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NATIONAL DAM SAFETY PROGRAM. LOWER (SOUTH) WICCOPEE DAM, LOWER --ETC(U)

SEP 78 J B STETSON DACW51-78-C-0035

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AD A065833

LOWER HUDSON RIVER BASIN

LOWER (SOUTH) WICCOPEE DAM

PUTNAM COUNTY NEW YORK

INVENTORY № 33

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

CONTRACT NO. DACW 51-78-C-0035

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1978

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, NEW YORK
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

2 OCT 1978

NANEN-F

Honorable Hugh L. Carey
Governor of New York
Albany, New York 12224

Dear Governor Carey:

The purpose of this letter is to inform you of a clarification of the guidelines used by this office in assessing dams under the National Program of Inspection of Dams.

Office of the Chief of Engineers has recently provided a clarification that dams with seriously inadequate spillways are to be assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The following dams in your state have previously been assessed as having seriously inadequate spillways, with capability to pass safely only the percentage of the probable maximum flood as noted in each report. They are now to be assessed as unsafe:

I.D. NO.	NAME OF DAM
N.Y. 59	Lower Warwick Reservoir Dam
N.Y. 4	Salisbury Mills Dam
N.Y. 45	Amawalk Dam
N.Y. 418	Jamesville Dam
N.Y. 685	Colliersville Dam
N.Y. 6	Delta Dam
N.Y. 421	Oneida City Dam
N.Y. 39	Croton Falls Dam
N.Y. 509	Chadwick Dam (Plattenkill)
N.Y. 66	Boyds Corner Dam
N.Y. 397	Cranberry Lake Dam
N.Y. 708	Seneca Falls Dam
N.Y. 332	Lake Sebago Dam
N.Y. 338	Indian Brook Dam
N.Y. 33	Lower(S) Wiccopee Dam (Lower Hudson W.S. for Peekskill)

NANEN-F
Honorable Hugh L. Carey

I.D. NO.	NAME OF DAM
N.Y. 49	Pocantico Dam
N.Y. 445	Attica Dam
N.Y. 658	Cork Center Dam
N.Y. 153	Jackson Creek Dam
N.Y. 172	Lake Algonquin Dam
N.Y. 318	Sixth Lake Dam
N.Y. 13	Butlet Storage Dam
N.Y. 90	Putnam Lake (Bog Brook Dam)
N.Y. 166	Pecks Lake Dam
N.Y. 674	Bradford Dam
N.Y. 75	Sturgeon Pool Dam
N.Y. 414	Skaneateles Dam
N.Y. 155	Indian Lake Dam
N.Y. 472	Newton Falls Dam
N.Y. 362	Buckhorn Lake Dam

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.

Consequently, it is advisable to implement the recommendations previously furnished in the reports for the above-mentioned dams as soon as practicable.

It is requested that owners of these dams be furnished a copy of this letter and that copies be permanently appended to all reports previously furnished to you.

Sincerely yours,

CLARK H. BENN
Colonel, Corps of Engineers
District Engineer

TABLE OF CONTENTS

FIGURES

APPENDIX

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

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Lower (South) Wiccopee Dam
Lower Hudson River Basin, Putnam County, N.Y.
Inventory No. N.Y. 33

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18. SUPPLEMENTARY NOTES

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National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Putnam County
Wiccopee Creek
Lower (South) Wiccopee Dam

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.
Lower (South) Wiccopee Dam was judged to be unsafe Non-emergency due to a seriously inadequate spillway.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam South Wiccopee NY33
(Formerly, Lower Hudson Watershed for Peekskill)

State Located New York
County Located Putnam
Stream Wiccopee Creek
Date of Inspection July 26, 1978

ASSESSMENT OF GENERAL CONDITIONS

The South Wiccopee Dam is the lower of two dams in the Wiccopee Watershed, owned by the City of Peekskill. The dams are used to augment flows into Peekskill Hollow Creek which is the source for raw water to the City's filtration plant, some 15-20 miles downstream of the dams. Both dams are concrete gravity structures. The lower structure, the only one inspected, is 31 feet in height.

On the basis of the Phase I visual examination and analysis, it has been determined additional investigative work needs to be performed to evaluate the dam's stability and the spillway's inadequate discharge capacity. Where uplift forces were considered in the stability analysis, unsatisfactory factors of safety due to overturning and sliding were computed. At this time, it is not unknown whether the dam's foundation is on rock. It is recommended that investigations to determine site geology and the condition of the dam structure be conducted with engineering analysis as required to fully evaluate the stability of the dam structure.

The spillway was found to be severely inadequate and can only pass 5 percent of the Probable Maximum Flood. The dam may be able to adequately handle being topped, but this cannot be concluded based on the information available for this report. Further investigations should be performed to refine the hydrologic analysis, determine whether the overtopping flood water head creates instability and whether erosion protection measures need to be installed at the toe of the dam.

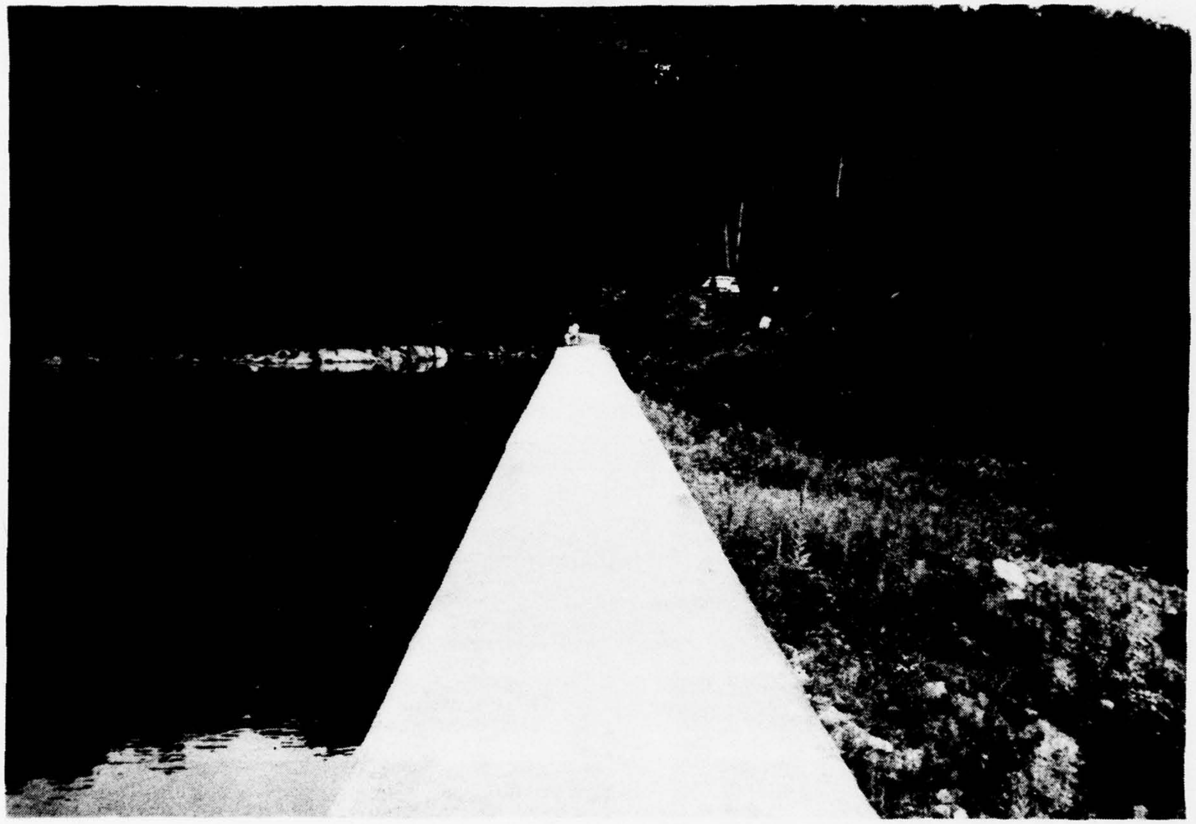
STATE OF NEW YORK
DALE ENGINEERING COMPANY, INCORPORATED
NO. 076
LICENSED PROFESSIONAL ENGINEER

Dale Engineering Company

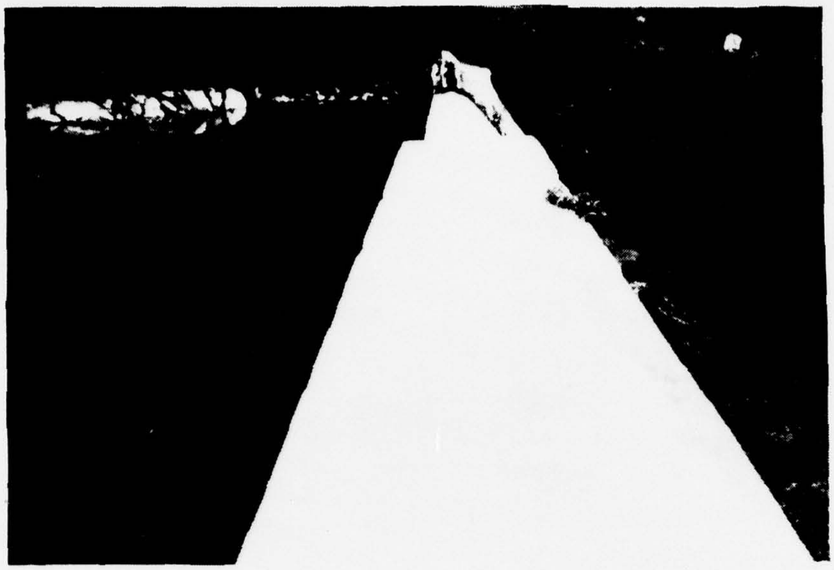
John B. Stetson, President

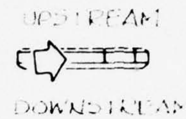
Approved By:
Date:

Col. Clark H. Benn
New York District Engineer
19 September 1978

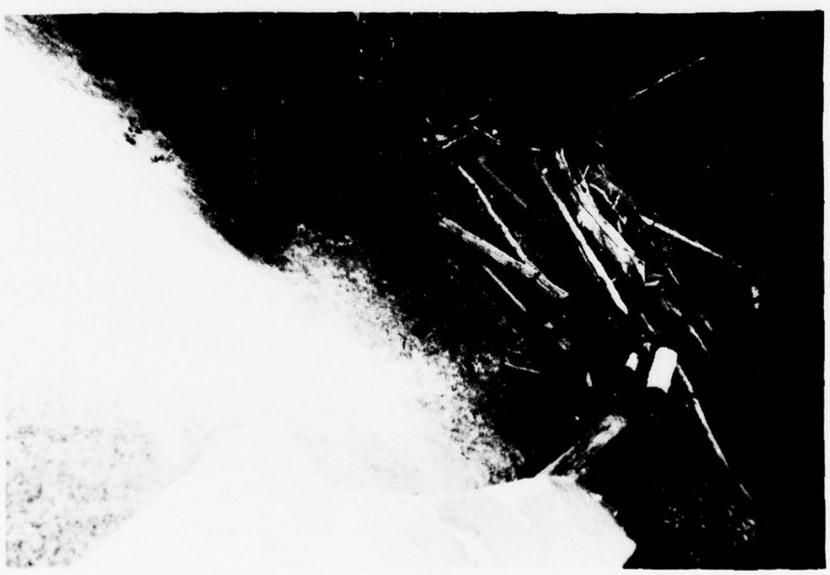


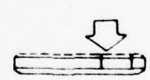
Overview on concrete gravity dam.



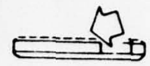


1. View across spillway.

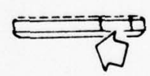




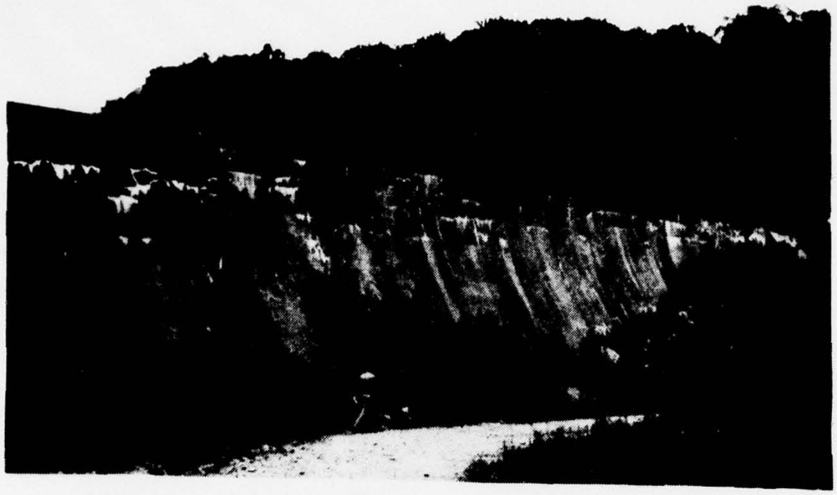
2. Debris below spillway.



3. Dam at west abutment.



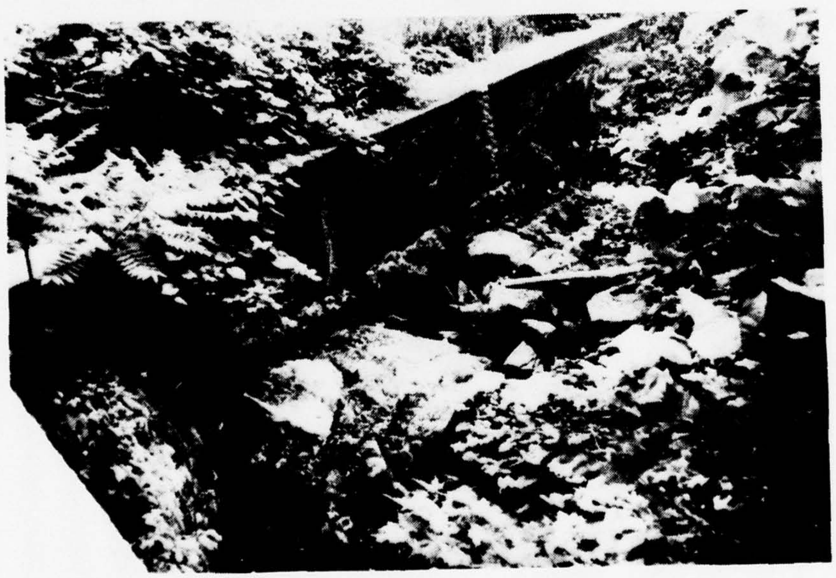
4. View of downstream face at west abutment.



5. View of center portion of downstream face of dam.

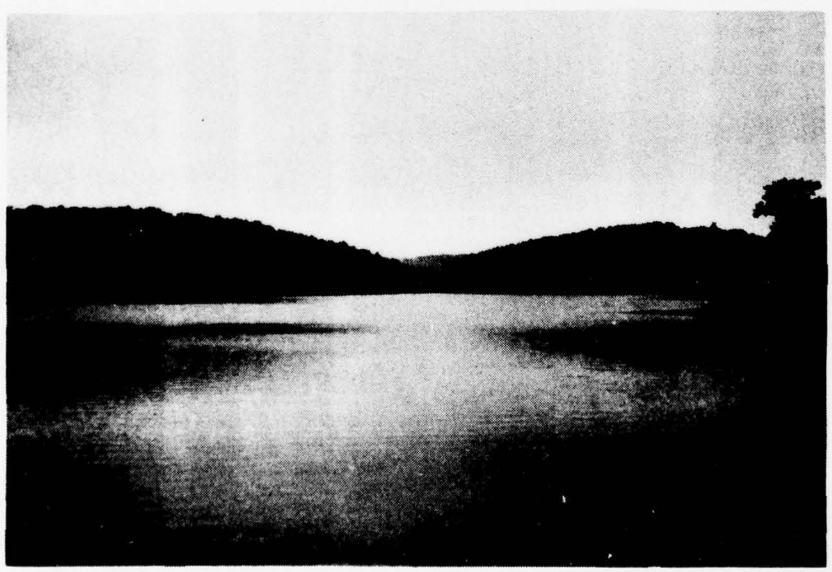
6. View of spillway from service road bridge below dam. Notice heavy growth.

7. View of channel below bridge.



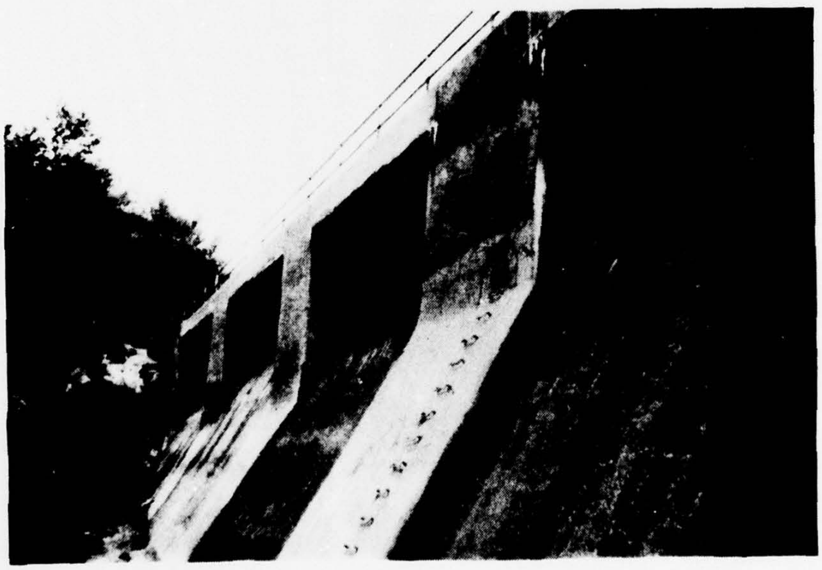
8. Spillway wall is undermined.

9. Outflow into main channel below center of dam.



10. View of reservoir above dam. North Wicopee dam is located in the valley section at far end of reservoir.

11. Typical shoreline detail.



12. Closeup of North Wicopee dam which was not inspected.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM - SOUTH WICCOPEE ID# - NY498

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Dale Engineering Company and The New York State Department of Environmental Conservation.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the South Wiccopee Dam and appurtenant structures, owned by the City of Peekskill, New York, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the State of New York.

This Phase I inspection report does not relieve an owner or operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The South Wiccopee Dam is a concrete gravity structure. The dam is approximately 375 feet long and 31 feet high. The top width of the structure is 5 feet, 6 inches. The width at the bottom of the dam is approximately 21 feet. No information is available on the exact material of the foundation. The major spillway of the structure is located near the east abutment and is formed in concrete with an ogee shaped crest. Discharge from this spillway is conducted into Wiccopee Creek which is a tributary of Peekskill Hollow Creek. The spillway is 48-1/2 feet long. A drainline is located near the center of the dam discharging into Wiccopee Creek. This drainline is controlled by a gate valve located in a manhole near the toe of the dam. It is a low level outlet control for two 24 inch pipes.

b. Location

South Wiccopee Dam is located in the Town of Putnam Valley in Putnam County, New York.

c. Size Classification

The maximum height of the dam is approximately 31 feet. The storage volume of the dam is approximately 1294 acre feet to the top of the dam structure. Therefore, the dam is in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

Wiccopee Creek is a tributary of Peekskill Hollow Creek which flows into the City of Peekskill. Numerous residential properties are located along Peekskill Hollow Creek. Therefore, the dam is in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by the City of Peekskill, New York.

f. Purpose of Dam

The dam presently functions as a water supply reservoir for the City of Peekskill. Discharges from the dam are used to supplement flow in Peekskill Hollow Creek, a major source of water for the City.

g. Design and Construction History

No plans or design information were discovered during the preparation of this report. A letter to the State of New York Conservation Commission on October 4, 1913, indicates that Dam No. 498 on the Lower Hudson Watershed owned by the Peekskill Water Works was inspected and found to be completed in accordance with the plans and apparently of good workmanship. In 1975, repairs were made to cracks in the concrete near the west end of the spillway near the top of the dam. This is the only other record of work having been done at the site.

h. Normal Operational Procedures

The South Wiccopee Dam is visited daily by an employee of the Peekskill Water Department. The daily visit includes a check for vandalism and general condition of the area. Visits to the site are discontinued during the winter months when heavy snow cover makes access to the site very difficult. Normal operation includes adjusting of the flow by manipulation of the drain valves in the south reservoir and the north reservoir.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of the Lower Wiccopee is 4.50 square miles.

b. Discharge at Dam Site

No discharge records are available at this site.

Computed Discharges:

Ungated spillway, top of dam	500 cfs
Ungated spillway, design flood	4417 cfs (1/2 PMF)
	11000 cfs (PMF)

c. Elevation (feet above MSL)

Top of dam	531
Maximum pool - design discharge	533+ (1/2 PMF)
Spillway crest	529
Stream bed at centerline of dam (estimate)	499

d. Reservoir

Length of maximum pool	2300 feet
Length of normal pool	2300 feet

e. Storage

Top of dam	1294 acre feet
Normal pool	1169 acre feet

f. Reservoir Surface

Top of dam	56.2 acre
Spillway pool	54.4 acre

g. Dam

Type - Concrete gravity.
Length - 375 feet.
Height - 30 feet.
Freeboard between normal reservoir and top of dam - 2 feet.
Top width - 5 feet, 6 inches.
Side slopes - Upstream vertical, dowstream 1.57 vertical to 1 horizontal
Zoning - None.
Impervious core - None.
Grout curtain - Not known.
Spillway width - 48-1/2 feet with an ogee section forming a sharp crested weir.
Discharge channel - rock channel with concrete side wall.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information available for review for the Upper Wiccopee Dam included:

1) Plans as shown in Figures 2 through 6.

2) Stability analysis performed in 1975 are shown in Figures 9 an 10.

2.2 CONSTRUCTION

No data was available in the construction of the dam.

2.3 OPERATION

See Section 4.

2.4 EVALUATION

The limited data provided herein lacks details describing whether the dam is founded on rock. Material properties of the concrete are also not known. Enough data has been provided to determine the geometry of the dam.

SECTION 3 - VISUAL INSPECTION

3.1 SUMMARY

a. General

The visual inspection of South Wiccopee Dam took place on July 26, 1978. The dam which is a concrete gravity structure has recently undergone repair work in 1976 under the direction of Malcolm Pirnie, Inc., a consulting engineering firm. On the South dam, this work is related to the repair of a lengthy crack. The plans for this repair work is included ~~on~~ in Figure 6.

b. Dam

The concrete gravity dam visually conforms to the plans as provided herein. It could not be determined from visual inspection whether the structure was founded on rock. The top and sides of the dam are shown in Photograph Numbers 1, 3, 4 and 5. No serious deficiencies were noted in the condition of the concrete structure. The downstream toe area shows no signs of seepage, cracking, movement or erosion.

c. Spillway

The spillway is located near the east abutment as shown in Photograph Number 1. The top of the dam is approximately two feet above the ogee spillway crest. The spillway portion of the dam was noted to be in good condition. The spillway was not discharging at the time of inspection. The spillway channel below the dam requires maintenance. Photograph Numbers 2, 6, 7 and 8 show debris, vegetative growth and erosion problems in the spillway channel. The channel is in need of maintenance and repair work so that it can function more adequately.

d. Appurtenant Structure

The outflow pipe is submerged below the dam and discharges into the existing main channel below the center of the dam. See Photograph Number 9. The service spillway channel discharges near the east abutment and ties into the natural stream below the outflow pipe. The low level outlets were reported to be operable with significant discharge coming from the two 24 inch pipes at the time of inspection.

e. Downstream Channel

The downstream channel presents no problems to the performance of the discharge capacity of the dam. The stream channel gradient appears quite adequate to carry flows away from the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not observed by the inspection team. During normal conditions, the water surface elevation of the reservoir is kept at the spillway crest. The South Wiccopee Dam is visited daily by an employee of the Peekskill Water Department. The daily visit includes a check for vandalism and general condition of the area. Visits to the site are discontinued during winter months when heavy snow cover makes access to the site very difficult. Normal operation includes adjusting of the flow by manipulation of the drain valves in the south reservoir and the north reservoir.

4.2 MAINTENANCE OF DAM

The dam is maintained by the Peekskill Water Department's full-time staff which visits the site daily. In 1976, substantial repair work was performed on the two dams as part of the City effort to continually maintain the dams.

The site is not accessible by the public. There is no outside full-time staff. During the year when weather permits, the site is inspected and/or maintained daily. There is no warning system at the site.

SECTION 5 - HYDROLOGY AND HYDRAULICS

5.1 EVALUATION OF FEATURES

a. Design Data

For this report, no information relevant to the hydrologic and/or hydraulic design for the dam was available. Analysis provided in Appendix C was performed utilizing information obtained from construction documents and other general sources of information listed in the reference section of this report. North and South Wiccopee Dams, also referred to as Upper and Lower Wiccopee Dams are both concrete gravity structures with built-in ogee sections across the dam face. The dams are located in a remote setting and are relatively inaccessible to the public. The upper dam section was constructed in combinations with the bridge and service road. The lower dam does not contain a road over it. The drainage areas contributing to the reservoirs are approximately 2.5 and 2 square miles for the lower and upper drainage areas respectively. The volume of the impoundment is purely a function of natural watershed. A number of small ponds and lakes lie upstream of the reservoir.

The purpose of this investigation is to evaluate the dam and spillway with respect to their flood control potential and/or adequacy. This potential was assessed in the development of the Probable Maximum Flood (PMF) for the watershed and a subsequent routing through the reservoir system. PMF is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration loss and concentration runoff of a specific location that is considered reasonably possible for a particular drainage area. No information was available on the historical flood events at the dams location. The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. In preparing the hydrograph, both Clark and Snyder coefficients were estimated. For the Clark Method values of Tc = 3.30 and R = 1.70 for the upper drainage area and Tc = 4.93 and R = 2.77 for the lower drainage area were computed. For the Snyder Method, values of Tpr = 3.06 and CP = 0.625 for the upper and Tpr = 1.82 and CP = 0.625 for the lower were computed. Two unit hydrographs were developed from these parameters and two sets of hydrographs were computed for the purposes of comparison. The results of these computations were not similar. More confidence was given to the Clark's parameters results which were then used as the flood hydrograph in the spillway analysis. The Probable Maximum Flood (PMF) hydrograph was determined using Probable Maximum Precipitation rainfall data obtained in Hydrometeorological Report No. 51. An index rainfall of 24.1 inches for 200 square miles for a period of 24 hours was used in the analysis. Both the PMF and 1/2 PMF were evaluated. The 1/2 PMF was assumed to be approximately the Standard Project Flood (SPF) in utilizing U.S. Army Corps of Engineers, Hydrologic

Engineering Center's, Computer Program (UHCOMP). Hydraulic studies were performed at the spillway gravity structure providing a stage-discharge analysis for weir flow. (See Appendix C).

The U.S. Army Corps of Engineers, Hydrologic Engineering Centers, Program HEC-1 using the Modified Puls Method for flood routing was used to evaluate the structure and the reservoirs. The peak flow discharges at the South Dam were 4,417 for the 1/2 PMF (SPF) and 11,000 cfs for the PMF. Only a minor reduction in the peak flow was obtained due to the reservoir effect. For the 1/2 PMF (SPF), the dam would be topped by 4 feet; for the PMF it would be topped by 6 feet. The greatest effect of this would be the dams stability.

b. <u>Experience Data</u>

The owners representatives were unable to provide data regarding the performance of the spillway during extreme rainfall events.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations And Data Review

The concrete dam retains stability at this time with no indication of misalignment, settlement or other structural movement. The physical condition of the dam top and face is generally good. The spillway section located at the easterly end of the dam is similarly in relatively good structural condition but some undermining of the spillway wall has occurred. The downstream spillway chute is overgrown with vegetation and has accumulated some debris.

No indication of through-the-dam seepage was observed on the dams downstream face, nor were any seepage evidences noted in the surface area below the dams downstream face.

The ground surface in front of the dam (downstream) varies in elevation. An earthen fill several feet in thickness has been dumped relatively recently along a section adjacent to the spillway. Reportedly, this material was placed after a stability analysis indicated a questionable factor of safety against overturning/sliding. The fill's purpose was to increase the forces acting to resist movement of the dam. The downstream ground surface along the central portion of the dam appears to be at an elevation corresponding to the bottom of the reservoir, and this is an area where the above referenced fill has not yet been placed.

b. Geology and Seismic Stability

According to the New York State Geologic Map (1970) the reservoir is situated in an area of heterogenous rock makeup - amphibolite, pyroxenic amphibolite, hornblende gneiss which is commonly biotitic and garnetiferous, and subordinate amounts of calcsilicate rock. This assemblage of metamorphic rock has not yet been given a formal name.

None of the available reports pertaining to the dam indicates if the dam, spillway and abutments are in contact with the bedrock or not. Depending upon the orientation of the foliation, joints and shear zones (if present), these rocks are believed to have considerable strength and bearing capacity. However, weathering of the biotite, hornblende and pyroxene may yield rotted seams conducive to seepage.

The area is designated as being in Zone 1 of the Seismic Probability Map. Because the reservoir is located within the Ramapo Fault System (Geologic Structures Map 2), the New York State Geological Survey believes this area should be upgraded to a Zone 3. Aggarwal and Sykes (1978) believe that the Ramapo Fault is capable of generating an earthquake of at least intensity VII.

As shown on Geologic Structures Map 1, numerous faults are known to exist in the vicinity of the reservoir. Several significantly large faults, as well as many small faults, exist outside the boundaries of Geologic Structures Map 1. Numerous additional lineaments, not shown on the maps in this report but shown on the Preliminary Brittle Structures Map of New York of the New York State Geological Survey (1977), may indicate additional fault zones present in this area.

Some of the earthquakes recorded for the area are tabulated below:

Date	Intensity-Modified Mercalli	Location Relative to Dam
1878	V	11 mi NW
1885	III	8 mi SW
1885	III	6 mi SW
1951	III	20 mi NNW
1952	V	22 mi NW
1967	V	15 mi S

Many earthquakes of lesser intensity are known to have occurred in this region, according to the records of the New York State Geological Survey. Some of the more recent earthquakes, 1962-1977, are shown on Geologic Structures Map 2.

c. Data Review and Stability Evaluation

Design drawings available for review, are limited to drawings dated 1941 and 1944, show a typical cross section for the dam, and ground surface elevations along the length of the dam for the reservoir side and downstream side of the dam. Information was not available on the dams foundation material (soil or rock) or on an assumed downstream ground water level. As part of the present study, stability evaluations have been performed. Actual properties of the sites foundation soil/rock have not been determined; where data was lacking, simplifying assumptions felt to be conservative were applied. The condition for

(1) a reservoir level at spillway elevation, with ice;
(2) a reservoir level topping the dam by one foot;
(3) a reservoir level at spillway elevation, with ice, and with earthquake forces acting (utilizing seismic coefficients applicable to a Zone 3 Seismic Probability area),
have been evaluated.

The analysis performed (See Appendix D) indicate unsatisfactory stability against overturning and sliding for the forces assumed. Where the computed factors of safety under certain conditions approach unity, below unity is considered to be unstable. In Case II listed below, the analysis included only one foot of flow over the dam, whereas the hydrologic analysis indicates that the discharge would be 4 feet over the dam for the 1/2 PMF. Subsequently, if the later height was considered, the factor of systems would be even lower than shown.

RESULTS OF STABILITY COMPUTATIONS

CASE		UPLIFT	FACTORS OF SAFETY OVERTURNING	FACTORS OF SAFETY SLIDING
I.	Water level at spillway crest, downstream water level at base of dam,	YES	1.08	0.7
	downstream ground elev. at base of dam,			
	upstream ground elev. at base of dam,	NO	1.70	1.08
	Ice acting Neglect vertical effect of water on upstream face (sloping) of dam.			
II.	Water level one foot above top of dam,	YES	1.13	---
	No ice,			
	Downstream ground surface and water level at base of dam.	NO	2.10	---
III.	Zone 3 seismic probability horizontal coef. = 0.1, vertical coef. = 0.05),	YES	0.90	---
	Water level at spillway and ice, dowstream water level and ground surface at base of dam.	NO	1.30	---

Critical to the analysis and resulting indication of stability are the items of uplift water pressures acting on the foundation of the dam and the permeability of the sites foundation soil/rock. The analysis uplift force was based on full headwater hydrostatic pressure acting on the dams foundation upstream corner and a zero tailwater hydrostatic pressure acting at the dams downstream corner with the resulting triangular force pattern applied to 100 percent of the dams section. The resulting uplift force represents a condition that is, to the analysis, very significant in arriving at the computed dangerously low factors of safety against overturning and sliding.

The assigned uplift force is conservative but could be too severe if the dam is embedded in sound rock. The prediction of uplift acting on the base of a gravity dam supported on rock without information on the permeability/seepage properties of the rock stratum represents an analytical area of great uncertainty. If the permeability of the rock stratum is very high, the uplift force assumed is reasonable; if the rock is layered and jointed, the assumed uplift force may actually be too low. Conversely, if the rock is very sound and impermeable, seepage would be very low and uplift pressures of significance would require a long period of time to develop. Similarly, within the masonry itself (say near the base of the dam (hydrostatic pressures from permeating headwater potentially causing the same effect as uplift at the base of the dam could require a considerable period of time before reaching a significant magnitude. A conclusion drawn from this latter condition is that the computed uplift shown in the stability analysis may not exist at present and only develop at some future time.

A current geologic-seismic evaluation for the general area of the reservoir site recommends a Zone 3 Seismic Probability designation. A stability analysis utilizing seismic coefficients suggested for Zone 3 designation indicates an unstable condition would exist when the reservoir level is at the spillway elevation and uplift forces act on the base of the dam.

In consideration of the questionable stability implied for the forces known to be in effect and anticipated, it is recommended that investigations to determine site geology and the condition of the dam structure be conducted with engineering analysis as required to fully evaluate the stability of the dam structure when subject to static and seismic loadings which could occur in the reservoir area. Knowledge of the structural condition of the dam is required for evaluating the residual internal integrity and resistance to seismic effects. The field investigation would include subsurface explorations (borings and geophysical methods) to delineate foundation soil and rock materials and determine their engineering properties.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

On the basis of the Phase I visual examination and analysis, it has been determined additional investigative work should be performed to evaluate the dam's stability. Where uplift forces were considered in the stability analysis, less than satisfactory factors of safety due to overturning and sliding were computed. At this time, it is not known whether the dam's foundation is on rock.

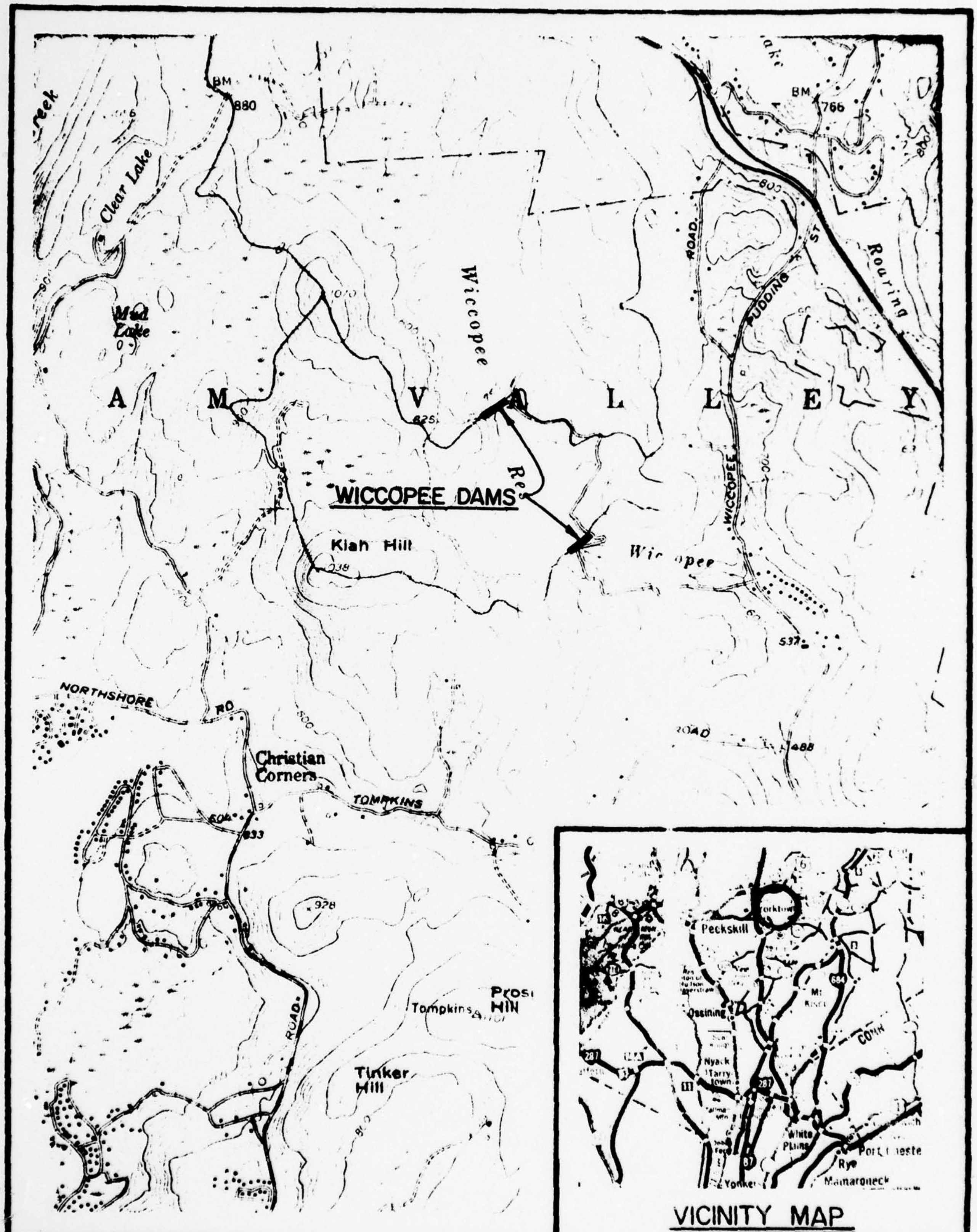
The visual examination of the gravity dam and downstream area did not locate any distress in the downstream earthen area toe area. The concrete dam retains stability at this time with no indication of misalignment, settlement or other structural movement. The physical condition of the dam's concrete, which was recently repaired, is generally good.

The hydrologic evaluation determined that the concrete gravity dam would be overtopped and the spillway has been found to be seriously inadequate to pass the 1/2 PMF. The spillway is capable of passing only 5 percent of the PMF. The consequences of overtopping in this type of structure has not been weighed. If the dam is not founded on rock, erosive forces on the ground surfaces below the dam could contribute significantly to the dam's stability. The stability anaysis results bear this out.

Because the dam is located in the Ramapo Fault, the New York State Geological Survey believes this area should be upgraded to a Zone 3.

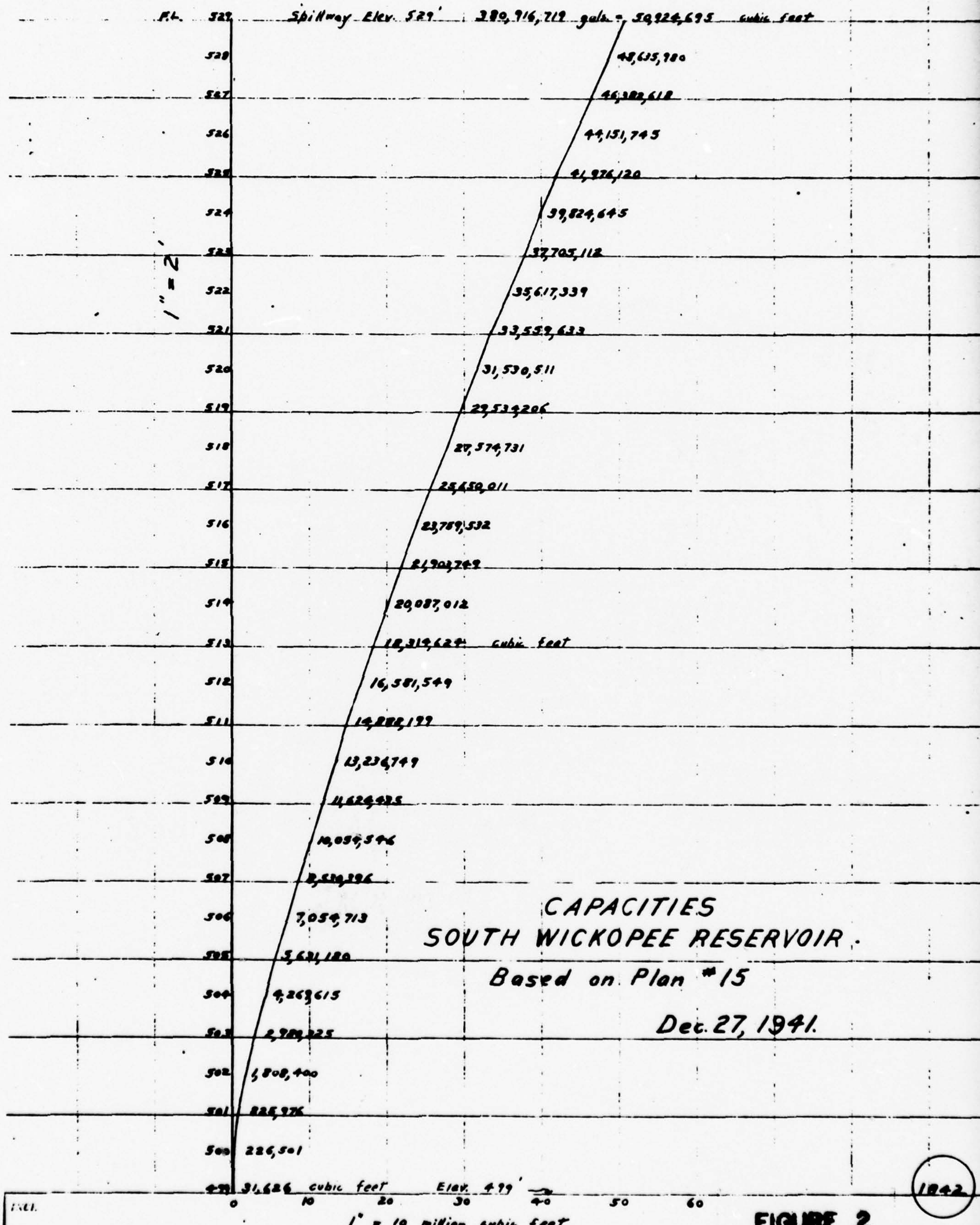
7.2 REMEDIAL MEASURES

It is recommended that investigations to determine site geology and the condition of the dam structure be conducted with engineering analysis as required to fully evaluate the stability of the dam structure when subject to static and seismic loadings which could occur in the reservoir area. The field investigation should include subsurface explorations (borings and geophysical methods) through the dam into the foundation to delineate foundation soil and rock materials and determine their engineering properties. Further hydrologic evaluation should be performed to refine the results obtained herein as part of the remedial measure's effort to be performed by the owner. Further studies may concur that some erosion protection will be needed at the toe of the dam. In addition, routine maintenance work should be performed to keep the spillway discharge channel clear of debris, to remove vegetation, and repair the side channel's wall section.



LOCATION PLAN

FIGURE I



CAPACITIES
SOUTH WICKOPEE RESERVOIR.
Based on Plan #15
Dec. 27, 1941.

FIGURE 2

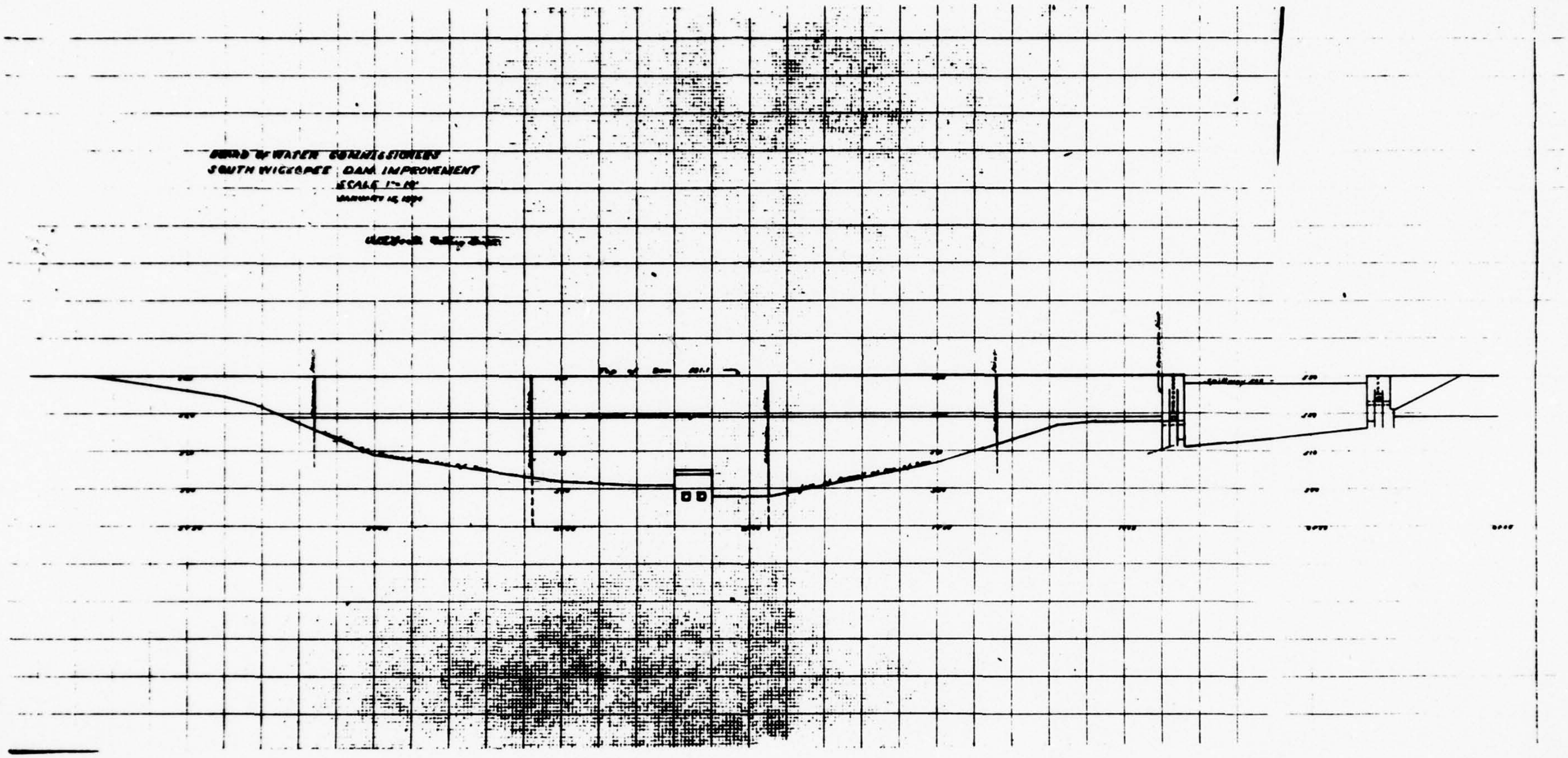

BOARD OF WATER COMMISSIONERS
SOUTH WICKOPEE DAM IMPROVEMENT
SCALE 1"=10'

FIGURE 3

EXHIBIT "II"

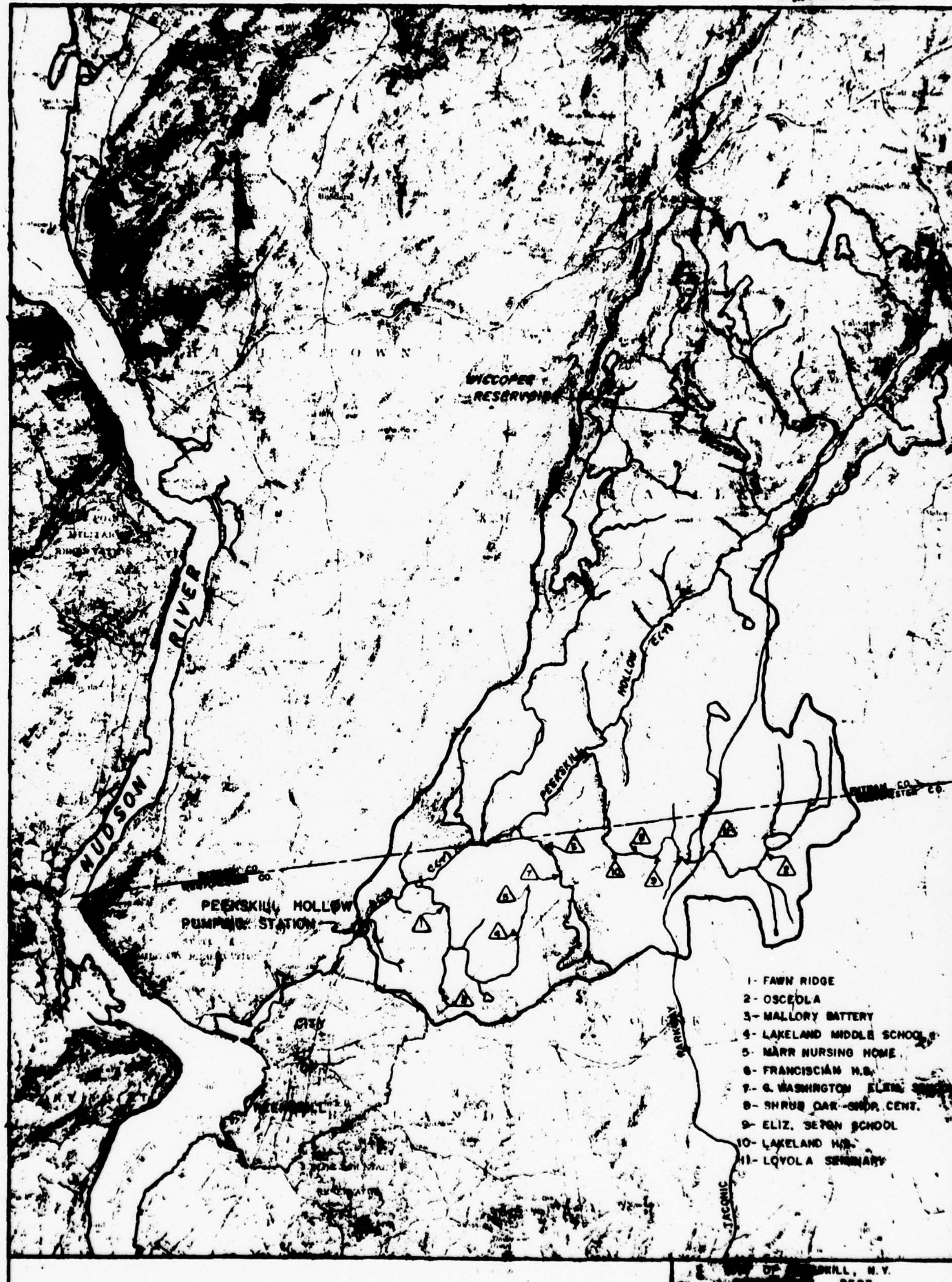


FIGURE 4

FIGURE 5

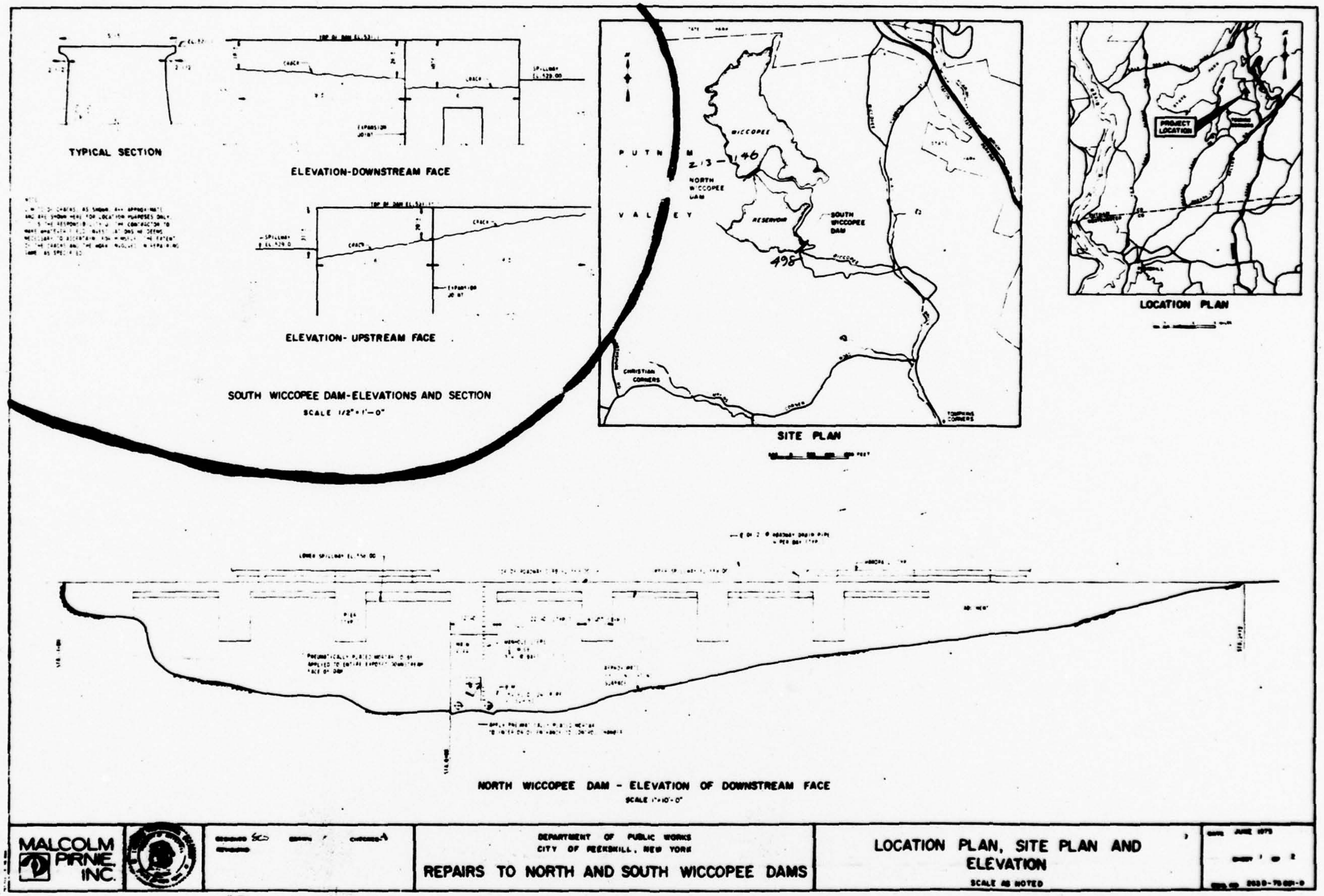
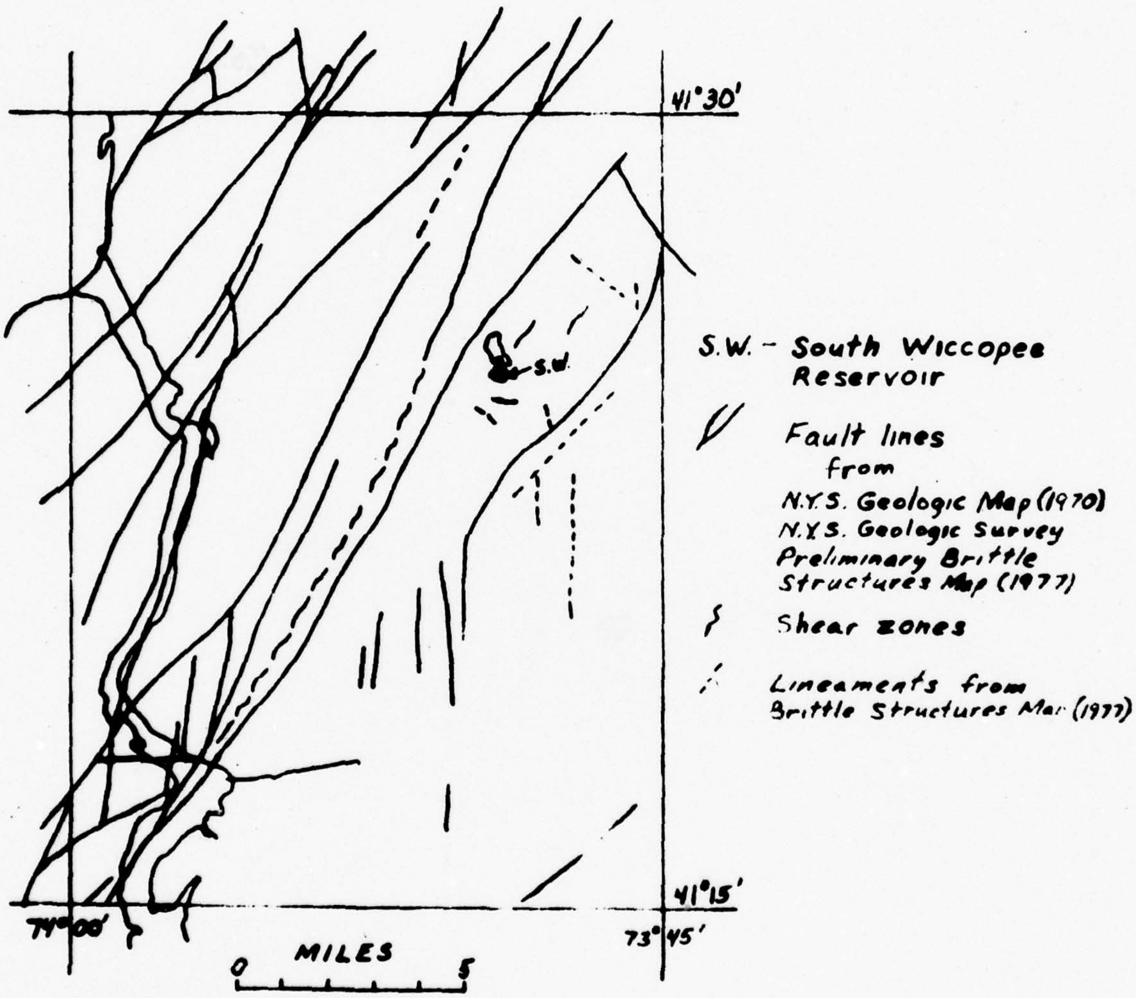

TYPICAL SECTION
ELEVATION-DOWNSTREAM FACE
ELEVATION- UPSTREAM FACE
SOUTH WICCOPEE DAM-ELEVATIONS AND SECTION
SCALE 1/2"=1'-0"
PUTNAM
VALLEY
WICCOPEE
NORTH WICCOPEE DAM
RESERVOIR
SOUTH WICCOPEE DAM
CHRISTIAN CORNERS
TOMPKINS CORNERS
SITE PLAN
PROJECT LOCATION
LOCATION PLAN
NORTH WICCOPEE DAM - ELEVATION OF DOWNSTREAM FACE
SCALE 1"=10'-0"
MALCOLM PIRNIE INC.
DEPARTMENT OF PUBLIC WORKS
CITY OF PEEKSKILL, NEW YORK
REPAIRS TO NORTH AND SOUTH WICCOPEE DAMS
LOCATION PLAN, SITE PLAN AND ELEVATION
SCALE AS NOTED
JUNE 1975

FIGURE 6



Geologic Structures Map 1

GEOLOGIC MAP
FIGURE 7

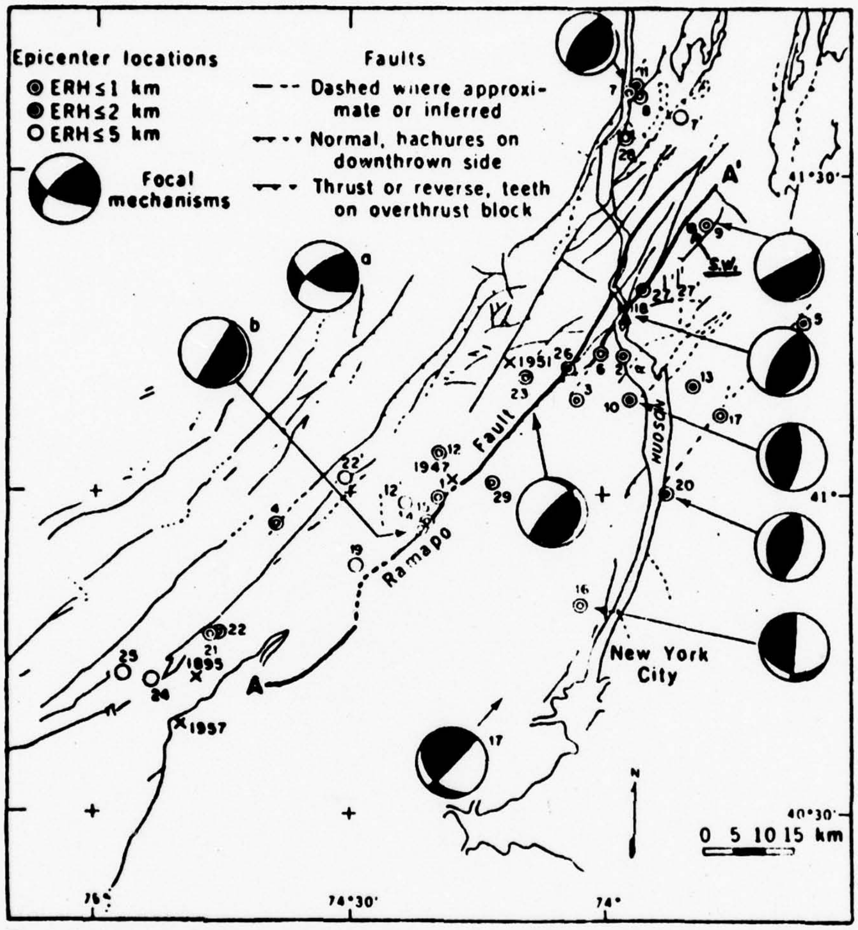


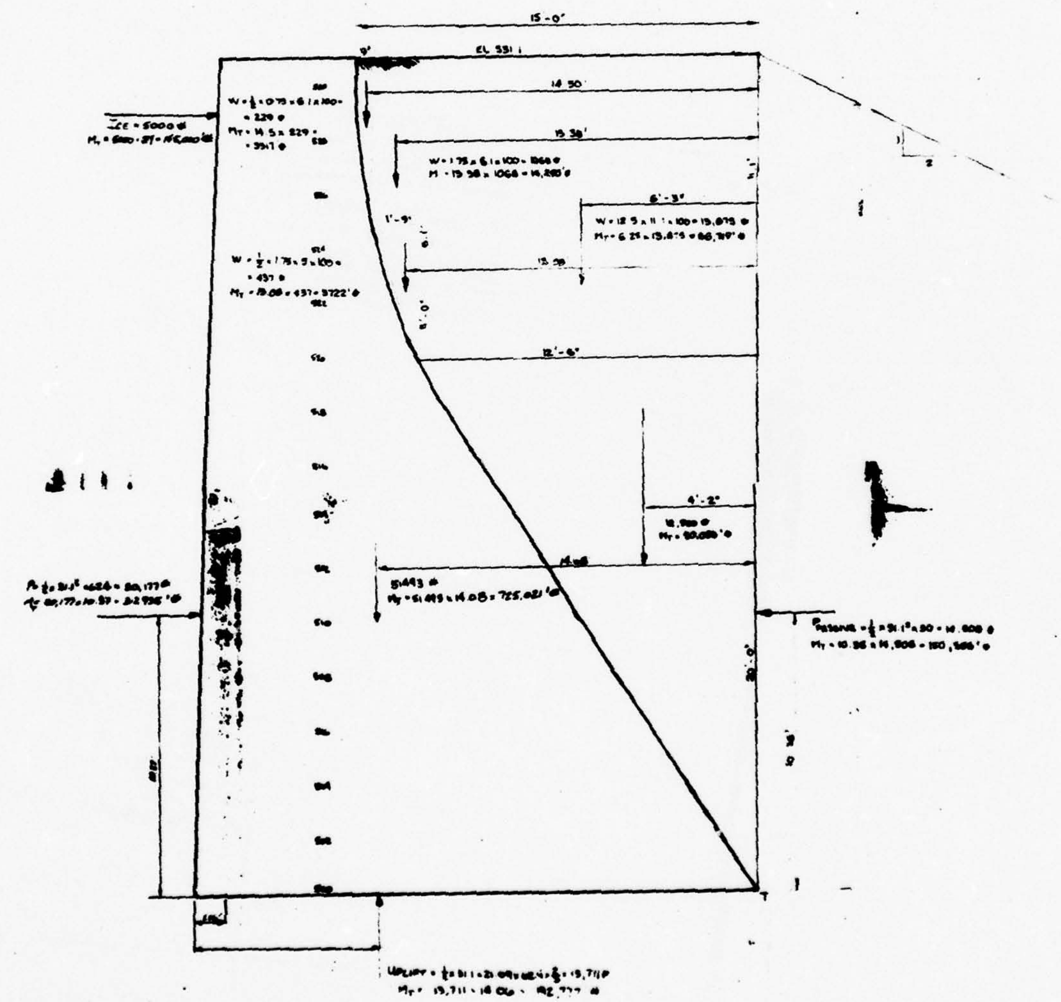
Fig. 2. Fault map (4, 5, 29) of southeastern New York and northern New Jersey showing epicenters (circles) of instrumentally located earthquakes from 1962 through 1977.

From Aggarwal and Sykes (1977). South Wiccope reservoir (S.W.) located in northeastern corner of map.

Geologic Structures Map 2.

GEOLOGIC MAP

FIGURE 8



CASE ① NO BACKFILL

ΣM_r 312,935 − 145,000 + 192,777 − 725,021
= 74,309 '#

ΣV = 51493 − 13711 = 37,782 '

$x = \Sigma M / \Sigma V$ = 1.97' from toe

SF = $M_{RESIST} / M_{OVERTURN}$ = 725,021 / (312,935 + 145,000 + 192,777) = 725,021 / 650,712

= 1.11

CASE II – BACKFILL [illegible] OF DAM (EL 55[illegible])

a) NEGLECT PASSIVE RESISTANCE

ΣM_T ↷ 312,935
145,000
192,777
650,712

ΣM_T ↶ 725,021
20,095
80,719
3,722
14,290
2,817
[illegible]
− 650,712
ΣM_T = 234,440 '#

ΣV 51,493
12,30[illegible]
13,875
437
1,068
229
− (13,711)
68,[illegible] #

$x = \Sigma M / \Sigma V$ = [illegible] = 3.50' from toe

SF = M_R / M_O = [illegible] / 650,712 = 1.33

b) INCLUDE PASSIVE RESISTANCE @ 30 PCF

ΣM_T ↶ = 885,152
130,[illegible]
1,0[illegible]
− 650,712
ΣM_T = 384,[illegible] '#

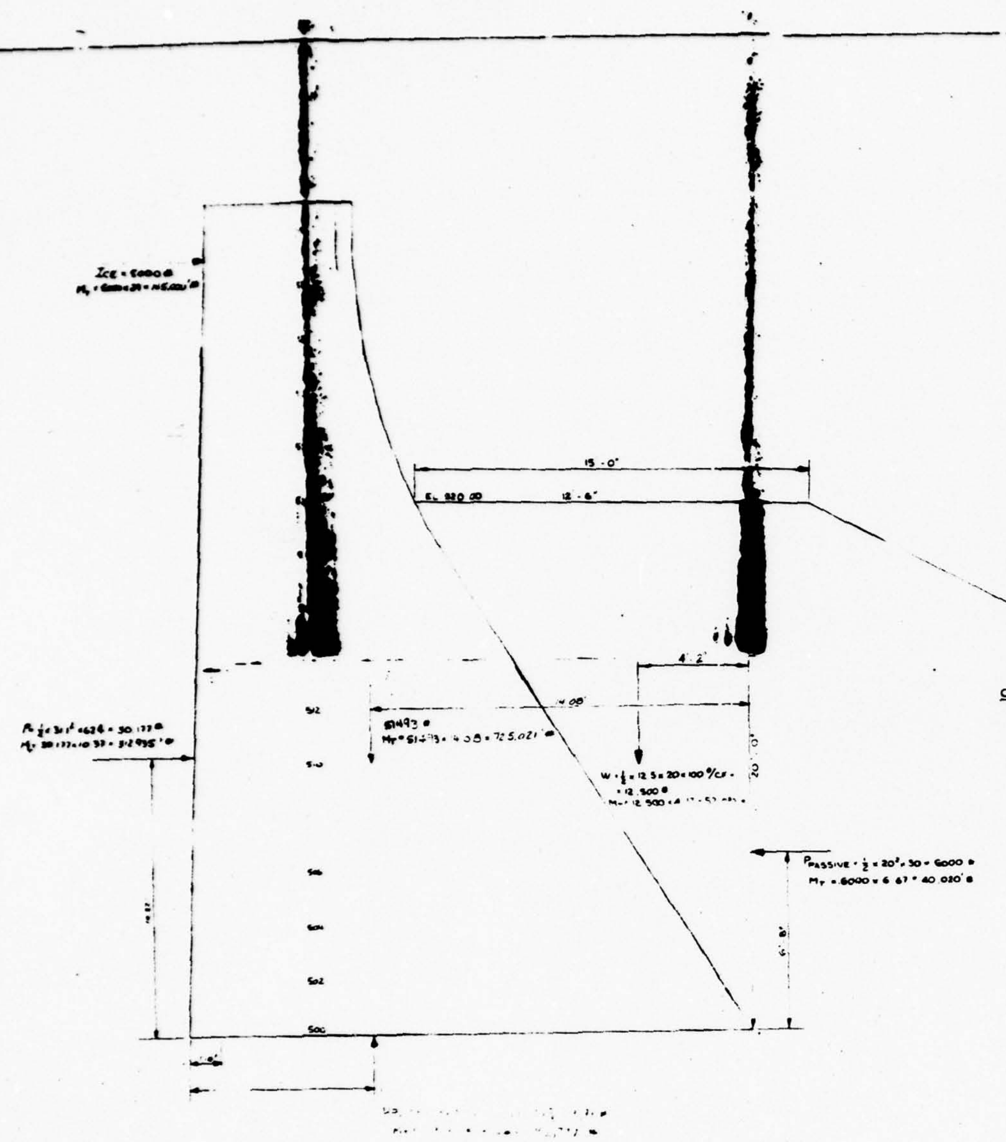
x = 384,[illegible] / 68,[illegible] = 5.83' from toe

SF = M_R / M_O = 1,0[illegible] / 650,712 = 1.59

MALCOLM PIRNIE, INC.	DEPARTMENT OF PUBLIC WORKS PEEKSKILL, NY — SOUTH WICCOPEE DAM	STABILITY ANALYSIS — SCALE 1/2" = 1'-0"

PRELIMINARY DRAWING — JULY 1976

FIGURE 9



CASE I NO BACKFILL

ΣM = 312,935 + 145,000 + 92,777 − 725,021 = 74,909 #

ΣV = 51,493 − 13,711 = 37,782'

$x = \Sigma M / \Sigma V$ = 1.47' from toe

$SF = M_{R\,OUT} / M_{OVERTURN} = \frac{725,021}{312,935 + 145,000 + 92,777} = \frac{725,021}{650,712} = \underline{1.11}$

CASE II - BACKFILL TO 520

a) NEGLECT PASSIVE PRESSURE

ΣM_T = 74,509 + 52,083 = 126,592' #

ΣV = 37,782 + 12,500 = 50,282 #

$x = \Sigma M / \Sigma V = \frac{126,592}{50,282} = \underline{2.51}'$ from toe

$SF = \frac{725,021 + 52,083}{650,712} = \frac{777,104}{650,712} = \underline{1.19}$

b) INCLUDE PASSIVE RESISTANCE @ 30 PCF

ΣM_T = 126,592 + 40,020 = 166,412 #

$x = \frac{166,412}{50,282} = \underline{3.31}'$ from toe

$SF = \frac{777,104 + 40,020}{650,712} = \underline{1.26}$

FIGURE 10

PRELIMINARY DRAWING

MALCOLM PIRNIE, INC.

REVISIONS

DEPARTMENT OF PUBLIC WORKS
PEEKSKILL, NY

SOUTH WICCOPEE DAM

STABILITY ANALYSIS

SCALE: ½" = 1'0"

DATE

SHEET — OF

DWG NO.

APPENDIX A

FIELD INSPECTION REPORT

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam SOUTH WICOPEE County PUTNAM State NEW YORK ID # NY 498

Type of Dam CONCRETE GRAVITY Hazard Category HIGH

Date(s) Inspection JULY 26, 1978 Weather CLOUDY Temperature 70^{0}

Pool Elevation at Time of Inspection 1'-11" below spillway M.S.L. Tailwater at Time of Inspection ----

Inspection Personnel:

NEAL F. DUNLEVY — DALE ENGINEERING COMPANY

F. W. BYSZEWSKI — DALE ENGINEERING COMPANY

D. F. MCCARTHY — DALE ENGINEERING COMPANY

RICHARD E. JACKSON, CITY OF PEEKSKILL, SUPT. OF WATER & SEWER

NEAL F. DUNLEVY Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	None observed.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No problem areas observed.	
DRAINS	None.	
WATER PASSAGES	None.	
FOUNDATION	No evidence of dam foundation material.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Repaired summer of 1976. Previously reported as containing severe cracks; repair of concrete noted. No problem areas observed.	
STRUCTURAL CRACKING	No evidence of cracking; was recently repaired in 1976.	
VERTICAL & HORIZONTAL ALIGNMENT	Good condition.	
MONOLITH JOINTS	None observed.	
CONSTRUCTION JOINTS	Joints observed.	Reportedly one of the three joints had to be grouted to repair leakage in 1975.
STAFF GAGE OF RECORDER	No gage.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	N/A	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	N/A	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	N/A	
VFRTICAL AND HORIZONTAL ALINEMENT OF THE CREST	N/A	
RIPRAP FAILURES	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	N/A	
ANY NOTICEABLE SEEPAGE	N/A	
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	Rock surface slightly worn. Right side undermined. Left side sediment and vegetative growth. Channel below bridge requires maintenance for debris removal.	
BRIDGE AND PIERS	Good condition.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	None.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	None.	
BRIDGE AND PIERS	None.	
GATES AND OPERATION EQUIPMENT	None.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None.	
INTAKE STRUCTURE	None. Pipe below dam.	
OUTLET STRUCTURE	Flow at location of outlet is submerged. Concrete headwall structure.	
OUTLET CHANNEL	Clear and unobstructed.	
EMERGENCY GATE	None.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Good condition.	
SLOPES	Variable - Gradient not significant.	
APPROXIMATE NO. OF HOMES AND POPULATION	Four homes within one mile to Tompkin Corners. Along Peekskill Hollow Road about twenty properties.	Nuisance flooding currently occurs along Peekskill Hollow Road in the spring of each year from Peekskill Hollow Creek. Wicopee Creek is tributary of Peekskill Hollow Creek.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No significant sloping of terrain into reservoir.	
SEDIMENTATION	None observed.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM Wicopee

ID # NY 498

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	See this report.
CONSTRUCTION HISTORY	None.
TYPICAL SECTIONS OF DAM	See this report.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See this report.
RAINFALL/RESERVOIR RECORDS	None.

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	SEE DAMS STABILITY ANALYSIS (THIS REPORT).
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Not known.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	See this report.
HIGH POOL RECORDS	Not known.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	See this report.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION: RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See this report.
OPERATING EQUIPMENT PLANS & DETAILS	None.

CHECK LIST
HYDROLOGIC & HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: ______

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 529

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 529

ELEVATION MAXIMUM DESIGN POOL: 531.1

ELEVATION TOP DAM: 531.1

CREST:

a. **Elevation** 529
b. **Type** Concrete weir
c. **Width** 3 feet
d. **Length** 49.5 feet
e. **Location Spillover** East End
f. **Number and Type of Gates** None

OUTLET WORKS: (Drawn down)

a. **Type** Two iron pipes (est. 24" ea.)
b. **Location** Center of dam
c. **Entrance Inverts** 498
d. **Exit Inverts** 498
e. **Emergency Draindown Facilities** No

HYDROMETEOROLOGICAL GATES:

a. **Type** --
b. **Location** --
c. **Records** --

MAXIMUM NON-DAMAGING DISCHARGE: --

APPENDIX B

PREVIOUS INSPECTION REPORTS

Put. Courier 3-5-75

Peekskill to repair Wicoppee Dam

PUTNAM VALLEY -- The two dams on Wicoppee Reservoir, located in Putnam Valley but are owned and maintained by the City of Peekskill, were inspected by Putnam Valley Town Supervisor J. Robert Houskeeper and Town Planner Joel Greenberg, Monday morning.

A crack located six inches above the level of the spillway, and approximately five feet long, was of paramount concern to local inhabitants and town officials when they learned about it ten days after it was discovered by Peekskill watershed guard T. Roberts.

After he had inspected it, Town Planner Greenberg said, "There was no other visual damage that he could ascertain." Peekskill has lowered the reservoir level to decrease pressure on the crack where water had been shooting out in a 50-foot stream.

The City of Peekskill has employed the firm of Malcolm Pirnie, Consulting Engineers of White Plains, to review both dams and submit an overall report of exact specifications to go out to bid in July.

The outer surface of the upper dam will be resurfaced with steel mesh and gunite, which is a concrete substance applied through a hose under pressure, and the walkway on top will also be repaired.

City Engineer Earl Potts said the five-foot crack in the lower dam, which is the immediate problem, will be repaired by the end of March, while the repairs on the upper dam, which are more extensive, will be made in September when the level of the reservoir can be let down.

During the summer brooks and streams dry up. The city depends upon the water from these reservoirs, but in the fall when the streams are again running high, work on the upper dam will begin.

Orden R d

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FROM COPY FURNISHED TO DDC

March 11, 1975

[illegible] F. Potts
[illegible]
[illegible] ill
[illegible]
[illegible] New York 10566

Re: Wiccopee Reservoir Dams
Town of Putnam Valley,
Putnam County

Dear Mr. Potts:

This office has been made aware of the City of Peekskill's intent to make repairs to the above dams. Please be advised that major repairs and reconstruction are regulated by this Department. In the case of minor repairs, the Department asks that it be notified, in writing, prior to start of work. I therefore request that you provide me with specific information regarding the nature and extent of the proposed work. We will further advise you of exact permit requirements on the basis of that information. Enclosed for your use are appropriate application forms and rules and regulations. Thank you.

Respectfully,

Ralph Manna, Jr.
Alternate Local Permit Agent
Environmental Analysis
Region 3

Enclosure

cc: S. [illegible] (w/enclosure)

[illegible]

B-2

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

IN REPLYING PLEASE REFER TO FILE NUMBER

No Reply

October 14th, 1913.

Mr. R. W. Sherman, Chief Engineer,

Conservation Commission.

Dear Sir:-

Concerning Dam No. 498 Lower Hudson Watershed, owned by the Peekskill Water Works, Water Supply Application No. 117:

I inspected this dam on October 9th, 1913, and found the concrete work finished according to the plans and apparently of good workmanship. The grading on the downstream side had not been quite finished nor the raceway entirely completed, and I suggested the filling in with earth on the upstream side on the east end of the dam. The contractors on this work are the Peekskill Construction Company, Antonio Renze, Manager, of Peekskill, N. Y.

Respectfully yours,

Alex Rice McKim

Inspector of Docks and [illegible].

McK/M.

B-3

Sept. 28, 1915.

Conservation Commission,

Albany, N. Y.

Gentlemen:-

Concerning Dam #498 Lower Hudson Watershed for the city of Peekskill.

I made my final inspection for this dam on August 12, 1915 and reported thereon August 16, 1915 as follows:

> "Dam #498 Lower Hudson. Final inspection for the Churchtown reservoir at Peekskill. Work all finished and apparently in good condition. On the west side, half-way down the slope, there was a small seepage from the ground 20 feet from the base of the dam downstream, due probably to insufficient backfill at this end of the dam. There was a bad odor from the water, due probably to algae. The concrete was hard and there were no cracks or leaks, but there were indications that there had been seepage through the dam, but in very small amounts."

Yours respectfully,

Inspector of Docks and Dams.

McK/C.

May

Peekskill Water Works,

Peekskill, N.Y.

Gentlemen:-

The two plans have been received for proposed dam at Wiccopee.

The drainage area of this dam would be about 2½ square miles, so that the spillway as marked 2 feet high by 30 feet wide would not be sufficient to pass the flood flow. The minimum width at any depth must be two-thirds of the depth below the highest water level, and the cut-off wall should be, on the upstream face, about 3 or 4 feet square, depending upon the character of the foundation bed, concerning which we know nothing as yet.

Very truly yours,

Conservation Commission,

By

Inspector of Docks and Dams.

McF/C.

APPENDIX C

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DESIGN BRIEF

DESIGNED BY: JPG DATE: 8-7-78
REVISED BY: PAGE: C-1 OF
PROJECT NO. 2210 SHORT TITLE: NY DAM INSPECTION
DESIGN SUBJECT: LOWER HUDSON WATER SUPPLY (PEEKSKILL) REF. DWGS.

WICCOPEE UPPER RESERVOIR

ESTIMATE OF CLARK'S PARAMETERS

ESTIMATE OF Tc (BPR)

$$Tc = (11.9\ L^3/H)^{.385} = (11.9(2.763)^3/435) = .578\ HR$$

SCS

$$L = \frac{l^{.8}(S+1)^{.7}}{1900\ Y^{.5}} = \frac{(14600)^{.8}(3.89+1)^{.7}}{1900(3.0)^{.5}} \qquad S = \frac{1000}{CN} - 10 = 3.89$$

$$= \frac{6516.26}{3290.90} = 1.98$$

$$Tc = L/.6 = 1.98/.6 = 3.30\ HR$$

NORTH ATLANTIC DIV WATER RESOURCES STUDY (FEB 72)

$$(Tc + R) = 10\ (a)\ (DA/S)^{.25}$$

$$= 10\ (1.75)(1.963/64)^{.25} = 7.323$$

$R/(Tc + R) = .36$ $Tc + R = 7.32$

$R/7.323 = .36$ $Tc = 7.32 - 2.63 = 4.69$

$R = 2.636$

DALE

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DESIGN BRIEF

DESIGNED BY: NFD | DATE: 8-8-78

CHECKED BY: | PAGE: C-2 OF

PROJECT NO.: 2210 | SHORT TITLE: NY DAM INSPECTIONS

MAIN SUBJECT: LOWER HUDSON WATER SUPPLY (PEEKSKILL) | REF. DWGS.

ESTIMATE OF SNYDER'S PARAMETERS

640 C_p =

$C_p = 0.625$ assumed

$C_T = 2.0$

$t_p = C_t\,(L \times L_{ca})^{0.3}$

$t_p = 2.0\,(2.76 \times 1.34)^{0.3}$

$t_p = 2.96$

$t_r = t_p/5.5 = 0.6$

$t_{pr} = t_p + 0.25\,(t_R - t_r)$

$t_{pr} = 2.96 + 0.25\,(1 - 0.6)$

$t_{pr} = 3.06$

SUMMARY OF PARAMETERS

CLARK'S			SNYDER'S
BPR	T_c = 0.6 hr		t_{pr} = 3.06
SCS (CN METHOD)	T_c = 3.3 hr	R = 2.72	C_p = 0.625
NORTH ATLANTIC DIV	T_c = 4.8 hr	R = 2.64	

$R/(T_c+R) = 0.36$

DALE

DESIGN BRIEF

DESIGNED BY NFD
DATE 8-8-78
CHECKED BY
PAGE C-3 OF
PROJECT NO. 2210 SHORT TITLE NY DAM INSPECTIONS
DESIGN SUBJECT LOWER HUDSON WATER SUPPLY (PEEKSKILL) REF. DWGS.

D-A-D RELATIONSHIP

DURATION	DEPTH	% OF INDEX
6 HR	25.8	107
12 HR	29.5	122
24 HR	32.9	137
48 HR	36.5	151
72 HR	38.3	159

INDEX RAINFALL

24.1 in.

BASE FLOW

2 cfs/sq.mi = 10 cfs

LOSS RATES

INITIAL LOSS = 1.0
CONSTANT LOSS = 0.1

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800

DESIGN BRIEF

PROJECT NAME NY DAM INSPECTION DATE 8-7-78

SUBJECT LOWER HUDSON WATER SUPPLY (PEEKSKILL) PROJECT NO. 2210

WICOPPEE - LOWER RESERVOIR DRAWN BY JPG

C-4

ESTIMATE OF CLARK'S PARAMETERS

ESTIMATE OF T_C

$$T_C = (11.9\ L^3/H)^{.385} = (11.9\ (3.902)^3/467) = 1.514\ HR$$

SCS

$$L = \frac{l^{.8}\ (S+1)^{.7}}{1900\ Y^{.5}} = \frac{(20600)^{.8}\ (3.89+1)^{.7}}{1900\ (23)^{.5}}$$

$$S = \frac{1000}{\overset{72}{CN}} - 10 = 3.89$$

$$= \frac{8582.424}{2881.493} = 2.978$$

$$T_C = L/.6 = 2.978/.6 = 4.964\ HR$$

NORTH ATLANTIC DIV WATER RESOURCES STUDY (FEB 72)

$$T_C + R = 10\ (C)\ (DA/S)^{.25}$$

$$= 10(1.78)(2.545/68)^{.25} = 7.697$$

$R/(T_C+R) = .36$

$R/(7.697) = .36$

$R = 2.771$

$2.771/(T_C + 2.771) = .36$

$2.771 = .36\ (T_C + 2.771)$

$2.771 = .36\ T_C + .998$

$4.93 = T_C$

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 **DESIGN BRIEF**

PROJECT NAME NY DAM INSPECTION DATE 8-2-78

SUBJECT LOWER HUDSON WATER SUPPLY (PEEKSKILL) PROJECT NO. 2210

WILCOPPEE - LOWER RESERVOIR DRAWN BY HED

C-5

ESTIMATE OF SNYDER'S PARAMETERS

640 C_p =

C_p = 0.625

C_t = 2.000

$t_p = C_t (L \times L_{ca})^{0.3}$

$t_p = 2.0 (1.14 \times 0.47)^{0.3}$

$t_p = 1.65$

$t_r = t_p / 5.5 = 0.3$

$t_{pr} = t_p + 0.25 (t_R - t_r)$

$= 1.65 + 0.25 (1 - .3)$

$= 1.82$

SUMMARY OF PARAMETERS

CLARK'S

BPR T_c = 1.52

SCS (CN METHOD) T_c = 4.6

NORTH ATLANTIC DIV T_c = 4.93 2.77

SNYDER'S

t_{pr} = 1.82

C_p = 0.625

$R/(T_c + R) = 0.36$

DESIGN BRIEF

DESIGNED BY NFD DATE 8-9-78
CHECKED BY
PAGE C-6 OF
PROJECT NO. SHORT TITLE
DESIGN SUBJECT REF. DWGS.

SUMMARY OF UNCOMP RUNS

UPPER WICCOPEE

					Peak Discharge
SPF	Clark's	Parameters	Tc 3.3	R 1.7	2366
"	Snyder's	"	3.86	2.42	2046
PMF	Clark's				4371
	Snyder's				3772

LOWER WICCOPEE

SPF	Clark's	Parameters	Tc 4.93	R 2.77	2356
"	Snyder's		2.53	092	3566
PMF	Clark's				575
"	Snyder's				496

```
--- OPERATIONS AVAILABLE ---

TIME INT = SET TIME INTERVAL OF ALL COMPUTATIONS
UNIT H   = COMPUTE UH BY INPUT, CLARK, OR SNYDER
RAIN     = INPUT RAIN AND LOSS RATE DATA
RUNOFF   = INPUT BASEFLOW, COMPUTE & PRINT HYDROGRAPH
PNT      = PRINT UNIT HYDROGRAPH ONLY
STOP     = STOP EXECUTION OF PROGRAM

USER MUST SELECT OPERATION DESIRED
MAY RETURN TO ANY OPERATION


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       1
ENTER TIME INTERVAL(MIN)=   60.


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       2
ENTER DRAINAGE AREA (SQMI) =        1.96
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )        2
ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE)=     0
ENTER CLARKS TC AND R (HRS) =        3.30       1.70

     TP       CP      TC       R

   2.64   0.691    3.30    1.70


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       3
ENTER RATIO  IMPERVIOUS =         0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )        2
ENTER SPS INDEX RAINFALL (IN) = 12.00
ENTER TRSPC AND TRSDA (SQMI) =          1.00       1.96
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =       1.00        0.10


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       3
ENTER RATIO  IMPERVIOUS =         0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )        2
ENTER SPS INDEX RAINFALL (IN) = 12.00
ENTER TRSPC AND TRSDA (SQMI) =          1.00       1.96
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =       1.00        0.10


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       4
ENTER A TITLE PLEASE -  U WICCOPEE SPF
ENTER STRTQ,QRCSN,AND RTIOR =       10.00    10.00      1.00

 HR MIN   RAIN   LOSS EXCESS   UNIT HG     RECSN     FLOW
  1   0   0.00   0.00   0.00       6?.       10.       10.
  2   0   0.00   0.00   0.00      225.       10.       10.
  3   0   0.00   0.00   0.00      331.       10.       10.
  4   0   0.00   0.00   0.00      282.       10.       10.
```

5	0	0.00	0.00	0.00	165.	10.	10.
6	0	0.00	0.00	0.00	90.	10.	10.
7	0	0.01	0.01	0.00	49.	10.	10.
8	0	0.01	0.01	0.00	27.	10.	10.
9	0	0.01	0.01	0.00	15.	10.	10.
10	0	0.01	0.01	0.00	8.	10.	10.
11	0	0.01	0.01	0.00	5.	10.	10.
12	0	0.01	0.01	0.00	3.	10.	10.
13	0	0.03	0.03	0.00		10.	10.
14	0	0.04	0.04	0.00		10.	10.
15	0	0.05	0.05	0.00		10.	10.
16	0	0.12	0.12	0.00		10.	10.
17	0	0.04	0.04	0.00		10.	10.
18	0	0.03	0.03	0.00		10.	10.
19	0	0.01	0.01	0.00		10.	10.
20	0	0.01	0.01	0.00		10.	10.
21	0	0.01	0.01	0.00		10.	10.
22	0	0.01	0.01	0.00		10.	10.
23	0	0.01	0.01	0.00		10.	10.
24	0	0.01	0.01	0.00		10.	10.
25	0	0.02	0.02	0.00		10.	10.
26	0	0.02	0.02	0.00		10.	10.
27	0	0.02	0.02	0.00		10.	10.
28	0	0.02	0.02	0.00		10.	10.
29	0	0.02	0.02	0.00		10.	10.
30	0	0.02	0.02	0.00		10.	10.
31	0	0.04	0.04	0.00		10.	10.
32	0	0.04	0.04	0.00		10.	10.
33	0	0.04	0.04	0.00		10.	10.
34	0	0.04	0.04	0.00		10.	10.
35	0	0.04	0.04	0.00		10.	10.
36	0	0.04	0.04	0.00		10.	10.
37	0	0.14	0.14	0.00		10.	10.
38	0	0.16	0.13	0.03		10.	12.
39	0	0.20	0.10	0.10		10.	24.
40	0	0.51	0.10	0.41		10.	70.
41	0	0.19	0.10	0.09		10.	150.
42	0	0.15	0.10	0.05		10.	203.
43	0	0.03	0.03	0.00		10.	186.
44	0	0.03	0.03	0.00		10.	130.
45	0	0.03	0.03	0.00		10.	82.
46	0	0.03	0.03	0.00		10.	50.
47	0	0.03	0.03	0.00		10.	32.
48	0	0.03	0.03	0.00		10.	22.
49	0	0.12	0.10	0.02		10.	18.
50	0	0.12	0.10	0.02		10.	20.
51	0	0.12	0.10	0.02		10.	25.
52	0	0.12	0.10	0.02		10.	29.
53	0	0.12	0.10	0.02		10.	32.
54	0	0.12	0.10	0.02		10.	33.
55	0	0.33	0.10	0.23		10.	48.
56	0	0.33	0.10	0.23		10.	96.
57	0	0.33	0.10	0.23		10.	166.
58	0	0.33	0.10	0.23		10.	225.
59	0	0.33	0.10	0.23		10.	260.
60	0	0.33	0.10	0.23		10.	279.

61	0	1.04	0.10	0.94		10.	338.
62	0	1.24	0.10	1.14		10.	517.
63	0	1.56	0.10	1.46		10.	822.
64	0	3.94	0.10	3.84		10.	1323.
65	0	1.45	0.10	1.35		10.	1969.
66	0	1.14	0.10	1.04		10.	2366.
67	0	0.20	0.10	0.10		10.	2183.
68	0	0.20	0.10	0.10		10.	1619.
69	0	0.20	0.10	0.10		10.	1056.
70	0	0.20	0.10	0.10		10.	650.
71	0	0.20	0.10	0.10		10.	419.
72	0	0.20	0.10	0.10		10.	293.
73	0	0.01	0.01	0.00		10.	216.
74	0	0.01	0.01	0.00		10.	154.
75	0	0.01	0.01	0.00		10.	99.
76	0	0.01	0.01	0.00		10.	54.
77	0	0.01	0.01	0.00		10.	32.
78	0	0.01	0.01	0.00		10.	21.
79	0	0.02	0.02	0.00		10.	16.
80	0	0.02	0.02	0.00		10.	13.
81	0	0.02	0.02	0.00		10.	12.
82	0	0.02	0.02	0.00		10.	11.
83	0	0.02	0.02	0.00		10.	10.
84	0	0.02	0.02	0.00		10.	10.
85	0	0.05	0.05	0.00		10.	10.
86	0	0.06	0.06	0.00		10.	10.
87	0	0.08	0.08	0.00		10.	10.
88	0	0.20	0.10	0.10		10.	17.
89	0	0.07	0.07	0.00		10.	32.
90	0	0.06	0.06	0.00		10.	43.
91	0	0.01	0.01	0.00		10.	38.
92	0	0.01	0.01	0.00		10.	27.
93	0	0.01	0.01	0.00		10.	19.
94	0	0.01	0.01	0.00		10.	15.
95	0	0.01	0.01	0.00		10.	13.
96	0	0.01	0.01	0.00		10.	12.
97	0					10.	11.
98	0					10.	10.
99	0					10.	10.
100	0					10.	10.
101	0					10.	10.
102	0					10.	10.
103	0					10.	10.
104	0					10.	10.
105	0					10.	10.
106	0					10.	10.
107	0					10.	10.
TOTAL		17.35	4.70	12.65	1269.	1070.	17120.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       1
ENTER TIME INTERVAL(MIN)=    60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       2
ENTER DRAINAGE AREA (SQMI) =        1.96
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )        3
ENTER SNYDERS CP AND TP (HRS) =              0.62        3.06
ENTER INITIAL EST. CLARKS TO R (HRS) (0=DEFAULT)=  0.00       0.00

      TP        CP        TC        R

     2.69     0.602     3.48     2.36
     2.85     0.598     3.74     2.26
     2.96     0.622     3.86     2.26
     3.04     0.641     3.86     2.31
     3.06     0.637     3.86     2.36
     3.07     0.634     3.86     2.39
     3.08     0.632     3.86     2.42
     3.08     0.630     3.86     2.42

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       3
ENTER RATIO  IMPERVIOUS =          0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )         2
ENTER SPS INDEX RAINFALL (IN) = 12.00
ENTER TRSPC AND TRSDA (SQMI) =              1.00        1.96
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =        1.00        0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       4
ENTER A TITLE PLEASE -   U WICCOFEE SFF
ENTER STRTQ,QRCSN,AND RTIOR =         10.00    10.00     1.00
```

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
1	0	0.00	0.00	0.00	40.	10.	10.
2	0	0.00	0.00	0.00	141.	10.	10.
3	0	0.00	0.00	0.00	237.	10.	10.
4	0	0.00	0.00	0.00	259.	10.	10.
5	0	0.00	0.00	0.00	203.	10.	10.
6	0	0.00	0.00	0.00	133.	10.	10.
7	0	0.01	0.01	0.00	88.	10.	10.
8	0	0.01	0.01	0.00	58.	10.	10.
9	0	0.01	0.01	0.00	38.	10.	10.
10	0	0.01	0.01	0.00	25.	10.	10.
11	0	0.01	0.01	0.00	17.	10.	10.
12	0	0.01	0.01	0.00	11.	10.	10.
13	0	0.03	0.03	0.00	8.	10.	10.
14	0	0.04	0.04	0.00	5.	10.	10.
15	0	0.05	0.05	0.00	4.	10.	10.
16	0	0.12	0.12	0.00	2.	10.	10.
17	0	0.04	0.04	0.00		10.	10.
18	0	0.03	0.03	0.00		10.	10.
19	0	0.01	0.01	0.00		10.	10.
20	0	0.01	0.01	0.00		10.	10.
21	0	0.01	0.01	0.00		10.	10.
22	0	0.01	0.01	0.00		10.	10.
23	0	0.01	0.01	0.00		10.	10.
24	0	0.01	0.01	0.00		10.	10.
25	0	0.02	0.02	0.00		10.	10.

26	0	0.02	0.02	0.00	10.	10.
27	0	0.02	0.02	0.00	10.	10.
28	0	0.02	0.02	0.00	10.	10.
29	0	0.02	0.02	0.00	10.	10.
30	0	0.02	0.02	0.00	10.	10.
31	0	0.04	0.04	0.00	10.	10.
32	0	0.04	0.04	0.00	10.	10.
33	0	0.04	0.04	0.00	10.	10.
34	0	0.04	0.04	0.00	10.	10.
35	0	0.04	0.04	0.00	10.	10.
36	0	0.04	0.04	0.00	10.	10.
37	0	0.14	0.14	0.00	10.	10.
38	0	0.16	0.13	0.03	10.	11.
39	0	0.20	0.10	0.10	10.	18.
40	0	0.51	0.10	0.41	10.	48.
41	0	0.19	0.10	0.09	10.	103.
42	0	0.15	0.10	0.05	10.	154.
43	0	0.03	0.03	0.00	10.	169.
44	0	0.03	0.03	0.00	10.	144.
45	0	0.03	0.03	0.00	10.	106.
46	0	0.03	0.03	0.00	10.	75.
47	0	0.03	0.03	0.00	10.	53.
48	0	0.03	0.03	0.00	10.	38.
49	0	0.12	0.10	0.02	10.	30.
50	0	0.12	0.10	0.02	10.	26.
51	0	0.12	0.10	0.02	10.	27.
52	0	0.12	0.10	0.02	10.	29.
53	0	0.12	0.10	0.02	10.	31.
54	0	0.12	0.10	0.02	10.	33.
55	0	0.33	0.10	0.23	10.	42.
56	0	0.33	0.10	0.23	10.	72.
57	0	0.33	0.10	0.23	10.	122.
58	0	0.33	0.10	0.23	10.	177.
59	0	0.33	0.10	0.23	10.	220.
60	0	0.33	0.10	0.23	10.	248.
61	0	1.04	0.10	0.94	10.	295.
62	0	1.24	0.10	1.14	10.	416.
63	0	1.56	0.10	1.46	10.	634.
64	0	3.94	0.10	3.84	10.	1012.
65	0	1.45	0.10	1.35	10.	1523.
66	0	1.14	0.10	1.04	10.	1943.
67	0	0.20	0.10	0.10	10.	2042.
68	0	0.20	0.10	0.10	10.	1776.
69	0	0.20	0.10	0.10	10.	1353.
70	0	0.20	0.10	0.10	10.	968.
71	0	0.20	0.10	0.10	10.	685.
72	0	0.20	0.10	0.10	10.	498.
73	0	0.01	0.01	0.00	10.	372.
74	0	0.01	0.01	0.00	10.	277.
75	0	0.01	0.01	0.00	10.	201.
76	0	0.01	0.01	0.00	10.	140.
77	0	0.01	0.01	0.00	10.	95.
78	0	0.01	0.01	0.00	10.	66.
79	0	0.02	0.02	0.00	10.	45.
80	0	0.02	0.02	0.00	10.	27.
81	0	0.02	0.02	0.00	10.	20.
82	0	0.02	0.02	0.00	10.	15.
83	0	0.02	0.02	0.00	10.	13.
84	0	0.02	0.02	0.00	10.	12.

85	0	0.05	0.05	0.00		10.	11.
86	0	0.06	0.06	0.00		10.	11.
87	0	0.08	0.08	0.00		10.	10.
88	0	0.20	0.10	0.10		10.	14.
89	0	0.07	0.07	0.00		10.	24.
90	0	0.06	0.06	0.00		10.	34.
91	0	0.01	0.01	0.00		10.	36.
92	0	0.01	0.01	0.00		10.	30.
93	0	0.01	0.01	0.00		10.	23.
94	0	0.01	0.01	0.00		10.	19.
95	0	0.01	0.01	0.00		10.	16.
96	0	0.01	0.01	0.00		10.	14.
97	0					10.	13.
98	0					10.	12.
99	0					10.	11.
100	0					10.	11.
101	0					10.	11.
102	0					10.	10.
103	0					10.	10.
104	0					10.	10.
105	0					10.	10.
106	0					10.	10.
107	0					10.	10.
108	0					10.	10.
109	0					10.	10.
110	0					10.	10.
111	0					10.	10.
TOTAL		17.35	4.70	12.65	1270.	1110.	17173.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =        1.96
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )        2
ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE)=      0
ENTER CLARKS TC AND R (HRS) =         3.30       1.70

       TP       CP       TC       R

    2.64    0.691    3.30    1.70


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      3
ENTER RATIO  IMPERVIOUS =         0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )       3
ENTER PMS INDEX RAINFALL (IN) = 24.00
ENTER R6,R12,R24,R48,R72,R96 =    107.00  122.00  137.00  151.00  159.00
ENTER TRSPC AND TRSDA (SQMI) =           0.00       1.96
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =      1.00       0.10


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -  U WICCOPEE PMF
ENTER STRTQ,QRCSN,AND RTIOR =       10.00   10.00     1.00
```

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
1	0	0.02	0.02	0.00	68.	10.	10.
2	0	0.02	0.02	0.00	225.	10.	10.
3	0	0.02	0.02	0.00	331.	10.	10.
4	0	0.02	0.02	0.00	282.	10.	10.
5	0	0.02	0.02	0.00	165.	10.	10.
6	0	0.02	0.02	0.00	90.	10.	10.
7	0	0.04	0.04	0.00	49.	10.	10.
8	0	0.04	0.04	0.00	27.	10.	10.
9	0	0.04	0.04	0.00	15.	10.	10.
10	0	0.04	0.04	0.00	8.	10.	10.
11	0	0.04	0.04	0.00	5.	10.	10.
12	0	0.04	0.04	0.00	3.	10.	10.
13	0	0.19	0.19	0.00		10.	10.
14	0	0.23	0.23	0.00		10.	10.
15	0	0.29	0.24	0.05		10.	13.
16	0	0.73	0.10	0.63		10.	64.
17	0	0.27	0.10	0.17		10.	180.
18	0	0.21	0.10	0.11		10.	279.
19	0	0.03	0.03	0.00		10.	277.
20	0	0.03	0.03	0.00		10.	203.
21	0	0.03	0.03	0.00		10.	128.
22	0	0.03	0.03	0.00		10.	76.
23	0	0.03	0.03	0.00		10.	46.
24	0	0.03	0.03	0.00		10.	30.
25	0	0.18	0.10	0.08		10.	27.
26	0	0.18	0.10	0.08		10.	40.
27	0	0.18	0.10	0.08		10.	63.
28	0	0.18	0.10	0.08		10.	83.
29	0	0.18	0.10	0.08		10.	96.
30	0	0.18	0.10	0.08		10.	103.

31	0	0.44	0.10	0.34		10.	124.
32	0	0.44	0.10	0.34		10.	185.
33	0	0.44	0.10	0.34		10.	272.
34	0	0.44	0.10	0.34		10.	346.
35	0	0.44	0.10	0.34		10.	390.
36	0	0.44	0.10	0.34		10.	413.
37	0	1.88	0.10	1.78		10.	524.
38	0	2.26	0.10	2.16		10.	880.
39	0	2.82	0.10	2.72		10.	1485.
40	0	7.15	0.10	7.05		10.	2439.
41	0	2.64	0.10	2.54		10.	3637.
42	0	2.07	0.10	1.97		10.	4371.
43	0	0.26	0.10	0.16		10.	4043.
44	0	0.26	0.10	0.16		10.	3000.
45	0	0.26	0.10	0.16		10.	1946.
46	0	0.26	0.10	0.16		10.	1182.
47	0	0.26	0.10	0.16		10.	745.
48	0	0.26	0.10	0.16		10.	507.
49	0	0.01	0.01	0.00		10.	363.
50	0	0.01	0.01	0.00		10.	254.
51	0	0.01	0.01	0.00		10.	160.
52	0	0.01	0.01	0.00		10.	84.
53	0	0.01	0.01	0.00		10.	47.
54	0	0.01	0.01	0.00		10.	27.
55	0	0.03	0.03	0.00		10.	19.
56	0	0.03	0.03	0.00		10.	15.
57	0	0.03	0.03	0.00		10.	13.
58	0	0.03	0.03	0.00		10.	11.
59	0	0.03	0.03	0.00		10.	10.
60	0	0.03	0.03	0.00		10.	10.
61	0	0.11	0.10	0.01		10.	11.
62	0	0.13	0.10	0.03		10.	14.
63	0	0.16	0.10	0.06		10.	24.
64	0	0.42	0.10	0.32		10.	58.
65	0	0.15	0.10	0.05		10.	115.
66	0	0.12	0.10	0.02		10.	151.
67	0	0.02	0.02	0.00		10.	134.
68	0	0.02	0.02	0.00		10.	91.
69	0	0.02	0.02	0.00		10.	57.
70	0	0.02	0.02	0.00		10.	36.
71	0	0.02	0.02	0.00		10.	24.
72	0	0.02	0.02	0.00		10.	18.
73	0					10.	14.
74	0					10.	12.
75	0					10.	11.
76	0					10.	10.
77	0					10.	10.
78	0					10.	10.
79	0					10.	10.
80	0					10.	10.
81	0					10.	10.
82	0					10.	10.
83	0					10.	10.
TOTAL		28.01	4.86	23.15	1269.	830.	30202.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =       1.96
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )       3
ENTER SNYDERS CP AND TP (HRS) =          0.62       3.06
ENTER INITIAL EST. CLARKS TC & (HRS) (0=DEFAULT)=  0.00      0.00

      TP        CP        TC        R

     2.69     0.602     3.48      2.36
     2.85     0.598     3.74      2.26
     2.96     0.622     3.86      2.26
     3.04     0.641     3.86      2.31
     3.06     0.637     3.86      2.36
     3.07     0.634     3.86      2.39
     3.08     0.632     3.86      2.42
     3.08     0.630     3.86      2.42


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -
```

```
--- OPERATIONS AVAILABLE ---

TIME INT = SET TIME INTERVAL OF ALL COMPUTATIONS
UNIT H   = COMPUTE UH BY INPUT, CLARK, OR SNYDER
RAIN     = INPUT RAIN AND LOSS RATE DATA
RUNOFF   = INPUT BASEFLOW, COMPUTE & PRINT HYDROGRAPH
PNT      = PRINT UNIT HYDROGRAPH ONLY
STOP     = STOP EXECUTION OF PROGRAM

USER MUST SELECT OPERATION DESIRED
MAY RETURN TO ANY OPERATION


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =       1.96
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )         3
ENTER SNYDERS CP AND TP (HRS) =          0.62        3.06
ENTER INITIAL EST. CLARKS TO & (HRS) (0=DEFAULT)=  0.00        0.00

       TP        CP        TC        R

     2.69     0.602      3.48      2.36
     2.85     0.598      3.74      2.26
     2.96     0.622      3.86      2.26
     3.04     0.641      3.86      2.31
     3.06     0.637      3.86      2.36
     3.07     0.634      3.86      2.39
     3.08     0.632      3.86      2.42
     3.08     0.630      3.86      2.42

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      3
ENTER RATIO  IMPERVIOUS =         0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )         3
ENTER PMS INDEX RAINFALL (IN) = 24.00
ENTER R6,R12,R24,R48,R72,R96 =     107.00  122.00  137.00  151.00  159.00
ENTER TRSPC AND TRSDA (SQMI) =          0.00        1.96
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =       1.00        0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -  U WICCOPEE PMF
ENTER STRTQ,QRCSN,AND RTIOR =       10.00    10.00     1.00

 HR MIN  RAIN  LOSS EXCESS  UNIT HG    RECSN     FLOW
  1   0  0.02  0.02  0.00       40.      10.      10.
  2   0  0.02  0.02  0.00      141.      10.      10.
  3   0  0.02  0.02  0.00      237.      10.      10.
  4   0  0.02  0.02  0.00      259.      10.      10.
  5   0  0.02  0.02  0.00      203.      10.      10.
```

6	0	0.02	0.02	0.00	133.	10.	10.
7	0	0.04	0.04	0.00	88.	10.	10.
8	0	0.04	0.04	0.00	58.	10.	10.
9	0	0.04	0.04	0.00	38.	10.	10.
10	0	0.04	0.04	0.00	25.	10.	10.
11	0	0.04	0.04	0.00	17.	10.	10.
12	0	0.04	0.04	0.00	11.	10.	10.
13	0	0.19	0.19	0.00	8.	10.	10.
14	0	0.23	0.23	0.00	5.	10.	10.
15	0	0.29	0.24	0.05	4.	10.	12.
16	0	0.73	0.10	0.63	2.	10.	43.
17	0	0.27	0.10	0.17		10.	118.
18	0	0.21	0.10	0.11		10.	201.
19	0	0.03	0.03	0.00		10.	239.
20	0	0.03	0.03	0.00		10.	214.
21	0	0.03	0.03	0.00		10.	161.
22	0	0.03	0.03	0.00		10.	113.
23	0	0.03	0.03	0.00		10.	78.
24	0	0.03	0.03	0.00		10.	55.
25	0	0.18	0.10	0.08		10.	43.
26	0	0.18	0.10	0.08		10.	44.
27	0	0.18	0.10	0.08		10.	57.
28	0	0.18	0.10	0.08		10.	73.
29	0	0.18	0.10	0.08		10.	86.
30	0	0.18	0.10	0.08		10.	95.
31	0	0.44	0.10	0.34		10.	111.
32	0	0.44	0.10	0.34		10.	151.
33	0	0.44	0.10	0.34		10.	215.
34	0	0.44	0.10	0.34		10.	284.
35	0	0.44	0.10	0.34		10.	338.
36	0	0.44	0.10	0.34		10.	374.
37	0	1.88	0.10	1.78		10.	455.
38	0	2.26	0.10	2.16		10.	690.
39	0	2.82	0.10	2.72		10.	1118.
40	0	7.15	0.10	7.05		10.	1842.
41	0	2.64	0.10	2.54		10.	2799.
42	0	2.07	0.10	1.97		10.	3583.
43	0	0.26	0.10	0.16		10.	3772.
44	0	0.26	0.10	0.16		10.	3284.
45	0	0.26	0.10	0.16		10.	2497.
46	0	0.26	0.10	0.16		10.	1776.
47	0	0.26	0.10	0.16		10.	1243.
48	0	0.26	0.10	0.16		10.	893.
49	0	0.01	0.01	0.00		10.	656.
50	0	0.01	0.01	0.00		10.	482.
51	0	0.01	0.01	0.00		10.	345.
52	0	0.01	0.01	0.00		10.	238.
53	0	0.01	0.01	0.00		10.	160.
54	0	0.01	0.01	0.00		10.	108.
55	0	0.03	0.03	0.00		10.	72.
56	0	0.03	0.03	0.00		10.	40.
57	0	0.03	0.03	0.00		10.	26.
58	0	0.03	0.03	0.00		10.	17.
59	0	0.03	0.03	0.00		10.	15.
60	0	0.03	0.03	0.00		10.	13.

61	0	0.11	0.10	0.01		10.	12.
62	0	0.13	0.10	0.03		10.	14.
63	0	0.16	0.10	0.06		10.	19.
64	0	0.42	0.10	0.32		10.	41.
65	0	0.15	0.10	0.05		10.	81.
66	0	0.12	0.10	0.02		10.	117.
67	0	0.02	0.02	0.00		10.	125.
68	0	0.02	0.02	0.00		10.	104.
69	0	0.02	0.02	0.00		10.	75.
70	0	0.02	0.02	0.00		10.	54.
71	0	0.[illegible]	0.02	0.00		10.	39.
72	0	0.02	0.02	0.00		10.	29.
73	0					10.	23.
74	0					10.	18.
75	0					10.	16.
76	0					10.	14.
77	0					10.	13.
78	0					10.	12.
79	0					10.	11.
80	0					10.	10.
81	0					10.	10.
82	0					10.	10.
83	0					10.	10.
84	0					10.	10.
85	0					10.	10.
86	0					10.	10.
87	0					10.	10.
TOTAL		28.01	4.86	23.15	1270.	870.	30266.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =      2.54
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )      2
ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE)=    0
ENTER CLARKS TC AND R (HRS) =       4.93      2.77

      TP       CP       TC       R

    3.95    0.673     4.93     2.77

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      3
ENTER RATIO  IMPERVIOUS =        0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )      2
ENTER SPS INDEX RAINFALL (IN) = 12.00
ENTER TRSPC AND TRSDA (SQMI) =          1.00      2.54
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)      1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =      1.00      0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -   L WICOPEE SPF
ENTER STRTQ,QRCSN,AND RTIOR =         5.00     5.00     1.00
```

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
1	0	0.00	0.00	0.00	32.	5.	5.
2	0	0.00	0.00	0.00	115.	5.	5.
3	0	0.00	0.00	0.00	211.	5.	5.
4	0	0.00	0.00	0.00	277.	5.	5.
5	0	0.00	0.00	0.00	279.	5.	5.
6	0	0.00	0.00	0.00	223.	5.	5.
7	0	0.01	0.01	0.00	155.	5.	5.
8	0	0.01	0.01	0.00	108.	5.	5.
9	0	0.01	0.01	0.00	75.	5.	5.
10	0	0.01	0.01	0.00	52.	5.	5.
11	0	0.01	0.01	0.00	36.	5.	5.
12	0	0.01	0.01	0.00	25.	5.	5.
13	0	0.03	0.03	0.00	18.	5.	5.
14	0	0.04	0.04	0.00	13.	5.	5.
15	0	0.05	0.05	0.00	9.	5.	5.
16	0	0.12	0.12	0.00	6.	5.	5.
17	0	0.04	0.04	0.00	5.	5.	5.
18	0	0.03	0.03	0.00	3.	5.	5.
19	0	0.01	0.01	0.00	2.	5.	5.
20	0	0.01	0.01	0.00		5.	5.
21	0	0.01	0.01	0.00		5.	5.
22	0	0.01	0.01	0.00		5.	5.
23	0	0.01	0.01	0.00		5.	5.
24	0	0.01	0.01	0.00		5.	5.
25	0	0.02	0.02	0.00		5.	5.
26	0	0.02	0.02	0.00		5.	5.
27	0	0.02	0.02	0.00		5.	5.
28	0	0.02	0.02	0.00		5.	5.
29	0	0.02	0.02	0.00		5.	5.
30	0	0.02	0.02	0.00		5.	5.

31	0	0.04	0.04	0.00	5.	5.
32	0	0.04	0.04	0.00	5.	5.
33	0	0.04	0.04	0.00	5.	5.
34	0	0.04	0.04	0.00	5.	5.
35	0	0.04	0.04	0.00	5.	5.
36	0	0.04	0.04	0.00	5.	5.
37	0	0.14	0.14	0.00	5.	5.
38	0	0.16	0.13	0.03	5.	6.
39	0	0.20	0.10	0.10	5.	12.
40	0	0.51	0.10	0.41	5.	36.
41	0	0.19	0.10	0.09	5.	84.
42	0	0.15	0.10	0.05	5.	140.
43	0	0.03	0.03	0.00	5.	178.
44	0	0.03	0.03	0.00	5.	182.
45	0	0.03	0.03	0.00	5.	154.
46	0	0.03	0.03	0.00	5.	116.
47	0	0.03	0.03	0.00	5.	83.
48	0	0.03	0.03	0.00	5.	60.
49	0	0.12	0.10	0.02	5.	44.
50	0	0.12	0.10	0.02	5.	34.
51	0	0.12	0.10	0.02	5.	31.
52	0	0.12	0.10	0.02	5.	31.
53	0	0.12	0.10	0.02	5.	32.
54	0	0.12	0.10	0.02	5.	34.
55	0	0.33	0.10	0.23	5.	42.
56	0	0.33	0.10	0.23	5.	67.
57	0	0.33	0.10	0.23	5.	112.
58	0	0.33	0.10	0.23	5.	171.
59	0	0.33	0.10	0.23	5.	229.
60	0	0.33	0.10	0.23	5.	276.
61	0	1.04	0.10	0.94	5.	332.
62	0	1.24	0.10	1.14	5.	443.
63	0	1.55	0.10	1.45	5.	642.
64	0	3.94	0.10	3.84	5.	1005.
65	0	1.45	0.10	1.35	5.	1525.
66	0	1.14	0.10	1.04	5.	2041.
67	0	0.20	0.10	0.10	5.	2356.
68	0	0.20	0.10	0.10	5.	2340.
69	0	0.20	0.10	0.10	5.	2018.
70	0	0.20	0.10	0.10	5.	1572.
71	0	0.20	0.10	0.10	5.	1172.
72	0	0.20	0.10	0.10	5.	867.
73	0	0.01	0.01	0.00	5.	652.
74	0	0.01	0.01	0.00	5.	494.
75	0	0.01	0.01	0.00	5.	370.
76	0	0.01	0.01	0.00	5.	271.
77	0	0.01	0.01	0.00	5.	194.
78	0	0.01	0.01	0.00	5.	137.
79	0	0.02	0.02	0.00	5.	98.
80	0	0.02	0.02	0.00	5.	70.
81	0	0.02	0.02	0.00	5.	49.
82	0	0.02	0.02	0.00	5.	34.
83	0	0.02	0.02	0.00	5.	19.
84	0	0.02	0.02	0.00	5.	13.
85	0	0.05	0.05	0.00	5.	9.
86	0	0.06	0.06	0.00	5.	6.
87	0	0.08	0.08	0.00	5.	7.

88	0	0.20	0.10	0.10		5.	9.
89	0	0.07	0.07	0.00		5.	17.
90	0	0.06	0.06	0.00		5.	26.
91	0	0.01	0.01	0.00		5.	33.
92	0	0.01	0.01	0.00		5.	33.
93	0	0.01	0.01	0.00		5.	27.
94	0	0.01	0.01	0.00		5.	21.
95	0	0.01	0.01	0.00		5.	16.
96	0	0.01	0.01	0.00		5.	13.
97	0					5.	10.
98	0					5.	9.
99	0					5.	8.
100	0					5.	7.
101	0					5.	6.
102	0					5.	6.
103	0					5.	6.
104	0					5.	5.
105	0					5.	5.
106	0					5.	5.
107	0					5.	5.
108	0					5.	5.
109	0					5.	5.
110	0					5.	5.
111	0					5.	5.
112	0					5.	5.
113	0					5.	5.
114	0					5.	5.
TOTAL		17.34	4.70	12.64	1646.	570.	21377.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =        2.54
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )      3
ENTER SNYDERS CP AND TP (HRS) =         0.62       1.82
ENTER INITIAL EST. CLARKS TO & (HRS) (0=DEFAULT)=  0.00       0.00

     TP       CP       TC       R

    1.67    0.546     1.99     1.27
    1.69    0.583     2.14     1.19
    1.73    0.596     2.25     1.13
    1.76    0.599     2.33     1.08
    1.78    0.601     2.39     1.04
    1.79    0.604     2.43     1.01
    1.79    0.607     2.47     0.98
    1.80    0.610     2.49     0.96
    1.80    0.612     2.49     0.94
    1.80    0.616     2.53     0.92
CP OR TP POSSIBLY NOT SATISFIED

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      3
ENTER RATIO  IMPERVIOUS =        0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )       2
ENTER SPS INDEX RAINFALL (IN) = 12.00
ENTER TRSPC AND TRSDA (SQMI) =           1.00       2.54
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)       1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =      1.00       0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -   L WICCOPEE SPF
ENTER STRTQ,QRCSN,AND RTIOR =        5.00      5.00      1.00

 HR MIN   RAIN   LOSS  EXCESS   UNIT HG    RECSN     FLOW
  1   0   0.00   0.00   0.00     205.        5.        5.
  2   0   0.00   0.00   0.00     563.        5.        5.
  3   0   0.00   0.00   0.00     538.        5.        5.
  4   0   0.00   0.00   0.00     235.        5.        5.
  5   0   0.00   0.00   0.00      72.        5.        5.
  6   0   0.00   0.00   0.00      22.        5.        5.
  7   0   0.01   0.01   0.00       7.        5.        5.
  8   0   0.01   0.01   0.00       2.        5.        5.
  9   0   0.01   0.01   0.00                 5.        5.
 10   0   0.01   0.01   0.00                 5.        5.
 11   0   0.01   0.01   0.00                 5.        5.
 12   0   0.01   0.01   0.00                 5.        5.
 13   0   0.03   0.03   0.00                 5.        5.
 14   0   0.04   0.04   0.00                 5.        5.
 15   0   0.05   0.05   0.00                 5.        5.
```

16	0	0.12	0.12	0.00	5.	5.
17	0	0.04	0.04	0.00	5.	5.
18	0	0.03	0.03	0.00	5.	5.
19	0	0.01	0.01	0.00	5.	5.
20	0	0.01	0.01	0.00	5.	5.
21	0	0.01	0.01	0.00	5.	5.
22	0	0.01	0.01	0.00	5.	5.
23	0	0.01	0.01	0.00	5.	5.
24	0	0.01	0.01	0.00	5.	5.
25	0	0.02	0.02	0.00	5.	5.
26	0	0.02	0.02	0.00	5.	5.
27	0	0.02	0.02	0.00	5.	5.
28	0	0.02	0.02	0.00	5.	5.
29	0	0.02	0.02	0.00	5.	5.
30	0	0.02	0.02	0.00	5.	5.
31	0	0.04	0.04	0.00	5.	5.
32	0	0.04	0.04	0.00	5.	5.
33	0	0.04	0.04	0.00	5.	5.
34	0	0.04	0.04	0.00	5.	5.
35	0	0.04	0.04	0.00	5.	5.
36	0	0.04	0.04	0.00	5.	5.
37	0	0.14	0.14	0.00	5.	5.
38	0	0.16	0.13	0.03	5.	11.
39	0	0.20	0.10	0.10	5.	42.
40	0	0.51	0.10	0.41	5.	162.
41	0	0.19	0.10	0.09	5.	315.
42	0	0.15	0.10	0.05	5.	312.
43	0	0.03	0.03	0.00	5.	186.
44	0	0.03	0.03	0.00	5.	85.
45	0	0.03	0.03	0.00	5.	33.
46	0	0.03	0.03	0.00	5.	14.
47	0	0.03	0.03	0.00	5.	8.
48	0	0.03	0.03	0.00	5.	6.
49	0	0.12	0.10	0.02	5.	9.
50	0	0.12	0.10	0.02	5.	20.
51	0	0.12	0.10	0.02	5.	31.
52	0	0.12	0.10	0.02	5.	36.
53	0	0.12	0.10	0.02	5.	37.
54	0	0.12	0.10	0.02	5.	38.
55	0	0.33	0.10	0.23	5.	81.
56	0	0.33	0.10	0.23	5.	199.
57	0	0.33	0.10	0.23	5.	312.
58	0	0.33	0.10	0.23	5.	361.
59	0	0.33	0.10	0.23	5.	376.
60	0	0.33	0.10	0.23	5.	381.
61	0	1.04	0.10	0.94	5.	528.
62	0	1.24	0.10	1.14	5.	970.
63	0	1.55	0.10	1.45	5.	1527.
64	0	3.94	0.10	3.84	5.	2467.
65	0	1.45	0.10	1.35	5.	3566.
66	0	1.14	0.10	1.04	5.	3488.
67	0	0.20	0.10	0.10	5.	2376.
68	0	0.20	0.10	0.10	5.	1276.
69	0	0.20	0.10	0.10	5.	575.
70	0	0.20	0.10	0.10	5.	294.
71	0	0.20	0.10	0.10	5.	208.
72	0	0.20	0.10	0.10	5.	179.
73	0	0.01	0.01	0.00	5.	151.
74	0	0.01	0.01	0.00	5.	93.
75	0	0.01	0.01	0.00	5.	39.

76	0	0.01	0.01	0.00		5.	15.
77	0	0.01	0.01	0.00		5.	8.
78	0	0.01	0.01	0.00		5.	6.
79	0	0.02	0.02	0.00		5.	5.
80	0	0.02	0.02	0.00		5.	5.
81	0	0.02	0.02	0.00		5.	5.
82	0	0.02	0.02	0.00		5.	5.
83	0	0.02	0.02	0.00		5.	5.
84	0	0.02	0.02	0.00		5.	5.
85	0	0.05	0.05	0.00		5.	5.
86	0	0.06	0.06	0.00		5.	5.
87	0	0.08	0.08	0.00		5.	5.
88	0	0.20	0.10	0.10		5.	26.
89	0	0.07	0.07	0.00		5.	61.
90	0	0.06	0.06	0.00		5.	59.
91	0	0.01	0.01	0.00		5.	28.
92	0	0.01	0.01	0.00		5.	12.
93	0	0.01	0.01	0.00		5.	7.
94	0	0.01	0.01	0.00		5.	6.
95	0	0.01	0.01	0.00		5.	5.
96	0	0.01	0.01	0.00		5.	5.
97	0					5.	5.
98	0					5.	5.
99	0					5.	5.
100	0					5.	5.
101	0					5.	5.
102	0					5.	5.
103	0					5.	5.
TOTAL		17.34	4.70	12.64	1644.	515.	21297.

```
--- OPERATIONS AVAILABLE ---

TIME INT = SET TIME INTERVAL OF ALL COMPUTATIONS
UNIT H   = COMPUTE UH BY INPUT, CLARK, OR SNYDER
RAIN     = INPUT RAIN AND LOSS RATE DATA
RUNOFF   = INPUT BASEFLOW, COMPUTE & PRINT HYDROGRAPH
PNT      = PRINT UNIT HYDROGRAPH ONLY
STOP     = STOP EXECUTION OF PROGRAM

USER MUST SELECT OPERATION DESIRED
MAY RETURN TO ANY OPERATION


SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      1
ENTER TIME INTERVAL(MIN)=   60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      2
ENTER DRAINAGE AREA (SQMI) =       2.54
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )        2
ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE)=     0
ENTER CLARKS TC AND R (HRS) =        3.30       1.70

       TP        CP        TC        R

     2.64     0.690     3.30      1.70

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      3
ENTER RATIO  IMPERVIOUS =         0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )        3
ENTER PMS INDEX RAINFALL (IN) = 24.00
ENTER R6,R12,R24,R48,R72,R96 =     107.00   122.00   137.00   151.00   159.00
ENTER TRSPC AND TRSDA (SQMI) =          0.00        2.54
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)        1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =      1.00       0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)      4
ENTER A TITLE PLEASE -   L WICCOPEE PMF
ENTER STRTQ,QRCSN,AND RTIOR =        5.00      5.00      1.00
```

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
1	0	0.02	0.02	0.00	88.	5.	5.
2	0	0.02	0.02	0.00	291.	5.	5.
3	0	0.02	0.02	0.00	430.	5.	5.
4	0	0.02	0.02	0.00	365.	5.	5.
5	0	0.02	0.02	0.00	214.	5.	5.
6	0	0.02	0.02	0.00	117.	5.	5.
7	0	0.05	0.05	0.00	64.	5.	5.
8	0	0.05	0.05	0.00	35.	5.	5.
9	0	0.05	0.05	0.00	19.	5.	5.
10	0	0.05	0.05	0.00	11.	5.	5.
11	0	0.05	0.05	0.00	6.	5.	5.
12	0	0.05	0.05	0.00	4.	5.	5.

13	0	0.20	0.20	0.00	5.	5.
14	0	0.23	0.23	0.00	5.	5.
15	0	0.29	0.20	0.09	5.	13.
16	0	0.74	0.10	0.64	5.	88.
17	0	0.27	0.10	0.17	5.	245.
18	0	0.22	0.10	0.12	5.	373.
19	0	0.03	0.03	0.00	5.	366.
20	0	0.03	0.03	0.00	5.	266.
21	0	0.03	0.03	0.00	5.	166.
22	0	0.03	0.03	0.00	5.	95.
23	0	0.03	0.03	0.00	5.	54.
24	0	0.03	0.03	0.00	5.	32.
25	0	0.18	0.10	0.08	5.	27.
26	0	0.18	0.10	0.08	5.	44.
27	0	0.18	0.10	0.08	5.	74.
28	0	0.18	0.10	0.08	5.	100.
29	0	0.18	0.10	0.08	5.	116.
30	0	0.18	0.10	0.08	5.	125.
31	0	0.45	0.10	0.35	5.	154.
32	0	0.45	0.10	0.35	5.	236.
33	0	0.45	0.10	0.35	5.	353.
34	0	0.45	0.10	0.35	5.	453.
35	0	0.45	0.10	0.35	5.	511.
36	0	0.45	0.10	0.35	5.	543.
37	0	1.91	0.10	1.81	5.	688.
38	0	2.30	0.10	2.20	5.	1157.
39	0	2.87	0.10	2.77	5.	1953.
40	0	7.27	0.10	7.17	5.	3210.
41	0	2.68	0.10	2.58	5.	4788.
42	0	2.10	0.10	2.00	5.	5754.
43	0	0.27	0.10	0.17	5.	5319.
44	0	0.27	0.10	0.17	5.	3945.
45	0	0.27	0.10	0.17	5.	2559.
46	0	0.27	0.10	0.17	5.	1555.
47	0	0.27	0.10	0.17	5.	981.
48	0	0.27	0.10	0.17	5.	668.
49	0	0.01	0.01	0.00	5.	479.
50	0	0.01	0.01	0.00	5.	333.
51	0	0.01	0.01	0.00	5.	206.
52	0	0.01	0.01	0.00	5.	105.
53	0	0.01	0.01	0.00	5.	55.
54	0	0.01	0.01	0.00	5.	29.
55	0	0.03	0.03	0.00	5.	18.
56	0	0.03	0.03	0.00	5.	12.
57	0	0.03	0.03	0.00	5.	8.
58	0	0.03	0.03	0.00	5.	7.
59	0	0.03	0.03	0.00	5.	6.
60	0	0.03	0.03	0.00	5.	5.
61	0	0.11	0.10	0.01	5.	6.
62	0	0.13	0.10	0.03	5.	11.
63	0	0.17	0.10	0.07	5.	24.
64	0	0.42	0.10	0.32	5.	70.
65	0	0.16	0.10	0.06	5.	147.
66	0	0.12	0.10	0.02	5.	195.
67	0	0.02	0.02	0.00	5.	173.
68	0	0.02	0.02	0.00	5.	114.
69	0	0.02	0.02	0.00	5.	68.
70	0	0.02	0.02	0.00	5.	40.

71	0	0.02	0.02	0.00		5.	24.
72	0	0.02	0.02	0.00		5.	16.
73	0					5.	11.
74	0					5.	8.
75	0					5.	7.
76	0					5.	5.
77	0					5.	5.
78	0					5.	5.
79	0					5.	5.
80	0					5.	5.
81	0					5.	5.
82	0					5.	5.
83	0					5.	5.
TOTAL		28.55	4.89	23.66	1643.	415.	39296.

```
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       1
ENTER TIME INTERVAL(MIN)=   60.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       2
ENTER DRAINAGE AREA (SQMI) =       2.54
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER )      3
ENTER SNYDERS CP AND TP (HRS) =          0.62       3.06
ENTER INITIAL EST. CLARKS TC & R (HRS) (0=DEFAULT)=  0.00       0.00

      TP        CP       TC        R

     2.69    0.602     3.48     2.36
     2.85    0.598     3.74     2.25
     2.96    0.622     3.86     2.25
     3.04    0.641     3.86     2.31
     3.06    0.637     3.86     2.35
     3.07    0.634     3.86     2.39
     3.08    0.632     3.86     2.41
     3.08    0.630     3.86     2.41

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       3
ENTER RATIO  IMPERVIOUS =        0.00
SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS )       3
ENTER PMS INDEX RAINFALL (IN) = 24.00
ENTER R6,R12,R24,R48,R72,R96 =     107.00  122.00  137.00  151.00  159.00
ENTER TRSPC AND TRSDA (SQMI) =           0.00       2.54
SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS)       1
ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) =      1.00       0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP)       4
ENTER A TITLE PLEASE -    L WICCOFEE PMF
ENTER STRTQ,QRCSN,AND RTIOR =        5.00     5.00     1.00

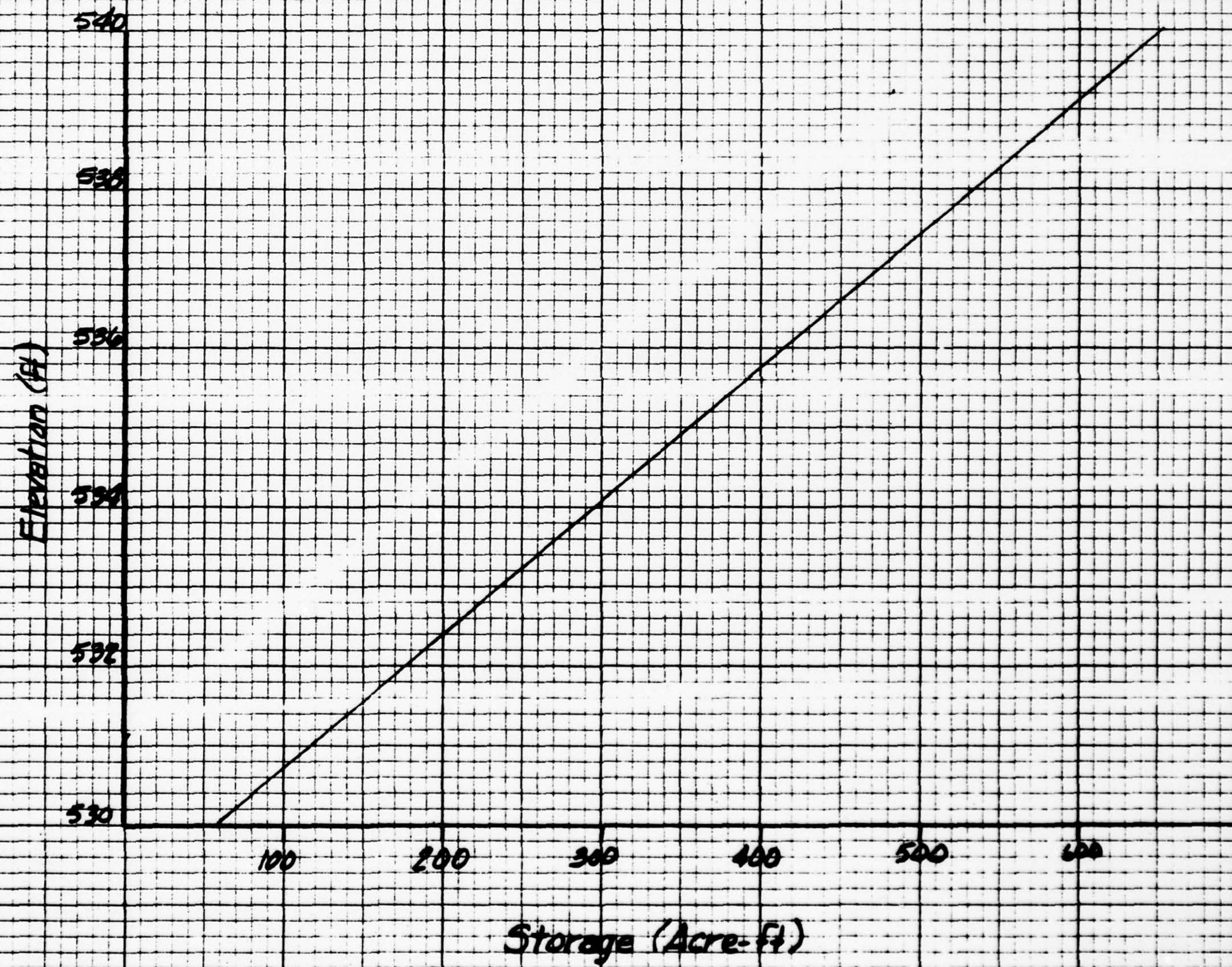
 HR MIN   RAIN   LOSS  EXCESS   UNIT HG    RECSN     FLOW
  1   0   0.02   0.02   0.00       52.       5.        5.
  2   0   0.02   0.02   0.00      183.       5.        5.
  3   0   0.02   0.02   0.00      308.       5.        5.
  4   0   0.02   0.02   0.00      336.       5.        5.
  5   0   0.02   0.02   0.00      263.       5.        5.
  6   0   0.02   0.02   0.00      173.       5.        5.
  7   0   0.05   0.05   0.00      114.       5.        5.
  8   0   0.05   0.05   0.00       75.       5.        5.
  9   0   0.05   0.05   0.00       49.       5.        5.
 10   0   0.05   0.05   0.00       33.       5.        5.
 11   0   0.05   0.05   0.00       22.       5.        5.
 12   0   0.05   0.05   0.00       14.       5.        5.
 13   0   0.20   0.20   0.00       10.       5.        5.
 14   0   0.23   0.23   0.00        6.       5.        5.
 15   0   0.29   0.20   0.09        4.       5.       10.
 16   0   0.74   0.10   0.64        3.       5.       55.
 17   0   0.27   0.10   0.17                 5.      159.
 18   0   0.22   0.10   0.12                 5.      270.
```

19	0	0.03	0.03	0.00	5.	318.
20	0	0.03	0.03	0.00	5.	283.
21	0	0.03	0.03	0.00	5.	211.
22	0	0.03	0.03	0.00	5.	145.
23	0	0.03	0.03	0.00	5.	97.
24	0	0.03	0.03	0.00	5.	66.
25	0	0.18	0.10	0.08	5.	49.
26	0	0.18	0.10	0.08	5.	50.
27	0	0.18	0.10	0.08	5.	66.
28	0	0.18	0.10	0.08	5.	87.
29	0	0.18	0.10	0.08	5.	104.
30	0	0.18	0.10	0.08	5.	116.
31	0	0.45	0.10	0.35	5.	137.
32	0	0.45	0.10	0.35	5.	190.
33	0	0.45	0.10	0.35	5.	276.
34	0	0.45	0.10	0.35	5.	369.
35	0	0.45	0.10	0.35	5.	442.
36	0	0.45	0.10	0.35	5.	490.
37	0	1.91	0.10	1.81	5.	598.
38	0	2.30	0.10	2.20	5.	906.
39	0	2.87	0.10	2.77	5.	1471.
40	0	7.27	0.10	7.17	5.	2425.
41	0	2.68	0.10	2.58	5.	3686.
42	0	2.10	0.10	2.00	5.	4718.
43	0	0.27	0.10	0.17	5.	4965.
44	0	0.27	0.10	0.17	5.	4320.
45	0	0.27	0.10	0.17	5.	3284.
46	0	0.27	0.10	0.17	5.	2335.
47	0	0.27	0.10	0.17	5.	1634.
48	0	0.27	0.10	0.17	5.	1174.
49	0	0.01	0.01	0.00	5.	863.
50	0	0.01	0.01	0.00	5.	633.
51	0	0.01	0.01	0.00	5.	450.
52	0	0.01	0.01	0.00	5.	307.
53	0	0.01	0.01	0.00	5.	203.
54	0	0.01	0.01	0.00	5.	133.
55	0	0.03	0.03	0.00	5.	86.
56	0	0.03	0.03	0.00	5.	45.
57	0	0.03	0.03	0.00	5.	26.
58	0	0.03	0.03	0.00	5.	15.
59	0	0.03	0.03	0.00	5.	11.
60	0	0.03	0.03	0.00	5.	9.
61	0	0.11	0.10	0.01	5.	8.
62	0	0.13	0.10	0.03	5.	10.
63	0	0.17	0.10	0.07	5.	18.
64	0	0.42	0.10	0.32	5.	47.
65	0	0.16	0.10	0.06	5.	101.
66	0	0.12	0.10	0.02	5.	149.
67	0	0.02	0.02	0.00	5.	159.
68	0	0.02	0.02	0.00	5.	132.
69	0	0.02	0.02	0.00	5.	93.
70	0	0.02	0.02	0.00	5.	64.

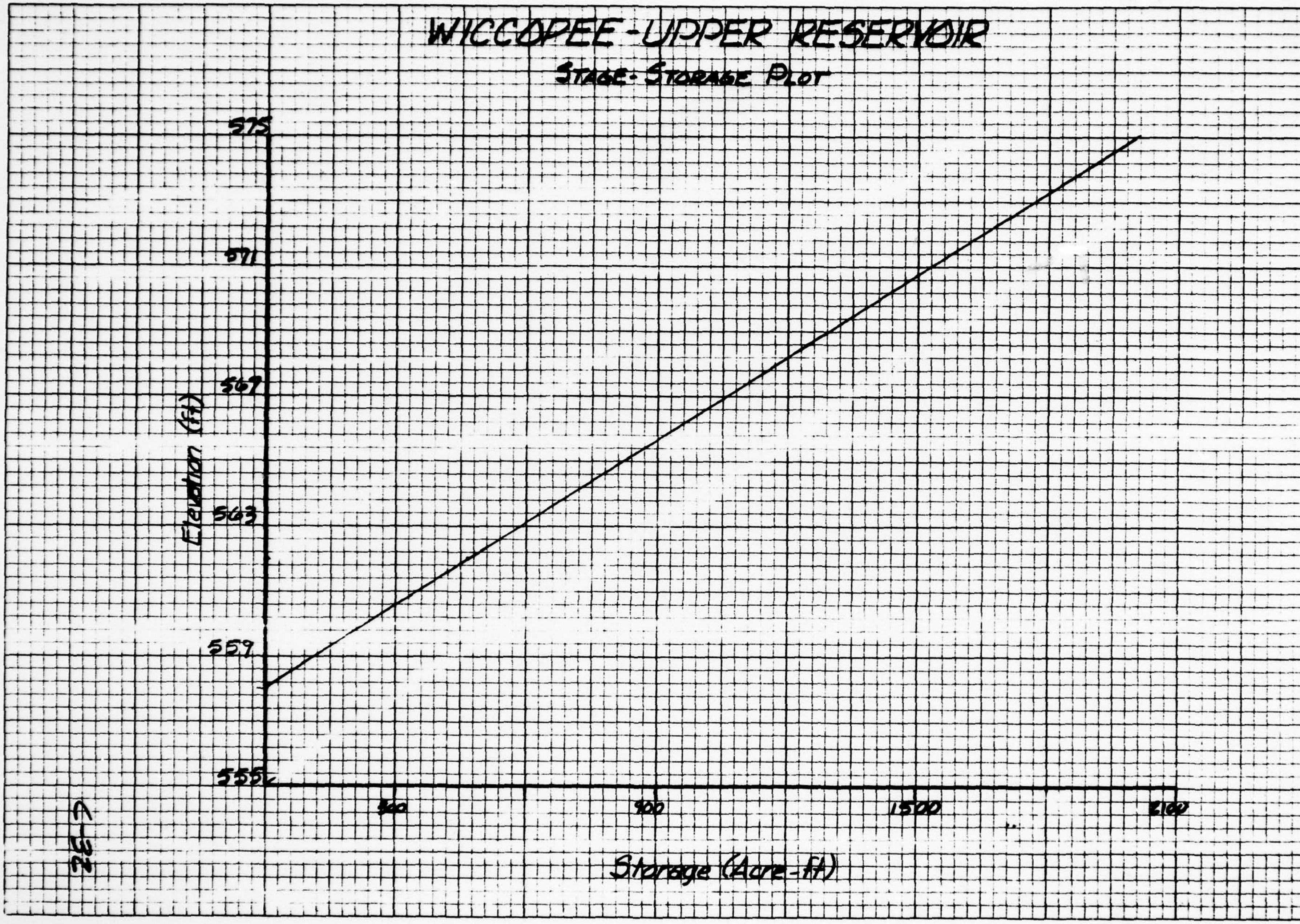
71	0	0.02	0.02	0.00		5.	44.
72	0	0.02	0.02	0.00		5.	31.
73	0					5.	22.
74	0					5.	16.
75	0					5.	12.
76	0					5.	10.
77	0					5.	8.
78	0					5.	7.
79	0					5.	6.
80	0					5.	5.
81	0					5.	5.
82	0					5.	5.
83	0					5.	5.
84	0					5.	5.
85	0					5.	5.
86	0					5.	5.
87	0					5.	5.
TOTAL		28.55	4.89	23.66	1644.	435.	39334.

WICCOPEE - LOWER RESERVOIR

STAGE - STORAGE PLOT



IE-7


WICCOPEE - UPPER RESERVOIR
STAGE - STORAGE PLOT
575
571
567
563
559
555
Elevation (ft)
300
900
1500
2100
Storage (Acre-ft)
C-32

DALE

DESIGN BRIEF

DESIGNED BY NFD — DATE 8.10.78
CHECKED BY — PAGE C-33 OF
PROJECT NO. — SHORT TITLE
DESIGN SUBJECT L. Wiccoppee (South dam) — REF. DWGS.

SPILLWAY RATING CURVE

DISCHARGE OVER OGEE CREST

H	Elevation	C	L	$H^{3/2}$	Q
0	529			–	0
1	530	3.2	48.5	1	155.2
2	531	3.3		2.8	448.2
3	532	3.4		5.2	857.5
4	533	3.5		8.0	1358.0
5	534	3.6		11.2	1955.5
6	535	3.7		14.7	2637.4

DISCHARGE OVER DAM

H	Elevation	C	L	$H^{3/2}$	Q
0	531	3.2	300	–	0
1	532	3.3		1	960
2	533	3.3		2.8	2772
3	534	3.3		5.2	5148
4	535	3.3		8.0	7920

SUMMARY

Elevation	Qs	Qd	QT
530	155.2	–	155
531	488	–	488
532	857	960	1817
533	1358	2772	4130
534	1955	5148	7103
535	2637	7920	10557

DALE

DESIGN BRIEF

DESIGNED BY: HFD DATE: 8.10.78
CHECKED BY: PAGE: C-34 OF
PROJECT NO. SHORT TITLE
DESIGN SUBJECT: U. Wiccopee (north dam) REF. DWGS.

length of spillway ogee weir 220 feet   157 ft upper, 63 ft lower
length of top of dam   320 feet

DISCHARGE OVER OGEE CREST (LOWER)

H	ELEV	C	L	$H^{3/2}$	Q
0	558				
1	559	3.2	63	1	201
2	560	3.3	63	2.8	582
3	561	3.4	63	5.2	1113

DISCHARGE OVER OGEE CREST (UPPER)

H	ELEV	C	L	$H^{3/2}$	Q
1	560	3.2	157	1	502
2	561	3.3	157	2.8	1450

DISCHARGE OVER OGEE CREST AT BRIDGE FASCIA (LOWER)

$$Q = 2/3 \sqrt{2g}\ C L \ (H_1^{3/2} - H_2^{3/2})$$

	H	Elevation	d/H₁	C	$2/3\sqrt{2g}$ CL	$H_1^{3/2}$	$H_2^{3/2}$	$(H_1^{3/2}-H_2^{3/2})$	Q
LOWER	0	558							
	1	559							
	2	560							
	3	561							
	4	562	.7	.64	216	8	1	7	1512
	5	563	.6	.65	219	11.2	2.8	8.4	1843
	6	564	.5	.67	225	14.7	5.2	9.5	2137
	7	565	.4	.68	228	18.5	8.0	10.5	2392
UPPER	4	562	.5	.67	565	5.2	1	4.2	2373
	5	563	.4	.68	573	8	2.8	5.2	2980
	6	564	.3	.69	581	11.2	5.2	6.0	3486
	7	565	.3	.69	581	14.7	8.0	6.7	3893

DALE

DESIGN BRIEF

DESIGNED BY NFD　　　DATE 8.10.78

CHECKED BY　　　PAGE C-35 OF

PROJECT NO.　　　SHORT TITLE

DESIGN SUBJECT U. Wiccopee (North dam)　　　REF. DWGS.

DISCHARGE OVER DAM

H	ELEV	C	L	$H^{3/2}$	Q
0	563		312		
1	564	2.68		1	836
2	565	2.68	↓	2.8	2341

SUMMARY

DESC	ELEV	H	Q SPILL	Q DAM	Q TOT
LOWER SPILL	558	0	0	0	0
UPPER SPILL	559	1	201	—	201
	560	2	582 + 502	—	1084
	561	3	1113 + 1450	—	2563
	562	4	1512 + 2373	—	3885
TOP BRIDGE	563	5	1843 + 2980	—	4823
	564	6	2137 + 3486	836	6459
	565	7	2397 + 3893	2341	8631

```
0OLD NY001S
0LNNFF
00100 A  SOUTH WICCOPEE DAM - SPF
0110 A  RESERVOIR ROUTING THROUGH NORTH AND SOUTH DAMS
0120 A  INCLUDES SERVICE SPILLWAY ONLY
0130 B     30       1
0140 1      3
0150 K      0
0160 M     -1              1.963
0170 N     25      29       32      33      48      96     166     225     260     279
0180 N    338     517      822    1323    1969    2366    2183    1619    1056     650
0190 N    419     293      216     154      99      54      32      21      16      13
0200 K      1
0210 Y                               1
0220 1      1
0230 2      0     115      230     345     460     575     690     805
0240 3      0     201     1004    2563    3885    4823    6459    8631
0250 K      0
0260 M     -1              2.545
0270 N     31      31       32      34      42      67     112     171     229     276
0280 N    332     443      642    1005    1525    2041    2356    2340    2018    1572
0290 N   1172     867      652     494     370     271     194     137      98      70
0300 K      2
0301 K      1
0310 Y                               1
0320 1      1                                              -1
0330 2      0      55      110     165     220     275     330
0340 3      0     155      488    1817    4130    7103   10557
0350 K     99
0360 A
0370 A
0380 A
0390 A
0400 A
0SAVE
```

AD-A065 833 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/2
NATIONAL DAM SAFETY PROGRAM. LOWER (SOUTH) WICCOPEE DAM, LOWER --ETC(U)
SEP 78 J B STETSON DACW51-78-C-0035

UNCLASSIFIED NL

2 OF 2

AD A065833

END
DATE
FILMED
5-79
DDC

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#OLD NY001P
#LNNFF
00100 A  SOUTH WICCOPEE DAM - PMF
0110 A  RESERVOIR ROUTING THROUGH NORTH AND SOUTH DAMS
0120 A  INCLUDES SERVICE SPILLWAY ONLY
0130 B     34       1
0140 1      3
0150 K      0
0160 N     -1             1.963
0170 N     27      40        63      83      96     103     124     185     272     346
0180 N    390     413       524     880    1485    2439    3637    4371    4043    3000
0190 N   1946    1182       745     507     363     254     160      84      47      27
0200 N     19      15        13      11
0210 K      1
0220 Y                                1
0230 1      1                                              -1
0240 2      0     115       230     345     460     575     690     805
0250 3      0     201      1004    2563    3885    4823    6459    8631
0260 K      0
0270 N     -1             2.545
0280 N     27      44        74     100     116     125     154     236     353     453
0290 N    511     543       688    1157    1953    3210    9788    5754    5319    3945
0300 N   2559    1555       981     668     479     333     206     105      55      29
0310 N     18      12         8       7
0320 K      2
0321 K      1
0330 Y                                1
0340 1      1                                              -1
0350 2      0      55       110     165     220     275     330
0360 3      0     155       488    1817    4130    7103   10557
0370 K     99
0380 A
0390 A
0400 A
0410 A
0420 A
#SAVE
```

****
EC-1 VERSION DATED JAN 1973
PDATED AUG 74
HANGE NO. 01
****

SOUTH WICCOPEE DAM - SPF
RESERVOIR ROUTING THROUGH NORTH AND SOUTH DAMS
INCLUDES SERVICE SPILLWAY ONLY

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
30	1	0	0	0	0	0	0	0	0

JOPER	NWT
3	0

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

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	1.96	0.0	0.0	0.0	0.0	0	0	0

INPUT HYDROGRAPH

25.	29.	32.	33.	48.	96.	166.	225.	260.	279.
338.	517.	822.	1323.	1969.	2366.	2183.	1619.	1056.	650.
419.	293.	216.	154.	99.	54.	32.	21.	16.	13.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2366.	1753.	634.	512.	15353.
INCHES		8.31	12.02	12.13	12.13
AC-FT		870.	1258.	1269.	1269.

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

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	115.	230.	345.	460.	575.	690.	805.	0.	0.
OUTFLOW=	0.	201.	1004.	2563.	3885.	4823.	6459.	8631.	0.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	2.	25.	3.
2	4.	27.	7.
3	6.	31.	10.
4	7.	33.	13.
5	9.	41.	17.
6	14.	72.	24.
7	22.	131.	38.
8	34.	196.	60.
9	48.	243.	84.
10	62.	270.	109.
11	78.	309.	136.
12	100.	428.	175.
13	134.	670.	347.
14	180.	1073.	697.
15	238.	1646.	1185.
16	291.	2168.	1867.
17	313.	2275.	2150.
18	299.	1901.	1977.
19	265.	1338.	1533.
20	228.	853.	1068.
21	194.	535.	811.
22	166.	356.	592.
23	145.	255.	429.
24	129.	185.	312.
25	118.	127.	222.
26	107.	77.	187.
27	96.	43.	168.
28	85.	27.	149.
29	75.	19.	131.
30	66.	15.	116.
SUM			14617.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2150.	1630.	606.	487.	14617.
INCHES		7.72	11.49	11.54	11.54
AC-FT		809.	1203.	1209.	1209.

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

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	2.54	0.0	0.0	0.0	0.0	0	0	0

INPUT HYDROGRAPH

31.	31.	32.	34.	42.	67.	112.	171.	229.	276.
332.	443.	642.	1005.	1525.	2041.	2356.	2340.	2018.	1572.
1172.	847.	652.	494.	370.	271.	194.	137.	98.	70.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2356.	1975.	808.	654.	19624.
INCHES		7.22	11.81	11.95	11.95
AC-FT		980.	1603.	1623.	1623.

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

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 0

34.	38.	42.	47.	59.	91.	150.	231.	313.	385.
468.	618.	989.	1702.	2710.	3908.	4506.	4317.	3551.	2640.
1983.	1459.	1081.	806.	592.	458.	362.	286.	229.	186.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4506.	3605.	1414.	1141.	34241.
INCHES		7.44	11.67	11.78	11.78
AC-FT		1789.	2806.	2831.	2831.

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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE=	0.	55.	110.	165.	220.	275.	330.	0.	0.	0.
OUTFLOW=	0.	155.	488.	1817.	4130.	7103.	10557.	0.	0.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	12.	34.	34.
2	12.	36.	35.
3	13.	40.	36.
4	13.	44.	38.
5	14.	53.	41.
6	17.	75.	48.
7	22.	121.	63.
8	32.	191.	90.
9	45.	272.	128.
10	61.	349.	191.
11	77.	427.	285.
12	94.	543.	389.
13	117.	804.	655.
14	145.	1345.	1345.
15	177.	2206.	2310.
16	207.	3309.	3578.
17	225.	4207.	4398.
18	225.	4411.	4417.
19	212.	3934.	3781.
20	191.	3096.	2911.
21	173.	2312.	2150.
22	158.	1721.	1650.
23	142.	1270.	1270.
24	129.	943.	944.
25	119.	699.	699.

26	112.	525.	526.
27	105.	410.	457.
28	96.	324.	404.
29	86.	258.	345.
30	77.	207.	290.
SUM			33505.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4417.	3566.	1386.	1117.	33505.
INCHES		7.36	11.44	11.52	11.52
AC-FT		1769.	2751.	2770.	2770.

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RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	0	2366.	1753.	634.	512.	1.96
ROUTED TO	0	2150.	1630.	606.	487.	1.96
HYDROGRAPH AT	0	2356.	1975.	808.	654.	2.54
2 COMBINED	0	4506.	3605.	1414.	1141.	4.51
ROUTED TO	0	4417.	3566.	1386.	1117.	4.51

PDATED AUG 74
HANGE NO. 01
****

SOUTH WICCOPEE DAM - PMF
RESERVOIR ROUTING THROUGH NORTH AND SOUTH DAMS
INCLUDES SERVICE SPILLWAY ONLY

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
34	1	0	0	0	0	0	0	0	0

JOPER	NWT
3	0

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

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	1.96	0.0	0.0	0.0	0.0	0	0	0

INPUT HYDROGRAPH

27.	40.	63.	83.	96.	103.	124.	185.	272.	346.
390.	413.	524.	800.	1485.	2439.	3637.	4371.	4043.	3000.
1946.	1102.	745.	507.	363.	254.	160.	84.	47.	27.
19.	15.	13.	11.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4371.	3239.	1148.	820.	27894.
INCHES		15.35	21.76	22.03	22.03
AC-FT		1607.	2278.	2306.	2306.

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

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE=	0.	115.	230.	345.	460.	575.	690.	805.	0.	0.
OUTFLOW=	0.	201.	1004.	2563.	3885.	4823.	6459.	8631.	0.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	15.	27.	27.
2	16.	34.	28.
3	18.	52.	31.
4	21.	73.	37.
5	25.	90.	44.
6	29.	100.	51.
7	34.	114.	60.
8	41.	155.	72.
9	53.	229.	93.
10	70.	309.	123.

11	89.	368.	156.
12	108.	402.	189.
13	127.	469.	292.
14	153.	702.	409.
15	196.	1183.	823.
16	262.	1962.	1499.
17	345.	3038.	2567.
18	426.	4004.	3492.
19	466.	4207.	3938.
20	443.	3522.	3684.
21	375.	2473.	2904.
22	301.	1564.	2000.
23	245.	964.	1281.
24	207.	626.	905.
25	177.	435.	679.
26	154.	309.	500.
27	136.	207.	359.
28	121.	122.	245.
29	108.	66.	189.
30	96.	37.	169.
31	85.	23.	149.
32	75.	17.	131.
33	66.	14.	115.
34	58.	12.	101.
SUM			27424.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3938.	3098.	1120.	807.	27424.
INCHES		14.68	21.23	21.66	21.66
AC-FT		1537.	2223.	2268.	2268.

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	2.54	0.0	0.0	0.0	0.0	0	0	0

INPUT HYDROGRAPH

27.	44.	74.	100.	116.	125.	154.	236.	353.	453.
511.	543.	600.	1157.	1953.	3210.	9788.	5754.	5319.	3945.
2559.	1555.	981.	660.	479.	333.	206.	105.	55.	29.
18.	12.	8.	7.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9788.	5096.	1716.	1223.	41565.
INCHES		18.63	25.09	25.32	25.32
AC-FT		2528.	3406.	3437.	3437.

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COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 0

54.	72.	105.	137.	160.	176.	214.	308.	446.	576.
667.	732.	900.	1646.	2776.	4709.	12355.	9246.	9257.	7629.
5463.	3555.	2262.	1573.	1158.	833.	565.	350.	244.	198.
167.	143.	123.	108.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12355.	8110.	2823.	2029.	68988.
INCHES		16.73	23.30	23.73	23.73
AC-FT		4024.	5601.	5704.	5704.

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

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE=	0.	55.	110.	165.	220.	275.	330.	0.	0.	0.
OUTFLOW=	0.	155.	488.	1817.	4130.	7103.	10557.	0.	0.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	19.	54.	54.
2	20.	63.	56.
3	22.	88.	63.
4	27.	121.	75.
5	32.	148.	90.
6	38.	168.	106.
7	44.	195.	125.
8	54.	261.	153.
9	69.	377.	241.
10	87.	511.	349.
11	105.	621.	458.
12	117.	699.	654.
13	125.	856.	856.
14	144.	1313.	1313.
15	177.	2211.	2317.

16	220.	3743.	4127.
17	327.	8532.	10352.
18	337.	10801.	11000.
19	297.	9252.	8476.
20	296.	8443.	8429.
21	250.	6546.	5771.
22	218.	4509.	4036.
23	184.	2909.	2605.
24	162.	1917.	1750.
25	146.	1365.	1366.
26	131.	996.	996.
27	119.	699.	699.
28	108.	457.	476.
29	96.	297.	404.
30	84.	221.	331.
31	74.	182.	271.
32	67.	155.	225.
33	60.	133.	188.
34	56.	116.	159.
SUM			68571.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11000.	8026.	2813.	2017.	68571.
INCHES		16.56	23.22	23.58	23.58
AC-FT		3982.	5582.	5670.	5670.

########## ########## ########## ########## ##########

RUNOFF SUMMARY, AVERAGE FLOW

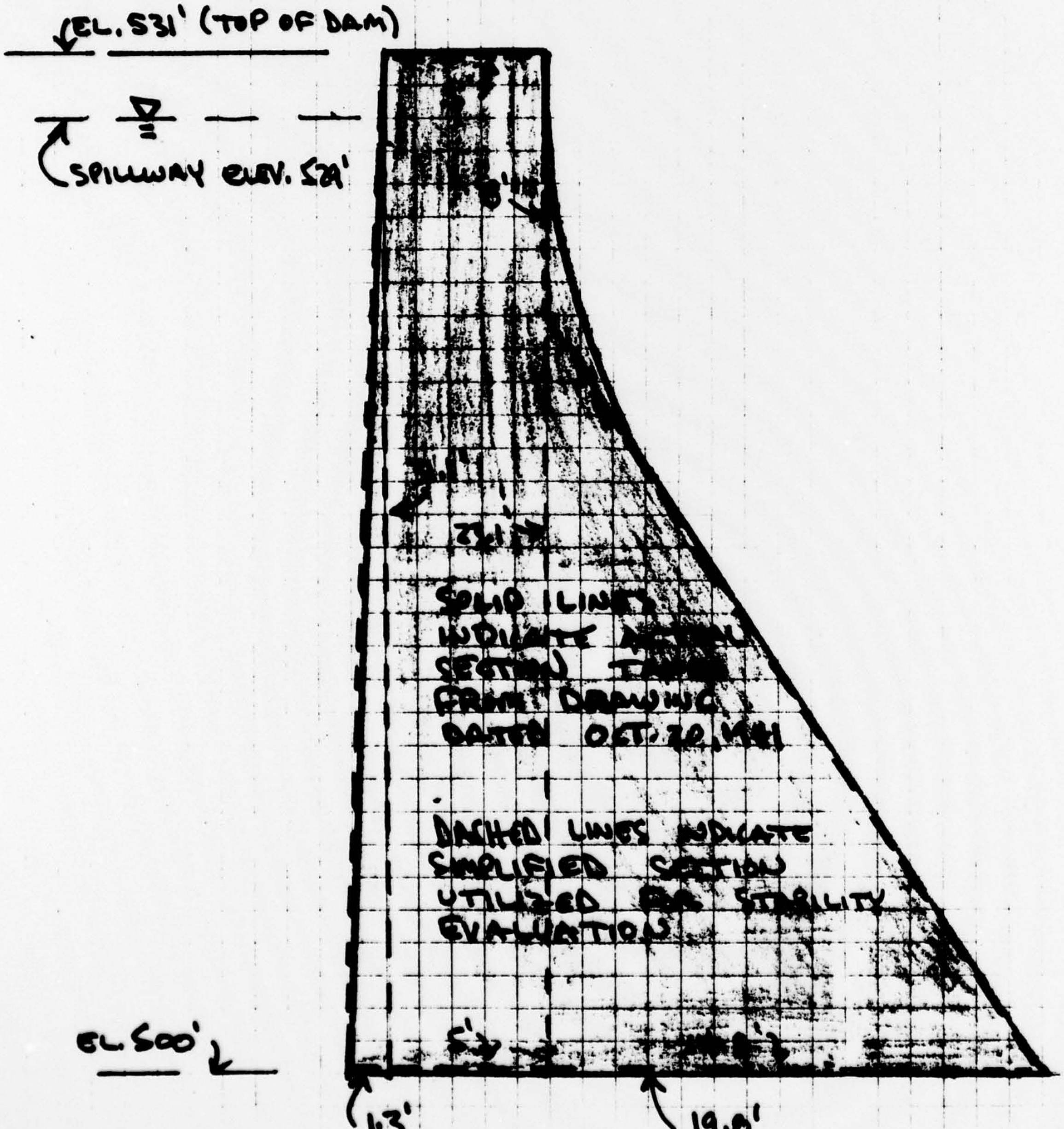
		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	0	4371.	3239.	1148.	820.	1.96
ROUTED TO	0	3938.	3098.	1120.	807.	1.96
HYDROGRAPH AT	0	9788.	5096.	1716.	1223.	2.54
2 COMBINED	0	12355.	8110.	2823.	2029.	4.51
ROUTED TO	0	11000.	8026.	2813.	2017.	4.51

APPENDIX D

STABILITY ANALYSIS

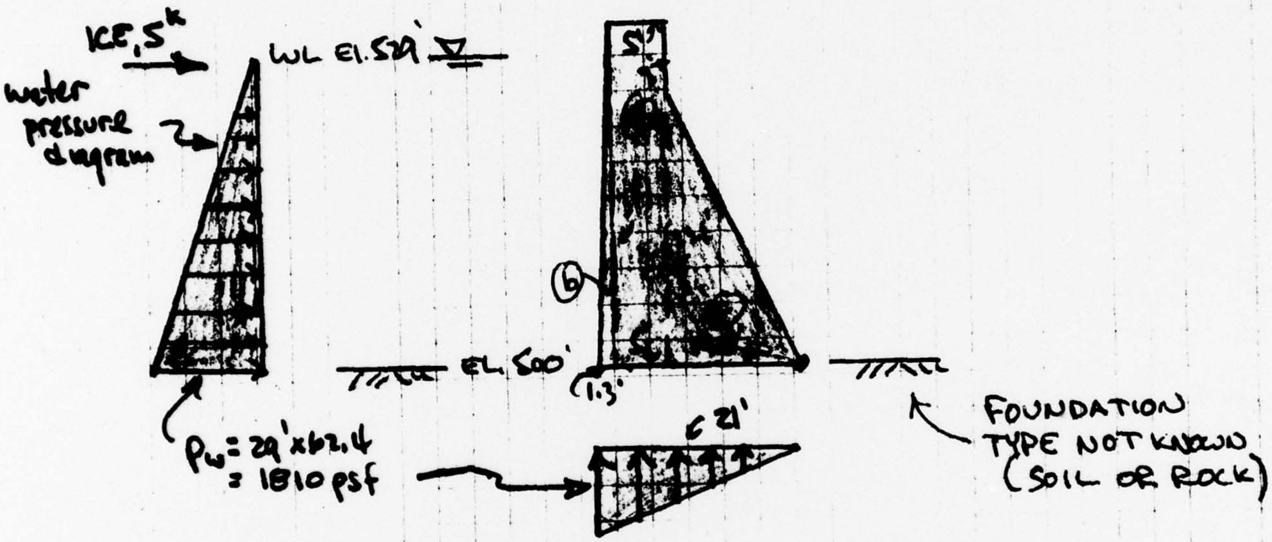
SOUTH WICKOPEE DAM
PEEKSKILL, N.Y.

Typical Section Taken From Drawing Dated October 20, 1941 "Board of Water Commissioners, Peekskill, N.Y.", South Wickopee Dam.



STABILITY - OVERTURNING & SLIDING

I. Assomed conditions
- WL at spillway elevation (EL. 529)
- Downstream WL at elevation corresponding to base of dam
- Downstream ground surface at base elev.
- Upstream ground surface at base elev. (behind dam)
- Ice acting
- neglect vertical effect on water on upstream face (sloping) of dam



A. OVERTURNING

Forces causing overturning about toe = horiz. water pressure + ice + uplift water pressure

$$M_{toe} = \left(29' \times 62.4\,pcf \times \frac{29'}{2} \times \frac{29'}{3}\right) + \left(5000^{\#} \times 29'\right) + \left(1810^{psf} \times \frac{21'}{2}\right)\left(\frac{2}{3} \times 21'\right) =$$

$$= 253.7^{1k} + 145^{1k} + 266.07^{1k} = 664.77$$

Force resisting overturning about toe = wt. of dam =

$$= \left(5 \times 31.1 \times .150\right)^{(a)}\left(14.8' + 2.5'\right) + \left(\tfrac{1}{2} \times 1.3' \times 31.1 \times .150\right)^{(b)}\left(19.8 + \frac{1.3}{3}\right) + \dots$$

$$+ \left(\tfrac{1}{2} \times .150 \times 23.1 \times 14.8\right)^{(c)}\left(\tfrac{2}{3} \times 14.8\right) = 403.5^{1k} + 61.3^{1k} + 252.8^{1k} = 717.6^{1k}$$

$$\text{FS against overturning} = \frac{717.6}{667.3} = 1.08 \pm \text{ (with uplift)}$$

$$= \frac{717.6}{414.5} = 1.7 \pm \text{ (no uplift)}$$

B. SLIDING

Forces causing sliding = horiz. water pressure + ice

$= \left(29' \times 62.4 \text{ pcf} \times \frac{29'}{2}\right) + 5000^{\#}/\text{ft} = 26.2^k + 5^k = 31.2^k$

Force resisting sliding = friction along base of dam =
(use coef. of friction = 0.65)

= (coef. friction)[wt. dam − uplift]

$= (0.65)\Big[(5 \times 31.1 \times .150)^{ⓐ} + (\tfrac{1}{2})(31.1 \times 1.3 \times .150)^{ⓑ} + (\tfrac{1}{2} \times 23.1 \times 14.8 \times .150)^{ⓒ} - \ldots$

$\ldots - \left(29 \times 62.4 \times \frac{21}{2}\right)\Big] = 0.65(52^k - 19^k) = 21.5^k$

FS against sliding $= \frac{21.5^k}{31.2^k} = 0.7 \pm$ (with uplift)

$= \frac{33.8}{31.2} = 1.08 \pm$ (no uplift)

II. Assumed conditions

- WL one foot above top of dam (EL. 532')
- no ice
- downstream ground surface and WL at base of dam

A. OVERTURNING

Forces causing overturning = horiz. water pressure + uplift =

$= \left(62.4 \times 32 \times \frac{32}{2}\right)\left(\frac{32}{3}\right) + \left(32 \times 62.4 \times \frac{21.1}{2}\right)\left(\frac{2}{3} \times 21.1\right)$

$= 341^{1k} + 296^{k} = 637^{1k}$

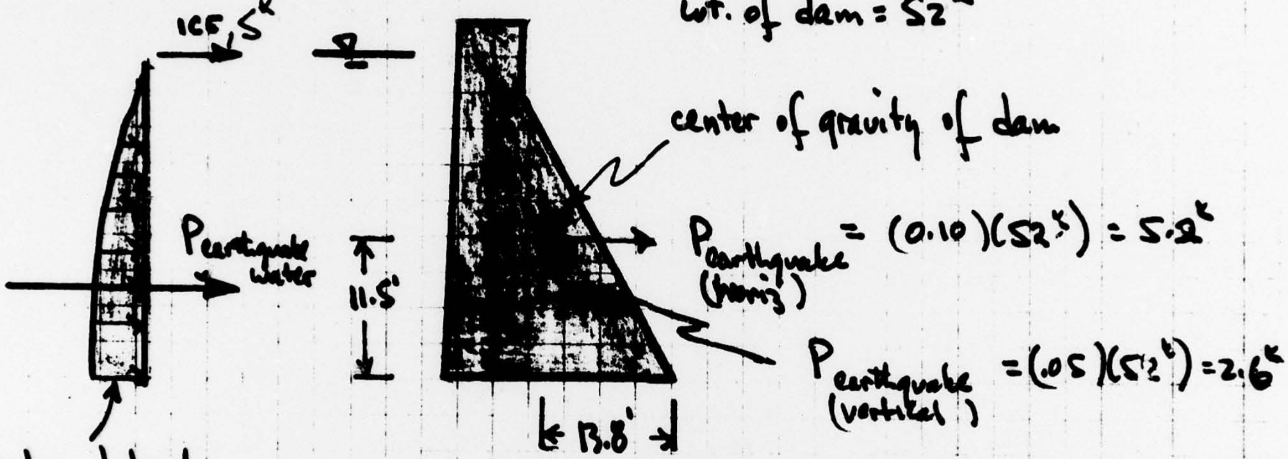
Forces resisting overturning = wt. of dam = 717.6^{1k} (from Part I)

FS against overturning $= \frac{717.6}{637} = 1.13 \pm$ (with uplift)

$= \frac{717.6}{341} = 2.1 \pm$ (no uplift)

III Assumed conditions -

- Zone 3 seismic probability (use horiz. seismic coeff = 0.10, vert. seismic coeff = 0.05)
- WL at spillway elev plus ice
- downstream WL and ground surface at base of dam



Pew: extra lateral pressure from effect of water during earthquake = $P_{earthquake\,(water)} = C\lambda\,(62.4 \times 29')$

$= (.73)(0.10)(62.4\ pcf \times 29') = 132$ psf, at EL 500'

Earthquake Effects

(1) Extra overturning moment about toe caused by extra water pressure $= (0.299)(P_{ew})(29' \times 29') = 33^{1K}$

(2) Extra overturning moment about toe due to motion of dam mass $= (5.2^k \times 11.5') + (2.6^k \times 13.8') = 95.7^{1K}$
(59.8) (35.9)

$$\text{FS against overturning} = \frac{717.6}{667.3 + 33 + 95.7} = 0.90 \pm \text{(with uplift)}$$

$$= \frac{717.6}{414.5 + 33 + 95.7} = 1.3 \pm \text{(no uplift)}$$

APPENDIX E

REFERENCES

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