

AD-A086 899

NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON
NATIONAL DAM SAFETY PROGRAM. LAKE SONOMA DAM (NJ 0193), PASSAIC--ETC(U)
MAR 80 J P TALERICO DACW61-79-C-0011

F/6 13/13

DACW61-79-C-0011

NL

UNCLASSIFIED

1-08

AD-A086899

END
DATE
FILMED
9-80
DTIC

~~LEVEL~~

(1)

PASSAIC RIVER BASIN
BRANCH OF BURNT MEADOW BROOK
PASSAIC COUNTY, NEW JERSEY

ADA 08 6899

LAKE SONOMA
NJ 00193

DAM
DTIC
ELECTE
JUL 21 1980
S

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

MARCH 1980

DOC FILE COPY

ORIGINAL CONTAINS COLOR PLATES: ALL DOC
PRODUCTIONS WILL BE IN BLACK AND WHITE

80 7 18 026

NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED
FROM THE BEST COPY FURNISHED BY
THE SPONSORING AGENCY. ALTHOUGH
IT IS RECOGNIZED THAT CERTAIN POR-
TIONS ARE ILLEGIBLE, IT IS BEING
RELEASED IN THE INTEREST OF MAKING
AVAILABLE AS MUCH INFORMATION AS
POSSIBLE.



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

IN REPLY REFER TO
NAPEN-N

9 JUL 1980

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

Dear Governor Byrne:

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

Based on visual inspection, available records, calculations and past operational performance, Lake Sonoma Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 95 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the 100 year flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within twelve months from the date of approval of this report. Within six months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within twelve months from the date of approval of this report the following remedial actions should be completed:

(1) Repair or replace the low-level outlet valve and provide a cover for the manhole.

(2) Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel.

(3) All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

NAPEN-N

Honorable Brendan T. Byrne

(4) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

c. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

d. Within one year from the date of approval of this report the following remedial actions should be initiated:

(1) Consider providing additional low-level outlet facilities to decrease the draw down time. Also consider providing headwater and tailwater gages.

(2) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

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

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

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

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CM029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CM029
Trenton, NJ 08625

Accession For	
NTIS General	☒
DDC TAB	☐
Unannounced	☐
Justification	☐
By _____	
Distribution _____	
Availability _____	
Dist	A

LAKE SONOMA DAM (NJ00193)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 16 November 1979 by Harris-ECI Associates Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lake Sonoma Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 95 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the 100 year flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within twelve months from the date of approval of this report. Within six months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within twelve months from the date of approval of this report the following remedial actions should be completed:

(1) Repair or replace the low-level outlet valve and provide a cover for the manhole.

(2) Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel.

(3) All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(4) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

c. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

d. Within one year from the date of approval of this report the following remedial actions should be initiated:

(1) Consider providing additional low-level outlet facilities to decrease the draw down time. Also consider providing headwater and tailwater gages.

(2) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED: 

JAMES G. TON

Colonel, Corps of Engineers
District Engineer

DATE: 9 JUL 1960

PASSAIC RIVER BASIN
BRANCH OF BURNT MEADOW BROOK, PASSAIC COUNTY
NEW JERSEY

LAKE SONOMA DAM

NJ00193

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA 19106

MARCH 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name: Lake Sonoma Dam, I.D. NJ 00193
State Located: New Jersey
County Located: Passaic County
Stream: Branch of Burnt Meadow Brook
River Basin: Passaic River
Date of Inspection: November 16, 1979

Assessment of General Conditions

Lake Sonoma Dam is an earthfill dam containing a concrete weir spillway at the left end of the dam. The overall condition of the dam is good. There is no sign of distress or instability in the embankment. The downstream channel is well defined with a rock channel bottom. The operation of the low-level outlet was not demonstrated satisfactorily during the inspection. The hazard potential is downgraded to "significant".

The adequacy of Lake Sonoma Dam is considered questionable in view of its lack of spillway capacity to pass the 100-year flood, which is the SDF for the dam, without overtopping the dam. The spillway is capable of passing a flood equal to 94 percent of the SDF (100-year storm) and is assessed as "inadequate".

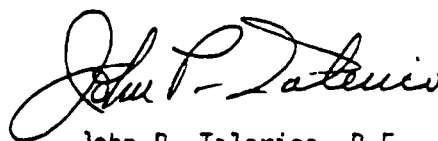
At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection the preliminary assessment of static stability is that it is satisfactory. The following actions, are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.
2. Repair or replace the low-level outlet valve and provide a cover for the manhole within twelve months.

3. Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel. This work should be started within twelve months.
4. All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.
5. Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.
6. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within twenty four months.

1. Consider providing additional low-level outlet facilities to decrease the drawdown time.
2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam and to form a coherent as-built set.
3. The owner should develop within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.



John P. Talerico, P.E.
HARRIS - ECI ASSOCIATES



Photo taken on January 21, 1980

L A K E S O N O M A D A M

View of spillway and embankment looking toward right side of lake.

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 the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide 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.

TABLE OF CONTENTS

ASSESSMENT OF GENERAL CONDITIONS

OVERVIEW PHOTO

PREFACE

Page

SECTION 1	PROJECT INFORMATION	1
	1.1 General	1
	1.2 Description of Project	1
	1.3 Pertinent Data	4
SECTION 2	ENGINEERING DATA.....	6
	2.1 Design	6
	2.2 Construction.....	6
	2.3 Operation	6
	2.4 Evaluation.....	6
SECTION 3	VISUAL INSPECTION.....	7
	3.1 Findings	7
SECTION 4	OPERATION PROCEDURES.....	9
	4.1 Procedures	9
	4.2 Maintenance of Dam.....	9
	4.3 Maintenance of Operating Facilities.....	9
	4.4 Evaluation	9
SECTION 5	HYDRAULIC/HYDROLOGIC	10
	5.1 Evaluation of Features.....	10
SECTION 6	STRUCTURAL STABILITY	12
	6.1 Evaluation of Structural Stability.....	12
SECTION 7	ASSESSMENT/REMEDIAL MEASURES	13
	7.1 Dam Assessment	13
	7.2 Remedial Measures	14

TABLE OF CONTENTS CONTINUED

<u>PLATES</u>	<u>No.</u>
KEY MAP AND VICINITY MAP.....	1 & 1A
GEOLOGIC MAP.....	2
DRAWINGS OF DAM.....	3

APPENDICES

APPENDIX A - CHECK LIST - VISUAL OBSERVATIONS CHECK LIST - ENGINEERING, CONSTRUCTION, MAINTENANCE DATA	1 - 14
APPENDIX B - PHOTOGRAPHS	
APPENDIX C - SUMMARY OF ENGINEERING DATA	1
APPENDIX D - HYDROLOGIC COMPUTATIONS	1 - 17

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LAKE SONOMA DAM, I.D. NJ 00193

S E C T I O N 1

1. PROJECT INFORMATION

1.1 General

a. Authority

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

b. Purpose of Inspection

The visual inspection of Lake Sonoma Dam was made on November 16, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Lake Sonoma Dam is an earthfill dam approximately 216-ft. long and 24-ft. high. According to the owner, the dam has a concrete core wall. There is an 18-ft. wide broad crested concrete weir spillway at the left end of the dam. The crest of the spillway is 4.0 ft. below the top of the dam. The embankment has a crest width of 9 feet with upstream and downstream slopes of 2H:1V.

The low-level outlet consists of a 12-inch cast iron pipe through the dam approximately 42 feet right of the spillway. The flow through the pipe is controlled by a manually operated gate valve located in the downstream side of the embankment. The inlet end of the pipe is located at the upstream toe of the slope. The outlet discharges into the downstream channel. From there the flow continues in a northerly direction for a distance of approximately 3700 feet to 2-6 ft. x 4 ft. C.M.P. Arches passing under Burnt Meadow Road.

There are no known borings or test pits taken for this dam.

A generalized description of soil condition is contained in Report No. 3, Passaic County, Engineering Soil Survey of New Jersey, by Rutgers University. The report, dated 1951, describes the lake area soils as ground moraine deposited during the Wisconsin glaciation. Ground moraine is unstratified, heterogeneous material including clay, silt and sand sizes, with varying amounts of gravel, cobbles and boulders. The underlying rock is variable in depth but is usually shallow. Geologic Overlay Sheet 22 describes the rock as Quartz-Oligoclase-Biotite Gneiss.

b. Location

Lake Sonoma Dam is located on a branch of the Wanaque River in the Township of West Milford, Passaic County, New Jersey. It is accessible by way of Burnt Meadow Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 121 acre-feet is less than 1,000 acre-feet. The dam is also classified as small because its height of 24 feet is less than 40 feet. The overall size classification of Lake Sonoma Dam is small.

d. Hazard Classification

A hazard potential classification of "significant" has been assigned to the dam. This is based on the facts that there are no dwellings immediately downstream, that Burnt Meadow Road, approximately 3,700 feet downstream, is lightly traveled and that the stream and a small pond downstream are used for trout fishing contributing to the recreational use of the area. Therefore, the possibility exists of the loss of a few lives in the event of dam failure.

e. Ownership

Lake Sonoma Dam is owned by:

Tapawingo Trout Preserve
Burnt Meadow Road, Box 38
Wanaque, N.J. 07465

Attention: Mr. Maitland Bleecker
Proprietor

f. Purpose

Lake Sonoma Dam is presently used for recreational purposes only.

g. Design and Construction History

No information is available on the original design of the dam which was completed in 1948. According to the owner, the dam has a concrete core wall. Information relating to the design and construction of this core wall does not exist.

h. Normal Operating Procedures

The discharge from the lake is unregulated and is allowed to naturally balance the inflow into the lake. The low-level outlet is used to lower the lake level by a manually operated control valve.

1.3 Pertinent Data

a. Drainage Area 0.4 sq. mi.

b. Discharge at Dam Site

Ungated spillway capacity at
elevation of top of dam: 386 cfs (790 NGVD)

Total spillway capacity at
maximum pool elevation(SDF): 437 cfs (790.07 NGVD)

c. Elevation (Feet above NGVD)

Top of dam: 790

Maximum pool design surcharge (SDF): 790.07

Recreation pool: 786.3

Spillway crest: 786.0

Streambed at centerline of dam: 764 (estimated)

Maximum tailwater: 766 (estimated)

d. Reservoir

Length of maximum pool: 1,600 ft. (estimated)

Length of recreation pool: 1,550 ft. (estimated)

e. Storage (acre-feet)

Spillway Crest: 74

Top of dam: 120

Maximum pool(SDF): 121

f. Reservoir Surface (acres)

Top of dam: 16.1 (estimated)

Maximum pool (SDF): 16.3 (estimated)

Recreation pool: N/A

Spillway crest: 9.2 (estimated)

g. Dam

Type:	Earthfill with concrete weir spillway
Length:	215.7 ft. (effective)
Height:	24 ft.
Top width:	9 ft.
Side slopes - Upstream:	2 H:1V
- Downstream:	2 H:1V
Zoning:	Unknown
Impervious core:	Concrete core. Length Unknown
Cutoff:	Unknown
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Concrete broadcrest weir with flashboards 3/4 length of spillway.
Length of weir:	18 ft.
Crest elevation:	786
Gates:	None
U/S Channel:	Lake Sonoma
D/S Channel:	Steep natural rocky channel

j. Regulating Outlets

Low level outlet:	12-inch C.I.P. with gate valve
Controls:	Manually operated
Emergency gate:	None
Outlet:	768 NGVD

SECTION 2

2. ENGINEERING DATA

2.1 Design

There are no available drawings or design computations for the Lake Sonoma Dam. No data from soil borings, soil tests, or other geotechnical data is available. No cross-sections suitable for assessing the stability are available.

2.2 Construction

Data is not available concerning the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is very poor.

b. Adequacy

The engineering data obtained in the field was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

c. Validity

Since no existing engineering data exists, the validity of that data could not be compared to the data obtained in the field.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Lake Sonoma Dam revealed the dam and spillway to be in good condition but in need of repairs. The lake level was above the crest of the spillway at the time of inspection.

b. Dam

The earth embankment appears sound. No surface cracking on the embankment or at the toe was noted. Sloughing or erosion of embankment and abutment slopes were not visible. No misalignment of the embankment in the horizontal or vertical plane was observed. Numerous trees, small to medium size, are growing on top and both sides of the embankment. No seepage was found exiting from the downstream slope. Some toe ponding was noticed about 100 feet right of the spillway. There was no flow present in the pond and it was believed that the water in the pond was from recent rains. No evidence of burrowing by animals was observed; however, the embankment was covered with leaves and therefore the possibility does exist that there may be burrow holes.

c. Appurtenant Structures

1. Spillways

No seepage or leakage was noticed at the wall and foundation of the spillway. Two flashboards, totaling 14 inches in height and spanning 3/4 of the spillway, are in good condition. The right abutment was in good condition with no cracks or spalling noted. Horizontal and vertical alignment of the spillway's crest was good. The left abutment and foundation of the spillway were keyed into gneiss, all of which were in good condition.

2. Outlet Works

The low level outlet drain, a 12-inch cast iron pipe, was observed exiting at the downstream side of the embankment. This low level outlet pipe, in a sound concrete headwall, was submerged but partly visible. Sediment was observed in the pipe. The low level control valve is housed in a concrete block manhole on the downstream slope of the embankment. There was no cover for the manhole. The valve appeared to be severely weathered and in poor condition. It was partly open with water flowing. Attempts to operate the valve with a "T" handle were in vain, the valve appeared to be rusted in position. The intake structure in the lake for the low level outlet drain could not be seen.

d. Reservoir Area

Earth slopes and rock outcropping surround the reservoir. The earth slopes are flat and stable while the rock slopes are moderate to steep and firm. The reservoir water was clear with no growth of algae.

e. Downstream Channel

The spillway's discharge channel is in good condition. Its bottom is composed mostly of bedrock and rock outcropping on the left with some concrete on the right. The rock outcropping was leveled off to serve as the left wall for the spillway discharge channel. The right wall consists of large boulders.

Downstream, the channel is also in good condition. The spillway discharge channel ends at the toe of the embankment. At that point, the channel turns abruptly to the right and continues on, parallel to the embankment, to the low level outlet where it then turns abruptly to the left. There are some fallen trees in the channel. The channel crosses under the Burnt Meadow Road bridge approximately 3,700 feet from the dam.

f. Geology

A visual inspection of geologic features shows that the rock exposed at the spillway and left abutment is sound gneiss. Although the underlying rock at the dam's right terminus is not exposed, adjacent exposures indicate the rock is also gneiss. The rock shows much low pressure quartz and feldspar banding. The observed jointing is generally tight but there is some localized spacing of less than four inches. Altitudes of lineation and joints (bearing on true north) are as follows:

Lineation:	N 35 E
Joint Set 1:	S 72 E
Joint Set 2:	S 40 E

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Lake Sonoma Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the spillway and the lake is not lowered on a regular basis.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Tapawingo Trout Preserve is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of the one manually operated 12 inch gate valve. At the time of inspection, operation of the valve was attempted but not demonstrated because the gate valve appeared to be rusted in position.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Lake Sonoma Dam is approximately 0.4 square miles. A drainage map of the watershed of Lake Sonoma dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderately sloped. Elevations range from approximately 1,100 feet above NGVD at the west end of the watershed to about 786 feet at the dam site. Land use patterns within the watershed are mostly woodland.

The evaluation of the hydraulic and hydrologic features of Lake Sonoma was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam falls in a range of 100-year Flood to 1/2 PMF. In this case, the low end of the range, 100-year Flood, is chosen since the factors used to select size and hazard classification are on the low-side of their respective ranges.

The 100-year Flood was calculated from 100-year precipitation using National Weather Service Hydro-35 and Technical Paper No. 40. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC-1DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates, were applied to the 100-year rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the 100-year Flood hydrograph utilizing program HEC-1DB.

The SDF peak outflow calculated for the dam is 437 cfs. This value is derived from the 100-year flood, assuming that the lake was originally at spillway crest elevation. The 100-year flood was routed through the dam and resulted in overtopping.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1DB program. The reservoir surface areas at various elevations were measured by planimeter from U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing. The spillway rating is presented in the Hydrologic Computations, Appendix D.

Breach analysis is not necessary for a "significant" hazard dam.

Drawdown calculations indicate that to empty the lake to an elevation of 768 NGVD through the one low-level sluice would take 4 days, assuming no inflow. This is considered to be an excessive drawdown period, and provision of additional outlets should be considered.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel is well defined and in good condition. The slopes of the channel are 2H. to 1V. or flatter.

Earth slopes and rock outcropping encompass the reservoir. The earth slopes are flat and stable while the rock slopes are moderate to steep and firm.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 0.07 feet. Computations indicate that the dam can pass approximately 94 percent of the SDF (100-year storm) without overtopping the dam crest. Since the 100-year storm is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no major signs of distress in the embankment of Lake Sonoma Dam. Numerous trees growing on both sides of the embankment could pose a threat to stability. The spillway was in good condition.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post-Construction Changes

There are no known post-construction changes.

e. Static Stability

A static stability analysis was not performed for Lake Sonoma Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since static stability safety factors have not been confirmed, it cannot be stated that seismic stability is satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

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

The adequacy of Lake Sonoma Dam is considered questionable in view of its lack of spillway capacity to pass the 100-year flood, which is the SDF for the dam, without overtopping. The spillway is assessed as "inadequate".

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment and foundation material engineering properties, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

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

Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set within twelve months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway are as follows:

1. Increase the embankment height of the dam thus permitting a higher discharge to pass over the spillway and reducing the possibility of over-topping.
2. Lower the spillway crest elevation.
3. Increase the effective spillway crest length.
4. A combination of any of the above alternatives.

b. Recommendations

1. Repair or replace low-level outlet valve and provide a cover for the manhole.
2. Remove the sediment from the low-level outlet pipe and outlet stilling basin and remove the fallen trees from the discharge channel. This work should be started within twelve months.
3. All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.
4. Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

2. Consider providing additional low-level outlet facilities to decrease the drawdown time.

c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

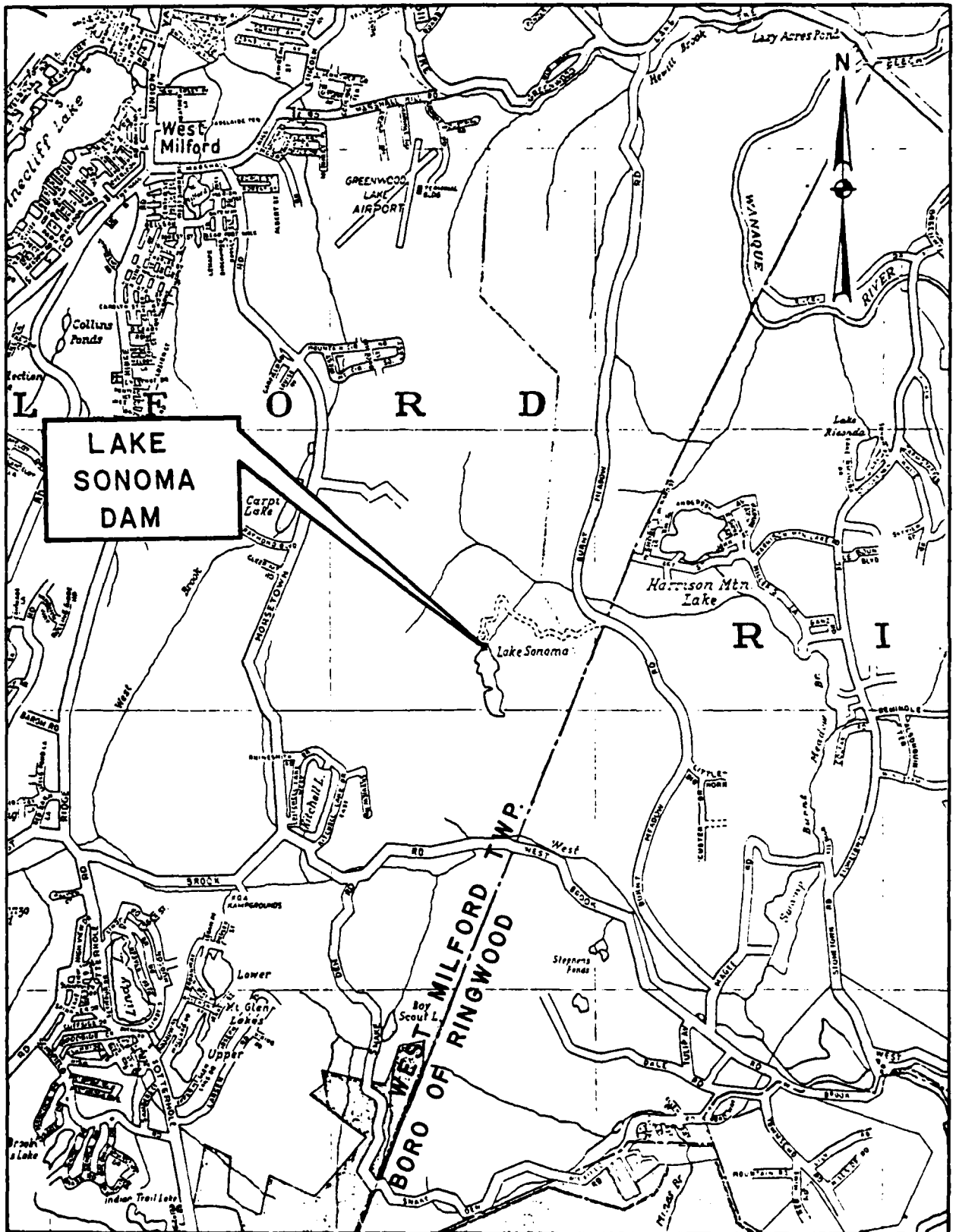
P L A T E S

LAKE SONOMA DAM
WEST MILFORD TWP.
PASSAIC COUNTY, N.J.

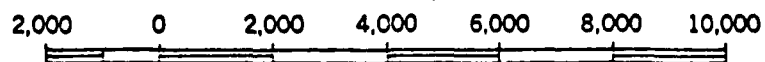


Scale in Miles (Approx.)



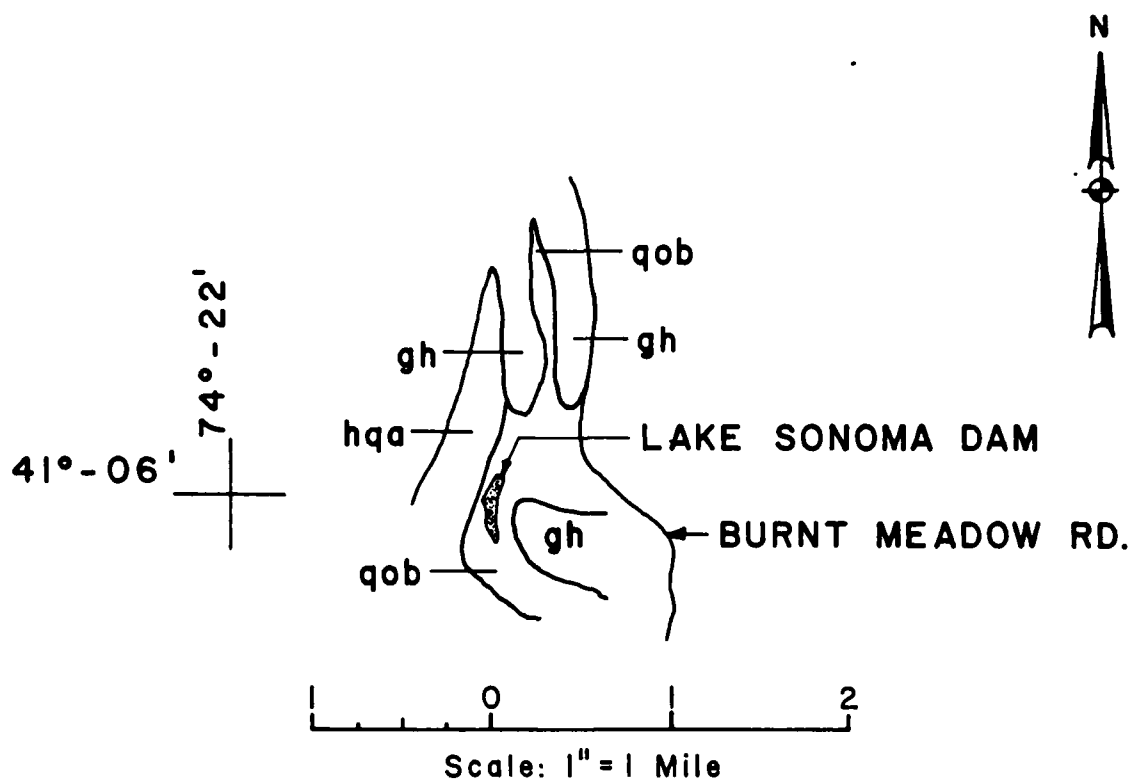


Scale in Feet (Approx.)



VICINITY MAP

PLATE 1A

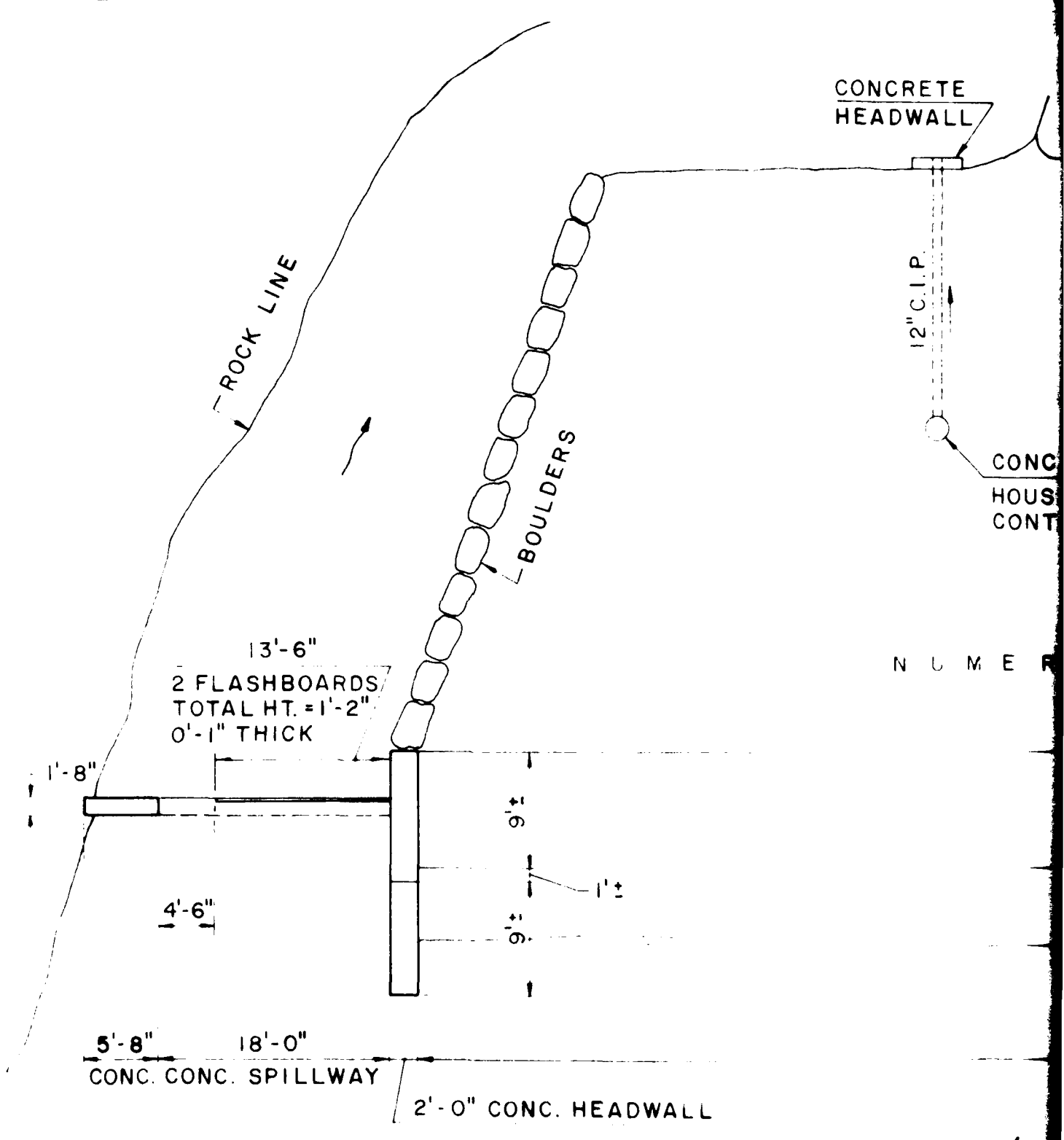


LEGEND:

PRECAMBRIAN

- gh Mostly Hornblende Granite and Gneiss.
- qob Quartz-Oligoclase-Biotite Gneiss.
- hqa Hyperstene-Quartz-Andesine Gneiss.

GEOLOGIC MAP
LAKE SONOMA DAM



CONCRETE
HEADWALL



12" C.I.P.

CONC. BLOCK MANHOLE (NO COVER)
HOUSING FOR LOW LEVEL
CONTROL VALVE

N U M E R O U S

B I R C H

T R E E S

TOP OF EARTH EMBANKMENT



190'±
EMBANKMENT

L A K E

S O N

PLAN

SCALE 1" = 10'

T R E E S

ENT

S O N O M A

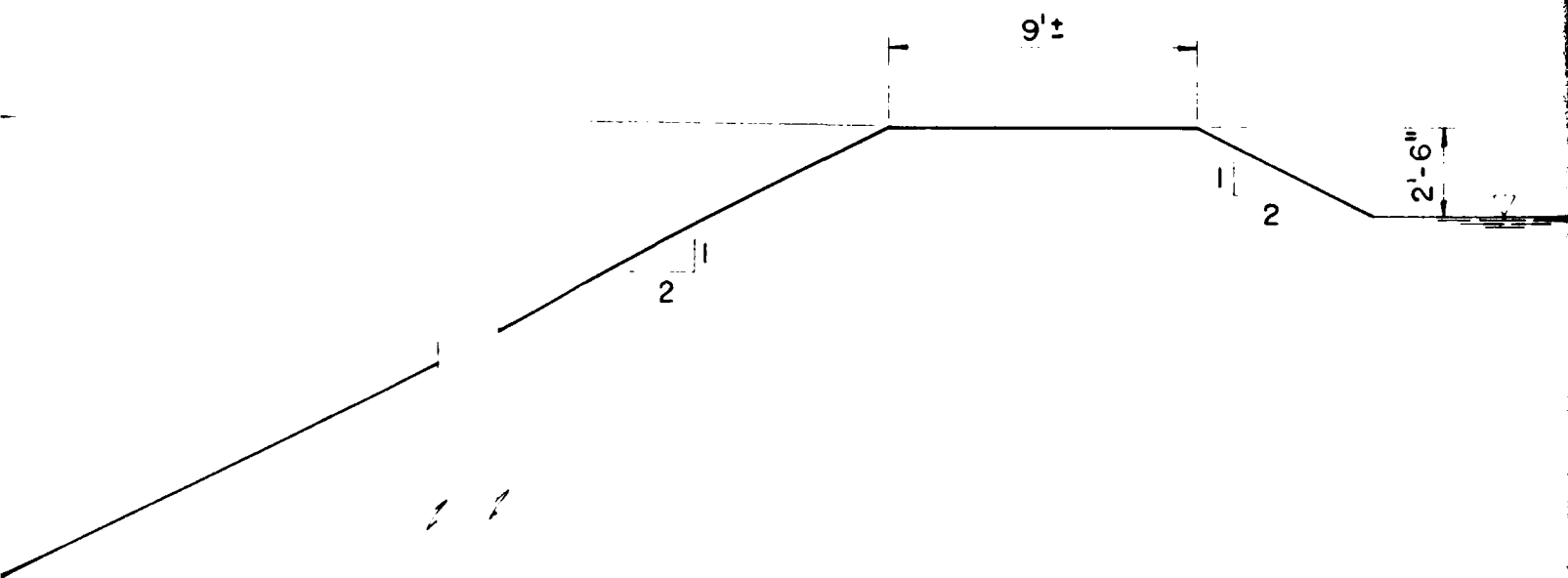
3



24' ±

9' ±

4



SECTION A - A

SCALE: 1" = 5'

LAKE SONOMA DAM
WEST MILFORD TWP., PASSAIC COUNTY, N. J.

SKETCHES OF PLAN AND SECTION
PREPARED FROM FIELD NOTES TAKEN
DURING INSPECTION ON NOV. 16, 1979

BY:
HARRIS - ECI ASSOCIATES
WOODBIDGE, NEW JERSEY

SCALE: AS SHOWN
DATE: JAN. 30, 1980
SHEET: 1 OF 1

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION
MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam LAKE SONOMA DAM County Passaic State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 16, 1979 Weather Clear Temperature 38°F
December 5, 1979

Pool Elevation at Time of Inspection 786 NGVD Tailwater at Time of Inspection 765 NGVD

Inspection Personnel:

November 16, 1979:

Chuck Chin
Henry King (Recorder)
Thomas Lakovich

December 5, 1979:

Chuck Chin
James McCormick

December 15, 1979:

Walter Jones

Owner/Representative:

November 16, 1979:

Maitland Bleecker, Proprietor
Tapawingo Trout Preserve
Burnt Meadow Road, Box 38
Wanaque, N.J. 07465

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE N/A		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS N/A		
DRAINS N/A		
WATER PASSAGES N/A		
FOUNDATIONS N/A		

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL AND HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

EMBANKMENT		REMARKS AND RECOMMENDATIONS
VISUAL EXAMINATION OF	OBSERVATIONS	
SURFACE CRACKS None noticed.		
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE None Observed.		
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES None.		
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST Good.		
RIPRAP FAILURES N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
EARTH EMBANKMENT Numerous trees, small to medium size, growing on both sides of and on top of the earth embankment.		Remove trees.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM Good. Embankment at right abutment. Rock at left.		
ANY NOTICEABLE SEEPAGE None Noticed.		
STAFF GAGE AND RECORDER None.		
DRAINS None.		5

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN STILLING BASIN	Could not see stilling basin because of sediment.	Clean out stilling basin.
INTAKE STRUCTURE	Low level outlet drain under water in lake. Not visible.	
OUTLET STRUCTURE	A 12-inch cast iron pipe, low level outlet drain, was observed exiting on the downstream side of the embankment. Low level drain has concrete headwall in good condition. Drain pipe was submerged but partly visible. Sediment was observed in the pipe. The control valve for the low level drain was housed in a concrete block manhole. Manhole had no cover. The valve was partly open. Attempts to operate the valve with a "T" handle were not successful - the valve appeared rusted in position.	Clean out pipe and check its condition. Repair or replace valve and provide cover for manhole.
OUTLET FACILITIES	none.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The concrete spillway appears in good condition. Two flashboards, totaling 14 inches high and spanning 3/4 of the spillway, are in good condition.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	Good condition. Discharge flows over mostly bedrock and some concrete. Levelled of bedrock forms left of retaining wall and the right is made up of boulders.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL N/A		
APPROACH CHANNEL N/A		
DISCHARGE CHANNEL N/A		
BRIDGE AND PIERS N/A		
GATES AND OPERATION EQUIPMENT N/A		

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

VISUAL EXAMINATION OF	RESERVOIR OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES Earth slopes and rock outcropping encompass the reservoir. The earth slopes are flat and stable while rock slopes are moderate to steep and firm.		
SEDIMENTATION None noticed.		

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.) Good Condition.	There are some fallen trees in the channel.	Remove fallen trees.
SLOPES 2 H. to 1 V. or flatter.	In good condition.	
APPROXIMATE NUMBER OF HOMES AND POPULATION No houses, but the stream and a small pond downstream are used for trout fishing contributing to the recreational use of the area.		

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None available.
REGIONAL VICINITY MAP	Available-Passaic County Map and U.S.G.S. Quadrangle Sheet for Manaque, New Jersey.
CONSTRUCTION HISTORY	None available.
TYPICAL SECTIONS OF DAM	Not available.
HYDROLOGIC/HYDRAULIC DATA	Not available.
OUTLETS - PLAN	Not available.
- DETAILS	Not available.
- CONSTRAINTS	None.
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

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

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic overlay sheet for Passaic County and Engineering Soils Survey of New Jersey, Report No. 3 - Passaic County, by Rutgers University (New Brunswick, N.J.).
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	Not available.

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

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	Unknown.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Taken on December 5, 1979
and January 21, 1980)

LAKE SONOMA DAM



Photo 1 - View of the upstream side of the embankment. Note trees growing on embankment.
(Photo taken on December 5, 1979).



Photo 2 - View of Lake Sonoma.
(Photo taken on January 21, 1980).

LAKE SONOMA DAM

Photo 3 - View towards embankment
from left abutment.
Note numerous trees
growing on embankment.
(Photo taken on January
21, 1980).



Photo 4 - View of spillway's discharge channel and the downstream
channel beyond at center and left.
(Photo taken on January 21, 1980).

LAKE SONOMA DAM



Photo 5 - View upstream toward spillway. Note leveled off bedrock serving as the left wall of the discharge channel and the boulders its right wall.
(Photo taken on January 21, 1980).



Photo 6 - View upstream toward spillway. Note flow from spillway's discharge channel making abrupt turn toward the low level outlet drain at bottom left of photo.
(Photo taken on January 21, 1980).

LAKE SONOMA DAM

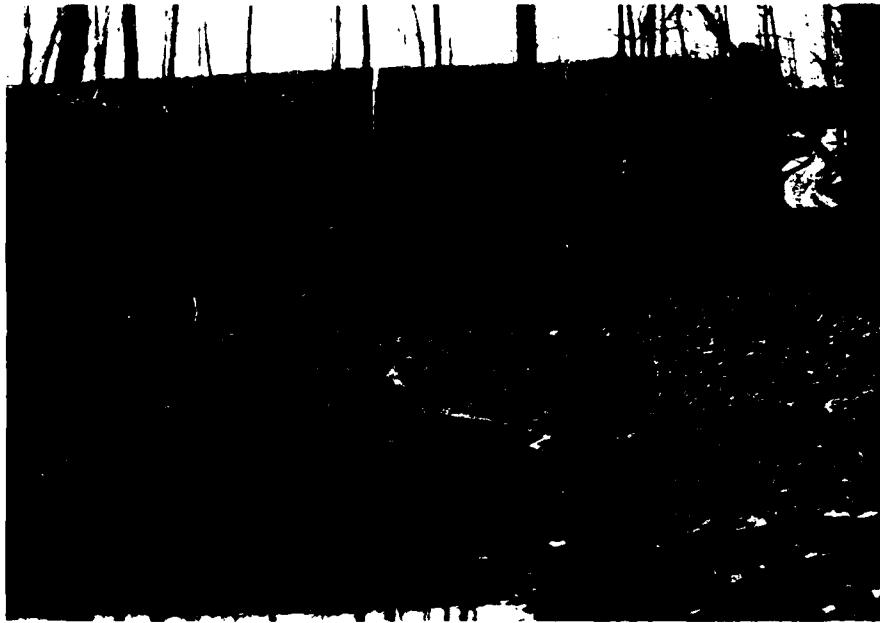


Photo 7 - View looking upstream. Spillway is at upper right. The low level outlet drain's headwall and the downstream channel are at lower left.
(Photo taken on December 5, 1979).

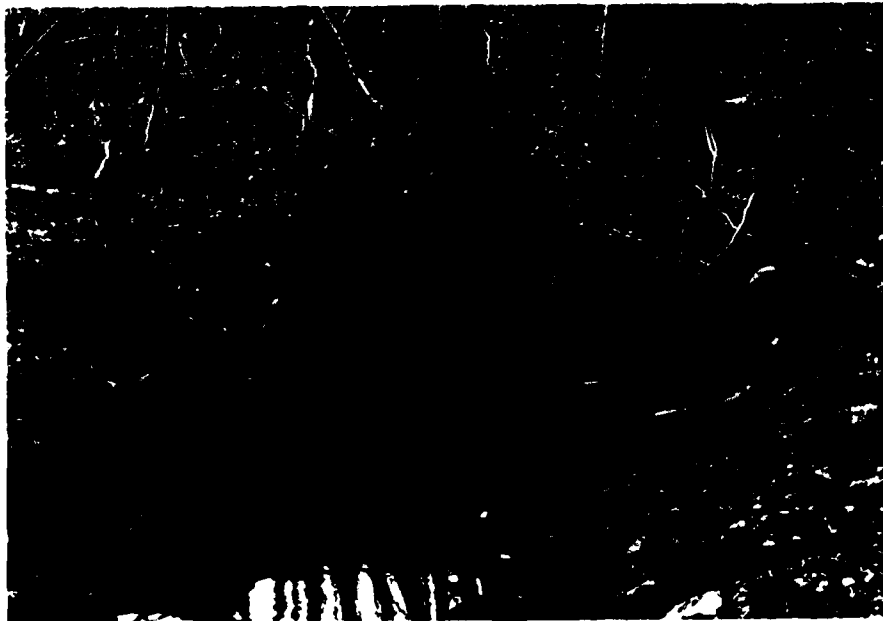


Photo 8 - View of downstream channel looking upstream toward the headwall for the low level outlet drain and the manhole (upper right) housing the low level control valve.
(Photo taken on December 5, 1979).

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: LAKE SONOMA DAM

Drainage Area Characteristics: 0.4 square miles.

Elevation Top Normal Pool (Storage Capacity): 786.3 NGVD (76 acre-feet)

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

Elevation Maximum Design Pool: 790.07 NGVD (SDF pool: 121 acre-feet)

Elevation Top Dam: 790 ft. NGVD (120 acre-feet)

SPILLWAY CREST:

- a. Elevation 786.0 NGVD
- b. Type Concrete Broad Crest weir with flashboards 3/4 length of spillway
- c. Width 20 inches
- d. Length 18 feet
- e. Location Spillover Left of spillway (where there are no flashboards)
- f. No. and Type of Gates None

OUTLET WORKS:

- a. Type 12-inch CIP
- b. Location D/S of weir. Approx. 40 ft. right side of spillway.
- c. Entrance Inverts N/A
- d. Exit Inverts 768 NGVD
- e. Emergency Draindown Facilities Gate Valve 12 dia. CIP

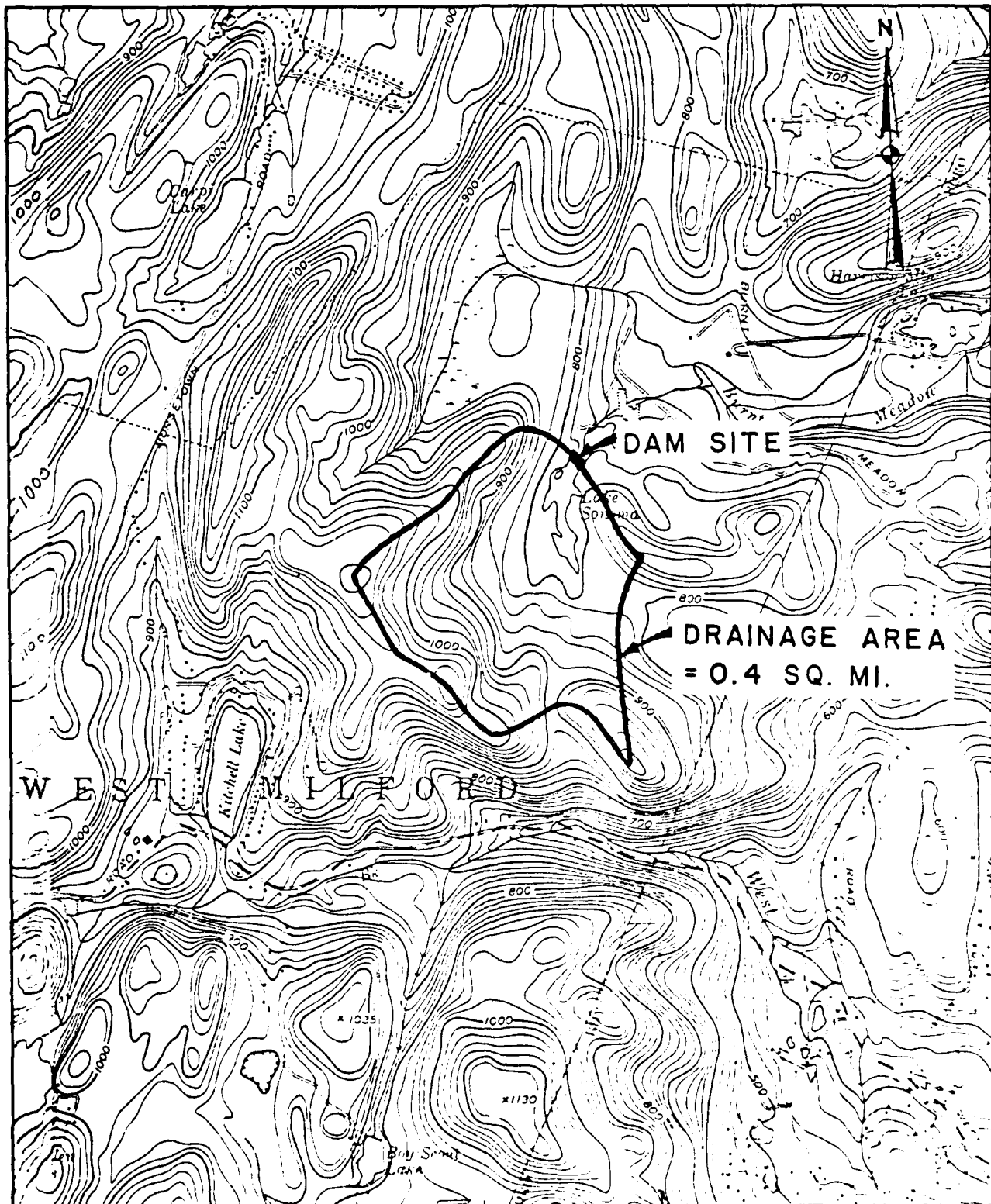
HYDROMETEOROLOGICAL GAGES:

- a. Type None
- b. Location None
- c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 437 cfs at elevation 790.07 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS



2,000 0 2,000 4,000

Scale: 1" = 2,000 FT.

LAKE SONOMA DAM
DRAINAGE BASIN

1 of 11
PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION
LAKE SONOMA DAM
COMPUTED BY C.L.C. CHECKED BY PK

SHEET NO. 1 OF 11
JOB NO. 10-A33-01
DATE 1-17-80

GROUP XVII.11

LAKE SONOMA DAM (NJ 00193)

SIZE CLASSIFICATION

Main Impoundment Surface Area	9.2 Acres
Average Depth of Lake	13 ft ±
Structural Height of Dam	24 ft
Size Classification	Small

HAZARD POTENTIAL CLASSIFICATION

Light to Moderate travelled roadway e/o/s of Dam

Hazard Potential

Significant

Recommended SDF

100 year

HYDROLOGIC ANALYSIS

Flood routing will be computed by HEC-1 DB computer program using SCS Triangular unit hydrograph with curvilinear transformation.

D.A. = 0.4 sq mi.

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION
LAKE SONOMA DAM
COMPUTED BY C.L.C. CHECKED BY PL

SHEET NO. 2 OF 11
JOB NO. 10-H53-01
DATE 1-13-80

INFILTRATION DATA

Drainage area consists of mostly MMg & some GMXZ4K
MMg

Hydrologic Soil Group 2

Initial Infiltration

1.0 in/hr

Constant Infiltration

0.1 in/hr

Ref: 'Engineering Soil Survey of N.J. Report 3, Passaic
County', by Rutgers University, July, 1951

TIME OF CONCENTRATION

1) From Velocity and Water Course Lengths

	<u>Slope (%)</u>	<u>Vel. (fps)</u>	<u>Remark</u>
Outlet Flow	$\frac{1100 - 786}{3000} = 10.5$	3.0	upper portion later lower

Ref: SA II Dam pg. 70

$$t_c = (3000 / 3.0) / 3600 = 0.28 \text{ hr}$$

2) From Hromogorak "Design of Small Dam", p. 71

$$\Delta H = 1100 - 786 = 314' \quad L = 3000$$

$$t_c = 0.15 \text{ hr}$$

Ref: Small Dam pg. 71

3) Using FHWA formula for Surface Flow (A = p + 2.305)

$$t_c = \frac{1.49(1.49 - 0.5)}{3.5} = \frac{1.49(1.49 - 0.5)}{1.49(60)} = .60$$

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION
LAKE SOLIMA DAM
COMPUTED BY S.L.C. CHECKED BY EL

SHEET NO. 3 OF 11
JOB NO. 10-A93-01
DATE 1-13-80

TIME OF CONCENTRATION (CONT.)

$$\text{Use } T_c = 0.34 \text{ hr}$$

$$\text{LAG} = 0.6 T_c = (0.6)(0.34) = 0.20 \text{ hr}$$

ELEVATION - AREA - CAPACITY RELATIONSHIP

Data estimated from U.S.G.S. map

Elevation (ft.)	761.4	786.3	800
Surface Area (Ac)	0	9.2	329

* Estimated bottom elevation of lake $H_T = \frac{1}{1.483} \left(\frac{Q}{A} \right)^{0.58} = \frac{1}{1.483} \left(\frac{1000}{329} \right)^{0.58} = 1.5 \text{ ft}$
HEC-1 U.S. computer program will develop storage-capacity relationship from the set of elevations & surface areas

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT San Joaquin River Gage No. 511
Lake Sonoma
COMPUTED BY EL CHECKED BY CLC

SHEET NO. 4 OF 11
JOB NO. LA 83-2
DATE 3/9/6

Precipitation frequency values (inches) of 100 yr in

5 min 0.77

10 min 1.28

15 min 1.64

30 min 2.35

60 min 3.05

2 hr 3.88

3 hr 4.35

4 hr 4.73

5 hr 4.98

6 hr 5.20

Ref. NOAA Tech Mem.

NWS HYDRO-35

Circled values obtained
by plotting.

Ref. TP NO. 40

Lake Sonoma Dam

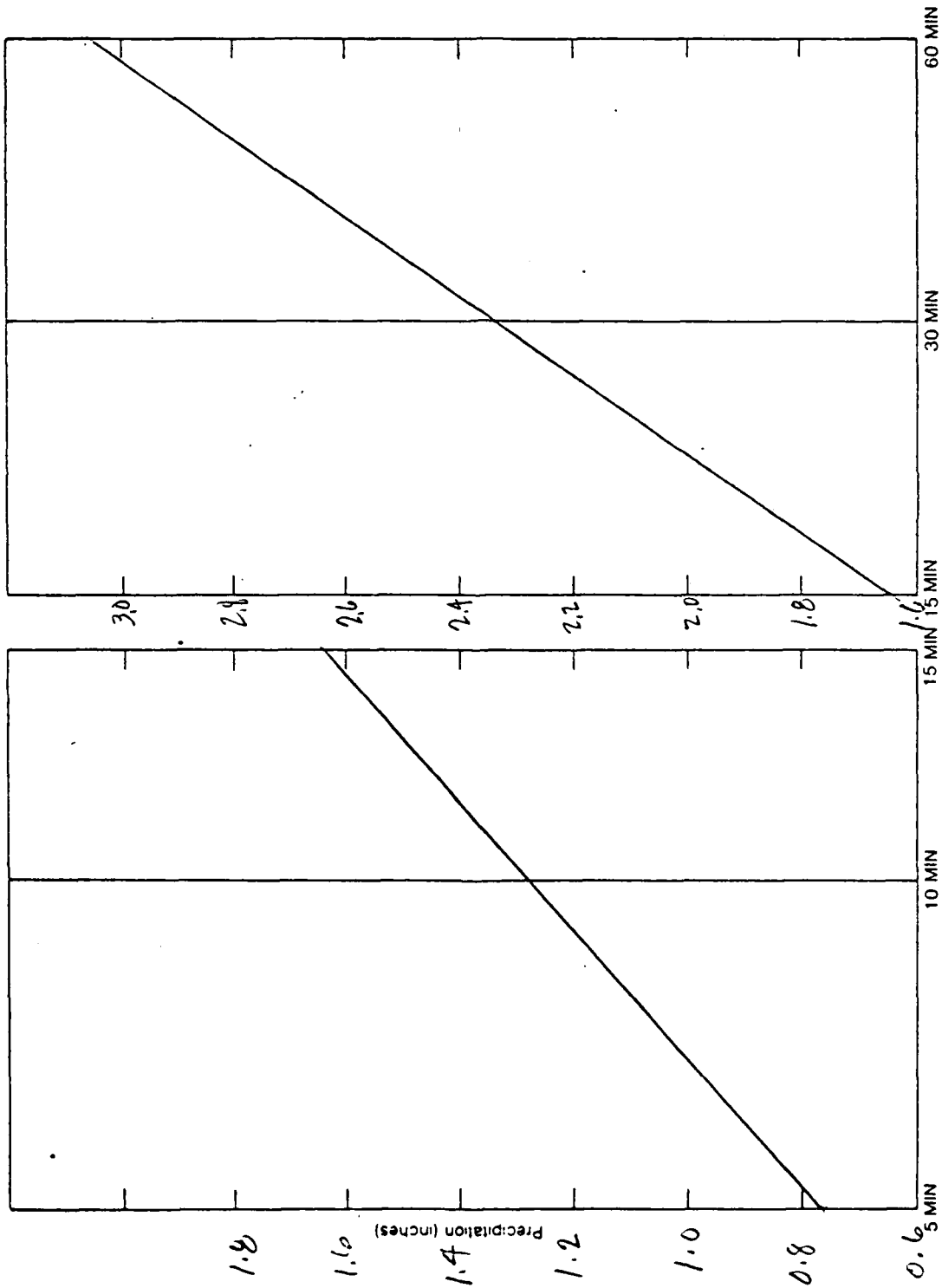
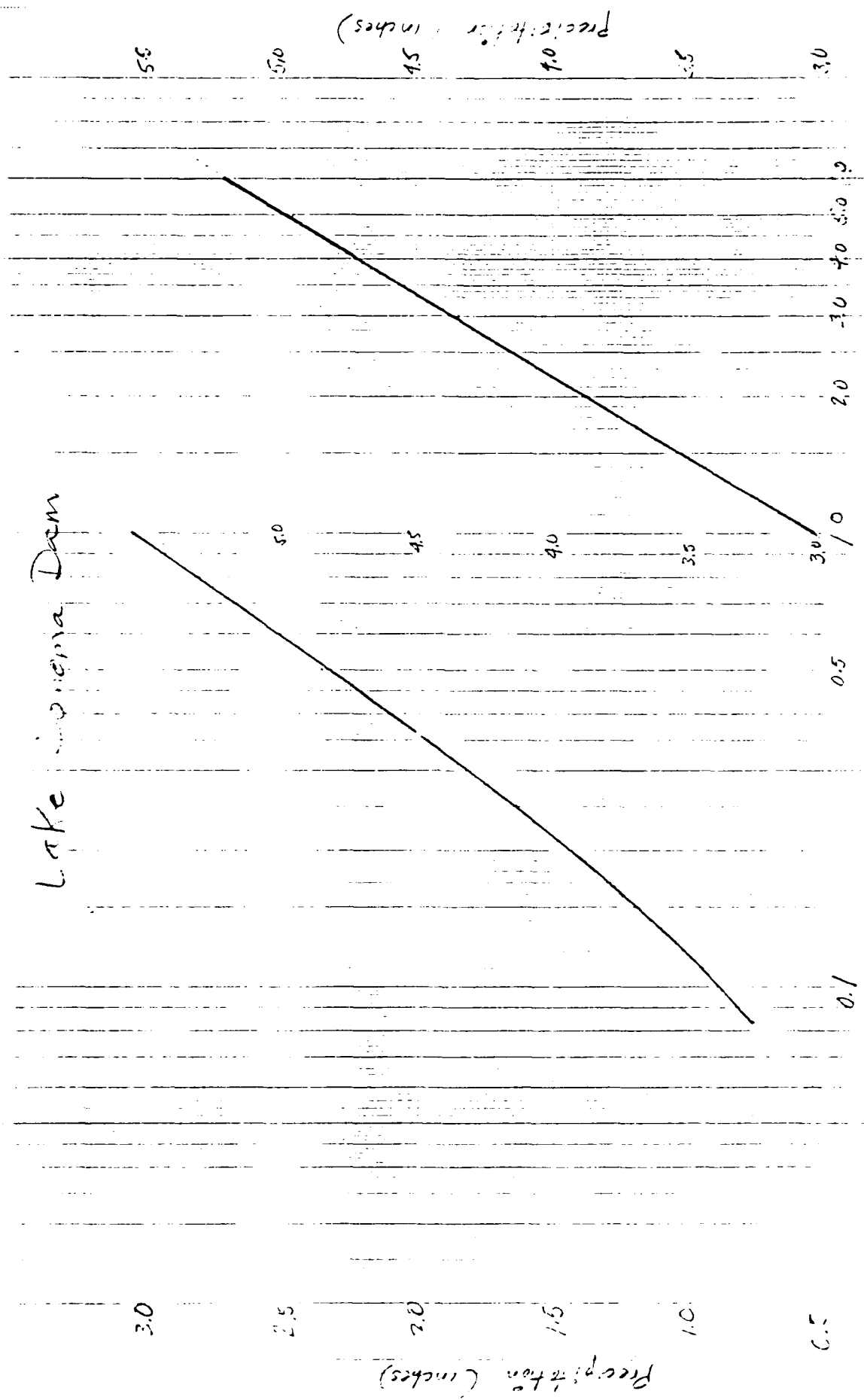


Figure 10.--Duration-interpolation diagram for 10- and 30-min estimates.

Lake Indiana Dam



6 of 11

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJ Dam Insp. Prog. - Corps 507
Lake Sanoma Dam
COMPUTED BY B.K. CHECKED BY CLC

SHEET No. 7 OF 11
JOB No. 10-A-82-01
DATE 3/18/82

100-yr Rainfall Distribution

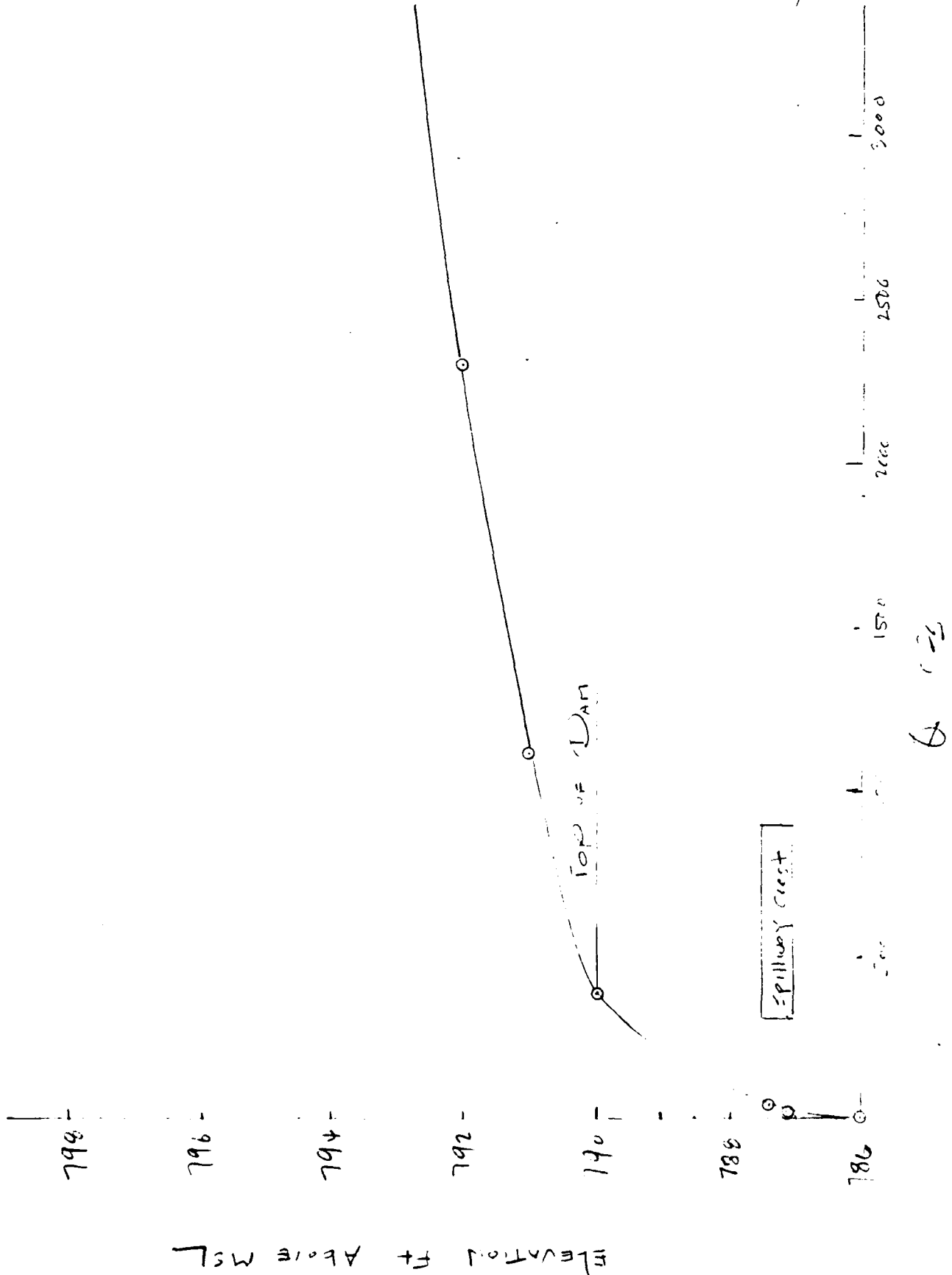
Time hr	Total Depth in	Incremental Depth in	Time hr	Total Depth in	Incremental Depth in
0.1	0.88	0.88	3.1	4.91	0.04
0.2	1.43	0.55	3.2	4.95	0.04
0.3	1.82	0.39	3.3	4.98	0.03
0.4	2.11	0.29	3.4	4.52	0.04
0.5	2.35	0.24	3.5	4.55	0.03
0.6	2.52	0.17	3.6	4.58	0.03
0.7	2.68	0.16	3.7	4.62	0.04
0.8	2.82	0.14	3.8	4.65	0.03
0.9	2.94	0.12	3.9	4.68	0.03
1.0	3.05	0.11	4.0	4.71	0.03
1.1	3.15	0.10	4.1	4.74	0.03
1.2	3.25	0.10	4.2	4.77	0.03
1.3	3.35	0.10	4.3	4.80	0.03
1.4	3.45	0.10	4.4	4.83	0.03
1.5	3.54	0.09	4.5	4.86	0.03
1.6	3.61	0.07	4.6	4.88	0.02
1.7	3.68	0.07	4.7	4.91	0.03
1.8	3.75	0.07	4.8	4.93	0.02
1.9	3.82	0.07	4.9	4.96	0.03
2.0	3.88	0.06	5.0	4.98	0.02
2.1	3.94	0.06	5.1	5.01	0.03
2.2	4.0	0.06	5.2	5.03	0.02
2.3	4.05	0.05	5.3	5.05	0.02
2.4	4.10	0.05	5.4	5.07	0.02
2.5	4.15	0.05	5.5	5.10	0.03
2.6	4.20	0.05	5.6	5.12	0.02
2.7	4.24	0.04	5.7	5.14	0.02
2.8	4.28	0.04	5.8	5.16	0.02
2.9	4.33	0.05	5.9	5.18	0.02
3.0	4.37	0.04	6.0	5.20	0.02

The values of total depth are obtained by adding

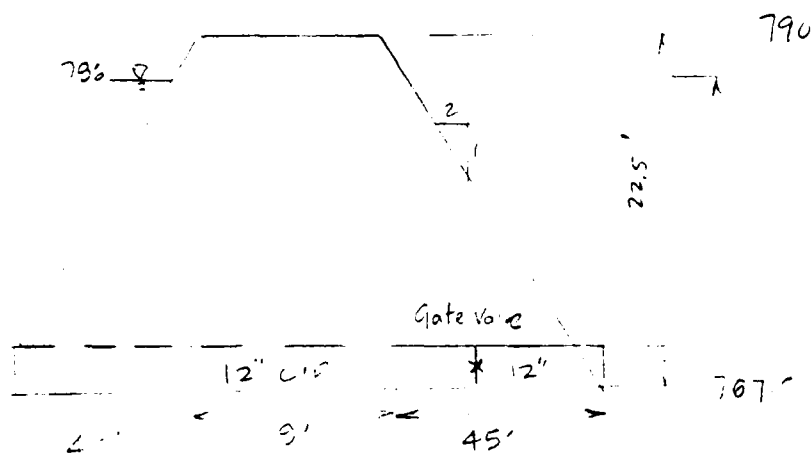
PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NU Dam Inspection Program
Lake Sonoma
COMPUTED BY B+ CHECKED BY CLC

SHEET NO. 9 OF 11
JOB NO. 10-A-2-1
DATE 1/29/20



Drawdown Computation



Assume $L = 45' + 9' + 45' = 99'$ SAY $L = 100'$

Assume $K_e = 0.5$, $K_{gate} = 0.19$ Full open HDC 37-1

$C = 0.00085$ d corr. at bridge

$$\frac{C}{E} = 0.00085 \quad f = 0.019 \quad \text{correction factor}$$

$$H = K_e + K_v + \frac{C}{E} + f = (0.5 + 0.19 + 0.00085 + 0.019) \frac{V^2}{2g}$$

$$= 3.57 \frac{V^2}{2g}$$

$$V = 0.53 \sqrt{2gh} = 0.26 \sqrt{h} \quad Q = 3.23 \sqrt{h} \quad (FS)$$

Assume water starts to draw @ elev 786.0

$$DA = 0.4 \text{ SF ft}$$

$$\text{in flow } 2.5 \text{ SF ft} = 0.8 \text{ cfs } \text{ (approx.)}$$

T.W. Assume at 100' depth of water

$$6 \text{ cfs} = 100' = 768$$

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJD
Lake Sorama
COMPUTED BY BK CHECKED BY CLC

SHEET NO 11 OF 11
JOB NO 10-AR3-01
DATE 1/29/50

Drawdown Computations - Continued

RES	Area	Av	Vol	A ₁	Q	t, hr	cal
Size	A ₂	Area	Ac-ft	ft	Ac-ft Q = 4.575	time of Drawdown to this Point	time hr
786	9.0						
		8.65	8.65	17.5	13.92	7.5	7.5
785	8.29						
		8.55	33.75	14.5	12.67	32.3	39.8
780	5.20						
		4.61	27.75	9.5	10.25	23.7	63.5
775	2.82						
		2.00	10.0	4.5	7.05	17.2	80.7
770	1.17						
		0.75	3.0	1	3.33	6.9	87.6
768	0.71						

Time of complete drawdown with no drawdown = 87.6 hr = 4 days

$$A_1 = \frac{A_2}{\left(\frac{h}{H_F} + 1\right)^2} \quad h + H_F = 25.0 \quad A_2 = 9.0$$

N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII 10A8301
 N J 00193 LAKE SONOMA, PASSAIC COUNTY, NJ
 100 YEARS ROUTING-FRC-HARRIS INC , WOODBRIDGE, N J

	0	6	0	0	0	3
A1	80					
A2	3					
A3	0					
B1	0					
B2						
B3						
C1	50					
C2	0.03	0.03	0.03	0.03	0.04	0.04
C3	0.04	0.04	0.05	0.05	0.05	0.06
C4	0.05	0.07	0.07	0.09	0.10	0.10
C5	0.08	0.39	0.29	0.17	0.16	0.12
C6	0.03	0.03	0.03	0.03	0.03	0.03
C7	0.02	0.02	0.02	0.02	0.02	0.02
C8	0.2				1.0	0.10
C9	-1	-05	2			
C10	1					
C11				0	0	1
C12				1		
C13						
C14						
C15						
C16						
C17						
C18						
C19						
C20						
C21						
C22						
C23						
C24						
C25						
C26						
C27						
C28						
C29						
C30						
C31						
C32						
C33						
C34						
C35						
C36						
C37						
C38						
C39						
C40						
C41						
C42						
C43						
C44						
C45						
C46						
C47						
C48						
C49						
C50						
C51						
C52						
C53						
C54						
C55						
C56						
C57						
C58						
C59						
C60						
C61						
C62						
C63						
C64						
C65						
C66						
C67						
C68						
C69						
C70						
C71						
C72						
C73						
C74						
C75						
C76						
C77						
C78						
C79						
C80						
C81						
C82						
C83						
C84						
C85						
C86						
C87						
C88						
C89						
C90						
C91						
C92						
C93						
C94						
C95						
C96						
C97						
C98						
C99						
C100						

ROUTING DISCHARGE THROUGH DAM

787.2	787.4	790	791	792	793	795	-1	0
18	24	386	1112	2296	3784	7478		
9.2	34.9							
786.3	800							

N J IAH SAFETY INSPECTION PROGRAM---GROUP XVII 10A8301
N J 00193 LANE SONOMA, PASSAIC COUNTY, NJ
100 YLAKS KOUTING,PRC-HARRIS INC., WOODBRIDGE, N J

JOB SPECIFICATION									
NRK	NMIN	IDAY	IHR	IMIN	METRC	IFLT	IFRT	INSTAN	
80	0	0	0	0	0	0	3	0	
		JOFER	NWT	LKOPT	TRACE				
		3	0	0	0				

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH THROUGH LAKE SONOMA

ISTAQ	ICOMP	IFCON	ITAPE	JPLT	JFRT	INAME	ISTAGE	IAUTO
LANE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA		ISAME		LOCAL				
INUND	TAREA	SNAP	TRSPA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	40	0.00	40	0.00	0.000	0	0	0
2	40	0.00	40	0.00	0.000	0	0	0

```
PRECIP: DATA
NP      STORM    IALJ      IAK
60      0.00    0.00      0.00
PRECIP: PATTERN
```

	LOSS DATA										
	KUP I	SINK	DJLNK	RTHU	ERATN	STRNS	RTUN	STRL	CNSTL	ALGX	RTIMP
	0	0 00	0 00	1 00	0 00	0 00	1 00	1 00	10	0 00	0 00

UNIT HYDROGRAPH DATA
IC= 0.00 LAG= .20

RECESSION DATA

SIRIQ=	-1.00	QRCN=	-.05	RTIOR=	2.00
--------	-------	-------	------	--------	------

	UNIT HYDROGRAPH 12 END OF PERIOD ORIGINATES, TC=						0 00 HOURS, LAG=	.20	VOL = 1.00
724	724	/24	436	218.	114	60	31	16.	9.

END-OF-PERIOD FLOW													
MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1 01	06	1	03	0 00	03	0	1 01	4 06	41	03	02	01	302
1 01	12	2	03	0 00	03	0	1 01	4 12	42	03	02	01	214
1 01	18	3	03	0 00	03	0	1 01	4 18	43	03	02	01	139
1 01	24	4	03	0 00	03	0	1 01	4 24	44	03	02	01	96
1 01	30	5	03	0 00	03	0	1 01	4 30	45	03	02	01	74
1 01	36	6	03	0 00	03	0	1 01	4 36	46	03	02	01	63
1 01	42	7	04	0 00	04	0	1 01	4 42	47	03	02	01	58
1 01	48	8	04	0 00	04	0	1 01	4 48	48	03	02	01	54
1 01	54	9	04	0 00	04	0	1 01	4 54	49	03	02	01	53
1 01	1 00	10	04	0 00	04	0	1 01	5 00	50	02	01	01	50
1 01	1 06	11	04	0 00	04	0	1 01	5 06	51	02	01	01	46
1 01	1 12	12	04	0 00	04	0	1 01	5 12	52	02	01	01	43
1 01	1 18	13	04	0 00	04	0	1 01	5 18	53	02	01	01	40
1 01	1 24	14	05	0 00	05	0	1 01	5 24	54	02	01	10	38
1 01	1 30	15	05	0 00	05	0	1 01	5 30	55	02	01	01	35
1 01	1 36	16	05	0 00	05	0	1 01	5 36	56	02	01	01	33
1 01	1 42	17	05	0 00	05	0	1 01	5 42	57	02	01	01	31
1 01	1 48	18	05	0 00	05	0	1 01	5 48	58	02	01	01	29
1 01	1 54	19	06	0 00	06	0	1 01	5 54	59	02	01	01	27
1 01	2 00	20	06	0 00	06	0	1 01	6 00	60	02	01	01	26
1 01	2 06	21	06	0 00	06	0	1 01	6 06	61	00	00	00	24
1 01	2 12	22	07	0 00	07	0	1 01	6 12	62	00	00	00	22
1 01	2 18	23	07	03	04	6	1 01	6 18	63	00	00	00	21
1 01	2 24	24	07	06	01	33	1 01	6 24	64	00	00	00	20
1 01	2 30	25	07	06	01	77	1 01	6 30	65	00	00	00	18
1 01	2 36	26	09	08	01	117	1 01	6 36	66	00	00	00	17
1 01	2 42	27	10	09	01	155	1 01	6 42	67	00	00	00	16
1 01	2 48	28	10	09	01	187	1 01	6 48	68	00	00	00	15
1 01	2 54	29	10	09	01	208	1 01	6 54	69	00	00	00	14
1 01	3 00	30	10	09	01	220	1 01	7 00	70	00	00	00	13
1 01	3 06	31	88	87	01	414	1 01	7 06	71	00	00	00	12
1 01	3 12	32	55	54	01	902	1 01	7 12	72	00	00	00	11
1 01	3 18	33	39	38	01	1191	1 01	7 18	73	00	00	00	10
1 01	3 24	34	29	28	01	1153	1 01	7 24	74	00	00	00	10
1 01	3 30	35	24	23	01	979	1 01	7 30	75	00	00	00	9
1 01	3 36	36	17	16	01	802	1 01	7 36	76	00	00	00	9
1 01	3 42	37	16	15	01	643	1 01	7 42	77	00	80	00	8
1 01	3 48	38	14	13	01	523	1 01	7 48	78	00	00	00	7
1 01	3 54	39	12	11	01	436	1 01	7 54	79	00	00	00	7
1 01	4 00	40	11	10	01	370	1 01	8 00	80	00	00	00	6
SUM 5 20 3 83 1 37 10136													
(132) (97) (35) (287 02)													

FLAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
1191	169	127	127	10140	10140
34	5	4	4	287	287
	3 93	3 93	3 93	3 93	3 93
	99 79	99 53	99 83	99 83	99 83
	84	84	84	84	84
	103	103	103	103	103

CFS	INCHES	AC-FT	THOUS CU M
1191	34		
5			
3 93			
99 79			
84			
103			

PLAN	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
1191	169	127	127	10140
34	5	4	4	287
CFS	3 93	3 93	3 93	3 93
INCHES	99 79	99 53	99 83	99 113
MM	84	84	84	84
AC-FT	103	103	103	103
THOUS CU M				

HYDROGRAPH ROUTING

ROUTING DISCHARGE THROUGH DAM

ISIAQ	ICOMP	ILCON	ITAFE	JFLI	JHKT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0
QLOSS	CLOSS	AVG	ROUTING DATA					
0 0	0 0 0 0	0 0 0	IKES	ISAME	IOP1	IPMP	LSTR	
			1	1	0	0	0	
NSIFS	NSTUL	LAG	AMSNN	X	ISN	SIUKA	ISPRAT	
1	0	0	0 0 0 0	0 0 0 0	0 0 0 0	-786	-1	

STAGE	786.00	787.20	787.40	790.00	791.00	792.00	793.00	795.00
-------	--------	--------	--------	--------	--------	--------	--------	--------

FLOW	0 00	18 00	24 00	386 00	1112 00	2296 00	3784 00	7478 00
------	------	-------	-------	--------	---------	---------	---------	---------

SURFACE AREA	0	9	35
--------------	---	---	----

CAPACITY	0	76	360
----------	---	----	-----

ELEVATION	761	786	800
-----------	-----	-----	-----

CREL	SPWID	CURW	EXPW	LLEVEL	COQL	CAREA	EXFL
786.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA			
TUFEL	COQD	EXPD	DAMWID
790.0	0.0	0.0	0.0

END-OF-PERIOD HYDROGRAPH ORIGINATES

MO	DA	HR	NN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1	01	06		1	10	0	0	74	786.0
1	01	12		2	20	0	0	74	786.0
1	01	18		3	30	0	0	74	786.0
1	01	24		4	40	0	0	74	786.0
1	01	30		5	50	0	0	74	786.0
1	01	36		6	60	0	0	74	786.0
1	01	42		7	70	0	0	74	786.0
1	01	48		8	80	0	0	74	786.0
1	01	54		9	90	0	0	74	786.0
1	01	00		10	1 00	0	0	74	786.0
1	01	06		11	1 10	0	0	74	786.0
1	01	12		12	1 20	0	0	74	786.0
1	01	18		13	1 30	0	0	74	786.0
1	01	24		14	1 40	0	0	74	786.0
1	01	30		15	1 50	0	0	74	786.0
1	01	36		16	1 60	0	0	74	786.0
1	01	42		17	1 70	0	0	74	786.0
1	01	48		18	1 80	0	0	74	786.0
1	01	54		19	1 90	0	0	74	786.0
1	01	00		20	2 00	0	0	74	786.0
1	01	06		21	2 10	0	0	74	786.0
1	01	12		22	2 20	0	0	74	786.0
1	01	18		23	2 30	6	0	74	786.0
1	01	24		24	2 40	33	0	74	786.0
1	01	30		25	2 50	77	1	74	786.1
1	01	36		26	2 60	117	2	75	786.2
1	01	42		27	2 70	155	4	76	786.3
1	01	48		28	2 80	187	6	78	786.4
1	01	54		29	2 90	208	9	79	786.6
1	01	00		30	3 00	220	12	81	786.8
1	01	06		31	3 10	414	15	83	787.0
1	01	12		32	3 20	902	40	89	787.5

1 01	3 18	33	3 30	1191	138	96	788.2
1 01	3 24	34	3 40	1153	230	105	788.9
1 01	3 30	35	3 50	979	300	111	789.4
1 01	3 36	36	3 60	802	348	116	789.7
1 01	3 42	37	3 70	643	377	119	789.9
1 01	3 48	38	3 80	523	415	120	790.0
1 01	3 54	39	3 90	436	437	121	790.1
1 01	4 00	40	4 00	370	425	121	790.1
1 01	4 06	41	4 10	302	395	120	790.0
1 01	4 12	42	4 20	214	378	119	789.9
1 01	4 18	43	4 30	139	362	117	789.8
1 01	4 24	44	4 40	96	343	115	789.7
1 01	4 30	45	4 50	74	322	113	789.5
1 01	4 36	46	4 60	63	302	111	789.4
1 01	4 42	47	4 70	58	282	109	789.3
1 01	4 48	48	4 80	54	263	108	789.1
1 01	4 54	49	4 90	53	246	106	789.0
1 01	5 00	50	5 00	50	229	104	788.9
1 01	5 06	51	5 10	46	213	103	788.8
1 01	5 12	52	5 20	43	198	102	788.7
1 01	5 18	53	5 30	40	185	100	788.6
1 01	5 24	54	5 40	38	171	99	788.5
1 01	5 30	55	5 50	35	159	98	788.4
1 01	5 36	56	5 50	33	148	97	788.3
1 01	5 42	57	5 70	31	137	96	788.2
1 01	5 48	58	5 80	29	127	96	788.1
1 01	5 54	59	5 90	27	118	95	788.1
1 01	6 00	60	6 00	26	109	94	788.0
1 01	6 06	61	6 10	24	101	93	788.0
1 01	6 12	62	6 20	22	94	93	787.9
1 01	6 18	63	6 30	21	87	92	787.9
1 01	6 24	64	6 40	20	80	92	787.8
1 01	6 30	65	6 50	18	74	91	787.8
1 01	6 36	66	6 60	17	69	91	787.7
1 01	6 42	67	6 70	16	64	90	787.7
1 01	6 48	68	6 80	15	59	90	787.6
1 01	6 54	69	6 90	14	54	90	787.6
1 01	7 00	70	7 00	13	50	89	787.6
1 01	7 06	71	7 10	12	47	89	787.6
1 01	7 12	72	7 20	11	43	89	787.5
1 01	7 18	73	7 30	10	40	88	787.5
1 01	7 24	74	7 40	10	37	88	787.5
1 01	7 30	75	7 50	9	34	88	787.5
1 01	7 36	76	7 60	9	31	88	787.5
1 01	7 42	77	7 70	8	29	88	787.4
1 01	7 48	78	7 80	7	27	87	787.4
1 01	7 54	79	7 90	7	25	87	787.4
1 01	8 00	80	8 00	6	24	87	787.4

437 AT TIME 3 90 HOURS

FEAR	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
437	142	106	106	8505	
12	4	3	3	241	
	3 30	3 30	3 30	3 30	
	83 73	83 73	83 73	83 73	
	70	70	70	70	
	87	87	87	87	

FEAR
CM'S
INCHES
MM
AC-FT
THOUS. CU M

KUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

	PEAK	6-HOUR	24 HOUR	72-HOUR	AREA
HYDROGRAPH AT	1191	169	127	127	.40
LANE (	53.73)(	4.78)(	3.59)(	3.59)(	1.04)
ROUTED TO	437	142	106	106	.40
DAM (	12.3)(	4.01)(	3.01)(	3.01)(	1.04)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STRUCTURE DURATION	INITIAL VALUE 786.00 74	SPILLWAY CREST 786.00 74	TOP OF DAM 790.00 120	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
		0	0		437	40	3.90	0.00

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

9-8