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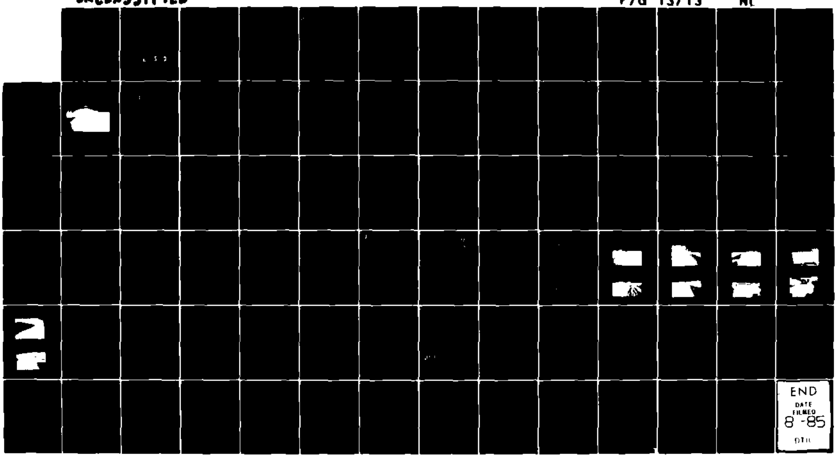

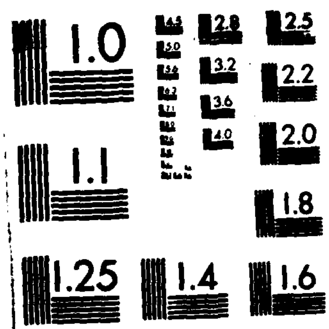

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WEYMOUTH RIVER BASIN

BRAINTREE & RANDOLPH, MASSACHUSETTS

GREAT POND UPPER RESERVOIR DAM

MA 00823

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

JUNE 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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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,

Weymouth River Basin
Braintree & Randolph, Massachusetts
Norroway County, Mass.

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

The dam consists of three homogeneous earth embankments: the left embankment known as "Dike A" is about 132 ft. long and 14 ft. high.; the middle embankment known as "Dike B" is about 1264 ft. long and 18 ft. high; and the right embankment known as "Dike C" is about 877 ft. long and 12 ft. high. The overall condition of the dam is fair owing to the inadequacy of the spillway.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION. CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

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DEC 29 1980

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts

Dear Governor King:

Inclosed is a copy of the Great Pond Upper Reservoir Dam (MA-00823) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Great Pond Upper Reservoir Dam would likely be exceeded by floods greater than 7 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Edward J. King

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. This report has also been furnished to the owner of the project, Town of Braintree Water Dept., Braintree, MA.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

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

Sincerely,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

GREAT POND UPPER RESERVOIR DAM

MA 00823

WEYMOUTH RIVER BASIN
BRAINTREE & RANDOLPH, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	MA 00823
Name of Dam:	Great Pond Upper Reservoir Dam
Town:	Braintree and Randolph
County and State:	Norfolk County, Massachusetts
Stream:	Norroway Brook
Date of Inspection:	18 April 1980

BRIEF ASSESSMENT

Great Pond Upper Reservoir Dam consists of three homogeneous earth embankments: the left embankment known as "Dike A" is about 132 ft. long and 14 ft. high; the middle embankment known as "Dam B" is about 1,264 ft. long and 18 ft. high; and the right embankment known as "Dike C" is about 877 ft. long and 12 ft. high. The embankments are separated by knolls of natural ground and the total crest length from the left abutment of Dike A to the right abutment of Dike C is about 2,660 ft. A concrete ogee-shaped spillway and stoplogs structure is located about 110 ft. left of the right abutment of Dike C. The spillway discharges into a paved stone masonry channel that leads into Great Pond Lower Reservoir. A valve chamber located in Dam B houses four valves which control the low level flows from the upper reservoir to the lower reservoir.

Great Pond Upper Reservoir is utilized as a water storage facility for the Towns of Braintree, Randolph and Holbrook. It is about 4,900 ft. long and has a surface of about 193 acres at top of stoplogs. The drainage area is 4.56 sq. mi. (2,920 acres) and the maximum storage to top of dam is 2,243 acre-ft.; the size classification is thus intermediate. Because failure of the dam could cause serious damage to several homes, a shopping center, a recreational building, an apartment complex, an industrial complex, and several roadways with the possibility of the loss of more than a few lives and the probability of excessive economic losses, it has been classified as having a high hazard potential. Based on the guidelines, the recommended test flood for the dam is a full PMF and the test flood inflow was computed to be 4,650 cfs.

The routed test flood outflow of 4,380 cfs overtops the crest of the embankments by about 0.8 ft. The spillway with stoplogs in place can pass 330 cfs or about 7 percent of the routed test flood outflow without overtopping the embankments.

The dam and appurtenant works are judged to be in generally good physical condition, however, the overall condition of the dam is only fair owing to the inadequacy of the spillway. Light brush was growing on the upstream slopes of all embankments and a light growth of trees and dense brush and small trees were prevalent on the downstream slopes of all embankments. There was also a light vegetative growth through the floor of the wasteway. The crests of the embankments have been rutted by vehicular traffic. The valve chamber's concrete is in need of repair and, though the valves within the chamber were not inspected, they were reported to be operative.

Within one year after receipt of this Phase I Inspection Report, the owner, the Town of Braintree, should retain the services of a registered professional engineer and implement the results of his evaluation of the following: (1) a detailed hydrologic-hydraulic investigation, including an assessment of the attenuating effects of Bear Swamp, to assess further the potential for overtopping and the adequacy of the spillway; (2) a seismic investigation and analysis by conventional equivalent static load methods; and, (3) inspect the spillway under no flow conditions.

The owner should also implement the following operating and maintenance measures: (1) remove brush and light tree growth from the slopes of all of the embankments to within a minimum of 10 ft. of toe where applicable; (2) remove the vegetation growth from the floor of the wasteway; (3) regrade the crest of the embankments to remove the rutted surfaces; (4) repair erosion areas on the downstream slope of Dam B and Dike C; (5) repair the deteriorated concrete valve chamber; (6) develop a formal surveillance and downstream emergency warning plan, including round-the-clock monitoring during periods of heavy precipitation; (7) institute procedures for an annual periodic technical inspection of the dam and its appurtenant structures; (8) implement a regular periodic maintenance program; and (9) prevent trespassing on the embankments.

Peter B. Dyson
Project Manager

COMMONWEALTH OF MASSACHUSETTS
PETER
BRIAN
DYSON
No. 18452
REGISTERED
PROFESSIONAL ENGINEER

This Phase I Inspection Report on Great Pond Upper Reservoir Dam (MA-00823) 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.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
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 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.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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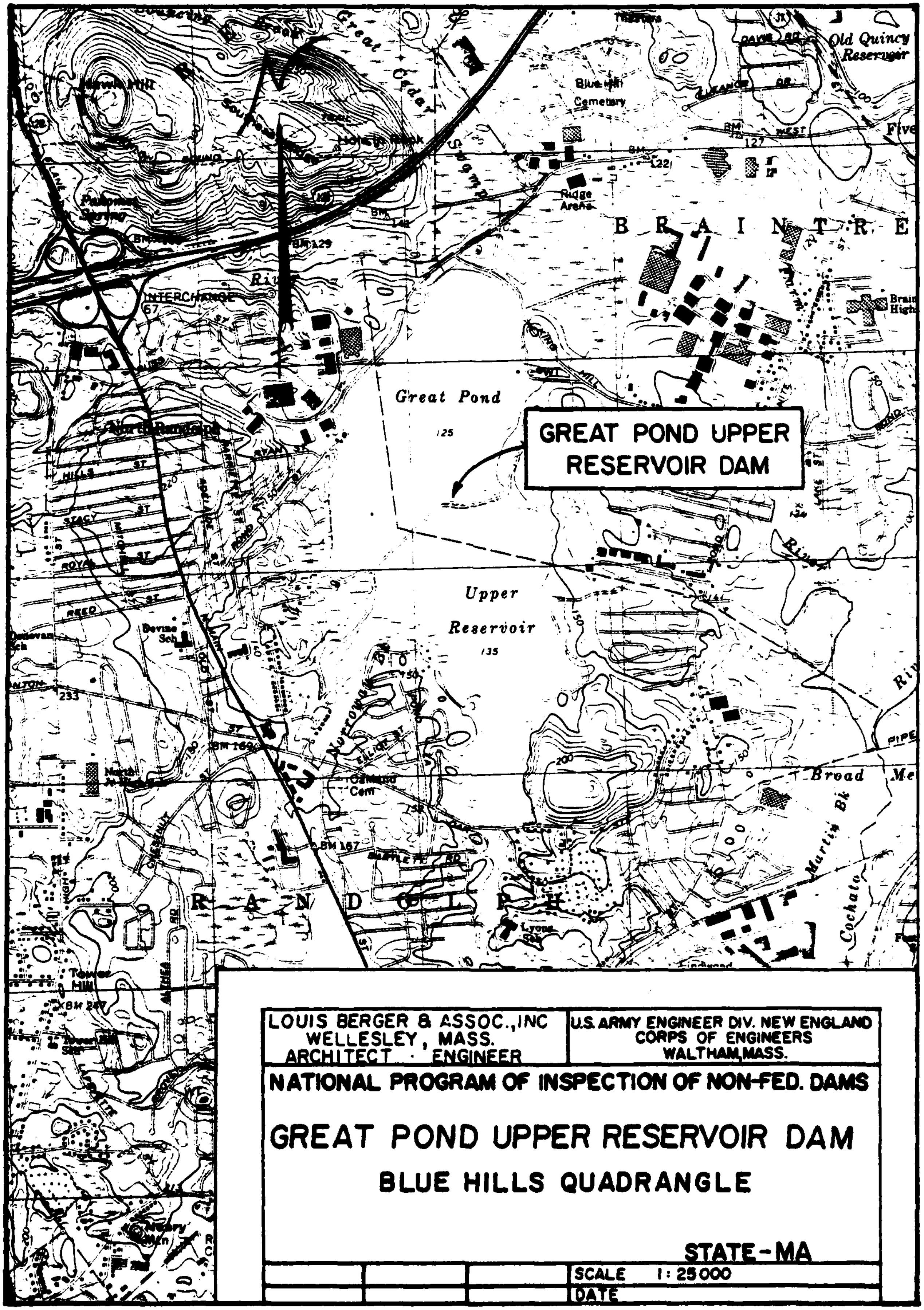
GREAT POND UPPER RESERVOIR DAM

OVERVIEW FROM LEFT ABUTMENT



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GREAT POND UPPER RESERVOIR DAM

BLUE HILLS QUADRANGLE

STATE-MA

SCALE 1:25000

DATE

PHASE I INSPECTION REPORT

GREAT POND UPPER RESERVOIR DAM MA 00823

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. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 28 March 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0043 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

(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) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Great Pond Upper Reservoir Dam is situated in Norfolk County in the Towns of Braintree and Randolph in eastern Massachusetts. The reservoir is located on Norroway Brook just upstream from Great Pond Lower Reservoir and Dam. Downstream of the lower reservoir and dam at the confluence of Norroway Brook and the Blue Hill River, is the Farm River. About 3.4 miles below the dam the Farm River joins the Monatiquot River which leads to the Weymouth Fore River. The dam is shown on U.S.G.S. Quadrangle, Blue Hills, Massachusetts with coordinates approximately at N 42° 11' 42", W 71° 02' 47".

b. Description of Dam and Appurtenances

(1) Description of Dam. The project consists of three earth embankments which were constructed across Great Pond separating the pond into Great Pond Upper Reservoir and Great Pond Lower Reservoir. The water surface of the upper reservoir is maintained about 10 ft. higher than that of the lower reservoir. The left, most westerly embankment (referred to as Dike A) is about 132 ft. long and has a maximum height of about 14 ft. The middle embankment (referred to as Dam B) is about 1,264 ft. long and has a maximum height of about 18 ft. The easterly embankment (referred to as

Dike C) is about 877 ft. long and has a maximum height of about 12 ft. Dike A and Dam B are separated by about 130 ft. of natural ground, and Dam B and Dike C are separated by about 260 ft. of natural ground. The total crest length of the facility from the left abutment of Dike A to the right abutment of Dike C is about 2,660 ft. All of the embankments are homogeneous sections and have a crest width of 12 ft. Each embankment has an upstream slope of 2½ horizontal to 1 vertical and a downstream slope of 2 horizontal to 1 vertical. The upstream slopes of the embankments are protected by 12 in. hand placed stone paving on 9 in. of gravel. A central earth cut-off below the centerline of the embankments has been carried to "hard bottom" which, in all probability, is glacial till. The cut-offs were constructed through existing organic soils. The depth of cut-off generally varies from about 4 ft. to 12 ft. under Dam B and locally as deep as 16 ft. under Dike A. The bottom width of the cut-off is approximately 20 ft. and it has side slopes of 1 horizontal to 1 vertical. Upstream and downstream earth cofferdams were utilized for dewatering purposes during the construction of the cut-offs.

(2) Spillway. The 31 ft. long spillway for Great Pond Upper Reservoir is located in Dike C about 100 ft. left of its right abutment. The weir is a concrete ogee-shaped section surmounted by four 7 ft. wide and 3 ft. high stoplog bays. The stoplog bays are separated by three 1 ft. wide concrete piers. The end piers are 3 ft. high and the center pier is 4.23 ft. high and serves as a support for the concrete bridge which spans the spillway wasteway. The top of dam is 5.23 ft. above spillway crest. The bridge abutments serve as the spillway training walls (see Appendix B drawing). Beyond the bridge, the 31 ft. wide downstream channel has a 12 in. paved floor and vertical training walls constructed of ashlar stone with no mortar in the joints. The spillway channel discharges into Great Pond Lower Reservoir.

(3) Valve Chamber. The valve chamber for the facility is located in Dam B about 150 ft. from its right abutment. The valve chamber is about 9½ ft. square and 18 ft. high, and its top is about flush with the crest of Dam B. Four gate valves are located in the valve chamber. There are three 24 in. dia. cast iron inlet pipes with 24 in. gate valves at selected levels along the upstream face of the structure. A single 24 in. dia. cast iron outlet pipe with a 24 in. gate valve leads from the valve chamber to Great Pond Lower Reservoir.

c. Size Classification. Great Pond Upper Reservoir Dam has a hydraulic height of about 18 ft. above downstream toe of slope, and impounds a normal storage of about 1,750 acre-ft. to spillway crest level and a maximum of about 2,504 acre-ft. to top of dam. In accordance with the size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, the project falls into the intermediate category on the basis of capacity and is therefore classified accordingly.

d. Hazard Classification. A breach failure of Great Pond Upper Reservoir Dam would release water into Great Pond Lower Reservoir, flooding the Randolph Pumping Station located on the rim of the Lower Reservoir and overtopping the lower reservoir dam. It is estimated that Great Pond Lower Dam would be slightly overtopped when the Upper Dam spillway is flowing full and the additional depth of overtopping would be about 4 ft. due to the breach discharge. No further flooding due to the spillway discharge alone is anticipated beyond the Lower Dam. Beyond the lower reservoir dam, the breach flood flows would enter the Farm River and cause severe flooding of the Ridge Arena, an industrial complex, a shopping center, several roadways, an apartment complex, and about ten houses, all of which are located in close proximity to the Farm River. The extreme stage of flooding is estimated to be about 5 ft. In this area of initial impact there is the possibility for the loss of more than a few lives and in accordance with the Recommended Guidelines for Safety Inspection of Dams, Great Pond Upper Reservoir has therefore been classified as having a high hazard potential.

e. Ownership. Great Pond Upper Reservoir is owned by the Town of Braintree, Massachusetts.

f. Operator. Mr. William Ewing, Water Superintendent, Town of Braintree Water Department, 2 JFK Memorial Drive, Braintree, Massachusetts. Telephone: (617) 843-0175.

g. Purpose of Dam. Great Pond Upper Reservoir is operated in conjunction with other water supply facilities for providing municipal water supplies to the Townsof Braintree, Randolph and Holbrook.

h. Design and Construction History. Records indicate that Great Pond Upper Reservoir Dam was constructed between 1940 and 1942. It was designed by Weston and Sampson, Consulting Engineers, Boston, Massachusetts. The dam was constructed across Great Pond near its midpoint to increase the water storage capability of the pond by raising the normal storage level in the upstream half of the pond. A site plan and two construction plans showing the dam as it was proposed can be found in Appendix B.

i. Normal Operating Procedures. No written operating procedures were disclosed. The spillway has been constructed to accommodate stoplogs. The stoplogs are normally installed on a year-round basis raising the water surface level by 3 ft. in the upper reservoir. The only other operating devices are three inlet gate valves and one outlet gate valve located in a valve chamber in Dam B. The valves are operated as needed to supply water to the lower reservoir where a pumping station and filtration plant are located.

1.3 Pertinent Data

a. Drainage Area. The drainage area contributing to Great Pond Upper Reservoir is situated along the lower reaches of Norroway Brook. The drainage area encompasses a total of about 4.56 sq. mi. (2,920 acres), of which 193 acres are occupied by the reservoir. The longest circuitous stream course leading to the dam is about 4.6 miles long with an elevation difference of about 135 ft., or at a slope of about 30 ft. per mile. The drainage area has a length of about 4.1 miles and an average width of about 1.1 miles. The upper part of the drainage area is predominately forested and contains Bear Swamp. The lower part of the drainage area is highly developed and heavily populated.

b. Discharge at Damsite

(1) Outlet Works Conduit. A 24 in. dia. low level outlet from Great Pond Upper Reservoir extends from the valve chamber at Great Pond Upper Reservoir downstream to Great Pond Lower Reservoir. The outlet pipe, with an invert elevation of 121.77, would be capable of discharging about 48 cfs when the valves are open and the reservoir water surface was at the top of the dam.

(2) Maximum Known Flood at Damsite. No records are available of flood inflows into Great Pond Upper Reservoir, nor of spillway releases and surcharge heads during such inflows. However, it was reported by the owner's representative that at one time the dam was slightly overtopped.

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of dam, elevation 139.0, is 330 cfs (stoplogs assumed in place). With the stoplogs removed the total ungated spillway capacity at top of dam would be 1,520 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity at test flood elevation, 139.8 ft., is 510 cfs (stoplogs assumed in place). With the stoplogs removed the ungated spillway capacity at test flood elevation 139.8 would be 860 cfs.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at elevation 139.8 is the same as (4) above - 510 cfs (stoplogs assumed in place).

(8) Total Project Discharge at Top of Dam. The total project discharge at top of dam, elevation 139.0 ft., with the stoplogs assumed in place and the low level outlet open, would be about 380 cfs. With the stoplogs removed and the low level outlet open, the total project discharge would be about 1,570 cfs.

(9) Total Project Discharge at Test Flood Elevation. The total project discharge would be about 4,430 cfs at elevation 139.8 ft. with the stoplogs in place and the low level outlet open.

c. Elevation (ft. N.G.V.D.)

(1) Streambed at toe of dam - 121.0

(2) Bottom of cutoff - Not applicable

(3) Maximum tailwater - Unknown

(4) Normal pool - Not applicable

(5) Full flood control pool - Not applicable

(6) Spillway crest - Ogee Crest - 133.77
Stoplog Crest - 136.77

(7) Design surcharge (Original Design) - Unknown

(8) Top of dam - 139.0

(9) Test flood surcharge - 139.8

d. Reservoir (Length in feet)

(1) Normal pool - 4,900

(2) Flood control pool - Not applicable

(3) Spillway crest pool - 4,900

(4) Top of dam - 4,900

(5) Test flood pool - 4,900

e. Storage (acre-feet)

(1) Normal pool - 1,750 - Elev. 136.77

(2) Flood control pool- Not applicable

(3) Spillway crest pool - 1,750, Elev. 136.77

(4) Top of dam - 2,243

(5) Test flood pool - 2,435

f. Reservoir Surface (acres)

(1) Normal pool - 193

(2) Flood-control pool - Not applicable

(3) Spillway crest - 193, Elev. 136.77

(4) Top of dam - 249

(5) Test flood pool - 268

g. Dam B

(1) Type - Earth embankment

(2) Length - 1,264 ft.

(3) Height - 18 ft.

(4) Top Width - 12 ft.

(5) Side Slopes - Upstream: 2½ horizontal to 1 vertical
Downstream: 2 horizontal to 1 vertical

(6) Zoning - Homogeneous earth fill

(7) Impervious Core - None

(8) Cutoff - Central earth cutoff to hard bottom

(9) Grout Curtain - Unknown

(10) Other - Upstream face paved with 12 in. hand placed stone.

Dike A

(1) Type - Earth embankment

(2) Length - 132 ft.

(3) Height - 14 ft.

(4) Top Width - 12 ft.

(5) Side Slopes - Upstream: 2½ horizontal to 1 vertical
Downstream: 2 horizontal to 1 vertical

(6) Zoning - Homogeneous earth fill

(7) Impervious Core - None

(8) Cutoff - Central earth cutoff to hard bottom

(9) Grout Curtain - Unknown

(10) Other - Upstream face paved with 12 in. hand placed stone

Dike C

(1) Type - Earth embankment with concrete spillway

(2) Length - 877 ft.

(3) Height - 12 ft.

(4) Top Width - 12 ft.

(5) Side Slopes- Upstream: 2½ horizontal to 1 vertical
Downstream: 2 horizontal to 1 vertical

(6) Zoning - Homogenous earth fill

(7) Impervious Core - None

(8) Cutoff - Central earth cutoff to hard bottom

(9) Grout Curtain - Unknown

(10) Other - Upstream face paved with 12 in. hand placed stone

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - Concrete ogee-shaped, with 3' high stoplogs

(2) Length of weir - 28 ft. at ogee crest
30 ft. at stoplog crest

(3) Crest elevation - With stoplogs - 136.77 ft.
Without stoplogs - 133.77 ft.

(4) Gates - None.

(5) U/S Channel - None

(6) D/S Channel - Stone masonry walls, stone paved floor, discharging into Great Pond.

j. Regulating Outlets

(1) Invert - 121.77 ft.

(2) Size - 24 inch diameter

(3) Description - Cast iron outlet pipe

(4) Control Mechanism - Hand operated gate valve in valve chamber

(5) Other - Three 24 inch cast iron pipes lead into valve chamber and each is controlled by a gate valve in the chamber. Inverts of inlet pipes are as follows:

Upper Pipe - 131.77
Middle Pipe - 126.77
Lower Pipe - 121.77

SECTION 2 - ENGINEERING DATA

2.1 Design Data

The original dam was designed in 1939 and 1940 by Weston and Sampson, Consulting Engineers, Boston, Massachusetts. Appendix B includes copies of 3 drawings showing site plans and details of the facilities "as proposed." No other engineering data or correspondence was recovered for the dam.

2.2 Construction Data

No records or correspondence regarding construction have been found.

2.3 Operation Data

There are no formal operating records for the dam. It was reported by the owner's representative that the low level outlet is operated as needed to supply water to the lower reservoir.

2.4 Evaluation

a. Availability. There was limited engineering data available. The basis of the evaluation presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. The validity of such engineering data as has been acquired is considered acceptable and is not challenged.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Great Pond Upper Reservoir and Dam took place on 18 April 1980. At that time the water level was slightly above the top of the stoplogs installed on the spillway. The discharge over the spillway was estimated to be less than 5 cfs. A slight amount of water could be heard passing through the valve chamber for the facility. There was no evidence of any major maintenance problems, but a few items require attention (see Section 7.3). In general, the dam was judged to be in good physical condition, however, the overall condition of the dam is only fair owing to the inadequacy of the spillway.

b. Dam. Great Pond Upper Reservoir Dam was constructed between 1940 and 1942 to serve as a water supply facility for the Towns of Braintree, Randolph and Holbrook. The dam is actually in three sections: a 132 ft. long, 14 ft. high earth embankment on the left known as Dike A; a 1,264 ft. long, 18 ft. high earth embankment in the middle known as Dam B; and a 877 ft. long, 12 ft. high earth embankment on the right known as Dike C. The embankments are separated by natural ground. The crests of the embankments are at the same elevation and have a width of 12 ft. The upstream face of each embankment is paved with 12 in. hand placed stone set on a 9 in. layer of gravel. The upstream slopes are 2½ horizontal to 1 vertical and the downstream slopes are 2 horizontal to 1 vertical. The remnants of a cofferdam used to construct a cutoff at the base of the embankments appear at the toe of the downstream slopes of the embankments.

Photo No. 3 is a view of the crest and downstream slope of Dike A, and, as may be noted, there is considerable brush growth on the slope. The overview photo shows the upstream slope of Dike A, taken from the far left end looking in the direction of Dam B. A slight amount of growth can be noted along the entire length of the upstream slopes of the embankments. Photo No. 1 is a view of the upstream slope of Dam B showing the hand placed stone slope protection. Photo No. 2 is a view of the downstream slope of Dam B taken from the left end looking toward the right end. As may be noted, there is considerable brush and light tree growth, and a relatively large pine on the downstream slope. Photo Nos. 4 and 5 show the growth on the upstream and downstream slope of Dike C in the vicinity of the spillway.

There is some minor erosion from trespassing on the downstream slope of Dam B in the vicinity of the valve chamber. There is also some minor erosion of the downstream slope where Dike C intersects the right training wall of the spillway. The gravel surface of the crest of Dam B is rutted as much as 6 to 12 in. deep on a continuing pattern spaced roughly every 15 to 20 ft. This is believed to be caused by trespassing of motorcycles and light vehicles on the dam. No signs of lateral or vertical movement were noted.

c. Appurtenant Structures. The spillway for the facility is located in Dike C about 110 ft. from its right abutment. The spillway weir is an ogee-shaped concrete structure surmounted by 4 bays which accommodate stoplogs to a height of 3 ft. The stoplogs were in place at the time of the inspection and the inspection party was informed that the stoplogs are normally kept installed. Photo No. 7 shows the spillway looking from downstream. In the foreground may be seen a concrete bridge which spans the wasteway and provides access from one side of the dam to the other. The bridge is in good condition. As may be noted in Photo Nos. 6 and 8, there is considerable growth in the floor of the wasteway as it leads from the upper reservoir to the lower reservoir. The walls of the wasteway downstream of the bridge abutments are constructed of ashlar blocks set in place with no mortar in the joints. The wasteway walls and the concrete in the spillway were judged to be in good condition. The stoplogs also appeared to be in good condition.

A valve chamber for the facility is located in Dam B about 150 ft. from its right abutment. The valve chamber contains three intake lines with gate valves and one outlet line equipped with a gate valve. All lines are 24 inch cast iron pipes and the three intake lines are located at different elevations. The lowest intake line is at the same elevation as the outlet line, and is used as a low level outlet. The downstream end of the outlet pipe is submerged in the lower reservoir. A small amount of leakage could be heard through the valve chamber, probably due to a valve being improperly seated. Photo No. 9 shows the top upstream end of the valve chamber. As may be noted in the photo, the concrete cap of the chamber is in poor condition, due to deterioration. The valve chamber was not inspected internally, but is reported to be operative.

d. Reservoir Area. The shores of the reservoir are mildly to steeply sloped and predominately unwooded. The reservoir shoreline upstream of the dam is in generally stable condition. There is evidence of some former mining of gravel, particularly upstream of the right abutment of Dike C. There is a dense population near the left rim of the reservoir and the very upstream rim of the reservoir is formed by a local street.

e. Downstream Channel. As noted above, the stone paved wasteway had some brush growth invading its floor. At the outlet of the wasteway, flows discharge into Great Pond Lower Reservoir, which is impounded by a 2,000 ft. long dam (see Photo No. 10). The spillway in the lower reservoir dam is about compatible with the upper reservoir dam. Just below the lower reservoir flows enter the Farm River in the area of Great Cedar Swamp. For a distance of about 1 mi. beyond the swamp, the Farm River channel is about 30 ft. wide and has no valley storage as it passes through a highly developed urban area. Downstream of this urban area the Farm River flows into another large swamp. Here the Farm River joins the Cochato River to form the Monatiquot River. After winding through mostly urban areas the Monatiquot River joins the Weymouth Fore River about 7.8 miles downstream of Great Pond Upper Reservoir Dam.

3.2 Evaluation

The visual inspection of the dam adequately revealed key characteristics as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. The Great Pond Upper Reservoir Dam, dikes and appurtenant works are judged to be in generally good physical condition. There is considerable tree and brush growth on the embankments. The riprap on the upstream slope of the embankments is in good condition. There is minor erosion of the downstream slope of Dam B near the valve chamber and along the downstream slope of Dike C along the right spillway training wall. The crest of the embankments is rutted. The concrete valve chamber is deteriorated. The spillway and training walls are in good condition. There is no regular maintenance program. For these reasons the dam, dikes and appurtenant works are judged to be in fair overall condition.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operation Procedures

a. General. The dam is owned and operated by the Town of Braintree Water Department. It is operated in conjunction with Great Pond Lower Reservoir to supply municipal water. Stoplogs are kept installed in the dam's spillway to increase the storage capacity of Great Pond Upper Reservoir. A valve chamber is located in the dam which enables water to be drawn from three different levels in the upper reservoir and discharged to the lower reservoir as needed for water supply purposes. The valve chamber also serves as a low level outlet for the facility.

b. Description of any Warning System in Effect. No warning system is in effect at Great Pond Upper Reservoir Dam.

4.2 Maintenance Procedures

a. General. There is no documented regular periodic maintenance program in effect at Great Pond Upper Reservoir Dam. There are, however, several items which require periodic maintenance, such as: the removal of brush and tree growth from the slopes of the earth embankments and the floor of the wasteway; the upkeep of the gravel crest of the embankments; the repair and upkeep of the stone protection on the upstream slopes; the surveillance of the embankments with regard to seeps and animal burrows; maintenance of the spillway; and maintenance of the valve chamber and its associated facilities.

b. Operating Facilities. The stoplogs in the spillway are installed on a permanent basis to increase the storage capacity of the upper reservoir. The valves in the valve chamber are operated as dictated by the demand for water in the lower reservoir. Though the valves were not operated during the time of the inspection, they were reported to be in an operative condition.

4.3 Evaluation

Overall maintenance of the dam is generally fair. Specific maintenance items are evaluated as follows: the crest of the spillway was free of debris and the stoplogs in the spillway structure were in good condition; the wasteway was in good condition with the exception of vegetation growing in the floor of the channel; no embankment seeps were evident; brush and tree growth removal from the embankment has been neglected in recent years; the crestof the dam is in need of grading; and, the exterior concrete surface of the valve chamber is in need of repair. A regular periodic maintenance program should be established. The owner should also establish a formal downstream warning system for the dam in the event of an emergency.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Great Pond Upper Reservoir Dam consists of three earth embankments impounding a normal storage of about 1,750 acre-ft. with provisions for an additional 493 acre-ft. of capacity in its surcharge space to top of dam. It is basically a high storage-low spillage facility used for water supply purposes. The spillway is equipped with 3 ft. high stoplogs which are normally kept in place. With stoplogs in place, the spillway is capable of discharging about 330 cfs with the surcharge to top of dam. In the event the stoplogs were removed, the spillway would be capable of discharging about 1,520 cfs with surcharge to top of dam. The general topographic characteristics of the 4.56 sq. mi. drainage area are best described as flat and coastal. The drainage area rises from a reservoir level of about 137 ft. to an elevation of about 270 ft. Bear Swamp, a relatively large swamp, is located in the upper reaches of the drainage area. The lower half of the drainage area is highly urbanized.

5.2 Design Data

No hydrologic computations or hydraulic data has been recovered for the dam with the exception of a plan dated November 1939 which shows a layout of the reservoir and lists part of the reservoir's proposed storage capacity (see Appendix B).

5.3 Experience Data

No records are available in regard to past operation of the reservoir, nor of surcharge encroachments and flows through the spillway. The maximum past inflows are unknown. However, it was reported by the owner's representative that at one time the dam was slightly overtopped.

5.4 Test Flood Analysis

Hydrologic and hydraulic characteristics of Great Pond Upper Reservoir and drainage area were evaluated in accordance with the criteria given in Recommended Guidelines for Safety Inspection of Dams. As indicated in Section 1.2, paragraphs c and d, Great Pond Upper Reservoir is classified as intermediate in size and has a high hazard potential. The recommended test flood for hydraulic evaluation of such a dam is a full PMF.

Precipitation data were obtained from Hydrometerological Report No. 33, which for this area of Massachusetts is about 23.5 in. of 6 hour maximum rainfall over a 10 sq. mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors, and an additional 0.4 in. was deducted for infiltration losses. The six hour rainfall was distributed into one hour incremental periods as suggested in COE Publication EC 1110-2-1411.

A triangular incremental unitgraph was assumed for the inflow hydrograph using a computed lag time of 9.3 hours to derive a time-to-peak for the triangular hydrograph of 8.04 hours (see computations on Sheets D-8 and D-9, Appendix D). The test flood hydrograph is shown on Sheet D-10, Appendix D, indicating a peak inflow of about 4,650 cfs or a CSM value of about 1,020. The effect of Bear Swamp on the runoff from the drainage area was not considered in this analysis.

Discharge tables and curves for the spillway and for over the top of the dam are shown on Sheets D-4 thru D-7, Appendix D.

For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on U.S.G.S. 2,000 ft. per in. quadrangle sheets and data abstracted from a Town of Braintree plan dated November 1939.

Flood routings were performed for both the test flood and a ½ PMF. The flood was routed assuming the stoplogs to be in place and the low level outlet to be closed. Results of the routings are shown on Sheets D-11 thru D-13, Appendis D, and are summarized as follows:

Flood Magnitude	Routed Test Flood Inflow (cfs)	Maximum Res. El. (ft.)	Max. Head Over Dam (ft.)	Routed Test Flood Outflow (cfs)
½ PMF	2,325	139.4	0.4	1,950
PMF (Test Flood)	4,650	139.8	0.8	4,380

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the dam by 0.8 ft. The project, however, can handle about 7 percent of the routed test flood outflow without overtopping the dam.

5.5 Dam Failure Analysis

A breach owing to structural failure of the dam by piping or sloughing is a possibility. For this analysis a breach was assumed to occur with the water level at the top of the dam and that Dam B would be the embankment to be breached. The "rule of thumb" method in the March 1978 Guidance Report was used as a guide for the breach analysis. With a breach width of about 500 ft., an outflow of 64,900 cfs would be realized. The spillway discharge at that time would be about 330 cfs. but has been neglected since it is only about 0.5 percent of the failure flow. Computations of the breach analysis are shown on Sheets D-14 thru D-21, Appendix D.

Immediately downstream of the dam is Great Pond Lower Reservoir and Dam. It is estimated that a breach of Great Pond Upper Reservoir Dam would cause the 2,000 ft. long lower dam to be overtopped by about 4 ft. and that the surcharge storage in the lower reservoir would reduce the flood flow to about 40,300 cfs. It is estimated that Great Pond Lower Dam would be slightly overtopped when the upper dam spillway is flowing full and the additional depth of overtopping would be about 4 ft. due to the breach discharge. No further flooding due to the spillway discharge alone is anticipated beyond the lower dam. The Randolph Pumping Station located on the left rim of the lower reservoir would sustain 3 ft. to 4 ft. of flooding due to the breach. Just downstream of Great Pond Lower Reservoir the flows from the reservoir join the Blue Hill River to form the Farm River in Great Cedar Swamp. It is estimated that several structures which are located adjacent to the swamp would be flooded by the flood waters up to a depth of about 5 ft. These structures include the Ridge Arena, a shopping center off Granite Street and an industrial complex located south of the swamp. It is estimated that the flood flow would be reduced to about 20,000 cfs as it passed out of the swamp. Just downstream of Great Cedar Swamp about ten houses, a commercial building, and three roadways, including Granite Street, would be flooded from 1 ft. to 5 ft. Beyond Granite Street, the Farm River is rather confined and it is estimated the depth of water in this reach would rise about 7 ft. due to the breach. This rise would flood part of an apartment complex, two houses, and Pond Street to a depth of about 5 ft. to 6 ft. About 2,300 ft. below Pond Street the Farm River enteres a large swamp where the flood surge should be significantly reduced before joining the Cochato River to form the Monatiquot River.

In summary, in the above area of initial impact, it is estimated that Ridge Arena, several industrial buildings, a pumping station, a shopping cneter, an apartment building, about ten houses and several roadways will be significantly flooded. There is also the potential for the loss of more than a few lives. Therefore in accordance with the Recommended Guidelines for Safety Inspection of Dams, the project has been classified as having a high hazard potential. Sheet D-22, Appendix D, shows the area of initial impact.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

There are no design calculations, as-built drawings or other data which would permit the preparation of structural stability computations. The dam and dikes are now stable and are in good physical condition. Deficiencies described below and in Section 7 should be corrected.

The field inspection revealed the following:

(1) There do not appear to be any records of seismic investigations or analyses for the dam and dikes.

(2) There is brush and tree growth on the slopes of the embankments.

(3) The crest of the embankments is irregular.

(4) There is brush growth in the downstream spillway channel.

6.2 Design and Construction Data

No plan or calculations of value to a stability assessment are available.

6.3 Post-Construction Changes

There are no records of any major post-construction changes made to the dam, dikes or spillway that are of significance to the stability of the facility. The stoplogs are shown on the plans and appear to be part of the original construction.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 3. Phase I Guidelines recommend, as a minimum, that suitable analysis made by conventional equivalent static load methods should be on record for dams in Zone No. 3. As far as can be determined, no such analysis has been made.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Great Pond Upper Reservoir Dam is judged to be in good physical condition, however because of the spillway inadequacy the dam is judged to be in only fair overall condition. The deficiencies revealed indicate that a further investigation should be carried out and that some remedial work is needed. The major concerns with the overall integrity of the dam are as follows:

(1) With the stoplogs in place the spillway will only pass about 7 percent of the routed test flood outflow.

(2) No seismic investigation and analysis has been made of the dam.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

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

7.2 Recommendations

It is recommended that the owner should retain the services of a registered professional engineer experienced in the design of earth dams to make investigations and studies of the following, and, if proved necessary, to design appropriate remedial works.

(1) Make a thorough study of the hydrology of the drainage basin including an assessment of the attenuating effect of Bear Swamp. Review the spillway adequacy in relation of the potential overtopping of the earth embankments. The removal of the stoplogs should also be considered.

(2) Make a seismic investigation of the dam and anlaysis by conventional equivalent static load methods.

(3) Inspect the spillway under a no flow condition.

The owner should implement all recommendations by the engineer.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

(1) Remove brush and light tree growth on the downstream slopes of all of the embankments to within a minimum of 10 ft. of toe where applicable. Remove brush growth on the upstream slopes of all of the embankments.

(2) Remove the vegetation growth from the floor of the wasteway.

(3) Regrade the crest of the embankments to remove the irregular rutted surfaces.

(4) Repair erosion of the downstream slope of Dam B and Dike C.

(5) Repair deteriorated concrete on the valve chamber.

(6) Develop an "Emergency Action Plan" that will include an effective preplanned downstream warning system, locations of emergency equipment, materials and manpower, authorities to contact and potential areas that require evacuation. The plan will also include round-the-clock monitoring of the project during periods of heavy precipitation.

(8) Implement a regular periodic maintenance program.

(9) Prevent trespassing on the embankments.

7.4 Alternatives

There are no practical alternatives to the above stated recommendations or remedial measures.

Appendix A

Inspection Checklist

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT GREAT POND UPPER RESERVOIR DAM

DATE 18 April 1980

OWNER Town of Braintree, MA

TIME 9:30 AM

WEATHER Clear and Warm

W.S. ELEV. 136.8 U.S. ____ DN.S.

INSPECTION PARTY

A/E REPRESENTATIVES	OWNER'S REPRESENTATIVES
1. Peter B. Dyson	1. William Ewing
2. Carl J. Hoffman	2.
3. William S. Zoino	3.
4. Pasquale E. Corsetti	4.
5. Robert F. Berry	5.

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Hydrologic	Roger F. Berry	LBA
2. Hydraulics/Structural	Carl J. Hoffman	LBA
3. Soils and Geology	William S. Zoino	GZA
4. General Features	Peter B. Dyson	LBA
5. General Features	Pasquale E. Corsetti	LBA
6.		
7.		
8.		
9.		
10.		

LBA - Louis Berger & Associates, Inc.
GZA - Goldberg-Zoino & Associates, Inc.

PERIODIC INSPECTION CHECKLIST

PROJECT	GREAT POND UPPER RESERVOIR DAM	DATE	18 April 1980
PROJECT FEATURE	Dam B	NAME	
DISCIPLINE	Soils and Geology	NAME	William S. Zoino

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	139.0
Current Pool Elevation	136.8
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	6 in. to 12 in. ruts
Lateral Movement	None
Vertical Alginment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	On downstream slope opposite valve chamber.
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	N/A

Extensive brush growth on downstream slope; neglibible brush growth on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT GREAT POND UPPER RESERVOIR DAM DATE 18 April 1980

PROJECT FEATURE Dike A NAME

DISCIPLINE Soils and Geology NAME William S. Zoino

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	139.0
Current Pool Elevation	136.8
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	6 in. to 12 in. ruts
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slop Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	N/A

Extensive brush growth on downstream slope; minor brush growth on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT GREAT POND UPPER RESERVOIR DAM DATE 18 April 1980

PROJECT FEATURE Dike C NAME

DISCIPLINE Soils and Geology NAME William S. Zoino

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	139.0
Current Pool Elevation	136.8
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	6 in. to 12 in. ruts
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	On downstream slope near spillway training wall.
Sloughing or Erosion of Slopes or Abutments	None
Rock Slop Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	N/A

Extensive brush growth on downstream slope; minor brush growth on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT	GREAT POND UPPER RESERVOIR DAM	DATE	18 April 1980
PROJECT FEATURE	Valve Chamber	NAME	
DISCIPLINE	Hydraulics/Structures	NAME	Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Poor
Rust or Staining	
Spalling	Yes
Erosion or Cavitation	Yes
Visible Reinforcing	No
Any Seepage or Efflorescence	No
Condition at Joints	N/A
Drain Holes	N/A
Channel	3-24" inlet pipes and 24" outlet pipe
Loose Rock or Trees Overhanging Channel	N/A
Condition of Discharge Channel	Outlet pipe discharges into lower reservoir

PERIODIC INSPECTION CHECKLIST

PROJECT GREAT POND UPPER RESERVOIR DAM DATE 18 April 1980

PROJECT FEATURE Spillway NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	None
General Condition	N/A
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	N/A
Floor of Approach Channel	N/A
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	Minor
Spalling	Minor
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	N/A
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Moderate growth of vegetation
Other Obstructions	None

PERIODIC INSPECTION CHECKLIST

PROJECT GREAT POND UPPER RESERVOIR DAM DATE 18 April 1980

PROJECT FEATURE Spillway Bridge NAME

DISCIPLINE Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Superstructure	None
Bearings	N/A
Anchor Bolts	N/A
Bridge Seat	N/A
Longitudinal Members	N/A
Underside of Deck	N/A
Secondary Bracing	N/A
Deck	N/A
Drainage System	N/A
Railings	N/A
Expansion Joints	N/A
Paint	N/A
b. Abutment & Piers & Deck	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat and Backwall	N/A

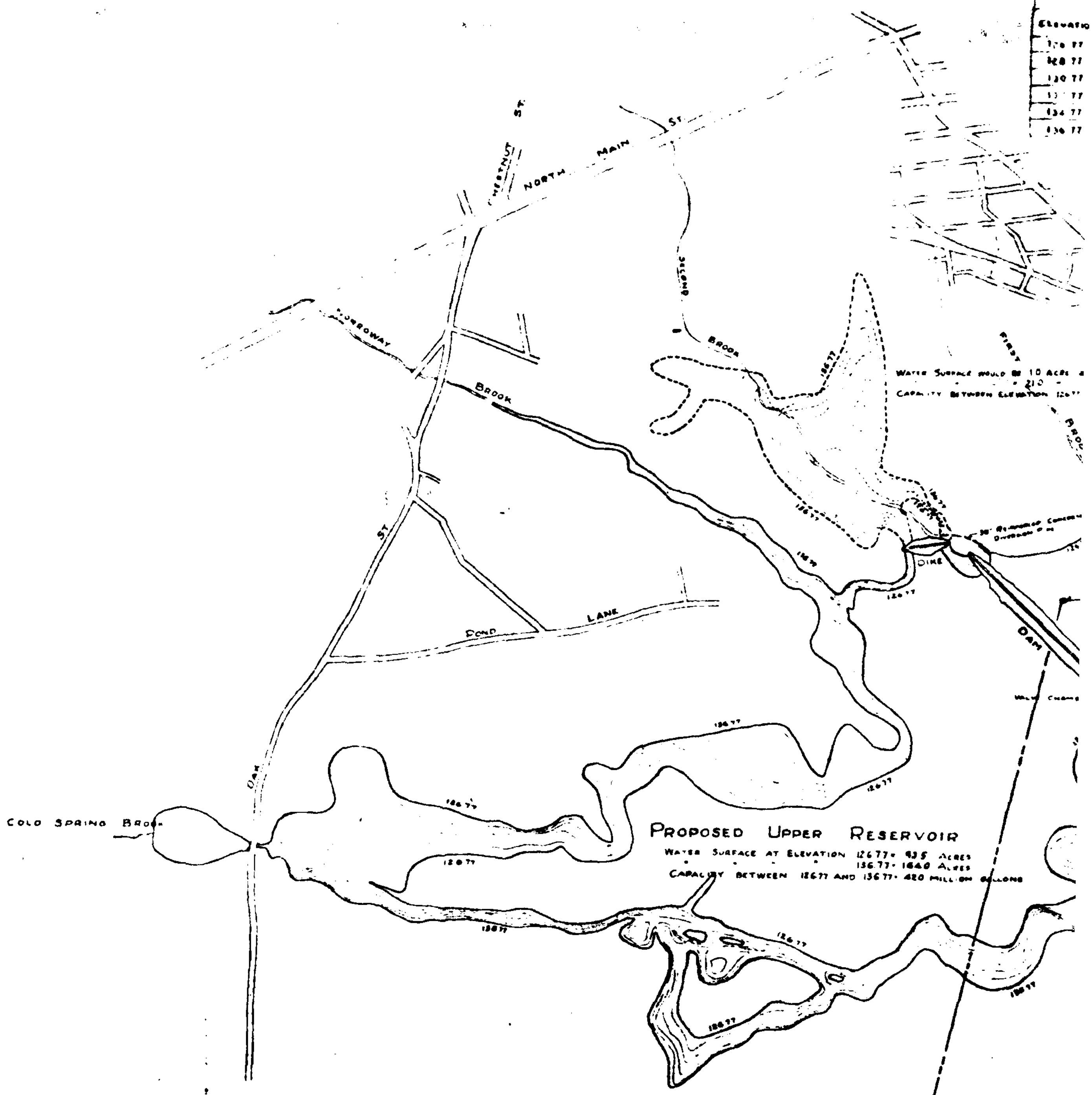
PERIODIC INSPECTION CHECKLIST

PROJECT: GREAT POND UPPER RESERVOIR **DATE:** 18 April 1980

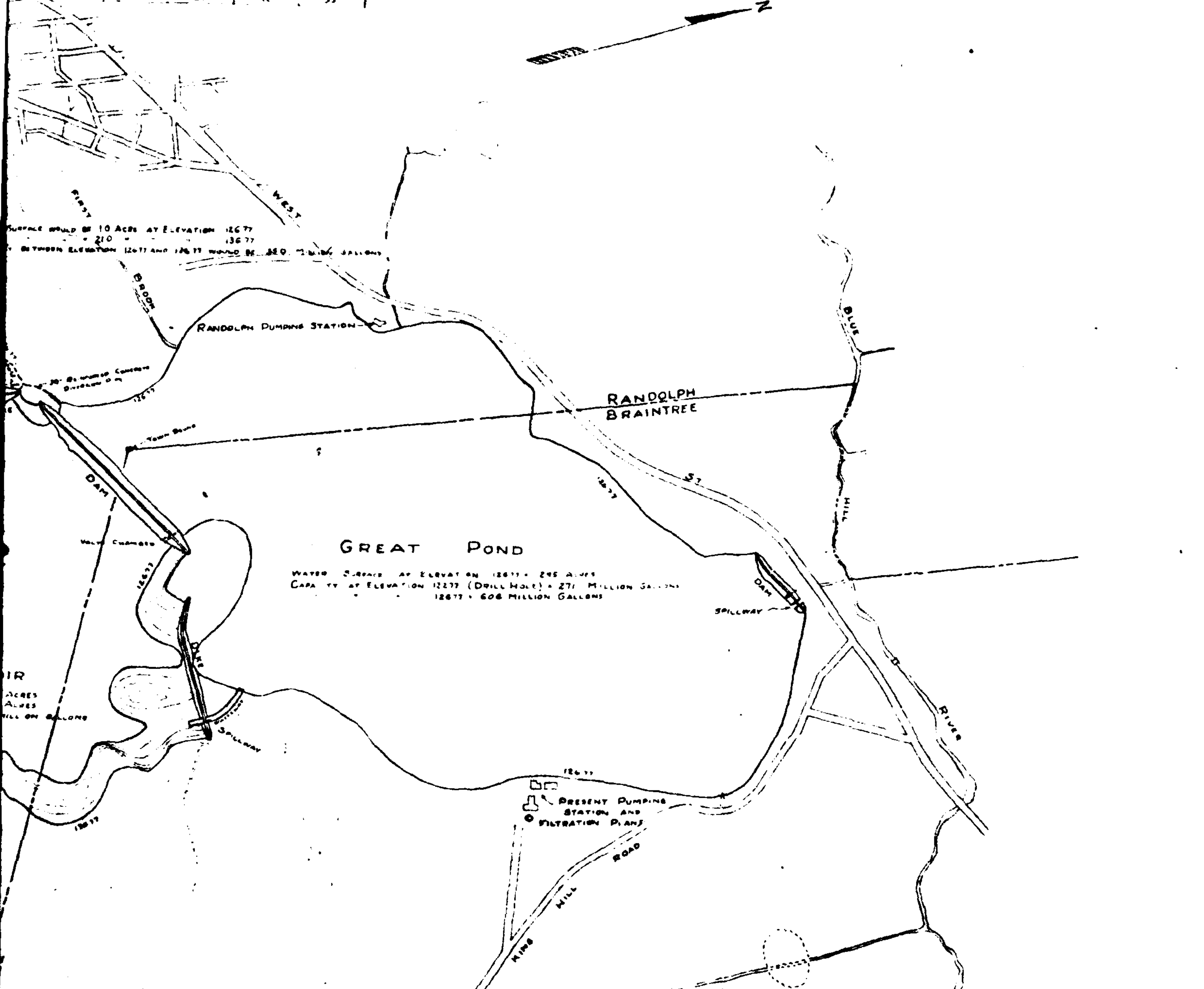
AREA EVALUATED	CONDITIONS
Outlet Works - Transition and Conduit	N/A
Outlet Works - Control Tower	N/A
Outlet Works - Intake Channel and Intake Structure	N/A

APPENDIX B

ENGINEERING DATA



Additional Storage in Upper Reservoir			
Elevation	Water Surface Acres	Storage Capacity - M G	
		Between Elevations	Total
126.77	93.5		0
128.77	103	63	68
130.77	130	76	138
132.77	140	88	227
134.77	151	93	320
136.77	164	100	420



Possible Additional Storage in Second Brook			
Elevation	Water Surface Acres	Storage Capacity – M.G. Between Elevations	Total
126.77	1		0
128.77	4	2	2
130.77	8.5	5	7
132.77	12	7	14
134.77	14.5	9	23
136.77	21	12	35

Storage in Great Pond Including Upper Reservoir			
Elevation	Water Surface Acres	Storage Capacity – MG Between Elevations	Total
122.77	205		271
124.77	265	153	424
126.77	295	182	606

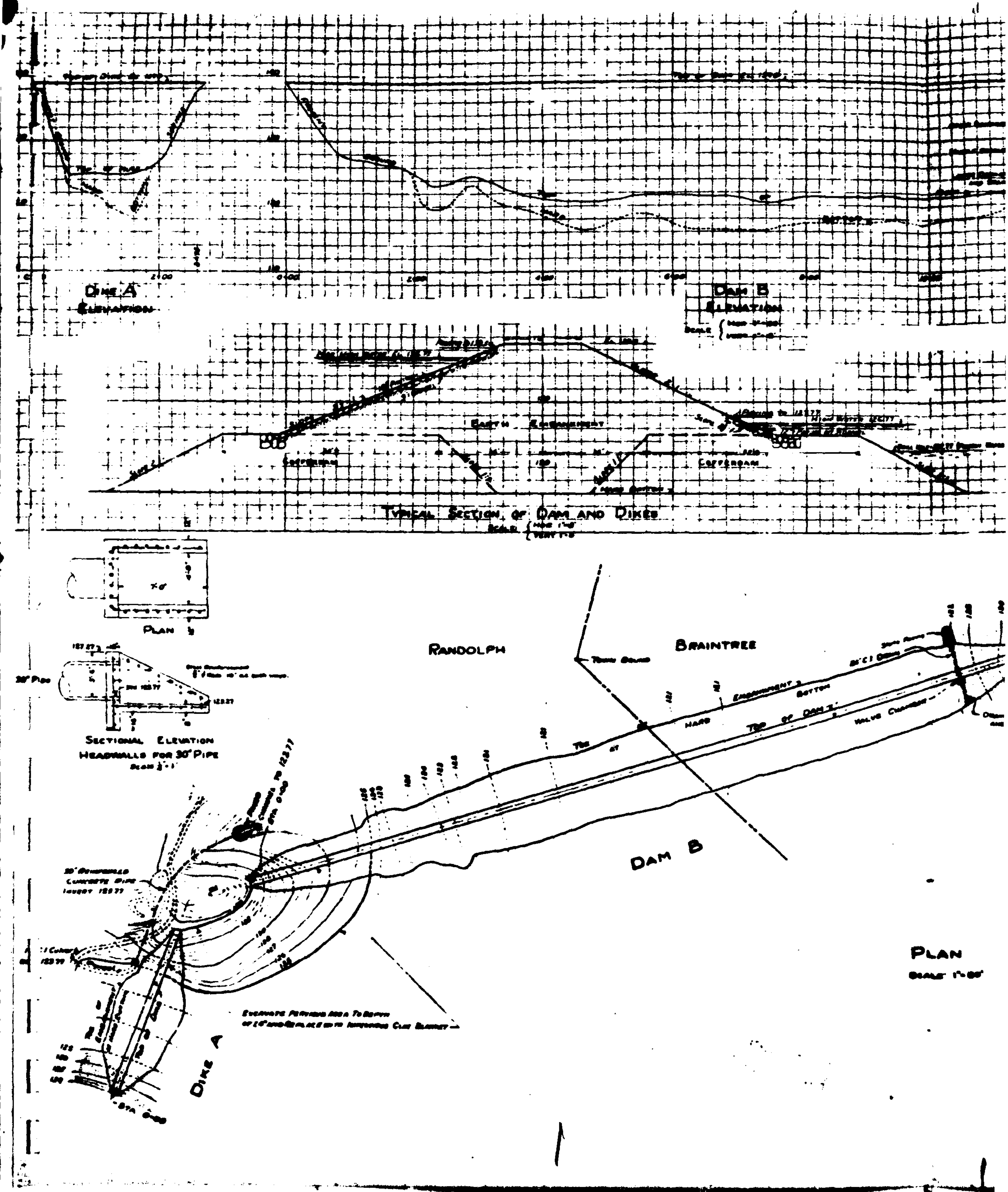
Town of Braintree
Mass.

Plan of
Upper and Lower Reservoirs
at Great Pond

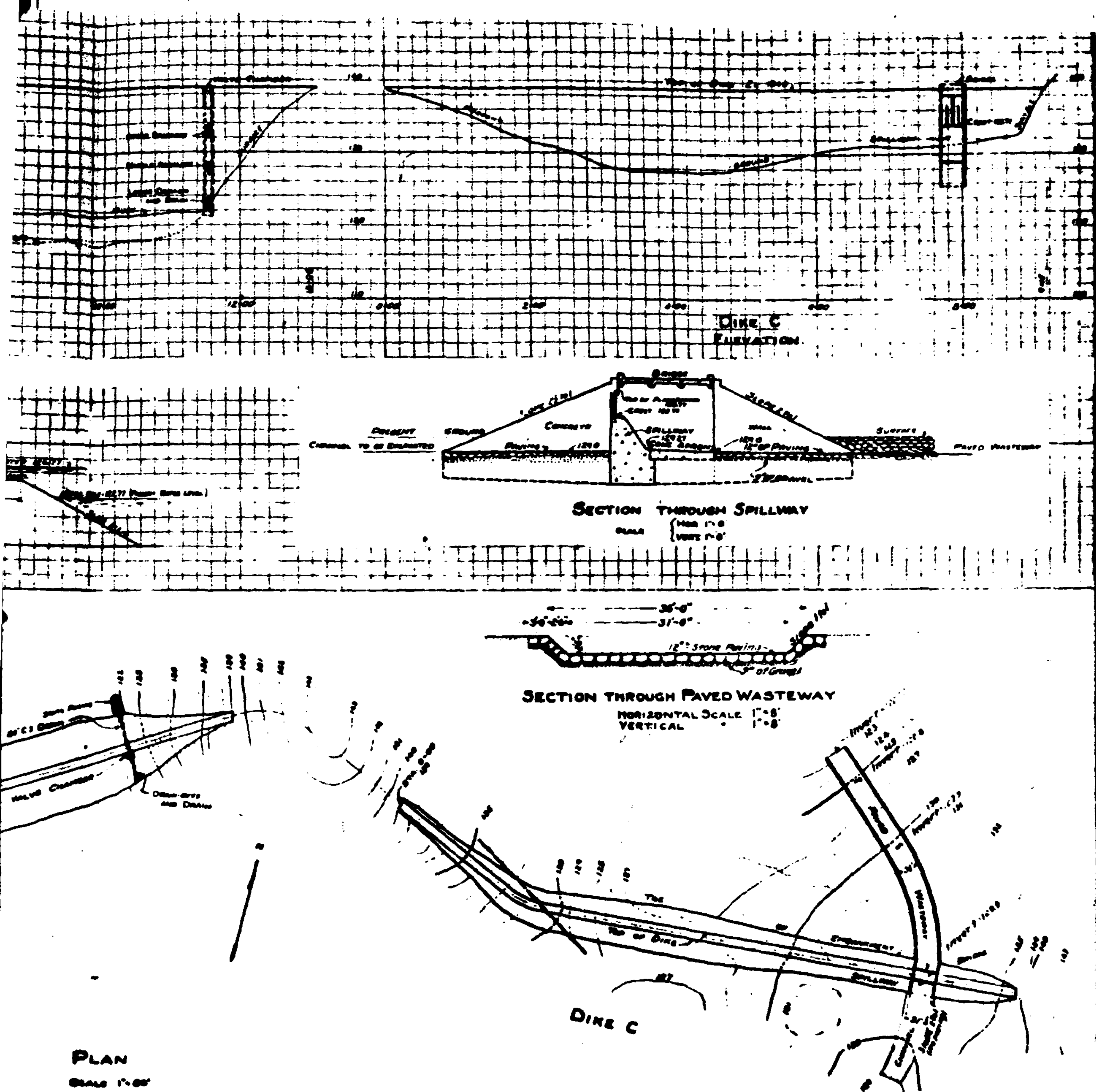
Scale 1" = 400'

Weston & Sampson
Consulting Engineers
Boston, Mass.

November, 1939



Dike A
Elevation
Dam B
Elevation
Earth Embankment
Cofferdam
Cofferdam
Typical Section of Dam and Dikes
Plan
Sectional Elevation
Headwalls for 30" Pipe
Randolph
Braintree
Town Bound
Embankment
Bottom
Hard
Top of Dam
Valve Chamber
Toe at
Dam B
Dike A
Plan



TOWN OF BRAINTREE
MASSACHUSETTS

UPPER DAM AND DIKES AT GREAT POND

PLAN AND SECTIONS

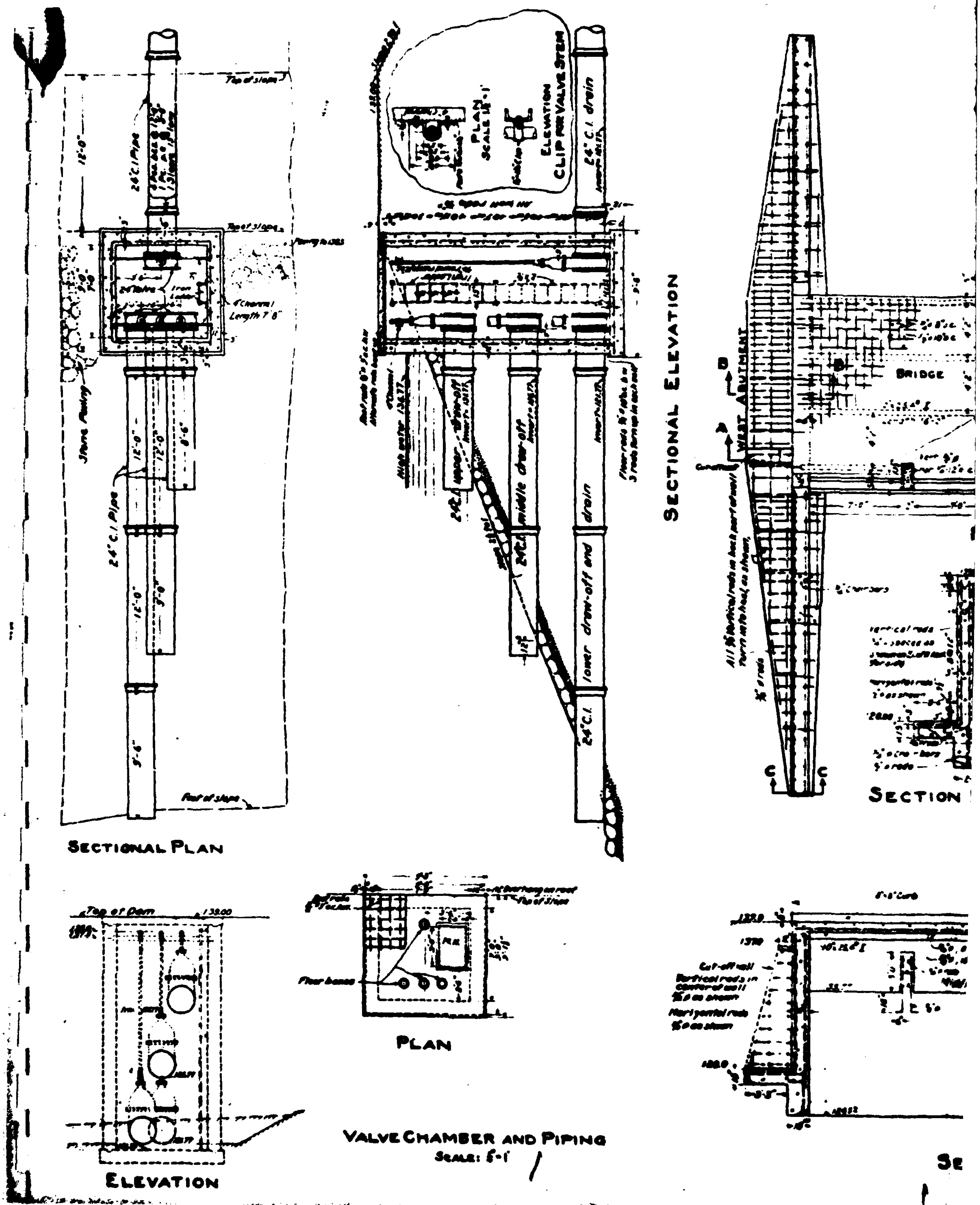
SCALES AS NOTED

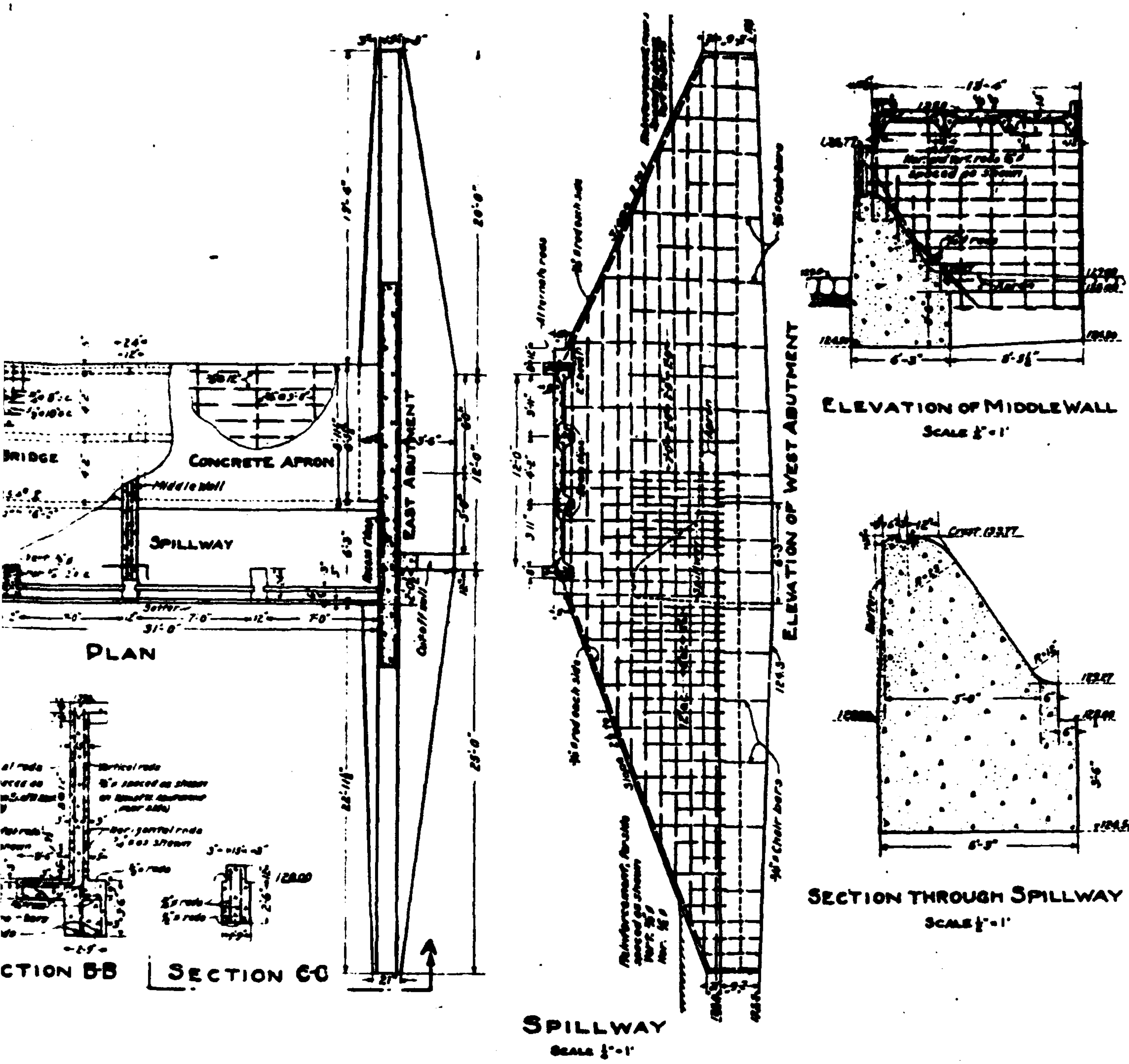
REVISED JANUARY 10, 1940 TO COMPLY WITH U.S. ENGINEERS' INSTRUCTIONS OF DECEMBER 26, 1939.

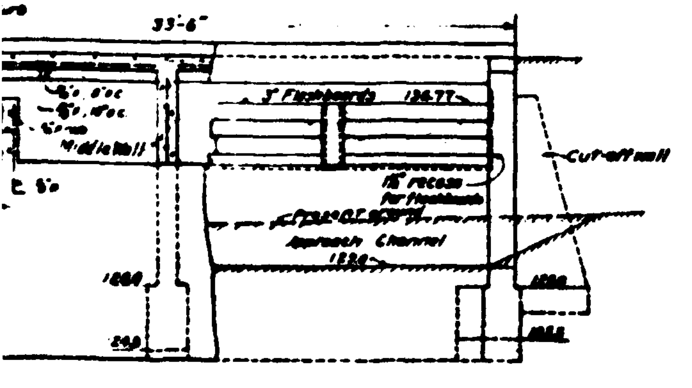
DEC. 11, 1939.

WESTON AND SAMPSON
CONSULTING ENGINEERS
BOSTON, MASS

B-2


Top of slope
24" C.I. Pipe
Stone Paving
Foot of slope
Sectional Plan
Elevation
Clip for Valve Stem
24" C.I. drain
upper draw-off
middle draw-off
lower draw-off and drain
24" C.I.
High water
Sectional Elevation
West Abutment
Bridge
Section
Top of Dam
Elevation
Floor bases
Plan
Cut-off wall
Valve Chamber and Piping





SECTION A-A

TOWN OF BRAINTREE
MASSACHUSETTS

UPPER DAM AND DIKES
AT GREAT POND

DETAILS OF
VALVE CHAMBER AND SPILLWAY
SCALES AS NOTED

WESTON & SAMPSON
CONSULTING ENGINEERS
BOSTON, MASS.

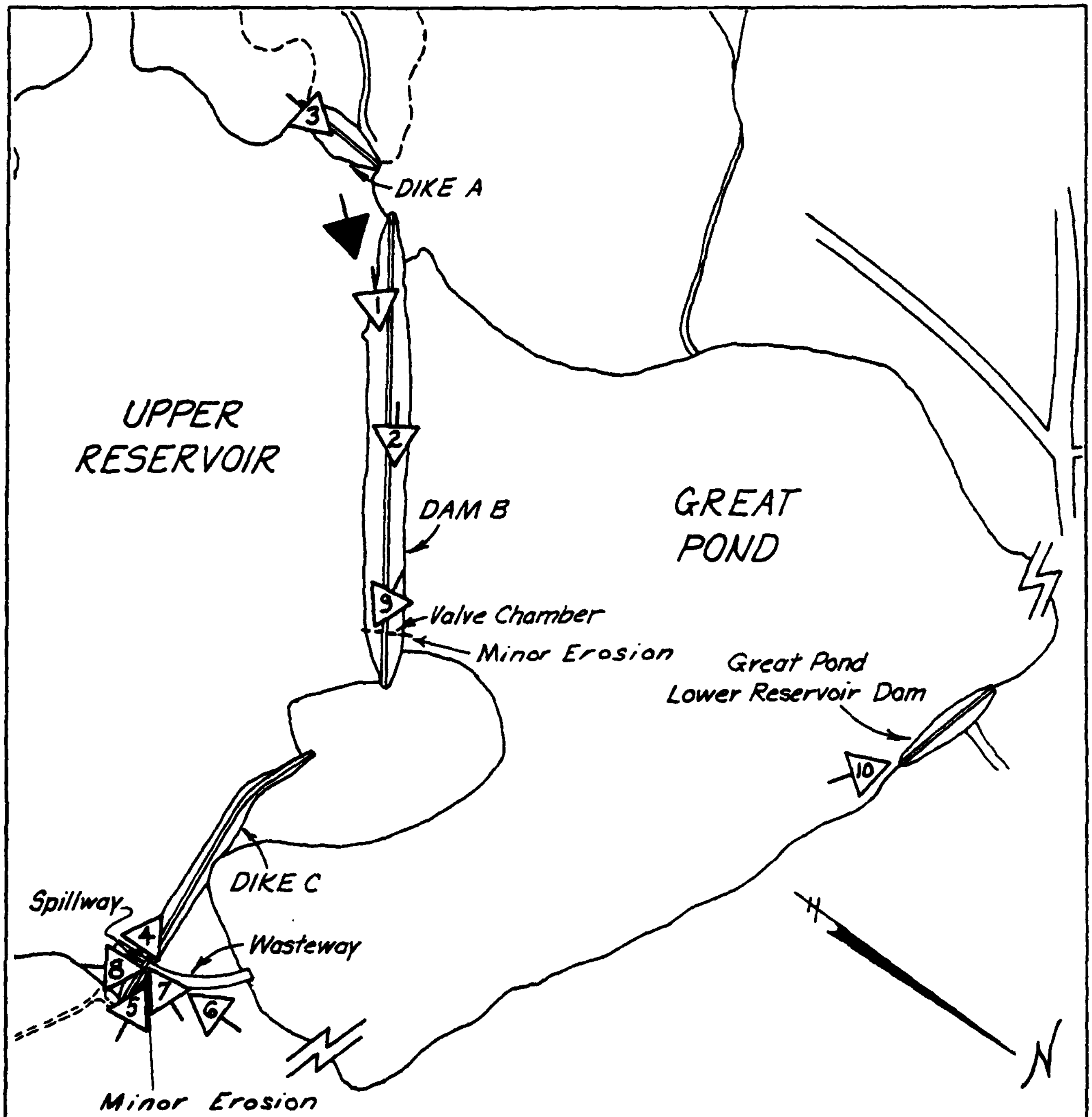
DECEMBER 11, 1939

B-3

13/73

APPENDIX C

PHOTOGRAPHS



OVERVIEW PHOTO ➡

APPENDIX 'C' PHOTOS ▷

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GREAT POND UPPER RESERVOIR DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE-MA

SCALE NONE

DATE

GREAT POND UPPER RESERVOIR DAM

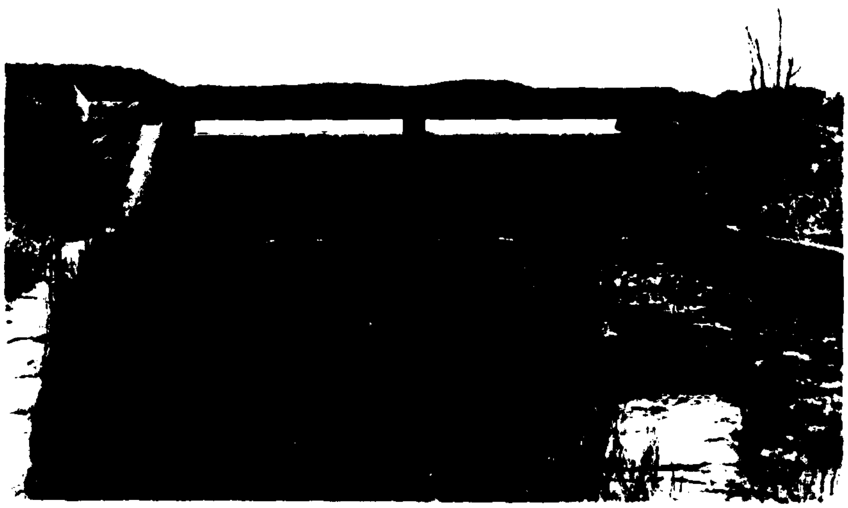
1. Upstream slope of Dam B

2. Downstream slope of Dam B

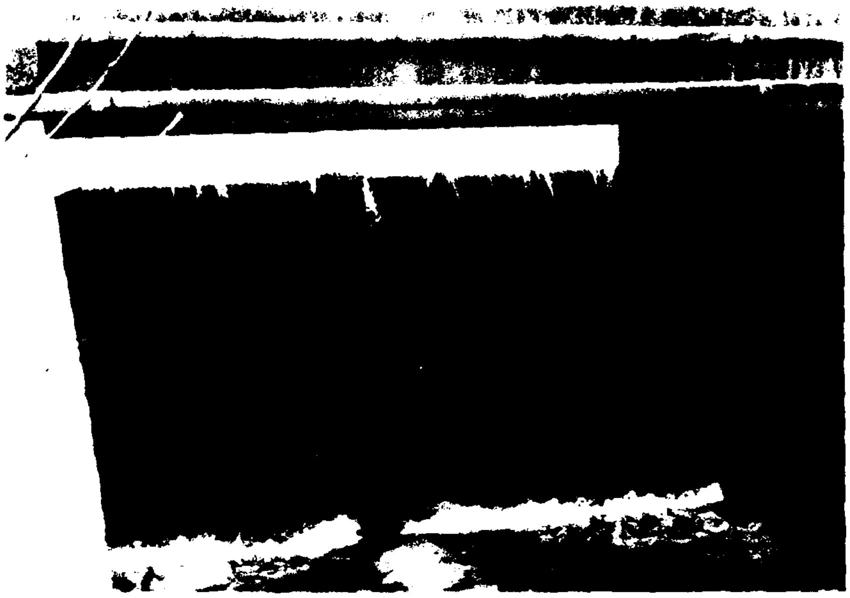
3. Crest and downstream slope of Dike A

4. Crest and upstream slope of Dike C

5. Downstream slope of Dike C

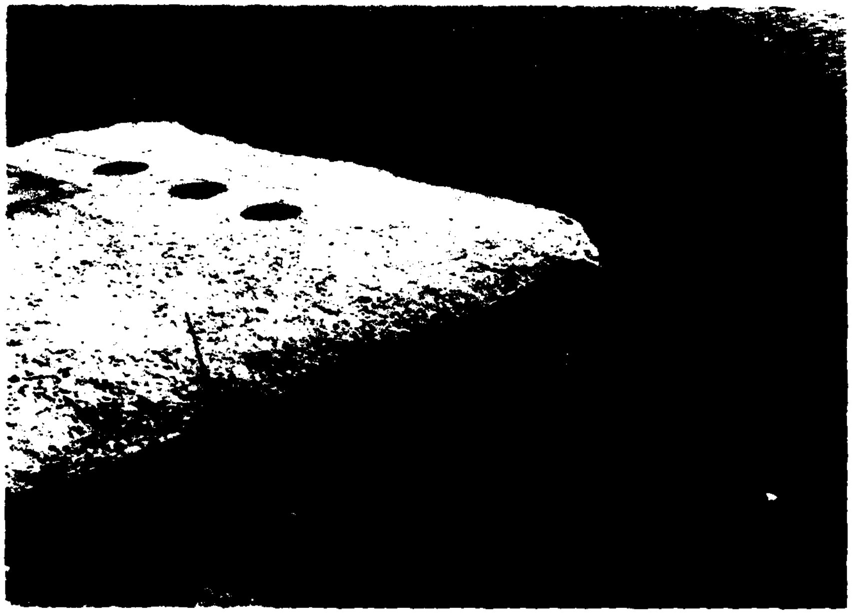


6. Overview of spillway crest and service bridge



7. Stoplogs on spillway crest

8. Spillway discharge channel



9. Deteriorated concrete valve chamber

10. Overview of Great Pond Lower Reservoir Dam

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BY RFB DATE 3-26-80 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 1 OF
CHKD. BY DATE INSPECTION OF DAMS PROJECT W-198
SUBJECT GREAT POND UPPER RESERVOIR

FIND DRAINAGE AREA (MAP SCALE 1:25,000)

READING # 2	~~72.05~~	READ # 3	101.38
" # 1	42.74	" # 2	72.05
	29.31		29.33

DRAIN AREA = 29.32 × 0.1556 = 4.56 SQ. MI = 2920 ACRES

FIND RESERVOIR AREA, ELEV 135

READ # 2	43.96	READ # 3	45.90
" # 1	42.03	" # 2	43.96
	1.93		1.94

RESERVOIR AREA = 1.935 (99.61) = 193 ACRES

AREA @ ELEV 140 ACRES

READ # 2	64.15	READ # 3	66.93
" # 1	[illegible]	" # 2	64.15
	2.72		2.78

AREA ELEV 140 = 2.75 (99.61) = 274 ACRES

BY RFB DATE 5-30-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF ____

CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT W-198

SUBJECT UPPER GREAT POND DAM, STORAGE CAPACITY

STORAGE AT ELEV. 126.77 ∴ $S_1 = (126.77 - 121)(93.5)(1/2)$

$S_1 = 270$ ACRE-FT

FROM TOWN OF BRAINTREE
PLAN 13/[illegible] DATED 11-39

STORAGE BETWEEN ELEV 126.77 & 136.77 = 420×10^6 GAL

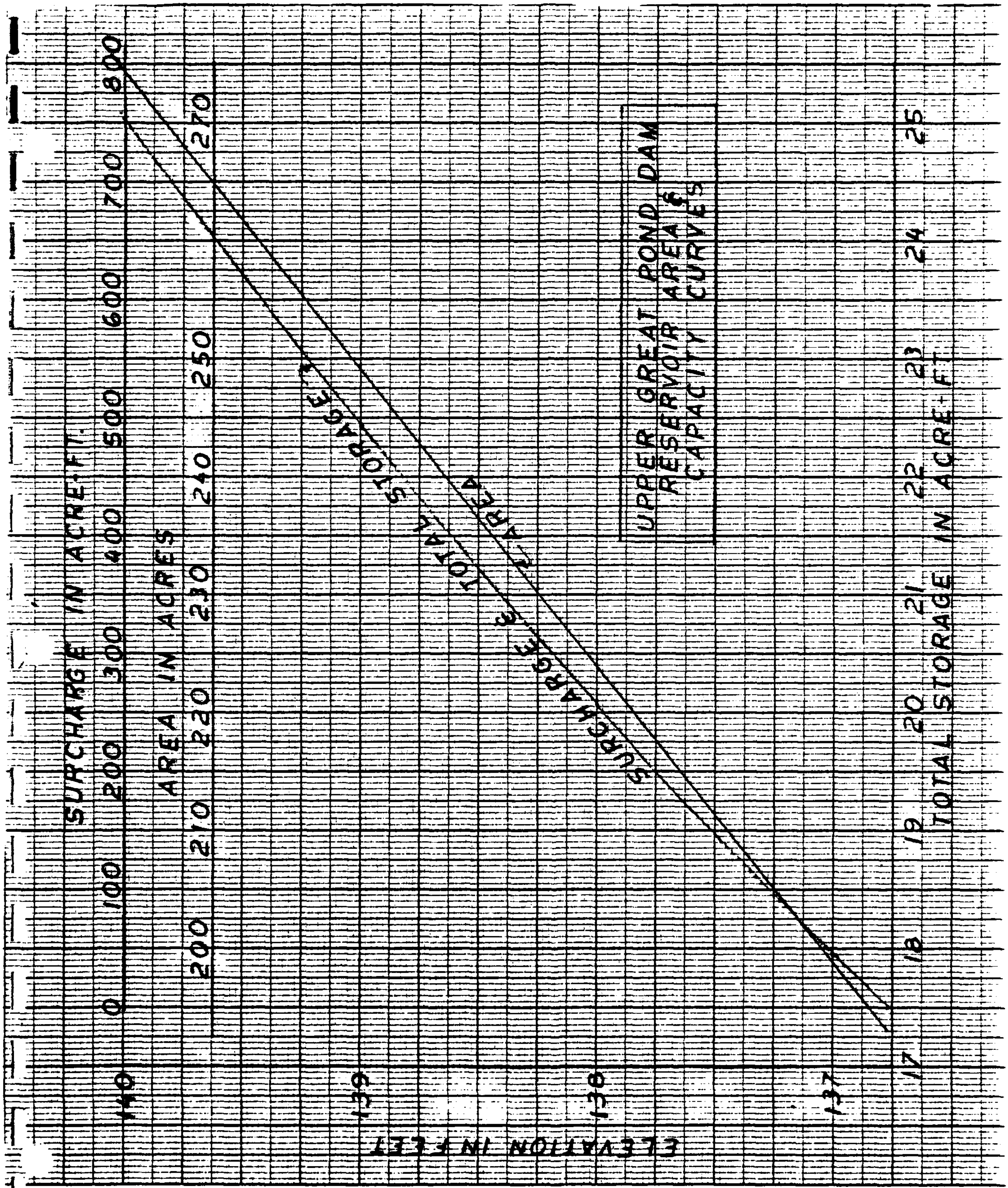
$$S_2 = \frac{420 \times 10^6 \text{ GAL}}{6.48 \text{ GAL/FT}^3 \times 43{,}560 \text{ AF/FT}^2} = 1488 \text{ A.F.}$$

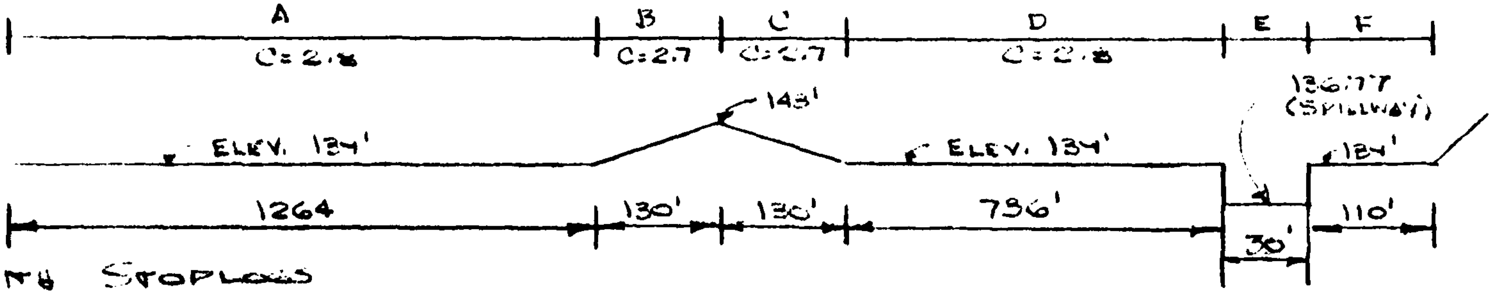
NORMAL STORAGE = $S_1 + S_2$ = 270 + 1488 = 1758 A-F

SAY V = 1750 ACRE-FT

SAY U.S.G.S. SHEET ELEV 135.0 = BRAINTREE PLAN ELEV 136.77, USE U.S.G.S SHEET FOR SURFACE AREAS.

ELEV. FT	AREA ACRES	AVE AREA	ΔH	Δ STORAGE	TOTAL STORAGE	SURCHARGE STORAGE
136.77	193		—		1750	
137	198.6	195.9	0.23	45	1795	45
[illegible]	223.8	211.3	1	211.4	2006	256
[illegible]	248.9	236.4	1	236.4	2243	493
140	274	261.4	1	261.4	2504	754


SURCHARGE IN ACRE-FT.
0
100
200
300
400
500
600
700
800
AREA IN ACRES
200
210
220
230
240
250
270
UPPER GREAT POND DAM
RESERVOIR AREA &
CAPACITY CURVES
TOTAL STORAGE
SURCHARGE & AREA
SURCHARGE & TOTAL STORAGE
17
18
19
20
21
22
23
24
25
TOTAL STORAGE IN ACRE-FT
140
139
138
137
ELEVATION IN FEET



WITH STOPLOGS
GIVEN - PERMANENT STOPLOGS, 3 FT HIGH = h

ELEV	SECTION E				A, D & F, C=2.8			B+C, C=2.7			Σ
FT	H		C	Q	H	L	Q	H	L	Q	Q
137.0	0.23		3.30	19	0	2110	0	0	0	0	20
137.5	0.73			62	0		0	0	0	0	60
138.0	1.23			135	0		0	0	0	0	135
138.5	1.73			225	0		0	0	0	0	225
139.0	2.23			330	0		0	0	0	0	330
139.5	2.73			447	.5		2061	.25	32	11	2545
140.0	3.23			575	1		5405	.50	65	22	6545
140.5	3.73			713	1.5						
141.0	4.23			861	2						
141.5	4.73			1018	2.5						
142.0	5.23			1184	3						
139.75	2.48			509	.75		5637	.38	41	31	4380
139.25	2.48		3.3	387	.25	2110	735	.125	5	–	1125

BY RFB DATE 5-29-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF 3
CHKD. BY ___ DATE ___ INSPECTION OF DAMS PROJECT W-158
SUBJECT UPPER GREAT POND, DISCHARGE CAPACITY

CAPACITY WITH STOPLOGS REMOVED
OGEE CREST WEIR

ASSUME $H_o = 2'$, $C = 4$ $q = CH^{3/2} = 11.3$ CFS/FT

$P = 5.77$ $P + H_o = 7.77$
$X = 2.7$
$Y = 2.3$ VELOCITY OF APPROACH $= \frac{11.3}{7.77} = 1.45$

$$h_a = \frac{V^2}{2g} = \frac{(1.45)^2}{64.4} = .033$$

$$\frac{h_a}{H_o} = \frac{.033}{2} = 0.0165$$

FROM FIG 247 - DSD - $n = 1.86$, $K = .50$

$$\frac{Y}{H_o} = K\left(\frac{X}{H_o}\right)^n \therefore \frac{2.3}{H_o} = .50\left(\frac{2.7}{H_o}\right)^{1.86} =$$

$$\frac{2.3}{.50} = H_o\left(\frac{2.7}{H_o}\right)^{1.86} = \frac{H_o(2.7)^{1.86}}{(H_o)^{1.86}}$$

$$4.6 = \frac{(2.7)^{1.86}}{(H_o)^{0.86}} = \frac{6.34}{(H_o)^{0.86}}$$

$$(H_o)^{.86} = \frac{6.34}{4.6} = 1.38 \qquad H_o = 1.45$$

SAY DESIGN HEAD = 1.5 FT

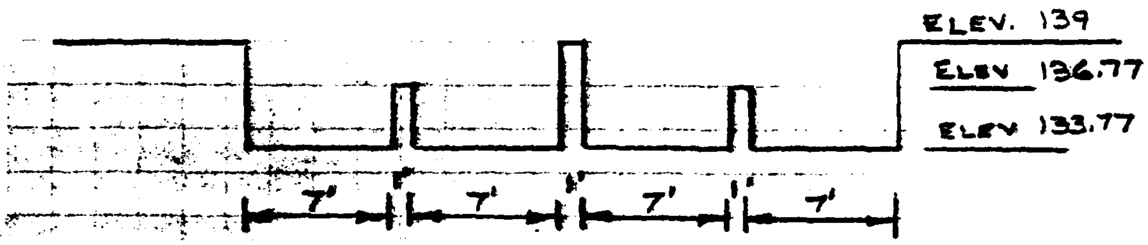
$$\frac{P}{H} = \frac{5.77}{1.5} = 3.85 \qquad \text{FIG 249 DSD} \therefore C_o = 3.95$$

BY RFB DATE 5-30-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 3 OF 3

CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT W-198

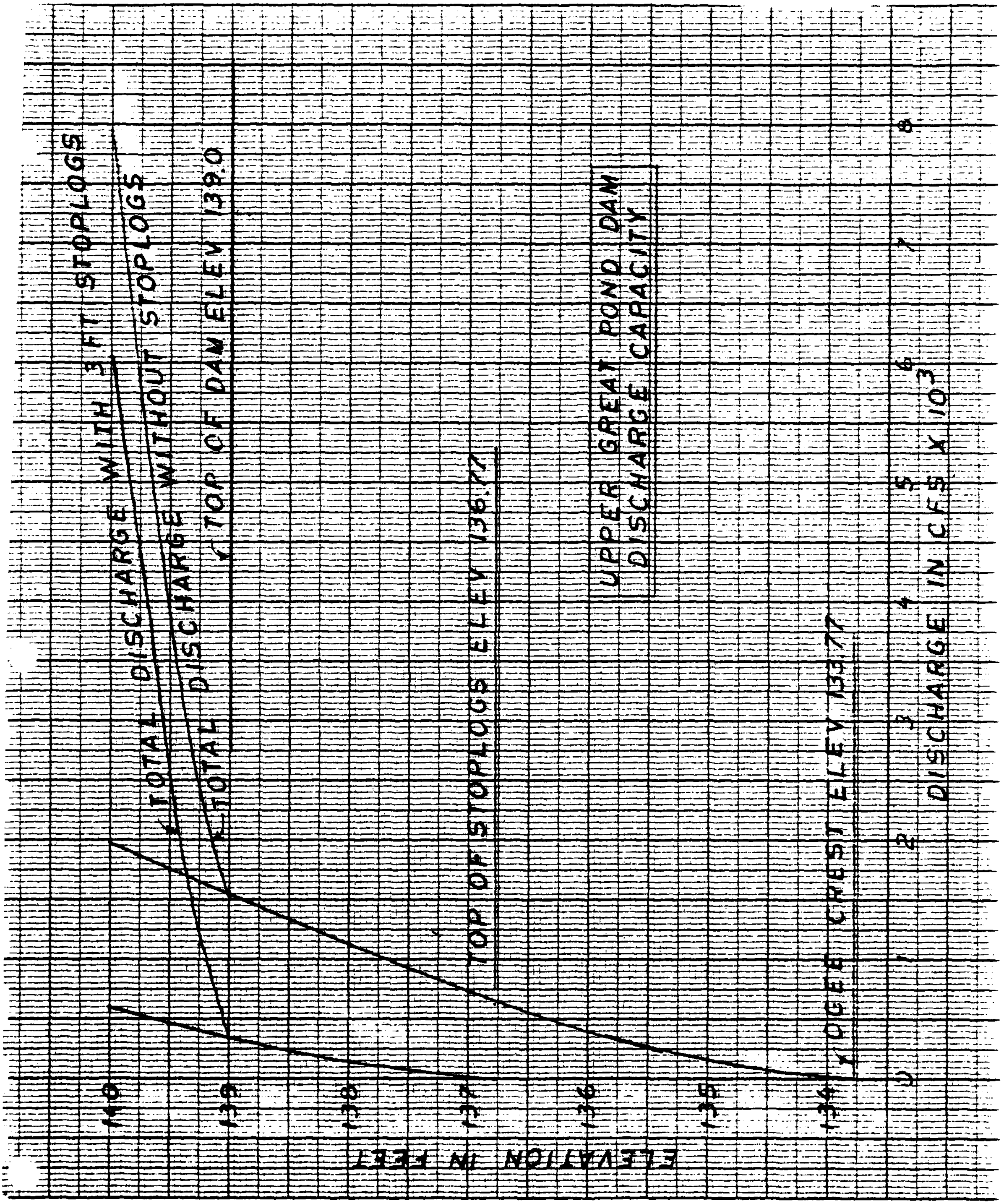
SUBJECT UPPER GREAT POND DAM, DISCHARGE CAPACITY

WITHOUT STOPLOGS



SPILLWAY SECTION $C_o = 3.95$

ELEV.	He	He/Ho	C/Co	C	L	Q	Q EMBANK	Σ Q
133.77	0	0	0	0	0	0	0	0
134.5	0.73	0.49	0.92	3.63	28	63	↓	65
135.0	1.23	[illegible]	0.97	3.83	↓	146	↓	145
135.5	1.73	1.15	1.02	4.03	↓	257	↓	255
136.0	[illegible]	1.49	1.06	4.19	↓	391	↓	390
136.77	3.0	2.0	1.07	4.22	↓	615	↓	615
137	3.23			↓	30	737	↓	735
137.5	3.73			↓	↓	914	↓	915
138	4.23			↓	↓	1104	↓	1105
138.5	4.73			↓	↓	1305	↓	1305
139	5.23			↓	↓	1518	0	1520
139.25	5.48			↓	↓	1628	740	2370
[illegible]	[illegible]			↓	↓	1740	2100	3840
[illegible]	[illegible]			↓	↓	1856	[illegible]	5725
[illegible]	[illegible]			↓	↓	1973	5970	7945



K&E STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH

DRAINAGE AREA, (TOTAL) = 4.56 SQ. MI.
BY INSPECTION RESERVOIR AREA < 25% D.A.

LENGTH OF LONGEST WATER COURSE, L = 24,000 FT
L = 4.55 MILES

ELEV DIFFERENCE = 270 - 135 = 135 FT

$\therefore$ SLOPE = $\frac{135}{4.55}$ = 29.67 FT/MI $\therefore \sqrt{S}$ = 5.45

NOW $\frac{LLc}{\sqrt{S}} = \frac{4.55 \times 4.55}{2(5.45)} = 1.90$

$\left(\frac{LLc}{\sqrt{S}}\right)^{.33} = (1.90)^{.33} = 1.24$

LAG = $K\left(\frac{LLc}{\sqrt{S}}\right)^{.33} = 1.24K$

ASSUME K = 7.5 — REFER TO CURVE "C" MOUNTAINOUS REGION, WELL FORESTED TERRAIN, B OF REC.

LAG = 7.5 (1.24) = 9.3 HRS

T_p = 0.41D + 0.82 LAG, WHERE D = 1.0 HRS

T_p = 0.41(1) + .82(9.3) = 8.04 HRS

CHECK VELOCITY

$T_c = \frac{T_p + .5D}{0.6}$

$T_c = \frac{8.04 + .5}{0.6} = 14.23$

$V = \frac{24,000}{14.23(3600)}$ = 0.47 FT/SEC O.K.

$T_R = 1.67\ T_P = 1.67(8.04) = 13.43$

$T_B = T_P + T_R = 8.04 + 13.43 = 21.47$

q_P = Peak Rate in cfs

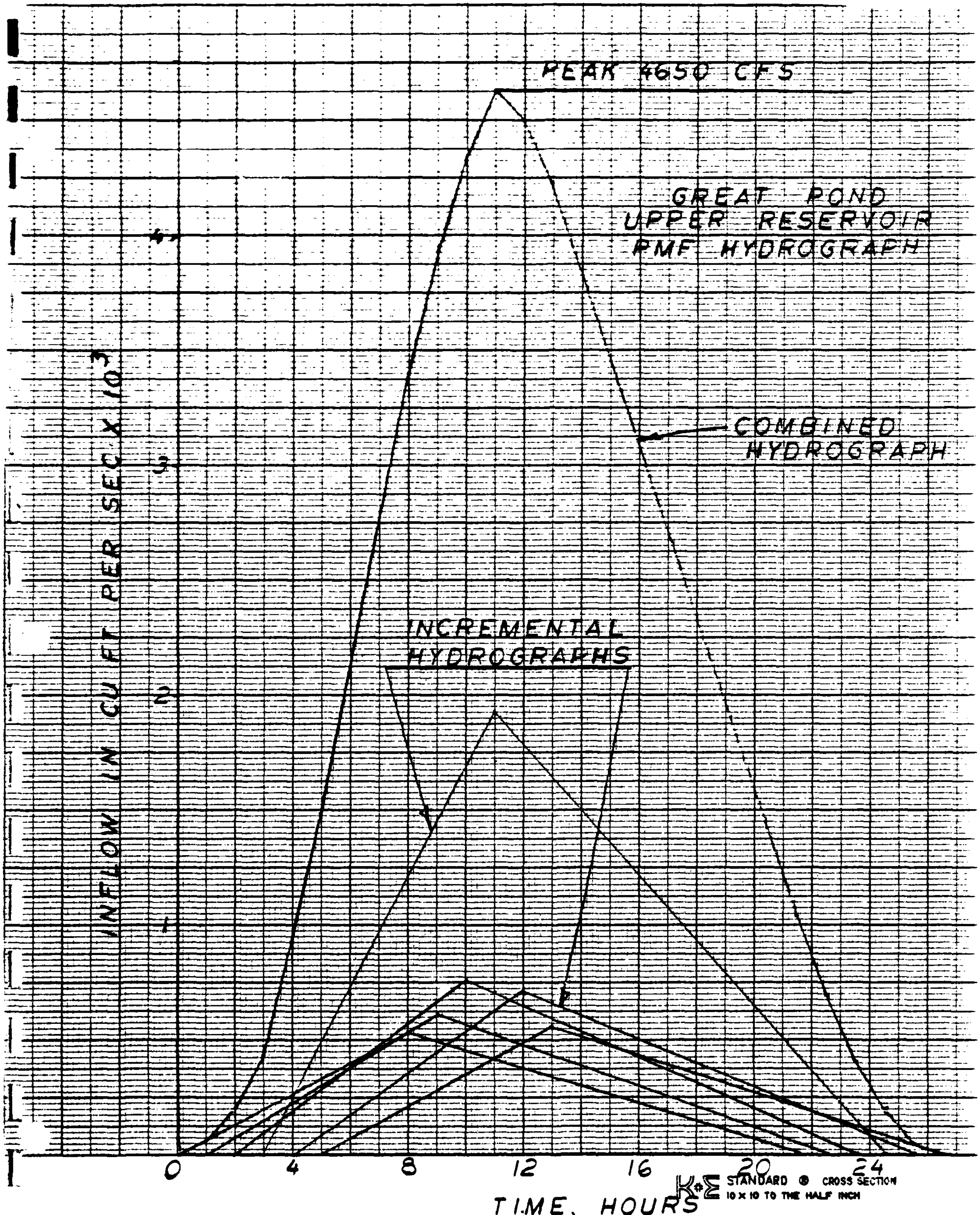
$q_P = \dfrac{484\ A\ Q}{T_P}$ A = Drainage Area
Q = Runoff inches

$q_P = \dfrac{484(4.56)(1)}{8.04} = 275$ cfs

PMF = 23.5"(.8) − 0.4 ([illegible]) = 18.4 inches

Flood Hydrograph for PMF q_P = 275 cfs

Time (hours)	Rainfall		Q	Time		
	%	Inches	cfs	Begin	Peak	End
0.0	–					
1.0	10	1.84	506	0	8.0	21.5
2.0	12	2.21	608	1.0	9.0	[illegible]
3.0	15	2.76	759	2.0	10.0	23.5
4.0	38	6.99	1922	3.0	11.0	24.5
5.0	14	2.58	710	4.0	12.0	25.5
6.0	11	2.02	556	5.0	13.0	26.5


PEAK 4650 CFS
GREAT POND
UPPER RESERVOIR
PMF HYDROGRAPH
COMBINED
HYDROGRAPH
INCREMENTAL
HYDROGRAPHS
INFLOW IN CU FT PER SEC X 10^3
4
3
2
1
0
4
8
12
16
20
24
TIME, HOURS
STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH

D-10

BY RFB DATE 5-30-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF
CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT W-93
SUBJECT [illegible] POND DAM [illegible] ROUTING

DRAINAGE AREA = 4.56 SQ.MI. = 2920 ACRES

SIZE CLASSIFICATION - INTERMEDIATE

MAXIMUM STORAGE @ ELEV. 139 = 2343 ACRE-FT

HAZARD CLASSIFICATION = HIGH
OCE GUIDELINES, USE PMF

FROM INFLOW HYDROGRAPH, PMF = 4650 CFS

ROUTE FLOOD WITH 3' STOPLOGS IN PLACE

STEP 1: Q_{P1} = 4,650 CFS

STEP 2a: ELEV = 139.80 FT

STEP 2b: SURCHARGE VOLUME = 700 ACRE-FT

$$\text{INCHES RUNOFF} = \frac{700 \text{ ACRE-FT}}{2920 \text{ ACRES}} \times 12 \text{ IN/FT} = 2.88''$$

STEP 2c: $Q_{P2} = 4{,}650 \times \left(1 - \frac{2.88}{19}\right) = 3945$ CFS

STEP 3a: FOR Q = 3945 CFS

SURCHARGE HEIGHT = 139.72

SURCHARGE VOLUME = 680 ACRE-FT

$$\text{INCHES RUNOFF} = \frac{680}{2920} \times 12 \text{ IN/FT} = 2.79'$$

STEP 2b: $\text{AVE. STOR.} = \frac{2.88 + 2.79}{2} = 2.835''$

BY ZFB DATE 5-30-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF

CHKD. BY ______ DATE ______ INSPECTION OF DAMS PROJECT ______

SUBJECT ______

AVG SURCHARGE = $\frac{2.8? \times 2920}{12 \text{ IN/FT}}$ = 689 ACRE-FT

FROM STAGE-STORAGE CURVE, STAGE = 139.75

FROM STAGE-DISCHARGE CURVE, Q_{P2} = 4,380 CFS

PMF OVERTOPS MAIN DAM BY 0.75 FT, Q = 4,380 CFS

TRY 1/2 PMF = 2,325 CFS

STEP 1: Q_{P1} = 2,325 CFS

STEP 2a: SURCHARGE HEIGHT = 139.46'

STEP 2b: SURCHARGE VOLUME = 6 ACRE-FT

INCHES OF RUNOFF = $\frac{610 \text{ ACRE-FT}}{2920 \text{ ACRES}} \times 12 \text{ IN/FT} = 2.51''$

STEP 2c: $Q_{P2} = 2{,}325\left(1 - \frac{2.51}{9.5}\right) = 1711$ CFS

STEP 3a: FOR Q = 1711

SURCHARGE HEIGHT = 139.36

SURCHARGE VOLUME = 583 ACRE-FT

INCHES OF RUNOFF = $\frac{583 \text{ ACRE-FT}}{2920 \text{ ACRES}} \times 12 \text{ IN/FT} = 2.40''$

BY EFB DATE 6-2-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 3 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT W-109

SUBJECT [illegible]

STEP 3b: AVE STORAGE = $\frac{2.51 + 2.40}{2}$ = 2.455"

AVE SURCHARGE = $\frac{2.455 \times 2920}{12\ \text{IN/FT}}$ = 597 ACRE-FT

FOR 597 ACRE-FT.

SURCHARGE HEIGHT = 139.41 FT

FROM STAGE DISCHARGE CURVE & Q_{P3} = 1950

½ PMF OVERTOPS DAM BY 0.41 FT Q = 1950 CFS

BY RFB DATE 6-2-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF 3

CHKD. BY ______ DATE ______ INSPECTION OF DAMS PROJECT W-193

SUBJECT GREAT POND, DOWNSTREAM ANALYSIS

FIND STORAGE AT ...

NORMAL STOR = 1750 A-FT

MAX STOR = 2240 A-FT

HEIGHT DAM = 139 - 121 = 18'

LENGTH DAM = 1264 FT 40% (1264) = 506 FT

$$Q_{P1} = 8/27\, W_b \sqrt{g}\, Y_o^{3/2}$$

$$Q_{P1} = 1.68\,(506)\,(18)^{3/2}$$

$$Q_{P1} = 64{,}900 \text{ CFS}$$

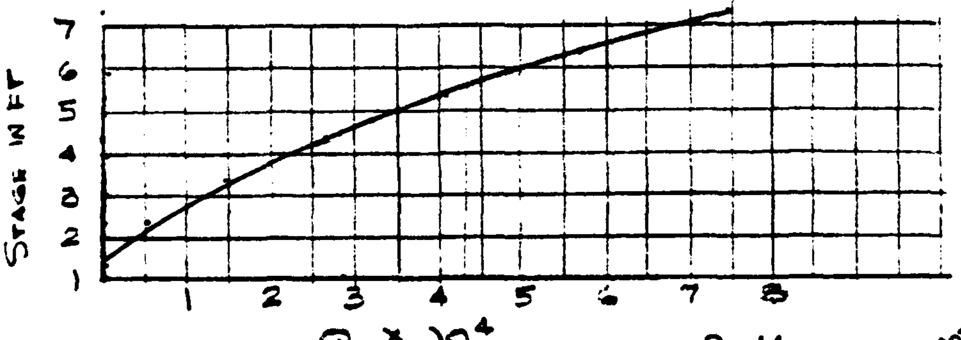
FIND RATING CURVE LOWER DAM

L = 400' + 1500 = 1900'

1.3'

400' | 32' | 1500'

H	C	L	Q	C	L	Q	Q_T
1.3	3.2	32	152	2.6	1900	0	150
1.8	"	"	247	"	"	1775	2020
2.3	"	"	357	"	"	4940	5330
3.3	"	"	614	"	"	13972	14590
4.3	"	"	913	"	"	25669	26,590
5.3	"	"	1249	"	"	39520	40,770
6.3	"	"	1619	"	"	55230	56,850
7.3	"	"	2020	"	"	72602	74,620



BY RFB DATE 6-2-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF 8
CHKD. BY ______ DATE ______ INSPECTION OF DAMS PROJECT W-
SUBJECT GREAT POND DOWNSTREAM ANALYSIS

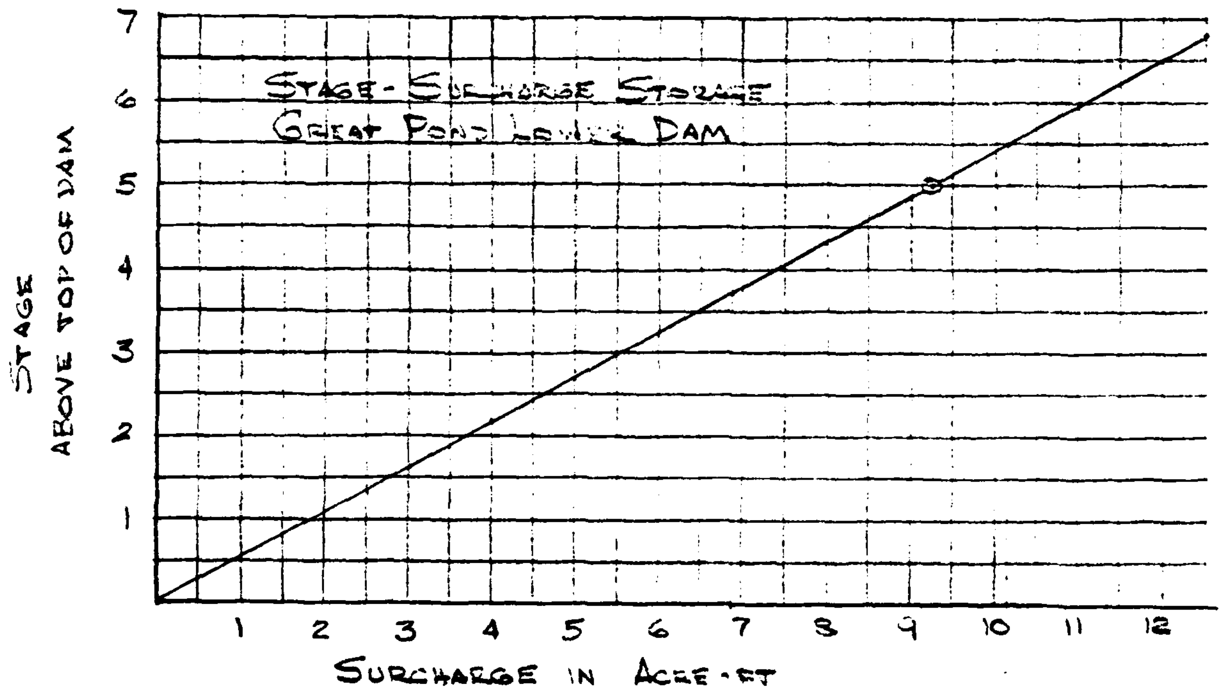
FIND STORAGE IN LOWER POND

ASSUME LEVEL OF POND IS AT TOP OF DAM WHEN UPPER POND FAILS.

SURFACE AREA = 202 (.93) = 155 ACRES (ELEV 125)

SAY SURFACE @ TOP OF DAM = 185 ACRES
" " " 5 FT ABOVE DAM = 185 ACRES

SURCHARGE VOL = 185 (5) = 925 ACRE-FT



Q_{P2} (TRIAL) = $Q_{P1} \left(1 - \frac{V_1}{S}\right)$

Q_{P2} (TRIAL) = $64{,}900 \left(1 - \frac{1020}{2240}\right)$

Q_{P2} (TRIAL) = 35,350 CFS

FOR Q = 35,250 [illegible], STAGE = 5.0, HEIGHT OVER DAM = 3.7

$V_2 = 680$ ACRE-FT $V_{AVE} = \frac{680+1020}{2} = 850$

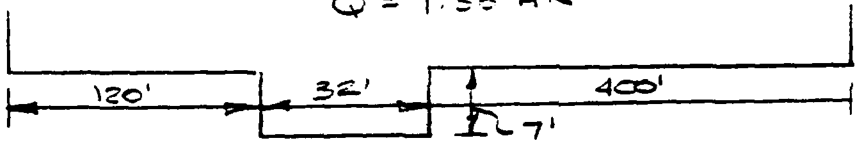
$Q_{P2} = 64{,}900 \left(1 - \frac{850}{2240}\right) = 40{,}272$ CFS

STA 38+00
Q_{P2} = 40,300 CFS, STAGE OVERTOP OF LOWER DAM IS 4.3 FT.

REACH FROM LOWER DAM TO REAR OF SHOPPING CENTER

$n = 0.045$ $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $S = \frac{10}{6000}$

$Q = 1.35\, A R^{2/3}$ $S^{1/2} = 0.0408$



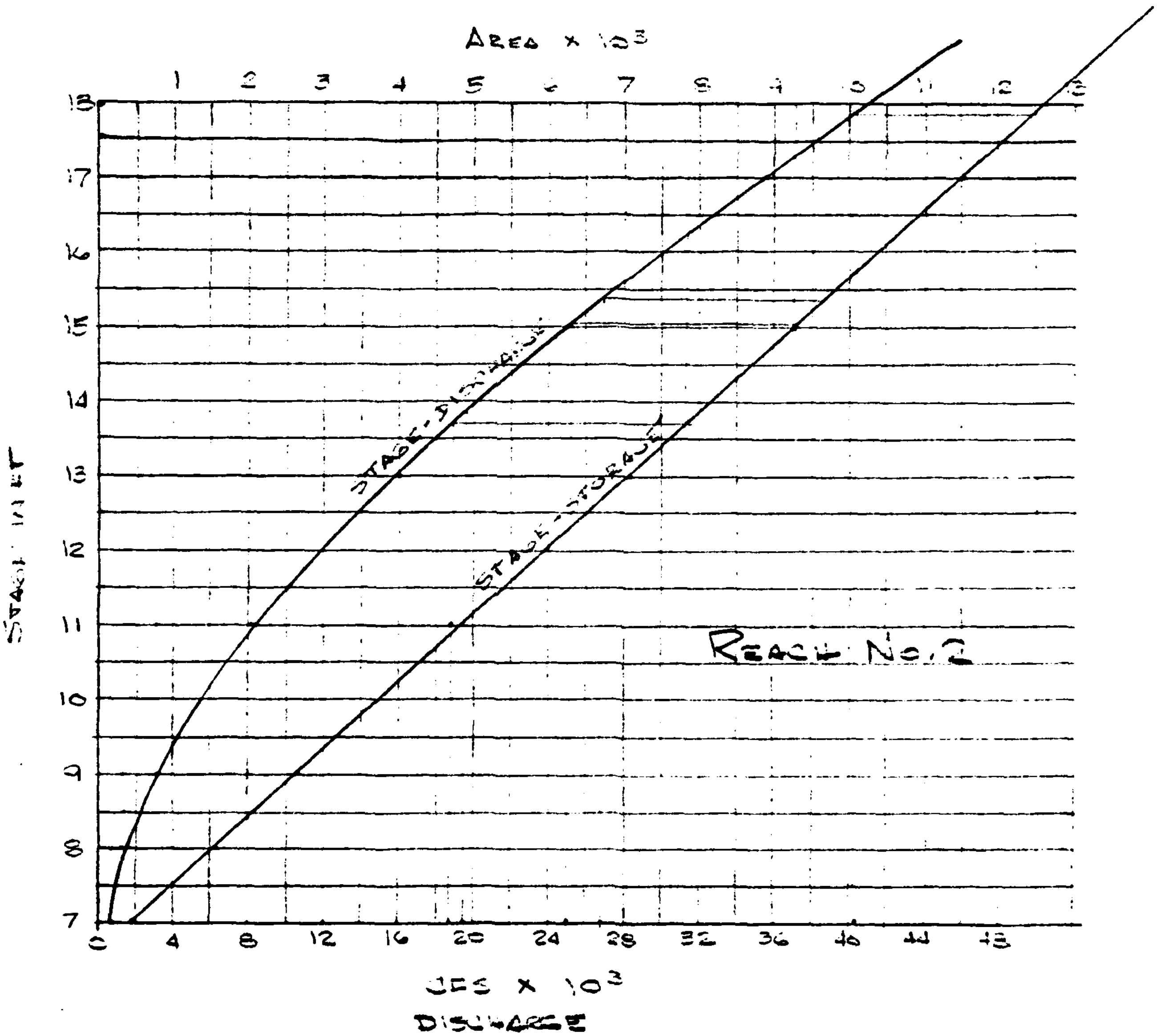
d	A	P	R	$R^{2/3}$	Q
7	224	46	4.87	2.87	868
8	776	566	1.37	1.23	1288
9	1328	570	2.33	1.76	3,155
11	2352	574	4.10	2.56	8126
13	3536	578	6.12	3.35	15992
15	4640	582	7.97	3.99	24,993
17	5744	584	9.83	4.59	35,600

NOTE: STORAGE FOR ABOVE IS AT LEAST TWICE AS GREAT AS FOR SECTION SHOWN SO DOUBLE AREAS. THIS IS AN ASSUMED AMOUNT OF STORAGE DUE TO THE IRREGULAR SECTIONS BETWEEN THE LOWER DAM AND THIS SECTION.

BY [illegible] DATE [illegible] **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 4 OF 8

CHKD. BY ______ DATE ______ [illegible] PROJECT [illegible]

SUBJECT [illegible]



BY RFB DATE 6-2-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 5 OF 8
CHKD. BY ______ DATE ______ Inspection of Dams PROJECT N-96
SUBJECT Great Pond Downstream Analysis

For Q = 40,300 , d = 17.8 , A = 12450

$V_1 = \frac{12450 \times 6000}{43,560} = 1714 > \frac{1}{2} S$

Use ½ reach, same section (Ridge to Arena)

$Q_{p_1}(\text{trial}) = 40,300 \left(1 - \frac{V}{S}\right)$

$Q_{p_1}(\text{trial}) = 40,300 \left(1 - \frac{857}{2240}\right) = 24,880$

For Q = 24,880 , d = 15.1 , A = 9300

$V_1 = \frac{9300 \times 3000}{43,560} = 640$ Acre-ft

$V_{AVE} = \frac{640 + 857}{2} = 748$

$Q_{P_2} = 40,300 \left(1 - \frac{748}{2240}\right) = 26,800$ CFS

For Q = 26,800 CFS, d = 15.4

STA 68+00

Depth of flooding @ Ridge Arena estimated @
15.4 − 7 = 8.4 FT − 3.5 = 4.9 FT
7' = ΔElev to top of bank, 3.5 = ΔElev. top of bank to Arena

For Q = 26,800 , d = 15.4 , A = 9650 FT

$V_1 = \frac{9650 (3000)}{43,560} = 664$ Acre-ft

$Q_{p_1}(\text{trial}) = 26,800 \left(1 - \frac{664}{2240}\right) = 18,855$ CFS

For Q = 18,855 , d = 13.7 , A = 7850 sq ft

$V_1 = \frac{7850 (3000)}{43,560} = 541$ Acre-ft

$V_{AVE} = \frac{664 + 551}{2} = 608$

$Q_{P_2} = 26,800 \left(1 - \frac{608}{2240}\right) = 19,525$ CFS

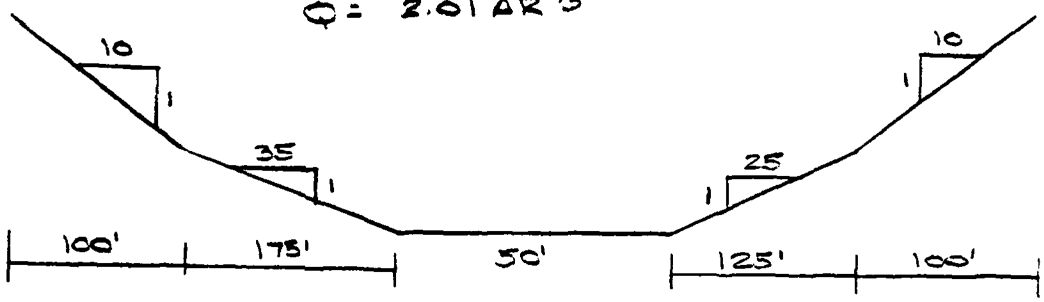
FOR Q = 19,500, d = 13.8 ft,
STA 98+00
DEPTH OF FLOODING AT SHOPPING CENTER = 7 FT

STA 98+00 TO STA 142+00

$n = .045$ $\quad Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $\quad S = \frac{10}{2700} = .0037$

$S^{1/2} = .061$

$Q = 2.01 A R^{2/3}$

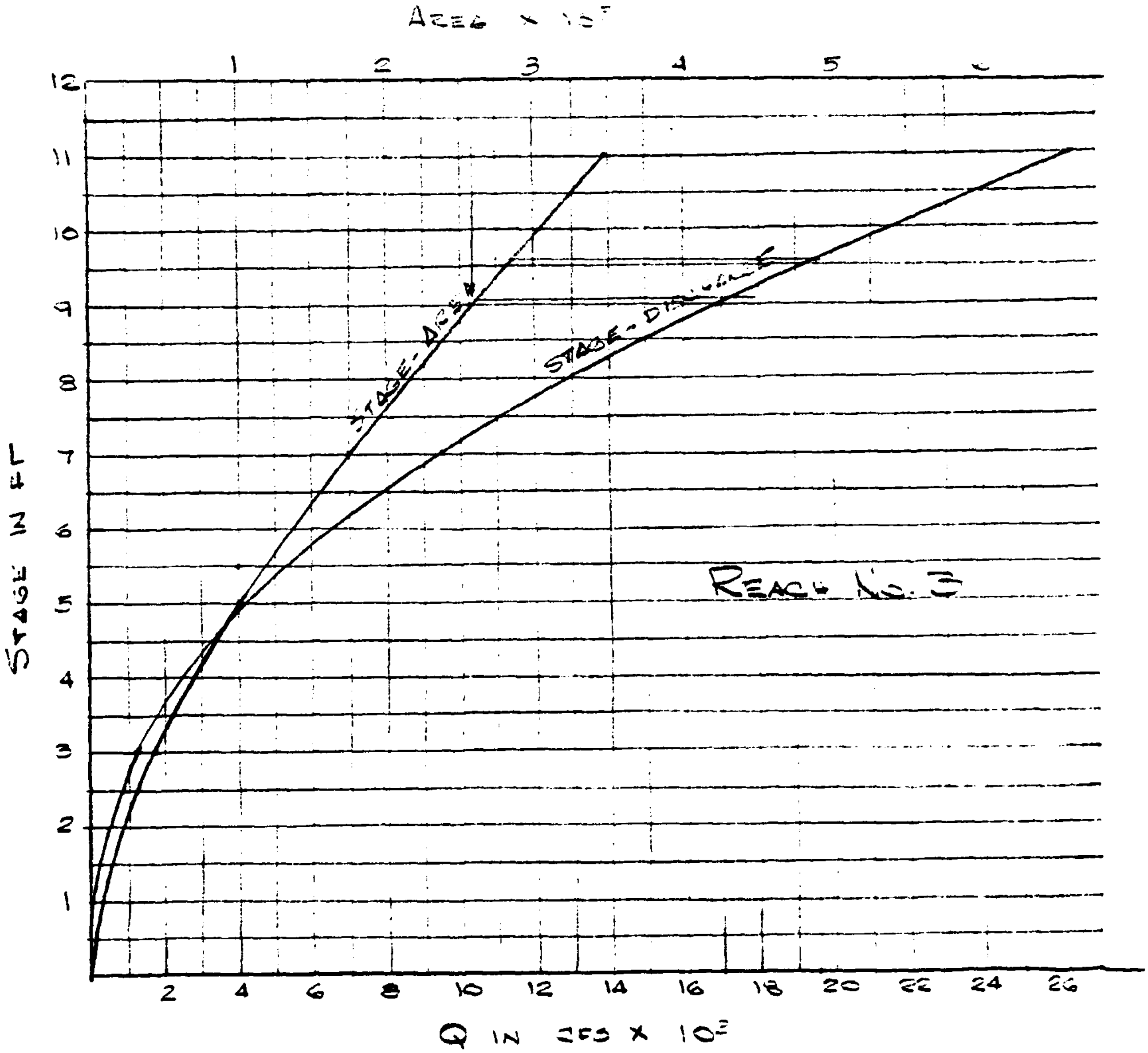


d	A	P	R	$R^{2/3}$	Q
3	420	230	1.83	1.49	1257
5	1000	350.1	2.86	2.01	4040
7	1740	390.3	4.46	2.71	9478
9	2560	430.5	5.95	3.28	16877
11	3460	470.7	7.35	3.78	26,288
13	4440	510.9	8.69	4.23	
15	5500	551.1	9.98	4.64	

BY RFB DATE 6-2-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 7 OF 8

CHKD. BY ______ DATE ______ Inspection of Dams PROJECT ______

SUBJECT ______ Downstream Analysis



FOR Q = 19,500 , STAGE = 9.6' , AREA = 2820

$$V_1 = \frac{2820 \times 4400}{43{,}560} = 285 \text{ ACRE-FT}$$

$$Q_{P2}\,(\text{TRIAL}) = 19{,}500\left(1 - \frac{285}{2240}\right)$$

$$Q_{P2}\,(\text{TRIAL}) = 17{,}020 \text{ CFS}$$

FOR $Q = 17{,}020$, STAGE 9.0 FT, AREA = 2600

$$V_2 = \frac{2600 \times 4400}{43{,}560} = 263 \text{ ACRE-FT}$$

$$V_{AVE} = \frac{263 + 285}{2} = 274 \text{ ACRE-FT}$$

$$Q_{P2} = 19{,}500\left(1 - \frac{274}{2240}\right) = 17{,}100 \text{ CFS}$$

STA 142+00, $Q = 17{,}100$ CFS, STAGE = 9.1
FOR $Q_S = 330$, $H \cong 2.1$ $\Delta H \cong 7$

LOW LEVEL OUTLET DISCHARGE:

$$Q = A\sqrt{\frac{2gH}{\Sigma K}}$$

$$\Sigma K = 0.5 + 1.0 + \frac{fL}{D}$$

$\Delta H \cong 10$

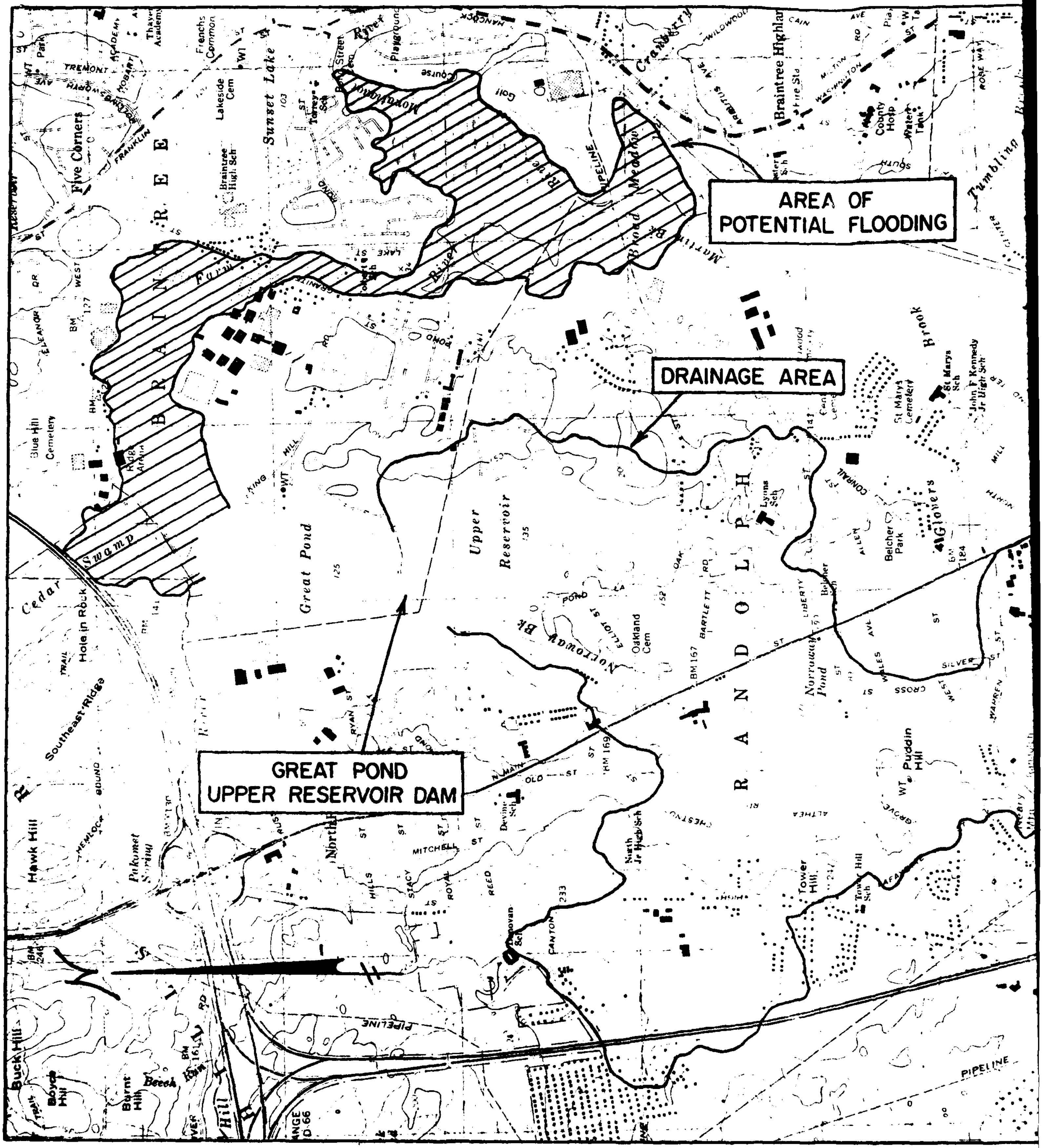
$L \cong 90$, $D = 2'$, $f = .029$

$$\frac{fL}{D} = \frac{.029(90)}{2} = 1.31$$

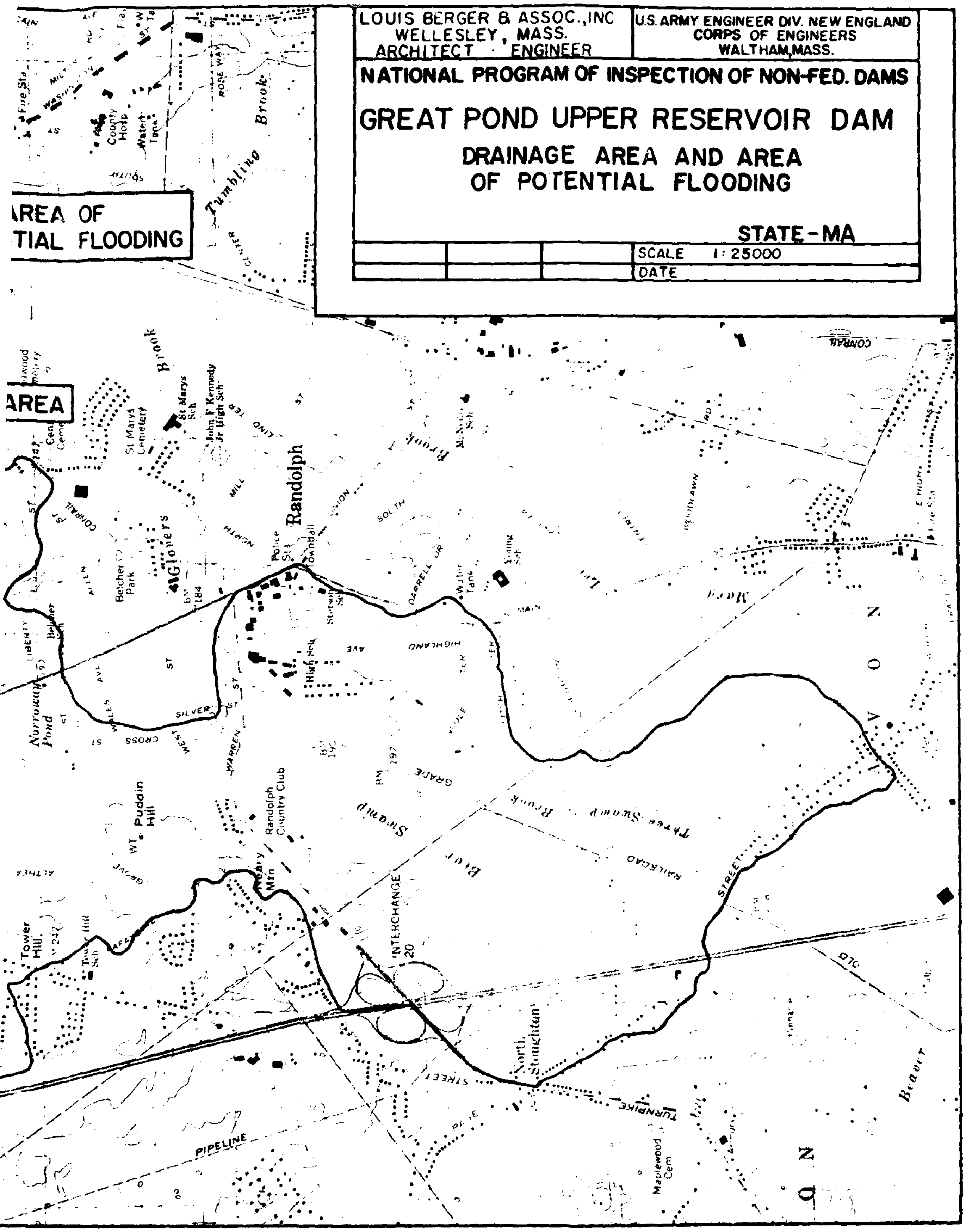
$$\Sigma K \cong 2.8$$

$$Q = \frac{\pi d^2}{4}\sqrt{\frac{64.4}{2.8}(10)}$$

$Q = 48$ CFS @ TOP OF DAM



AREA OF POTENTIAL FLOODING
DRAINAGE AREA
GREAT POND UPPER RESERVOIR DAM
Great Pond
Upper Reservoir
Five Corners
Sunset Lake
Braintree High Sch
Lakeside Cem
Blue Hill Cemetery
Cedar Swamp
Farm River
Broad Meadow
Cranberry
Braintree Highlands
County Hosp
Tumbling Brook
Hole in Rock
Southeast Ridge
Hawk Hill
Pakumet Swamp
Buck Hill
Boyce Hill
Burnt Hill
Beech Hill
Oakland Cem
Norroway Pond
Belcher Park
Glovers Brook
St Marys Cemetery
John F Kennedy Jr High Sch
Puddin Hill
Tower Hill
Devine Sch
Donovan Sch
Lyons Sch
North Jr High Sch
R A N D O L P H
PIPELINE


LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS.
ARCHITECT · ENGINEER
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
GREAT POND UPPER RESERVOIR DAM
DRAINAGE AREA AND AREA
OF POTENTIAL FLOODING
STATE-MA
SCALE 1:25000
DATE
AREA OF
TIAL FLOODING
AREA
Randolph
Tumbling Brook
Brook
St Marys Cemetery
St Marys Sch
John F Kennedy Jr High Sch
County Hosp
Water Tank
Police Sta
Townhall
Belcher Park
Glovers
High Sch
Stetson Sch
Water Tank
Young Sch
Narrows Pond
Puddin Hill
Randolph Country Club
Tower Hill
Three Swamp Brook
INTERCHANGE 20
North Stoughton
Maplewood Cem
PIPELINE
CONRAIL
HIGHLAND AVE
SILVER ST
CROSS ST
GRADE
RAILROAD
STREET
TURNPIKE
OLD
Beaver

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
MA	823	NED	MA	021	11				GREAT POND UPPER RESERVOIR DAM	4211.7	7102.8	18APR80

POPULAR NAME	NAME OF IMPOUNDMENT
UPPER RESERVOIR	GREAT POND UPPER RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	09	NORROWAY BROOK	BRAINTREE	0	56800

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1940	S	24	18	2250	1750	NED	N	N	N	N	

REMARKS
22-ESTIMATED

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	2270	U	30	330	42000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF BRAINTREE, MA.	WESTON + SAMPSON, ENGNRS	

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOC INC	18APR80	PL92-367

REMARKS

END

DATE FILMED

8-85

DTIC