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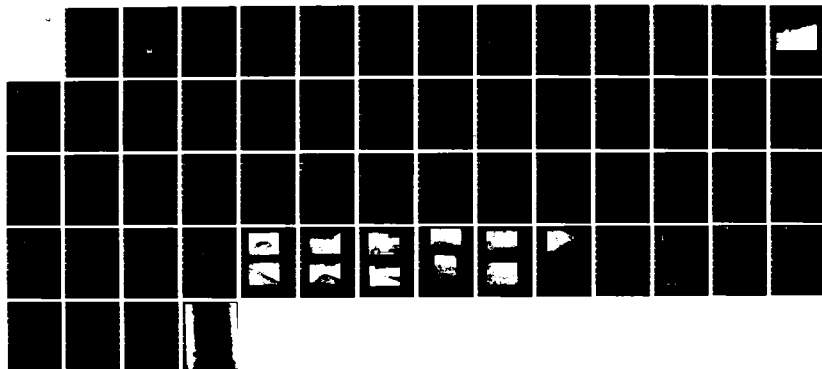
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
ROCKWOOD LAKE DAM (CT. (U) CORPS OF ENGINEERS WALTHAM
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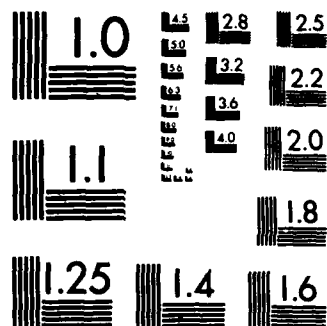
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AD-A142 687

CONNECTICUT WESTERN COASTAL AREA
GREENWICH, CONNECTICUT

ROCKWOOD LAKE DAM
CT 00046

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DTIC

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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SEPTEMBER 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Rockwood Lake Dam is an earth embankment reported to have a concrete core wall, built in 1893. The dam section is 1,200 ft. long with a maximum height of 36 ft. The top of the dam is 12 ft. wide. The downstream side slopes of the earth embankment vary from 1 1/2 horizontal to 1 vertical up to 3 horizontal to 1 vertical. The upstream slope above the water line is about 2 horizontal to 1 vertical. Riprap is in place on the upstream face. A concrete spillway with a riprapped apron is 80 ft. long, with 2-ft. wide crest, is located approx. in the center of the dam.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF

NEDED



Dist
A-1

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

NOV 11

Dear Governor Grasso:

I am forwarding to you a copy of the Rockwood Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the Connecticut-American Waterworks Company, Inc., Greenwich District, 125 Putnam Avenue, Greenwich, Connecticut 06830, ATTN: Mr. Joseph Yates, Manager. Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely yours,

John P. Chandler
JOHN P. CHANDLER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

ROCKWOOD LAKE DAM

CT 00046

CONNECTICUT WESTERN COASTAL AREA
GREENWICH, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: ROCKWOOD LAKE DAM
State Located: Connecticut
County Located: Fairfield County
Stream: Rockwood Lake Brook
Date of Inspection: 27 JULY 1978

BRIEF ASSESSMENT

Rockwood Lake Dam is an earth embankment reported to have a concrete core wall, built in 1893. The dam section is 1,200 feet long with a maximum height of 36 feet. The top of the dam is 12 feet wide. The downstream side slopes of the earth embankment vary from 1 1/2 horizontal to 1 vertical up to 3 horizontal to 1 vertical. The upstream slope above the water line is about 2 horizontal to 1 vertical. Riprap is in place on the upstream face. A concrete spillway with a riprapped apron is 80 feet long, with 2-foot wide crest, is located approximately in the center of the dam.

The visual inspection indicates that the Rockwood Lake Dam is in poor condition. The major concerns regarding the long-term safety of the dam with respect to soils and geology are the apparent seepage areas on the downstream face of the dam along the toe and particularly in the vicinity of Station 4+25 and 8+25.

The maximum spillway capacity at the top of dam is approximately equal to the discharge rate of the test flood. Therefore, the test flood can be passed by the spillway with minimum overtopping estimated to be 0.1 feet.

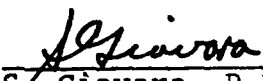
It is recommended that the owner should retain the services of a suitable engineering firm to investigate the apparent seepage on the downstream face and along the toe of the dam

and to determine what type of seepage control measures are required. The owner should cut the brush on the downstream slope and brush and trees for a distance of 50 feet downstream of the dam. A program for weekly monitoring of the seeps observed on the downstream face, along the toe and downstream of the dam, should be implemented.

The owner should take such action as is necessary to prevent trespassing by foot and horse traffic on the crest, slopes, and abutments of the dam. Animal burrows should be backfilled on both the upstream and downstream slopes on a regular basis.

It is recommended that a definite plan for around-the-clock surveillance be implemented during periods of unusually heavy rains and a formal warning system be developed for use in the event of an emergency.

Recommendations and remedial measures described should be implemented by the owner within one year after receipt of this Phase I Inspection Report.


S. Giavara, P.E.
Principal

Registered, CT 7634

This Phase I Inspection Report on Rockwood Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.



CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

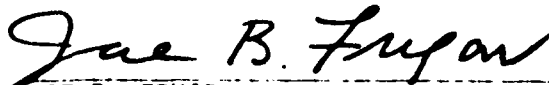


FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division



SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. 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 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. 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.

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7. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

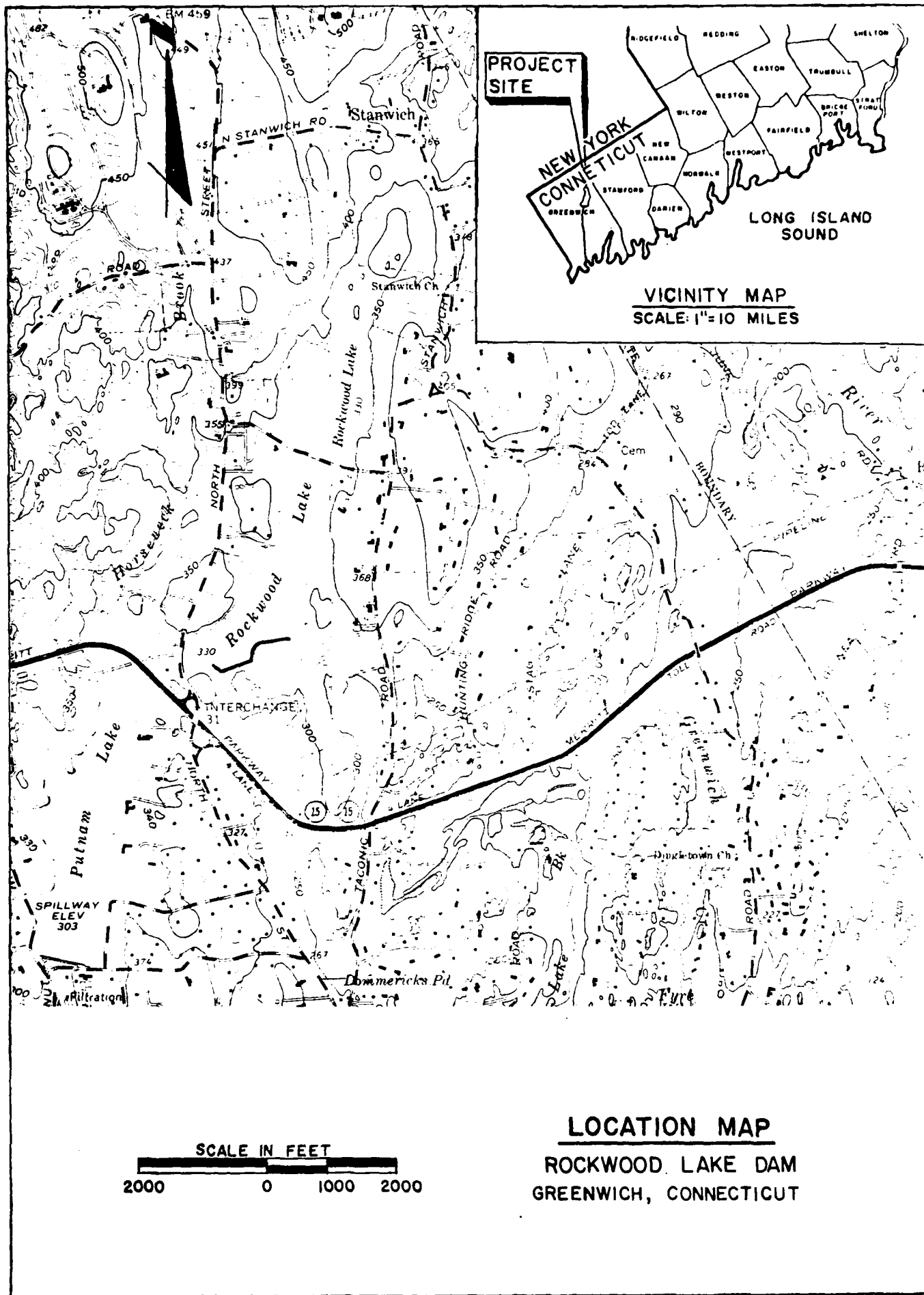
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ROCKWOOD LAKE DAM



PROJECT
SITE

NEW YORK
CONNECTICUT

VICINITY MAP
SCALE: 1"=10 MILES

LOCATION MAP

ROCKWOOD LAKE DAM
GREENWICH, CONNECTICUT

PHASE I INSPECTION REPORT
ROCKWOOD LAKE DAM CT 00046

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection through the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 25 April 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0309 has been assigned by the Corps of Engineers for this work.

b. Purpose.

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT:

a. Description of Dam and Appurtenances. Earth embankment with concrete core wall, built 1893. The dam section is 1,200 feet long with a maximum height of 36 feet. The top of the dam is 12 feet wide. The downstream side slopes of the earth embankment vary from 1 1/2 horizontal to 1 vertical up to 3 horizontal to 1 vertical. The upstream slope above the water line is about 2 horizontal to 1 vertical. Riprap is in place on the upstream face. The concrete spillway with a riprapped apron is 80 feet long, with 2-foot wide crest.

b. Location. The dam is located approximately 5 miles north of the Town of Greenwich business district within the Connecticut western coastal area. The Merritt Parkway is just downstream of the dam.

c. Size Classification. The applicable guideline indicates that for an intermediate category the storage in acre-feet for the impoundment must be greater than or equal to 1,000 and less than 50,000. The size of classification may be determined by either storage or height, whichever gives the larger size category. Based on the storage capacity of the dam, the size classification is intermediate. The top of dam storage for Rockwood Lake Dam is 1,534 acre-feet.

d. Hazard Classification. The dam is classified as having a high hazard potential. This classification is based on the 10 or more houses situated along the valley which would be affected by a dam failure flood wave. It should be noted, however, overland flow from Rockwood Lake must either overtop or breach the Merritt Parkway embankment before reaching the highly populated area.

e. Ownership. Rockwood Lake Dam is owned by the Connecticut-American Waterworks Company, Inc. - Greenwich District.

f. Purpose of Dam. The dam was constructed to form a supplemental impounding reservoir for Putnam Lake. The reservoir forms part of the water company's supply and distribution system, providing potable water to the residents of Greenwich. Rockwood Lake has virtually no watershed, getting most of its water from Mianus Reservoir by pumping. Two 12-inch diameter pipes and one 20-inch diameter pipe connect Rockwood Lake to Putnam Reservoir.

g. Design and Construction History. The dam was originally built in 1883. The designers of the original dam is unknown. Construction plans and history is unknown.

h. Normal Operating Procedures. Water used to supplement Putnam Reservoir is taken through the 20-inch pipe otherwise it spills over the concrete spillway feeding Rockwood Lake Brook.

1.3 PERTINENT DATA:

a. Drainage Area -

0.8 sq. miles

- b. Discharge at Dam Site -
- | | |
|----------------------------------|---------------------------|
| Maximum Known Flood | Unknown |
| Warm Water Outlet | Not Available |
| Div. Tunnel Low Pool Outlet | Not Applicable |
| Diversion Tunnel Outlet | Not Applicable |
| Gated Spillway | None |
| Ungated Spillway at Max. Pool | 700 CFS @ 1 Ft. freeboard |
| Total Spillway Cap. at Max. Pool | 1,310 CFS @ no freeboard |
- c. Elevation (above M.S.L.) -
- | | |
|---------------------------------------|----------------|
| Top of Dam | 330 |
| Max. Design Pool | Not Available |
| Full Flood Control Pool | Not Available |
| Recreation Pool | Not Available |
| Spillway Crest Ungated | 327 |
| Upstream Portal Invert. Div. Tunnel | Not Applicable |
| Downstream Portal Invert. Div. Tunnel | Not Applicable |
| Streambed at Centerline of Dam | 320+ |
| Maximum Tailwater | Unknown |
- d. Reservoir -
- | | |
|------------------------------|----------------|
| Length of Max. Pool | 6,500 |
| Length of Recreation Pool | Not Applicable |
| Length of Flood Control Pool | Not Applicable |
- e. Storage -
- | | |
|--------------------|-----------------|
| Recreation Pool | Not Applicable |
| Flood Control Pool | Not Applicable |
| Design Surcharge | Not Applicable |
| Top of Dam | 1,534 Acre-Feet |
- f. Reservoir Surface (acres) -
- | | |
|--------------------|----------------|
| Top of Dam | Not Available |
| Max. Pool | Not Available |
| Flood Control Pool | Not Applicable |
| Recreation Pool | Not Applicable |
| Spillway Crest | 110 |
- g. Dam -
- | | |
|------------------|---|
| Type: | Earth embankment, concrete core |
| Length: | 1,200 feet |
| Height: | 36 feet |
| Top width: | 12 feet |
| Side slopes: | Downstream: Between 1 vertical to 1-1/2 horizontal and 1 vertical to 3 horizontal |
| | Upstream: 1 vertical to 2 horizontal |
| Zoning: | Concrete core, Rolled earth shell |
| Impervious Core: | Concrete core |
| Grout Curtain: | Unknown |

h. Diversion and Regulating Tunnel -

Type: Not Applicable
Length: Not Applicable
Diameter: Not Applicable
Access: Not Applicable
Regulation: Not Applicable

i. Spillway -

Type: Ogee
Length of Weir: 80 feet
Crest Elevation: 327
Gates: Ungated
Upstream Channel: Reservoir
Downstream Channel: Swampy
Spillway is founded on: Unknown

j. Regulating Outlets -

Gates: None
Conduits: 20" diameter pipe, material unknown.
Used to supplement Putnam Lake supply.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No engineering data has been found to provide any information about the design of Rockwood Lake Dam.

2.2 CONSTRUCTION:

No information relative to the construction of the dam is available. It was reported that the dam has a concrete core wall, but no drawings were located to substantiate this information. Information presented in this report was primarily obtained by interviews and direct measurements of the existing structures.

2.3 OPERATION:

Formal operation records are not available for this dam.

2.4 EVALUATION:

a. Availability. Only minimal engineering information is available for this dam.

b. Adequacy. The adequacy of design, construction and operation cannot be evaluated.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. The dam is an earthen embankment. The downstream slope was grassed and water was noted seeping out of the slope about 39 feet down from the crest, approximately 150 feet west of the spillway. Apparent seepage was also observed along most of the downstream toe. Several animal holes were noted on the downstream slope. An erosion path across the top of dam has been formed due to traffic. Erosion has also occurred just west of the spillway on the top of dam. No lateral movement was observed. The horizontal and vertical alignment of the embankment was good. The riprap is in poor condition along the entire upstream face. The concrete spillway section is in good condition, however, the top of the spillway has a considerable amount of exposed aggregate. The stone-masonry training walls are generally in fair condition; with some loss of mortar observed.

b. Dam.

1) Upstream Slope - The upstream slope is partially covered with riprap in some place to within 2 feet of the crest. In other locations the riprap is missing. The upstream slope is generally covered with grass and small brush.

2) Crest - The crest of the dam is covered with grass, and there is a foot-path worn bare along its entire length.

3) Downstream Slope - The downstream slope is covered with brush and grass with a considerable amount of moisture-loving vegetation growing along most of the toe of the slope together with numerous small and large trees. A small 8-inch diameter, 2-foot deep test pit was excavated approximately 10 feet down the slope near Station 2+0. The soil exposed was a slightly gravelly silty coarse to fine sand. No water or seepage was observed at the test pit. At approximately Station 2+25, a circular stone and concrete foundation was located near the toe of the downstream slope which contained the blow off valve. Water was ponded just downstream of the masonry structure at elevation 295.5 with no apparent evidence of flow. At approximately Station 4+25, there is an area of seepage approximately 40 feet down the slope from the crest, the upper limit of which was about 15 feet below the level of water in the reservoir at the time of the inspection. The ground was noticeably wet and slightly spongy at this location during the inspection. Some water is flowing from this area, however it is

clear with no visual evidence of turbidity. The majority of the seepage appears to be originating underneath a stump of a 2-foot diameter tree which was reported to have been cut last spring. The wet spot apparently encompasses an area approximately 20 feet long by 10 feet wide on the slope.

At approximately Station 8+25, there is an area of visible seepage at the toe of the slope. The water has an orange discoloration, but there is no visual evidence of turbidity.

One combination foot and horse path has been worn bare between the toe and crest of the downstream slope near Station 10+75.

c. Appurtenant Structures. The gate house was destroyed in a fire several years ago. A stone foundation remains near the toe of slope at Station 2+25. The well of the foundation is full of debris and the control valve could not be located. The 18-inch diameter blow off pipe was uncovered just south of the gate house in a wet area. Three other outlet pipes consisting of one 20-inch diameter and two 12-inch pipes leave the reservoir towards the west into a gate house, a 20-inch diameter pipe transports flow for about 500 feet emptying into Putnam Lake. Valving for these pipes were not located.

d. Reservoir Area. The reservoir has well vegetated banks at slight to moderate slopes. There was no indication of slides or sloughing. The depth of sediment and rate of accumulation in the reservoir are unknown.

e. Downstream Channel. The spillway channel is about 85 feet wide, very poorly defined. A stone riprap apron in good condition protects the spillway from erosion and forms the first 20-foot section of the channel. Flow disperses overland into a heavily wooded wet area. Because the downstream channel is poorly defined, water can flow laterally along the toe of dam.

3.2 EVALUATION:

A bare path along the crest of the dam, another bare path from the crest to the toe of the downstream slope and a sparsely vegetated area at the contacts between the dam and the spillway structure have resulted from foot and horse traffic. There is also an extensive growth of bushes and trees on the downstream slope and evidence (in the form of moisture-loving vegetation) that seepage may be discharging along many locations at or near the toe of the downstream slope. Several areas of visible seepage were located at or near the toe of the downstream slope of the earth embankment. These conditions can

lead to future problems if not remedied. Unless the 18-inch blow off valve is located, there is no convenient method of lowering the water level of the reservoir. During high discharge flow conditions, water can move laterally along the toe of the downstream slope and possibly lead to problems.

SECTION 4 - OPERATION PROCEDURES

4.1 PROCEDURES:

Rockwood Lake is used to supplement Putnam Reservoir. There is virtually no watershed. Rockwood Lake's water level is maintained by pumping from the Mianus Reservoir. Water is withdrawn through one 20-inch diameter and two 12-inch diameter pipes under North Street and then in a 20-inch diameter pipe about 500 feet to Putnam Reservoir.

4.2 MAINTENANCE OF DAM:

The dam does not appear to be well maintained and should receive additional attention. The grass slopes should be properly maintained and the toe should be free of trees and brush.

4.3 MAINTENANCE OF OPERATING FACILITIES:

The regulating gates and valves could not be located.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

There was no warning system of any kind in effect at the time of the inspection. The Connecticut-American Waterworks Company is currently developing procedures which will provide for surveillance during peak flow conditions and a warning system.

4.5 EVALUATION:

The Rockwood Lake Dam which is over 85 years old needs maintenance as described in detail in Section 7 of this report. Although not designed for rapid drawdown, it should be noted that if the need should arise, drawdown could be effected only through the operational procedure of opening the 18-inch blow off. Therefore, this valve should be located and periodically exercised to insure proper functioning.

SECTION 5 - HYDRAULICS/HYDROLOGY

5.1 EVALUATION OF FEATURES:

a. Design Data. There is no available information on the hydraulic design criteria for this dam and appurtenances. Under established criteria (OCE Guidelines) the recommended spillway design flood for the size (intermediate) and hazard potential (high) classification is the probable maximum flood (PMF). The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

An estimate of the magnitude of the test flood at the site is based on an analysis of regional flood frequency data and empirical methods, as presented in Appendix D.

As a conservative approach to the investigation, the more critical test flood hydrograph was used throughout. The peak inflow rate of 1,600 CFS was used.

A stage-discharge relationship was calculated for the spillway and indicates the following flows, based upon a coefficient of 3.0 and a length of 84 feet.

Stage - Discharge Relationship

<u>Stage</u>	<u>Head, Ft.</u>	<u>Discharge Rate, CFS</u>
327	0	0
328	1	250
329	2	710
330	3	1,310

The maximum spillway capacity, with no freeboard, is less than the peak discharge rate of the test flood. (Compare 1,310 CFS with 1,375 CFS.) In order to determine the effect of the reservoir storage capacity, a hydrograph of the test flood was routed through the reservoir.

The hydrograph was formed by assuming the test flood had a duration of 24 hours, with the peak of 1,600 CFS occurring at 8 hours from the beginning of runoff. The rising and falling limbs of the hydrograph was assumed to be changing at a constant rate, forming a triangle. The routing operation indicated that the peak rate of discharge would be reduced to 1,375 CFS, resulting in a stage elevation of 330.1 feet.

b. Experience Data. Discussion with water company personnel indicates that in their experience (20 years) the dam has not been overtopped.

c. Visual Observations. The on-site inspection of the dam provided the data for the hydraulic evaluation of the spillway.

d. Overtopping Potential. The maximum spillway capacity is equal to more than one-half of the test flood. However, the peak rate of discharge from the test flood will just overtop the embankment (0.1 feet).

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

a. Visual Observations. Several items that detrimentally effect long-term stability were noted:

Seepage areas were located on the downstream slope at Station 4+25 and near the toe at Station 8+25. Moisture-loving vegetation exists along most of the toe of the slope and the ground was wet and spongy where this grass was growing at the time of the inspection. One footpath (or possibly horsepath) has been worn bare between the toe and the crest of the downstream slope in the vicinity of Station 10+75. Immediately downstream of the dam the ground is wet and spongy.

Numerous small 3 to 4-inch diameter animal holes were seen on the downstream face. One large 5 feet by 5 feet by 3 feet deep hole, which was filled with brush and trees, was located at the toe of the embankment in the vicinity of Station 10+75.

Riprap protection is absent along several areas of the upstream face of the embankment.

b. Design and Construction Data. No information is available regarding the design and construction of this dam.

c. Operating Records. No major operational problems were reported, notwithstanding several tropical storms and hurricanes. The dam has subjected to a full head of water during most of the project life. No other information is available insofar as it is pertinent to the embankment or foundations.

d. Post-Construction Changes. Records indicate that the dam was built in 1893, raised 4 feet in 1906 and 1 foot in 1922.

e. Seismic Stability. This dam is in Seismic Zone 1 and, in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. The visual inspection indicates that the Rockwood Lake Dam is in poor condition. The major concerns regarding the long-term safety of the dam with respect to soils and geology are:

1) The apparent seepage areas on the downstream face of the dam along the toe and particularly in the vicinity of Station 4+25 and 8+25.

2) Existence of deep hole in the vicinity of the toe near Station 10+75.

The test flood peak discharge is estimated to be 1,460 CFS. The elevation discharge relations indicate that this flow will just overtop the dam by 0.1 feet.

b. Adequacy of Information. The information available is such that the assessment of the safety of the dam must be based on the visual inspection and field measurements.

c. Urgency. The recommendations and remedial measures should be implemented by the owner within one year after receipt of this Phase I Report.

d. Need for Additional Investigations. Additional investigations to further assess the apparent seepage and determine suitable seepage control measures are necessary.

7.2 RECOMMENDATIONS:

It is recommended that the following measures be undertaken by the owner:

a. The owner should retain the services of a suitable engineering firm to investigate the apparent seepage on the downstream face and along the toe of the dam and to determine what type of seepage control measures are required.

b. The origin of the large hole at the toe of the slope in the vicinity of Station 10+75 should be investigated and properly backfilled to minimize future problems.

c. The spalling of spillway crest should be repaired and the stone-masonry training walls should be repointed.

7.3 REMEDIAL MEASURES:

It is important that the following items be accomplished:

a. Alternatives. Not Applicable.

b. Operation and Maintenance and Procedures.

1) The owner should cut the brush on the downstream slope and brush and trees for a distance of 50 feet downstream of the dam. A competent engineer should be engaged to supervise the removal of the tree roots and replacement with proper backfill.

2) The riprap on the upstream face should be repaired and carried up to the crest of the dam.

3) Spillway channel should be improved to ensure that lateral movement of water along the toe of slope is controlled.

4) Erosion adjacent to the spillway channel should be repaired.

5) A program for weekly monitoring of the seeps observed on the downstream face, along the toe and downstream of the dam, should be implemented. Monitoring should be visual to evaluate the turbidity of the water and also photographic evidence that would provide a record to suggest whether there are substantial changes in the volume or in the size of the wet areas from one inspection to another. Presence of suspended solids in the water or substantial changes in flow not related to changes in reservoir level should be considered as indications of a critical condition.

6) The owner should properly maintain the vegetation on the downstream slope of the dam by periodic mowing.

7) The owner should take such action as is necessary to prevent trespassing by foot and horse traffic on the crest, slopes, and abutments of the dam.

8) The toe and an area 50 feet downstream of the toe should be maintained free of trees and brush.

9) Animal burrows should be backfilled on both the upstream and downstream slopes on a regular basis.

10) Arrangements should be made to locate, operate, and maintain the 18-inch blow off.

11) The owner should develop a formal warning system. An operational procedure to follow in the event of an emergency should also be adopted.

12) The owner should implement a program of continued periodic inspections on an annual basis.

APPENDIX A

VISUAL INSPECTION - CHECK LIST

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR Richard F. Murdock

DISCIPLINE Geotechnical

INSPECTOR Robert C. Smith

DISCIPLINE Project Manager

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	329 - 330
Current Pool Elevation	325.4
Maximum Impoundment to Date	
Surface Cracks	None
Pavement Condition	Erosion path across top of dam due to traffic.
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Erosion next to spillway
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Animal holes existing on downstream slope.
Sloughing or Erosion of Slopes or Abutments	Sta. 4+25, water seeping out of slopes 239 ft. down from crest
Rock Slope Protection - Riprap Failures	Riprap in poor condition along the entire upstream face.
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Apparent seepage along most of downstream toe.

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam DATE July 27, 1978
 INSPECTOR Richard F. Murdock DISCIPLINE Geotechnical
 INSPECTOR Robert C. Smith DISCIPLINE Project Manager

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u> - (continued)	
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

INSPECTOR _____

DATE July 27, 1978

DISCIPLINE _____

DISCIPLINE _____

None

AREA EVALUATED

OUTLET WORKS - INTAKE CHANNEL AND
INTAKE STRUCTURE

- a.
- Approach Channel
 - Slope Conditions
 - Bottom Conditions
 - Rock Slides or Falls
 - Log Boom
 - Debris
 - Condition of Concrete Lining
 - Drains or Weep Holes
 - Intake Structure
 - Condition of Concrete
 - Stop Logs and Slots

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR _____

DISCIPLINE _____

INSPECTOR _____

DISCIPLINE _____

AREA EVALUATED

CONDITION

OUTLET WORKS - CONTROL TOWER

a. Concrete and Structural

None

General Condition

Condition of Joints

Spalling

Visible Reinforcing

Rusting or Staining of
Concrete

Any Seepage or Efflorescence

Joint Alignment

Unusual Seepage or Leaks in
Gate Chamber

Cracks

Rusting or Corrosion of
Steel

b. Mechanical and Electrical

Air Vents

Float Wells

Crane Hoist

Elevator

Hydraulic System

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR _____

DISCIPLINE _____

INSPECTOR _____

DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u> (continued) Service Gates Emergency Gates Lightning Protection System Emergency Power System Wiring and Lighting System In Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR _____

DISCIPLINE _____

INSPECTOR _____

DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u> General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths	None

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR _____

DISCIPLINE _____

INSPECTOR _____

DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u> General Condition of Concrete Rust or Staining Spalling Erosion or Cavitation Visible Reinforcing Any Seepage or Efflorescence Condition at Joints Drain Holes Channel Loose Rock or Trees Over- hanging Channel Condition or Discharge Channel	None

PERIODIC INSPECTION CHECK LIST

PROJECT Rockwood Lake Dam

DATE July 27, 1978

INSPECTOR James MacBroom

DISCIPLINE Hydraulics/
Hydrology

INSPECTOR Richard Murdock

DISCIPLINE Geotechnical

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u> a. Approach Channel General Condition Loose Rock Overhanging Channel Trees Overhanging Channel Floor of Approach Channel b. Weir and Training Walls General Condition of Concrete Rust or Staining Spalling Any Visible Reinforcing Any Seepage or Efflorescence Drain Holes c. Discharge Channel General Condition Loose Rock Overhanging Channel Trees Overhanging Channel Floor of Channel Other Obstructions	Reservoir Good, some surface spalling. Stone masonry walls in poor condition. None None Not defined. Heavy brush, trees. Short riprap section in excel- lent condition. Remainder in poor condition.

APPENDIX B
ENGINEERING DATA

CHECK LIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Rockwood Lake

I.D. NO. CT 00046

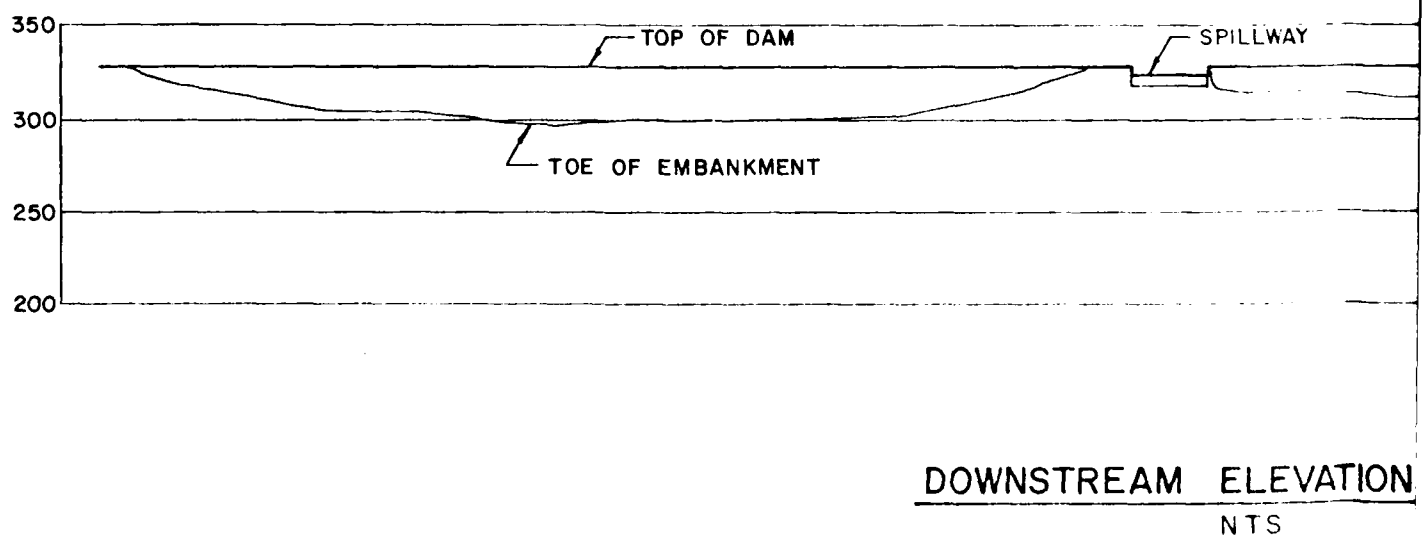
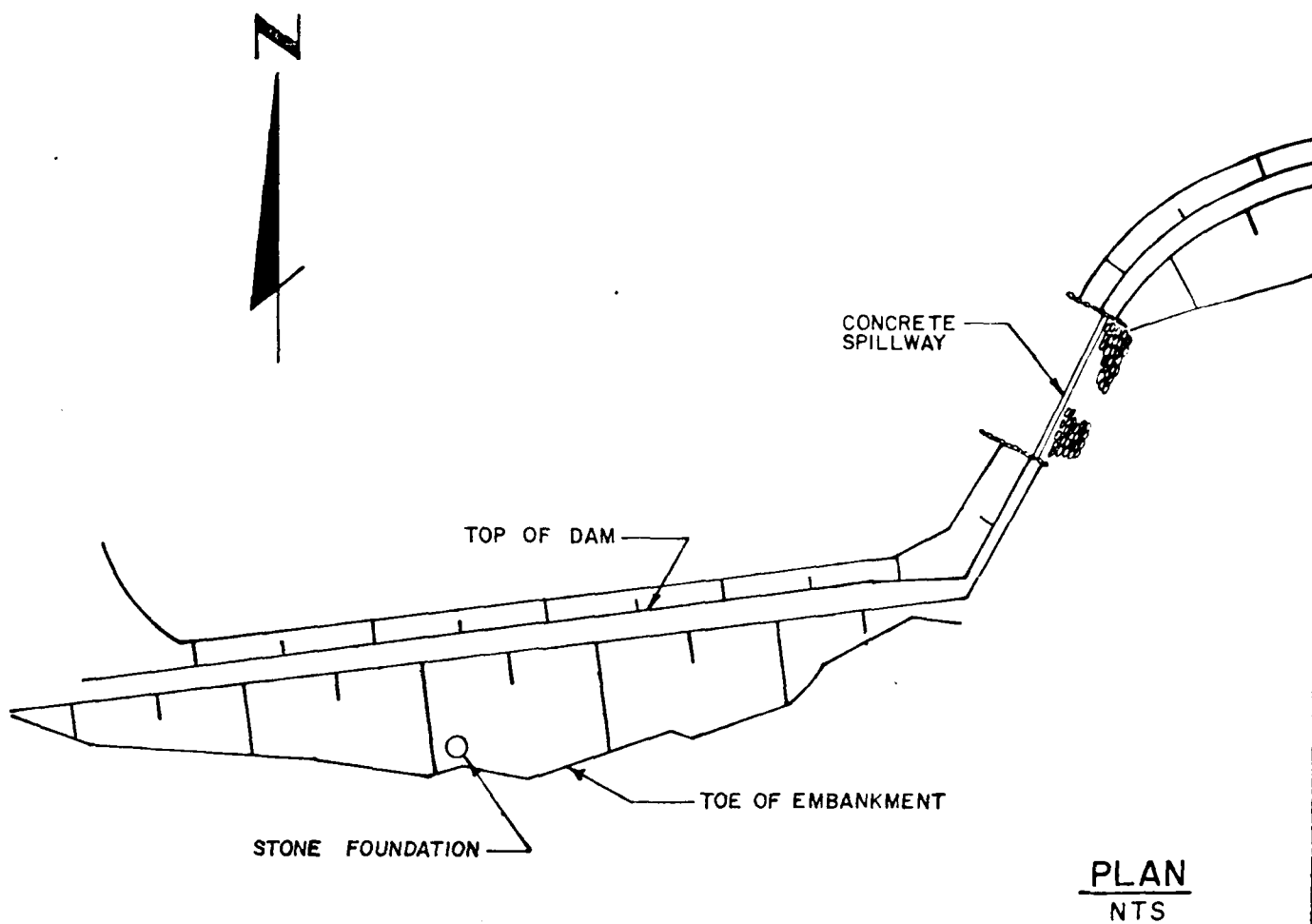
ITEM	REMARKS
AS-BUILT DRAWINGS	None Exist
REGIONAL VICINITY MAP	Available From U.S.G.S.
CONSTRUCTION HISTORY	Unknown
TYPICAL SECTIONS OF DAM	From Field Measurements
OUTLETS - Plan	From Field Measurements
- Details	From Field Measurements
- Constraints	Unknown
- Discharge Ratings	Unavailable
RAINFALL/RESERVOIR RECORDS	From Connecticut-American Waterworks Co.
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	None
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	None
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

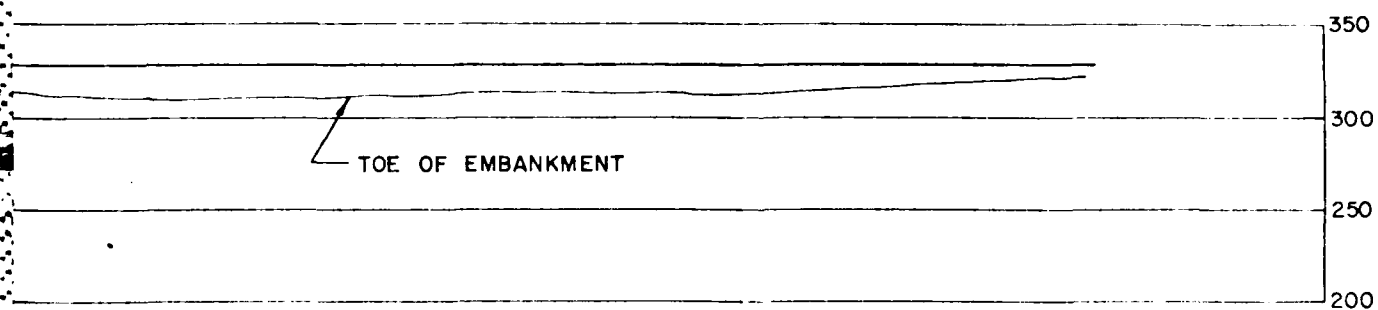
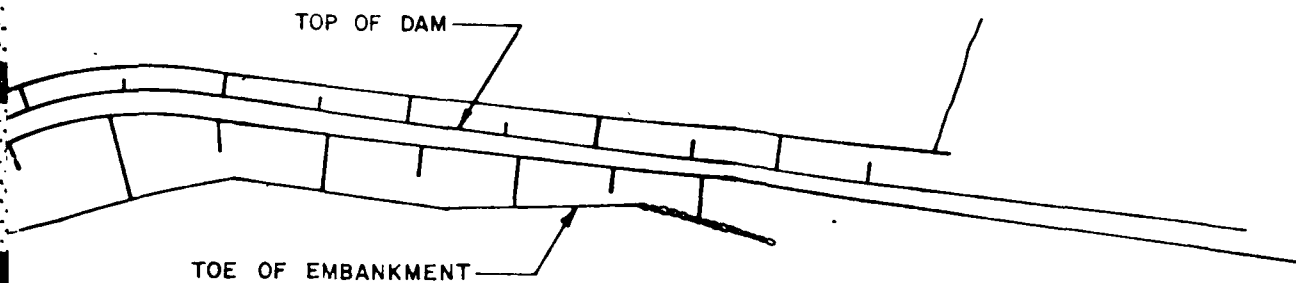
CHECK LIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
PHASE INAME OF DAM Rockwood LakeI.D. NO. CT 00046

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	None
MONITORING SYSTEMS	None
MODIFICATIONS	From Connecticut-American Waterworks Co.
HIGH POOL RECORDS	Informal
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	From Connecticut-American Waterworks Co.
SPILLWAY PLAN	From Field Measurements
SECTIONS	From Field Measurements
DETAILS	None
OPERATING EQUIPMENT PLANS & DETAILS	None





SECTION OF DAM

ROCKWOOD LAKE DAM
ROCKWOOD LAKE BROOK

APPENDIX C

PHOTOGRAPHS

ROCKWOOD LAKE DAM
LOCATION OF PHOTOGRAPHS

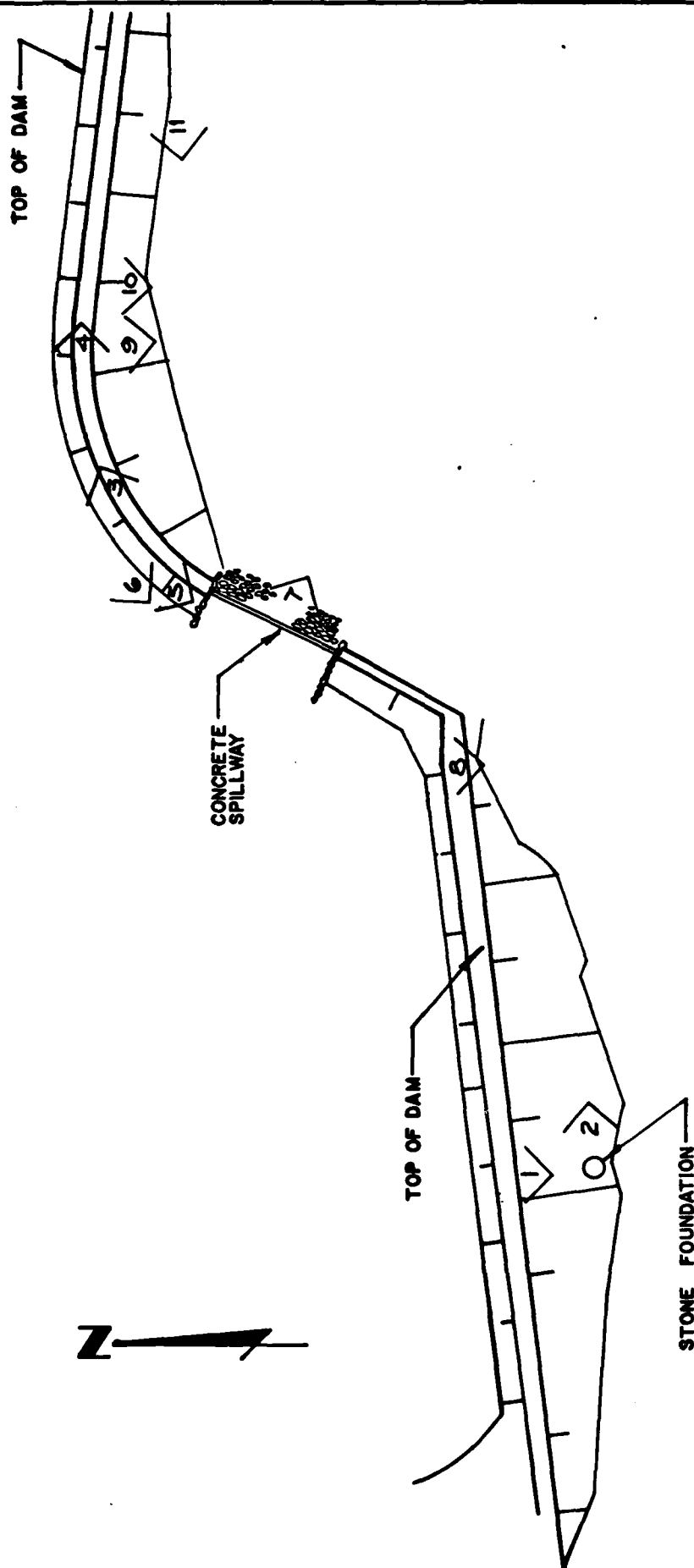




PHOTO #1: The remains of the gate house.

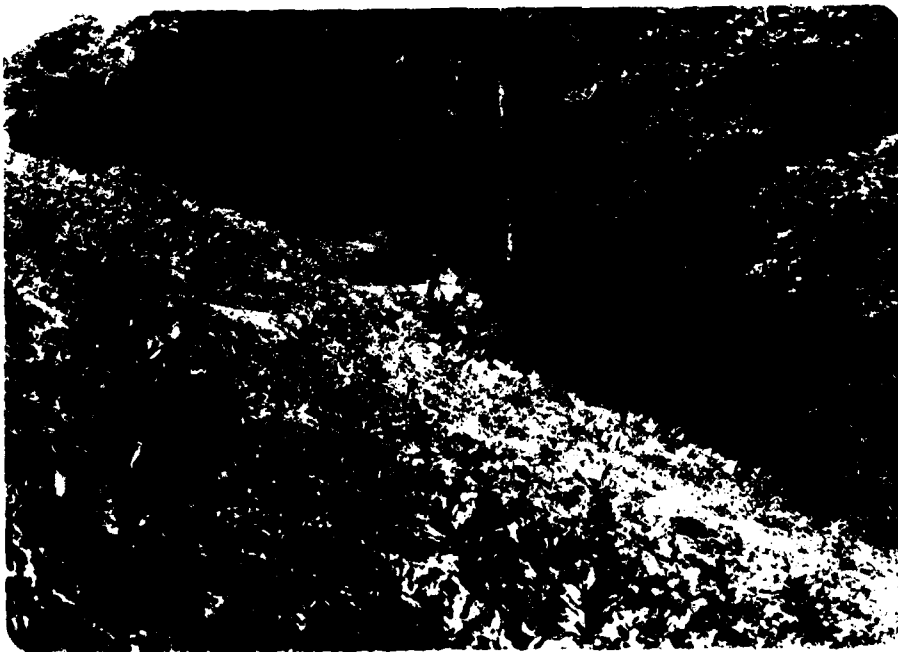


PHOTO #2: Looking east along the embankment, from Station 3+00.



PHOTO #3: Looking east along the embankment, from
Station 7+50.



PHOTO #4: Looking east along the embankment, from
Station 10+00.



PHOTO #5: View of the spillway, looking west.



PHOTO #6: Upstream face of the embankment.

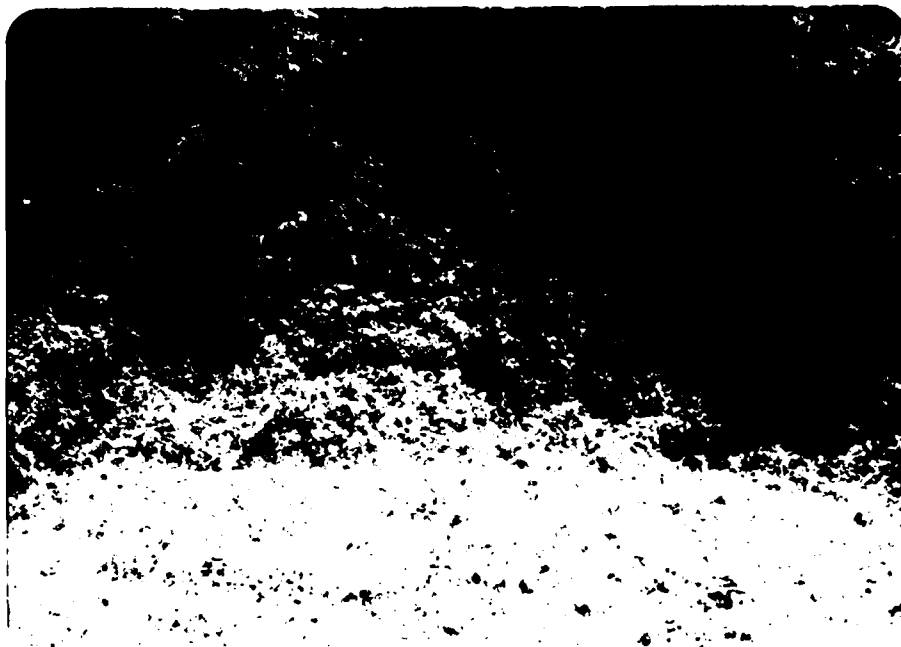


PHOTO #7: Area directly downstream of the spillway.
Note lack of a defined spillway discharge
channel, and heavy vegetation.



PHOTO #8: View of seep area near toe of slope at
Station 4+20.



PHOTO #9: Seepage from toe of embankment.

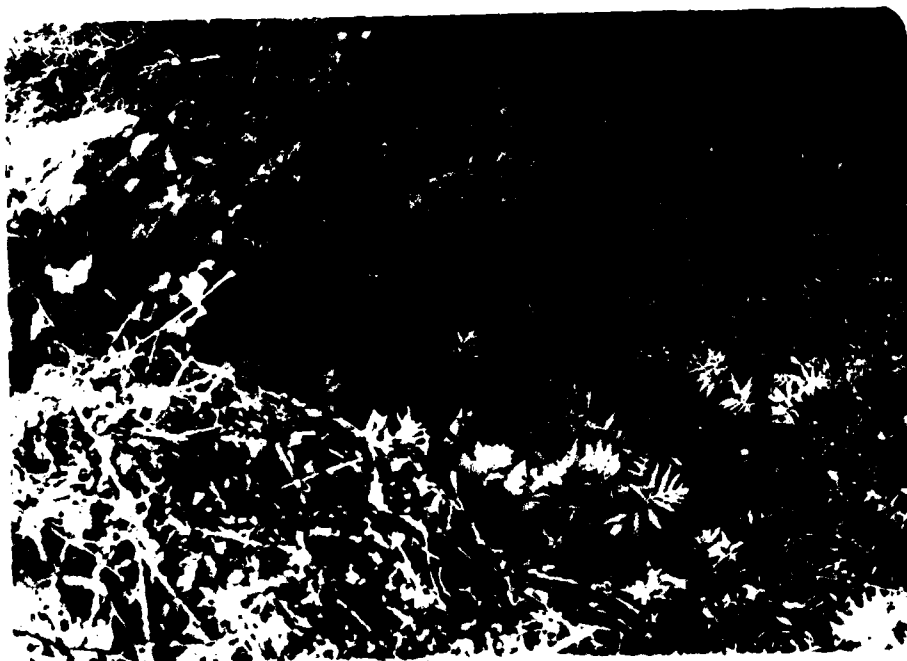


PHOTO #10: Seepage from toe of embankment.

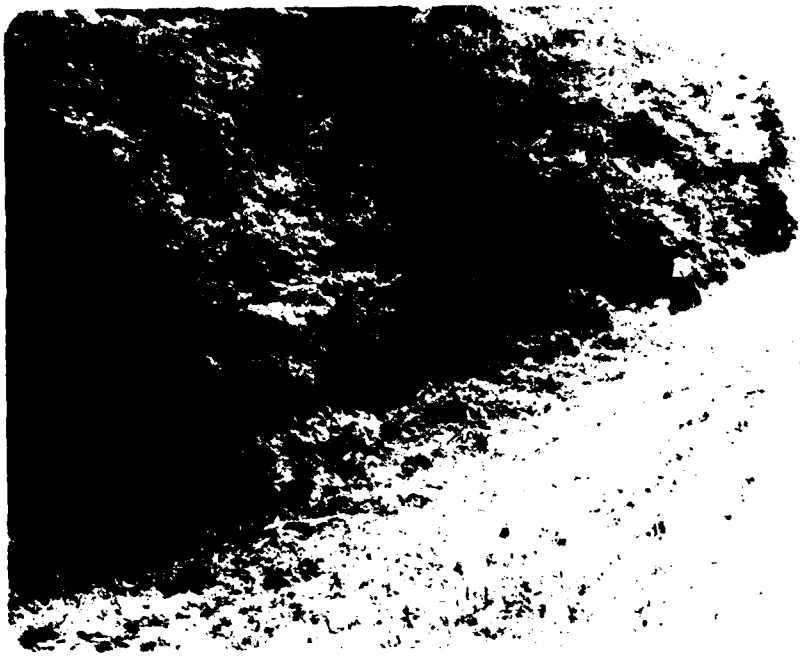
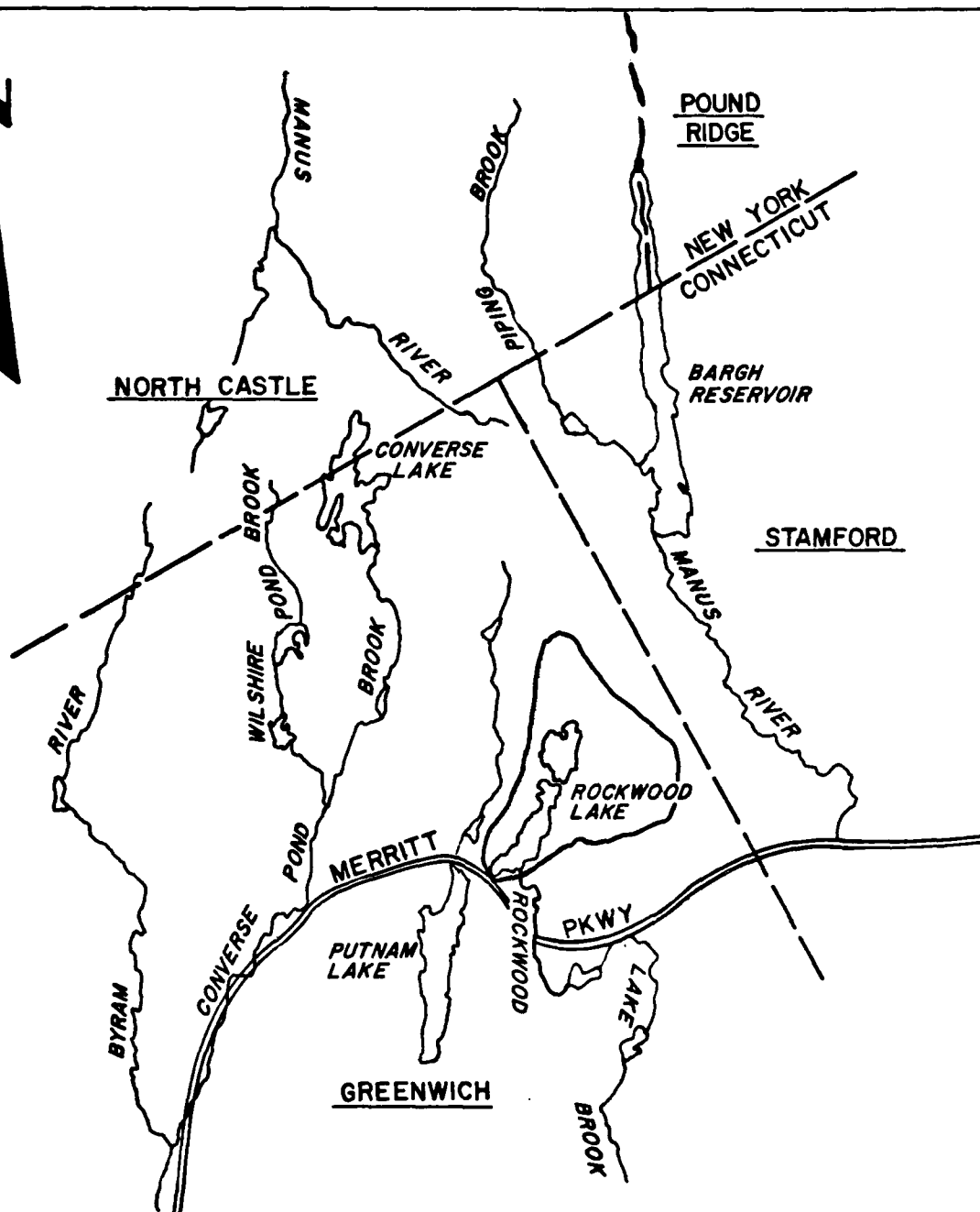


PHOTO #11: View along toe of slope, looking west.

APPENDIX D
HYDROLOGIC COMPUTATIONS



DRAINAGE AREA MAP
ROCKWOOD LAKE DAM
GREENWICH, CONNECTICUT

TEST FLOOD FLOW ESTIMATE

TEST FLOOD IS 1/2 P.M.F.
WATERSHED IS 0.8 SQ. MILES

METHOD #1

REFER TO "DESIGN OF SMALL DAMS"
BY BUREAU OF RECLAMATION, WASH. D.C., 1973

6 HR DURATION P.M.F. IS 25 INCHES (FIG. 15)
AREA-DEPTH REDUCTION IS 20% (PP 48)
EFFECTIVE RAIN = 20 INCHES

CN $\approx$ 70 ASSUMED

RUNNOFF = 16.5 INCHES (FIG. A-4)

AVE T_c = 0.33 HR.

$$T_p = \frac{D}{2} + 0.6 T_c = \frac{6}{2} + 0.6(0.33) = 3.2 \text{ HR}$$

$$Q_p = \frac{484 (A)(R)}{T_p} = \frac{484(0.8)(16.5)}{3.2} = 1996 \text{ CFS}$$

SAY PMF = 2,000 CFS

METHOD #2

REFER TO CONN. WATER RESOURCES BULLETIN
#17, BY USGS.

BY INTERPOLATION, MAF $\approx$ 50 CFS

$$Q_{100} = 5 \times \text{MAF} = 5 \times 50 = 250 \text{ CFS}$$

$$\text{P.M.F.} = 5 \times \text{MAF} = 1250 \text{ CFS}$$

SAY PMF = 1200 CFS

FOR SPILLWAY TEST FLOOD, USE 1600 CFS

FORMATION OF INFLOW HYDROGRAPH

- 1) TEST FLOOD = 1600 CFS
- 2) FORM A TRIANGULAR HYDROGRAPH WITH
A 24 HOUR DURATION, PEAK AT 8 HOURS

<u>TIME HOURS</u>	<u>UNIT FLOW RATE</u>	<u>FLOW RATE CFS</u>
0	0	0
2	0.25	400
4	0.50	800
6	0.75	1200
8	1.00	1600
10	0.875	1400
12	0.75	1200
16	0.50	800
20	0.25	400
24	0	0

ROCKWOOD DAM

78-36-10

FLOOD ROUTING

JGM

9/19/78

INPUT DATA:

SEGMENT 1

SEGMENT 2

IE-327 IV-

UNSUBMERGED WEIR

DISCHARGE COEFFICIENT = 3

DISCHARGE COEFFICIENT = 2.5

0.0 E-327 A-110.00

LENGTH OF WEIR = 84

LENGTH OF WEIR = 1100

ELEVATION OF WEIR = 327

ELEVATION OF WEIR = 330

HR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	327.00FT	0.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
2.00	400CFS	33.05AC-F	327.27FT	0.00FT	36CFS	2.97AC-F	30.07AC-F	30.07AC-F
4.00	800CFS	132.23AC-F	327.96FT	0.00FT	239CFS	25.78AC-F	106.44AC-F	106.44AC-F
6.00	1,200CFS	297.52AC-F	328.82FT	0.00FT	620CFS	96.90AC-F	200.61AC-F	200.61AC-F
8.00	1,600CFS	528.92AC-F	329.64FT	0.00FT	1,084CFS	237.84AC-F	291.07AC-F	291.07AC-F
10.00	1,400CFS	776.85AC-F	330.05FT	0.00FT	1,375CFS	441.18AC-F	335.67AC-F	335.67AC-F
12.00	1,200CFS	991.73AC-F	329.99FT	0.00FT	1,304CFS	662.64AC-F	329.09AC-F	329.09AC-F
16.00	800CFS	1,322.31AC-F	329.52FT	0.00FT	1,008CFS	1,044.95AC-F	277.35AC-F	277.35AC-F
20.00	400CFS	1,520.66AC-F	328.85FT	0.00FT	635CFS	1,316.80AC-F	203.85AC-F	203.85AC-F
24.00	0CFS	1,586.77AC-F	328.07FT	0.00FT	281CFS	1,468.39AC-F	118.38AC-F	118.38AC-F
30.00	0CFS	1,586.77AC-F	327.33FT	0.00FT	48CFS	1,550.15AC-F	36.62AC-F	36.62AC-F

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	46	DIVISION	NED	STATE	CT	COUNTY	001	CORNER DIST.	04	NAME	ROCKWOOD LAKE DAM	LATITUDE (NORTH)	4105.0	LONGITUDE (WEST)	7337.0	REPORT DATE	DAY	MO	YR	08	SEP	78
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POPULAR NAME	NAME OF IMPONDMENT
	ROCKWOOD LAKE

REGION	RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 07	ROCKWOOD LAKE BROOK	GREENWICH	5	60100

TYPE OF DAM	YEAR COMPLETED	PURPOSES	IMPOUNDING CAPACITIES		
			STAGNANT HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	MAXIMUM (ACRE-FT.)
CTHEPL	1895	S	36	34	1534

DIST OWN FED R PRV/FED SCS A VER/DATE
N N N N N 23AUG78

REMARKS
21 CONCRETE CURB

DIS HAS	SPILLWAY	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CV)	POWER CAPACITY INSTALLED	PROCESSED	NAVIGATION LOCKS							
						LENGTH (FT.)	WIDTH (FT.)	DEPTH (FT.)	LENGTH (FT.)				
1	1200 U	80	1310										

OWNER	ENGINEERING BY	CONSTRUCTION BY
CUNNEAMERICAN WATERWORKS		

REGULATORY AGENCY		
DESIGN	CONSTRUCTION	OPERATION
NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
FLANNERY GLAVANA, ASSOC, PC	27 JUL 78	PL 92-367

REMARKS

END

FILMED

8

1941