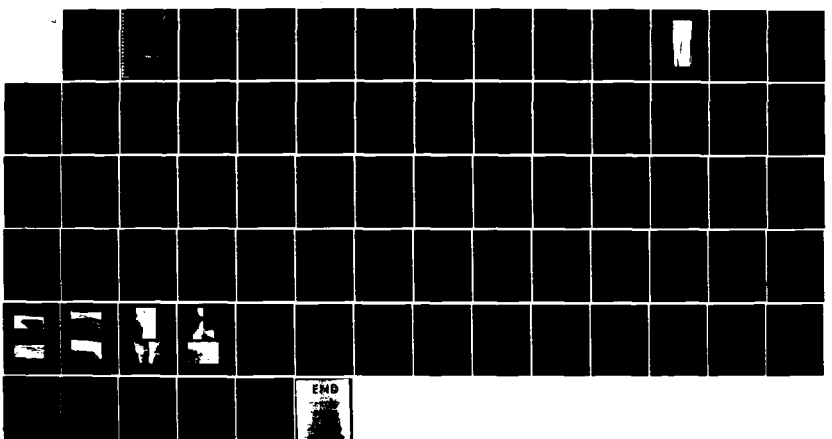
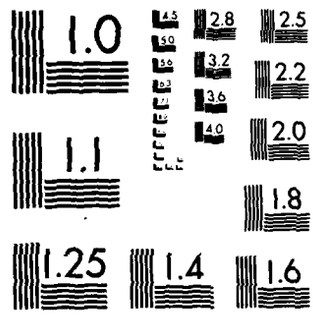
AD-A143 513 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS SOUTH NORWALK RESERVO..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV DEC 78 1/1

UNCLASSIFIED F/G 13/13 NL





NORWALK RIVER BASIN
WILTON, CONNECTICUT

SOUTH NORWALK RESERVOIR DAM
CT. 00212

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

DECEMBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00212	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) South Norwalk Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE December 1978 13. NUMBER OF PAGES 50
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

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

DAMS, INSPECTION, DAM SAFETY,

Norwalk River Basin
Wilton, Conn.
South Norwalk Reservoir Dam

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

The South Norwalk Reservoir Dam consists of an earth structure with a stone masonry core that is 810 ft. long with a rockfill toe on the base of the downstream side. There is an emergency spillway on the west side of the dam. The dam is classified as intermediated in size and has a high hazard potential based on downstream habitation. Based on visual inspection, records available at the site and past operatoinal performance, the facility is judged to be in fair condition.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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

REPLY TO
ATTENTION OF

NEDED

JAN 2 0 1979

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

Dear Governor Grasso:

I am forwarding to you a copy of the South Norwalk Reservoir 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 Second Taxing District, Norwalk, Connecticut 06850.

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
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:	CT 00212
Name:	South Norwalk Reservoir
State Location:	Connecticut
County Location:	Fairfield
Stream:	Belden Hill Brook
Date of Inspection:	October 3, 1978

BRIEF ASSESSMENT

The South Norwalk Reservoir Dam consists of an earth structure with a stone masonry core that is 810 feet long with a rockfill toe on the base of the downstream side. There is an emergency spillway on the west side of the dam. The dam is classified as intermediate in size and has a high hazard potential based on downstream habitation.

Based on visual inspection, records available at the site and past operational performance, the facility is judged to be in fair condition. A review of the engineering data available reveals that there are areas of concern which must be corrected in order to assure the safety of the facility.

Seepage discharges in the vicinity of the toe of the main dam and the downstream earth slopes should be further investigated to determine their origin and monitored to determine any change. The spillway channel is in poor condition with many signs of cracking and spalling.

The drainage area contributing to the dam is 2.39 square miles. The project will pass the test flood (Probable Maximum Flood) without overtopping the dam.

Some recommended measures to be undertaken by the owner include establishing metering points for seepage measurements and a formal warning system.

The owner should implement the recommendations and remedial measures described in Section 7 within two years after receipt of this Phase I Inspection Report.

Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager

Richard F. Lyon
Connecticut P.E. #8443
Project Engineer

This Phase I Inspection Report on South Norwalk Reservoir 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.

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

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 investigations and analyses involving topographic mapping, subsurface evaluations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the need for such studies.

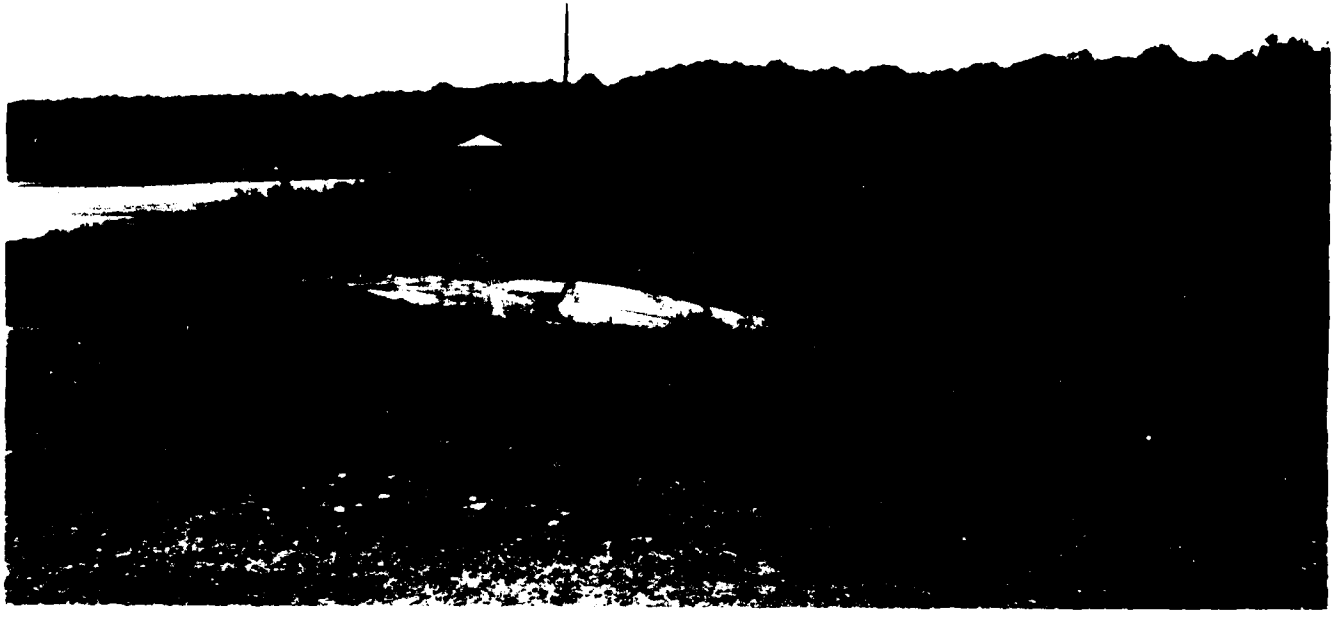
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving 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.

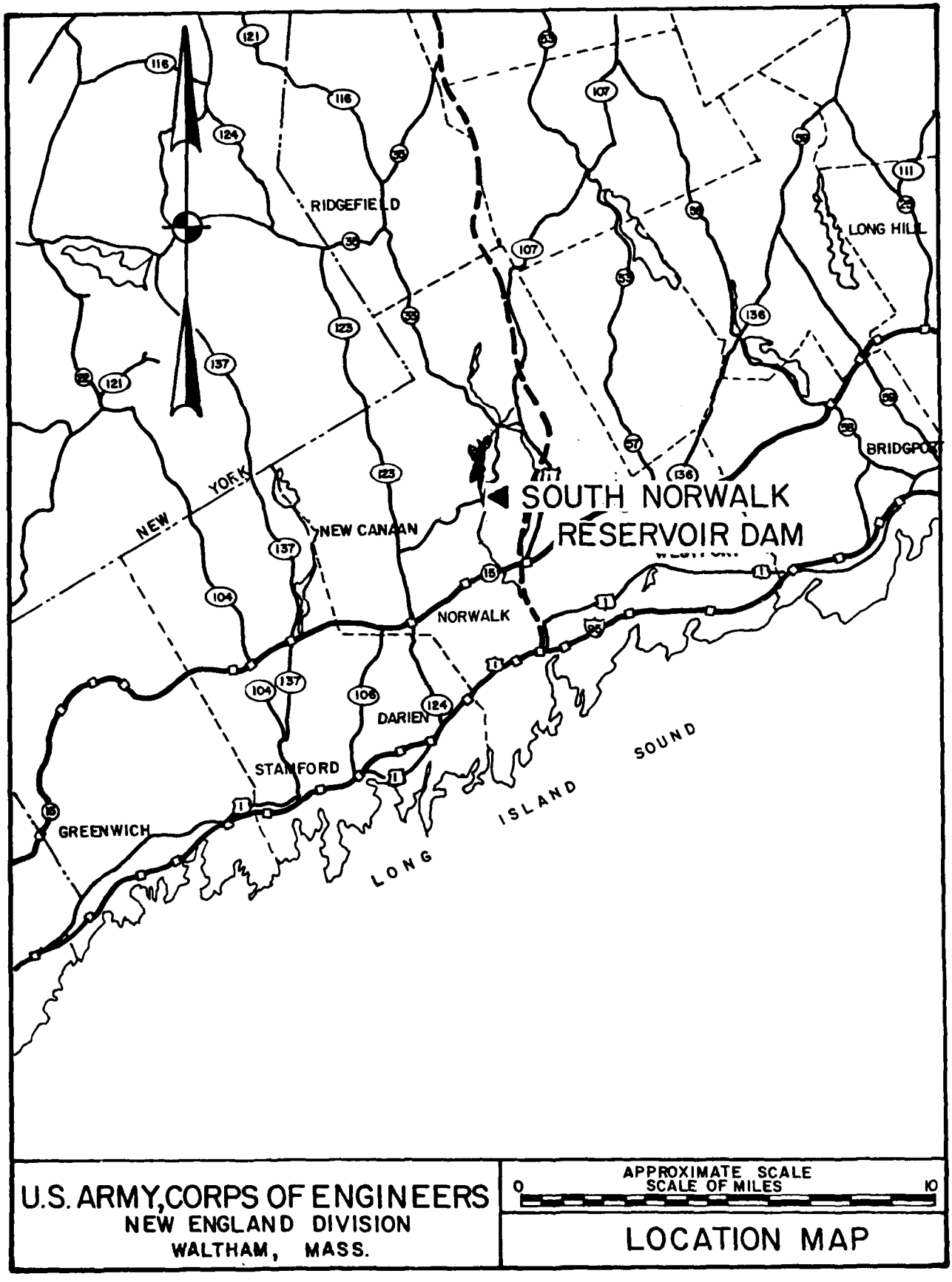
Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because 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 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

TABLE OF CONTENTS (CONTINUED)



OVERVIEW PHOTO



U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

LOCATION MAP

PHASE I INSPECTION REPORT

SOUTH NORWALK RESERVOIR DAM CT 00212

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 throughout 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. Storch Engineers 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 were issued to Storch Engineers under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0000 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 prepare 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. Location - The South Norwalk Reservoir Dam is located approximately 1 mile north of the City of Norwalk in Wilton, Connecticut.

b. Description of Dam and Appurtenances - The dam is an earth structure with a stone masonry core and is approximately 810 feet long. A 50 foot wide concrete spillway and spillway channel serves to carry flood water past the dam. There is a gate house, an 18 inch diameter blowoff as well as two, 18 inch diameter lines which feed an adjacent filtration plant.

c. Size Classification - The size classification of the dam is intermediate. The storage (3,180 acre-feet) governs the classification per criteria set forth in the Recommended Guidelines for Safety Inspection of Dams (Intermediate - greater than 1,000 and less than 50,000 acre-feet) by the Corps of Engineers.

d. Hazard Classification - The hazard classification is high per the criteria set forth in the guidelines mentioned in Section 1.2.c above. Failure of the dam would result in

the inundation of approximately 35 homes as well as the water filtration plant just below the dam and portions of downtown Norwalk (Appendix D, Plate 5).

e. Ownership - The South Norwalk Reservoir Dam is owned by the Second Taxing District of Norwalk, Connecticut.

f. Operator - The person in charge of day to day operation of the dam is John Hiscock, Second Taxing District, Norwalk, Connecticut; Telephone Number: 866-4446.

g. Purpose of the Dam - The dam impounds the South Norwalk Reservoir which serves as a primary water-supply for the City of Norwalk.

h. Design and Construction History - The South Norwalk Reservoir Dam was constructed in 1899 and reconstructed in 1950 to provide an increased capacity for water supply. The design for the reconstruction was prepared for the Second Taxing District of Norwalk by Buck, Seifert and Jost, Consulting Engineers, New York City, New York.

i. Normal Operating Procedures - There is a regular staff of personnel that work at the water filtration plant. The function of the maintenance staff is not only the care of the filtration plant but also control of the water level in the reservoir and maintenance of the facility itself.

1.3 Pertinent Data

a. Drainage Area - A 2.39 square mile drainage area contributes to the dam. The terrain is rolling with mixed amounts of residential and undeveloped land.

b. Discharge at Damsite - The maximum known spillway discharge was approximately 1,400 cfs during the flood of August, 1955.

(1) Outlet works: (conduits) size 1-18 inch blowoff and 2-18 inch conduits for water supply at inlet elevation 244.2.

(2) Maximum known flood at damsite: 1,400 cfs.

(3) Ungated spillway capacity at maximum pool elevation: 2,700 cfs at 278.5 elevation.

(4) Gated spillway capacity at pool elevation: N/A cfs at N/A elevation.

(5) Gated spillway capacity at maximum pool elevation: N/A cfs at N/A elevation.

(6) Total spillway capacity at maximum pool elevation: 2,700 cfs at 278.5 elevation.

c. Elevation (Feet above MSL)

(1) Top of Dam: 278.5

(2) Maximum pool-design surcharge: 278.5

(3) Full flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 271.6

(6) Upstream portal invert diversion tunnel: 244.2

(7) Streambed at centerline of dam: 244

(8) Maximum tailwater: 246

d. Reservoir

(1) Length of maximum pool: 6,500 feet

(2) Length of recreation pool: N/A

(3) Length of flood-control pool: N/A

e. Storage (Acre-Feet)

(1) Recreation pool: N/A

(2) Flood-control pool: N/A

(3) Design surcharge: 3,180

(4) Top of Dam: 3,180

f. Reservoir Surface (Acres)

(1) Top of Dam: 174

(2) Maximum pool: 174

(3) Flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 151

g. Dam

(1) Type: Earth embankment

(2) Length: 810 feet ±

(3) Height: 35 feet ±

(4) Top width: 20 feet

(5) Side slopes: U/S and D/S 1:3

(6) Zoning: Unknown

(7) Impervious Core: Concrete and stone masonry

(8) Cutoff: unknown

(9) Grout curtain: unknown

(10) Other: N/A

h. Diversion and Regulating Tunnel

(1) Type: Cast iron

(2) Length: 240 feet ±

(3) Closure: N/A

(4) Access: None

(5) Regulating Facilities: N/A

i. Spillway

(1) Type: Concrete channel - 50 feet wide

(2) Length of weir: N/A

(3) Crest elevation: 271.6

(4) Gates: None

(5) U/S Channel: riprap and natural ground

(6) D/S Channel: natural channel

(7) General: N/A

j. Regulating Outlets

Regulating outlets include 3, 18 inch pipes. One is a blowoff and two are for water supply.

(1) Invert: 244.2

(2) Size: 18 inches

(3) Description: Cast iron

(4) Control Mechanism: manually operated gates

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

The design calculations for the reconstruction in 1950 were not available. The contract plans were available and were reviewed. The design for the reconstruction included such features as piezometer installation, a rock fill toe replacement and reconstruction of the emergency spillway. The consulting engineer was Buck, Seifert & Jost of New York City, New York (Appendix B, Reference 1).

2.2 Construction

The facility was constructed in 1899 and reconstructed in 1950 to add to the impoundment capacity of the reservoir. The construction and reconstruction was not recorded with any photographs. Other written information was very limited, however, the contract plans for the reconstruction were secured and reviewed. None of the staff of the Second Taxing District had any recollections of the construction period.

2.3 Operation

The valves at the toe of the main dam are exercised periodically as they serve the water filtration plant that is immediately downstream. Because the reservoir is primarily for purposes of water supply, the level is controlled by the

valves at the toe of the dam. According to maintenance personnel, the water level is usually so low (approximately 8 feet down) that the spillway does not flow.

2.4 Evaluation

a. Availability - Design and construction information is readily available. A list of references used to study the dam is contained in Appendix B.

b. Adequacy - The information made available along with the visual inspection, past performance history and hydrologic and hydraulic assumptions were more than adequate to assess the condition of the facility.

c. Validity - The validity of the information is not questionable and the history of the facility seems to bear this out.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on October 3, 1978 by members of the engineering staff of Storch Engineers, with the help of Mr. John Hiscock of the Second Taxing District, Norwalk, Connecticut. A copy of the visual inspection check list is contained in Appendix A.

Before the inspection commenced, the design and construction documents were studied and compact sketches were prepared for use during the inspection (Appendix B, Plates 1 and 2).

In general, the overall appearance and condition of the facility and its appurtenant structures is fair.

b. Dam - The toe of the main dam where the area is swampy has trees and brush which obscured the view of the embankment (Appendix C, Photo 8). At the lower part of the toe, there are two, 18 inch diameter pipes for the purpose of carrying the raw water from the reservoir to the filtration plant which is just located downstream of the crest. Just below the toe of the main dam, there is a steady seepage flow (Appendix C, Photo 8) which was estimated to be approximately 10 to 12 gallons per minute. This seepage is clear and does not show any signs of particle movement. The upstream face of the dam is in good condition with no visible signs of distress (Appendix C, Photos 1 and 2).

c. Appurtenant Structures - The gate house and wooden service bridge (Appendix C, Photo 2) are in excellent condition with no visible signs of cracking, spalling or distress. The valves and operators are operable and used as required to aerate the reservoir and control the supply of raw water to the filtration plant.

The spillway of the main dam dike (Appendix C, Photos 3, 4 and 5) is made of reinforced concrete that appears to be in very poor condition. The training walls of the approach area are distressed and cracked (Appendix C, Photo 6). The channel floor has exposed reinforcing and the concrete is spalling.

d. Reservoir Area - The area immediately adjacent to the facility is in a natural state with no signs of erosion.

e. Downstream Channel - The channel for the outlet (Appendix C, Photo 4) of the main dam is overgrown with many trees.

The downstream channel of the spillway is fairly dry and is lined with 8-10 inch stones and exhibits no evidence of washout or distress.

3.2 Evaluation

The visual inspection did not reveal any apparent areas of distress. The general condition of the facility and its appurtenant structures is fair.

The seepage flows from the body of the main dam could not be monitored because there were no underdrains. The normal flow of the water through the dam appears slight and was observed at the rockfill toe of the main dam. Surface cracks, embankment bulges, piping or boils were not observed.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The responsibility of maintenance of the facility is with the Second Taxing District of Norwalk, Connecticut. There are approximately 8-10 persons for maintenance and their center of operations is at the water filtration plant. The care of the main dam, its appurtenant structures as well as the control of the water level is the responsibility of this maintenance staff. There is no written or formal operating procedure available for control of the flow during a major storm.

4.2 Maintenance of Dam

The only item maintained on a regular basis is the mowing of the grass at the main dam.

4.3 Maintenance of Operating Facilities

The facilities which operate the main dam consist of two, 18 inch diameter lines which feed the water filtration plant and one, 18 inch diameter blowoff. The condition of the gate house and lower valve chamber which contain these operators is discussed in Section 3.

4.4 Description of Warning System

There is no warning system in effect for the facility.

4.5 Evaluation

The maintenance of the operating equipment is adequate, however, the overgrowth on the toe of the main dam should be removed. Discussions of the recommendations for these routine items of maintenance are presented more fully in Section 7.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - The 50 foot wide spillway channel and various blowoff and water supply pipes are the only means of transmitting water past the dam.

Using the guide curves supplied by the Corps of Engineers (rolling terrain), the test flood inflow (Probable Maximum Flood) into the reservoir is 5,000 cfs and the routed outflow is 2,600 cfs. The pond elevation at the test flood outflow is 278.3 or 0.2 feet below the top of the dam. The hydraulic capacity of the spillway before overtopping the dam is 2,700 cfs or about 3.9 percent greater than the test flood outflow.

b. Experience Data - The South Norwalk Reservoir Dam has experienced the floods of November, 1927; March, 1936; September, 1938 and the reconstructed dam, the flood of August (maximum) and October, 1955. During the flood of August, 1955, the depth of the flow over the spillway was approximately 4.5 feet and the discharge was approximately 1,400 cfs.

c. Visual Observations - The spillway at the time of the inspection was in poor condition with settlement of the channel floor, spalling concrete and exposed reinforcing bars.

d. Overtopping Potential - Our calculations indicate that the test flood outflow will not overtop the dam.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation - There has been no routine inspection conducted by the resident staff, however, in June, 1973, this dam was observed by personnel of the State of Connecticut, Department of Environmental Protection. This visual inspection showed that although the structural stability of the dam is sufficient there is a seepage flow through it sufficient to form a wet area just off the rockfill toe.

b. Design and Construction Data - The design and construction data available was in the form of the reconstruction drawing set (Appendix B, Reference 1) and oral information.

c. Operating Records - There are no operating records for the dam. The water level of the South Norwalk Reservoir is not monitored.

d. Post Construction Changes - The following changes have been noted since the completion of the dam's construction in 1899:

1. Reconstruction of the dam in 1950 included the raising of the crest by 8 feet, a new rolled fill of the downstream slope with a

drainage rock blanket, an intake and screen chamber and the concrete service spillway (Appendix B, Plates 1 and 2).

e. Seismic Stability - The dam is located in Seismic Zone 1 and in accordance with Recommended Phase I Guidelines does not warrant a seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - After consideration of the available documents, the results of this inspection and the meetings with the resident staff, the general condition of the South Norwalk Reservoir Dam is judged to be fair.

Considerable damage to the spillway's concrete and unmonitored seepage through the body of the dam could cause a difficult situation in the future especially during periods of the heavy rainfalls.

b. Adequacy of Information - The information available is such that assessment of the safety of the dam should be based primarily on the visual inspection results and the past operational performance of the dam and its appurtenant structures.

c. Urgency - It is considered that the recommendations suggested below be implemented within two years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation - Additional investigations of the dam should be implemented by the owner as outlined in the following sections.

7.2 Recommendations

In view of the lack of engineering data for evaluating the condition of the dam, it is recommended that the following measures be undertaken by the owner:

a. Monitoring of the dam for seepage including any necessary seepage analyses or other pertinent studies.

b. Determination of the elevations of the dam's base and condition of the rock foundation and concrete of the spillway.

The above recommendations should be done by a qualified registered professional engineer or engineering firm.

7.3 Remedial Measures

It is considered important that the following items be attended to as early as practical:

a. Alternatives - Not applicable.

b. O & M Maintenance and Procedures -

1. Brush and trees on the downstream slope and on the eastern wet area near the toe of the dam should be removed to facilitate the visual observation of existing and potential seepage, movements and pipings.

2. Weakened and damaged concrete of the spillway should be removed and replaced. All concrete

surfaces of the spillway with caverns, potholes and cracks should be repaired.

3. Plans for around-the-clock surveillance should be developed for periods of unusually heavy rains and a formal warning system should be put into operation for use in the event of an emergency.

4. A program of biennial periodic technical inspection should be established.

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT South Norwalk Reservoir Dam

DATE 10-3-78

TIME 11:00 a.m.

WEATHER Cloudy

W.S. ELEV. 263± U.S. N/A DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. Gary Giroux
4. John Schearer
5. Rodolfo Aloma
6. John Hiscock
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir DATE 10-3-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME G. Giroux

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good
Current Pool Elevation	Good
Maximum Impoundment to Date	Good
Surface Cracks	None observed
Pavement Condition	N/A
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Fair with some cracking observed in the retaining wall spillway
Indications of Movement of Structural Items on Slopes	Not observed
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	None observed
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	Rock fill toe
Toe Drains	None
Instrumentation	None

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir Dam DATE 10-3-78

PROJECT FEATURE NAME M. Petrovsky

DISCIPLINE NAME R. Aloma

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	
Current Pool Elevation	North west dike not included in
Maximum Impoundment to Date	scope of inspection
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir Dam DATE 10-3-78

PROJECT FEATURE _____ NAME J. Schearer

DISCIPLINE _____ NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	UNDERWATER
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Good sound concrete structure
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir Dam DATE 10-3-78

PROJECT FEATURE _____ NAME M. Petrovsky

DISCIPLINE _____ NAME R. Lyon

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	N/A
Spalling	None observed
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None observed
Cracks	None observed
Rusting or Corrosion of Steel	None observed
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	Chain operated for lifting screens
Elevator	N/A
Hydraulic System	N/A
Service Gates	Operable
Emergency Gates	N/A
Lightning Protection System	N/A
Emergency Power System	None
Wiring and Lighting System in	None

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir Dam DATE 10-3-78

PROJECT FEATURE _____ NAME G. Giroux

DISCIPLINE _____ NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	N/A cast iron pipe with valve
Spalling	embedded within the body
Erosion or Cavitation	of the dam
Cracking	
Alignment of Monoliths	Not observed
Alignment of Joints	Not observed
Numbering of Monoliths	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT South Norwalk Reservoir Dam — DATE 10-3-78

PROJECT FEATURE — NAME R. Aloma

DISCIPLINE — NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	None
Floor of Approach Channel	Good
b. Weir and Training Walls	
General Condition of Concrete	Fair to poor
Rust or Staining	None
Spalling	Extensive on floor of spillway
Any Visible Reinforcing	channel
Any Seepage or Efflorescence	Minor Areas
Drain Holes	none
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	None observed
Floor of Channel	Overgrown with brush
Other Obstructions	and grass

APPENDIX B

LIST OF REFERENCES

1. Norwalk, Connecticut; Second Taxing District; Improvements to Waterworks System; City Lake Reservoir; Drawings No. 459-20 to No. 459-29; February, 1950.

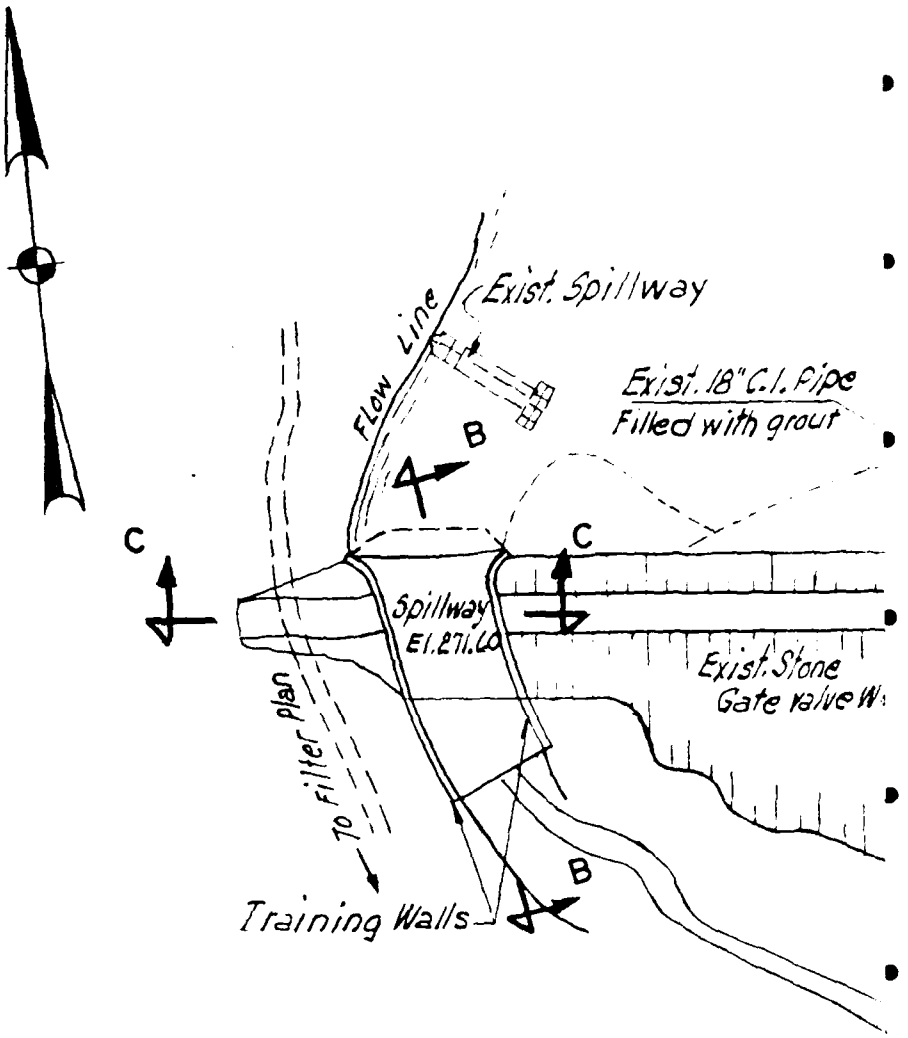
2. Recommended Guidelines for Safety Inspection of Dams; Department of the Army; Office of the Chief of Engineers; Washington, D.C.; November, 1976.

3. Guide Curves for the Probable Maximum Flood (PMF) for Regions of New England based on past Corps of Engineers' Studies; March, 1978.

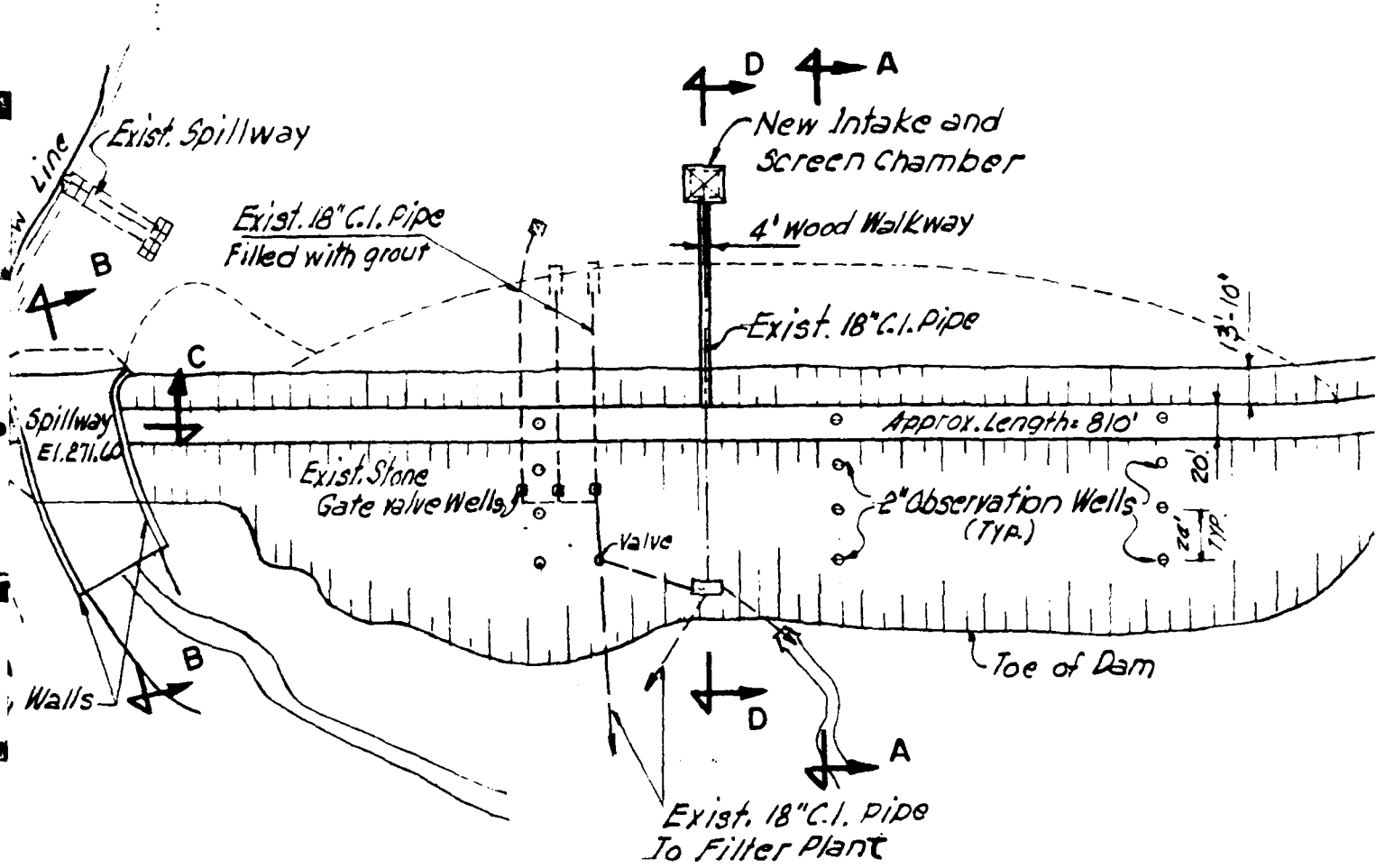
4. Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations; New England Division; Corps of Engineers; March, 1978.

5. Rule of Thumb; Guidance for Estimating Downstream Dam Failure Hydrographs; Corps of Engineers; April, 1978.

6. Instrumentation of Earth and Rockfill Dams; EM 1110-2-1908; Department of the Army; Corps of Engineers; August, 1971.



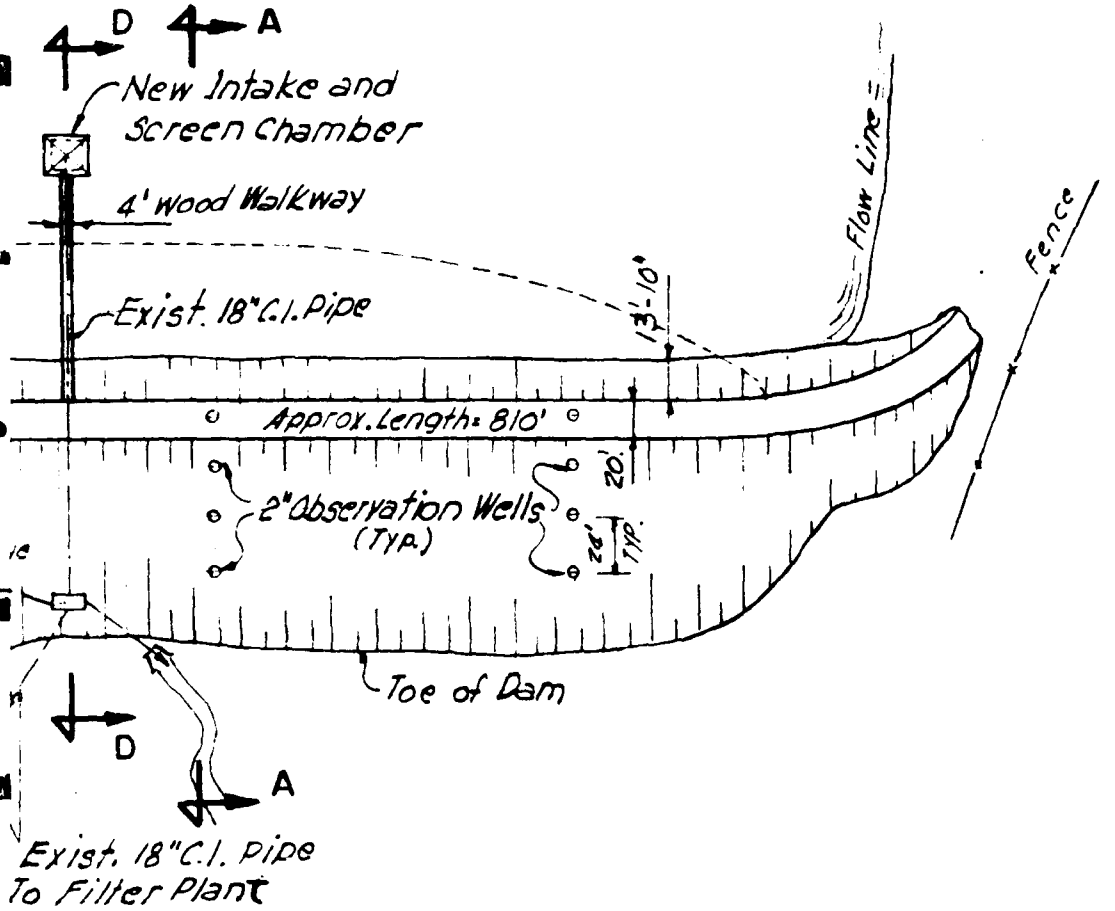
NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE SECOND TAXING DISTRICT NORWALK, CONN. (1)



PLAN

NOT TO SCALE

STORCH ENGIN
WETHERSFIELD, CON
NATIONAL PROGF
SOUTH NC
BELDEN HILL BR



LAN

TO SCALE

PLATE-1

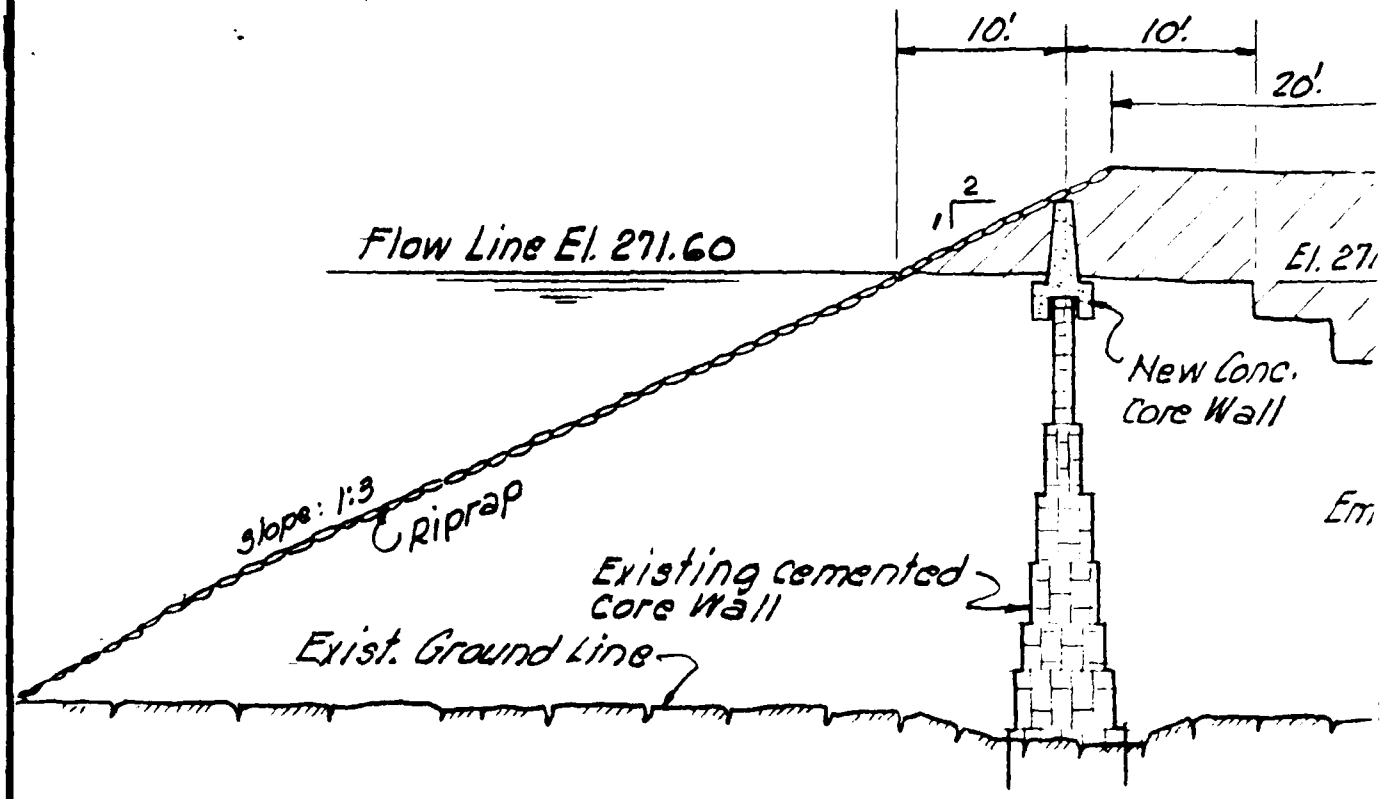
STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SOUTH NORWALK RESERVOIR DAM

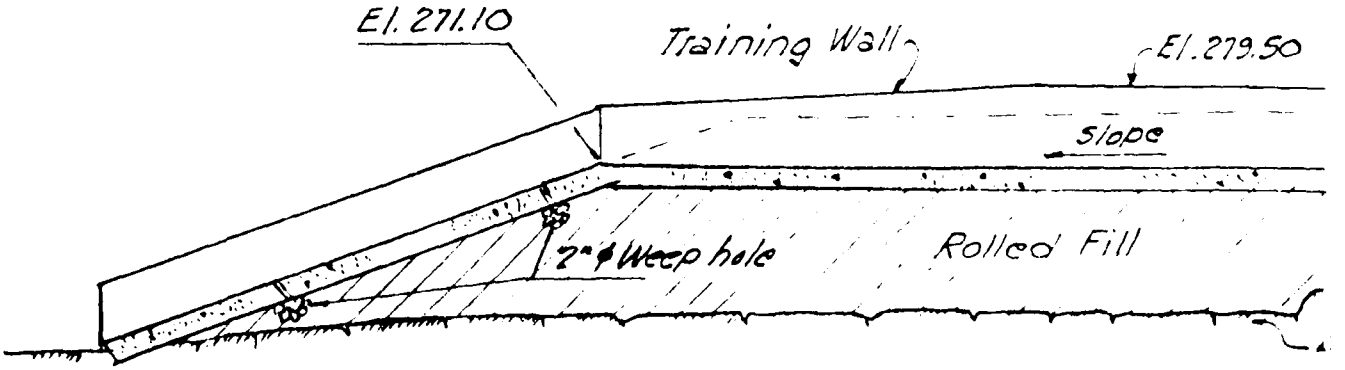
BELDEN HILL BROOK CONNECTICUT

			SCALE: AS SHOWN
			DATE : NOV. - 1978



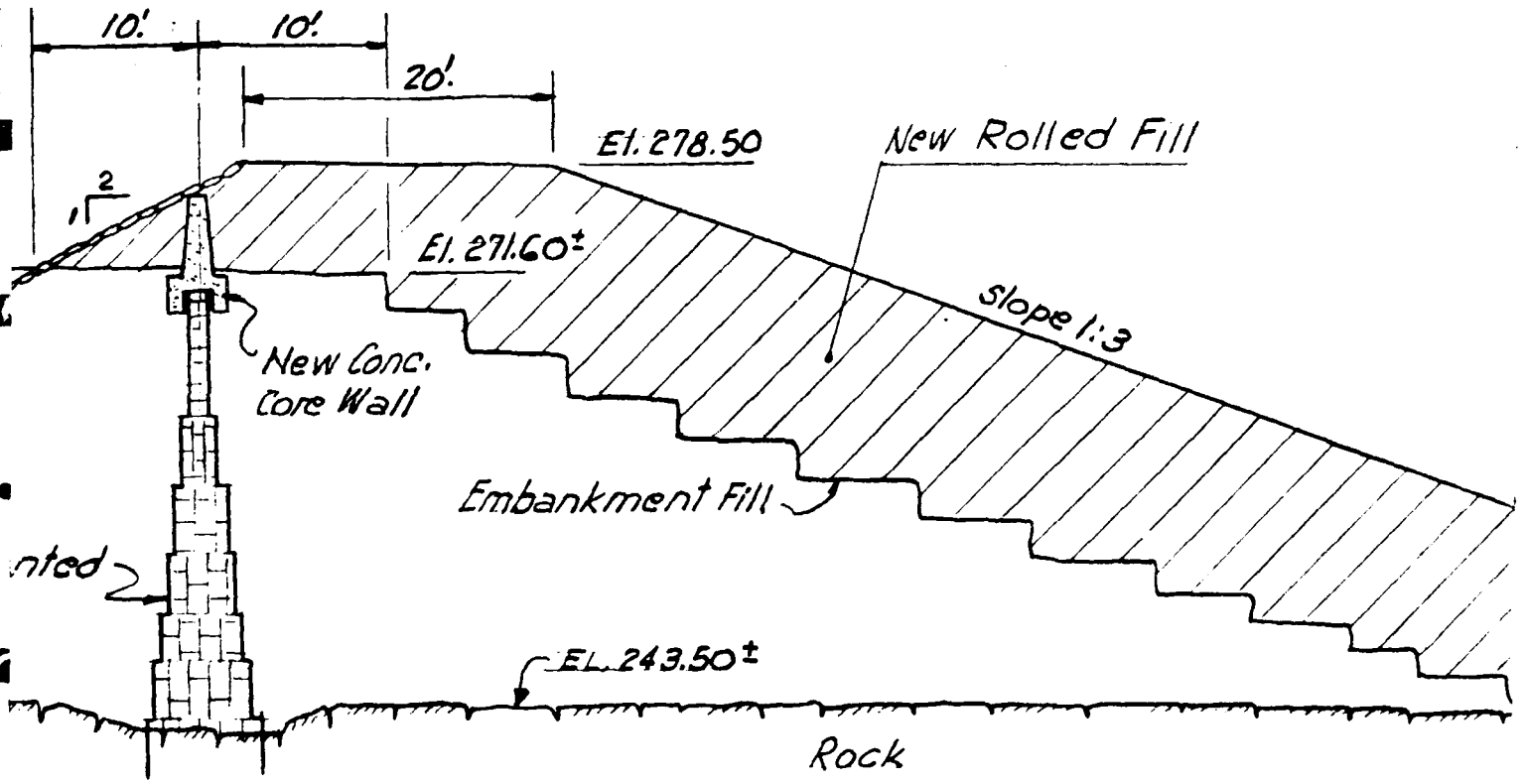
SECTI

NOT TO S



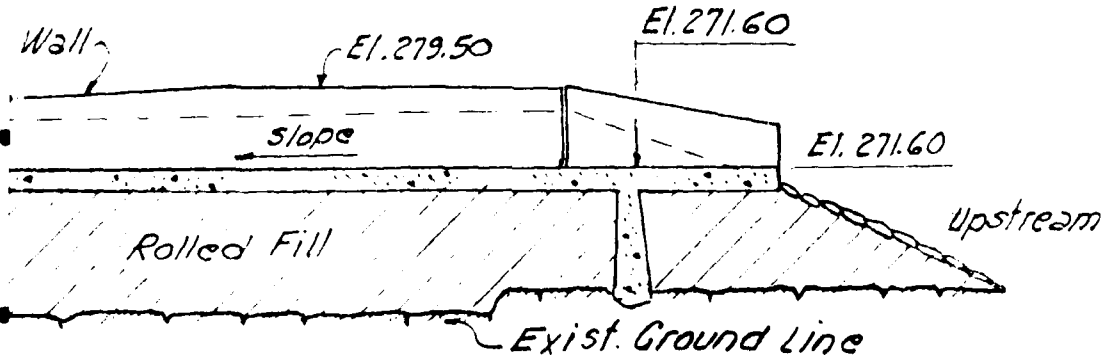
①

SECTION-BB ②



SECTION-AA

NOT TO SCALE



SECTION BB②

STORCH ENGINE
WETHERSFIELD, CONNE
NATIONAL PROGRA
SOUTH NOF
BELDEN HILL BRO

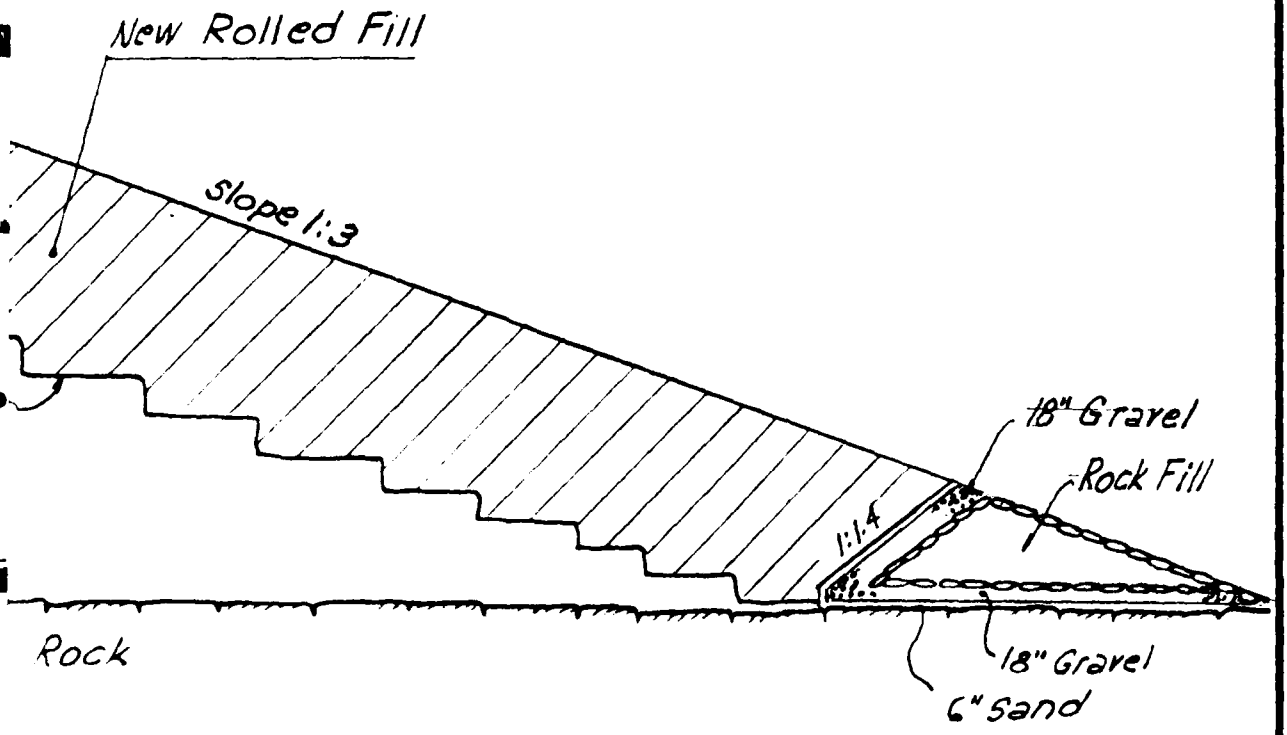


PLATE-2

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

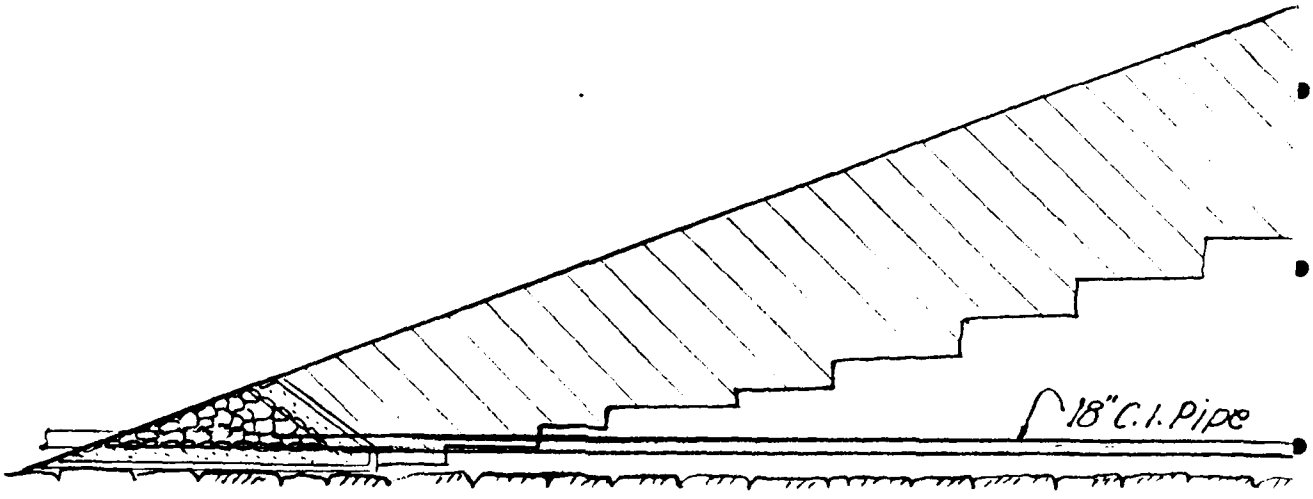
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

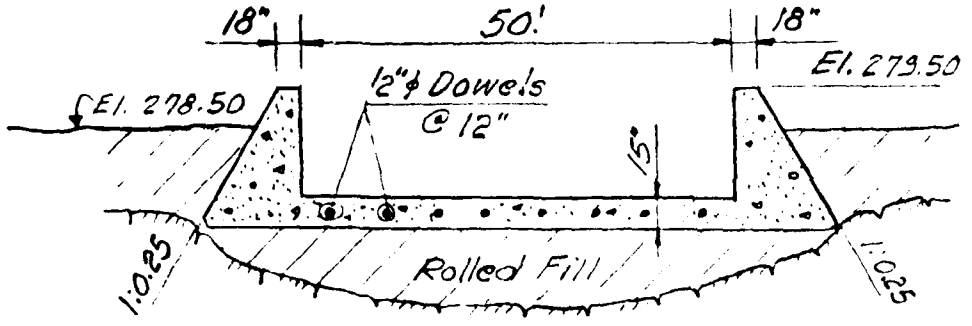
SOUTH NORWALK RESERVOIR DAM

BELDEN HILL BROOK (3) CONNECTICUT

SCALE: AS SHOWN

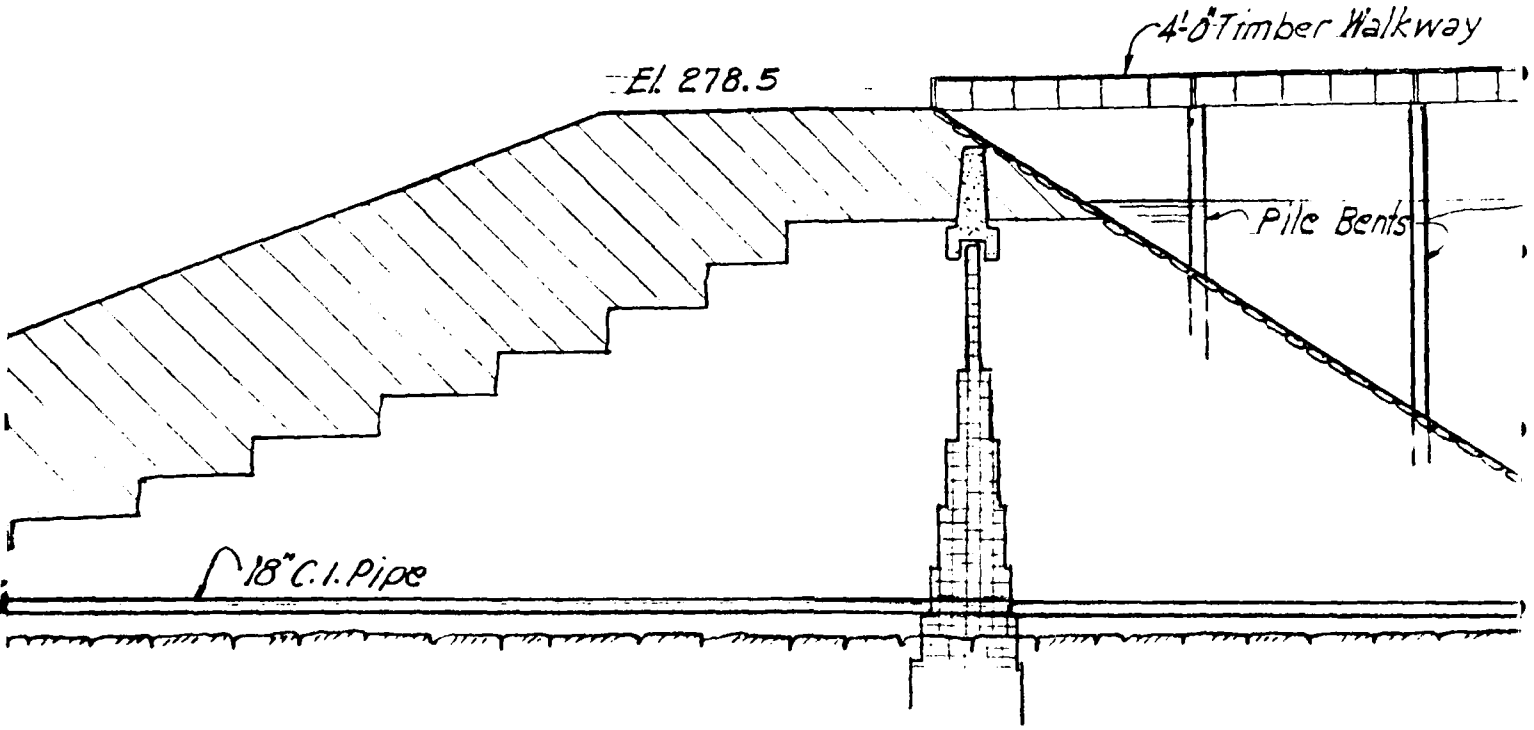
DATE : NOV. - 1978





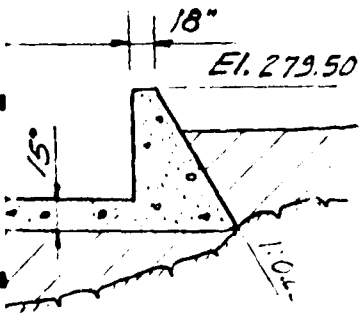
SECTION-CC

NOT TO SCALE



SECTION- DD

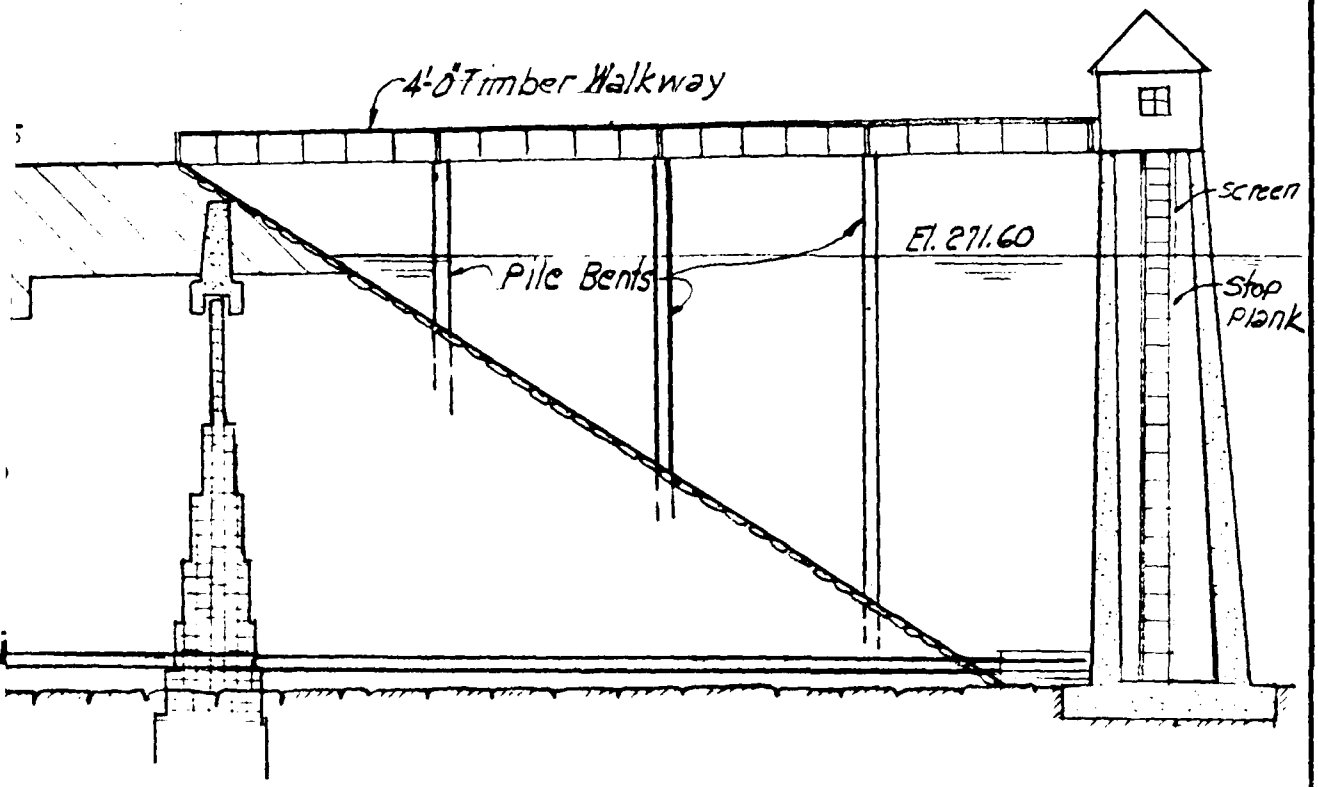
NOT TO SCALE



N-CC

(2)

STORCH ENGINE
WETHERSFIELD, CONN
NATIONAL PROGR
SOUTH NO
BELDEN HILL BR



ON-DD

SCALE

PLATE-3

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

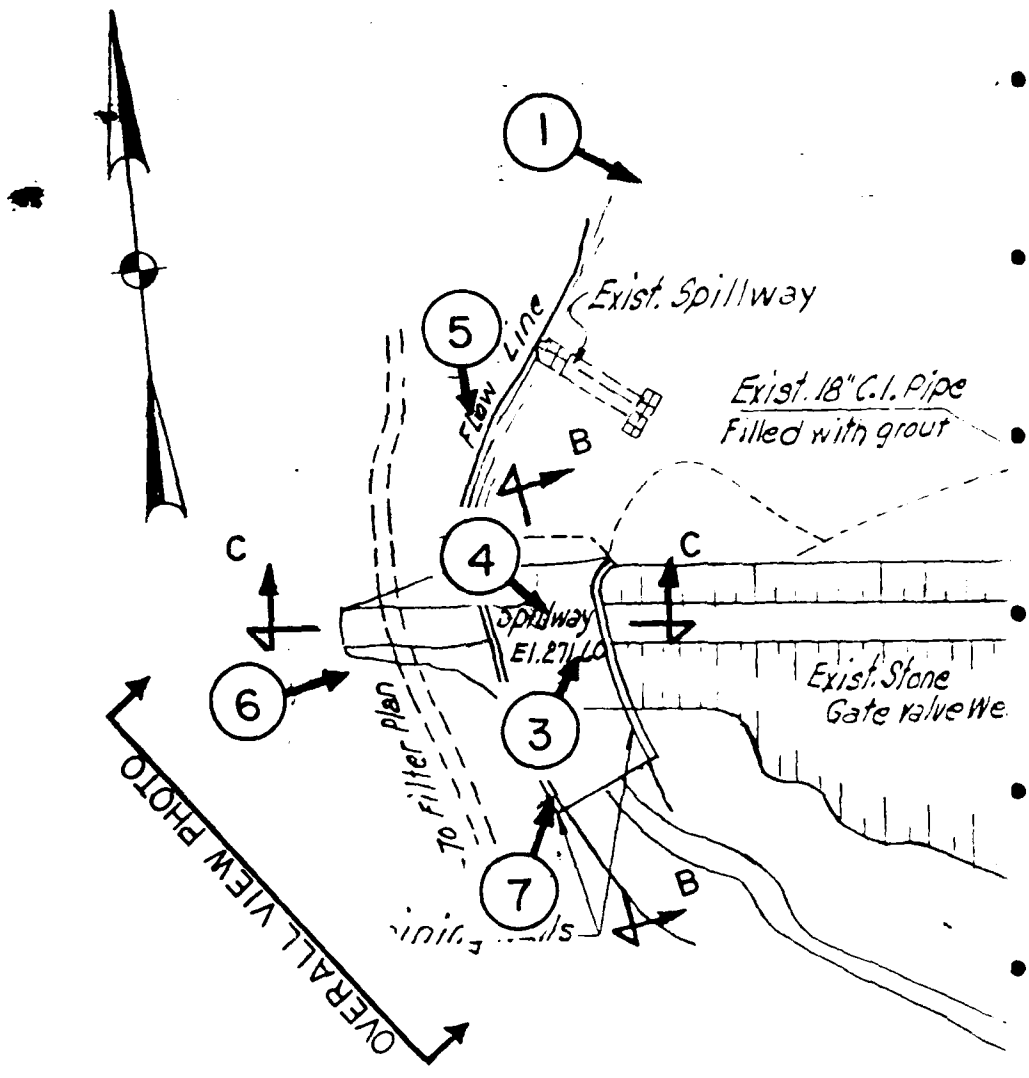
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SOUTH NORWALK RESERVOIR DAM

BELDEN HILL BROOK (3) CONNECTICUT

			SCALE: AS SHOWN
			DATE : NOV. 1978

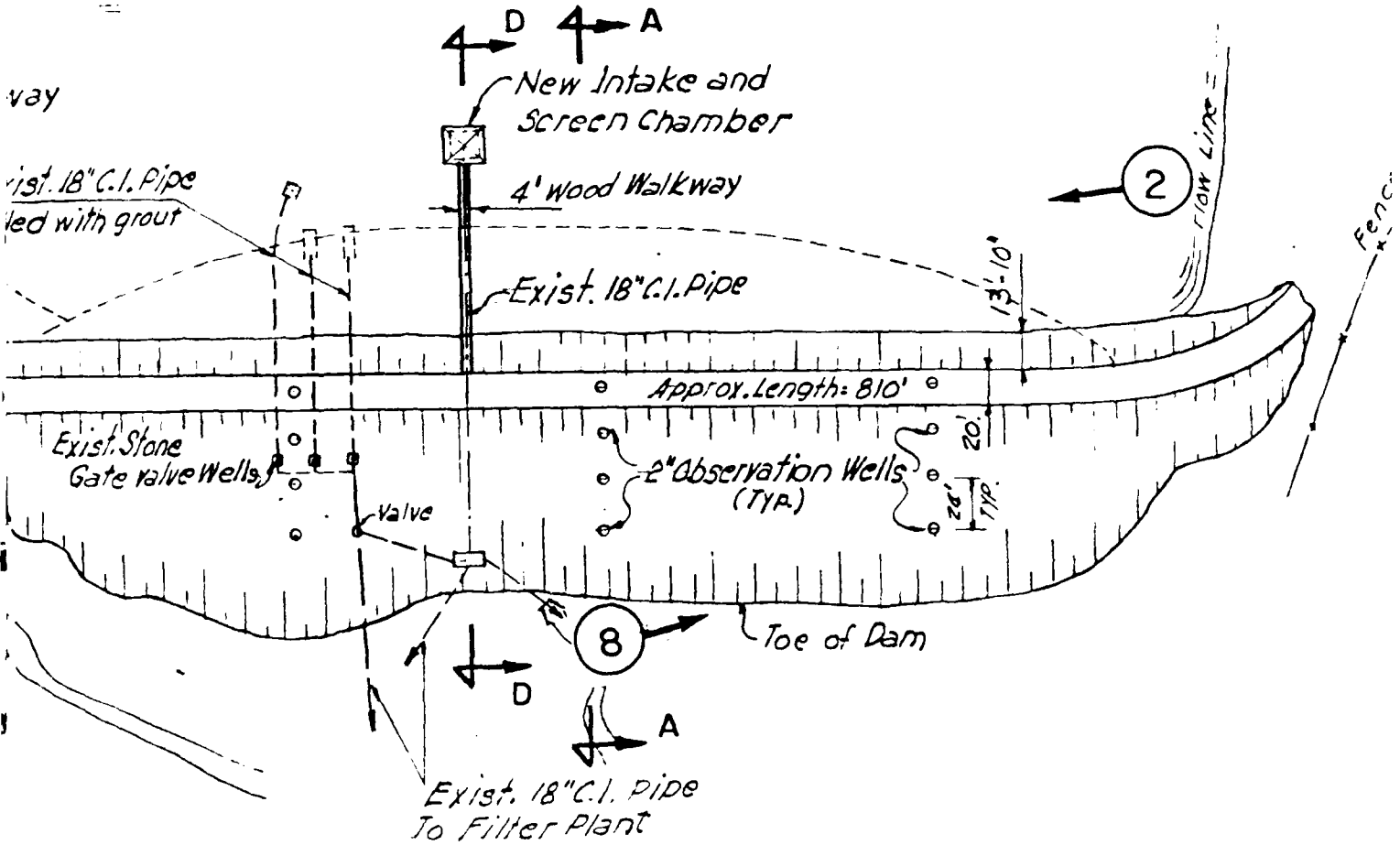
APPENDIX C



(1)

NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE SECOND TAXING DISTRICT NORWALK, CONN.

(2) → DENOTE

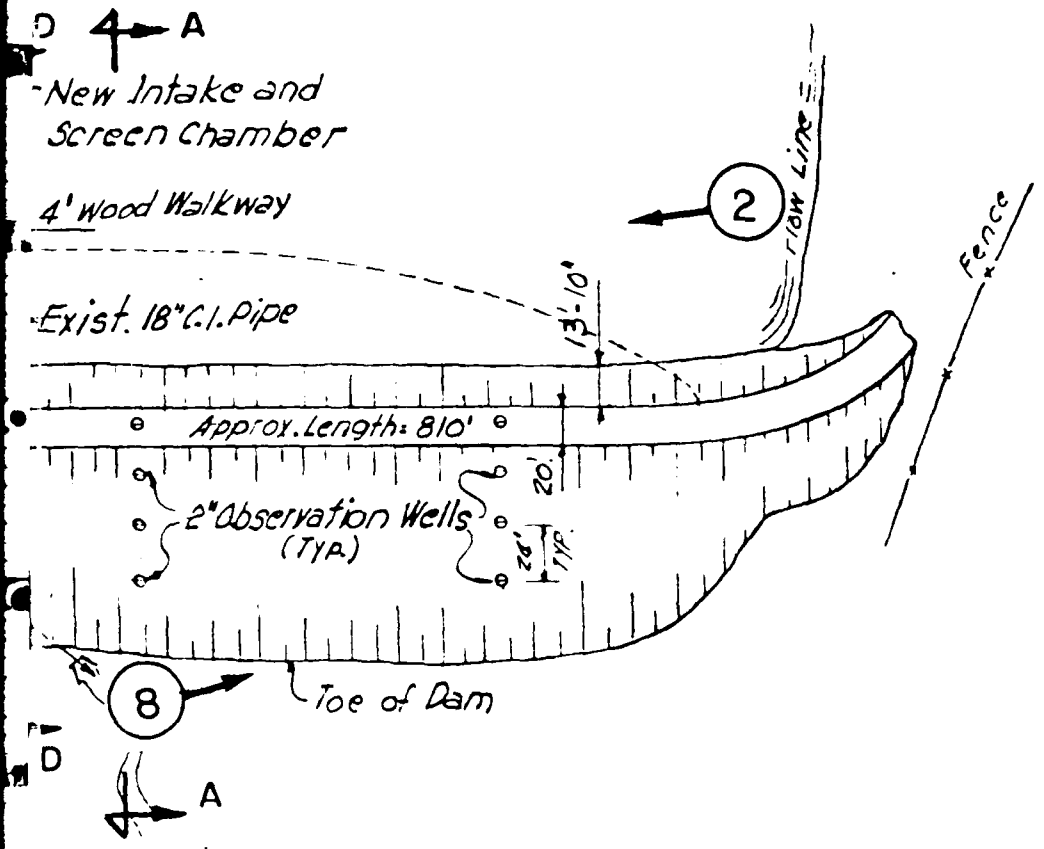


PLAN

NOT TO SCALE

(2) → DENOTES PHOTO LOCATION

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY
NATIONAL PROGRAM OF INSPECTION SOUTH NORWALK RESE BELDEN HILL BROOK	
	SCALE: A DATE :



F. 18" C.I. Pipe
Per Plant

N

ALE

ION

PLATE-4

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SOUTH NORWALK RESERVOIR DAM

BELDEN HILL BROOK (5) CONNECTICUT

SCALE: AS SHOWN

DATE : NOV - 1978

PHOTO 1

GATE HOUSE FROM UPSTREAM

PHOTO 2

CREST OF DAM LOOKING WEST

PHOTO 3

SPILLWAY LOOKING UPSTREAM

PHOTO 4

SPILLWAY LOOKING DOWNSTREAM

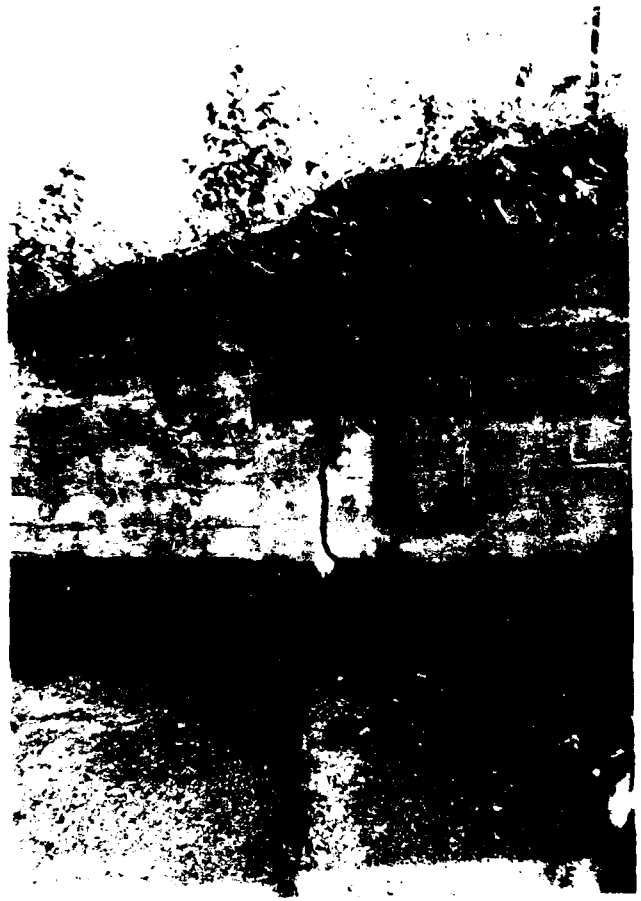


PHOTO 6

DAMAGE IN SPILLWAY RETAINING WALL

PHOTO 5

CREST OF SPILLWAY

PHOTO 8

SEEPAGE AT TOE OF DAM

PHOTO 7

DAMAGE TO SPILLWAY APRON

APPENDIX D

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

SOUTH NORWALK RESERVOIR DAM

STAGE DISCHARGE

$Q = 1.49/n \; R^{2/3} S^{1/2} A$ $\qquad d_c = .3\sqrt[3]{Q/b^2}$

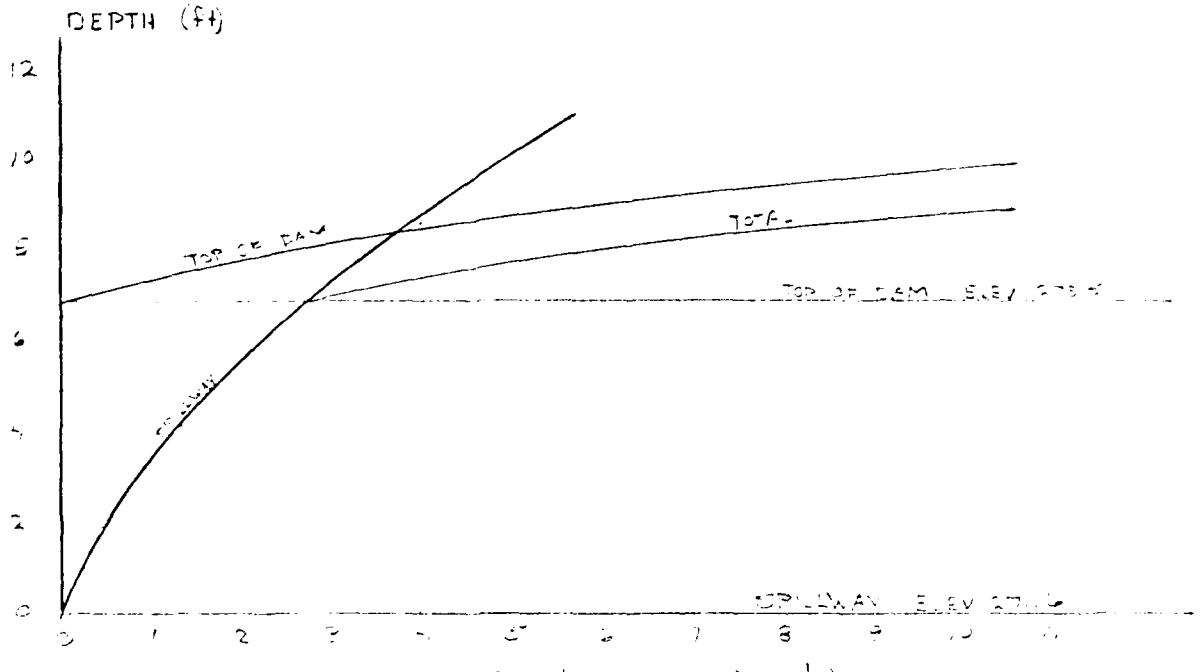
$n = .016 \quad S = .008355 \quad S^{1/2} = .094$

D	WP	A	R	$R^{2/3}$	V	Q	d_c	V	$V^2/2g$	H
1.0	52	50	.96	.974	9.5	425	1.31	6.49	.65	1.96
2.0	54	100	1.85	1.51	13.18	1318	2.79	9.44	1.39	4.18
3.0	56	150	2.68	1.93	16.85	2527	4.3	11.75	2.15	6.45
4.0	58	200	3.45	2.28	19.9	3990	5.83	13.65	2.89	8.72
5.0	60	250	4.17	2.59	22.6	5654	7.36	15.35	3.66	11.0

Flow in the spillway channel is supercritical and the control point is at the entrance where critical depth controls.

OVER TOP OF DAM

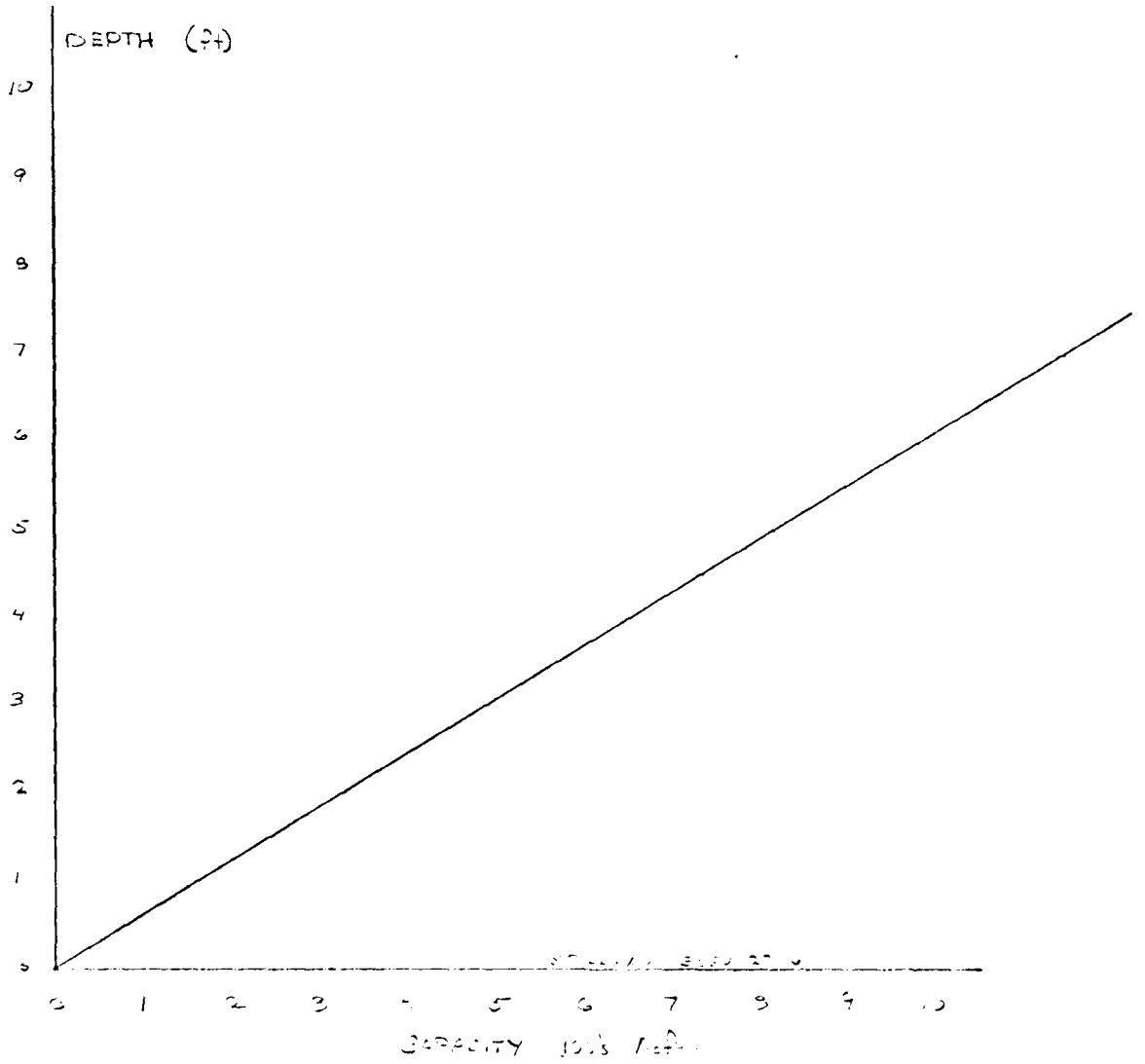
Depth	C	L	Q
1	2.5	910	2025
2	2.5	910	5727
3	2.5	910	10522



STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

SOUTH [illegible] RESERVOIR DAM
CAPACITY CURVE

ELEV	DEPTH	AREA	AVG AREA	VOL	Σ VOL
271.6		151			0
	8.4		165	1386	
280		179			1386



STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

SOUTH NORWALK RESERVOIR DAM

DETERMINATION OF PMF & SDF

DRAINAGE AREA - 2.38 SM

INFLOW - 2100 cfs/SM

PMF_I = 5000 cfs

Determine the effect of surcharge storage on the Maximum Probable Discharge.

① Q_{p1} = 5000 cfs

② a. H_1 = 7.85'

b. $STOR_1$ = 10.0

c. $Q_{p2} = Q_{p1}(1 - STOR/19) = 5000\left(1 - 10/19\right) = 2370$ cfs

③ a. H_2 = 6.45'

$STOR_2$ = 8.24"

b. $STOR_A$ = 9.124"

$Q_{pA} = 5000\left(1 - 9.124/19\right) = 2600$ cfs

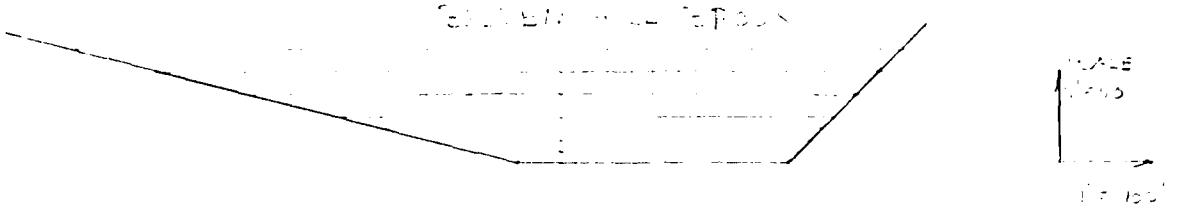
H_A = 6.7' = ELEV 278.3

$STOR_A$ = 8.7" OK

PMF_o = 2600 cfs

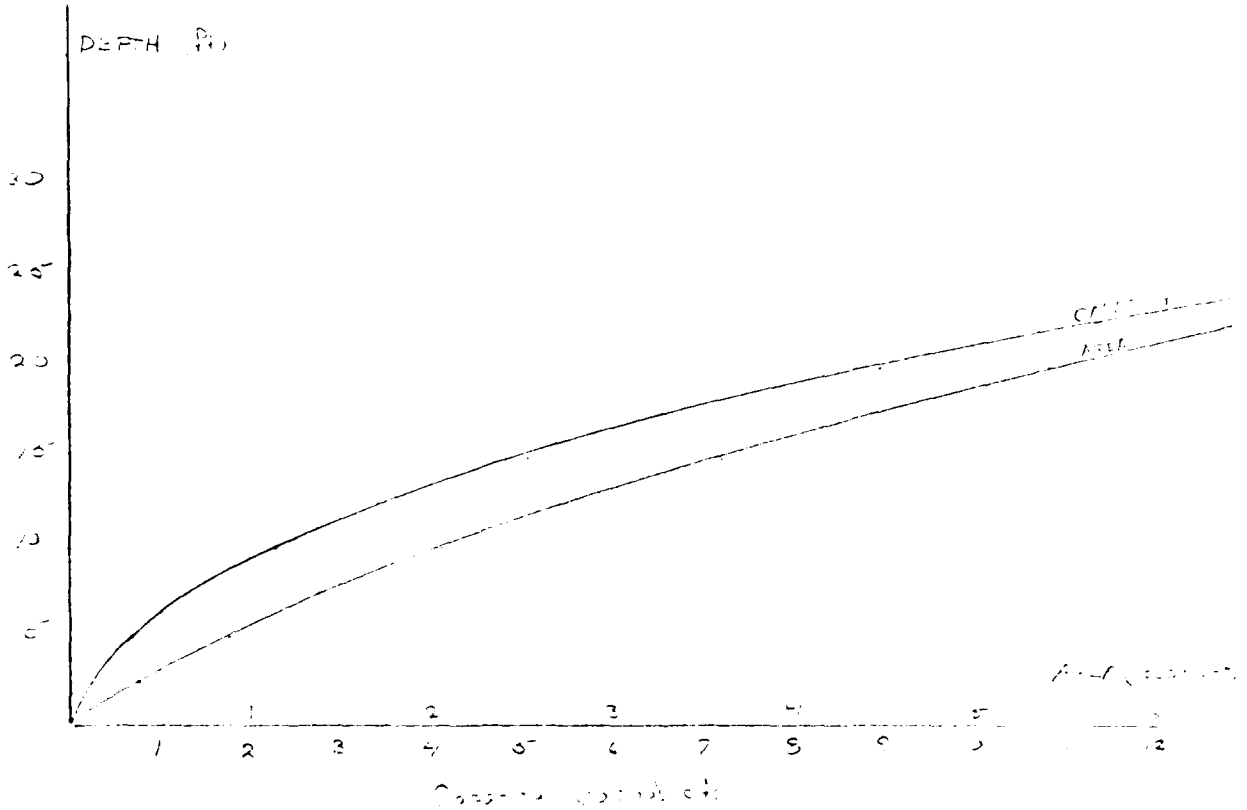
Capacity of the spillway when the pond elevation is @ the top of the dam

Q = 2700 cfs or 104% of the PMF



n = .07 S = .019 ft/ft

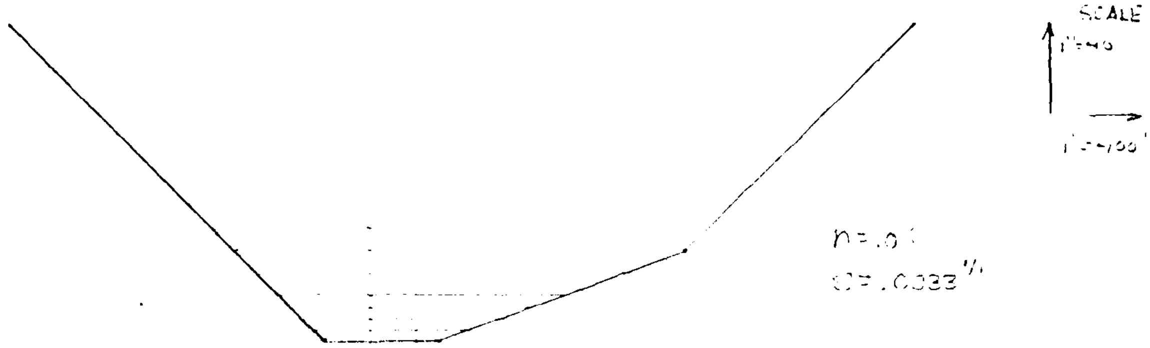
D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
2.5	115	387	2.2	1.69	.138	4.9	1916
5.0	210	875	4.1	2.59	.138	7.59	6630
7.5	245	1397	5.66	3.19	.138	9.3	12999
10	275	2050	7.45	3.8	.138	11.2	22950
12.5	345	3000	10.6	4.8	.138	14.1	50760
15	400	5400	13.5	5.67	.138	16.6	89605
25	470	[illegible]	16.9	6.34	.138	18.5	137230



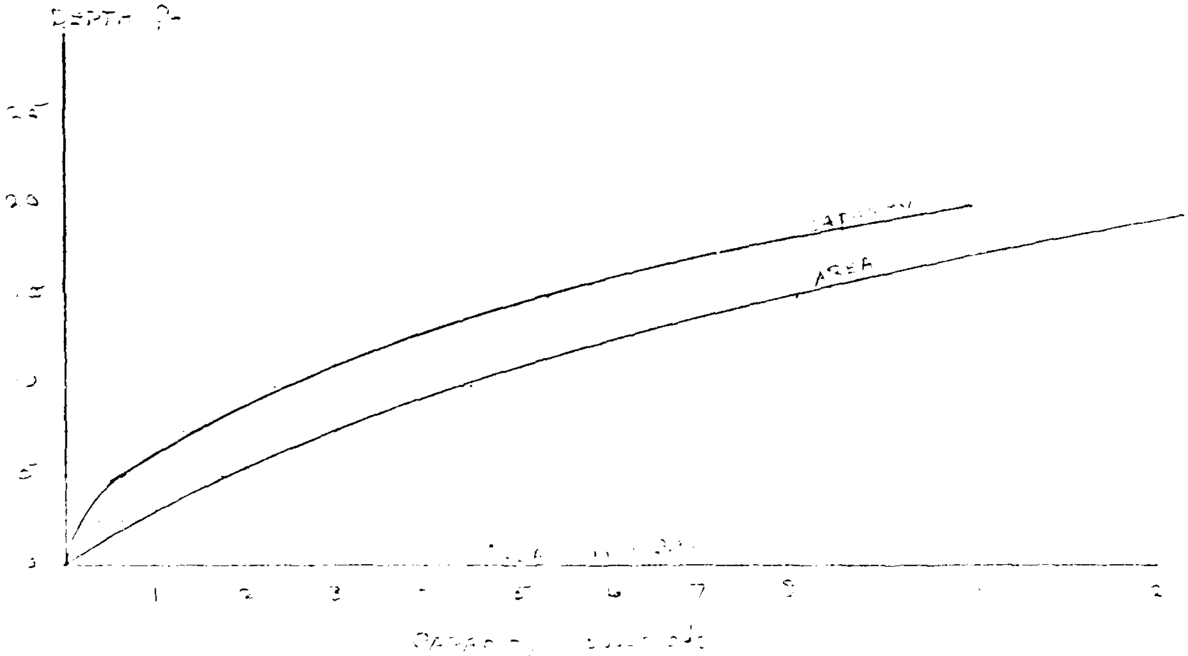
[illegible]

[illegible]

[illegible]

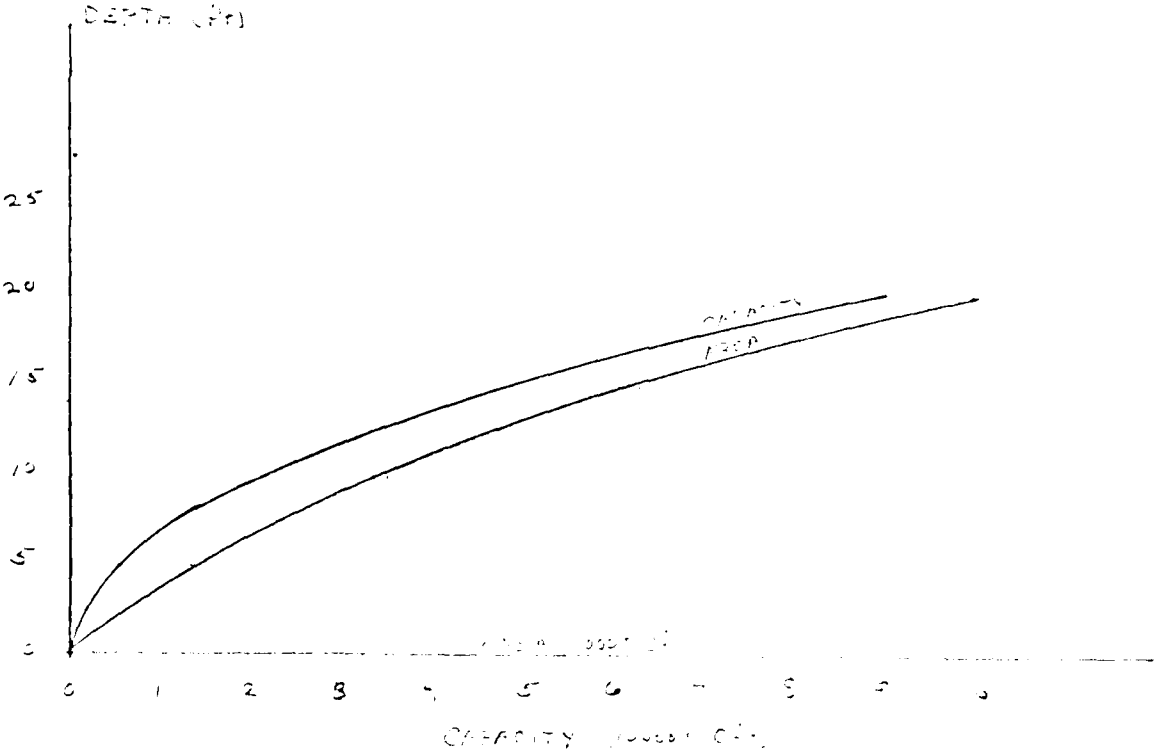


D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
2.5	350	625	1.79	1.47	.057	2.07	[illegible]
5	750	1750	3.89	2.47	.057	3.49	6110
[illegible]	550	3000	5.45	3.1	.057	4.37	13130
10	650	[illegible]	6.9	3.63	.057	5.13	[illegible]
[illegible]	800	8100	13.12	[illegible]	.057	6.6	[illegible]
20	1000	13000	13	5.53	.057	7.91	101050



n = .035 S = 0.033 %

D	W	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
2.5	270	600	2.22	1.7	.057	2.55	1730
5.0	300	1350	3.35	2.16	.057	4.17	5630
7.5	450	2250	5.26	3.06	.057	6.19	11,930
10	500	3750	7.0	3.66	.057	6.20	21,700
15	650	6300	9.69	4.55	.057	7.70	48,550
20	800	10000	12.2	5.3	.057	9.99	99,930



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS

SECTION I @ Dam

① $S = 4000$ Ac-ft

② $Q_{p1} = \frac{8}{27} W_b \sqrt{g} y^{1.5} = \frac{8}{27} 200 \sqrt{32.2} \, 25^{1.5} = 104,440$ cfs

SECTION II @ Confluence with Silvermine River

a $H_1 = 18.5'$ $A_1 = [illegible]$ ft^2 $L_1 = 7000'$

$V_1 = 771$ Ac-ft

b $Q_{p2} = 104,440 (1 - 771/4000) = 84310$ cfs

$H_2 = 17$ $A_2 = 4200$ ft^2

$W_{b2} = 1500$ $V_{ol} = 723$ Ac-ft

$Q_{p2} = 104,440 (1 - 723/4000) = 85500$ cfs

$H_2 = 17.1$ $A_2 = 4400$ ft^2

SECTION III @ MERRITT PARKWAY

a $H_2 = 17.1$ $A_2 = 10,000$ ft^2 $L_2 = 6000$

$V_2 = 1377$ Ac-ft

b $Q_{p3} = 85500 (1 - 1377/4000) = 56100$ cfs

$H_3 = 15.5'$ $A_3 = 9500$ ft^2

$W_{b3} = 9250$ ft $V_{ol} = 12 = $ Ac-ft

$Q_{p3} = 85500 (1 - 1277/4000) = 58210$ cfs

$H_3 = 15.5'$ $A_3 = 9700$ ft^2

SECTION III @ Confluence with Norwalk River

a $H_3 = 15.5$ $A_3 = 9700$ $L_3 = 4000'$

$V_3 = 735$ Ac-ft

b $Q_{p4} = 58210 (1 - 735/4000) = 47500$ cfs

$H_4 = 14'$ $A_4 = 7500$

$W_{b4} = 7500$ $V_{ol} = 720$ Ac-ft

$Q_{p4} = 58210 (1 - 727/4000) = [illegible]$

$H_4 = 14.2$ $A_4 = 7700$ ft^2

SECTION V @ Boston Post Rd.

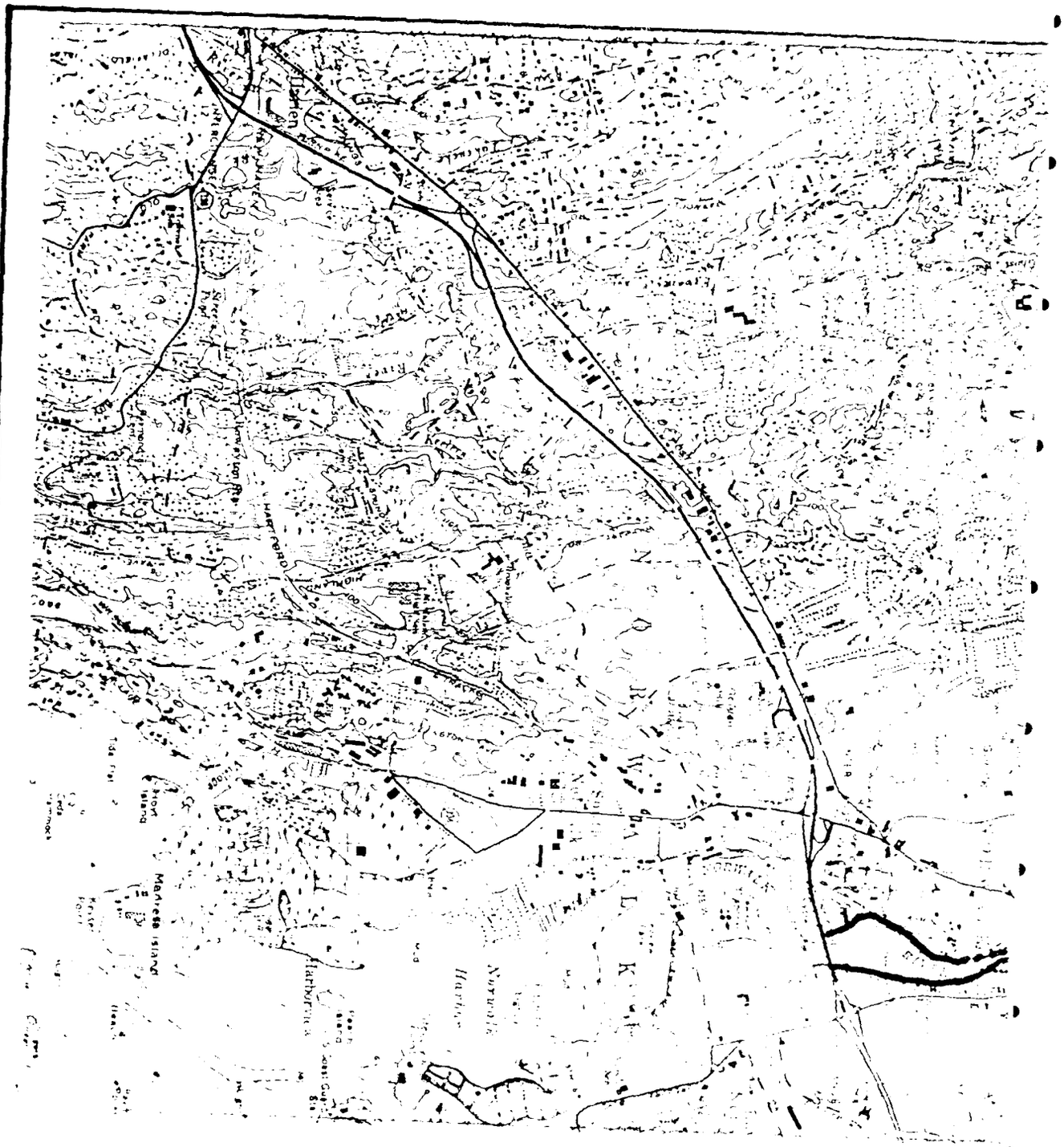
a. $Q_{1.5} = 4.84 \times C \times (1 - 11.2/T_c) = 5.2$ cfs

$H_c = 12.5$ $f_c = 500$ ft²

$V_{1.5} = 10.4$ fps

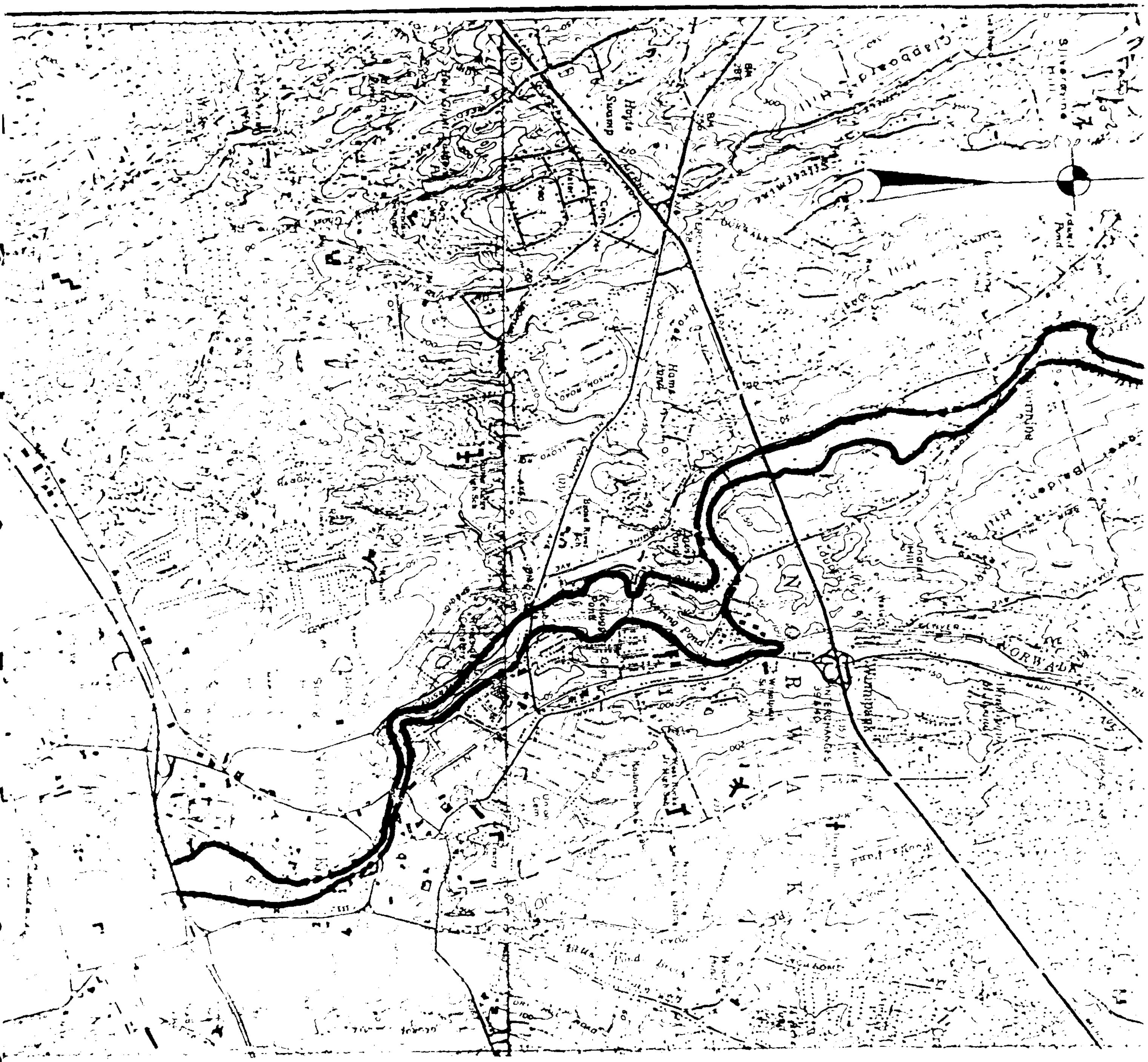
$Q_{100} = 500 \times C \times (1 - 1300/T_c) = 350$ cfs

$H_c = 13$



LEGEND

DENOTES LIMITS OF FLOODING
IN CASE OF DAM FAILURE



SCALE 1:24 000

0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

DATUM IS MEAN SEA LEVEL

G

STORCH ENGINEE

WETHERSFIELD, CONNECT

NATIONAL PROGRAM

SOUTH NORW

BELDEN HILL BROO

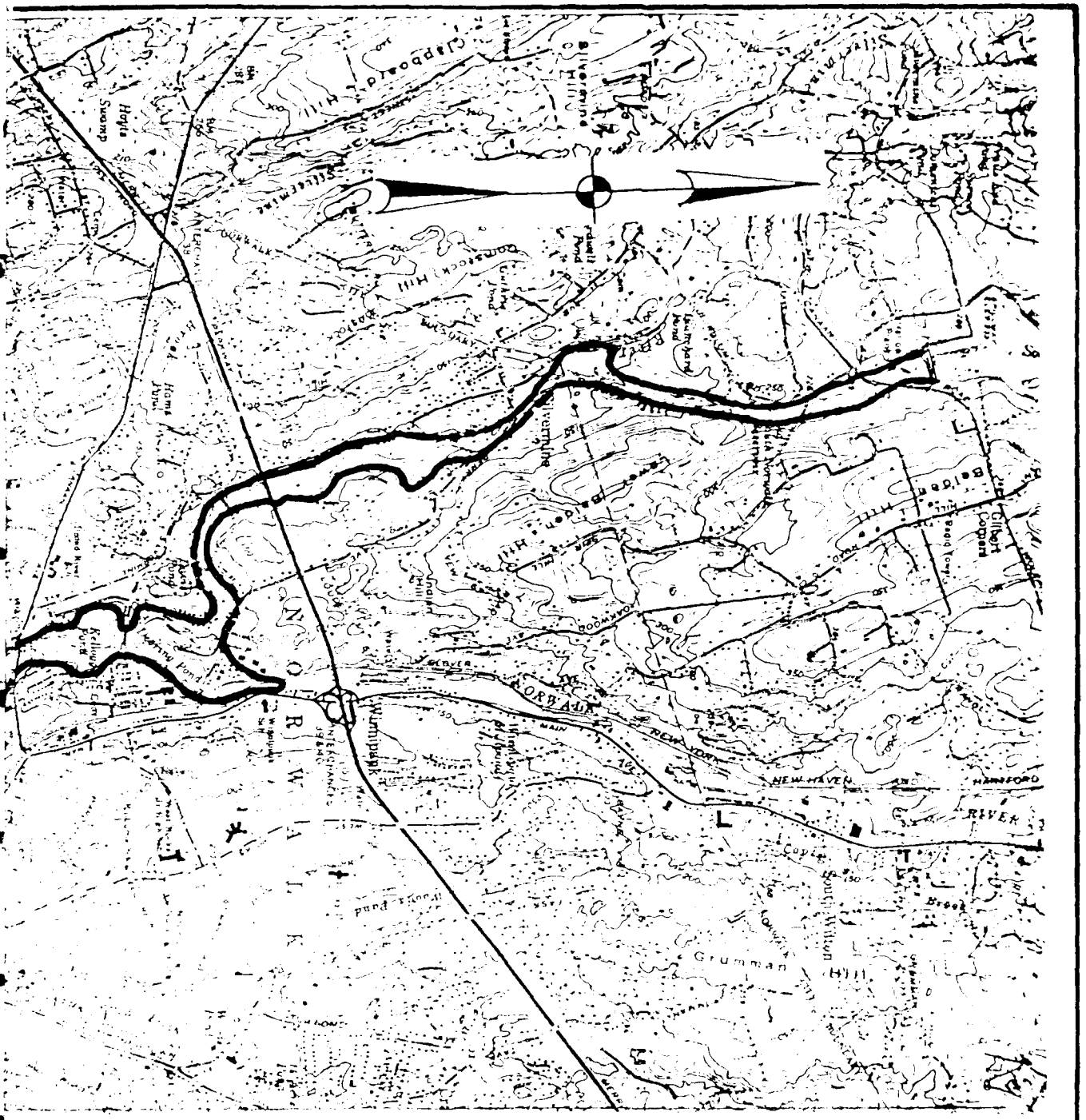


PLATE-5

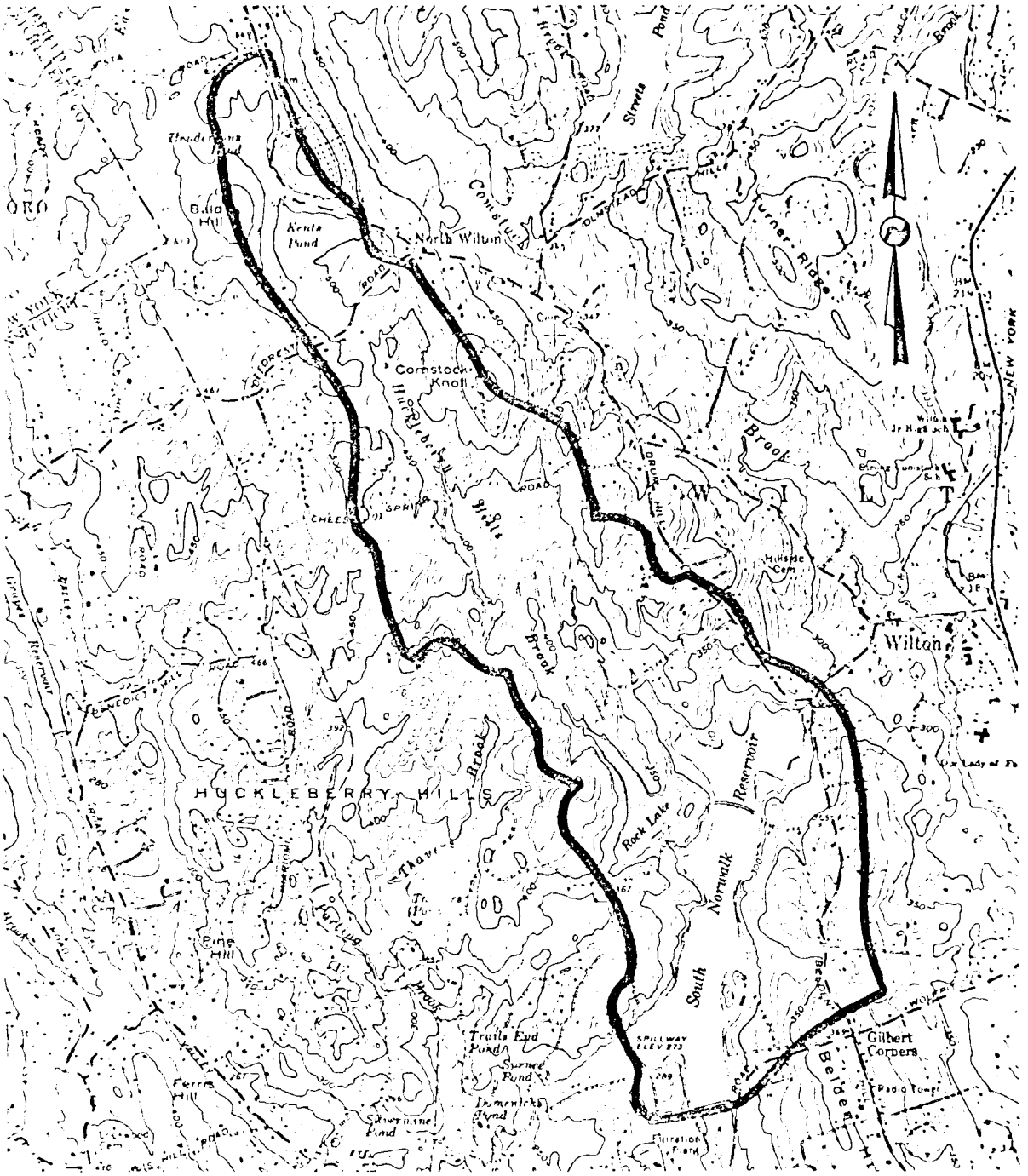
STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	US ARMY ENGINEER DIVISION NEW ENGLAND WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SOUTH NORWALK RESERVOIR DAM

BELDEN HILL BROOK CONNECTICUT

SCALE:	AS SHOWN
DATE	NOV 1978



LEGEND

DENOTES DRAINAGE AREA

FROM U.S.G.S. QUAD. SHEET

NORWALK NORTH, CONNECTICUT

PLATE 6

U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

SCALE 1/2 0 1 MILE

DRAINAGE AREA MAP

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
CT	212	NED	CT	001	05				SOUTH NORWALK RESERVOIR DAM	4110.3	7326.9	20	DEC	78

POPULAR NAME	NAME OF IMPOUNDMENT
	SOUTH NORWALK RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	HELDEN HILL BROOK	SILVERMINE	1	3000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC HEIGHT (FT.)	HYDRAU HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REEVCTPG	1899	S	35	34	3180	2040	NED	N	N	N	N	15JAN79

REMARKS
PD=ESTIMATE

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	810	U	50	2700	106500											

OWNER	ENGINEERING BY	CONSTRUCTION BY
SECOND TAXING DISTRICT N	BUCK, SEIFERT AND JOST	NOT KNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
STOCH ENGINEERS	03	OCT	78	PL92-367

REMARKS
34=APPROXIMATE 48=NORWALK CT

END

FILMED

8-84