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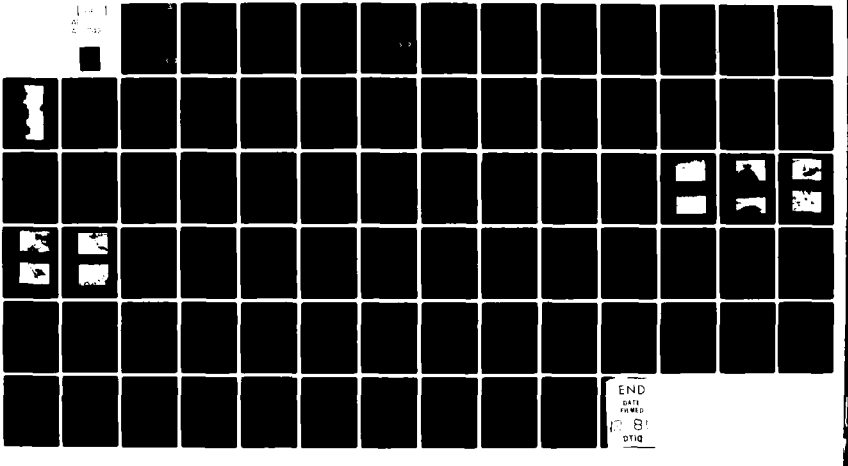

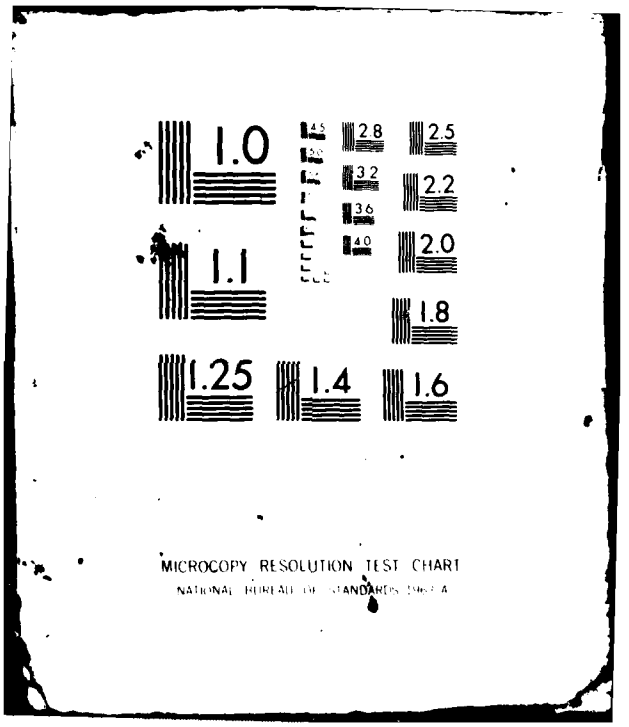
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LOWER HUDSON RIVER BASIN

LEVEL II

SPARKLE LAKE DAM

WESTCHESTER COUNTY, NEW YORK
INVENTORY NO. N.Y. 1330

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1981

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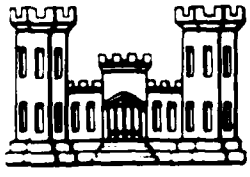
LOWER HUDSON RIVER BASIN

SPARKLE LAKE DAM

WESTCHESTER COUNTY, NEW YORK
INVENTORY NO. N.Y. 1330

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1981

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Dam Safety
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Sparkle Lake Dam
Westchester County
Lower Hudson River Basin

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.

The examination of documents and visual inspection of Sparkle Lake Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using Corps of Engineers screening criteria for initial review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding 48 percent of Probable Maximum Flood (PMF). The overtopping of the dam could cause the erosion of both abutments and the downstream face of the dam resulting in dam failure, thus significantly increasing the hazard to life and property downstream. The pipe spillway is, therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

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

PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SPARKLE LAKE DAM
I.D. NO. N.Y. 1330
D.E.C. NO. 213D-4463
LOWER HUDSON RIVER BASIN
WESTCHESTER COUNTY, NEW YORK

CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	Sparkle Lake Dam (I.D.No. NY-1330)
STATE LOCATED:	New York
COUNTY LOCATED:	Westchester County
STREAM:	Unnamed (TR of Hallocks Mill Brook)
BASIN:	Lower Hudson River
DATE OF INSPECTION:	6 May 1981

ASSESSMENT

The examination of documents and visual inspection of Sparkle Lake Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using Corps of Engineers screening criteria for initial review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding 48 percent of Probable Maximum Flood (PMF). The overtopping of the dam could cause the erosion of both abutments and the downstream face of the dam resulting in dam failure, thus significantly increasing the hazard to life and property downstream. The pipe spillway is, therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

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

It is, therefore, recommended that within 3 months of notification to the owner, detailed hydrological-hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow of at least the one-half PMF. Within twelve months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of the studies, should have been completed. In the interim, a detailed emergency action plan must be developed. Also around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has a number of problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within 12 months:

1. The results of the aforementioned analysis will determine the appropriate remedial measures required.

2. The buried portion of the spillway outlet pipe should be exposed. The discharge from the pipe should be diverted away from the toe of the dam.

3. The seepage occurring at the downstream toe should be monitored and observations recorded. Construction of weirs and monitoring of flow at bi-weekly intervals should be performed to properly ascertain the nature of the seepage.

4. Erosion areas at the contact between upstream slope and the crest should be refilled, compacted and reseeded.

5. The trees, bushes and saplings should be removed from the upstream and downstream slopes and crest. A program of periodic cutting and mowing of the embankment surfaces should be provided.

6. The longitudinal and transverse cracks at the crest should be repaired.

7. A program of periodic inspection and maintenance of the dam and appurtenances should be provided including yearly operation and lubrication of the reservoir drain system. This information should be documented for future reference. The emergency action plan

described in Section 7.1d should be maintained and updated periodically during the life of the structure.

8. Extension of reservoir drain control stem located in the manhole should be considered.

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

Approved by:

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

Date: 14 Aug 81

1. OVERVIEW OF DAM.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SPARKLE LAKE DAM
I.D. NO. N.Y. 1330
D.E.C. NO. 213D-4463
LOWER HUDSON RIVER BASIN
WESTCHESTER COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers Contract No. DACW 51-81-C-0008 in a letter dated 14 December 1980 in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367 dated 8 August 1972.

b. Purpose of Inspection

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

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenant Structures

The Sparkle Lake Dam is an earth embankment approximately 310 feet long of which about 100 feet from the right abutment constitutes the original dam cross section and the remainder a modified cross section. From observations the original dam cross section has a crest width of about 15 feet; and downstream slope of 1(V) to 1.5(H). The modified section has a crest width varying from 15 to 150 feet; and the downstream slope varying from 1(V):1.5(H) to 1(V) : 2.5(H). The maximum height of the dam is 10 feet. The upstream slope at both cross sections is vertical, protected by a hand placed stone wall for a length of 220 feet from the right abutment; and stepped concrete-stone walkway for the remainder of the embankment. The concrete stone walkway serves as landing for small boats.

A 15-inch diameter corrugated metal pipe (CMP) located approximately in the middle of the dam serves as the principal spillway of the dam. The discharge through the pipe is ungated and empties into a 10 feet circular manhole which is located in

the wider portion of the crest of the dam. There is another corrugated metal pipe emptying at the bottom of the manhole. (referred on drawings in Appendix A as "Existing"). The purpose and extent of the pipe is unknown. The discharges from the manhole flow into two outlet drains which are 15-inch diameter corrugated metal pipes. The outlets are at different elevations; the lower outlet drain (referred as "Existing" on drawing) exits at the downstream toe in the vicinity of the reservoir drain outlet. The higher outlet drain also exits at the downstream toe further downstream of the lower outlet drain.

A 15-inch diameter corrugated metal pipe (CMP) which serves as a reservoir drain is located 100 feet from the right abutment. Discharge through the pipe is controlled by a manually operated gate valve located about 20 feet downstream from the upstream face of the dam and at the bottom of a 10 foot diameter concrete manhole. The outlet from the manhole is a 15-inch diameter corrugated metal pipe which exits at the downstream toe into a natural channel. According to a drawing the inlet of the drain is about 40 feet from the upstream face of the dam. It is reported that the concrete structure, shown on the drawing, around the inlet was not constructed.

b. Location

The dam is located at the south end of Sparkle Lake, about 750 feet north of the junction of Granite Springs Road and Broadway, and north of Yorktown Heights in Westchester County, New York.

c. Size Classification

The dam is 10 feet high and has a storage capacity of 84 acre-feet and is therefore classified as a small dam.

d. Hazard Classification

The dam is in the "high" hazard potential category because of several homes located about 750 feet downstream from the dam and the town of Yorktown Heights which is about 2 miles downstream from the dam.

e. Ownership

The Sparkle Lake Dam is owned by the Town of Yorktown. The address is Town Hall, 363 Underhill Avenue, Yorktown Heights, New York 10598. The telephone number is 914-962-5722. At present the person to contact is Mr. John Goldstein, the Town Engineer. The maintenance of the dam is carried out by the Highway Department, Town of Yorktown.

f. Purpose of Dam

The impoundment provided by the dam is used for recreational purposes.

g. Design and Construction History

The original design and the construction records are not available. The exact date of construction of the dam and the contractor's name are unknown. It is reported that in 1976 the reservoir drain and its control were installed. The design and supervision of construction was done by the Town Engineer. The plan and details of the reservoir drain and its control are shown on the drawings included in Appendix A.

h. Normal Operating Procedures

Lake level is maintained at the invert of the pipe spillway except in winter when the lake is lowered to kill algae growth.

1.3 PERTINENT DATA

a. Drainage Area (square miles)	0.16
b. Discharge at Dam (cfs)	
Maximum Known Flood at Site	Unknown
Pipe Spillway, Ungated at Maximum Pool (El 489.3)	7.7
Reservoir Drain at Maximum Pool (El 489.3)	10
c. Elevation (feet above MSL USGS Datum)	
Top of Dam	489.3
Spillway Invert	485.0
Minimum Pool	485.0
Maximum Pool	489.3
d. Reservoir	
Length of Normal Pool (feet)	5,000
Surface Area of Maximum Pool (acres)	22.8
Surface Area of Normal Pool (acres)	17.45
e. Storage (acre-feet)	
Spillway Invert	84
Top of Dam	171

f. Dam

Type	Earth
Length (feet)	310
Height (feet)	10
Crest Width (feet)	Varies from 15 to 150 feet
Side Slopes:	
Upstream	Vertical
Downstream	Varies from 1(V):1.5(H) to 1(V):2.5(H)

g. Spillway

Type	Uncontrolled, Corrugated Metal Pipe (CMP)
Diameter (inches)	15

h. Reservoir Drain

Type	15-inch CMP
Control	Manually operated gate valve which is located at the bottom of a concrete manhole. The manhole is located about 20 feet downstream from upstream face of the dam.

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

The records of the owner contain no data on site geology. However, there is data available in the literature on the general geology of the area (Ref. 4). Sparkle Lake Dam is located in the Hudson Highlands section of the New England Uplands physiographic province. The province is characterized by a low, but rugged mountain range consisting primarily of igneous and metamorphic rock. The rock underlying the area of the dam is Precambrian biotite-quartz-plagioclase paragneiss with subordinate biotite granitic gneiss, amphibolite and calcilicate rock.

2.2 SUBSURFACE INVESTIGATIONS

There are no records of subsurface investigations available. It is known that the surficial soils in the vicinity of the dam and reservoir are coarse grained glacial till material.

2.3 DESIGN RECORDS

There are no design data, construction drawings or design memoranda available for the dam. However, there are two drawings prepared by the owner (see Appendix A) showing the plan of the dam, the pipe spillway; and the plan and details of the reservoir drain and its control.

2.4 CONSTRUCTION RECORDS

Records of the original construction or subsequent modifications are not available for the project.

2.5 OPERATION RECORDS

There are no records of operation of the dam. There is no formal operation and maintenance manual for the project. No records of reservoir levels and rainfall have been kept.

2.6 EVALUATION OF DATA

Information was made available by the New York State Department of Environmental Conservation and the owner. The information obtained from the available data, personal interviews and the visual inspection is considered adequate for this Phase I Inspection and Evaluation.

The drawings in the appendix shows that a concrete structure was recommended at the reservoir drain inlet.

However it is reported by the owner's engineer that the concrete structure was not constructed at the time of installation of the reservoir drain. In addition the datum for the elevations shown on the drawings could not be determined. For the purpose of this report the USGS datum shown on the Mohegan Lake Quadrangle is used and elevations of the dam and the appurtenant structures are converted as follows:

USGS El 485 = El 396.5 (Shown on the drawing. See Apendix A)

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of the Sparkle Lake Dam was performed on 6 May 1981. The weather was sunny with the temperature ranging between 70° and 75° F. The reservoir level at the time of the inspection was at El 485.7, about 8 inches above the invert of the pipe spillway.

b. Dam

The dam appears to be in good condition. The horizontal and vertical alignments of the crest are generally good. The asphalt walkway on the crest has several longitudinal and transverse cracks, located about 100 feet from the right abutment (see Photograph 4). The size of the cracks varies from hairline to 1/8 inch wide. In addition there are newly planted trees at a wider section of the crest.

It is reported that in the vicinity of the principal spillway pipe and about the middle of the crest a "blow off" occurred and was repaired by plugging it with clay. The repaired area appears to be in good condition.

The upstream slope, including the stone protection, appears to be in good condition except where erosion has occurred near the crest at two locations (see Photographs 9 and 10). In addition there are bushes, saplings and trees growing through the stones in the vicinity of the right abutment (Photograph 3).

The downstream slope of the dam is in good condition except for the existence of heavy vegetation consisting of the trees, saplings, bushes and overgrown grass. In addition 50 feet from the toe, near the right abutment, the area is wet and spongy with standing water resulting from minor seepage (see Photograph 11).

c. Spillway

The condition of the pipe spillway (15-inch CMP) from the upstream face of the dam to the manhole and the two 15-inch CMP outlet drains from the manhole to the downstream toe of the dam could not be observed. The outlet of one of the outlet drains which is located in the vicinity of the reservoir drain is buried (see Photograph 7).

d. Appurtenant Structures

The reservoir drain and the control which is located at the base of the manhole were not operated during the inspection. It is reported that the drain and the control are in operating condition.

e. Abutments

There are no signs of seepage or other unusual conditions at both abutments.

f. Downstream Channel

The discharge from the reservoir drain and the pipe spillway outlets flows into a natural channel. Although the channel contains natural vegetation including large trees, saplings and overgrown grass, its present condition would not impede discharges from the spillway and the reservoir drain.

g. Reservoir Area

In the vicinity of the dam there is no evidence of sloughing, potentially unstable slopes or other unusual conditions which would adversely affect the dam. No evidence of excessive sedimentation was observed. The reservoir water was relatively clean.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not reveal serious problems which would adversely affect the adequacy of the dam and the appurtenant facilities. The following summarizes the encountered problem areas in order of importance with the recommended remedial action.

1. The buried portion of the spillway outlet pipe should be exposed. The discharge from the pipe should be diverted away from the toe of the dam.

2. The seepage occurring at the downstream toe should be monitored and observations recorded. Construction of weirs and monitoring of flow at bi-weekly intervals should be performed to properly ascertain the nature of the seepage.

3. Erosion areas at the contact between upstream slope and the crest should be refilled, compacted and reseeded.

4. The trees, bushes and saplings should be removed from the upstream and downstream slopes and crest. A program of periodic cutting and mowing of the embankment surfaces should be provided.

5. The longitudinal and transverse cracks at the crest should be repaired.

6. A program of periodic inspection and maintenance of the dam and appurtenances should be provided including yearly operation and lubrication of the reservoir drain system. This information should be documented for future reference. The emergency action plan described in Section 7.1d should be maintained and updated periodically during the life of the structure.

7. Extension of reservoir drain control stem located in the manhole should be considered.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no operating procedures for regulating the discharge. Flow is discharged through an ungated pipe spillway and the regulated reservoir drain. The lake is generally kept at the level of the pipe spillway invert except in the winter when the lake is lowered to kill algae growth.

4.2 MAINTENANCE OF DAM AND SPILLWAY

The presence of undesirable vegetation on the downstream face of the dam; the erosion at the upstream edge of the crest; clogging at the outlet end of one of the spillway drain outlets (near the reservoir drain) indicates that the dam is not adequately maintained.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect or in preparation.

4.4 EVALUATION

The maintenance of the Sparkle Lake Dam is inadequate in the following areas:

1) The clogging at the outlet end of the principal spillway.
2) Control of vegetation on the crest and downstream and upstream slopes of the dam.
3) Maintenance of the upstream face of slopes where erosion has occurred.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Sparkle Lake Dam is located on an unnamed tributary of Hallocks Mill Brook, about two miles north of Yorktown Heights, Yorktown Township, Westchester County (Hydrologic Unit Code No. 02030101). The drainage basin of 0.16 square miles is about 60 percent urbanized (primarily in the vicinity of the lake), with the remainder wooded. Oriented in a primarily north-south direction, the basin at its widest point is approximately 1/4 miles.

Moderate slopes characterize the drainage basin.

Sparkle Lake encompasses about 17 acres (0.027 square miles) at its normal pool elevation of 485 feet, which represents 17 percent of the drainage area.

5.2 ANALYSIS CRITERIA

The analysis of the adequacy of the spillway was performed by developing a design flood, using the unit hydrograph method and the Probable Maximum Precipitation (PMP). The all season 200 square mile 24 hours PMP for the Yorktown area, taken from Weather Bureau sources, is 22 inches. The unit hydrographs were computed by the Snyder method using coefficients of 2 and 0.625 for C_T and C_p, respectively. The inflow hydrograph was developed by the U.S. Army Corps of Engineers HEC-1DB computer program. Loss rates of 1.0 inch initial loss and 0.1 inch/hour constant loss were estimated as representative of the basin for the design storm.

In accordance with the Corps recommended guidelines for Safety Inspection of Dam (Ref. 3), the adequacy of the spillway was analyzed using the Probable Maximum Flood (PMF). A multi-plan analysis was performed for the full, 0.75, 0.50 and 0.25 PMF.

5.3 SPILLWAY CAPACITY

The ungated 15-inch corrugated metal pipe (CMP) serves as the principal spillway and is located at about the middle of the dam. The invert of the spillway is at El 485.0 which is about 4.3 feet from the top of the dam (El 489.3). The computed maximum discharge with lake surface at El 489.3 is 7.7 cfs.

5.4 RESERVOIR CAPACITY

The normal reservoir capacity is listed as 84 acre-feet. The computed surcharge storage of 87 acre-feet is equivalent to approximately 10.2 inches of runoff over the entire basin.

5.5 FLOODS OF RECORD

There are no records available of floods or maximum lake elevation.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated on the basis of the spillway discharge capacity and the available surcharge storage to meet the selected design flood inflows.

The analysis was performed using the HEC-1DB computer package and assuming that the water surface in the reservoir was at spillway crest elevation at the start of the flood event. The computed PMF peak inflow was 601 cfs. Following is a summary table of the HEC-1DB analysis.

TABLE 1

RATIO OF PMF (%)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	OVERTOPPING (ft)
1.00	601	480	0.62
0.75	450	250	0.40
0.50	300	21	0.06
0.25	150	5	0.00

The HEC-1DB analysis indicated that floods greater than 48 percent of the PMF would overtop the dam.

5.7 EVALUATION

The dam does not have sufficient spillway capacity to pass either the PMF or one-half (1/2) PMF without overtopping of the dam. The overtopping could cause the failure of the dam, thus significantly increasing the hazard to life downstream . Therefore, the spillway is assessed as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations did not indicate either existing or potential problems with the dam. The observed seepage at the downstream toe of the dam in the vicinity of the right abutment is not considered to represent an unstable or otherwise dangerous condition at the present time. However, if left uncorrected it could lead to a hazardous condition.

b. Design and Construction Data

There exist no design computations or other data regarding the stability of the dam. There are no records of the original construction and subsequent modifications.

c. Stability Analysis

Since the dam is an embankment, the stability analysis of the dam is beyond the scope of work for the Phase I Inspection. There are no gravity structures at the dam.

d. Operation Records

There are no records of the regulating gate operation.

e. Post-Construction Changes

It is reported that since the construction of the dam, the area at and beyond the downstream toe were used as a dump area and has resulted in widening of the crest except for about 100 feet at the right abutment.

f. Seismic Analysis

The dam is located in Zone 1 in accordance with the guidelines set forth by the Corps of Engineers. However, based on the past earthquake history in the vicinity of the project, the New York State Geological Society recommends that the dam be considered in Zone 2.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Examination of available documents and a visual inspection of the dam and the appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 48 percent of the PMF. The overtopping of the dam could cause the erosion of the abutments and the downstream face of the dam resulting in dam failure, thus significantly increasing the hazard for loss of life downstream. The spillway is therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. 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.

In addition to "seriously inadequate" spillway, the dam has a number of deficiencies which if left uncorrected, have the potential for the development of hazardous conditions. These deficiencies are:

1. Seepage occurring at the downstream toe at the right abutment.

2. Erosion areas at the contact between the upstream slope and the crest.

b. Adequacy of Information

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

c. Need for Additional Investigations

Since the spillway is considered to be "seriously inadequate", additional hydrologic/hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed. After the in-depth hydrologic/hydraulic investigations have been completed, remedial measures must be initiated to provide spillway capacity sufficient to discharge the outflow from the one-half (1/2) PMF event.

d. Urgency

The additional hydrologic/hydraulic investigations which are required must be initiated within 3 months from the date of notification. Within 12 months of notification, remedial measures as a result of these investigations must be initiated, with completion of these measures during the following year. In the interim, develop an emergency action plan for the notification of downstream residents and proper governmental authorities in the event of overtopping, and provide around-the-clock surveillance of the dam during periods of extreme runoff. The other problem areas listed below must be corrected within one year from notification.

7.2 RECOMMENDED MEASURES

The following are the recommended measures:

1. The results of the aforementioned analysis will determine the appropriate remedial measures required.

2. The bur. d portion of the spillway outlet pipe should be exposed. The discharge from the pipe should be diverted away from the toe of the dam.

3. The seepage occurring at the downstream toe of the right abutment should be monitored and observations recorded. Construction of weirs and monitoring of flow at bi-weekly intervals should be performed to properly ascertain the nature of the seepage.

4. Erosion areas at the contact between the upstream slope and the crest should be refilled, compacted and reseeded.

5. The trees, bushes and saplings should be removed from the upstream and downstream slopes and crest. A program of periodic cutting and mowing of the embankment surfaces should be provided.

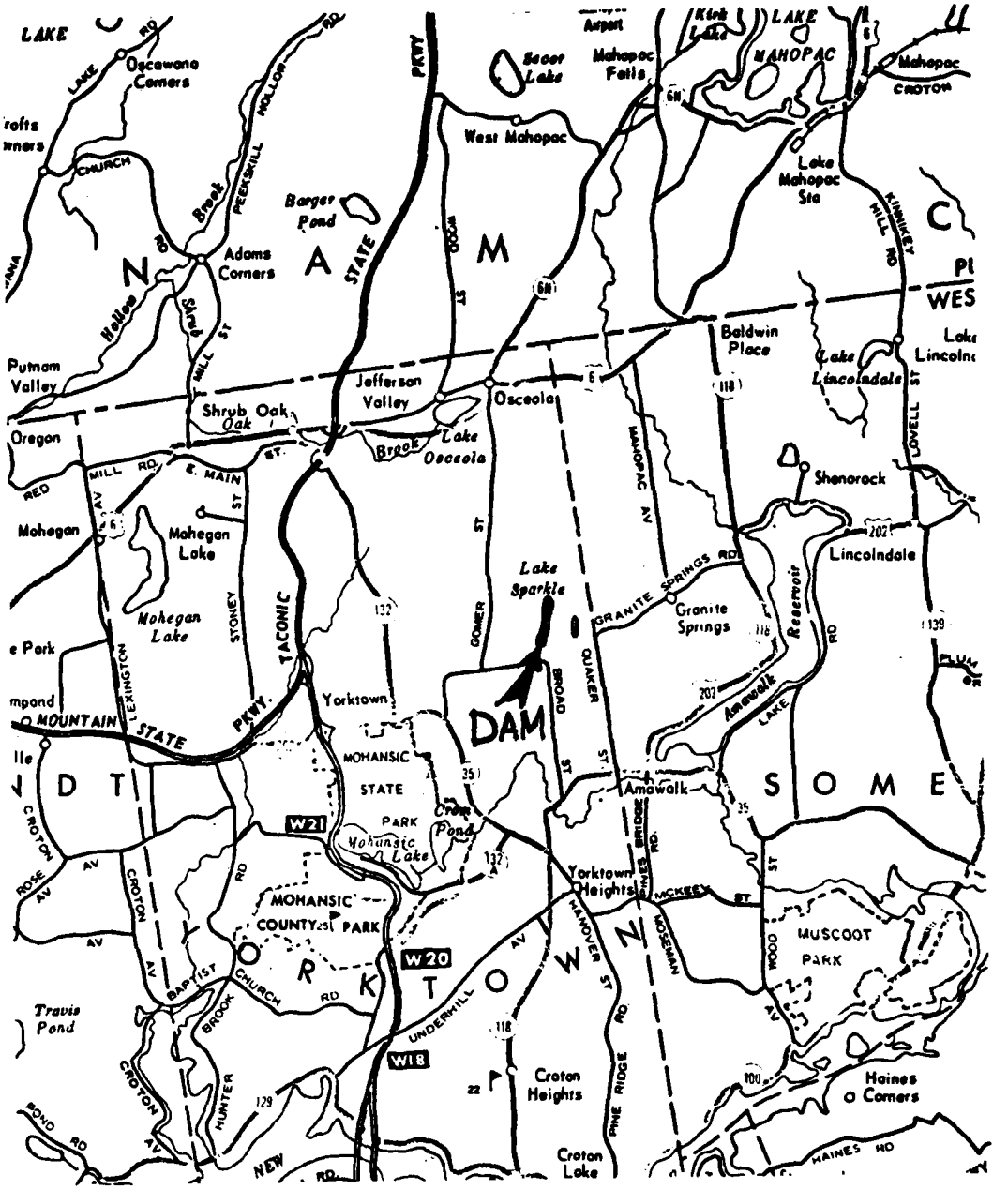
6. The longitudinal and transverse cracks at the crest should be repaired.

7. A program of periodic inspection and maintenance of the dam and appurtenances should be provided including yearly operation and lubrication of the reservoir drain system. This information should be documented for future reference. The emergency action plan described in Section 7.1d should be maintained and updated periodically during the life of the structure.

8. Consideration should be given to extending the reservoir drain valve stem.

DRAWINGS

APPENDIX A

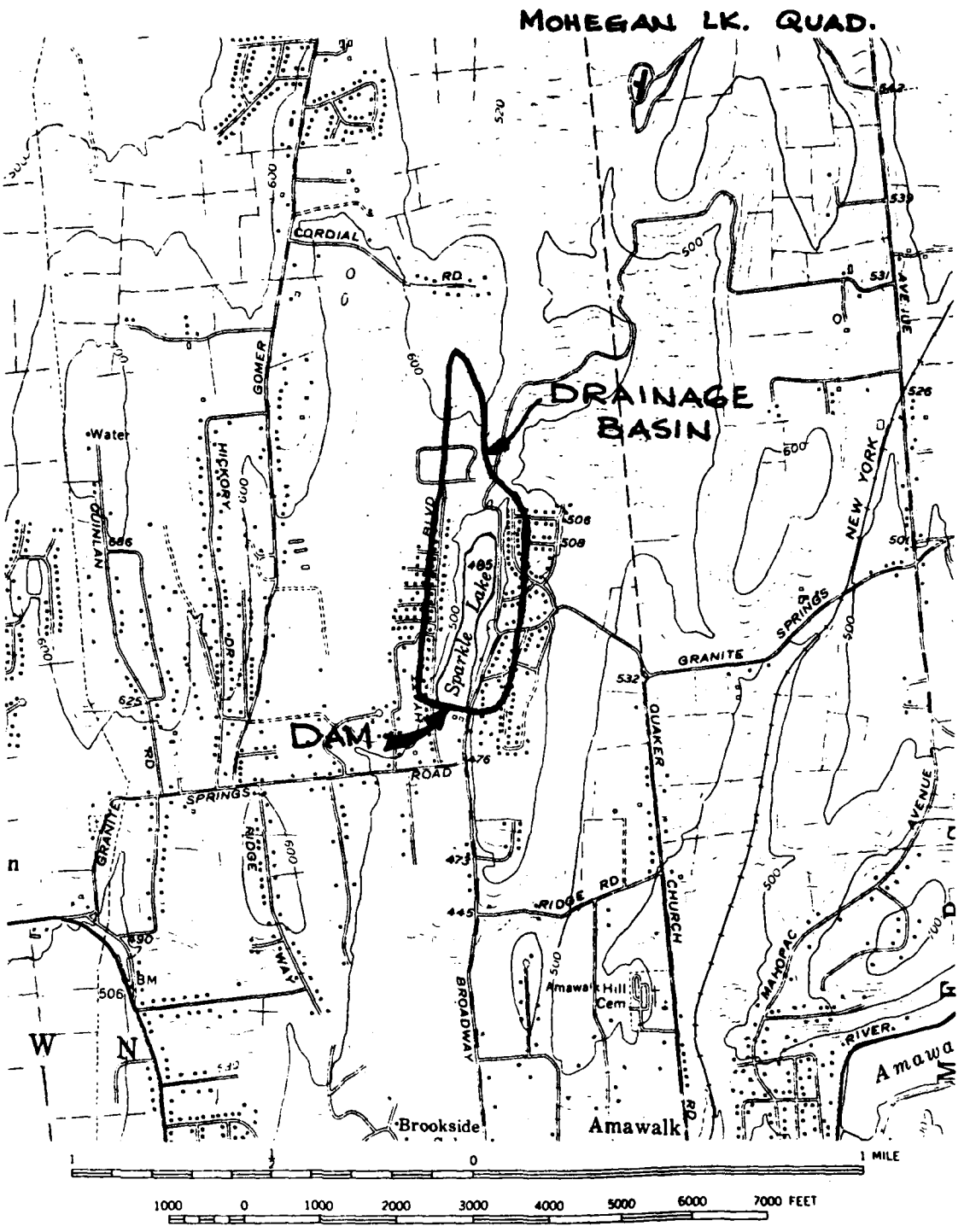


SCALE

0 1 2 3 4 Miles

VICINITY MAP

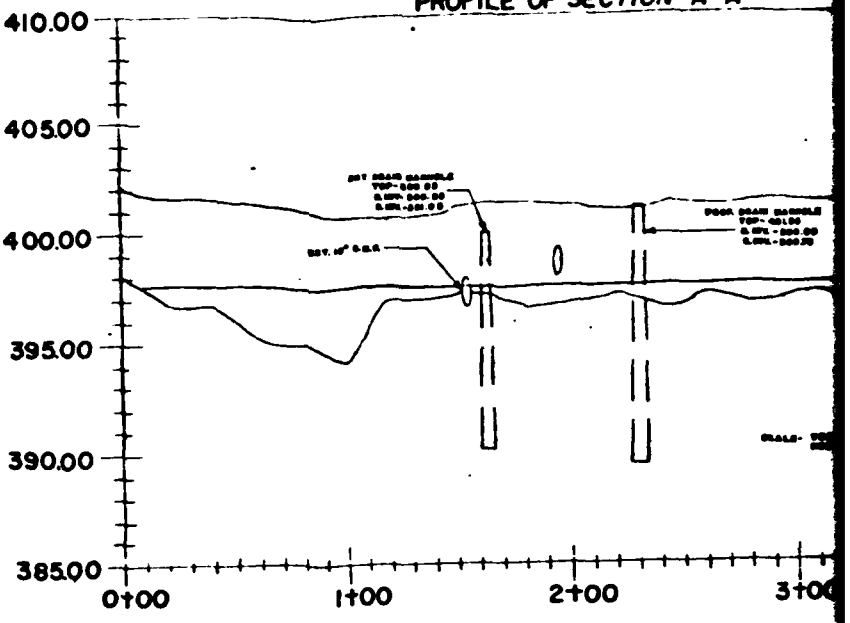
SPARKLE LAKE DAM



SCALE 1:24:000

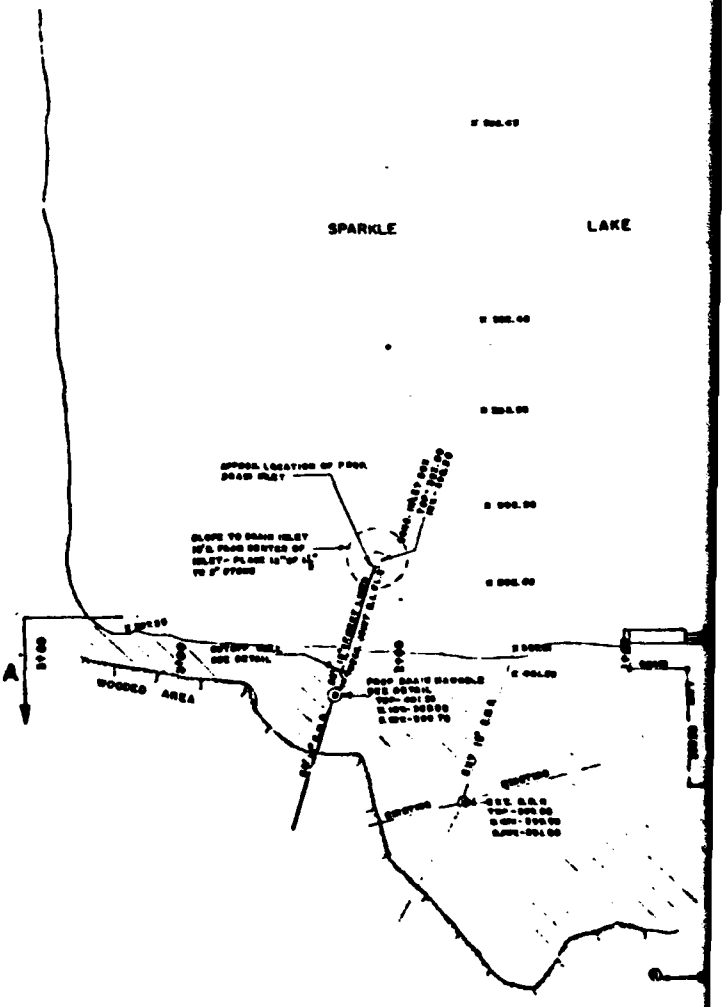
TOPOGRAPHIC MAP
SPARKLE LAKE DAM

PROFILE OF SECTION A-A

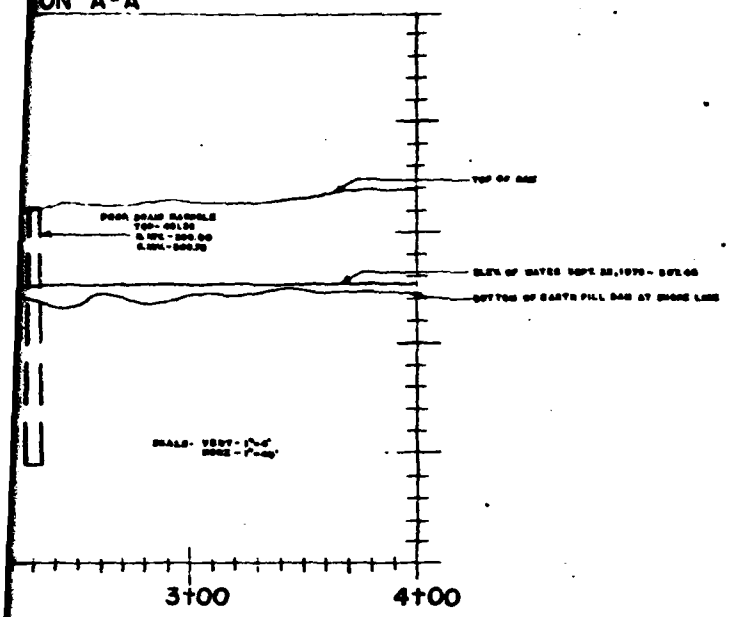


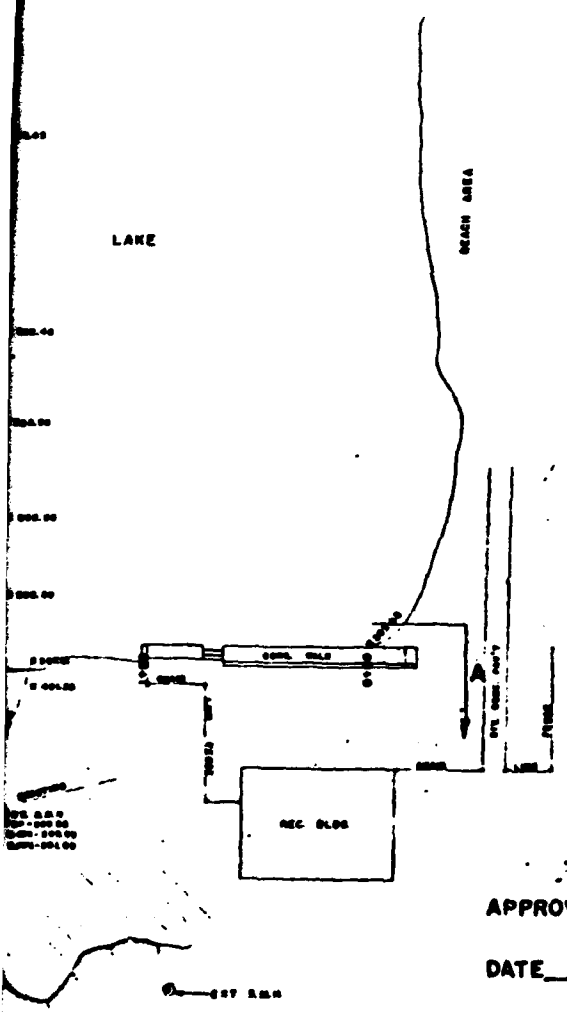
NOTES

EARTH DAM AREA



ON A-A

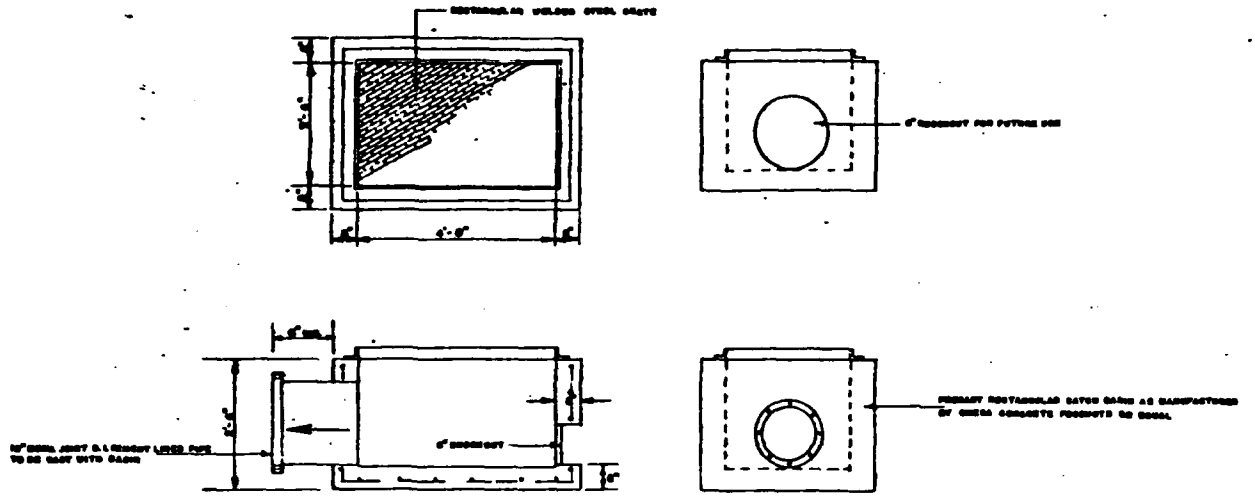




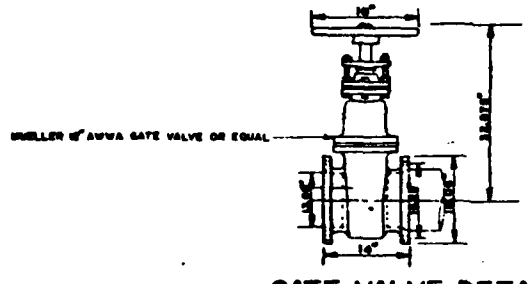
APPROVED BY _____
TOWN ENGINEER

DATE 10/22/75

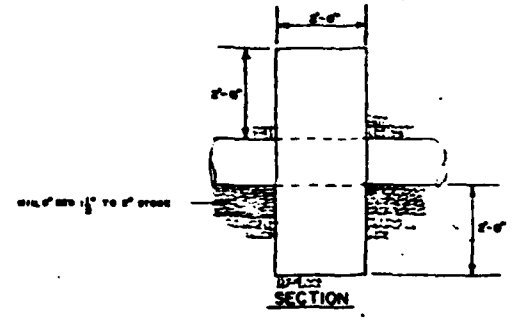
TOWN PROJECT	
INSTALLATION OF DRAIN FOR SPARKLE LAKE	
PREPARED BY ENGINEERING DEPARTMENT TOWN OF YORKTOWN	
SHEET NO. 1 OF 2	PLAN & PROFILE
SCALE 1"=40'	BY E.B.N.
DATE - 10 - 16 - 75	2



INLET STRUCTURE DETAIL



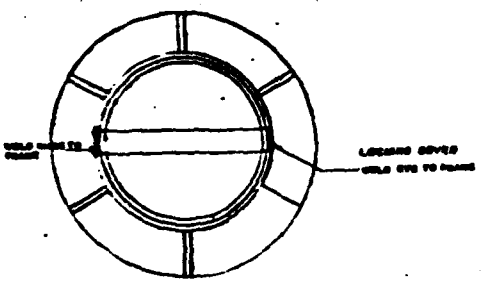
GATE VALVE DETAIL

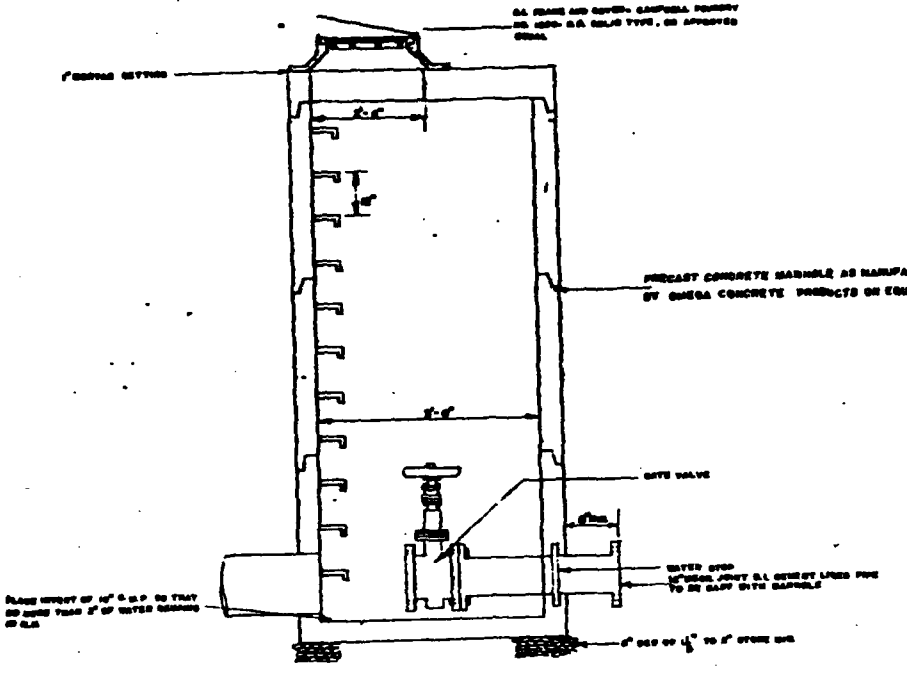


SECTION

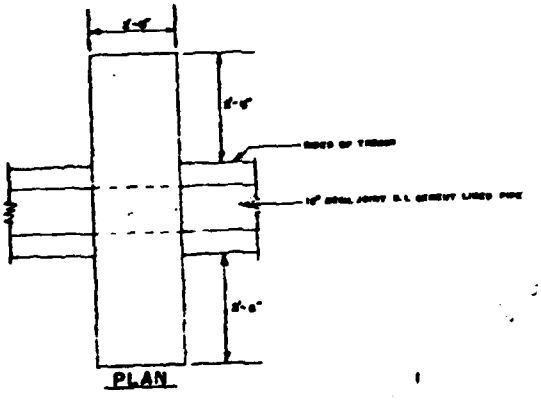
CUTOFF WA

1





DRAIN MANHOLE DETAIL



PLAN

OFF WALL DETAIL

APPROVED BY _____ TOWN ENGINEER

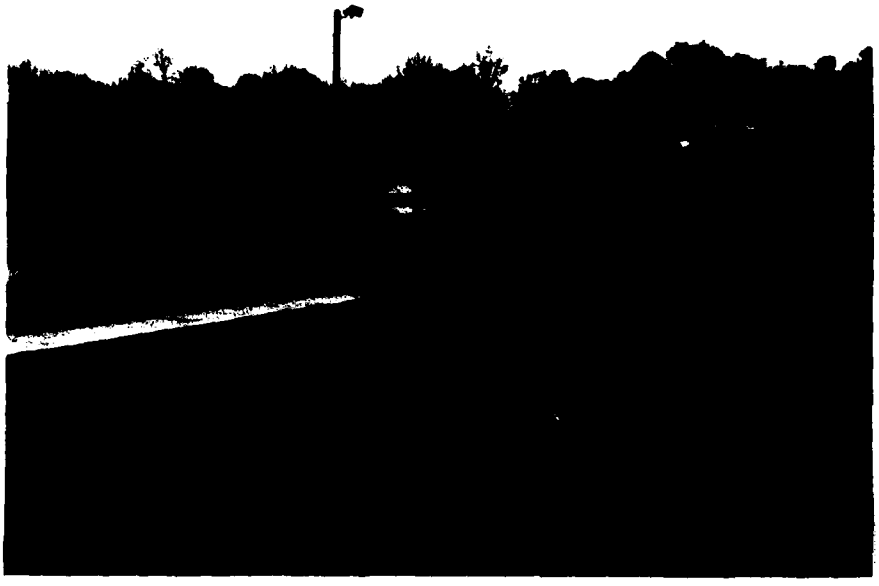
DATE 10/22/75

TOWN PROJECT
INSTALLATION OF DRAIN FOR SPARKLE LAKE
PREPARED BY ENGINEERING DEPARTMENT TOWN OF YORKTOWN
SHEET NO. 2 OF 2 DETAIL SH
DATE 10-21-75 BY E.B.N.

PHOTOGRAPHS

APPENDIX B

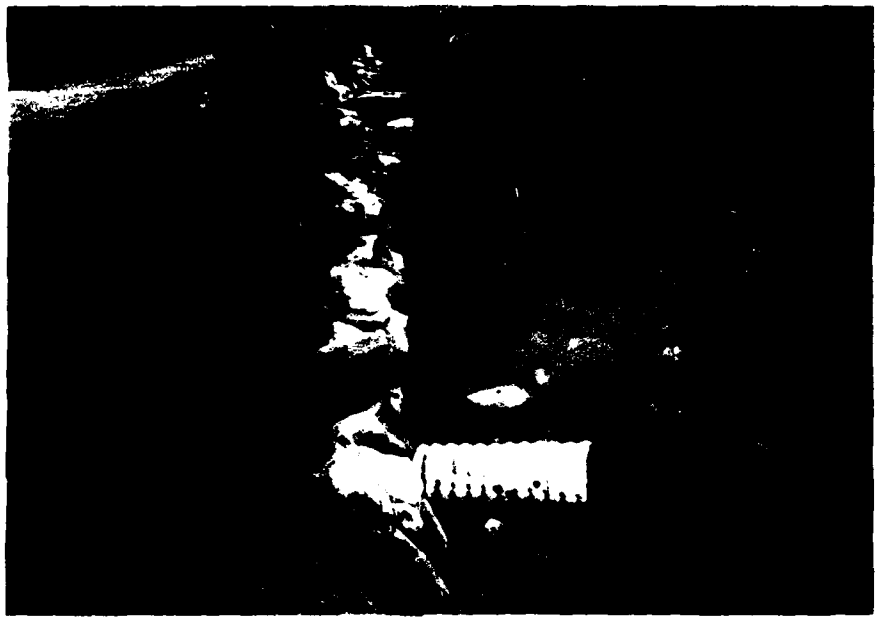
2. VIEW OF DOWNSTREAM SLOPE OF DAM.
(NOTE: Vegetation)



3. VIEW OF UPSTREAM SLOPE OF DAM.
(NOTE: Vegetation at Left Side of the Dam)

4. VIEW OF CREST LOOKING LEFT. (NOTE: Widening of Crest, Vegetation and Cracks)

5. VIEW OF CREST LOOKING RIGHT. (NOTE: Recreational Building)

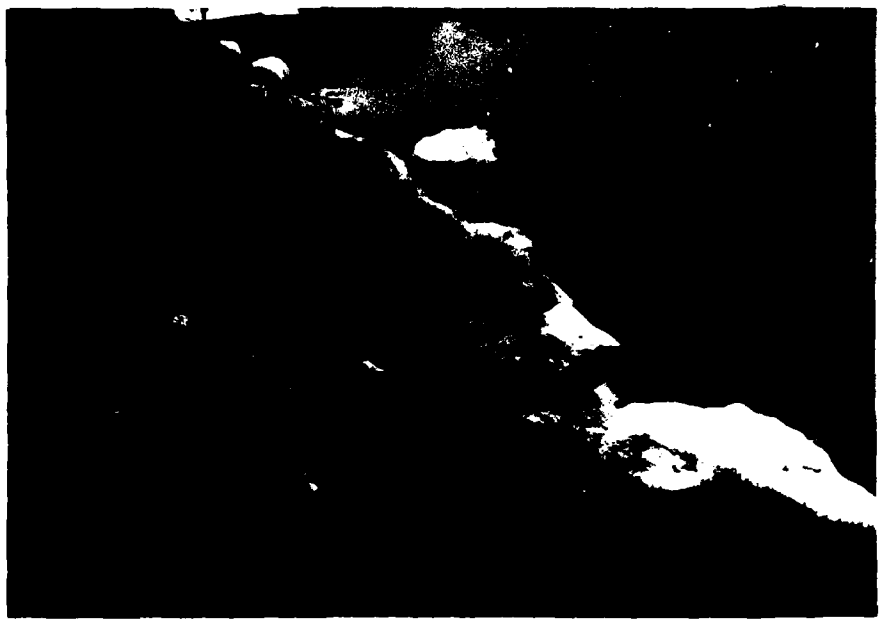


6. VIEW OF UPSTREAM SLOPE AND PIPE SPILLWAY SPILLWAY

7. VIEW OF OUTLET OF RESERVOIR DRAIN. (NOTE: Flow Discharge is from Burried Pipe Spillway Outlet)

8. CLOSEUP VIEW OF OUTLET OF RESERVOIR DRAIN.

9. VIEW OF EROSION AT UPSTREAM FACE.



10. VIEW OF EROSION AT UPSTREAM FACE.

11. VIEW AT DOWNSTREAM TOE IN VICINITY OF RIGHT ABUTMENT. (NOTE: Seepage)

VISUAL INSPECTION CHECKLIST

APPENDIX C

VISUAL INSPECTION CHECKLIST

Basic Data

a. General

Name of Dam SPARKLE LAKE DAM

Fed. I.D. # 1330 DEC Dam No. 213D-4463

River Basin HUDSON RIVER

Location: Town YORK TOWN County WESTCHESTER

Stream Name TR - HALLOCKS MILL BROOK

Tributary of HUDSON RIVER

Latitude (N) 41°-18.2' Longitude (W) 73°-47.0'

Type of Dam EARTH

Hazard Category HIGH (1)

Date(s) of Inspection MAY 6, 1981

Weather Conditions SUNNY; 70°-75°F

Reservoir Level at Time of Inspection about El 485.7 Ft. (USGS) * 8" above invert of pipe spillway.

b. Inspection Personnel HARVEY FELDMAN & JYOTINDRA PATEL

c. Persons Contacted (Including Address & Phone No.)

MR. John Goldstein, Town Engineer, TOWN OF YORKTOWN
TOWN HALL, 363 Underhill Avenue
Yorktown Heights, NEW YORK 10598
914-962-5722

d. History:

Date Constructed 1940 ** Date(s) Reconstructed 1976 - addition of the reservoir drain

** as reported in the inventory sheet.

Designer Unknown

Constructed By Unknown

Owner TOWN OF YORKTOWN.

* See Sheet No. 6.

2. Embankment

a. Characteristics

(1) Embankment Material Earth fill; classification of Earth fill is unknown. (See also #5)

(2) Cutoff Type Unknown

(3) Impervious Core Unknown

(4) Internal Drainage System Unknown

(5) Miscellaneous It is reported dam downstream slope and downstream area near toe was used as dump area. Consisting of man made fill.

b. Crest

(1) Vertical Alignment Good

(2) Horizontal Alignment Good

(3) Surface Cracks Asphalt pavement about 100' ft from right abutment has transverse and longitudinal cracks otherwise none observed on rest of the crest.

(4) Miscellaneous At left abutment contact there is a recreation building; Several Small to large trees; Some recently planted.

c. Upstream Slope Protected by Stone wall.

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

(2) Undesirable Growth or Debris, Animal Burrows none observed

(3) Sloughing, Subsidence or Depressions some sloughing about 10 ft along crest/Slope contract.

(4) Slope Protection Stone wall. Condition good.

(5) Surface Cracks or Movement at Toe Unobserrable - below water level

d. Downstream Slope

(1) Slope (Estimate - V:H) Varies from 1V:1.5H to 1V:2H

(2) Undesirable Growth or Debris, Animal Burrows. Entire slope covered with brushes, shrubs, garbage; and small to large sizes trees.

(3) Sloughing, Subsidence or Depressions minor sloughing near the trees. No subsidence or depression were observed.

(4) Surface Cracks or Movement at Toe where observable none exists.

(5) Seepage 50 ft of toe from right abutment is wet but no observable running water. In this area swamps like vegetation observed

(6) External Drainage System (Ditches, Trenches; Blanket) none observed except downstream channel for principal reserroir drain.

(7) Condition Around Outlet Structure During 1976 modification of dam outlet structure was proposed but was not constructed.

(8) Seepage Beyond Toe Seepage along toe extends beyond toe. (see # d.5.)

e. Abutments - Embankment Contact

Both abutment contacts is natural ground.

(1) Erosion at Contact None observed.

(2) Seepage Along Contact None observed.

3) Drainage System

a. Description of System appears to be none

b. Condition of System —

c. Discharge from Drainage System —

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

) Reservoir

a. Slopes Steep slops, stable and at both abutment roadway exits

b. Sedimentation could not be ascretain; however lake water is clear.

c. Unusual Conditions Which Affect Dam None

b) Area Downstream of Dam

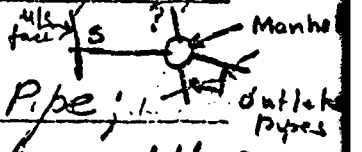
a. Downstream Hazard (No. of Homes, Highways, etc.) several homes, town of Yorktown Heights and State routes.

b. Seepage, Unusual Growth No seepage or unusual growth observed.

c. Evidence of Movement Beyond Toe of Dam None was observed

d. Condition of Downstream Channel Filled with debris i.e garbage, Vegetation such as trees, brushes, shrubs and overgrown grass

) Spillway(s) (Including Discharge Conveyance Channel)



Spillway is 15" ϕ corrugated Metal Pipe; uncontrolled; intake near upstream face of the Dam

a. General The CMP pipe is interrupted by a drop manhole located within the crest of dam. Discharge for spillway and an other pipe whose intake could not be determined collect in the manhole. Discharges from manhole flow via two outlets located at the bottom of manhole..

b. Condition of Service Spillway

Structural Condition; could not be ascertain.

c. Condition of Auxiliary Spillway No Auxiliary spillway

d. Condition of Discharge Conveyance Channel Spillway outlet is invicinity of reservoir Drain outlet. The Channel is overgrown with bushes, sapplings, trees and debris. The channel is a natural channel.

5) Reservoir Drain/Outlet

Type: Pipe ✓ Conduit _____ Other _____

Material: Concrete ✓ Metal _____ Other _____

Size: 12"ϕ from Intake to Manhole, 18"ϕ " Manhole to Outlet Length about 116' (Gate valve located at midway along the pipe in a manhole)

Invert Elevations:* Entrance 479.0' Exit 477.5' at D/S toe ✓

Physical Condition (Describe): Unobservable _____

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: reported good; the gate operated during winter to lower lake.

Means of Control: Gate _____ Valve ✓ Uncontrolled _____

Operation: Operable ✓ Inoperable _____ Other _____

Present Condition (Describe): good condition; reported in operating condition. Gate was not operated during the inspection.

* Elevation MSL * USGS DATUM.
DWGS IN APPENDIX SHOW OTHER DAM ASSUMS USGS 485' = 396.5' (DWGS).

9) Structural — No Structural Items.

a. Concrete Surfaces

b. Structural Cracking

c. Movement - Horizontal & Vertical Alignment (Settlement)

d. Junctions with Abutments or Embankments

e. Drains - Foundation, Joint, Face

f. Water Passages, Conduits, Sluices

g. Seepage or Leakage

h. Joints - Construction, etc. _____

i. Foundation _____

j. Abutments _____

k. Control Gates _____

l. Approach & Outlet Channels _____

m. Energy Dissipators (Plunge Pool, etc.) _____

n. Intake Structures _____

o. Stability _____

p. Miscellaneous _____

10) Appurtenant Structures (Powerhouse, Lock, Gatehouse, Other)

a. Description and Condition There are none. The manholes for the reservoir drain and pipe spillway (located at the crest) are in good condition.

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX D

1579-18 → SPARKLE LAKE DAM

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	489.3 *	22.71	111
2) Design High Water (Max. Design Pool)	Unknown	—	—
3) Auxiliary Spillway Crest	None		
4) Pool Level with Flashboards	None		
5) Service Spillway Crest	485	17.45	84

DISCHARGES

	Volume (cfs)
1) Average Daily	UNKNOWN
2) Spillway @ Maximum High Water (PMF	7?7
3) Spillway @ Design High Water	UNKNOWN
) Spillway @ Auxiliary Spillway Crest Elevation	NONE
5) Low Level Outlet (Reservar Drain)	10
) Total (of all facilities) @ Maximum High Water (PMF)	1737
) Maximum Known Flood	UNKNOWN
8) At Time of Inspection	UNKNOWN

* Based on USGS DATUM.
USGS 485 = 396.5
(topographic sheet) (Drawing).

CREST: DAM ELEVATION: 489.3

Type: Earth Fill

Width: Varies 15'- 150' Length: 310'

Spillover Pipe Spillway

Location (Spillway) Middle of Dam

SPILLWAY:

SERVICE		AUXILIARY
485 (INV.)	Elevation	NONE
CORRUGATED METAL PIPE	Type	
15" DIA.	Width	
	Type of Control	
✓	Uncontrolled	
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
	Chute Length	
	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES: NONE USED

Type : _____

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM: NONE

Warning System: _____

_____

Method of Controlled Releases (mechanisms):

_____

_____

DRAINAGE AREA: 103.76 ac. = 0.16 sq mi

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: _____

Terrain - Relief: ROLLING

Surface - Soil: UNKNOWN

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

Unknown

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE OBSERVED IN VICINITY OF DAM

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter: NONE

Location: _____

Elevation: _____

Reservoir:

Length @ Maximum Pool TOP OF DAM. 0.45 (Miles)

Length of Shoreline (@ Spillway Crest) 0.95 (Miles)

TAMS

Job No. _____ Sheet 1 of 17

Project SPARKLE LAKE DAM Date JUNE 23, 81

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

Ch'k. by JMD

SNYDER COEF

$C_T = 2$

$640 C_p = 400$

$L = 0.47$ mi

$L_{CA} = 0.11$ mi

$T_p = C_1 (L L_{CA})^{0.3} = 2(0.47 \times 0.11)^{0.3} = 0.82$ hours.

$T_R = 0.82/5.5 = 0.149$ hrs.

for $T_R = 0.23$ hrs

$T_{PR} = T_p + 0.25(T_R - T_R) = 0.82 + 0.25(0.181) = 0.865$

USE $T_{PR} = 0.87$ hours.

Percent impervious $17.45/103.76 \times 100 = 16.8\%$ (0.17)

HYDROMET # 33:
ALL SEASON 24 HOUR 200 SQ MILE PMP = 22

DURATION (HRS)	% INDEX RAINFALL
6	112
12	123
24	133
48	141

TAMS

Job No. _____ Sheet 2 of 17

Project SPARKLE LAKE DAM Date JUNE 23, 81

Subject HYDROLOGIC / HYDRAULIC COMPUTATIONS By DLC

Ch'k. by JMD

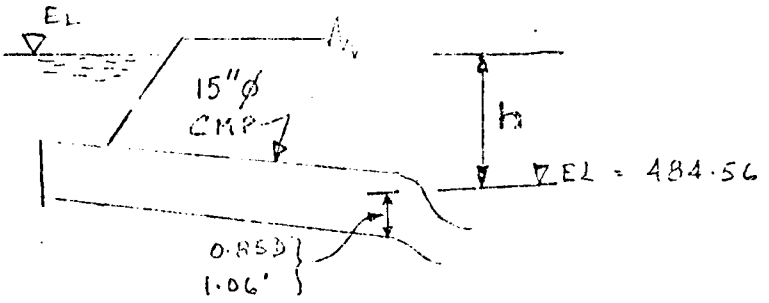
DAM LENGTH 310' @ EL = 489.3

SPILLWAY (15"ϕ CMP) INVERT EL. = 485.0

LENGTH TO MANHOLE = 75.0'

CMP INVERT EL AT MANHOLE = 483.5'

ASSUMING



DISCHARGE WITH LAKE EL AT TOP OF DAM EL 489.3

$h = 489.3 - 484.56 = 4.74'$

USING $K_c = 0.5$ $Q_{MAX} = 7.7$ cfs. [X] [Y] (Design of Small Dams) (Fig B-II 288-D-2911)

@ $h = 10.44$ $Q = 11.2$

@ $h = 2.0'$ $Q = 5.0$ cfs. [X]

Discharge Capacity of 15"ϕ CMP :

EL	Q
485	0
487	5.0
489.3	7.7
495.0	11.2

TAMS

Job No. _____ Sheet 3 of 17

Project SPARKLE LAKE DAM Date JUNE 23, 81

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

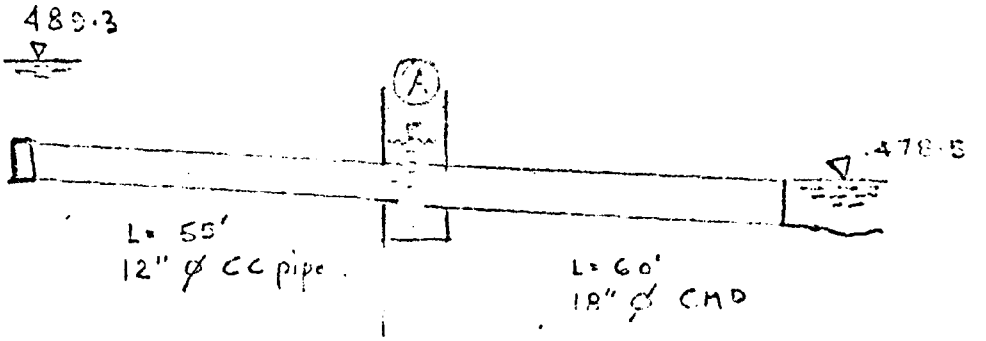
Ch'k. by JMD

DISCHARGE OF 12" cement pipe (low level outlet)

Assume 0.5 Entrance loss coef.

pipes flowing full

and tailwater at top of outlet @ EL.



WITH Q = 10 cfs

h needed for 18" ø = 2.6' (Fig B-11)

i.e headwater EL = 478.5 + 2.6 = 481.1 @ (A)

for 12" pipe with h = 489.3 - 481.1 = 8.2'

Q = 10.2 cfs (Fig B-10)

therefore with water surface at EL 489.3

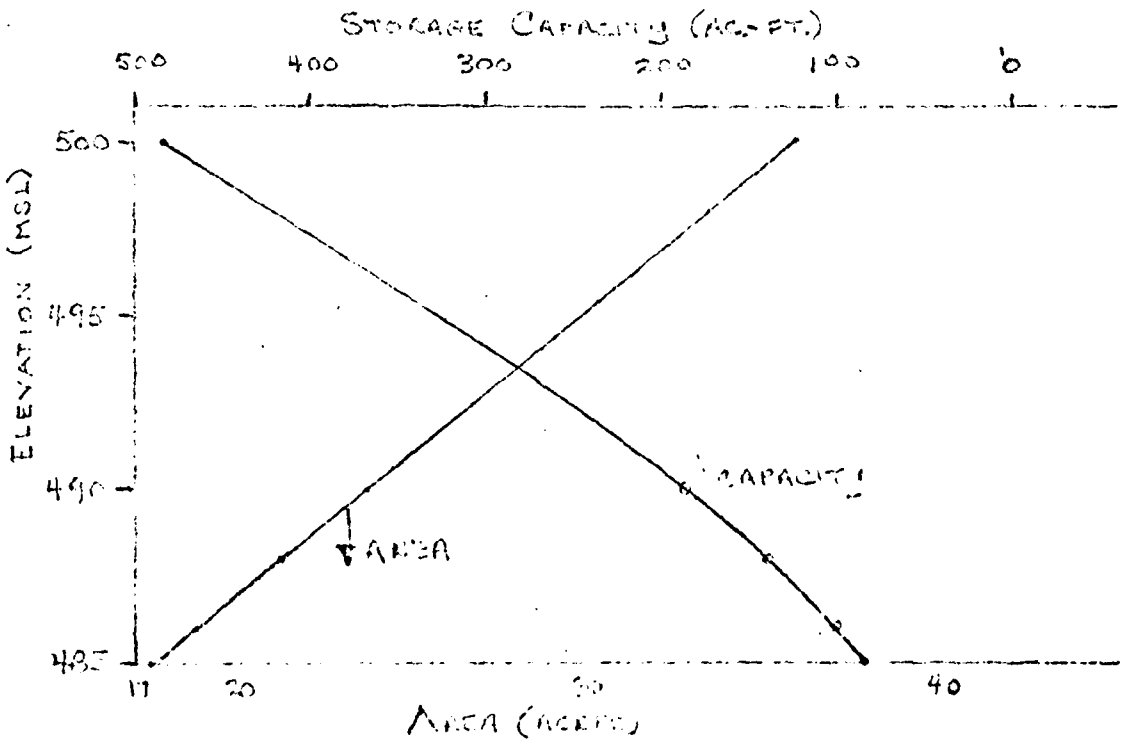
MAX LOW LEVEL OUTLET FLOW = 10 cfs.

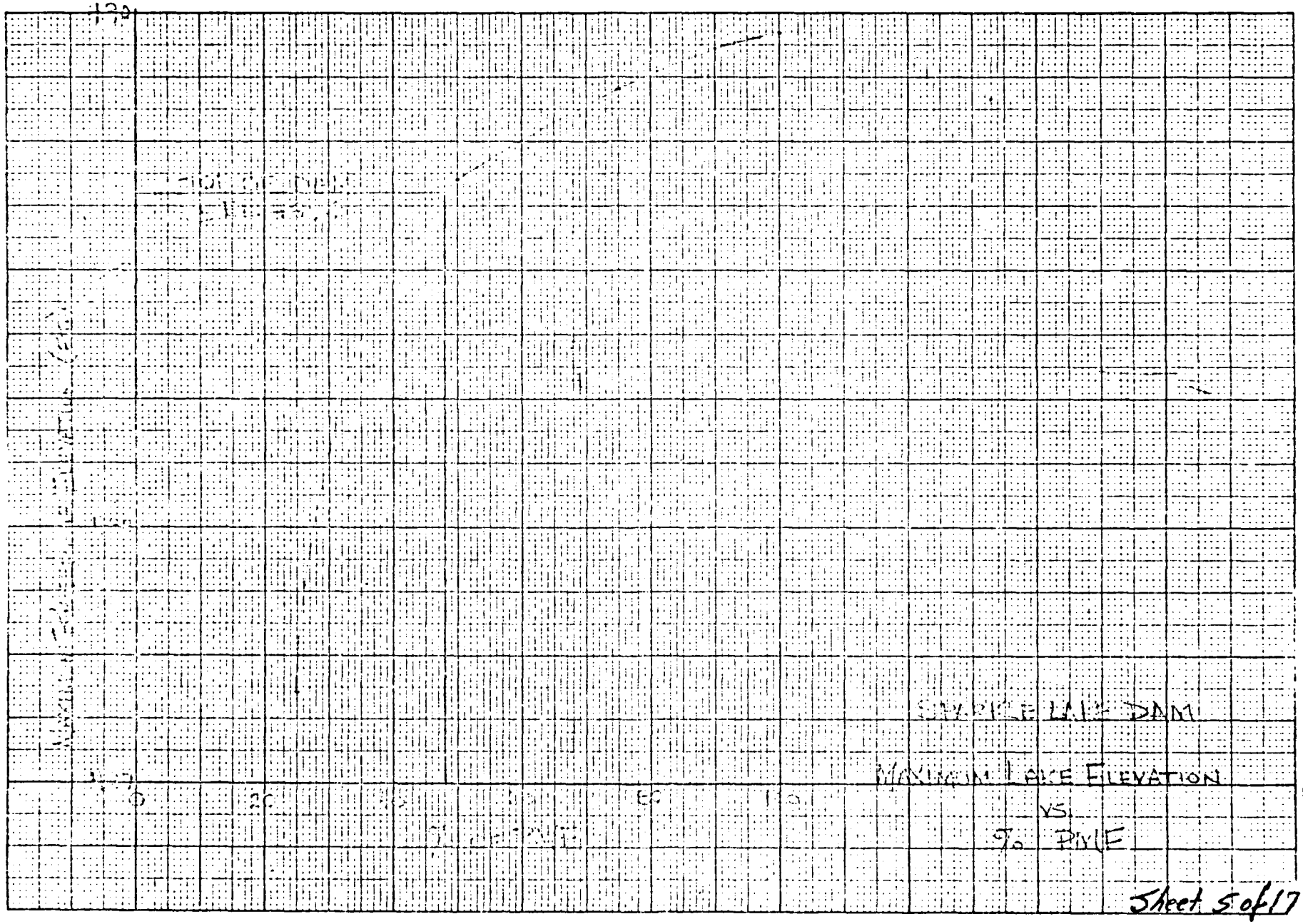
OUTLET ASSUMED closed DURING PMF Analysis.

TAMS

Job No. 1579-13 Sheet 4 of 17
Project SPARKLE LAKE DAM Date JUNE 23, '81
Subject HYDROLOGIC HYDRAULIC COMPUTATIONS By D.L.C.
Ch'k. by J.M.D.

EL.	(ft.) ΔH	(ac.) AREA	MEAN AREA	(ac.-ft) Δ VOL.	(ac.-ft.) STORAGE
485		17.45			84
	1		18.06	18.06	
486		18.67			102.1
	2		19.895	39.79	
488		21.12			141.9
	2		22.345	44.69	
490		23.57			186.5
	10		29.69	296.9	
500		35.81			483.4





Sheet 5 of 17

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1                                  SPARKLE LAKE DAM
    2                A2                                  PHASE 1 SAFETY INSPECTION
    3                A3                                  HEC 1 PMF ANALYSIS (NO DAM BREAK)
    4                B    150        0       20        0        0        0        0        0        0        0
    5                P1     5
    6                J      1        4        1
    7                J1     1     0.75      0.5     0.25
    8                K      0        1                                                  1
    9                K1       1 SPARKLE LAKE BASIN RUNOFF
   10                M      1        1     0.16                0.16                                        1
   11                P               22      112      123      133      141
   12                T                                                                  1      0.1              0.17
   13                W   0.87    0.625
   14                X     -1     -0.1      1.5
   15                K      1        2                                                  1
   16                K1       2 ROUTE HYDROGRAPH THROUGH SPARKLE LAKE
   17                Y                                           1        1
   18                Y1     1                                                          84       -1
   19                Y4   485      487    489.3      495
   20                Y5     0        5     7.70    11.20
   21                SS    84    102.1    141.9    186.5    483.4
   22                SE   485      486      488      490      500
   23                SS   485
   24                SO 489.3      3.1      1.5      310
   25                K     99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/07/07.
     TIME= 10.52.33.

                                SPARKLE LAKE DAM
                          PHASE 1 SAFETY INSPECTION
                          HEC 1 PMF ANALYSIS (NO DAM BREAK)

                                JOB SPECIFICATION
          NO    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
         150     0     20      0      0     0      0      0      0      0
                JOPER    NWT   LROPT   TRACE
                   5      0      0       0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1  NRTIO= 4  LRTIO= 1
                RTIOS=   .25    .50    .75   1.00

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

                          SUB-AREA RUNOFF COMPUTATION

                          1 SPARKLE LAKE BASIN RUNOFF

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

                                HYDROGRAPH DATA
          IHYDG  IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO  ISNOW  ISAME  LOCAL
              1     1     .16   0.00     .16    0.00   0.000      0      1      0

                                PRECIP DATA
                 SPFE    PMS     R6     R12     R24     R48     R72     R96
                 0.00   22.00  112.00  123.00  133.00  141.00    0.00    0.00
 TRSPC COMPUTED BY THE PROGRAM IS  .800

                                LOSS DATA
          LROPT  STRKR   DLTKR   RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
              0   0.00    0.00    1.00   0.00   0.00   1.00   1.00    .10    0.00    .17

                          UNIT HYDROGRAPH DATA
                TP=   .87    CP= .63    NTA=  0

                          RECESSION DATA
                STRTQ=  -1.00    QRCSN=  -.10    RTIOR= 1.50
 APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 2.91 AND R= 2.38 INTERVALS

          UNIT HYDROGRAPH 15 END-OF-PERIOD ORDINATES, LAG=   .86 HOURS, CP=  .63  VOL= 1.00
            15.    51.    71.    60.    39.    26.    17.    11.     7.     5.
             3.     2.     1.     1.     1.

                                END-OF-PERIOD FLOW
   0
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q    MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q
  1.01    .20      1    .00    .00    .00       0.     1.02   1.20      76    .04    .01    .03       2.
  1.01    .40      2    .00    .00    .00       0.     1.02   1.40      77    .04    .01    .03       3.
  1.01   1.00      3    .00    .00    .00       0.     1.02   2.00      78    .04    .01    .03       3.
  1.01   1.20      4    .00    .00    .00       0.     1.02   2.20      79    .04    .01    .03       3.
  1.01   1.40      5    .00    .00    .00       0.     1.02   2.40      80    .04    .01    .03       3.
  1.01   2.00      6    .00    .00    .00       0.     1.02   3.00      81    .04    .01    .03       3.
  1.01   2.20      7    .00    .00    .00       0.     1.02   3.20      82    .04    .01    .03       3.
  1.01   2.40      8    .00    .00    .00       0.     1.02   3.40      83    .04    .01    .03       3.
  1.01   3.00      9    .00    .00    .00       0.     1.02   4.00      84    .04    .01    .03       3.
  1.01   3.20     10    .00    .00    .00       0.     1.02   4.20      85    .04    .01    .03       3.
```

Sheet 3 of 17

END OF PERIOD FLOW

DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.20	1	.00	.00	.00	0.	1.02	1.20	76	.04	.01	.03	3.
1.01	.40	2	.00	.00	.00	0.	1.02	1.40	77	.04	.01	.03	3.
1.01	1.00	3	.00	.00	.00	0.	1.02	2.00	78	.04	.01	.03	3.
1.01	1.20	4	.00	.00	.00	0.	1.02	2.20	79	.04	.01	.03	3.
1.01	1.40	5	.00	.00	.00	0.	1.02	2.40	80	.04	.01	.03	3.
1.01	2.00	6	.00	.00	.00	0.	1.02	3.00	81	.04	.01	.03	3.
1.01	2.20	7	.00	.00	.00	0.	1.02	3.20	82	.04	.01	.03	3.
1.01	2.40	8	.00	.00	.00	0.	1.02	3.40	83	.04	.01	.03	3.
1.01	3.00	9	.00	.00	.00	0.	1.02	4.00	84	.04	.01	.03	4.
1.01	3.20	10	.00	.00	.00	0.	1.02	4.20	85	.04	.01	.03	4.
1.01	3.40	11	.00	.00	.00	0.	1.02	4.40	86	.04	.01	.03	4.
1.01	4.00	12	.00	.00	.00	0.	1.02	5.00	87	.04	.01	.03	4.
1.01	4.20	13	.00	.00	.00	0.	1.02	5.20	88	.04	.01	.03	4.
1.01	4.40	14	.00	.00	.00	0.	1.02	5.40	89	.04	.01	.02	4.
1.01	5.00	15	.00	.00	.00	0.	1.02	6.00	90	.04	.01	.03	4.
1.01	5.20	16	.00	.00	.00	0.	1.02	6.20	91	.11	.08	.03	5.
1.01	5.40	17	.00	.00	.00	0.	1.02	6.40	92	.11	.08	.03	8.
1.01	6.00	18	.00	.00	.00	0.	1.02	7.00	93	.11	.08	.03	13.
1.01	6.20	19	.01	.00	.01	0.	1.02	7.20	94	.11	.08	.03	17.
1.01	6.40	20	.01	.00	.01	0.	1.02	7.40	95	.11	.08	.03	20.
1.01	7.00	21	.01	.00	.01	0.	1.02	8.00	96	.11	.08	.03	21.
1.01	7.20	22	.01	.00	.01	0.	1.02	8.20	97	.11	.08	.03	23.
1.01	7.40	23	.01	.00	.01	0.	1.02	8.40	98	.11	.08	.03	23.
1.01	8.00	24	.01	.00	.01	0.	1.02	9.00	99	.11	.08	.03	24.
1.01	8.20	25	.01	.00	.01	0.	1.02	9.20	100	.11	.08	.03	24.
1.01	8.40	26	.01	.00	.01	0.	1.02	9.40	101	.11	.08	.03	24.
1.01	9.00	27	.01	.00	.01	0.	1.02	10.00	102	.11	.08	.03	24.
1.01	9.20	28	.01	.00	.01	0.	1.02	10.20	103	.11	.08	.03	25.
1.01	9.40	29	.01	.00	.01	0.	1.02	10.40	104	.11	.08	.03	25.
1.01	10.00	30	.01	.00	.01	0.	1.02	11.00	105	.11	.08	.03	25.
1.01	10.20	31	.01	.00	.01	0.	1.02	11.20	106	.11	.08	.03	25.
1.01	10.40	32	.01	.00	.01	0.	1.02	11.40	107	.11	.08	.03	25.
1.01	11.00	33	.01	.00	.01	0.	1.02	12.00	108	.11	.08	.03	25.
1.01	11.20	34	.01	.00	.01	0.	1.02	12.20	109	.66	.63	.03	33.
1.01	11.40	35	.01	.00	.01	0.	1.02	12.40	110	.66	.63	.03	61.
1.01	12.00	36	.01	.00	.01	0.	1.02	13.00	111	.66	.63	.03	100.
1.01	12.20	37	.04	.01	.03	0.	1.02	13.20	112	.79	.76	.03	135.
1.01	12.40	38	.04	.01	.03	1.	1.02	13.40	113	.79	.76	.03	163.
1.01	13.00	39	.04	.01	.03	1.	1.02	14.00	114	.79	.76	.03	196.
1.01	13.20	40	.05	.01	.04	1.	1.02	14.20	115	.99	.96	.03	206.
1.01	13.40	41	.05	.01	.04	2.	1.02	14.40	116	.99	.96	.03	228.
1.01	14.00	42	.05	.01	.04	2.	1.02	15.00	117	.99	.96	.03	249.
1.01	14.20	43	.06	.01	.05	2.	1.02	15.20	118	1.72	1.70	.03	277.
1.01	14.40	44	.06	.01	.05	2.	1.02	15.40	119	4.72	4.69	.03	371.
1.01	15.00	45	.06	.01	.05	3.	1.02	16.00	120	1.05	1.02	.03	525.
1.01	15.20	46	.10	.02	.09	3.	1.02	16.20	121	.92	.89	.03	601.
1.01	15.40	47	.28	.05	.24	4.	1.02	16.40	122	.92	.89	.03	543.
1.01	16.00	48	.05	.03	.03	6.	1.02	17.00	123	.92	.89	.03	452.
1.01	16.20	49	.06	.03	.03	7.	1.02	17.20	124	.72	.70	.03	348.
1.01	16.40	50	.06	.03	.03	8.	1.02	17.40	125	.72	.70	.03	338.
1.01	17.00	51	.06	.03	.03	8.	1.02	18.00	126	.72	.70	.03	298.
1.01	17.20	52	.04	.02	.03	8.	1.02	18.20	127	.06	.03	.03	259.
1.01	17.40	53	.04	.02	.03	8.	1.02	18.40	128	.06	.03	.03	236.
1.01	18.00	54	.04	.02	.03	7.	1.02	19.00	129	.06	.03	.03	146.
1.01	18.20	55	.00	.00	.00	6.	1.02	19.20	130	.06	.03	.03	99.
1.01	18.40	56	.00	.00	.00	5.	1.02	19.40	131	.06	.03	.03	67.
1.01	19.00	57	.00	.00	.00	3.	1.02	20.00	132	.06	.03	.03	59.
1.01	19.20	58	.00	.00	.00	2.	1.02	20.20	133	.06	.03	.03	56.
1.01	19.40	59	.00	.00	.00	2.	1.02	20.40	134	.06	.03	.03	54.
1.01	20.00	60	.00	.00	.00	1.	1.02	21.00	135	.06	.03	.03	52.
1.01	20.20	61	.00	.00	.00	1.	1.02	21.20	136	.06	.03	.03	50.
1.01	20.40	62	.00	.00	.00	1.	1.02	21.40	137	.06	.03	.03	48.
1.01	21.00	63	.00	.00	.00	1.	1.02	22.00	138	.06	.03	.03	46.
1.01	21.20	64	.00	.00	.00	1.	1.02	22.20	139	.06	.03	.03	44.
1.01	21.40	65	.00	.00	.00	1.	1.02	22.40	140	.06	.03	.03	42.
1.01	22.00	66	.00	.00	.00	1.	1.02	23.00	141	.06	.03	.03	41.
1.01	22.20	67	.00	.00	.00	1.	1.02	23.20	142	.06	.03	.03	39.
1.01	22.40	68	.00	.00	.00	1.	1.02	23.40	143	.06	.03	.03	37.
1.01	23.00	69	.00	.00	.00	1.	1.03	0.00	144	.06	.03	.03	36.
1.01	23.20	70	.00	.00	.00	1.	1.03	.20	145	0.00	0.00	0.00	35.
1.01	23.40	71	.00	.00	.00	1.	1.03	.40	146	0.00	0.00	0.00	33.
1.02	0.00	72	.00	.00	.00	1.	1.03	1.00	147	0.00	0.00	0.00	32.
1.02	.20	73	.04	.01	.03	1.	1.03	1.20	148	0.00	0.00	0.00	31.
1.02	.40	74	.04	.01	.03	1.	1.03	1.40	149	0.00	0.00	0.00	29.
1.02	1.00	75	.04	.01	.03	2.	1.03	2.00	150	0.00	0.00	0.00	28.

1.01	20.40	62	.00	.00	.00	1.	1.02	21.20	136	.06	.03	.03		50.
1.01	21.00	63	.00	.00	.00	1.	1.02	21.40	137	.06	.03	.03		48.
1.01	21.20	64	.00	.00	.00	1.	1.02	22.00	138	.06	.03	.03		46.
1.01	21.40	65	.00	.00	.00	1.	1.02	22.20	139	.06	.03	.03		44.
1.01	22.00	66	.00	.00	.00	1.	1.02	22.40	140	.06	.03	.03		42.
1.01	22.20	67	.00	.00	.00	1.	1.02	23.00	141	.06	.03	.03		41.
1.01	22.40	68	.00	.00	.00	1.	1.02	23.20	142	.06	.03	.03		39.
1.01	23.00	69	.00	.00	.00	1.	1.02	23.40	143	.06	.03	.03		37.
1.01	23.20	70	.00	.00	.00	1.	1.03	0.00	144	.06	.03	.03		36.
1.01	23.40	71	.00	.00	.00	1.	1.03	.20	145	0.00	0.00	0.00		35.
1.02	0.00	72	.00	.00	.00	1.	1.03	.40	146	0.00	0.00	0.00		33.
1.02	.20	73	.04	.01	.03	1.	1.03	1.00	147	0.00	0.00	0.00		32.
1.02	.40	74	.04	.01	.03	1.	1.03	1.20	148	0.00	0.00	0.00		31.
1.02	1.00	75	.04	.01	.03	2.	1.03	1.40	149	0.00	0.00	0.00		29.
							1.03	2.00	150	0.00	0.00	0.00		28.
									SUM	24.82	21.75	3.06		7258.
										(630.)	(553.)	(78.)		205.52)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	601.	308.	99.	48.	7246.
CMS	17.	9.	3.	1.	205.
INCHES		17.94	23.01	23.41	23.41
MM		455.55	584.56	594.51	594.51
AC-FT		153.	196.	200.	200.
THOUS CU M		189.	242.	246.	246.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	2.	2.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	2.	3.	4.	5.	5.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	8.	15.
25.	34.	41.	47.	52.	57.	62.	69.	93.	131.
150.	134.	113.	97.	84.	74.	65.	58.	37.	25.
17.	15.	14.	13.	13.	12.	12.	11.	11.	11.
10.	10.	9.	9.	9.	8.	8.	8.	7.	7.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	150.	77.	25.	12.	1812.
CMS	4.	2.	1.	0.	51.
INCHES		4.48	5.75	5.85	5.85
MM		113.89	146.14	148.63	148.63
AC-FT		38.	49.	50.	50.
THOUS CU M		47.	61.	62.	62.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	2.	3.	4.	4.
4.	4.	4.	3.	3.	2.	2.	1.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	4.	6.	9.	10.	11.	11.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	17.	30.
55.	67.	82.	93.	103.	114.	124.	138.	185.	263.
300.	272.	226.	194.	169.	149.	129.	103.	73.	49.
34.	29.	28.	27.	26.	25.	24.	23.	22.	21.
20.	20.	19.	18.	17.	17.	16.	15.	15.	14.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	300.	154.	49.	24.	3623.
CMS	8.	4.	1.	1.	103.
INCHES		8.96	11.51	11.70	11.70
MM		227.78	292.28	297.26	297.26
AC-FT		75.	97.	99.	99.
THOUS CU M		94.	121.	123.	123.

12.	12.	12.	12.	12.	12.	11.	12.	12.	12.	
50.	47.	44.	3.	83.	114.	124.	13[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	169.	149.	129.	103.	73.	49.	
34.	29.	28.	27.	26.	25.	24.	23.	22.	21.	
20.	20.	19.	18.	17.	17.	16.	15.	15.	14.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	300.	154.	49.	24.	3623.
CMS	9.	4.	1.	1.	103.
INCHES		8.97	11.51	11.70	11.70
MM		227.78	292.28	297.25	297.25
AC-FT		76.	98.	100.	100.
THOUS CU M		94.	121.	123.	123.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	2.	2.	2.	2.	2.	3.	4.	6.	6.
6.	6.	6.	5.	4.	4.	3.	2.	1.	1.
1.	1.	1.	1.	1.	1.	0.	0.	0.	0.
0.	0.	0.	1.	1.	2.	2.	2.	2.	2.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	6.	10.	13.	15.	16.	17.	17.	18.	18.
18.	18.	18.	18.	18.	18.	18.	18.	25.	46.
75.	101.	122.	140.	155.	171.	187.	203.	278.	394.
450.	407.	339.	291.	253.	223.	194.	155.	110.	74.
51.	44.	42.	40.	39.	37.	36.	34.	33.	32.
30.	29.	28.	27.	26.	25.	24.	23.	22.	21.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	450.	231.	74.	36.	5436.
CMS	13.	7.	2.	1.	154.
INCHES		13.45	17.26	17.55	17.55
MM		341.66	438.42	445.88	445.88
AC-FT		115.	147.	150.	150.
THOUS CU M		142.	182.	185.	185.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
2.	2.	2.	2.	3.	3.	4.	6.	7.	8.
8.	8.	8.	7.	6.	5.	3.	2.	2.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	2.	3.	3.	3.	3.
3.	3.	3.	4.	4.	4.	4.	4.	4.	4.
5.	8.	13.	17.	20.	21.	23.	23.	24.	24.
24.	24.	25.	25.	25.	25.	25.	25.	33.	61.
100.	135.	163.	186.	206.	228.	249.	277.	371.	525.
601.	543.	452.	388.	338.	298.	269.	206.	146.	99.
67.	59.	56.	54.	52.	50.	48.	46.	44.	42.
41.	39.	37.	36.	35.	33.	32.	31.	29.	28.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	601.	308.	99.	48.	7246.
CMS	17.	9.	3.	1.	205.
INCHES		17.94	23.01	23.41	23.41
MM		455.65	584.56	594.51	594.51
AC-FT		153.	196.	200.	200.
THOUS CU M		189.	242.	246.	246.

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

HYDROGRAPH ROUTING

2 ROUTE HYDROGRAPH THROUGH SPARKLE LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	1	0	0	0	0	1	1	1

Sheet 10 of 17

HYDROGRAPH ROUTING

2 ROUTE HYDROGRAPH THROUGH SPARKLE LAKE

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	84.	-1

STAGE	485.00	487.00	489.30	495.00	
FLOW	0.00	5.00	7.70	11.20	
CAPACITY=	84.	102.	142.	187.	483.
ELEVATION=	485.	486.	488.	490.	500.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
485.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
489.3	3.1	1.5	310.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

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

STORAGE

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	86.	86.	86.	86.
86.	86.	87.	87.	87.	87.	87.	87.	88.	88.
88.	89.	90.	91.	93.	94.	96.	98.	100.	103.
107.	110.	114.	116.	119.	121.	123.	124.	125.	126.
125.	127.	127.	127.	127.	128.	128.	128.	128.	129.
128.	128.	129.	129.	129.	129.	129.	129.	129.	129.

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0

Sheet 9 of 17

85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
[illegible]	[illegible]	[illegible]	[illegible]	5.	85.	86.	85.	86.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	87.	87.	87.	87.	86.	86.
88.	89.	90.	91.	93.	94.	96.	98.	100.	103.
107.	110.	114.	116.	119.	121.	123.	124.	125.	126.
126.	127.	127.	127.	127.	128.	128.	128.	128.	128.
128.	128.	129.	129.	129.	129.	129.	129.	129.	129.

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.2	485.2	485.2	485.2	485.2	485.2	485.2
485.2	485.3	485.3	485.4	485.5	485.6	485.6	485.7	485.9	486.0
486.2	486.4	486.6	486.7	486.8	486.9	487.0	487.1	487.2	487.2
487.2	487.2	487.2	487.3	487.3	487.3	487.3	487.3	487.3	487.3
487.3	487.3	487.3	487.3	487.3	487.3	487.3	487.4	487.4	487.4

PEAK OUTFLOW IS 5. AT TIME 50.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5.	5.	2.	1.	174.
CMS	0.	0.	0.	0.	5.
INCHES		.31	.55	.56	.55
MM		7.92	14.03	14.28	14.28
AC-FT		3.	5.	5.	5.
THOUS CU M		3.	6.	6.	6.

STATION 2, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	3.	3.	4.	4.	5.
5.	5.	6.	7.	7.	7.	7.	7.	7.	8.
8.	8.	8.	8.	12.	16.	18.	20.	21.	21.
21.	21.	20.	20.	19.	19.	19.	17.	17.	16.

STORAGE

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	85.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
85.	85.	85.	85.	85.	85.	85.	86.	86.	86.
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.
86.	86.	86.	86.	87.	87.	87.	88.	88.	88.
89.	89.	89.	89.	90.	90.	90.	91.	91.	92.
93.	94.	96.	99.	101.	104.	107.	111.	115.	121.
129.	137.	143.	149.	154.	158.	162.	165.	167.	169.
169.	170.	171.	171.	171.	172.	172.	172.	172.	172.
172.	172.	172.	172.	172.	172.	172.	172.	172.	172.

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sheet 12 of 17

			[illegible]	[illegible]	84.	84.	84.	85.	85.
85.	85.	85.	85.	85.	[illegible]	[illegible]	5.	85.	85.
85.	85.	8				[illegible]	[illegible]	65.	65.
85.	85.	85.	85.	85.	85.	85.	85.	86.	86.
86.	86.	86.	85.	85.	86.	86.	86.	86.	86.
86.	86.	85.	86.	87.	87.	87.	88.	88.	88.
89.	89.	89.	89.	90.	90.	90.	91.	91.	92.
93.	94.	96.	99.	101.	104.	107.	111.	115.	121.
129.	137.	143.	149.	154.	158.	162.	165.	167.	168.
167.	170.	171.	171.	171.	172.	172.	172.	172.	172.
172.	172.	172.	172.	172.	172.	172.	172.	172.	172.

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.2	485.2	485.2	485.2	485.2
485.2	485.3	485.3	485.3	485.3	485.3	485.4	485.4	485.4	485.4
485.5	485.6	485.7	485.8	486.0	486.1	486.3	486.4	486.7	487.0
487.4	487.7	488.1	488.3	488.5	488.7	488.9	489.0	489.1	489.2
489.2	489.3	489.3	489.3	489.3	489.3	489.3	489.4	489.4	489.4
489.4	489.4	489.4	489.4	489.4	489.4	489.3	489.3	489.3	489.3

PEAK OUTFLOW IS 21. AT TIME 46.67 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	21.	17.	6.	3.	434.
CMS	1.	0.	0.	0.	12.
INCHES		.99	1.38	1.40	1.40
MM		25.13	35.13	35.61	35.61
AC-FT		8.	12.	12.	12.
THOUS CU M		10.	15.	15.	15.

STATION 2, PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
2.	2.	3.	3.	4.	4.	5.	5.	6.	5.
7.	7.	35.	197.	250.	242.	218.	188.	151.	114.
84.	64.	54.	48.	44.	41.	39.	38.	36.	34.
33.	32.	31.	30.	28.	27.	26.	25.	24.	24.

STORAGE

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	85.	85.	85.	85.	85.
85.	85.	85.	86.	86.	86.	86.	86.	86.	86.
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.
86.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	88.	88.	88.	89.	89.	90.	90.
91.	91.	92.	92.	93.	93.	94.	94.	95.	95.
97.	100.	103.	105.	110.	114.	119.	125.	131.	140.
152.	163.	173.	178.	180.	180.	179.	178.	177.	175.
175.	174.	174.	174.	173.	173.	173.	172.	172.	172.
173.	173.	173.	173.	172.	173.	172.	172.	172.	172.

Sheet 13 of 17

STAGE

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.	
84.	84.	84.	84.	84.	84.	85.	85.	85.	85.	
85.	85.	85.	85.	85.	85.	85.	85.	86.	86.	
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.	
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.	
86.	87.	87.	87.	87.	87.	87.	87.	87.	87.	
87.	87.	87.	88.	88.	88.	89.	89.	90.	90.	
91.	91.	92.	92.	93.	93.	94.	94.	95.	96.	
97.	100.	103.	106.	110.	114.	119.	125.	131.	140.	
152.	163.	173.	178.	180.	180.	179.	178.	177.	176.	
175.	174.	174.	174.	173.	173.	173.	173.	173.	173.	
173.	173.	173.	173.	173.	173.	172.	172.	172.	172.	

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.1	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.2	485.2	485.2	485.2	485.2
485.2	485.2	485.2	485.2	485.2	485.2	485.3	485.3	485.3	485.3
485.4	485.4	485.4	485.5	485.5	485.6	485.8	486.6	486.9	487.0
485.7	485.9	486.0	486.2	486.4	486.6	486.9	487.1	487.5	487.9
488.4	489.0	489.4	489.6	489.7	489.7	489.7	489.6	489.6	489.5
489.5	489.5	489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4
489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4

PEAK OUTFLOW IS 250. AT TIME 41.67 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	250.	104.	31.	15.	2233.
CMS	7.	3.	1.	0.	63.
INCHES		6.07	7.18	7.21	7.21
MM		154.13	182.44	183.16	183.16
AC-FT		52.	61.	62.	62.
THOUS CU M		64.	75.	76.	76.

STATION 2, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	2.
2.	3.	3.	4.	5.	5.	6.	6.	6.	7.
51.	493.	480.	431.	377.	331.	291.	258.	198.	148.
108.	82.	69.	62.	57.	54.	52.	49.	47.	45.
44.	42.	40.	39.	37.	36.	34.	33.	32.	31.

STORAGE

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	85.	85.	85.	85.	85.	85.	85.
86.	86.	86.	86.	86.	86.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	88.	88.	88.	88.	88.	88.	88.
88.	88.	89.	89.	89.	90.	91.	91.	92.	92.
93.	94.	94.	95.	96.	96.	97.	97.	98.	99.
102.	105.	109.	113.	119.	125.	131.	138.	147.	159.
176.	183.	185.	184.	183.	182.	181.	180.	178.	177.
176.	175.	174.	174.	174.	174.	174.	174.	174.	173.
173.	173.	173.	173.	173.	173.	173.	173.	173.	173.

84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.					5.	85.	85.
86.	86.	86.	86.	86.	86.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	88.	88.	88.	88.	88.	88.	88.
88.	88.	89.	89.	89.	90.	91.	91.	92.	92.
93.	94.	94.	95.	95.	96.	97.	97.	98.	99.
102.	105.	109.	113.	119.	125.	131.	138.	147.	159.
174.	183.	185.	184.	183.	182.	181.	180.	178.	177.
176.	175.	174.	174.	174.	174.	174.	174.	174.	173.
173.	173.	173.	173.	173.	173.	173.	173.	173.	173.

STAGE

485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.0
485.0	485.0	485.0	485.0	485.0	485.0	485.0	485.1	485.1	485.1
485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1	485.1
485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2
485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2
485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2	485.2
485.2	485.2	485.3	485.3	485.3	485.3	485.4	485.4	485.4	485.5
485.5	485.5	485.6	485.6	485.6	485.7	485.7	485.7	485.8	485.9
486.0	486.1	486.3	486.6	486.8	487.1	487.5	487.8	488.2	488.8
489.4	489.9	489.9	489.9	489.8	489.8	489.7	489.7	489.6	489.6
489.5	489.5	489.5	489.4	489.4	489.4	489.4	489.4	489.4	489.4
489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4	489.4

PEAK OUTFLOW IS 480. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	480.	194.	56.	27.	4026.
CMS	14.	5.	2.	1.	114.
INCHES		11.27	12.97	13.00	13.00
MM		286.26	329.34	330.30	330.30
AC-FT		96.	111.	111.	111.
THOUS CU M		119.	136.	137.	137.

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

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .50	RATIO 3 .75	RATIO 4 1.00
HYDROGRAPH AT	1	.16	1	150.	300.	450.	601.
		(.41)		(4.25)	(8.50)	(12.75)	(17.01)
ROUTED TO	2	.16	1	5.	21.	250.	480.
		(.41)		(.15)	(.59)	(7.07)	(13.58)

SUMMARY OF DAM SAFETY ANALYSIS

Sheet #6 of 17

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	485.00	485.00	489.30
	STORAGE	84.	84.	171.
	OUTFLOW	0.	0.	8.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	485.00	485.00	489.30
STORAGE	84.	84.	171.
OUTFLOW	0.	0.	8.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.25	487.36	0.00	129.	5.	0.00	50.00	0.00
.50	489.36	.06	172.	21.	5.67	46.67	0.00
.75	489.70	.40	190.	250.	9.33	41.67	0.00
1.00	489.92	.62	185.	480.	10.00	41.00	0.00

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 AUG 80

STABILITY ANALYSIS

APPENDIX E

Since there are no concrete gravity structures at the damsite, no stability analysis is performed (Ref. 3).

REFERENCES

APPENDIX F

REFERENCES

1. "Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations", U. S. Army Corps of Engineers, Hydrologic Engineering Center, September 1979.

2. "Seasonal Variation of the Probable Maximum Precipitation, East of the 105th Meridian for Areas from 10 to 1,000 Square Miles, and Durations of 6, 12, 24 and 48 Hours", Hydrometeorological Report No. 33. Weather Bureau, U.S. Department of Commerce, April 1956.

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

4. The University of the State of New York, The State Education Department State Museum and Science Service Geological Survey - MAP and Chart Serves No. 5, Geologic MAP of New York 1961, Lower Hudson Sheet.

5. "Design of Small Dams," United States Department of the Interior, Bureau of Reclamation, 1974.