5    213.4
  212.0    211.8    211.6    211.4    211.3   211.2    211.0     210.9    212.5    212.2
  210.7    210.6    210.5    210.5    210.4   210.4    210.3     210.3    210.8    210.7
                                                                          210.3    210.2

                      PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
            CFS       8729.    7856.    4254.     1612.       116389.
            CMS        247.     222.     120.       46.         3296.
         INCHES                 4.84    10.48     11.92         11.95
             MM               122.92   266.26    302.67        303.54
          AC-FT                3895.    8438.     9591.         9619.
     THOUS CU M                4805.   10409.    11831.        11865.


                    MAXIMUM STORAGE =        55.

 MAXIMUM STAGE IS     220.2


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

                         SUB-AREA RUNOFF COMPUTATION

            SUB-BASIN C RUNOFF

                     ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        C       0       0       0       0       0       0       0       0

                                     HYDROGRAPH DATA
          IHYDG    IUHG    TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       1     2.40    0.00    2.40    0.00   0.000       0       1       0

                                       PRECIP DATA
                 SPFE     PMS      R6     R12     R24     R48     R72     R96
                 0.00   21.90  110.50  122.00  132.00  142.00    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     .01

                               UNIT HYDROGRAPH DATA
                          TP=  2.93     CP= .63      NTA=  0
```

RTIOR= 3.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 7.61 AND R= 2.35 INTERVALS

UNIT HYDROGRAPH 15 END-OF-PERIOD ORDINATES, LAG= 2.91 HOURS, CP= .62 VOL= 1.00

56.	193.	314.	318.	233.	152.	98.	64.	42.	27.
18.	11.	7.	5.	3.					

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.01	.00	.01	2.	1.03	3.00	51	0.00	0.00	0.00	1309.
1.01	2.00	2	.01	.00	.01	2.	1.03	4.00	52	0.00	0.00	0.00	1173.
1.01	3.00	3	.01	.00	.01	2.	1.03	5.00	53	0.00	0.00	0.00	1051.
1.01	4.00	4	.01	.00	.01	2.	1.03	6.00	54	0.00	0.00	0.00	941.
1.01	5.00	5	.01	.00	.01	1.	1.03	7.00	55	0.00	0.00	0.00	844.
1.01	6.00	6	.01	.00	.01	1.	1.03	8.00	56	0.00	0.00	0.00	756.
1.01	7.00	7	.03	.00	.03	1.	1.03	9.00	57	0.00	0.00	0.00	677.
1.01	8.00	8	.03	.00	.03	1.	1.03	10.00	58	0.00	0.00	0.00	607.
1.01	9.00	9	.03	.00	.03	1.	1.03	11.00	59	0.00	0.00	0.00	544.
1.01	10.00	10	.03	.00	.03	1.	1.03	12.00	60	0.00	0.00	0.00	487.
1.01	11.00	11	.03	.00	.03	1.	1.03	13.00	61	0.00	0.00	0.00	436.
1.01	12.00	12	.03	.00	.03	1.	1.03	14.00	62	0.00	0.00	0.00	391.
1.01	13.00	13	.15	.00	.15	1.	1.03	15.00	63	0.00	0.00	0.00	350.
1.01	14.00	14	.18	.00	.17	1.	1.03	16.00	64	0.00	0.00	0.00	314.
1.01	15.00	15	.22	.00	.22	2.	1.03	17.00	65	0.00	0.00	0.00	281.
1.01	16.00	16	.56	.25	.30	16.	1.03	18.00	66	0.00	0.00	0.00	252.
1.01	17.00	17	.21	.11	.10	57.	1.03	19.00	67	0.00	0.00	0.00	226.
1.01	18.00	18	.16	.06	.10	106.	1.03	20.00	68	0.00	0.00	0.00	202.
1.01	19.00	19	.01	.00	.01	128.	1.03	21.00	69	0.00	0.00	0.00	181.
1.01	20.00	20	.01	.00	.01	114.	1.03	22.00	70	0.00	0.00	0.00	162.
1.01	21.00	21	.01	.00	.01	84.	1.03	23.00	71	0.00	0.00	0.00	145.
1.01	22.00	22	.01	.00	.01	62.	1.04	0.00	72	0.00	0.00	0.00	130.
1.01	23.00	23	.01	.00	.01	56.	1.04	1.00	73	0.00	0.00	0.00	117.
1.02	0.00	24	.01	.00	.01	50.	1.04	2.00	74	0.00	0.00	0.00	105.
1.02	1.00	25	.12	.02	.10	45.	1.04	3.00	75	0.00	0.00	0.00	94.
1.02	2.00	26	.12	.02	.10	40.	1.04	4.00	76	0.00	0.00	0.00	84.
1.02	3.00	27	.12	.02	.10	36.	1.04	5.00	77	0.00	0.00	0.00	75.
1.02	4.00	28	.12	.02	.10	32.	1.04	6.00	78	0.00	0.00	0.00	67.
1.02	5.00	29	.12	.02	.10	29.	1.04	7.00	79	0.00	0.00	0.00	60.
1.02	6.00	30	.12	.02	.10	26.	1.04	8.00	80	0.00	0.00	0.00	54.
1.02	7.00	31	.34	.24	.10	37.	1.04	9.00	81	0.00	0.00	0.00	48.
1.02	8.00	32	.34	.24	.10	80.	1.04	10.00	82	0.00	0.00	0.00	43.
1.02	9.00	33	.34	.24	.10	150.	1.04	11.00	83	0.00	0.00	0.00	39.
1.02	10.00	34	.34	.24	.10	220.	1.04	12.00	84	0.00	0.00	0.00	35.
1.02	11.00	35	.34	.24	.10	271.	1.04	13.00	85	0.00	0.00	0.00	31.
1.02	12.00	36	.34	.24	.10	305.	1.04	14.00	86	0.00	0.00	0.00	28.
1.02	13.00	37	1.94	1.84	.10	416.	1.04	15.00	87	0.00	0.00	0.00	25.
1.02	14.00	38	2.32	2.22	.10	761.	1.04	16.00	88	0.00	0.00	0.00	22.
1.02	15.00	39	2.90	2.80	.10	1391.	1.04	17.00	89	0.00	0.00	0.00	20.
1.02	16.00	40	7.36	7.26	.10	2380.	1.04	18.00	90	0.00	0.00	0.00	18.
1.02	17.00	41	2.71	2.61	.10	3664.	1.04	19.00	91	0.00	0.00	0.00	16.
1.02	18.00	42	2.13	2.03	.10	4653.	1.04	20.00	92	0.00	0.00	0.00	14.
1.02	19.00	43	.18	.08	.10	4741.	1.04	21.00	93	0.00	0.00	0.00	13.
1.02	20.00	44	.18	.08	.10	3969.	1.04	22.00	94	0.00	0.00	0.00	12.
1.02	21.00	45	.18	.08	.10	2910.	1.04	23.00	95	0.00	0.00	0.00	10.
1.02	22.00	46	.18	.08	.10	2267.	1.05	0.00	96	0.00	0.00	0.00	9.
1.02	23.00	47	.18	.08	.10	2031.	1.05	1.00	97	0.00	0.00	0.00	8.
1.03	0.00	48	.18	.08	.10	1820.	1.05	2.00	98	0.00	0.00	0.00	7.
1.03	1.00	49	0.00	0.00	0.00	1631.	1.05	3.00	99	0.00	0.00	0.00	7.
1.03	2.00	50	0.00	0.00	0.00	1461.	1.05	4.00	100	0.00	0.00	0.00	6.
									SUM	24.88	21.18	3.70	48575.
										(632.)	(538.)	(94.)	(1375.49)

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
	4			72.	
CMS	134.	105.	50.	19.	[illegible]
INCHES		14.38	27.44	31.26	31.38
MM		365.24	697.06	794.07	796.98
AC-FT		1840.	3511.	4000.	4014.
THOUS CU M		2269.	4331.	4933.	4951.

HYDROGRAPH AT STA C FOR PLAN 1, RTIO 1

2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	16.	57.	106.	128.	114.
84.	62.	56.	50.	45.	40.	36.	32.	29.	26.
37.	80.	150.	220.	271.	305.	416.	761.	1381.	2380.
3664.	4653.	4741.	3969.	2910.	2267.	2031.	1820.	1631.	1461.
1309.	1173.	1051.	941.	844.	756.	677.	607.	544.	487.
436.	391.	350.	314.	281.	252.	226.	202.	181.	162.
145.	130.	117.	105.	94.	84.	75.	67.	60.	54.
49.	43.	39.	35.	31.	28.	25.	22.	20.	16.
14.	14.	13.	12.	10.	9.	8.	7.	7.	6.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4741.	3710.	1770.	672.	48572.
CMS	134.	105.	50.	19.	1375.
INCHES		14.38	27.44	31.26	31.38
MM		365.24	697.06	794.07	796.98
AC-FT		1840.	3511.	4000.	4014.
THOUS CU M		2269.	4331.	4933.	4951.

HYDROGRAPH AT STA C FOR PLAN 1, RTIO 2

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	0.	1.	1.	1.	8.	29.	53.	64.	57.
42.	31.	29.	25.	22.	20.	18.	16.	14.	13.
19.	40.	75.	110.	136.	152.	208.	381.	690.	1190.
1832.	2226.	2370.	1985.	1455.	1134.	1016.	910.	815.	731.
655.	586.	525.	471.	422.	378.	339.	303.	272.	244.
218.	195.	175.	157.	141.	126.	113.	101.	91.	81.
73.	65.	58.	52.	47.	42.	38.	34.	30.	27.
24.	22.	19.	17.	16.	14.	13.	11.	10.	9.
8.	7.	6.	6.	5.	5.	4.	4.	3.	3.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2370.	1855.	885.	336.	24286.
CMS	67.	53.	25.	10.	688.
INCHES		7.19	13.72	15.63	15.69
MM		182.62	348.53	397.03	398.49
AC-FT		920.	1755.	2000.	2007.
THOUS CU M		1135.	2165.	2467.	2476.

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COMBINE HYDROGRAPHS

COMBINE CHANNEL FLOW & SUBBASIN RUNOFF AT STN 114+00.

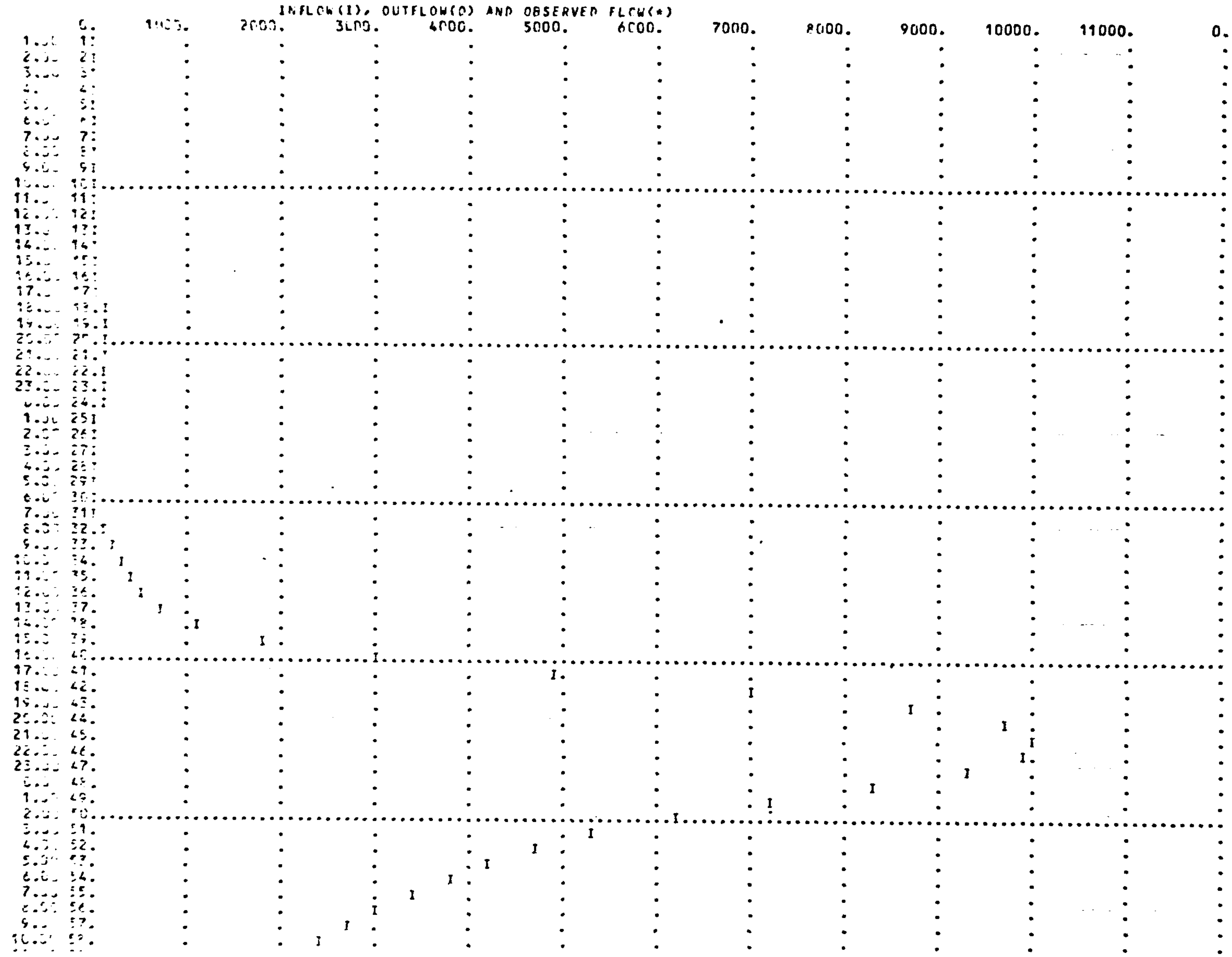
ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW	2	0	0	2	1	1	0	0

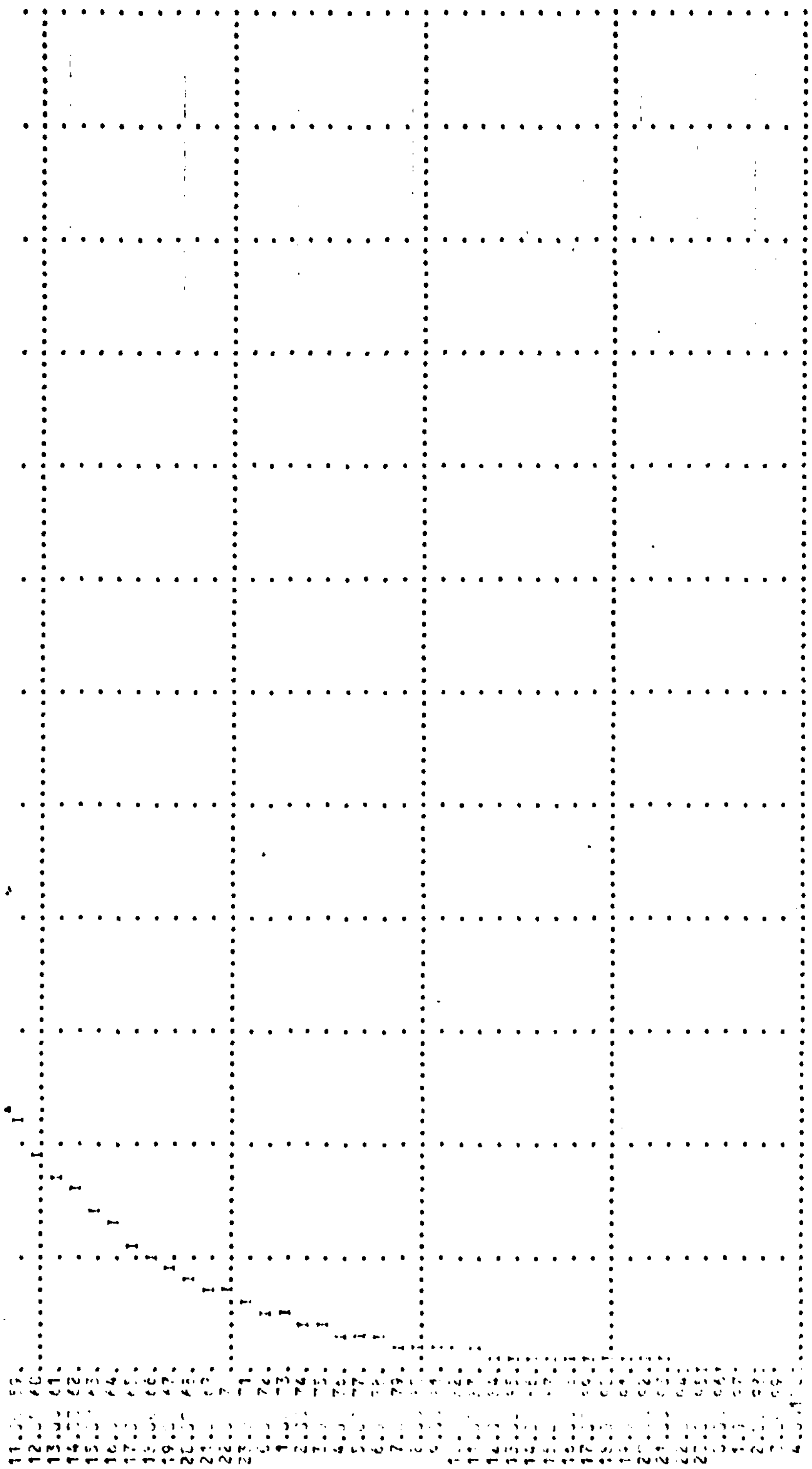
SUM OF 2 HYDROGRAPHS AT INFLOW PLAN 1 RTIO 1

[illegible]	11.	14.	1[illegible].	11.	11.	10.	10.	[illegible]	
49.	[illegible]0.	12			.	8.	135.	166.	161.
[illegible].	120.	112.	102.	91.	81.	73.	68.	67.	72.
10[illegible].	151.	327.	530.	768.	1050.	1436.	2226.	3690.	6166.
[illegible]25.	14[illegible]8.	17708.	19525.	20119.	19760.	18543.	16554.	14288.	12241.
1[illegible]560.	9356.	8351.	7500.	6708.	6019.	5385.	4836.	4332.	3893.
349[illegible].	3146.	2620.	2521.	2264.	2025.	1816.	1630.	1462.	1309.
[illegible]173.	1051.	942.	844.	756.	677.	611.	550.	497.	448.
399.	359.	321.	288.	259.	233.	208.	187.	167.	150.
124.	120.	108.	97.	87.	78.	70.	62.	56.	50.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20119.	18494.	10243.	3890.	281350.
CMS	570.	524.	290.	110.	7967.
INCHES		9.63	21.78	24.81	24.93
MM		249.71	553.18	630.29	633.12
AC-FT		9171.	20316.	23148.	23252.
THOUS CU M		11312.	25060.	28553.	28681.

STATIONINFLOW





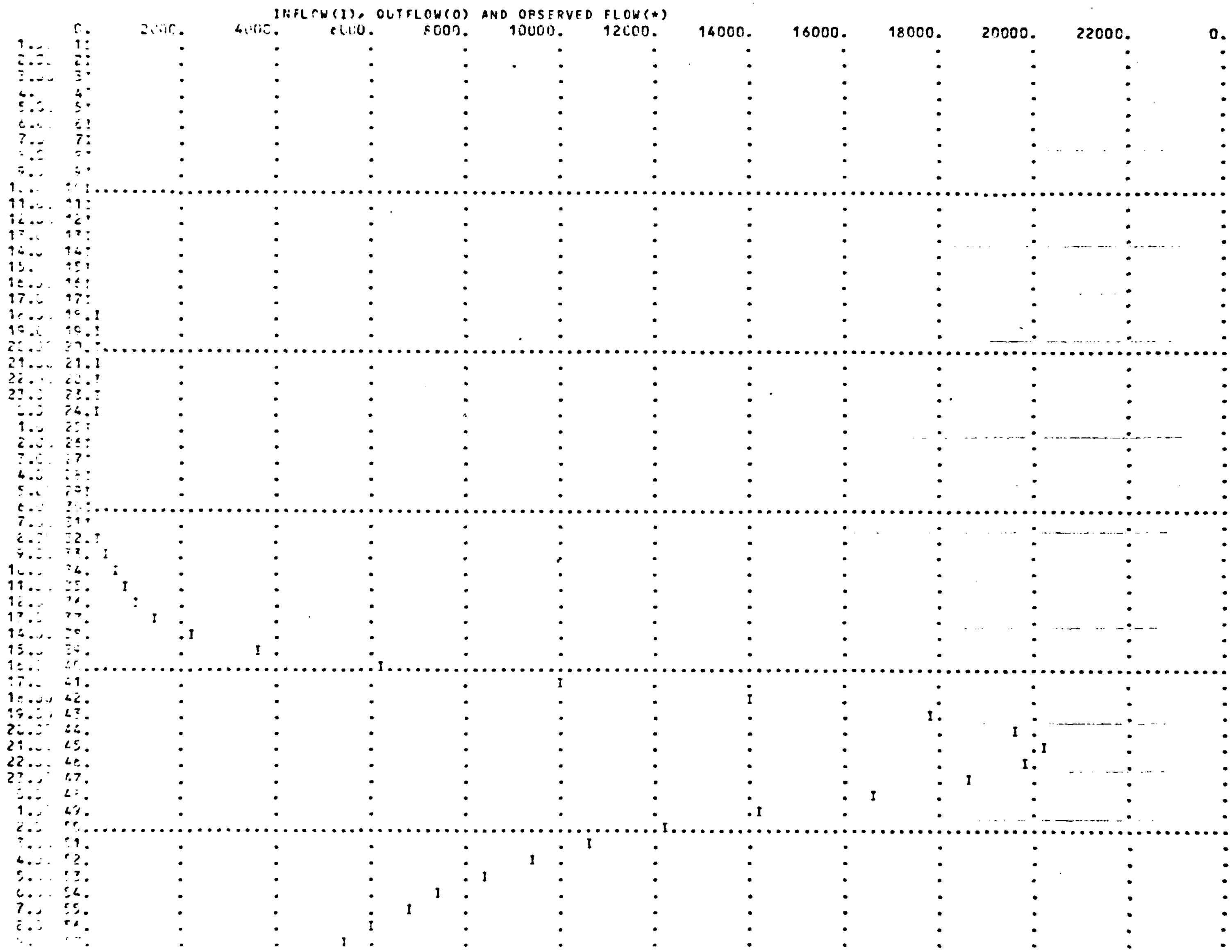
SUM OF 2 HYDROGRAPHS AT INFLOW PLAN 1 RTIO 2

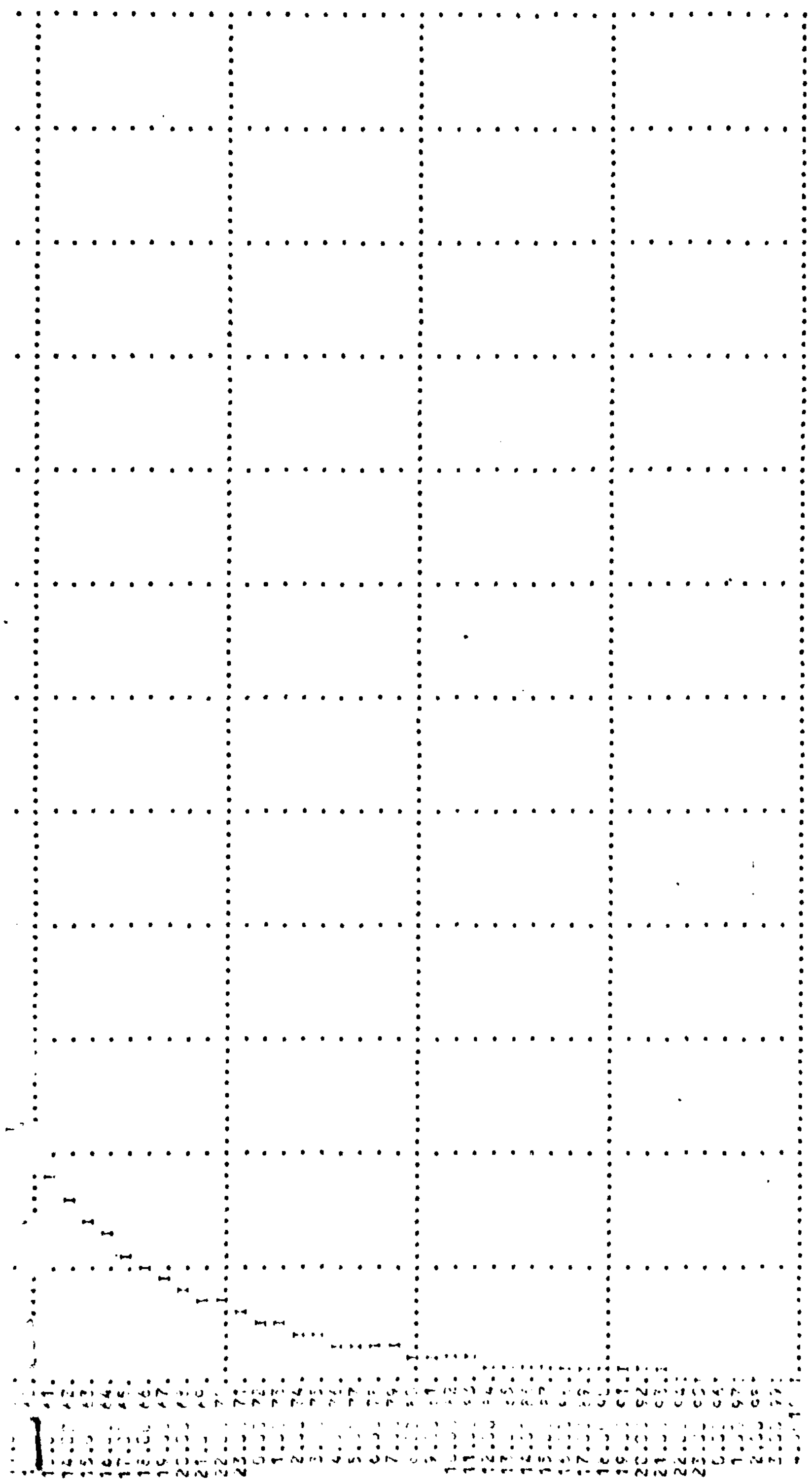
18.	6.	7.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	6.	7.	16.	39.	67.	83.	81.
69.	60.	56.	51.	46.	40.	36.	34.	34.	36.
50.	90.	163.	260.	371.	504.	687.	1114.	1826.	3033.
4563.	7027.	8731.	9676.	10045.	9862.	9343.	8321.	7228.	6165.
5216.	4472.	4188.	3767.	3379.	3042.	2725.	2437.	2188.	1957.
1756.	1577.	1413.	1266.	1134.	1016.	910.	816.	731.	655.
593.	533.	481.	433.	386.	347.	310.	278.	251.	225.
202.	181.	162.	145.	130.	116.	104.	93.	84.	75.
67.	60.	54.	48.	43.	39.	35.	31.	28.	25.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10045.	9222.	5121.	1945.	140675.
CMS	284.	261.	145.	55.	3983.
INCHES		4.90	10.89	12.41	12.46
MM		124.51	276.58	315.14	316.56
AC-FT		4573.	10158.	11574.	11626.
THOUS CU M		5640.	12529.	14276.	14341.

CNF

STATIONINFLOW





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HYDROGRAPH ROUTING

RESERVOIR ROUTING GARNERVILLE DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
100	1	0	0	1	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	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	100.	-1

STAGE	185.00	210.00	212.00	214.00	216.00	218.00	220.00
FLOW	0.00	0.00	608.00	1720.00	3160.00	4860.00	6790.00
CAPACITY=	0.	100.	123.	150.	182.	219.	260.
ELEVATION=	185.	210.	212.	214.	216.	218.	220.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
210.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
216.9	2.8	1.5	260.

STATION 100, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

				OUTFLOW					
[illegible]	27.	12.	13.	12.	11.	10.	10.	9.	9.
9.	9.	10.	11.	12.	23.	56.	109.	152.	164.
149.	125.	115.	107.	96.	86.	76.	70.	67.	70.
[illegible]	147.	259.	436.	669.	972.	1314.	1973.	3254.	5744.
[illegible]	[illegible]	17467.	19481.	20080.	19834.	18636.	16733.	14451.	12403.
[illegible]	9449.	8445.	7576.	6794.	6088.	5460.	4897.	4405.	3967.
[illegible]	3230.	2569.	2599.	2330.	2089.	1870.	1680.	1511.	1353.
[illegible]	[illegible]	973.	872.	781.	700.	630.	575.	521.	470.
472.	777.	339.	303.	272.	245.	220.	197.	176.	158.
142.	127.	114.	102.	91.	82.	73.	66.	59.	53.
				STORAGE					
101.	101.	100.	101.	100.	100.	100.	100.	100.	100.
100.	100.	100.	100.	100.	101.	102.	104.	106.	106.
[illegible]	105.	104.	104.	104.	103.	103.	103.	103.	103.
173.	125.	110.	116.	124.	132.	140.	156.	184.	219.
252.	249.	264.	315.	319.	317.	310.	299.	285.	272.
[illegible]	251.	243.	236.	229.	223.	217.	211.	206.	199.
192.	184.	176.	170.	164.	158.	153.	149.	145.	141.
[illegible]	135.	132.	129.	127.	125.	124.	122.	120.	118.
116.	114.	113.	111.	110.	109.	108.	107.	107.	106.
115.	105.	104.	104.	103.	103.	103.	102.	102.	102.
				STAGE					
[illegible]	210.1	210.0	210.0	210.0	210.0	210.0	210.0	210.0	210.0

[illegible]	[illegible]	[illegible]	210.0	210.0	210.1	210.2	210.4	210.5	210.5
[illegible]	210.4	210.4	210.4	210.3	210.3	210.3	210.2	210.2	210.2
[illegible]	210.5	210.9	211.4	212.1	212.7	213.3	214.4	216.1	218.0
[illegible]	221.5	222.1	222.7	222.9	222.8	222.5	221.9	221.2	220.6
[illegible]	219.5	219.2	218.8	218.5	218.2	217.9	217.6	217.3	216.9
[illegible]	214.1	215.7	215.2	214.8	214.5	214.2	213.9	213.6	213.3
[illegible]	212.9	212.7	212.5	212.3	212.2	212.0	211.9	211.7	211.5
211.4	211.2	211.1	211.0	210.9	210.8	210.7	210.6	210.6	210.5
[illegible]	210.4	210.4	210.3	210.7	210.3	210.2	210.2	210.2	210.2

[illegible] IS 2[illegible]. AT TIME 45.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20[illegible]0.	18457.	10247.	3890.	281344.
CMS	569.	523.	290.	110.	7967.
INCHES		9.81	21.79	24.81	24.93
MM		249.20	553.39	630.28	633.10
AC-FT		9152.	20324.	23148.	23252.
THOUS CU M		11289.	25069.	28552.	28680.

STATION 100, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

19.	12.	6.	7.	6.	6.	5.	5.	5.	5.
5.	5.	5.	5.	6.	11.	28.	54.	76.	82.
73.	44.	58.	53.	48.	43.	38.	35.	34.	35.
43.	71.	129.	216.	320.	443.	602.	977.	1598.	2676.
47[illegible]4.	6899.	8533.	9665.	9996.	9923.	9379.	8457.	7317.	6294.
53[illegible]0.	4759.	4253.	3859.	3495.	3125.	2811.	2512.	2253.	2018.
[illegible]	1627.	1460.	1308.	1172.	1050.	941.	843.	755.	677.
[illegible]	561.	505.	455.	407.	365.	327.	293.	263.	237.
212.	190.	170.	153.	137.	123.	110.	98.	88.	79.
71.	63.	57.	51.	46.	41.	37.	33.	29.	26.

STORAGE

101.	100.	100.	100.	100.	100.	100.	100.	100.	100.
100.	100.	100.	100.	100.	100.	101.	102.	103.	103.
103.	102.	102.	102.	102.	102.	101.	101.	101.	101.
1[illegible]2.	105.	105.	108.	112.	117.	123.	132.	147.	171.
[illegible]	239.	244.	252.	255.	254.	250.	243.	234.	225.
216.	210.	204.	197.	189.	181.	174.	168.	162.	157.
152.	148.	144.	140.	137.	134.	131.	129.	127.	125.
123.	121.	119.	117.	115.	114.	112.	111.	110.	109.
[illegible]	107.	106.	104.	105.	105.	104.	104.	103.	103.
103.	102.	102.	102.	102.	102.	101.	101.	101.	101.

STAGE

210.1	210.0	210.0	210.0	210.[illegible]	210.0	210.0	210.0	210.0	210.0
210.0	210.0	210.0	210.0	210.0	210.0	210.1	210.2	210.3	210.3
210.2	210.2	210.2	210.2	210.2	210.1	210.1	210.1	210.1	210.1
210.1	210.2	210.4	210.7	211.1	211.5	212.0	212.7	213.8	215.3
217.3	218.5	219.2	219.6	219.7	219.7	219.5	219.2	218.7	218.3
217.8	217.5	217.2	216.9	216.4	216.0	215.5	215.1	214.7	214.4
214.1	213.8	213.5	213.7	213.0	212.8	212.6	212.4	212.3	212.1
212.0	211.8	211.7	211.5	211.3	211.2	211.1	211.0	210.9	210.8
210.7	210.6	210.6	210.5	210.5	210.4	210.4	210.3	210.3	210.3
210.2	210.2	210.2	210.2	210.1	210.1	210.1	210.1	210.1	210.1

[illegible] IS [illegible]. AT TIME 45.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	996.	9224.	51[illegible].	1[illegible].	140672.
CMS	282.	241.	145.	55.	3983.
INCHES		4.90	10.89	12.41	12.46
MM		124.54	276.67	315.14	316.55
AC-FT		4574.	10161.	11574.	11626.
THOUS CU M		5642.	12533.	14276.	14340.

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HYDROGRAPH ROUTING

MINISCEONGO CREEK D/S OF DAM

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	2+00	1	0	0	0	0	0	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0400	.0400	.0400	175.0	220.0	200.	.02100

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
1500.00 220.00 1590.00 200.00 1690.00 195.00 1730.00 194.00 1960.00 180.00
2100.00 175.00 2040.00 183.00 2140.00 200.00

STORAGE	0.00	.21	.32	1.91	3.55	5.73	8.47	11.77	15.61	20.22
	25.52	31.41	37.50	43.71	50.03	56.47	63.02	69.69	76.48	83.38
OUTFLOW	0.00	269.74	1712.77	5024.41	11258.62	21151.23	35379.80	54575.94	79333.71	111150.87
	155850.76	210681.88	276066.53	349415.36	430443.56	518955.38	614808.89	717898.36	828144.10	945485.95
STAGE	175.00	177.37	179.74	182.11	184.47	186.84	189.21	191.58	193.95	196.32
	198.68	201.05	203.42	205.79	208.16	210.53	212.89	215.26	217.63	220.00
FLOW	0.00	269.74	1712.77	5024.41	11258.62	21151.23	35379.80	54575.94	79333.71	111150.87
	155850.76	210681.88	276066.53	349415.36	430443.56	518955.38	614808.89	717898.36	828144.10	945485.95

STATION 2+00, PLAN 1, RTIO 1

OUTFLOW

75.	0.	35.	0.	25.	0.	21.	0.	19.	0.
17.	1.	18.	3.	20.	15.	63.	101.	159.	158.
155.	122.	121.	102.	102.	81.	81.	65.	72.	65.
91.	136.	261.	432.	671.	967.	1315.	1966.	3252.	5728.
9647.	13736.	17462.	19476.	20082.	19833.	18643.	16737.	14460.	12405.
11494.	9449.	8451.	7575.	6799.	6087.	5465.	4896.	4410.	3966.
3602.	3222.	2913.	2598.	2334.	2037.	1873.	1678.	1514.	1352.
1215.	1085.	976.	870.	784.	698.	632.	573.	523.	468.
424.	375.	340.	301.	274.	244.	222.	195.	178.	157.

[illegible]	[illegible]	13.	[illegible]	[illegible]	51.	74.	69.	63.	52.

STOR

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.	2.
3.	4.	5.	5.	5.	5.	5.	5.	4.	4.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

175.7	175.0	175.3	175.0	175.2	175.0	175.2	175.0	175.2	175.0
175.2	175.[illegible]	175.2	175.0	175.2	175.1	175.5	175.9	176.4	176.4
176.4	176.1	176.1	175.9	175.9	175.7	175.7	175.6	175.6	175.6
177.8	176.2	177.3	177.6	178.0	178.5	179.1	179.9	180.8	182.4
183.0	183.1	186.0	186.4	186.6	186.5	186.2	185.8	185.2	184.7
184.3	183.8	183.4	183.1	182.8	182.5	182.3	182.0	181.7	181.3
181.1	180.8	180.6	180.4	180.2	180.0	179.9	179.7	179.4	179.1
178.9	178.7	178.5	178.4	178.2	178.1	178.0	177.9	177.8	177.7
177.6	177.5	177.5	177.4	177.4	177.1	176.9	176.7	176.6	176.4
176.3	176.1	176.0	175.9	175.8	175.7	175.7	175.6	175.5	175.5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20052.	18455.	10247.	3590.	281355.
CMS	569.	523.	290.	110.	7967.
INCHES		9.81	21.79	24.81	24.93
MM		249.18	553.39	630.28	633.13
AC-FT		9151.	20324.	23148.	23252.
THOUS CU M		11288.	25069.	28553.	28682.

MAXIMUM STORAGE = 5.

MAXIMUM STAGE IS 186.6

STATION 2+00, PLAN 1, RTIO 2

OUTFLOW

37.	0.	17.	0.	12.	0.	10.	0.	9.	0.
9.	0.	9.	1.	10.	8.	31.	51.	79.	79.
73.	61.	61.	51.	51.	40.	41.	33.	36.	33.
45.	69.	131.	213.	322.	441.	603.	972.	1596.	2669.
4337.	6859.	6533.	9659.	10001.	9919.	9387.	8455.	7326.	6292.
5394.	4747.	4460.	3854.	3492.	3121.	2817.	2508.	2259.	2014.
1813.	1623.	1466.	1304.	1177.	1046.	945.	839.	760.	673.
614.	557.	509.	451.	411.	361.	331.	289.	267.	234.
216.	187.	173.	150.	140.	120.	112.	96.	91.	77.
73.	61.	59.	49.	47.	39.	38.	31.	31.	25.

STOR

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.
2.	2.	3.	3.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	[illegible]	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

175.3	175.0	175.2	175.0	175.1	175.0	175.1	175.0	175.1	175.0
175.1	175.0	175.1	175.0	175.1	175.1	175.3	175.4	175.7	175.7
175.7	175.5	175.5	175.4	175.4	175.4	175.4	175.3	175.3	175.3
175.4	175.6	176.1	176.9	177.5	177.6	177.9	178.5	179.5	180.4
181.6	182.8	183.4	183.9	184.0	184.0	183.8	183.4	183.0	182.6
182.2	181.9	181.6	181.3	181.0	180.7	180.5	180.3	180.1	180.0
179.8	179.6	179.3	179.1	178.9	178.6	178.5	178.3	178.2	178.0
177.9	177.8	177.8	177.7	177.6	177.5	177.5	177.4	177.3	177.1
176.9	176.6	176.5	176.3	176.2	176.1	176.0	175.8	175.8	175.7
175.6	175.5	175.5	175.4	175.4	175.3	175.3	175.3	175.3	175.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10001.	9225.	5123.	1945.	140677.
CMS	283.	261.	145.	55.	3984.
INCHES		4.90	10.89	12.41	12.46
MM		124.55	276.67	315.14	316.56
AC-FT		4574.	10161.	11574.	11626.
THOUS CU M		5642.	12534.	14276.	14341.

MAXIMUM STORAGE = 3.

MAXIMUM STAGE IS 184.0

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HYDROGRAPH ROUTING

MINISCEONGO CREEK D/S HIGH TENSION WIRES

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
21+00	1	0	0	0	0	0	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0350	.0400	.0300	140.0	170.0	1900.	.01800

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
4900.00 170.00 7300.00 160.00 7660.00 152.00 7900.00 151.00 7930.00 150.00
8100.00 140.00 8140.00 150.00 8180.00 160.00

STORAGE	0.00	.60	2.39	5.38	9.57	14.95	21.53	30.10	44.10	66.65
	98.33	139.14	189.09	247.91	312.14	380.72	453.65	530.93	612.56	698.54
OUTFLOW	0.00	64.81	411.54	1217.35	2613.09	4737.85	7704.27	10314.66	15349.60	25187.90
	40035.55	61173.39	89736.98	128315.76	178784.85	238017.43	306177.81	383473.51	470136.95	566415.35

STAGE	140.00	141.58	143.16	144.74	146.32	147.90	149.47	151.05	152.63	154.21
	155.79	157.37	158.95	160.53	162.11	163.69	165.26	166.84	168.42	170.00
FLOW	0.00	64.31	411.54	1213.35	2613.09	4737.85	7704.27	10314.66	15349.60	25187.90
	40135.05	61173.39	89736.98	128315.76	178784.85	238017.43	306177.81	383473.51	470136.95	566415.35

STATION 21+00, PLAN 1, RTIO 1

OUTFLOW

127.	0.	28.	10.	14.	12.	10.	11.	8.	10.
5.	10.	9.	11.	11.	21.	50.	105.	149.	144.
155.	134.	115.	109.	96.	87.	76.	71.	67.	70.
54.	138.	249.	424.	658.	953.	1299.	1936.	3197.	5445.
9443.	17612.	17357.	19464.	20061.	19865.	18477.	16806.	14527.	12474.
1[illegible]746.	9497.	6463.	7610.	6808.	6115.	5471.	4920.	4416.	[illegible]
3411.	7745.	2913.	2615.	2376.	2102.	1875.	1689.	1516.	1362.
1216.	1095.	976.	879.	784.	705.	632.	578.	527.	473.
424.	381.	340.	306.	273.	247.	221.	199.	177.	160.
142.	126.	114.	103.	92.	83.	74.	66.	60.	53.

STOR

1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	3.	4.	6.	8.	11.	17.
27.	39.	49.	54.	55.	54.	52.	47.	42.	36.
31.	27.	24.	21.	20.	18.	17.	15.	14.	13.
12.	11.	10.	10.	9.	8.	7.	7.	6.	6.
5.	5.	4.	4.	4.	3.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	0.

STAGE

141.9	140.0	140.7	140.3	140.3	140.3	140.2	140.3	140.2	140.2
141.2	140.2	140.2	140.3	140.3	140.5	141.2	141.8	142.0	142.0
142.0	141.9	141.5	141.5	141.7	141.7	141.6	141.6	141.6	141.6
141.7	141.9	142.4	143.2	143.6	144.2	144.8	145.6	146.7	148.4
[illegible]	152.1	153.0	153.3	153.4	153.4	153.2	152.9	152.4	151.7
151.2	150.6	149.9	149.4	149.0	148.6	148.3	148.0	147.7	147.3
147.1	146.8	146.5	146.3	146.0	145.7	145.5	145.3	145.1	144.9
144.7	144.5	144.3	144.1	143.9	143.7	143.6	143.5	143.4	143.3
142.2	143.0	142.8	142.7	142.5	142.4	142.3	142.2	142.1	142.0
141.9	141.9	141.5	141.8	141.7	141.7	141.6	141.6	141.4	141.3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20061.	19469.	10247.	3890.	281375.
CMS	568.	523.	290.	110.	7968.
INCHES		9.82	21.79	24.81	24.93
MM		249.37	553.41	630.28	633.17
AC-FT		9158.	20325.	23148.	23254.
THOUS CU M		11297.	25070.	28553.	28684.

MAXIMUM STORAGE = 55.

MAXIMUM STAGE IS 153.4

STATION 21+00, PLAN 1, RTIO 2

OUTFLOW

61.	0.	14.	5.	7.	6.	5.	5.	4.	5.
4.	5.	4.	6.	6.	11.	25.	51.	75.	83.
[illegible]	65.	[illegible]	54.	49.	44.	[illegible]	35.	34.	35.
[illegible]	[illegible]	[illegible]	[illegible]	313.	435.	595.	948.	1570.	2619.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5435.	4742.	[illegible]	[illegible]	[illegible]	[illegible]	75.	2511	227	[illegible]
[illegible]24.	1627	147[illegible]	1[illegible]	[illegible]	1153.	948.	846.	761.	679.
614.	562.	509.	456.	410.	367.	329.	295.	265.	239.
214.	192.	171.	154.	137.	124.	110.	100.	88.	80.
71.	64.	57.	52.	46.	42.	37.	33.	30.	27.

STOR

1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	2.	2.	3.	4.	6.	10.
14.	20.	24.	28.	29.	29.	27.	24.	21.	18.
16.	15.	14.	13.	12.	11.	10.	9.	9.	8.
7.	7.	6.	6.	5.	5.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	2.	2.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.

STAGE

141.5	140.0	140.3	140.1	140.2	140.1	140.1	140.1	140.1	140.1
140.1	140.1	140.1	140.1	140.1	140.3	140.6	141.2	141.6	141.7
141.6	141.6	141.4	141.3	141.2	141.1	140.9	140.9	140.8	140.8
141.0	141.6	141.9	142.2	142.7	143.2	143.5	144.2	145.1	146.3
147.6	149.0	150.6	150.6	150.9	150.8	150.5	149.9	149.3	148.7
148.3	147.9	147.6	147.2	147.0	146.7	146.5	146.2	145.9	145.6
145.4	145.2	145.0	144.8	144.7	144.4	144.2	144.0	143.8	143.7
143.6	143.5	143.3	143.2	143.2	143.0	142.8	142.6	142.5	142.4
142.3	142.2	142.1	142.0	141.9	141.8	141.8	141.7	141.7	141.6
141.6	141.6	141.4	141.3	141.1	141.0	140.9	140.8	140.7	140.7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10024.	9232.	5123.	1945.	140686.
CMS	284.	261.	145.	55.	3984.
INCHES		4.91	10.89	12.41	12.46
MM		124.64	276.68	315.14	316.58
AC-FT		4578.	10161.	11574.	11627.
THOUS CU M		5647.	12534.	14276.	14342.

MAXIMUM STORAGE = 29.

MAXIMUM STAGE IS 150.9

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HYDROGRAPH ROUTING

MINISCEONGO CREEK U/S OF CEMETARY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
39+00	1	0	0	0	0	0	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0300	.0400	.0300	111.0	150.0	1200.	.01100

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
6920.00 150.00 6940.00 140.00 6970.00 130.00 6980.00 120.00 7000.00 115.00
7030.00 120.00 7070.00 130.00 7100.00 140.00

STORAGE	0.00	.70	2.80	6.28	10.64	15.70	21.46	27.92	35.08	42.99
	51.74	61.74	71.76	83.05	95.12	107.56	120.29	133.29	146.56	160.12
OUTFLOW	0.00	61.90	393.06	1211.44	2696.95	4761.48	7448.37	10803.30	14873.04	20084.98
	24242.81	33424.17	41643.73	50989.29	61979.59	74781.35	88766.74	103922.56	120240.34	137715.02
STAGE	115.00	116.84	118.66	120.53	122.37	124.21	126.05	127.89	129.74	131.58
	133.42	135.26	137.11	138.95	140.79	142.63	144.47	146.32	148.16	150.00
FLOW	0.00	61.90	393.06	1211.44	2696.95	4761.48	7448.37	10803.30	14873.04	20084.98
	24242.81	33424.17	41643.73	50989.29	61979.59	74781.35	88766.74	103922.56	120240.34	137715.02

STATION 39+00 , PLAN 1, RTIO 1

OUTFLOW

214.	9.	22.	13.	9.	15.	8.	12.	9.	10.
9.	9.	10.	10.	12.	19.	45.	100.	147.	165.
153.	131.	117.	109.	98.	87.	78.	70.	68.	69.
63.	131.	238.	408.	649.	933.	1285.	1906.	3144.	5555.
9379.	17533.	17291.	19451.	20052.	19881.	18705.	16847.	14571.	12519.
11771.	9524.	6504.	7630.	6828.	6131.	5489.	4931.	4433.	3995.
3624.	3257.	2975.	2623.	2345.	2107.	1886.	1693.	1524.	1364.
1223.	1130.	983.	882.	790.	708.	637.	579.	528.	474.
427.	382.	344.	307.	277.	248.	224.	200.	179.	160.
144.	129.	116.	103.	93.	83.	74.	67.	60.	54.

STOR

2.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	3.	4.	5.	6.	8.	12.	17.
25.	33.	39.	42.	43.	43.	41.	38.	35.	31.
26.	25.	23.	22.	20.	19.	17.	16.	15.	14.
13.	12.	11.	10.	10.	9.	8.	8.	7.	7.
4.	6.	5.	5.	4.	4.	4.	4.	3.	3.
3.	3.	2.	2.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

117.7	115.0	115.7	115.5	115.3	115.4	115.2	115.3	115.3	115.3
115.3	115.3	115.3	115.3	115.4	115.6	116.3	117.1	117.3	117.4
117.3	117.2	117.1	117.1	117.0	117.0	116.9	116.9	116.9	116.9
117.0	117.2	117.8	118.7	119.3	119.9	120.6	121.4	122.8	124.8
127.1	129.1	130.6	131.4	131.6	131.5	131.1	130.4	129.6	128.7
127.9	127.2	126.6	126.2	125.6	125.1	124.7	124.3	123.9	123.5
123.2	122.9	122.6	122.3	121.9	121.6	121.4	121.1	120.9	120.7
120.5	120.3	120.0	119.8	119.6	119.4	119.2	119.1	119.0	118.9
118.8	118.6	118.4	118.2	118.0	117.9	117.7	117.6	117.5	117.4
117.3	117.2	117.1	117.1	117.0	117.0	116.9	116.9	116.8	116.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20052.	18475.	10247.	3890.	291411.
CMS	568.	523.	290.	110.	7960.
INCHES		[illegible]	21.79	24.81	24.92

AC-FT	142.	1032.	231		1257.
THOUS CU M	11302.	25071.	28553.		28687.

MAXIMUM STORAGE = 43.

MAXIMUM STAGE IS 131.6

STATION 39+00 , PLAN 1, RTIO 2

OUTFLOW

99.	0.	11.	9.	4.	7.	4.	6.	4.	5.
5.	5.	5.	5.	6.	10.	23.	47.	73.	83.
76.	66.	59.	54.	50.	44.	39.	36.	34.	34.
[illegible]	62.	121.	200.	305.	426.	587.	622.	1543.	2573.
4276.	4733.	6491.	9562.	10041.	9896.	9468.	8496.	7415.	6319.
5456.	4756.	4306.	3862.	3524.	3136.	2837.	2529.	2273.	2035.
1822.	1642.	1470.	1322.	1180.	1067.	947.	856.	760.	687.
613.	567.	509.	460.	411.	372.	331.	298.	267.	241.
215.	194.	173.	155.	139.	125.	112.	100.	90.	80.
72.	64.	59.	52.	47.	42.	38.	34.	30.	27.

STOR

1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.	0.	0.
[illegible]	1.	1.	2.	2.	3.	4.	5.	7.	10.
15.	20.	23.	26.	26.	26.	25.	23.	21.	19.
17.	16.	15.	13.	13.	12.	11.	10.	9.	9.
8.	8.	7.	7.	6.	6.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.	0.	0.

STAGE

117.0	115.0	115.3	115.3	115.1	115.2	115.1	115.2	115.1	115.1
115.1	115.1	115.1	115.2	115.2	115.3	115.7	116.4	116.9	117.0
116.9	116.9	116.8	116.6	116.5	116.3	116.2	116.1	116.0	116.0
116.2	116.8	117.2	117.6	116.2	118.8	119.1	119.9	120.9	122.2
123.2	125.6	126.6	127.2	127.5	127.4	127.2	126.6	126.0	125.3
124.7	124.2	123.8	123.4	123.1	122.8	122.5	122.2	121.8	121.5
121.3	121.1	120.8	120.7	120.5	120.2	119.9	119.7	119.5	119.3
119.2	119.1	118.9	118.8	118.7	118.6	118.3	118.2	118.0	117.8
117.7	117.6	117.5	117.4	117.3	117.2	117.1	117.1	117.0	116.9
116.9	116.9	116.7	116.6	116.4	116.3	116.1	116.0	115.9	115.8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10041.	9236.	5123.	1945.	140702.
CMS	284.	262.	145.	55.	3984.
INCHES		4.91	10.89	12.41	12.47
MM		124.70	276.68	315.14	316.62
AC-FT		4580.	10162.	11574.	11626.
THOUS CU M		5649.	12534.	14276.	14343.

MAXIMUM STORAGE = 26.

MAXIMUM STAGE IS 127.5

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS: RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	A	8.20	1	9221.	4611.
		(21.24)		(261.12)(	130.56)(
HYDROGRAPH AT	B	6.90	1	8336.	4168.
		(17.87)		(236.05)(	118.02)(
2 COMBINED	A+B	15.10	1	17400.	8700.
		(39.11)		(492.70)(	246.35)(
ROUTED TO	18+00	15.10	1	17416.	8733.
		(39.11)		(493.17)(	247.29)(
ROUTED TO	76+00	15.10	1	17455.	8735.
		(39.11)		(494.28)(	247.36)(
ROUTED TO	114+0	15.10	1	17493.	8728.
		(39.11)		(495.35)(	247.15)(
HYDROGRAPH AT	C	2.40	1	4741.	2370.
		(6.22)		(134.24)(	67.12)(
2 COMBINED	INFLOW	17.50	1	20119.	10045.
		(45.32)		(569.71)(	284.44)(
ROUTED TO	100	17.50	1	20080.	9996.
		(45.32)		(568.60)(	283.06)(
ROUTED TO	2+00	17.50	1	20082.	10001.
		(45.32)		(568.66)(	283.19)(
ROUTED TO	21+00	17.50	1	20061.	10024.
		(45.32)		(568.07)(	283.84)(
ROUTED TO	29+00	17.50	1	20052.	10041.
		(45.32)		(567.80)(	284.32)(

PLAN 1 STATION 18+00

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	17416.	338.3	46.00
.50	8733.	336.0	46.00

PLAN 1 STATION 76+00

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS

1.00	17455.	279.3	46.00
.50	8735.	277.2	46.00

PLAN 1 STATION 114+0

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	17493.	223.2	46.00
.50	8728.	220.2	46.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	210.00	210.00	216.90
STORAGE	100.	100.	199.
OUTFLOW	0.	0.	3925.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	222.97	5.97	319.	20080.	21.00	45.00	0.00
.50	219.74	2.84	255.	9996.	13.00	45.00	0.00

PLAN 1 STATION 2+00

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	20082.	186.6	45.00
.50	10001.	184.0	45.00

PLAN 1 STATION 21+00

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	20061.	153.4	45.00
.50	10024.	150.9	45.00

PLAN 1 STATION 39+00

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	20052.	131.6	45.00
.50	10041.	127.5	45.00

STABILITY ANALYSIS

APPENDIX E

TAMS

Job No. 1551-10 | Sheet 1 of 23
Project New York Dam Inspection GARNERVILLE | Date 6-2-80
Subject Stability Analysis | By JJF
Ch'k. by

Assumptions

1) The unit weight of masonry is assumed to be 165 lbs/cuft

2) Ice load of 5000 lbs/ft^2 acting about 1ft from top of dam (COE Criteria)

3) Angle of internal resistance of Soil (fill) is assumed to be 35° based on observations and engineering judgement

4) Dam Site is in Seismic Zone I

5) At rest Earth Pressure for upstream Fill

LOADING Condition

CASE I - Normal loading; LAKE level at spillway crest El. 210. No Ice load

Case II - Normal loading; Lake level at spillway crest El. 210, with Ice load.

Case III Unusual loading; LAKE level at ½ PMF

CASE IV - Extreme loading; Lake level at PMF

CASE V Unusual loading; LAKE level at Spillway crest and earthquake force of 0.05g.

TAMS

Job No. 1551
Project New York Dam Inspections - GARNERVILLE
Subject Stability Analysis

Sheet 2 of 23
Date 6-2-80
By JJF
Ch'k. by

Stability Criteria

a) overturning - Resultant force shall fall within the middle third of the base for cases I and II and the resultant force shall fall within the middle half of base for cases III, IV, and V

b) Sliding For case I & II, Friction factor of safety against sliding is to be 1.5 For Case III, V friction factor of safety against sliding is to be 1.25. For case IV friction factor of safety is to be 1.1

AD-A092 042 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. GARNERVILLE DAM (INVENTORY NUMBER --ETC(U)
AUG 80 E O'BRIEN DACW51-79-C-0001

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TAMS

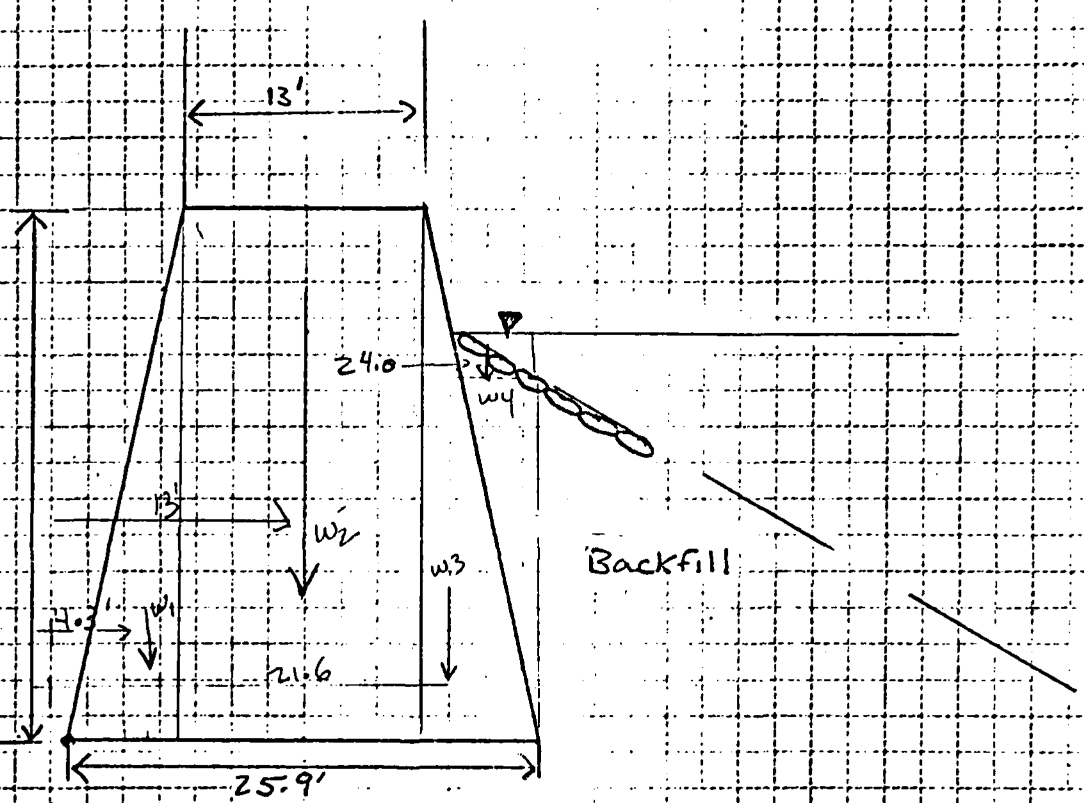
Job No. 1551-10 | Sheet 3 of 23

Project NYS Dam Inspection | Date 6-2-80

Subject GARNERVILLE DAM - Stability Analysis | By JJF

NON-OVER FLOW SECTION | Ch'k. by

Dead loads



Scale 1" = 10'

Σm about Toe

		k		M.A.		KF
$w_1 = \frac{1}{2}(29)(6.45)(0.165)$	=	15.43	x	4.3	=	66.35
$w_2 = 13(29)(0.165)$	=	62.2	x	13.0	=	808.60
$w_3 = \frac{1}{2}(29)(6.45)(0.165)$	=	15.43	x	21.6	=	333.32
$w_4 = \frac{1}{2}(23)(4)(0.125)$	=	5.75	x	24.0	=	138.0

$\Sigma F_V = 98.81$ $\qquad$ $\Sigma M_R = 1346.34$

$\bar{x} = \frac{1346.34}{98.81} = 13.63$ - OK within middle ⅓

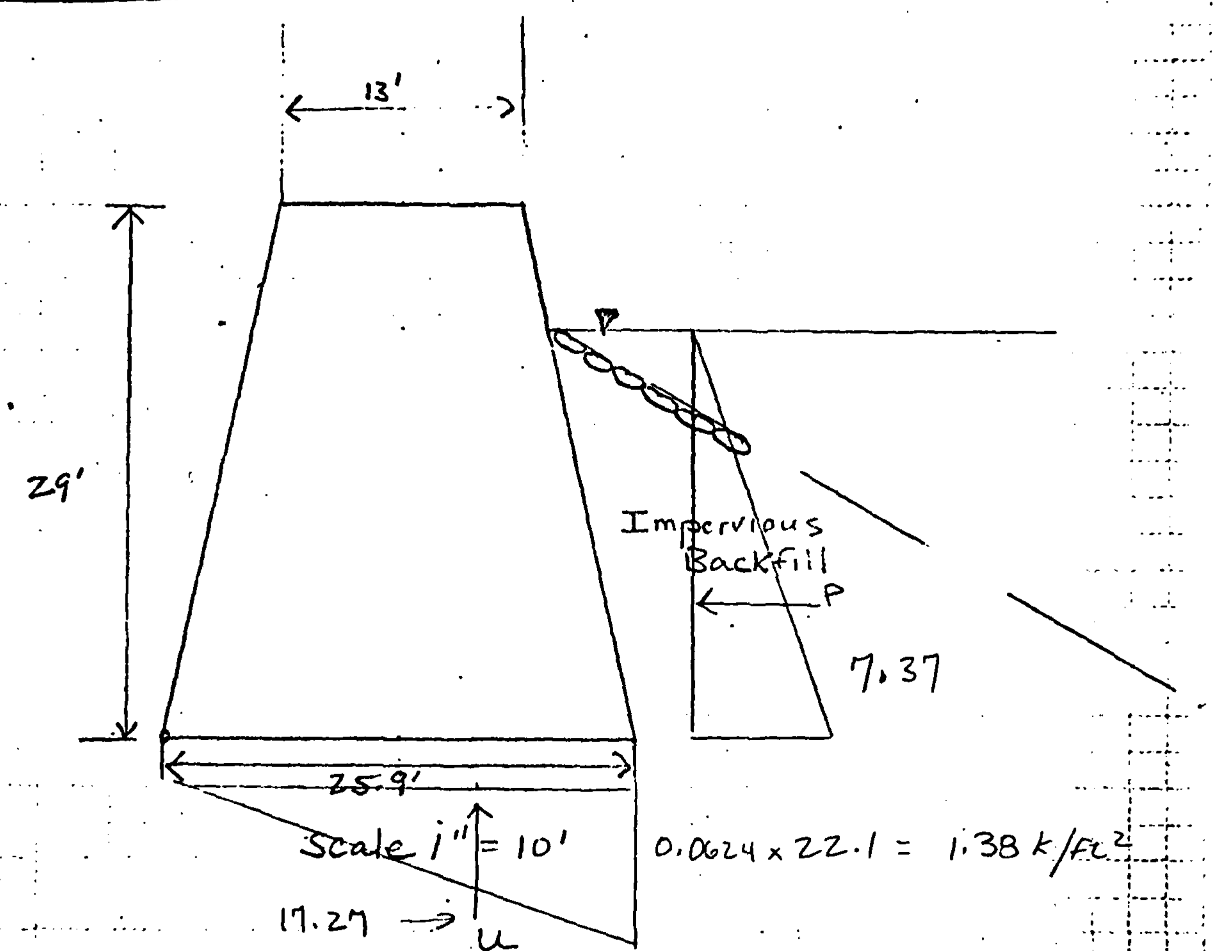
$\bar{y} = 12.90$ ft.

TAMS

Job No. 1551-10
Project NYS Dam Inspection
Subject GARNERVILLE DAM - Stability Analysis

Sheet 4 of 23
Date 6-2-80
By JJF
Ch'k. by

Hydrostatic Forces   a) - NORMAL LOADING



$0.0624 \times 22.1 = 1.38\ k/ft^2$

$\Sigma M_{TOE} =$

	K	x	m.A.	=	KF
$P = 1/2 \times 1.38 \times 22.1 =$	15.25	x	7.37	=	112.39
$U = 1/2 \times 1.38 \times 25.9 =$	17.87	x	17.27	=	308.61
					421.00

$F_V \uparrow$ 17.87

$F_H \leftarrow$ 15.25

$M_o =$ 421.00

TAMS

Job No. 1551-10 Sheet 5 of 23

Project NYS Dam Inspection Date 6-2-80

Subject GARNERVILLE DAM - Stability Analysis By JJF

Ch'k. by

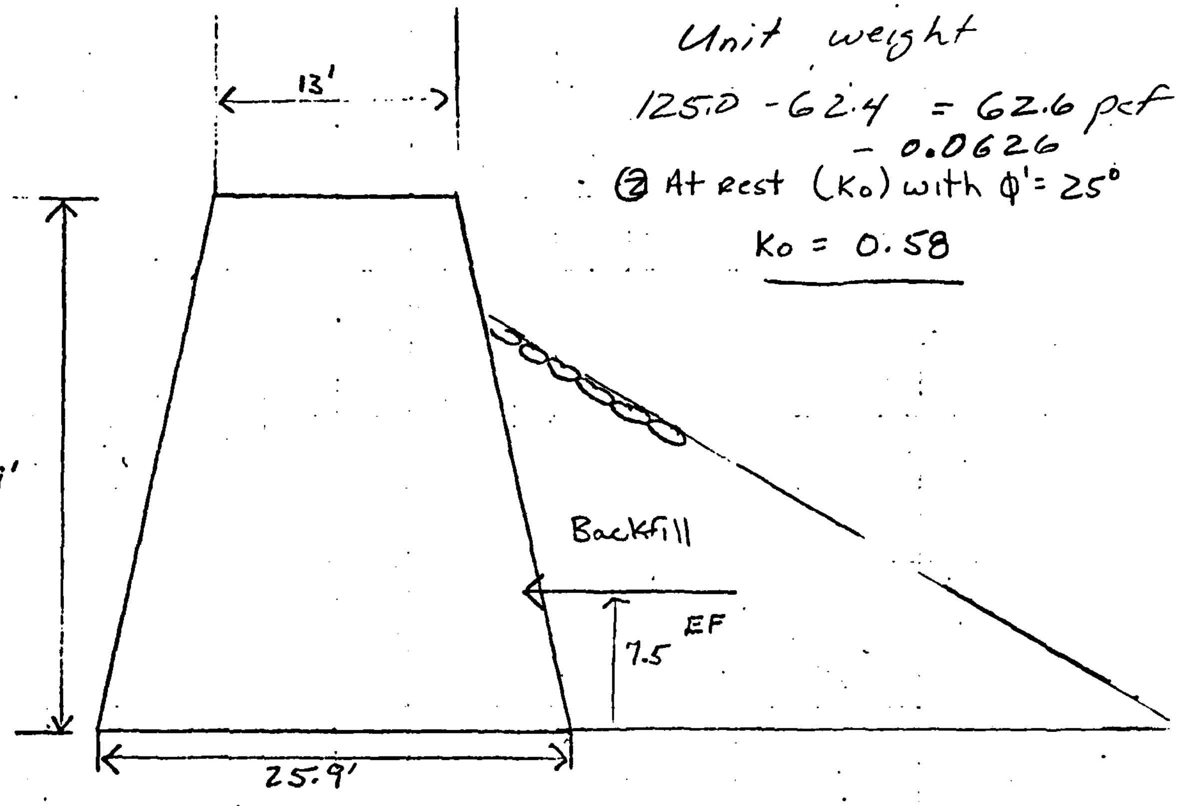
EARTH Forces

Assumed ① Submerged Unit weight

125.0 - 62.4 = 62.6 pcf
- 0.0626

② At rest (K_o) with $\phi' = 25°$

$K_o = 0.58$



Scale 1" = 10'

	K	MA	KF
$EF = (0.60)\frac{1}{2}(45)(17.5)(0.0626) =$	14.3	7.5	107.25

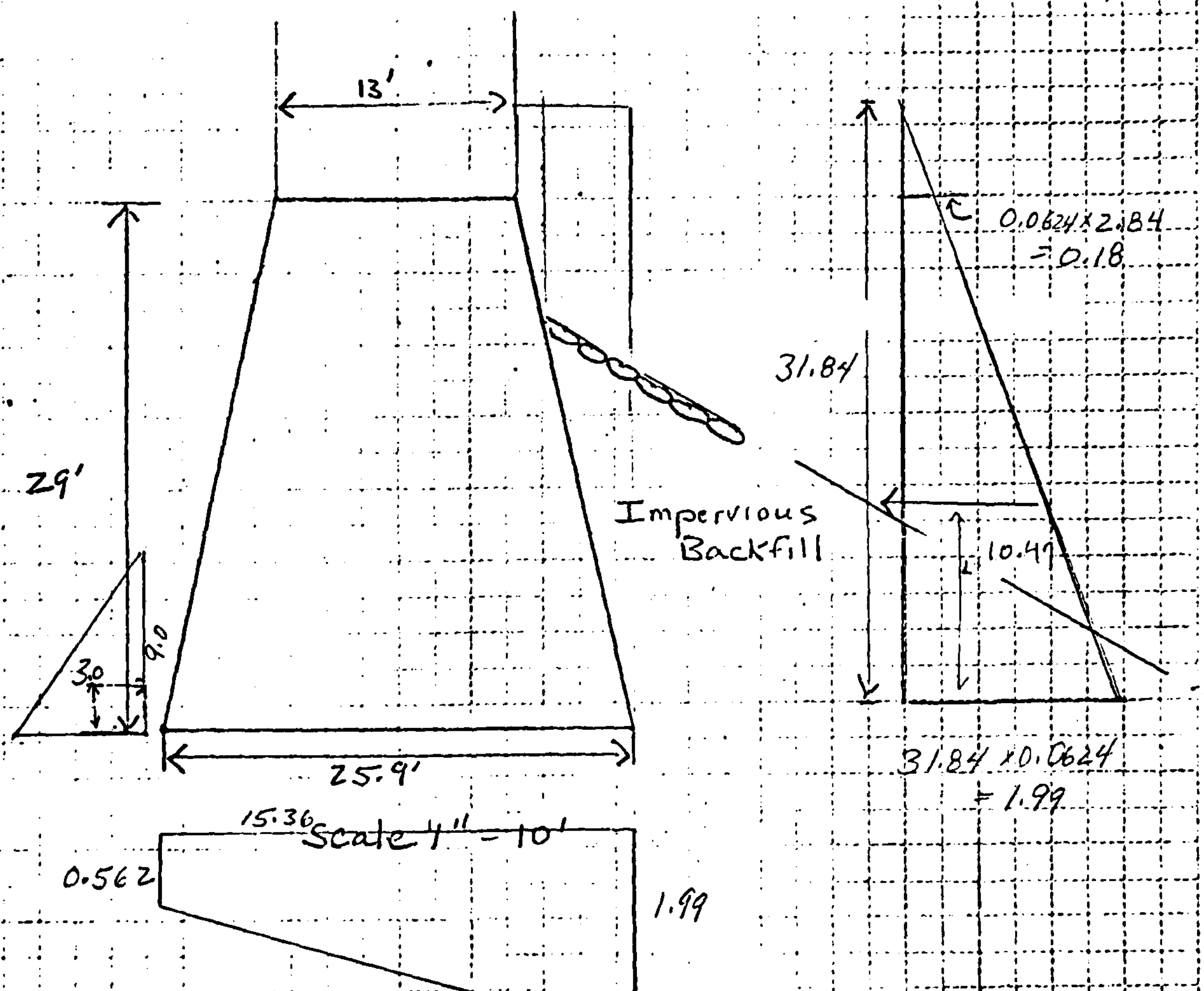
ICE LOAD

K		MA		KF
5.0	×	21.6	=	108

TAMS

Job No. 1551-10 | Sheet 6 of 23
Project: NYS Dam Inspection | Date: 6-2-80
Subject: Garnerville Dam - Stability Analysis | By: JJF
Ch'k. by:

1/2 PMF   ws elevation = 219.74



	K		MA	Mo	MR
$P_H = \frac{1.99 + 0.18}{2}(29) =$	31.47 ←	×	10.47	329.49	
$P_T = \frac{1}{2}(0.562)(9.0)(0.6) =$	1.517 →	×	3.0		4.55
$u = \frac{1.99 + 0.562}{2}(25.9) =$	33.05 ↑	×	15.36	507.62	
$W_w = 0.0624\left((5 \times 9.8) + \frac{9.8+2.8}{2}(1.5)\right) =$	3.65	×	24.0		87.55
				837.11	92.10

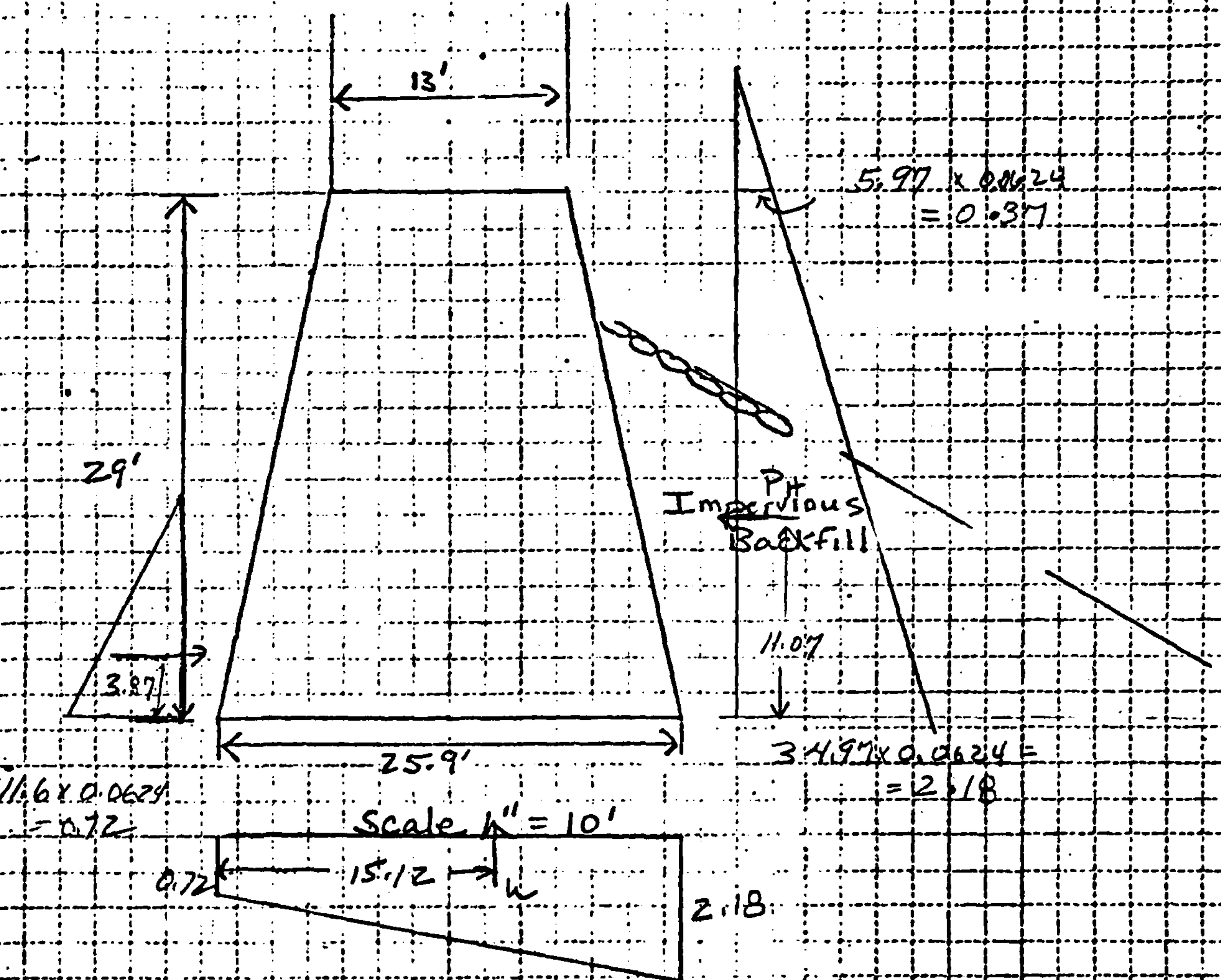
$\leftarrow F_H = 29.95$

$\uparrow F_V = 29.4$

TAMS

Job No. 1551-10 | Sheet 7 of 23
Project NYS Dam Inspection | Date 6-2-80
Subject Garnerville Dam - Stability Analysis | By JJF
Ch'k. by

PMF   w.s. elevation = 222.87 (5.97)



	K	Mr	Mo	Mr
$P_H = \frac{2.18 + 0.37}{2}(29) =$	37.01 ←	11.07	409.7	
$P_T = \frac{1}{2}(0.72)(11.6)(0.6) =$	2.51 →	3.87		9.71
$u = \frac{2.18 + 0.72}{2}(25.9) =$	37.56 ↑	15.12	568.02	
$W_W = 5 \times 12.45 \times 0.0624 + \frac{12.45 + 5.97}{2}(1.5)(.0624) =$	4.75 ↓	24		114.0
			977.72	123.71

$F_V = 32.81$ $F_H = 34.5$

TAMS

Job No. 1551-10
Project New York Dam Insp - Garnerville
Subject Stability Analysis

Sheet 8 of 23
Date 6-2-80
By JJF
Ch'k. by

CASE I NORMAL LOADING - Without Ice

	FV	FH	MR	MO
Dead LOAD	98.81	0	1346.34	
Hydrostatic	-17.87	15.25		421.0
EARTH FORCE		14.3		107.5
	80.94	29.55	1346.34	528.25

$$\Sigma m = 1346.34 - 528.5 = 817.84$$

$$\bar{e} = \frac{25.9}{2} - \frac{817.84}{80.94}$$

$$\bar{e} = 12.95 - 10.10 = 2.85$$ OK inside middle 1/3

$$P = \frac{80.94}{25.9}\left(1 \pm \frac{6 \times 2.85}{25.9}\right)\frac{1000}{144} = 21.7 \pm 14.3 \begin{cases} 36.0 \\ 7.4 \end{cases}$$

Friction Factor of Safety

$$FFS \quad \frac{80.94 \times \tan 35^\circ}{29.55} = 1.92$$ OK

TAMS

Job No. 1551
Project New York Dam Insp. - Garnerville
Subject Stability Analysis
Sheet 9 of 23
Date 6-2-80
By JJF
Ch'k. by

Case II NORMAL LOADING WITH ICE LOAD

	FV	FH	Mr	Mo
DEAD LOAD	98.81	0	1346.34	—
Hydrostatic	-17.87	15.25	-	421.0
EARTH FORCE	0	14.30	0	107.25
ICE LOAD	0	5.0	0	108.00
	80.94	34.55	1346.34	636.25

$$\Sigma m = 1346.34 - 636.25 = 710.09$$

$$\bar{e} = \frac{25.9}{2} - \frac{710.09}{80.94}$$

$$\bar{e} = 12.95 - 8.77 = 4.18'$$

Resultant location 8.77 - 8.6 = 0.17' ok within the middle 1/3 of base

$$\bar{P} = \frac{80.94}{25.9}\left(1 \pm \frac{6 \times 4.18}{25.9}\right) \times \frac{1000}{144} = 21.7 \pm 21.0 \quad \begin{matrix} 42.7 \text{ Toe} \\ 0.7 \text{ Heel} \end{matrix}$$

FRICTION FACTOR OF SAFETY

$$FFS = \frac{80.94 \times \tan 35^\circ}{34.55} = 1.64 \quad \text{ok}$$

TAMS

Job No. 1551-10 | Sheet 10 of 13
Project NYS Dam Insp. GARNERville | Date 6-2-80
Subject Stability Analysis | By JJF OR
Ch'k. by

Case III - 1/2 PMF

	FV	FH	MR	MO
Dead Load	98.81	0	1346.34	
Hydrostatic	30.67	31.63	104.39	888.83
Earth Force	0	14.3	0.	107.25
	68.14	45.93	1450.73	996.08

$$\Sigma M = 1450.73 - 996.08 = 454.75$$

$$\bar{e} = \frac{25.9}{2} - \frac{454.65}{68.14} = 6.28$$

$$\frac{454.65}{68.14} - \frac{25.9}{4} = -$$

$$6.67 - 6.48 = 0.19$$ - inside middle 1/2 of base

$$\bar{p} = \frac{68.14}{25.9}\left(1 \pm \frac{6 \times 6.28}{25.9}\right)\frac{1000}{144} = 18.27 \pm 26.49$$

Toe 44.76

Heel -8.22

Friction factor of safety

$$FFS = \frac{68.14 \tan 35^\circ}{45.93} = 1.03 < 1.25$$

∴ No Good

TAMS

Job No. 1551-10

Project NYS Dam Inspection - Garnerville

Subject Stability Analysis

Sheet 11 of 23

Date 6-2-80

By JJF

Ch'k. by

Case IV PMF

	FV	FH	MR	Mo
Dead Load	98.81		1346.34	
Hydrostatic	-32.81	34.50	123.71	977.72
Earth Force		14.3		107.25
	66.0	48.8	1470.05	1084.96

$$\Sigma M = 1470.05 - 1084.96 = 385.09$$

$$\bar{e} = \frac{25.9}{2} \quad \frac{385.09}{66.0} = 6.62$$ – No good outside middle 1/2

$$\frac{385.09}{66} - \frac{25.9}{4} = -0.39$$

$$\bar{P} = \frac{66.0}{25.9}\left(1 \pm \frac{6 \times 6.62}{25.9}\right)\frac{1000}{144} = 17.69 \pm 27.13$$

$\therefore$ 44.82 (toe)
-9.44 (heel)

Friction Factor of Safety

$$FFS = \frac{66.0 \tan 35^\circ}{48.8} = 0.95 < 1.15$$ No good

TAMS

Job No. 155170 Sheet 12 of 23

Project NYS DAM INSP GARNERVILLE Date 6-2-80

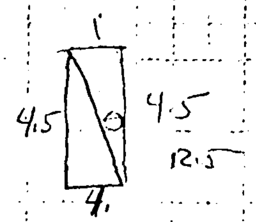
Subject Stability Analysis By JJF

Ch'k. by

CASE V ; NORMAL LOADING

Zone 2 = 0.05

ZANGERS Method $C = 0.64$
when 2 = 12.5



① Hydrodynamic Forces

$$P = 0.64 \times 0.05 \times 0.0624 \times (22.1)^2 = 0.98$$

$$M_P = (0.98)(0.4) \times 22.1) = 8.7 \text{ KF}$$

② Dynamic Force

a) $W_E = 14. K \times 0.64 \times 0.05 = .46$

$M_P = 0.46 \times 7.5 = 3.4 K$

b) $W_D = 0.05 (98.81) = 4.94$

$M_{WD} = 4.94 K \times 12.90 = 63.73$ KF

	FV	FH	MR	Mo
Dead Load	98.81	0	1346.34	
Hydrostic	-17.87	15.25	-	421.0
EARTHFORCE		14.3		107.25
Hydrodynamic		0.98		8.1
DYNAMIC		5.4		67.13
	80.94	35.93	1346.34	604.08

$\Sigma M = 1346.34 - 604.88 = 742.26$

$\dfrac{742.26}{80.94} = 9.17$ OK within middle 1/2

$\bar{e} = \dfrac{25.9}{2} - 9.17 = 3.78$ OK, center 1/2

TAMS

Job No. 1551-10
Project NYS Dam Insp - Garnerville
Subject Stability Analysis

Sheet 13 of 23
Date 6-2-80
By Joel
Ch'k. by

Case V cont.

$$p = \frac{80.94}{25.9} \cdot \left(1 \pm \frac{6 \times 3.78}{25.9}\right) \times \frac{1000}{144} = 21.7 \pm 19 = \begin{cases} 40\,psi \\ 2.7\,psi \end{cases}$$

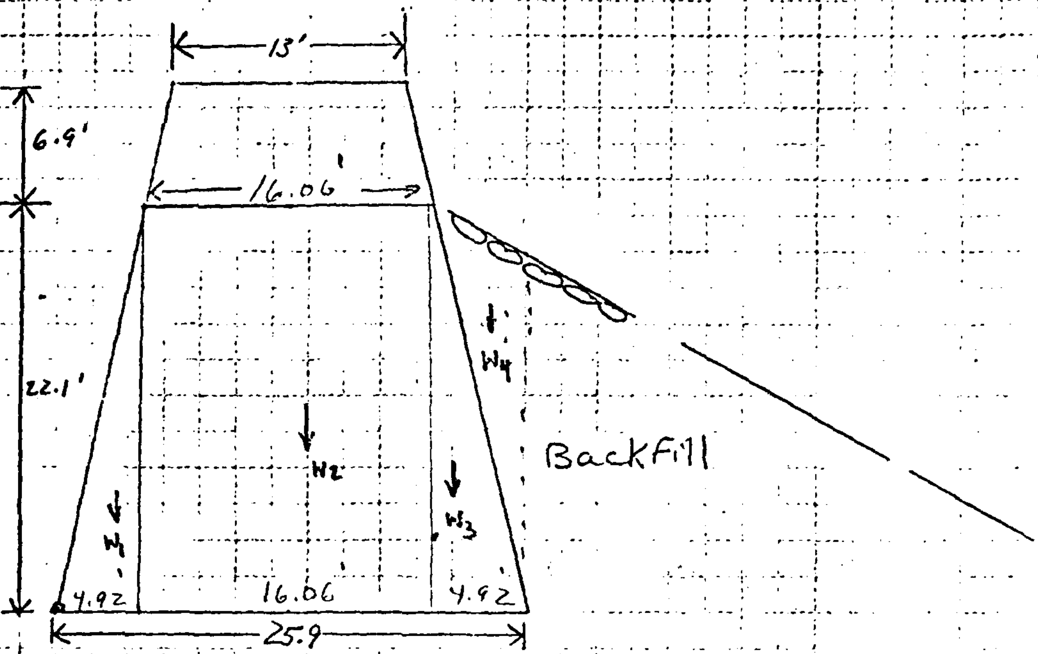
Friction Factor of Safety

$$FFS = \frac{80.94 \times \tan 35}{35.93} = 1.51 \text{ OK}$$

TAMS

Job No. 1546-10 | Sheet 14 of 23
Project NYS State Dam Insp - Garnerville | Date 6-11-80
Subject Stability - Spillway Section | By JJF
Ch'k. by

Dead loads: Case 2



Scale 1" = 10'

ΣM about Toe

	K	mA	KF
$w_1 = \frac{1}{2}(4.92)(22.1)(0.165) =$	8.97	x 3.28	29.42
$w_2 = 16.06(22.1)(0.165) =$	58.56	x 12.95	758.38
$w_3 = \frac{1}{2}(4.92)(22.1)(0.165) =$	8.97	x 22.62	202.91
$w_4 = \frac{1}{2}(23)(4)(0.125) =$	5.75	x 24.0	138.0
	82.25		1128.71

$$\bar{x} = \frac{1128.71}{82.25} = 13.72'$$

$$\bar{y} = 11.9'$$

TAMS

Job No. 1546-10

Sheet 15 of 23

Project NYS State Dam Insp - GARNERVILLE

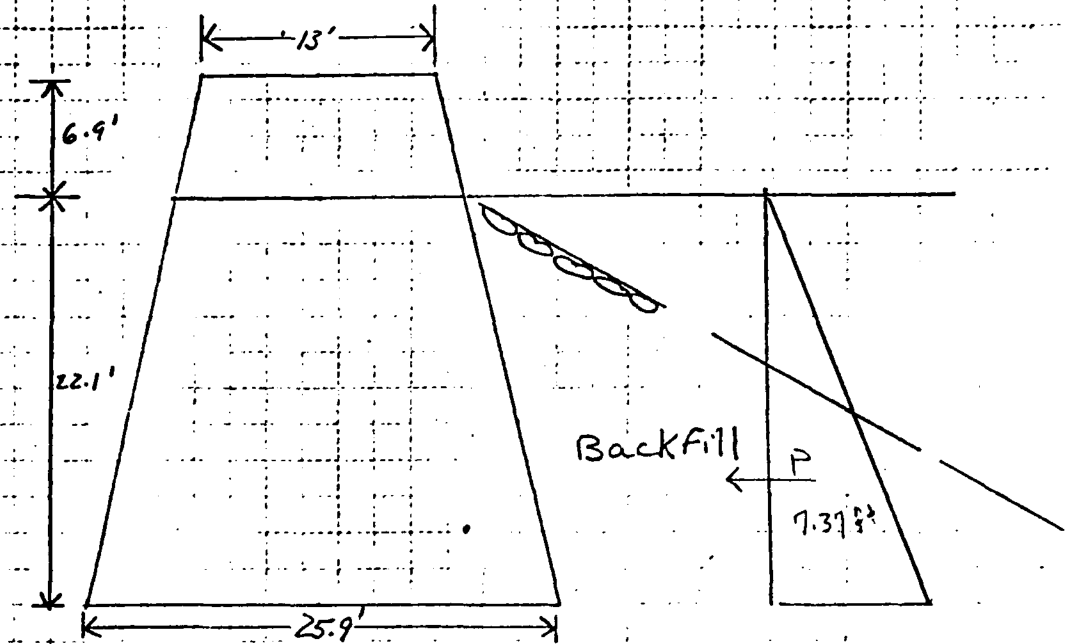
Date 6-11-80

Subject Stability - Spillway Section

By JJF

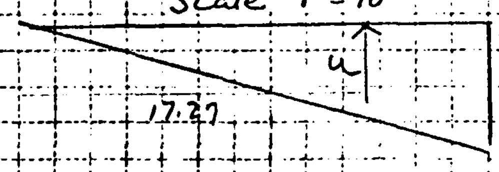
Ch'k. by

Hydrostatic Forces Normal Loading - Case 2



Scale 1" = 10'

0.0624 x 22.1 = 1.38 K/Ft²



ΣM Toe

	K	MA	KF
P = 1/2 x 1.38 x 22.1 =	15.25 x 7.37		112.39
u = 1/2 x 1.38 x 25.9 =	17.87 x 17.27		308.61
			421.0

Fv = ↑ 17.87 K

FH = ← 15.25 K

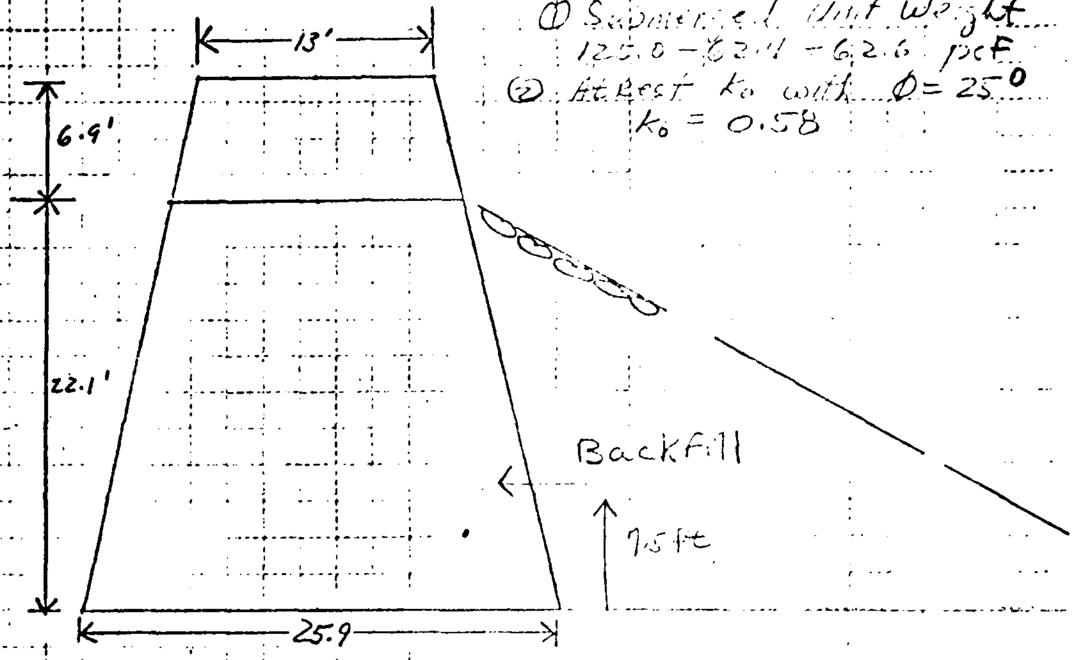
M = 421.00 KF

TAMS

Job No. 1546-10 | Sheet 16 of 33
Project NYS State Dam Insp - GARNERVILLE | Date 6-11-80
Subject Stability - Spillway Section | By JJF
Ch'k. by

EARTH Forces - Case 2

Assumed
① Submerged Unit Weight
125.0 - 62.4 = 62.6 pcF
② At Rest k_o with $\phi = 25^0$
$k_o = 0.58$



Scale 1" = 10'

EF = 0.58(½)(45)(17.5)(0.0626)

K	M.A	KF
[illegible]	[illegible]	[illegible]

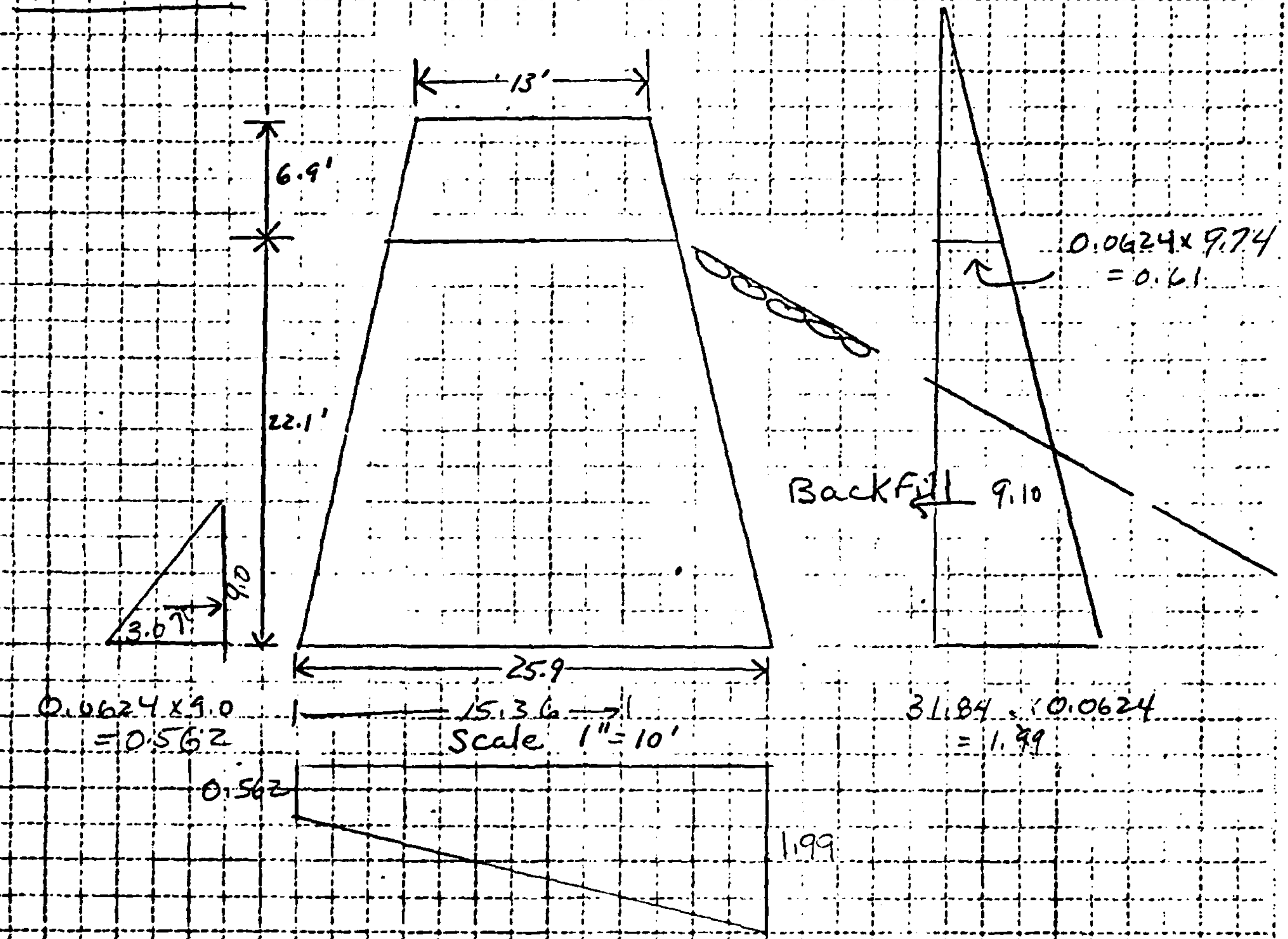
ICE LOAD

K	M.A	= KF
5.0	21.6	108.0

TAMS

Job No. 1546-10 | Sheet 17 of 23
Project NYS State Dam Insp - GARNERVILLE | Date 6-11-80
Subject Stability - Spillway Section | By JJF
Ch'k. by

½ PMF   u.s. elev 219.74



	F	MA	Mo	MR
$P_H = \frac{1.99 + 0.61}{2}(22.1) =$	28.73	9.1	261.44	
$P_T = \frac{1}{2}(0.624)(9)(0.6) =$	1.517	3.0		4.55
$u = \frac{1.99 + 0.56}{2}(25.9) =$	33.05	15.36	507.62	
$W_W = 5 \times 9.8 \times 0.0624 + \frac{9.8 + 2.8}{2}(1.5) \times 0.0624 =$	3.65	8.4		87.55
			769.1	92.1

$F_H = 27.21 \leftarrow$ $F_V = 29.4 \uparrow$

TAMS

Job No. 1546-10

Project NYS State Dam Insp - Garnerville

Subject Stability - Spillway Section

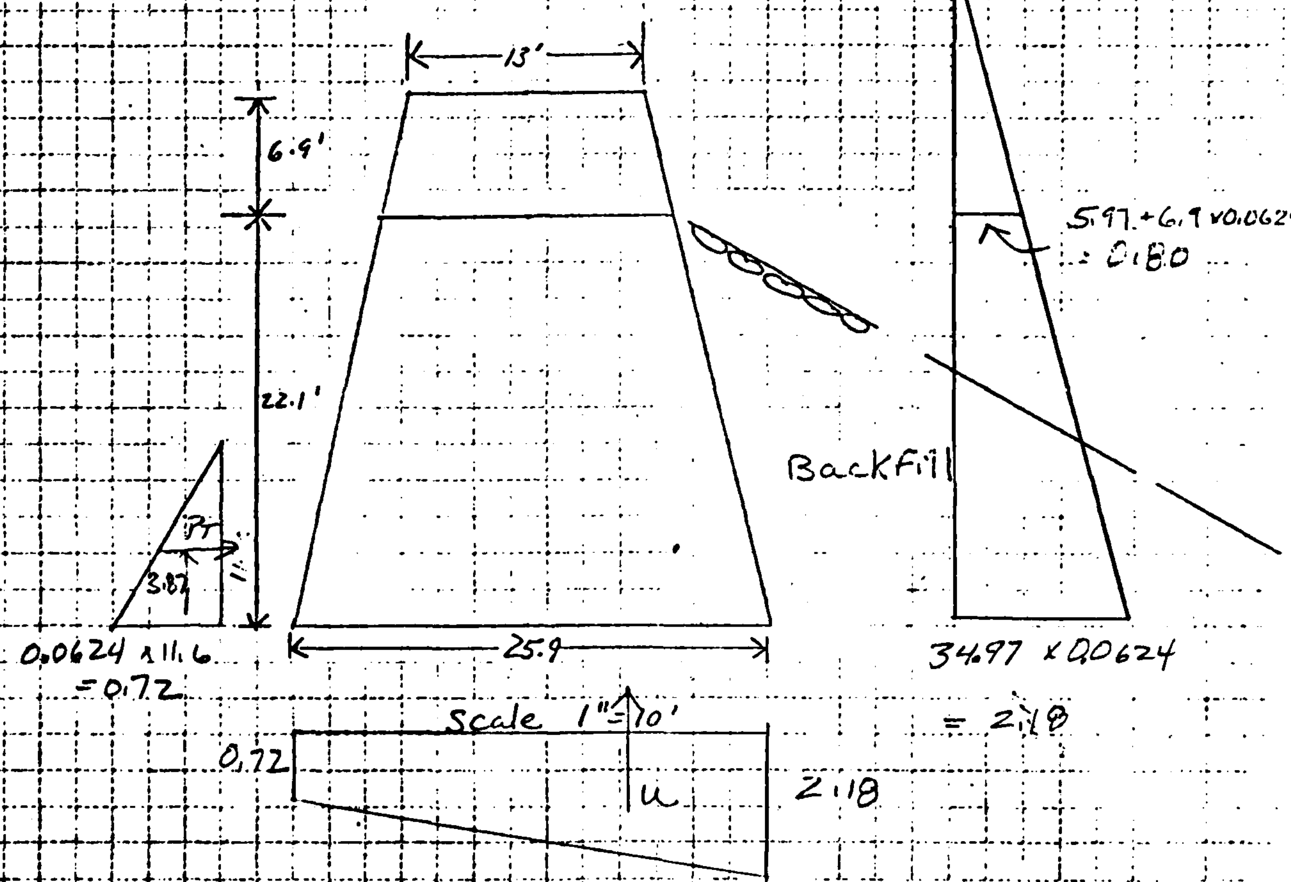
Sheet 18 of 25

Date 6-11-80

By JJF

Ch'k. by

PMF W.S. Elev. 222.87 (15.97)



	K	MA	Mo	MR
$P_H = \frac{2.18 + 0.80}{2}(22.1)$ =	32.93←	8.8	281.8	
$P_T = 1/2(0.72)(11.6)(0.6)$ =	2.51→	3.87		9.71
$u = \frac{2.18 + 0.72}{2}(25.9)$ =	37.56↑	15.12	568.02	
$W_W = 5 \times 12.45 \times 0.0624 + (0.0624)\frac{12.45 + 5.97}{2}(1.5)$ =	4.75↓	24.0		114.0
			857.82	123.7

FH = 30.42

FV 32.81

TAMS

Job No. 1546-10
Project NYS DAM Insp - GARNERVILLE
Subject Stability Spillway Section

Sheet 19 of 23
Date 6-11
By JJF
Ch'k. by

Case I Normal Loading - Without Ice

	FV	FH	MR	Mo
Dead LOAD	82.25		1128.71	
Hydrostatic	-17.87	15.25		421.0
EARTH FORCE		14.3		107.25
	64.38	29.55	1128.71	528.25

$\Sigma M = 1128.71 - 528.25 = 600.26$

$\bar{e} = \frac{25.9}{2} - \frac{600.26}{64.38} = 12.95 - 9.32 = 3.62'$

Resultant location

$9.32 - 8.6 = 0.72$ - OK INSIDE Middle 1/3

$\bar{p} = \frac{64.38}{25.9}\left(1 \pm \frac{6 \times 3.2}{25.9}\right)\frac{1000}{144} = 17.26 \pm 12.80 = \begin{cases} 30.05 \text{ psi} \\ 4.46 \text{ psi} \end{cases}$

Friction Factor of Safety

$\frac{64.38}{29.55} \tan 35 = 1.53$

TAMS

Job No. 1546-10 | Sheet 120 of 23
Project NYS Dam Insp GARNERVILLE | Date 6-11-80
Subject Stability - Spillway Section | By JJF
Ch'k. by

Case II Normal Loading - with ice load

	F_V	F_H	M_R	M_O
Dead Load	82.25		1128.71	
Hydrostatic	-17.87	15.25	'	421.0
Earth Force		14.3		107.25
Ice load	0	5.0	0	108.1
	64.38	34.55	1128.71	636.25

$$\Sigma M = 1128.71 - 636.25 = 492.46$$

$$\bar{e} = \frac{25.9}{2} - \frac{492.46}{64.38} = 7.65'$$

Resultant Location $\frac{492.46}{64.38} - \frac{25.9}{3} = -0.95'$ No good outside middle 3

$$\bar{P} = \frac{64.38}{25.9}\left(1 \pm \frac{6 \times 7.65}{25.9}\right)\frac{1000}{144} = 21.7 \pm 38.45 \begin{cases} 60.15 \\ -16.99 \end{cases}$$

Friction Factor of Safety

$$\frac{64.38 \tan 35^\circ}{34.55} = 1.30$$ Not acceptable

TAMS

Job No. 1546-10 | Sheet 21 of 23
Project NYS Dam Inspection - GARNERVILLE | Date 6-11
Subject Stability Spillway Section | By JJF
Ch'k. by

Case III - 1/2 PMF

	FV	FH	MR	Mo
Dead load	82.25		1128.71	
Hydrostatic	-29.4	27.21	92.10	769.1
EARTH FORCE		14.3		107.25
	52.85	41.51	1220.8	876.35

$$\Sigma M = 1220.8 - 876.35 \quad 344.46 \text{ KF}$$

$$\frac{25.9}{2} - \frac{344.46}{52.85} = 6.79'$$

$$\frac{344.46}{52.85} - \frac{25.9}{4} = 0.29$$

Marginally in Center 1/2

$$\bar{P} = \frac{52.85}{25.9}\left(\frac{1 \pm 6 \times 5.93}{25.9}\right)\frac{1000}{144} = 14.17 \pm 19.5 \begin{cases} 33.67 \text{ psi} \\ -5.33 \text{ psi} \end{cases}$$

Friction Factor of Safety

$$\frac{52.85 \tan 35^0}{41.51} = 0.90 < 1.25 \quad \text{No Good}$$

TAMS

Job No. 1564-10 | Sheet 22 of 23
Project NGS Dam Insp. GARNERVILLE | Date 6-11
Subject Stability - Spillway | By JJF
Ch'k. by

Case IV PMF

	FV	FH	MR	Mo
Dead Load	82.25		1128.71	
Hydrostatic	-32.81	30.42	123.70	857.82
Earth Force		14.3		107.25
	49.44	44.72	1252.41	965.07

$\Sigma M = 1252.41 - 965.07 \quad 287.35$

$\bar{e} = \frac{287.34}{49.44} - \frac{25.9}{4} = 0.42$ No good outside middle 1/2

$\bar{P} = \frac{49.44}{25.9}\left(1 \pm \frac{6 \times 6.63}{25.9}\right)\left(\frac{1000}{144}\right) = 13.25 \pm 20.28$

$\therefore$ 33.58 psi (toe)
- 7.03 psi (heel)

Friction Factor of Safety

FFS $\frac{49.44 \tan 35^\circ}{44.72} = 0.78 < 1.00$ No good

TAMS

Job No. 1546
Project NYS Dam Inspection - GARNERVILLE
Subject Stability Analysis - Spillway

Date 6-11
By JJF
Ch'k. by

Case V - Normal loading

Hydrodynamic Force = 8.7 KF (see Sh. 12)
Dynamic Force - EARTH 3.4 KF "
- Dead
0.05(82.25) × 11.9 48.93 KF
61.03

	FV	FH	MR	MO
Dead LOAD	82.25		1128.71	
Hydrostatic	-17.87	15.25		421.0
EARTH Force		14.3		107.25
Hydrodynamic		0.98		8.7
Dynamic		4.58		52.33
	64.38	35.11	1128.71	589.28

$\Sigma M = 1128.71 - 589.28 = 539.43$

$\frac{25.9}{2} - \frac{539.43}{64.38} = 4.57$

$\frac{539.43}{64.38} = 8.37$ OK - inside middle 1/2

-6.47
1.89

$\bar{P} = \frac{64.38}{25.9}\left(1 \pm \frac{6 \times 4.57}{25.9}\right)\frac{1000}{144} = 17.26 \pm 18.27$ } 35.53 psi, -1.01 psi

Friction Factor

$\frac{64.38 \tan 35^\circ}{35.11} = 1.28$ OK

REFERENCES

APPENDIX F

References

1. "HEC-1 Flood Hydrograph Package for Dam Safety Investigations", U.S. Army Corps of Engineers, September 1978

2. "Lower Hudson River Basin Hydrolic Flood Routing Model" for New York District Corps of Engineers, Water Resources Engineers, Inc., January 1977

3. "Standard Project Flood Determination", EM-1110-2-1411, Army Corps of Engineers, Washington, D.C., Rev. 1965

4. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian", Hydrometeorological Report No. 51, National Weather Service, June 1978

5. "National Program of Inspection of Dams", Vol. 3, Department of the Army, Office of the Chief of Engineers, 1975

6. "Flood Hydrograph Analyses and Computations", EM-1110-2-1405, U.S. Army Corps of Engineers, August, 1959

7. "Recommended Guidelines for Safety Inspection of Dams", Department of the Army, Office of the Chief of Engineers, Appendix D

8. "The Geology of New York State", by Broughton, J.E., et al., N.Y. State Museum and Science Service, Geological Survey, Albany, New York, Map and Chart Series: No. 5, 1962

9. "Soil Association Map of New York State", by M.G. Cline, New York State College of Agriculture, Cornell University, Ithaca, New York, February, 1963

10. "Orange County Soils. Soil Association Leaflet 2", by E.G. Knox, et al., New York State College of Agriculture, Cornell University, Ithaca, New York, October, 1954