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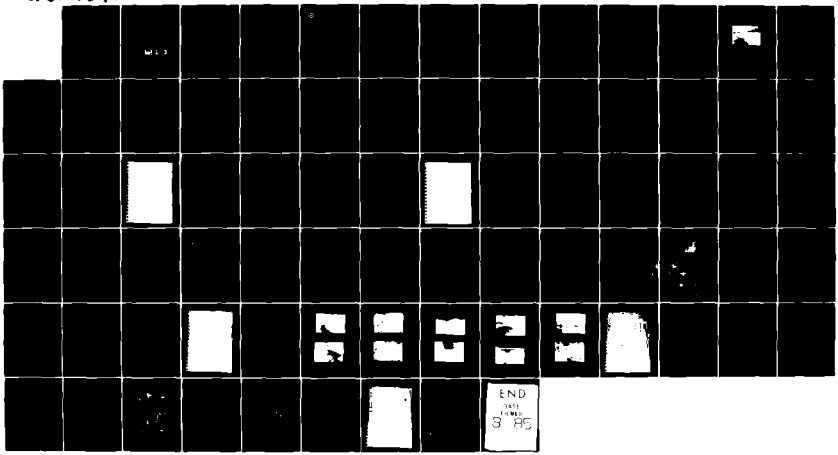

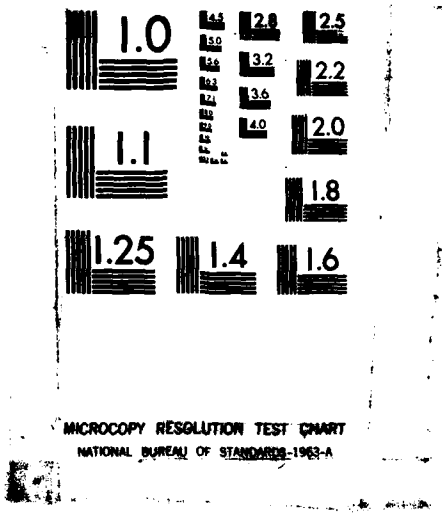
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MASSACHUSETTS—RHODE ISLAND COASTAL BASIN
BRAINTREE, MASSACHUSETTS

AD-A155 499

OLD QUINCY RESERVOIR DAM
MA 00827

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

NOVEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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

DAMS, INSPECTION, DAM SAFETY,

Massachusetts-Rhode Island Coastal River Basin
Braintree Massachusetts
Town Brook

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

The dam is an earth embankment with a masonry core wall. It is about 550 ft. long and has a maximum height of 37 ft. The facility is considered to be in poor condition. It is small in size with a hazard potential of high. Investigations are recommended to determine the effect of the downstream seepage on the dam.

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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REPLY TO
ATTENTION OF
NEDED

JAN 17 1980

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Old Quincy 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 Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, city of Quincy, Massachusetts.

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 Quality Engineering for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

OLD QUINCY RESERVOIR
MA 00827

MASSACHUSETTS-RHODE ISLAND COASTAL BASIN
BRAINTREE, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00827
Name of Dam: OLD QUINCY RESERVOIR
Town: BRAINTREE
County and State: NORFOLK COUNTY, MA
Stream: TOWN BROOK
Date of Inspection: 10 September 1979

BRIEF ASSESSMENT

Old Quincy Reservoir Dam was constructed in 1888. The dam is an earth embankment with a masonry core wall. The dam is approximately 550 feet long and has a maximum height of 37 feet. The stone masonry channel at the right abutment forms the spillway. The outlet works for this facility consists of a stone masonry intake structure within the reservoir and two 20 inch pipes passing underneath the dam and valved at both ends.

The facility is considered in poor condition. Seepage was observed immediately downstream of the toe of the dam. The downstream face of the dam contains stumps, trees and eroded areas.

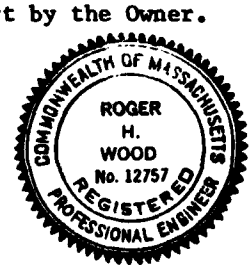
Based on the size classification, small, and hazard potential classification, high, in accordance with Corps of Engineers Guidelines, the spillway test flood is the Probable Maximum Flood (PMF). Hydrologic analysis indicates that the routed test flood outflow would be 2,120 cfs at a water surface elevation of 84.10. Due to the irregularities at the crest of the shoreline, the dam would not be overtopped at the test flood stage, but only 400 cfs would be discharged through the spillway while the remaining 1,720 cfs would overflow the northern shoreline of the reservoir. This overbank flow would cause flooding in developed areas.

Investigations are recommended to determine the effect of the downstream seepage on the dam, the seismic stability of the embankment, the necessary rehabilitation of embankment surfaces and the needs of increasing the discharge capabilities and regrading the reservoir banks to minimize the potential for future downstream flooding. Recommended remedial measures include the clearing of brush and trees from the spillway, the repairing of stone masonry walls and channels, the restoring of the 6 inch drain line to an operating condition and the establishing of provisions for emergency closure of pipelines at the gatehouse. The Owner should develop a formal maintenance program, operational procedure, and an emergency procedures plan and should institute a program of annual technical inspections. The remedial measures and recommendations should be performed within one year of receipt of this report by the Owner.

CAMP DRESSER & McKEE INC.

Roger H. Wood

Roger H. Wood
Vice President



This Phase I Inspection Report on Old Quincy 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 judgement and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials 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 Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction 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.

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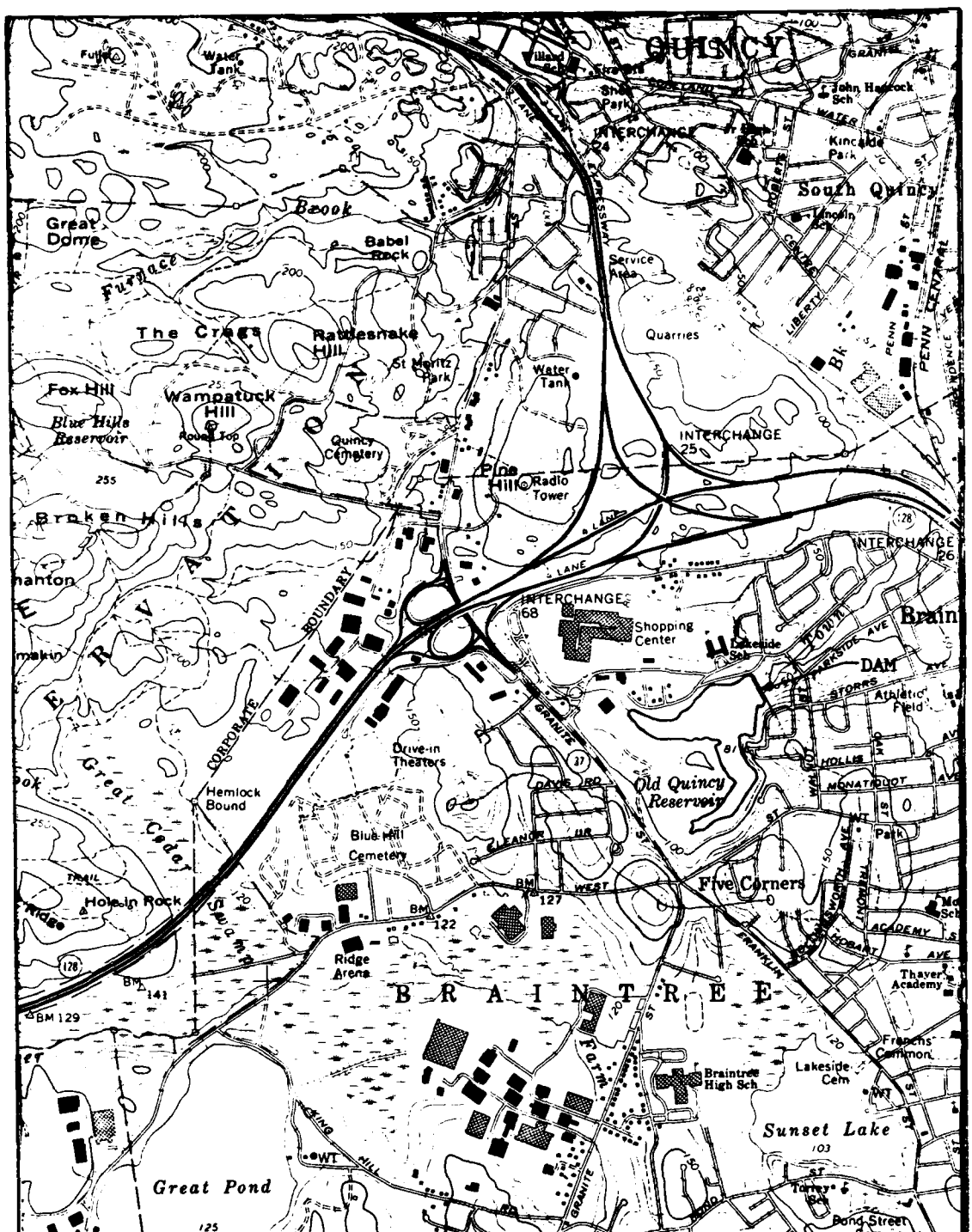
1. OVERVIEW OF DAM FROM LEFT ABUTMENT.



DAM OLD QUINCY RESERVOIR

IDENTIFICATION NO. MA 00827

LOCATION MAP
USGS QUADRANGLE

BLUE HILLS, MASS

APPROX. SCALE: 1" = 2000'

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

OLD QUINCY RESERVOIR DAM

MA 00827

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, 8 August 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.

Camp Dresser & McKee 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 Camp Dresser & McKee Inc. under a letter of 27 March 1979, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-79-C-0053 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

b. Purpose - The primary purpose of the investigation is to:

(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 - Old Quincy Reservoir Dam is located on the west side of Walnut Street between Howie Road and Parkside Avenue in the Town of Braintree, Massachusetts, as shown on the report's Location Map. The dam impounds waters of Town Brook to form Old Quincy Reservoir. Discharges from the dam are conveyed by Town Brook to Boston Harbor, a distance of approximately 3.6 miles. The coordinates for the dam are 71 degrees - 01.0 minutes longitude and 42 degrees - 13.2 minutes latitude.

b. Description of Dam And Appurtenances - Old Quincy Reservoir Dam consists of an earth embankment with a masonry core wall, a gatehouse and outlet pipes near the center of the dam and an overflow spillway channel at the right abutment. The general layout of the dam and appurtenances is shown on the plan of dam included in Appendix B.

The embankment is approximately 550 feet long, with a maximum height of about 37 feet and a present crest width of approximately 15 feet. The present crest width is the result of erosion from the original crest width of 20 feet. Side slopes are approximately 2H to 1V both upstream and downstream. The upstream slope is paved with large flat stones, about 2 feet thick.

Embankment materials consist primarily of sand and gravel which were placed in layers and rolled. The core wall is 7 to 10 feet thick at its lowest elevation and tapers to about 2.5 feet thick at the top. The wall is primarily of stone masonry construction. However, about 2/3 of the upper 15 feet of wall is concrete. The right half of the wall is founded on compact granular foundation materials. The left half of the wall extends downward to the top of a concrete wall which was cast within a sheeted trench. A detailed description of the embankment and its construction is included in an article in the Journal of New England Waterworks Association, Volume 3, Sept. 1888 to June 1889 by Mr. L. A. Taylor, CE, Boston, MA entitled "The Quincy Dam". In addition, Appendix B includes subsurface data obtained during a recent study of this facility.

The spillway is formed by a cut stone masonry channel approximately 25 feet wide and 5 feet high near the right abutment of the dam. The invert of the channel is paved with large field stones. The weir is formed by a cut stone sill projecting slightly above the invert. Joints in the stone masonry walls have been mortared. Just downstream of the dam, the channel transitions into a trapezodial fieldstone paved channel which forms a chute to carry the water down the natural slope to the stream below.

The intake structure for the outlet works is a stone masonry tower constructed at the upstream toe of the dam and extending upward to the crest elevation of the dam. Originally a gatehouse was on top of this structure and a bridge extended from the structure to the dam. Both the gatehouse and bridge are no longer in existence and the stone masonry tower is covered with a steel plate. Two 20 inch pipelines and one 6 inch pipeline leave this tower and extended through the dam to the downstream toe. Each of the pipelines is gated at the tower (a 1956 plan shows a 10 inch valve on the 6 inch pipeline). The pipelines pass through grouted stone masonry cut-off walls and the main core wall of the dam. The location of the outlet for the 6 inch pipe is unknown. One of the 20 inch pipelines is gated at the

downstream toe of the dam and terminated. The other 20 inch pipeline has a 20 x 20 x 12 inch tee leading to a 12 inch blowoff and a 20 x 12 inch reducer. The reducer is followed by a gate valve which controls the 12 inch water supply line serving the General Dynamics Shipyard.

c. Size Classification - The height of the dam is approximately 37 feet and the estimated storage capacity is 794 acre-feet at the top of the dam. According to the Guidelines established by the Corps of Engineers, the dam is classified in the small category based both on the height and storage capacity.

d. Hazard Classification - The results of the dam failure analysis indicates that a flood wave resulting from the failure of the dam embankment would destroy many residential homes downstream of the dam along Town Brook. In that the potential loss of life would be more than a few, the dam is classified in the "high" hazard category.

e. Ownership - The dam is owned by the City of Quincy, Massachusetts. The owner is represented by Mr. Owen J. Eaton, Superintendent - Water Division, 55 Sea Street, Quincy, MA 02169. (Phone 617/773-1380 extension 217.)

f. Operator - Mr. Owen J. Eaton, Superintendent - Water Division, 55 Sea Street, Quincy, MA 02169, (Phone 617/773-1380 extension 217), has the responsibility for the operation of the dam.

g. Purpose of the Dam - Old Quincy Reservoir Dam was originally constructed for a water supply to the City of Quincy, Massachusetts. It is now used to supply industrial water to the General Dynamics shipyard and to provide a degree of flood protection to the area along Town Brook.

h. Design and Construction History - The dam was constructed during 1887 and 1888 for the Quincy Water Company. The designer was Mr. L. A. Taylor, Civil Engineer, Boston, MA. No major modifications to the facilities are known to have taken place. Observation of the facility indicates that the bridge to the gatehouse and the superstructure of the gatehouse have been removed since the original construction. A feasibility study was prepared for the Metropolitan District Commission in March, 1978, detailing flood control systems for Town Brook. Major modifications to Old Quincy Reservoir Dam and appurtenances are presently under investigation by Metcalf & Eddy Engineers, Boston, MA.

i. Normal Operational Procedures - The dam is visited a minimum of once a week for observation of the water level. Additional visits are made during prolonged periods of rainfall. Gates at the downstream end of the outlet pipe are adjusted to provide flood protection to the downstream residences and to control the flow of water to the General Dynamics Shipyard. Maintenance to the facility is performed on an as-needed basis. There is no written procedure for the operation of the dam.

1.3 Pertinent Data - The USGS Quadrangel: Blue Hills, MA, 1971 indicates a reservoir water surface elevation of 81. Recent studies of the dam indicate spillway crest elevation is elevation 80.87, National Geodetic Vertical Datum (NGVD), formerly referred to as Mean Sea Level. Elevations contained in this report are based on this spillway crest elevation and survey information obtained during the recent studies rather than the local datum used on the original design plans.

a. Drainage Area - The drainage area tributary to the dam site is 1.44 square miles. The southerly portion of the drainage area is rolling terrain which has been heavily developed with residential dwellings. The center portion of the drainage area has been developed with commercial buildings including a shopping center and Interstate Highway interchange. The northerly end of the drainage area, which is furthest away from the dam, is forested rolling hills which are part of the Blue Hills Reservation.

b. Discharge at Dam Site - There are no records of discharges at the dam site.

(1) Outlet works size: one 20-inch reservoir drain and one 20-inch supply line with a 12 inch blowoff. Estimated capacity at spillway crest is 100 cfs.

(2) Maximum known flood at damsite...Unknown

(3) Ungated spillway capacity at top of dam:

460 cfs @ 84.4 elev.

(4) Ungated spillway capacity at test flood elevation:

400 cfs @ 84.1 elev.

(5) Gated spillway capacity at normal pool elevation...N/A

(6) Gated spillway capacity at test flood elevation...N/A

(7) Total spillway capacity at test flood elevation:

400 cfs @ 84.1 elev.

(8) Total project discharge at test flood elevation:

2,120 cfs @ 84.1 elev.

c. Elevation (ft. above NGVD)

(1) Streambed at centerline of dam 47.5

(2) Test flood tailwater ..... below spillway crest

(3) Upstream portal invert diversion tunnel ..... N/A

(4) Normal pool 75.0

(5) Flood protection pool 80.9

(6) Spillway crest 80.9

(7) Design surcharge (Original Design) ..... Unknown

(8) Top of dam 84.4

(9) Test flood surcharge 84.1

d. Reservoir

(1) Length of test flood pool ..... 2600 ft.

(2) Length of normal pool ..... 2000 ft.

(3) Length of flood protection pool .....2200 ft.

e. Storage (acre-feet)

(1) Normal pool 300

(2) Flood protection pool 552

(3) Spillway crest pool 552

(4) Top of dam 794

(5) Test flood pool 772

f. Reservoir Surface (acres)

(1) Normal pool 34

(2) Flood protection pool 36

(3) Spillway crest 36

(4) Test flood pool 59

(5) Top of dam 61

g. Dam

(1) Type ..... Earth Embankment

(2) Length ..... 550 ft.

(3) Height ..... 37 ft.

(4) Top width ..... 15 ft. (Approx.)

(5) Side slopes ..... 2H:1V U/S & D/S

(6) Zoning ..... None

(7) Impervious Core ..... Stone Masonry and Concrete Core Wall

(8) Cutoff ..... Partial (see App. B)

(9) Grout Curtain ..... None

h. Diversion and Regulating Tunnel ..... None

i. Spillway

(1) Type ..... Stone Masonry Broad crested

(2) Length of weir ..... 25 ft.

(3) Crest elevation 80.9

(4) Gates ..... None

(5) U/S Channel ..... Old Quincy Reservoir

(6) D/S Channel ..... Stone Paved Trapezodial Chute

j. Regulating Outlets

There are three pipelines (two 20 in. and one 6 in.) leaving the intake tower and passing through the dam. The two 20 in. pipelines are gated both at the upstream and downstream toes of the dam. The 6 in. pipeline is gated at the upstream toe of the dam (1956 plans called for a 10 inch valve on this line). Estimated invert elevation of all lines is elevation 51.9. The outlet for the 6 inch pipe could not be located. This line was the drain line for the intake chamber and it is not operable at the present time. One of the 20 inch pipelines terminates at a gate valve at the downstream toe of the dam. The other 20 inch pipeline is teed at the downstream toe with gates on both branches. Each of the branches are 12 inch pipes, one going to the General Dynamics Shipyard and the other serving as a blowoff pipe.

SECTION 2: ENGINEERING DATA

2.1 Design Records - Design records in the form of a contract plan and specifications were located. The plan gives the general features of the facility but does not go into detail. The specifications are a hand written document which states the general features of construction but refers to the engineer for specific details.

2.2 Construction Records - The only record of the construction that was located was an article entitled "The Quincy Dam" written by Mr. L. A. Taylor, the design engineer, and published in the Journal of the New England Waterworks Association, Volume 3, September 1888 to June 1889. Mr. Taylor describes the construction of the dam and problems associated with it in the article. The article also contains several plans which appear to be as-built drawings.

2.3 Operational Records - No operational records other than County and State Inspection Reports were located.

2.4 Evaluation

a. Availability - The article entitled "The Quincy Dam" was located at the Massachusetts Institute of Technology library. Other documents described above are available at the City Engineer's Office, City of Quincy, Massachusetts.

b. Validity - The general configuration of the dam and spillway as shown on the design plans and in the article entitled "The Quincy Dam" are in good agreement with the configuration observed in the field. Only the superstructure at the gatehouse and the bridge from the dam to the gatehouse were missing from the facility, and they are believed to have been removed since the original construction.

c. Adequacy - The available data in combination with the visual inspection described in the following section is adequate for the purposes of the Phase I Investigation.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual examination of Old Quincy Reservoir Dam was conducted on 10 September 1979.

In general, the earthen embankment was observed to be in poor condition. The spillway and outlet works were observed to be in better condition but still require some remedial work. The reservoir level at the time of site examination was approximately 8 feet below the spillway weir crest.

Visual inspection checklists are included in Appendix A and selected photographs are given in Appendix C. Prior inspection reports are included in Appendix B.

b. Dam - The dam is considered to be in poor condition, based primarily on the observed condition of the embankment. The following specific items pertaining to the dam and spillway were noted during the site examination:

(1) The upstream face has a growth of weeds, brush and small trees, as shown in Photos 1 thru 4. There has been significant settling and displacement of stone paving along the slope between the gatehouse and the right abutment, as shown in Photo 4. Stones are locally displaced at other places along the slope.

(2) The crest has no vegetation and is rutted as shown in Photo 3.

(3) The downstream slope has a thick growth of weeds and brush, with large stumps and isolated bare spots, as shown in Photos 5 and 6. Some large trees remain on the slope near the abutments. There are several eroded areas on the slope, the worst of which extends from toe to crest, near the center of the dam as shown in Photo 6.

(4) There is a swampy area beginning about 50 feet below the toe on the left side of the embankment. Some standing water was noted in this area, but no evidence of flow or soil movement was noted. Also, slight seepage and iron staining was noted near the end of the 20 inch discharge pipe. No evidence of soil movement was apparent. It should be noted that these observations relative to the evidence of seepage were made at a time when the reservoir was relativey low.

(5) Minor growth of weeds and brush are present in the spillway as shown in Photos 7 and 8.

(6) The cut stone masonry sidewalls of the spillway are in need of repointing with mortar.

(7) The left wall near the end of the spillway, as shown in Photo 8, has been removed for the soil boring operations taking place at the dam site during the time of the inspection.

(8) The paved trapezodial discharge chute has areas covered with soil and is overgrown with weeds, brush and trees.

c. Appurtenant Structures - The outlet works intake tower is covered with a loose steel plate as shown in Photo 9. The tower's stone masonry has lost mortar from the exterior joints. The 6 inch drain line from the tower is inoperative. With the exception of the 6 inch pipeline outlet, which could not be located, the outlet ends of the pipelines from the intake tower appear to be in satisfactory condition. Scour, as shown in Photo 10, has taken place where these pipes discharge into Town Brook.

d. Reservoir Area - The area around the reservoir is heavily developed. Residential development is present at the east and south sides of the reservoir. A main thoroughfare runs along the west side of the reservoir while a shopping center is present just to the north of the reservoir. The terrain immediately adjacent to the north and west sides of the reservoir shoreline is relatively flat, portions of which are lower than the top of dam. Immediately adjacent to the south and easterly shoreline is a developed hillside.

No significant potential for landslides into the Pond which would create waves which might overtop the dam were observed. No conditions were noted that would result in a sudden increase of sediment load into the pond.

e. Downstream Channel - Town Brook, which flows from Old Quincy Reservoir to the Atlantic Ocean, has a relatively flat gradient. Water from the spillway is carried in a stone paved trapezoidal chute down the natural side slope of the valley until it is discharged into Town Brook. The Brook remains in a natural channel for approximately 400 feet to where it passes under a roadway and a residential house lot in a 36 in. culvert. The discharge end of this culvert is shown in Photo 11. The brook flows through the downstream communities of Braintree, South Quincy and Quincy through a series of open channels, culverts and conduits as it passes beneath various roads and developed areas.

3.2 Evaluation - The dam is considered to be in poor condition due primarily to lack of maintenance. The observed evidence of seepage is not considered serious at this time. However, changes in the pattern or quantity of seepage which may occur with time or with higher reservoir levels could be important in respect to embankment performance. While the spillway and outlet works are in better condition, they still require remedial work to return them to a satisfactory condition.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - In general, there is no written procedure for the operation of the dam. It was reported that the reservoir water level is lowered in anticipation of heavy runoff for the purpose of flood control.

4.2 Maintenance of the Dam - While trees were being cut on the downstream face of the dam during the visual inspection, the size of the trees and the presence of a heavy growth of brush indicates that little maintenance has been performed at this facility. There is no written formal procedure for maintenance of the dam.

4.3 Maintenance of Operating Facilities - The dam is visited weekly for observation of the water level with additional inspections during prolonged periods of rainfall. The gates at the downstream end of the outlet pipes are adjusted to control the water being furnished to General Dynamics shipyard and to control the release of water from the dam to provide a degree of flood protection for the area adjacent to Town Brook.

4.4 Description of any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation - Formal operational procedures, maintenance programs, warning system and emergency preparedness plan should be established for this dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General - Old Quincy Reservoir Dam is a 90 year old earth dam 550 feet in length with a spillway located at the right abutment of the dam. The spillway consists of a cut stone masonry channel approximately 25 feet wide and 5 feet high at the abutments. The reservoir is used as a water supply for the General Dynamics Shipyard and provides a degree of flood protection to the urbanized area located downstream along Town Brook. The pond has a water surface area of approximately 36 acres and a storage of 552 acre-feet at spillway crest elevation. The design freeboard between the spillway crest and top of dam was 5 ft. However, the existing dam crest varies, with three low points approximately 3.6 feet above spillway crest. Furthermore, portions of the northwest shoreline of the reservoir are lower than the top of dam beginning at the left abutment and extending some 1500 feet to the west. Portions of the shoreline are only 1.5 to 2.0 feet above the spillway crest.

b. Design Data - There is no hydraulic/hydrologic design data available for the dam, except for a reservoir stage-storage relationship chart. It is of interest to note, however, that the previously referenced article entitled "The Quincy Dam" by the design engineer, L.A. Taylor, presented in June, 1889 states: "The watershed above the dam is just 1000 acres and is a good one, in that it is sparsely settled and probably always will be so, there being very little tillage land, and that mostly of a very poor quality." Development within the watershed has certainly changed since that time, having a direct effect on the runoff characteristics of the drainage area.

c. Experience Data - The greatest flood of record occurred during August 17-19, 1955 with a total recorded rainfall of 13.76 inches in the Blue Hills and 12.47 inches in Boston. The 18-hour rainfall depth for the Town Brook watershed was 7.02 inches. There are no records or estimates of discharge at the damsite but it is known that the reservoir overflowed its north bank into Lakeside Drive causing significant flooding before rejoining Town Brook.

   The second greatest flood of record was the March 17-18, 1968 storm which had a total recorded rainfall of 7.53 inches and 5.07 inches at Blue Hills and Boston, respectively. The 18-hour rainfall depth for the Town Brook watershed was 5.70 inches. The reported spillway discharge level was 2 feet and the estimated discharge 200 cfs.

d. Visual Observations - The visual inspection of the dam and reservoir was made on 10 September 1979. At that time, the pond was about 8 feet below spillway crest. Minor vegetation was present in the spillway channel and thick vegetation together

with small bushes were observed in the spillway approach channel. The discharge channel, downstream of the spillway, has areas covered with soil and is overgrown with weeds, brush and trees. The presence of vegetation and debris will have an adverse effect on the hydraulic capacity of the spillway.

e. Test Flood Analysis - Based on the Corps of Engineers Guidelines, the recommended test flood range for the size (small) and hazard potential (high) is the 1/2 PMF to a full PMF (Probable Maximum Flood). The PMF was adopted as the test flood and was determined using the Corps of Engineers Guidelines for "Estimated Maximum Probable Discharge" in Phase I Dam Safety Investigations together with hydrological data developed for the Town Brook watershed by E.F. Childs of the Corps of Engineers and presented in a 1970 paper entitled "Effect of Urban Expansion on Hydrologic Investigations". A peak inflow rate of 1760 csm was adopted for the 1.44 sq. mi. drainage area which results in a test flood inflow of 2,500 cfs.

Surcharge storage routing of the test flood inflow resulted in a routed test flood outflow of 2,120 cfs at a stage elevation of 84.10. At test flood stage, the dam is not overtopped, but only 400 cfs is discharged through the spillway with the remaining 1,720 cfs overflowing the northern shoreline of the reservoir.

f. Dam Failure Analysis - Based on the Corps of Engineers Guidelines for estimating Dam Failure Hydrographs, and assuming that a failure would occur along 40 percent of the mid-height length (120 feet) of the dam, the peak failure outflow is estimated to be 45,400 cfs. As a result of the dam failure, an estimate water depth of 12.5 feet would occur over Walnut Street which is located about 600 feet downstream of the dam. It is estimated that Common Street, located about 0.5 miles further downstream, would be overtopped by about 8 feet of water. Flooding of this magnitude would destroy scores of residential homes located downstream of the dam.

Based on the potential loss of life and property resulting from a failure of Old Quincy Reservoir Dam, the dam is classified in the "high" hazard category.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - There was no visible evidence of dam or spillway instability during the site examination on 10 September 1979. Evidence of seepage was noted but is not, at this time, considered to be significant with respect to embankment stability.

b. Design and Construction Data - A plan and construction specifications for the original dam construction were obtained from the owner. Also a paper describing the construction of the dam was published by L. A. Taylor, the designer, in the Journal of the New England Waterworks Association, Volume 3, September 1888 to June 1889. These documents suggest that reasonable construction methods were used in building the dam embankment.

c. Operating Records - Other than the continued existence of the embankment since construction in 1888 and State and County Inspection Reports in recent years, there are no operating records to aid in the evaluation of structural stability.

d. Post-Construction Changes - There are no known modifications which would effect structural stability. However, the Town Brook drainage system, *including Old Quincy Reservoir Dam*, is being studied at the present time. It is understood that subsurface exploration associated with the proposed modifications have been taken. Some preliminary engineering data relative to the nature of the embankment and foundations materials and of embankment seepage conditions were provided by the consultant, Metcalf & Eddy, Inc. of Boston, Massachusetts. Data appear to confirm that the embankment is composed of reasonably compact sand and gravel. Also, piezometer data from the consultant indicate that the core wall is serving to lower phreatic surface in the downstream portion of the embankment. Based on the data, it is expected that the embankment will be stable under static conditions.

e. Seismic Stability - Old Quincy Reservoir Dam is located within Seismic Zone 3 and in accordance with the Guidelines, suitable analysis relative to seismic stability should be on record. While it appears that the pertinent data needed for seismic analysis are reasonably available, no records of such studies were located. Therefore, the stability of the embankment under seismic loading is unknown.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual examination of Old Quincy Reservoir Dam and spillway revealed no evidence of instability or other conditions which would warrant urgent remedial action. However, because of the presence of erosion, trees and tree stumps on the downstream face of the dam and observed seepage at the dam, the overall condition of the project is considered to be poor.

b. Adequacy of Information - The evaluation of the dam and spillway have been based primarily on the visual examination, consideration of available records, past performance and application of engineering judgment. The information available or obtained was adequate for the purposes of the Phase I assessment. However, it is recommended that additional information relative to the seepage conditions be obtained as outlined in Section 7.2.

c. Urgency - The recommendations for additional investigations and remedial measure outlined in Section 7.2 and 7.3 respectively, should be undertaken by the Owner within one year of his receipt of this report.

d. Need for Additional Investigations - Additional investigations should be performed as outlined in Section 7.2.

7.2 Recommendations

It is recommended that the Owner arrange for the following investigations to be performed by a qualified registered professional engineer:

(1) Examine the embankment, abutments and downstream areas for evidence of seepage, including observation of piezometers, when the reservoir is at design level. Assess the significance of the observed seepage conditions with respect to long-term stability of the embankment.

(2) Determine seismic stability of the embankment.

(3) Perform a detailed hydrologic/hydraulic investigation to review the spillway adequacy and bank overflow potential for the purpose of providing adequate spillway discharge capacity. The investigation should also address regrading required of the dam crest and to minimize unintentional over-bank discharges from the reservoir.

(4) Prepare a plan for the removal of trees, brush and roots from the embankment surfaces, regrading the embankment to a uniform cross-section and establishing erosion protection of the finished surfaces. The plan should include the renewal of riprap and the filling of holes with compacted material.

The Owner should implement corrective measures as required, based on the results of the above engineering evaluations. A portion of these investigations may be accomplished by the present study of the dam by another consultant. Relevant conclusions of this present study may be implemented rather than instituting a separate investigation.

7.3 Remedial Measures

a. Operations and Maintenance Procedures - It is recommended that the following remedial measures be undertaken by the Owner to correct deficiencies noted during the visual examination.

(1) Repoint the joints in the cut stone masonry work at the outlet works intake tower and the spillway.

(2) Repair the breech in the left wall of the discharge channel downstream of the spillway.

(3) Clear the paved trapezodial discharge chute of soil overburden, brush and trees.

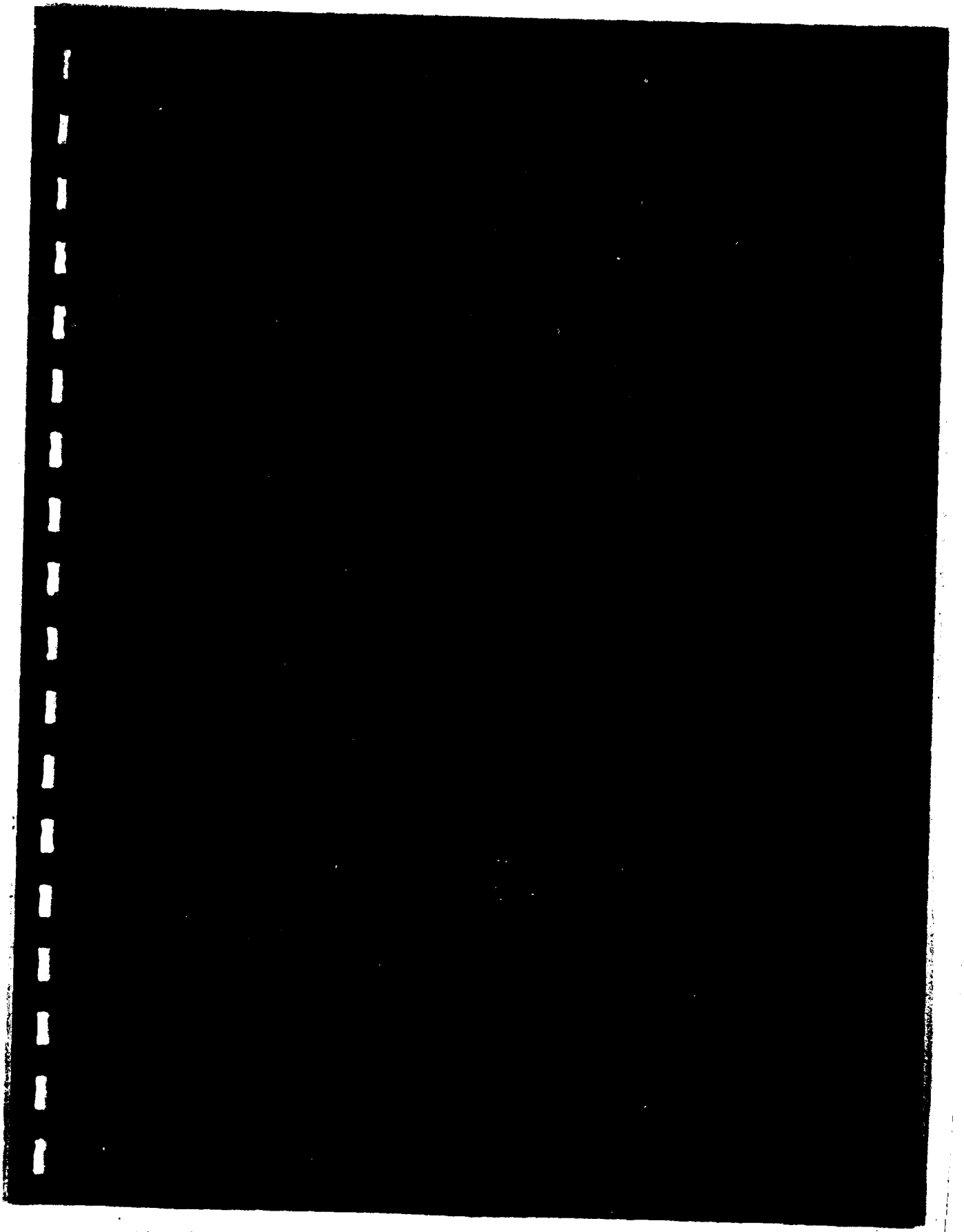
(4) Restore the six inch drain line from the intake tower to operating condition and make provisions for emergency closure of all pipelines at the intake tower.

(5) Establish a formal maintenance program and operational procedure. Include in the program the regular cutting of weeds and grass at the crest and downstream slope of the dam, the clearing of brush and overhanging trees from the spillway discharge channel and the testing of all valves associated with the outlet works.

(6) Prepare an emergency preparedness plan and warning system and provide surveillance of the dam during periods of heavy precipitation.

(7) Institute a program of annual technical inspections.

7.4 Alternatives - Town Brook is currently being studied to provide flood protection to the downstream habitants. Should the study include major modification and/or replacement of Old Quincy Reservoir Dam, all or part of the recommendations included in this report may be negated.



VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Old Quincy Reservoir

DATE: 10 September 1979

TIME: 1330

WEATHER: Scattered clouds - 80° ± F

WATER SURFACE ELEVATION UPSTREAM: 8 feet below spillway crest.

STREAM FLOW: 12 " drain discharging.

INSPECTION PARTY:

1. Roger Wood - Structural and Operation
2. Joseph Downing - Hydraulics and Hydrology
3. Joseph Araujo - Assistant Hydraulics & Hydrology
4. John Critchfield - H & A
5. Douglas Gifford - H & A

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		

PRESENT DURING INSPECTION:

1.
2.
3.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Old Quincy Reservoir DATE: 10 Sept. 1979
EMBANKMENT: Dam BY: JWC & DGG

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Brush, weeds & small trees.
b. Sloughing or Erosion	b. See 1c.
c. Rock Slope Protection - Riprap Failures	c. Slope paved with 3 ft. stones. Significant settling and displacement at two locations right of gatehouse. Stones locally dislodged at other places.
d. Animal Burrows	d. None observed.
2. Crest	2.
a. Vegetation	a. No vegetation. Gravel surface.
b. Sloughing or Erosion	b. Ruts, some erosion along edges.
c. Surface cracks	c. None observed.
d. Movement or Settlement	d. None apparent.
3. Downstream Slope	3.
a. Vegetation	a. Large stumps and trees, brush, weeds with some bare spots.
b. Sloughing or Erosion	b. Severe erosion near center 6-10 ft. wide and up to 3 ft. deep, toe to crest. Less severe erosion at other locations.
c. Surface cracks	c. None observed.
d. Animal Burrows	d. None observed.
e. Movement or Cracking near toe	e. None apparent.
f. Unusual Embankment or Downstream Seepage	f. Soft, wet area about 50 ft. downstream of toe on left side. No apparent flow or soil movement. Slight seepage (<1gpm) exiting beside 20 in. outlet pipe.
g. Piping or Boils	g. None observed.
h. Foundation Drainage Features	h. None known.
i. Toe Drains	i. None known.
4. General	4.
a. Lateral Movement	a. None apparent.
b. Vertical Alignment	b. Irregular due to erosion.
c. Horizontal Alignment	c. Satisfactory.
d. Condition at Abutments and at Structures	d. Satisfactory.
e. Indications of Movement of Structural Items	e. None observed.
f. Trespassing	f. Frequent, unrestricted.
g. Instrumentation Systems	g. One apparent old piezometer or observation well noted. One recently installed piezometer.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Old Quincy Reservoir DATE: 10 Sept. 1979

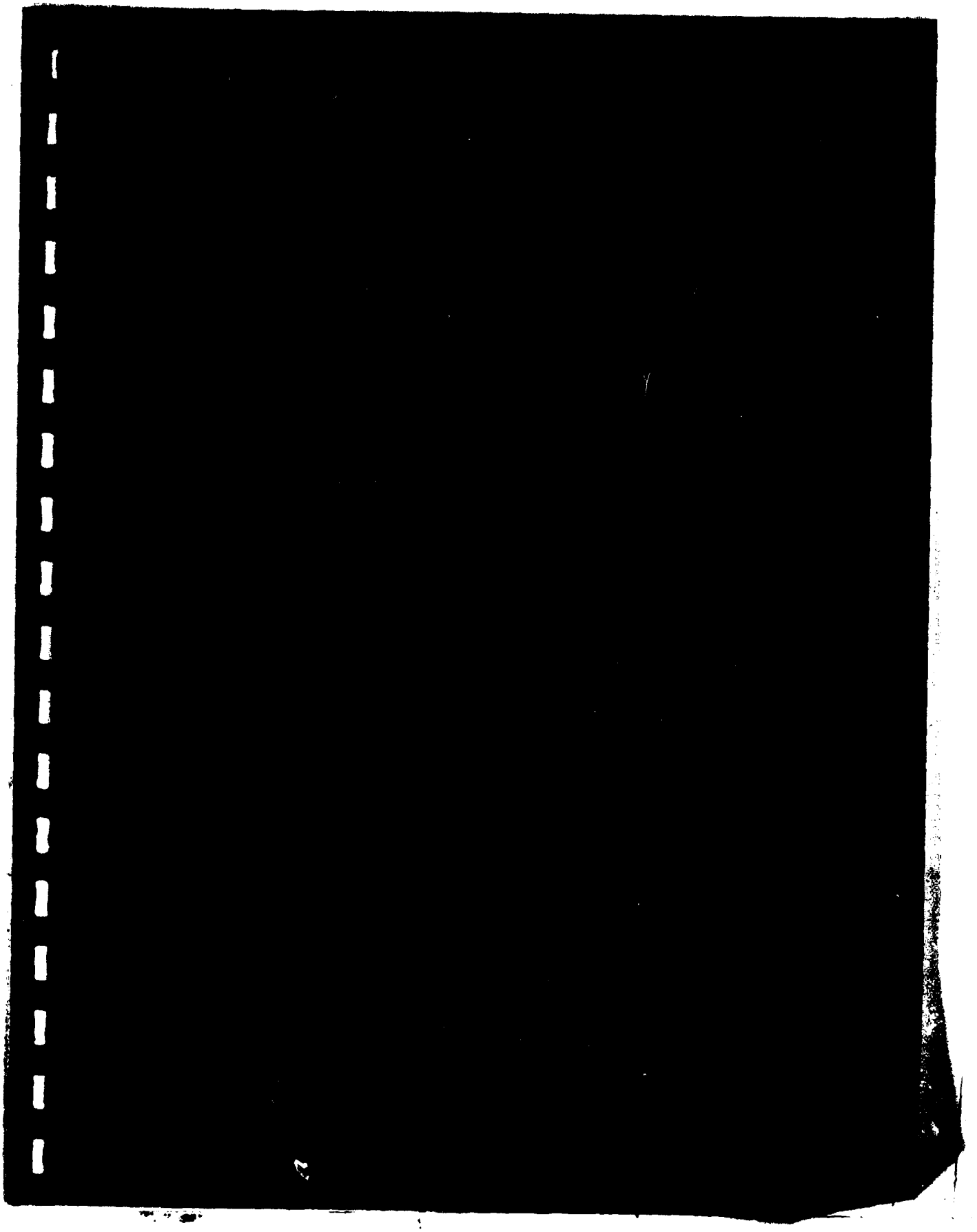
SPILLWAY: BY: R. Wood

CHECK LIST	CONDITION
1. Approach Channel	1.
a. General Condition	a. Fair.
b. Obstructions	b. Brush and very young trees.
c. Log Boom etc.	c. None.
2. Weir	2.
a. Flashboards	a. None.
b. Weir Elev. Control (Gate)	b. None.
c. Vegetation	c. Light brush and weeds - two trees downstream end.
d. Seepage or Efflorescence	d. None observed.
e. Rust or Stains	e. None observed.
f. Cracks	f. None observed.
g. Condition of Joints	g. Rubble stone masonry-well filled.
h. Spalls, Voids Or Erosion	h. None observed.
i. Visible Reinforcement	i. N/A
j. General Struct. Condition	j. Fair.
3. Discharge Channel	3.
a. Apron	a. Invert covered with earth.
b. Stilling Basin	b. None observed.
c. Channel Floor	c. See a.
d. Vegetation	d. Overgrown.
e. Seepage	e. Not visible.
f. Obstructions	f. See d.
g. General Struct. Condition	g. Fair to poor. Stone sidewall covered with earth. Left side removed for present boring crew operations - floor covered with soil. D/S trapazoidal channel covered with brush & few trees-scour at end.
4. Walls	4.a. Spillway
a. Wall Location_____	(1) Minor grass and weed in cut stone masonry joints.
(1) Vegetation	(2) None observed.
(2) Seepage or Efflorescence	(3) None observed.
(3) Rust or Stains	(4) None observed.
(4) Cracks	(5) Most of mortar missing for several inches in depth.
(5) Condition of Joints	(6) See (5).
(6) Spalls, Voids or Erosion	(7) N/A.
(7) Visible Reinforcement	(8) Fair to good.
(8) General Struct. Condition	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Old Quincy Reservoir DATE 10 Sept. 1979
OUTLET WORKS: BY: R. Wood

CHECK LIST	CONDITION
1. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates	1. Underwater - not observable.
2. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks	2. In reservoir - no access. Superstructure has been removed. Substructure cut stone granite. Mortar missing from almost all joints.
3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks	3. Three pipes with valves at toe of dam. 1-20" reported silted in, 1-12" discharging during inspection and 1-12" pipe to General Dynamics shipyard. a. None. b. Pond eroded downstream of drains. c. Channel beyond overgrown. d. None observed.
4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	4. Manual operated gates only.
5. Other	



LIST OF AVAILABLE DOCUMENTS

OLD QUINCY RESERVOIR DAM

DOCUMENT	LOCATION
1. Effect of Urban Expansion on Hydrologic Investigations by E. F. Childs, September 1979	The Hydrologic Engineering Center Corps of Engineers, Davis, CA; Proceedings of a Seminar on Urban Hydrology, 1-3 September 1970.
2. Report to Commonwealth of Massachusetts MDC on Flood Control Systems for Town Brook, Quincy and Braintree, March 1978.	Metcalf & Eddy Engineers 50 Staniford St, Boston, MA 02114

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APPENDIX B-2

THE QUINCY DAM.

BY.

L. A. TAYLOR, C. E., Boston, Mass.

This dam, which was built for the Quincy Water Co[illegible]ny, is located in the town of Braintree, three-fourths of a mile westerly fro[illegible] the Braintree depot. It is built across the valley of Town Brook and is one and one-fourth miles up stream from the pumping station of the company located in the same valley. The water shed above the dam is just 1000 acres and is a good one, in that it is sparsely settled and probably always will be so, there being very little tillage land, and that mostly of a very poor quality. A large portion of the water shed consists of rocky hills rising abruptly several hundred feet above the valley and covered with stunted oaks that have their hold on fissures in the rocks. The reservoir covers forty-seven acres and holds about 180,000,000 gallons. The dam is located about six hundred feet below the junction of two valleys that rise a little more rapidly than one in one hundred. The side slopes of the valleys are generally very abrupt rising at the rate of from ten to thirty feet in a hundred. The southerly half of the basin is a clayey soil very thickly covered with granite boulders, the northerly half sand and gravel. Nearly the whole surface was covered with brush, woods and stumps. There is scarcely anywhere more than a few inches of loam or surface mould and very little shallow flowage. The entire basin was grubbed during the autumn and winter of 1887-8, the trees, stumps and brush cut close to the ground, and the brush, limbs, leaves, and as far as possible, stumps and roots burned. During the following summer and autumn this was repeated, the young growth cut and burned and over a large area the stumps and roots were entirely removed.

Work was commenced in September, 1887, and continued without interruption till November, 1888, when the dam was finished, the work during the winter consisting mainly of clearing the basin, quarrying, splitting and cutting stone and driving the sheet piling. Weir measurements were taken of the water flowing in the brook, a rain gauge was procured and during the past autumn months was in constant use. After clearing the ground of all surface obstructions the pipe line was located at the foot of the southerly slope where the ground was covered with surface boulders, under which was a very compact clayey gravel. The pipe lines consist of two lines of 20 inch cast-iron pipe, extending from the foot of the lower slope to a gate house at the foot of the upper slope of the dam. These pipes are laid two feet apart and between them a line of six inch pipe is laid to the center of the gate house to act as a drain pipe in case it should be necessary to clear and clean the gate chamber. The three lines of pipe have gates in the middle of the gate chamber. One line of 20 inch terminates at the gate and the other passes through the upper wall of the gate chamber, and by means of an open channel is connected with the lowest part of the reservoir which it can drain. The pipes are inclosed in a masonry wall, the bottom of which is at least two and a half feet below the bottom of the pipes and extends on each side and over the top at least one foot. The pipe wall itself is imbedded in a trench excavated in the compact soil. At the center of the embankment the main core wall of the dam envelopes the pipe wall, extending eight feet below the bottom of the same, and is ten feet in thickness. Between the main core wall and the gate house are two cut off walls enveloping the pipe walls, sunk two and a half feet into the ground, and extending four or five feet on each side and two and a half feet higher than the pipe wall. These walls are two and a half feet thick. All the stone used in the wall were small, laid by hand, every joint thoroughly filled with cement and the face above the surface of the ground laid very rough and uneven. From the main core wall to the gate house Portland cement was used, and as in the case of the Rosendale cement mixed, two parts sand of the very best quality to one part cement. The weight of the 20 inch pipe was 190 lbs. and the 6 inch 30 lbs. per ft; all of them were laid with gasket and lead joints and thoroughly caulked in the usual manner. The line of 20 inch pipe terminating in the gate chamber is reduced below the dam to 12 inch and continues down the valley to the pumping station. Before being reduced a 12 inch branch and 12 inch gate are so placed that this may be used as a waste pipe in addition to the other line which extends into the reservoir and is used exclusively as such. The capacity of these pipes is sufficient to discharge the full flow of the brooks during heavy rains. The foundation of the gate house is twenty-two feet square and extends about nine feet below the bottom of the pipes. This foundation is built solidly in cement masonry. The walls of the gate chamber are five feet thick at the level of the pipes and three feet thick at the level of the top of the embankment, thirty-five feet above. The gate chamber is eight feet square. On the reservoir side there is an opening two and a half feet in width through the wall from the top to within 8.15 feet of the bottom of the pipes. Two sets of guides with composition faces are set in the sides of this opening. One set is to receive wire screens and the outer set stop plank by which the flow of water

may be regulated and drawn from any desired elevation, but with the expectation that it will nearly always be drawn from the immediate surface. The walls of the gate chamber are in regular courses of twenty-four and eighteen inches, with cut beds and builds and rock face backed on the inside by rubble masonry. The guides are set in brick work and strongly fastened in place by long bolts passing into the stone masonry.

The soundings and borings taken across the valley and into the gravel hill at the northerly end of the dam developed the fact that the hard bottom dipped very rapidly downward from near the pipe wall. The material overlying was, mainly, very fine sand, and it was decided to drive two rows of sheet piling along the center line of the dam. The up stream row, three and a half feet from the center, was six inch hard pine, each edge grooved for a spline which was two and seven-eighths inches by one and seven-eighths. These splines were tightly fitted in the grooves and fastened by heavy spikes. The down stream row, seven feet in the clear from the up-stream row, was four inch hard pine and fitted with splines two and a half by one and three-eighths inches. This sheet piling commenced about fifteen feet northerly from the pipe wall, was driven across the lowest part of the valley and about half way up the northerly slope, which is very steep, rising thirty-five feet in a hundred or about three horizontal to one vertical. The length is 193 feet. The four inch sheeting is discontinued here and the six-inch is continued 117 feet, making an angle up stream of 34° 15′ to the top of the slope and across the crest of the hill to a point eighty feet beyond the end of the embankment. A trench from four to eight feet in depth was excavated across the valley up the slope and on the crest of the ridge from twelve to nineteen feet deep. The length of the sheeting driven in this trench was from fifteen to twenty-six feet. Commencing about fifteen feet from the pipe wall the bottom was reached, twenty-five feet below the natural surface of the ground, and twenty-one feet below the bottom of the pine wall. Fifty-seven feet farther north it was thirty-one and a half feet below the surface, and in twenty-three feet more was only nineteen and a half. In the next fifty feet, which is at the foot of the steep slope, and where the brook crosses the line, the hard bottom rises to within fifteen feet of the surface, one huge boulder, in fact, coming within seven or eight feet in the up-stream line of sheeting. From this point to the northerly end, the surface rises much more rapidly than the hard bottom, and one hundred feet from the brook, or at the top of the slope the depth was forty-four feet and at the end, eighty feet farther north, the depth was thirty-five feet. The driving was done with a hammer weighing about 1,600 pounds, sliding on a bar of heavy railroad iron, the hammer having a guide on the back for that purpose. This bar, and consequently the hammer can be lowered, and the driving done without the use of a follower, to the bottom of the trench. The machine, which is one of George H. Cavanaugh's, was well adapted to the work. The work of driving was very slow and of course very expensive. The drop of the hammer was usually about six feet, sometimes four and occasionally ten, but the drop of six feet was about as effective as ten, and the danger of crippling the pile very much less. After having driven the pile, say two feet, the sand

was so hard that from one-half to three-fourths of an inch was about the greatest distance that one blow would move the pile, and as the depth increased the resistance increased very rapidly, and at last they were driven an inch in twelve to sixteen blows. It was quite difficult to determine when hard bottom had been reached, as upon striking a boulder the foot would drive to one side or broom up, so the progress was about the same as in the sand.

The ends of the piles, which were eight, ten and sometimes twelve inches wide, were cut on a slant so as to make them hug the one already driven. In the bottom of the trench two rows of joists were placed in the exact line of the piling either four or six inches apart, to hold the piles in line, which, after being carefully plumbed were fastened rigidly at the level of the platform on which the driver rested. The foot was also fastened by heavy chains and wedges to keep it in proper position. In spite of these precautions it was sometimes impossible to drive them in line, as one side would split away from the spline. Sometimes they would keep in line till the fastenings were removed or until the next one was driven, when they would both spring badly out of place. These had to be pulled by tackle blocks, levers and jack screws, which was very slow and tedious work. At one point a half dozen were driven apparently satisfactorily, when they went out of line nearly all together and had to be pulled. Nearly all the trouble was with the shortest piles. Occasionally one of the others would break or splinter from the timber being defective but not often.

After having driven the double row, that is 193 feet, the difficulties encountered had been such that it was decided to excavate between the piling to the bottom for at least a portion of the distance to see the exact nature of the foundation and also the condition of the piling at and near the bottom. Accordingly for about ninety feet in length and where the bottom was from fifteen to twenty feet below the surface, the sand was excavated to the foundation which was a very hard gravel with some clay, almost entirely free from water and very thickly covered with boulders imbedded in the compact gravel. The piling was found in much better condition than expected, the six inch from its greater stability being better than the four inch. Where the piles were driven on to the boulders some were so badly broken and broomed they were cut away at the bottom. Most were, however, so driven that they formed a perfectly tight joint, conforming to the inequalities of the stone and almost incorporating themselves with it. The gravel was almost as hard as the stone and was penetrated about a foot. From the southerly end of the piling to the southerly end of the trench above mentioned was about eighty feet. This was excavated twenty feet below the surface of the ground or to the same level as the section above mentioned.

Over this portion the piling was in good condition and it was not thought necessary to go any deeper. The time occupied by driving this section of piling was from January 1, to about March 25, 1888. In the latter part of August the six inch was extended as before stated. About four feet back of the end of the row, a pile was fitted and driven against the side of those already driven to make the angle 34° 15′. On the first attempt the joint was not good and a second one was tried which proved satisfactory. It was

thought this would make a better and safer joint than to fit the spline or pile on the end for fear of splitting the weaker portion of the pile and not being able to discover it in driving. It also presented a longer bearing surface. In driving this section of piling a water jet was used to some extent, but not very successfully, probably owing to insufficient pressure. The rate of progress was not much greater, and the tendency was to pull the pile away from the one already driven. The space between the rows of piling was filled with concrete, and also the trench in which the six-inch was driven on the slope, and on the crest of the hill. In the latter case the thickness of the wall was four feet at the base and enclosed three feet of the upper part of the piling.

The concrete was composed of one part Hoffman cement, two parts of sand and five parts gravel. The gravel and sand were of the very best quality. The sand was measured in barrels and the gravel in a shallow form laid on a plank platform. After mixing and wetting the cement and sand, it was spread over the gravel and three pairs of shovelers turned it over on the platform and a fourth mixing of the material was made by shoveling into a box, by which it was lowered, a batch at a time, by a steam derrick into the trench, or in some cases it was shoveled into wheelbarrows. The mixture was more uniform when the derrick was used, as the concrete could be deposited in bulk in the proper place, and the tendency of the coarser gravel to separate was not so great. Italian laborers were employed and the organization was about as follows: Six men measured the gravel, spread the mortar, mixed the materials, and filled the scales or wheelbarrows, two mixed the cement and sand, one measured the sand, one attended the watering and two rammed the concrete in place in six inch layers. When wheelbarrows were used there were three or four wheelers. Each batch made twenty-two or twenty-three cubic feet, and forty-five barrels of cement used was an average day's work.

The masonry core wall was commenced on the concrete and was at least seven feet thick at the level of the top of the pipe wall, twenty-seven feet below high water level. The top of the wall was two and a half feet thick and was two feet above high water. The stone were large boulders, split to a proper size, none being very large, mostly less than nine cubic feet. This size was used to make better work in the wall, and also because the largest stone were cut for the gate house, over fall stone and sidewalls for the waste-way. Great care was taken in cleaning and wetting the stone and that at least two stone should be used, with a heavy mortar joint between them, to make the thickness of the wall. About two-thirds of the upper fifteen feet of the wall was built of concrete, as it was desirable to save the stone for slope paving, as a large quantity of gravel had been accumulated from the sand screenings, and very largely because the derrick and its surroundings required so much more room on the embankment than the concrete bed. A large quantity of stone were taken to the derrick on a small platform car running on a track of three feet gauge. They were loaded by a derrick. The car ran by gravity to the work and was pushed back by three men who did the loading. The whole operation was very successful in economy of time and money.

It may be interesting to state the method of dealing with the water coming

into the trench where the piling was driven. From the bank at the northerly end of the trench, there was a small quantity, where the piling was shallowest in two or three places; some came from behind it, and near the pipe wall a stream came from the down stream side from the brook below the end of the pipes. A three-inch drain pipe was laid in the bottom of the trench, and care taken to take into it all the water trickling into the trench. A three-inch Pulsometer pump was located about sixty-five feet from the pipe wall and was run as occasion required. When the concrete bottom was put in three chimneys of three-inch drain pipe were built into it. Two were near the pipe wall forty or fifty feet from the pump and were brought up about twenty-four feet above the bottom of the trench. Another towards the northerly end and about 100 feet from the pump was brought up thirty-seven feet above the bottom of the pump well. When the work had progressed so it was desirable to close the pipes the water was pumped down as low as possible and the pipes rapidly filled with pure cement grout. The grout was mixed in half hogsheads, a barrel of cement being used at a time, and so mixed as to run very freely. The filling was commenced at the point farthest away from the pump and where there was the greatest head. The pump was run until the cement showed very freely in the discharge, when it was stopped, the suction pipe removed, and the filling continued at all the pipes or chimneys, most of it being from the one first mentioned. Twelve or fourteen barrels of cement were used. After the cement had set for several days the pipes were built over. The quantity of grout used shows it must have driven the water back and penetrated considerably outside the lines of the piling.

Previous to the commencement of the embankment the surface material upon the southerly slope of the base of the dam was cleared for at least a depth of two feet, across the level part of the valley, from four to six feet where the stream had repeatedly changed its course, and upon the northerly slope ten or twelve feet in depth was either removed or mixed with other material for the embankment. The filling was put on in layers of six inches in thickness, and each layer rolled with a heavy roller or rammed by hand as the location and occasion demanded.

At the north end of the embankment the filling is carried on a curve up stream ninety feet, making the top of the dam one hundred and ten feet thick. Considerable clayey gravel was obtained from the south slope of the basin, but it was mainly sand and gravel from the north side of the basin. The coarsest gravel was kept on the up-stream side near the slope paving. The top of the dam and lower slope are covered with twelve inches of loam. The top of the dam, except as stated above, at the north end is twenty feet wide, and both the outer and inner slopes are two horizontal to one vertical. The length of the embankment is five hundred and fifty feet. The inner slope is covered with a paving two feet thick carefully laid by hand to the required slope. The water required for wetting the embankment, mixing mortar and other uses, was furnished by a Knowles pump placed at the lower end of the pipe line and distributed by an inch and a half pipe wherever needed. The gate house

is sixty feet from the top line of the inner slope, and an iron-trussed foot bridge four and a half feet wide in the clear, built by the Boston Bridge Works, spans this space. The gate chamber is surmounted by a brick building with granite trimmings, in which is the gate hoisting apparatus. The waterway is at the extreme southerly end of the dam entirely on natural ground. It is twenty-five feet wide and five feet from the top of the dam to the overfall stone. The main core wall runs across the waterway and six feet below the top of the overfall stone that rests upon it. The side walls are ashlar masonry four feet thick at the bottom and two and a half at the top. The bottom of the waterway, from a point twenty-six feet up stream from the main core wall to a point sixty-six feet down stream from the same, is laid in cement masonry two and a half feet thick. The remainder of the paving, one hundred and fifty-three feet in length, is three feet thick and laid dry. The overfall stone is thirty feet above the bottom of the pipes in the gate house. By the expenditure of a small sum of money the waters of the Blue Hill River, that has a large water shed, may be turned into this reservoir the highest point in the ridge, being only four and a half feet above the river, and that for only a short distance.

In concluding it is a pleasure to state that the officers of the Quincy Water Company have done all in their power to aid the writer in successfully carrying forward this work, never hampering him in any way in the carrying out of expensive details. I am also under many obligations to the Superintendent, Mr. Frank E. Hall, a member of this Association, whom you all know, for cordial co-operation and assistance in many matters of detail connected with the work, and to my assistant, Mr. C. H. Truesdell, also a member of this Association, who had direct charge of the work during the entire period of construction.

NORFOLK COUNTY DAM INSPECTION

TOWN: BRAINTREE Number D-93

Location West of Lakeside Drive - east of Granite Street

Owner City of Quincy

Purpose Used Fore River - Water

Construction Earth dam

Storage Basin: Length 2500 ft. Width 600 ft. Ave. Depth 18 ft.

Maximum Head at Spillway 10 ft. Capacity 200,000,000 gals.

Length of Spillway 25 ft. Outlets 24" pipe

Dam Constructed by Date

Recent Repairs None Date

Conditions below Dam (Roads, Bldgs., etc.)

Getting built up with houses.

INSPECTION: Date Oct. 19, 1942 Inspector W. S. Carson

Condition Good

Remarks None

INSPECTION: Date October 15, 1945 Inspector W. S. Carson

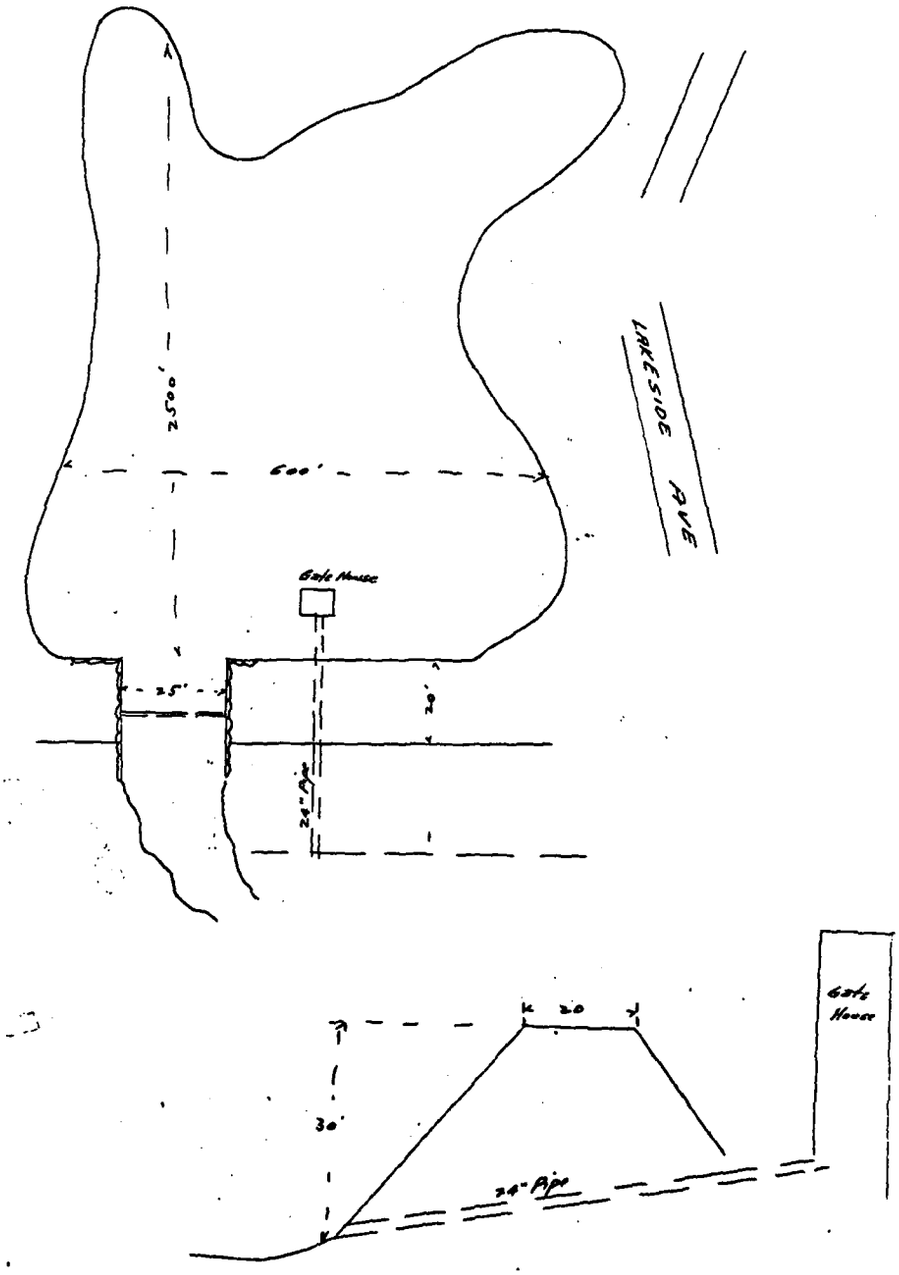
Condition Good

Remarks Fore River man cleaning screen from outlet

INSPECTION: Date Inspector

Condition

Remarks


2500'
600'
LAKESIDE AVE
Gate House
25'
20'
24" Pipe
20
30'
24" Pipe
Gate House

Braintree

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town BRAINTREE. Dam No. 6-11-48-7
Name of Dam OLD QUINCY RESER INSPECTED BY: SCREEN.
Date of Inspection 1-10-78.

2. Owner/s: Per: Assessors_____. Prev Inspection_____.
Reg. of Deeds_____. Pers. Contract_____.

	Name	St. & No.	City/Town	State	Tel No.
1.	CITY OF QUINCY		QUINCY	MASS	
2.					
3.					

3. Caretaker(if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name	St. & No.	City/Town	State	Tel. No.
OWEN J. EATON SUPT.	QUINCY WATER DEPT			773-1360

4. No. of pictures taken_____.

5. Degree of Hazard: (If dam should fail completely)*

1. Minor_____. 2. Moderate_____.
3. Severe_____. 4. Disastrous_____.

*This rating may change as land use changes (Future development)

6. Outlet Control: Automatic_____. Manual_____.
Operative_____yes ;_____No.
Comments:_____

7. Upstream Face of Dam: Condition?
1. Good V. . 2.Minor Repairs_____.
3. Major Repairs____. 4.Urgent Repairs_____..
Comments: TREES & BRUSH ALONG EDGE

DAI NO. 6-11-90-7

8. Downstream Face of Dam: Condition: 1. Good ____, 2. Minor Repairs ✓.
3. Major Repairs ____, 4. Urgent Repairs ____.
(Gullies)
Comments: Several washouts from top of Dam to Toe of slope. Trees & Brush block face.

9. Emergency Spillway: Condition: 1. Good ✓. 2. Minor Repairs ____.
3. Major Repairs ____. 4. Urgent Repairs ____.
Comments: ____

10. Water level @ time of inspection: 10' ft. above ____, below ✓,
top of dam ✓, principal spillway ____,
other ____.

11. Summary of Deficiencies Noted:
Growth (trees and brush) on Embankment Downstream & upstream face
Animal burrows and Washouts Down stream face.
Damage to slopes or top of dam Top of Dam has No vegetation
Cracked or Damaged Masonry None
Evidence of Seepage Possible seepage at Toe East end of Dam Toe face
Evidence of Piping None
Erosion None
Leaks None
Trash and/or debris impeding flow None
Clogged or blocked spillway None
Other ____

DAM NO. 6-41-90-7

12. Remarks & Recommendations: (Fully Explain)

Top of Dam was UNEven Gravel Surface
No Vegetation Along Top of Dam

13. Overall Condition:

1. Safe_____.
2. Minor repairs needed_____.
3. Conditionally safe-major repairs needed_____.
4. Unsafe_____.
5. Reservoir impoundment no longer exists(explain)
   Recommend removal from inspection list._____.

INSPECTION REPORT - DAMS AND RESERVOIRS

(1.) Location: City/Town Braintree. Dam No. 6-11-40-7. CORPS #

Name of Dam Old Quincy Reservoir Inspected by: Michael Pacillo Warren Blanchard

Date of Inspection Feb 2 1978

(2.) Owner/s: per: Assessors _____. Prev. Inspection _____.

Reg. of Deeds _____. Pers. Contact _____.

	Name	St. & no.	City/Town	State	Tel. no.
1.	City of Quincy		Quincy	Mass	
2.					
3.					

(3.) Caretaker: (if any) e.g. superintendant, plant manager, appointed by absentee owner, appointed by multi owners.

Name	St. & no.	City/Town	State	Tel. no.
Owen T. Eaton Supt. D.P.W.		Quincy		

(4.) No. of Pictures taken NONE.

(5.) Degree of Hazard: (if dam should fail completely)*

1. Minor _____. 2. Moderate _____.

2. Severe _____. 4. Disastrous X.

* This rating may change as land use changes (future development)

(6.) Outlet Control: Automatic _____. Manual _____.

SIZE Operative _____ yes; _____ No.

Comments: UNKNOWN

(7.) Upstream Face of Dam: Condition:

1. Good _____. 2. Minor Repairs _____.

3. Major Repairs _____. 4. Urgent Repairs _____.

Comments: See Report dated JAN. 6 1978 by Inspection Team from District

DAM NO: 6-11-40-7

Downstream Face of Dam: Condition: 1. Good_____. 2. Minor Repairs_____.
3. Major Repairs____. 4. Urgent Repairs_____.

Comments: SEE Report dated 1-10-78

(9.) Emergency Spillway: Condition: 1. Good_____. 2. Minor Repairs_____.
3. Major Repairs____. 4. Urgent Repairs_____.

Comments: [redacted]
SEE page three (3) of this report

(10.) Water level @ time of inspection: ___1___. ft. above_____. below_____.
top of dam_____. principal spillway___X___.
other_____.

(11.) Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment SEE Report of 1-10-78
Animal Burrows and Washouts_____.
Damage to slopes or top of dam_____.
Cracked or Damaged Masonry_____.
Evidence of Seepage_____.
Evidence of Piping_____.
Erosion_____.
Leaks_____.
Trash and/or debis impeding flow_____.
Clogged or blocked spillway_____.
Other_____.

DAM NO. 6 11-40-

(12) Remarks & Recommendations: (Fully Explain)

EMERGENCY SPILLWAY WAS FILLED WITH GRAVEL AT THE ORDERS AND SUPERVISION OF ROBERT FRAZIER, SUPT OF THE HIGHWAY DEPT OF BRAINTREE.

FIVE CREWMEN, SMALL BULLDOZER AND BACKHOE ON THE SIGHT REMOVING THE GRAVEL TODAY.

MR FRAZIER WAS INSTRUCTED BY MIKE BARILLO AND WARREN BLANCHARD THAT ALL FILL WAS TO BE REMOVED AND REPAIRS TO SPILLWAY IF ANY AS A RESULT OF THIS FILLING.

CITY OF QUINCY SHOULD BE NOTIFIED THAT IT IS THEIR RESPONSIBILITY TO FOLLOW THIS MATTER UP ALSO.

(13) Overall Condition:

1. Safe_____.
2. Minor repairs needed_____.
3. Conditionally safe - major repairs needed_____.
4. Unsafe X.
5. Reservoir impoundment no longer exists (explain)

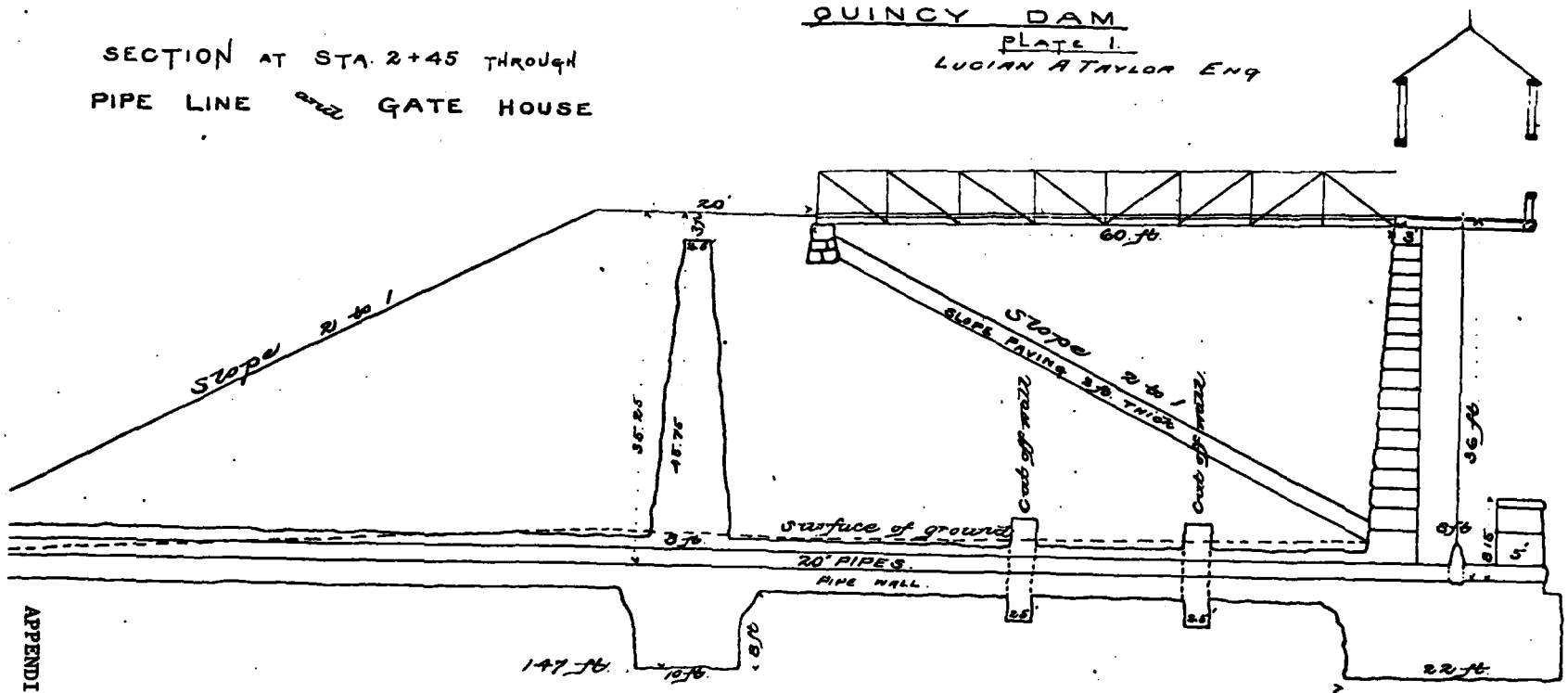
Recommend removal from inspection list

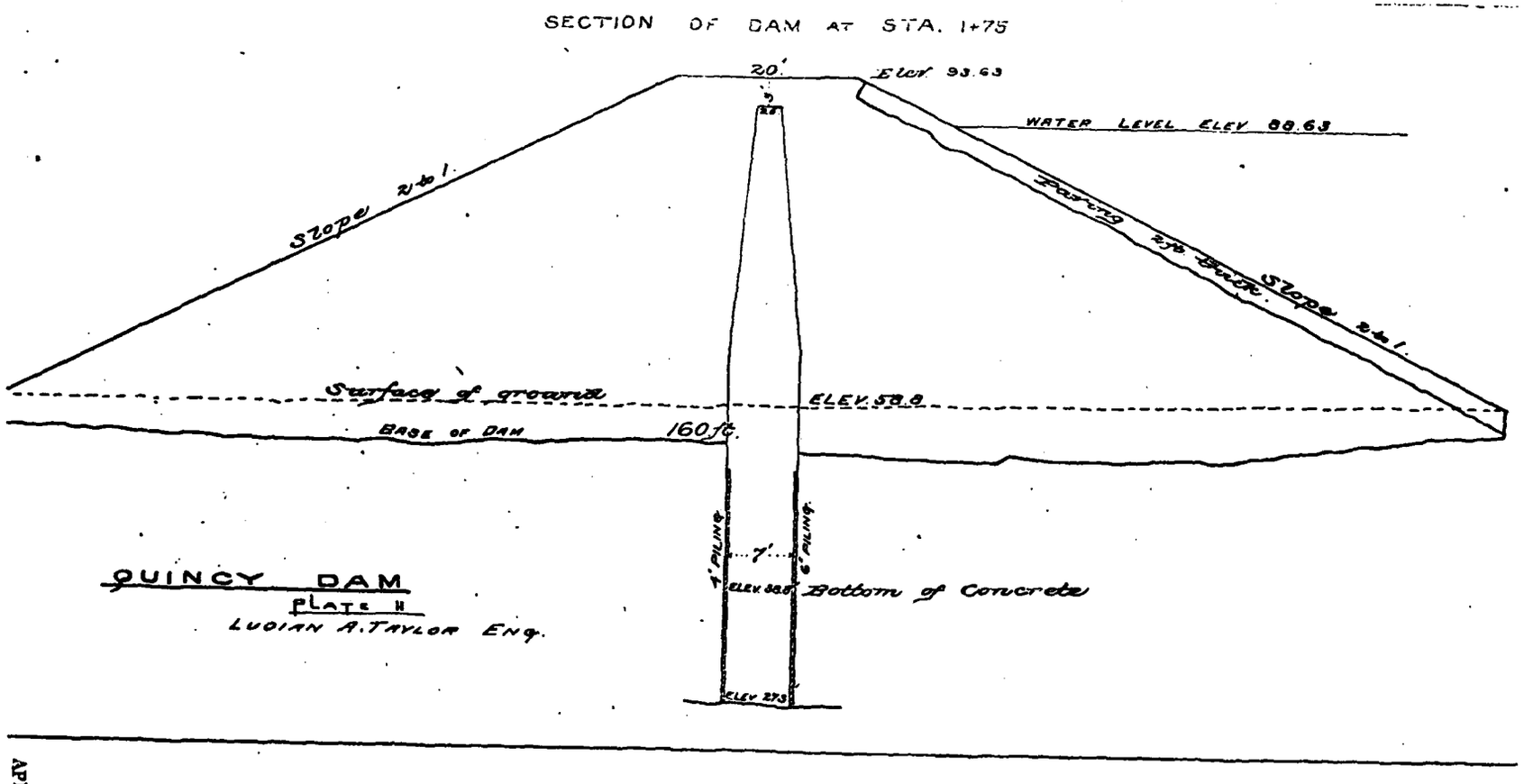
QUINCY DAM

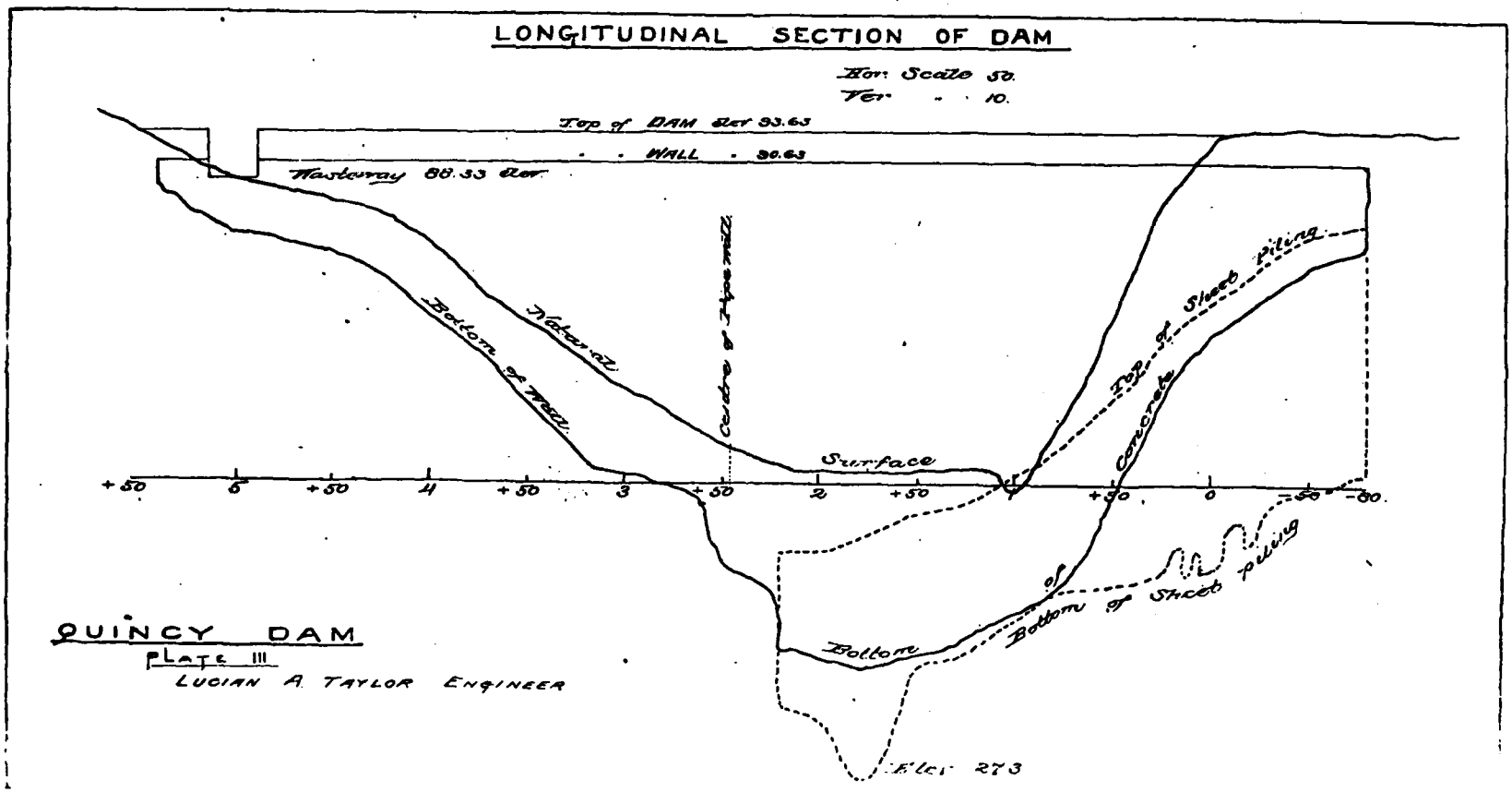
PLATE 1.

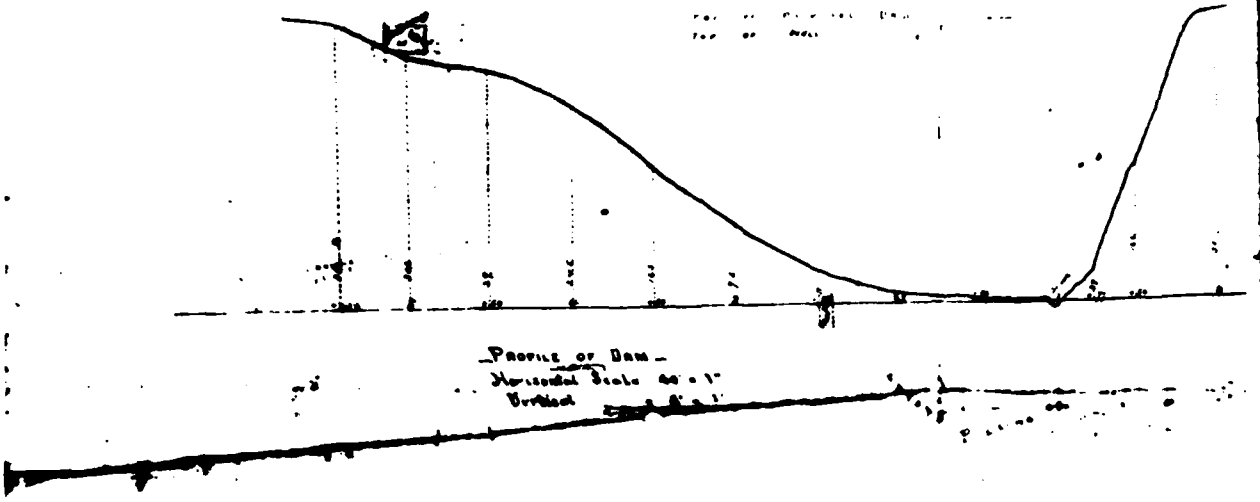
LUCIAN A TAYLOR ENG

SECTION AT STA. 2+45 THROUGH PIPE LINE AND GATE HOUSE

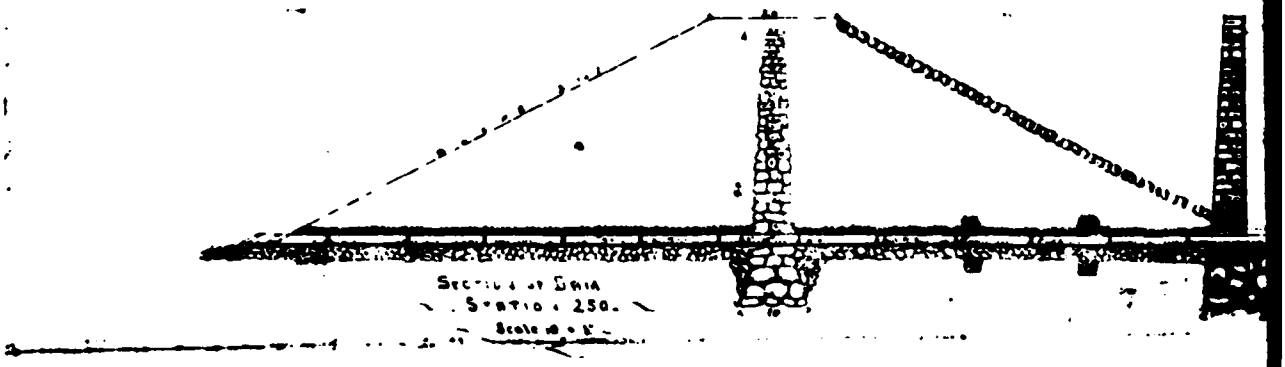



SECTION OF DAM AT STA. 1+75
20'
Elev 93.63
WATER LEVEL ELEV 88.63
Slope 2 to 1
Slope 2 to 1
Surface of ground
ELEV. 59.9
BASE OF DAM
160 ft.
4' PILING
6' PILING
7'
ELEV 88.8
Bottom of Concrete
ELEV 27.3
QUINCY DAM
PLATE II
LUCIAN A. TAYLOR ENG.

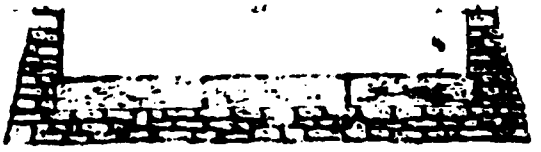

LONGITUDINAL SECTION OF DAM
Hor. Scale 50.
Ver. " 10.
Top of DAM Elev 93.63
" WALL " 90.63
Roadway 88.33 Elev
Bottom of Wall
Natural
Surface
Center of Apron
Top of Sheet piling
Concrete
Bottom of Sheet piling
Bottom
+50
6
+50
4
+50
3
+50
2
+50
1
+50
0
-50
-80
Elev 273
QUINCY DAM
PLATE III
LUCIAN A. TAYLOR ENGINEER

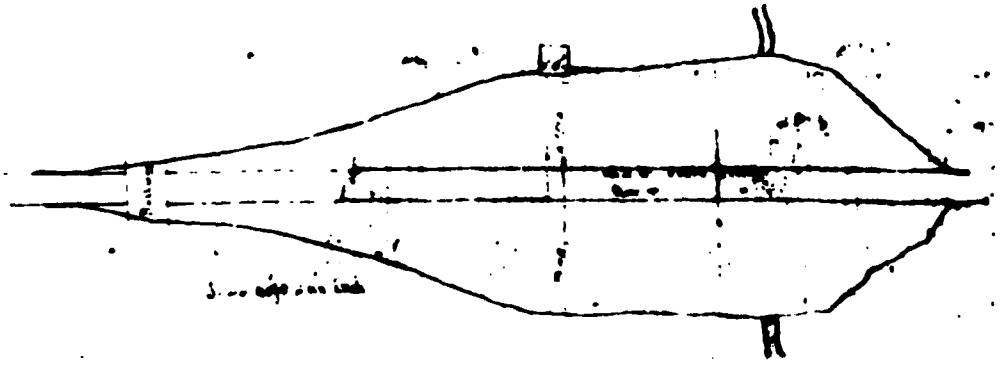


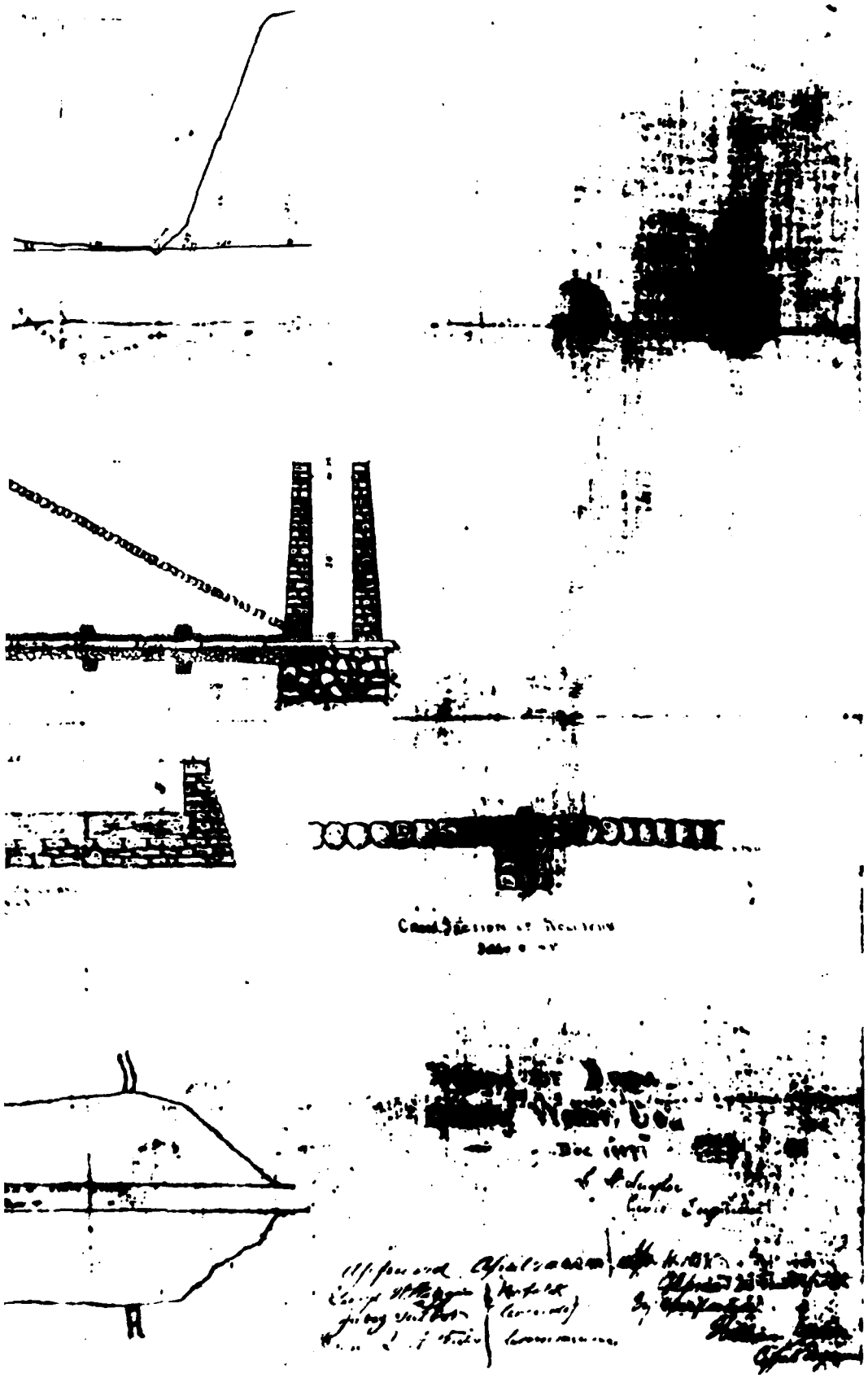
Profile of Dam

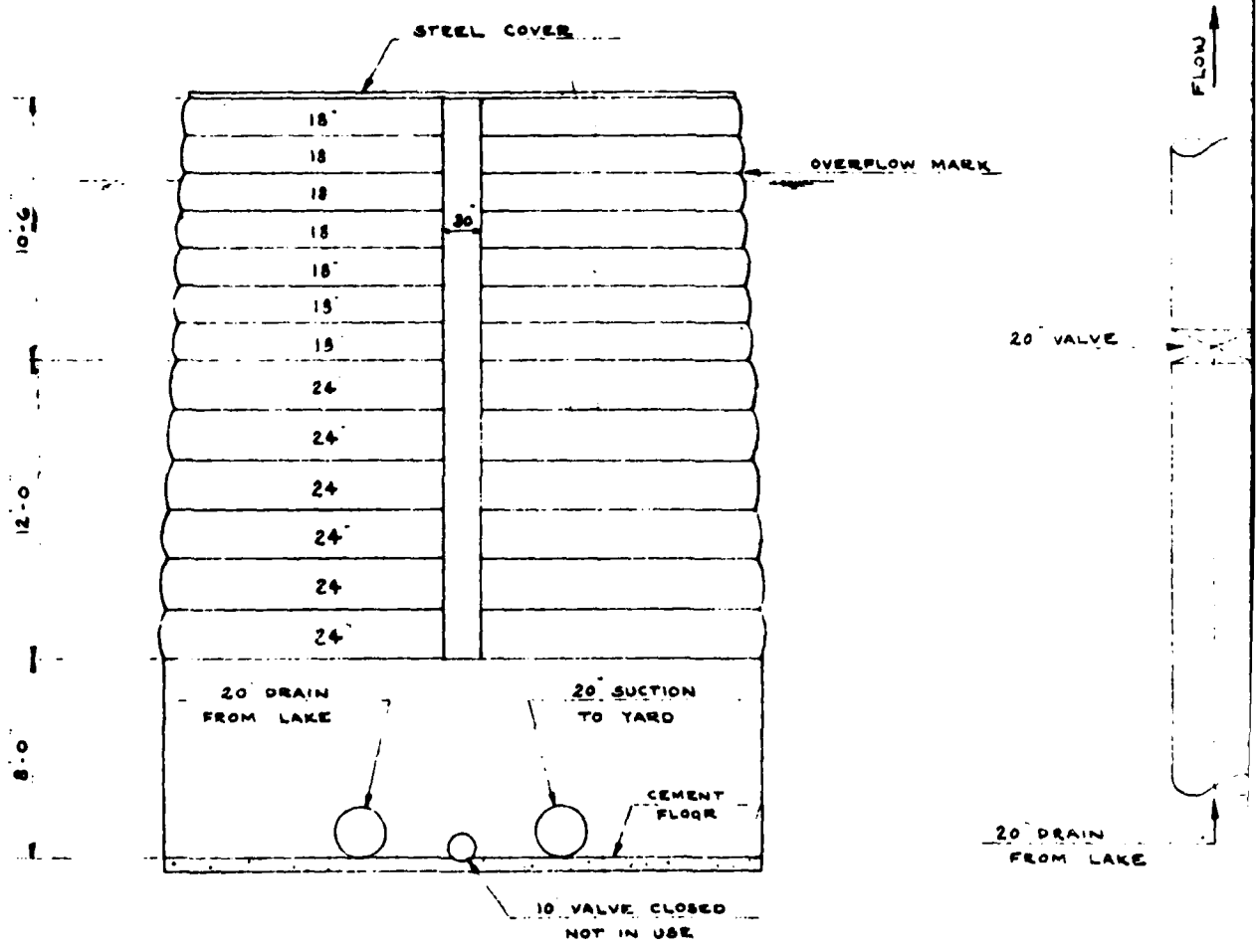


Section of Dam

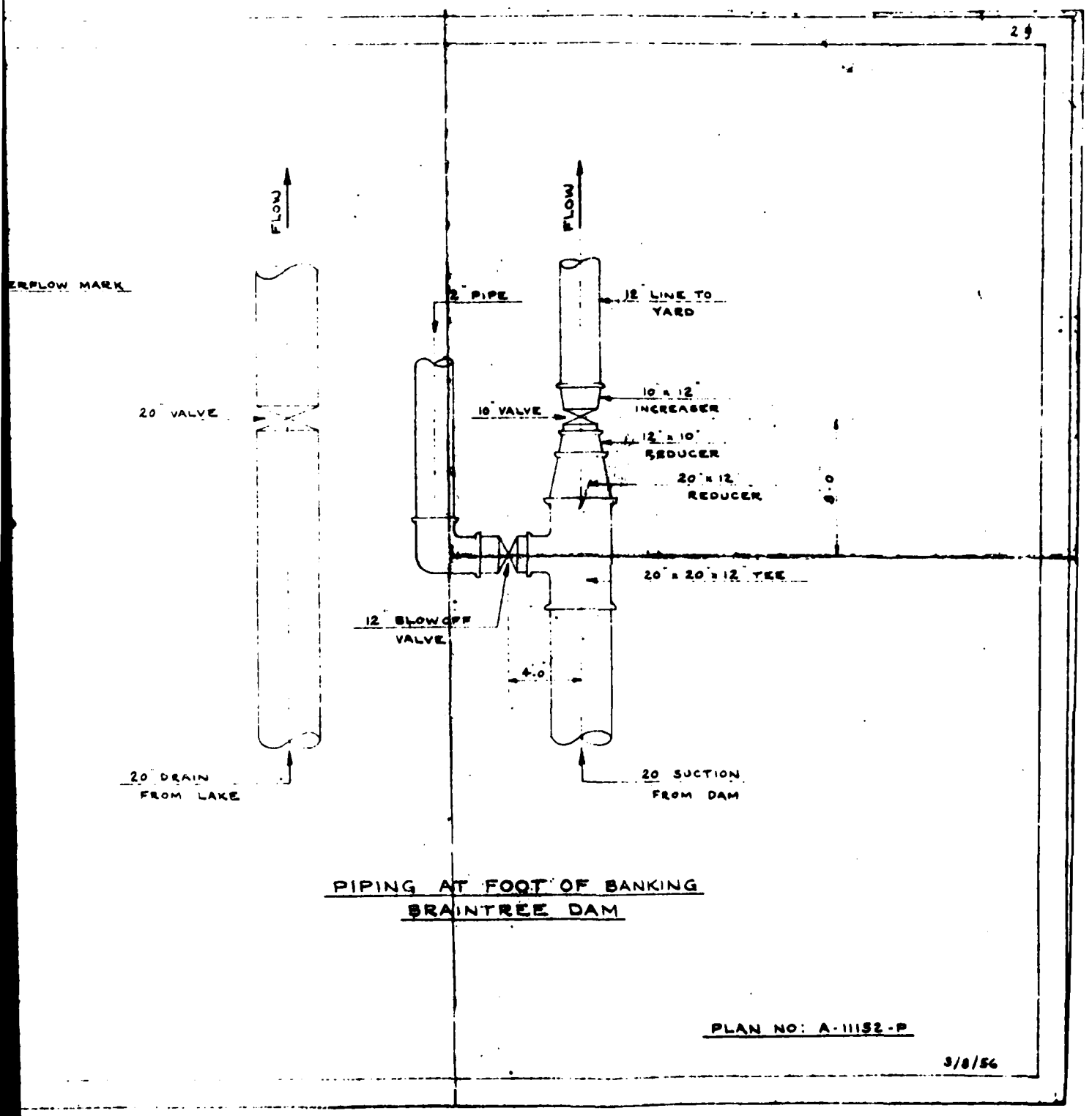








BRAINTREE DAM GATE HOUSE



PIPING AT FOOT OF BANKING
BRAINTREE DAM

PLAN NO: A-11152-P

3/8/56

American Drilling & Boring Co., Inc.
100 WATER STREET EAST PROVIDENCE, R. I.

Bit # ____ Fig. ____
Bit # ____ Fig. ____

SHEET 1 OF 1
DATE
HOLE NO. D-21
LINE & STA.
OFFSET
SURF. ELEV. 44.15 M.V.

TO Comm. of Mass. MDC -Engr. Div. | ADDRESS Boston, Mass.
PROJECT NAME Town Brook Flood Control | LOCATION Quincy-Braintree, Mass.
REPORT SENT TO above | PROJ. NO. E-444
SAMPLES SENT TO " | OUR JOB NO. 6-54

GROUND WATER OBSERVATIONS
At 10' in casing Hours
Piezometer-1st @ 39' 2nd @ 18'
Riser pipe w/ cap & lock
At ____ after ____ Hours
Also bentonite balls & O. Sand

	Rods-AW	CASING	SAMPLER	CORE BAR
Type		HW & BW	S/S	
Size I.D.		3-1/2 & 2-1/2"	1-3/8"	
Hammer Wt.		300#	140#	BIT
Hammer Fall		24"	30"	

	Date	Time
START	10/10/75	
COMPLETE	10/15/75	
TOTAL HRS.		
BORING FOREMAN	R.V. Long	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 12" on Sampler	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and any unusual conditions.	SAMPLE No.	Pen	Rec
HW	6	0'-2'	D	4	dry loose	2.0'	Brown fine loamy SAND, little fine gravel, FILL	1	24"	10
cas-	8			5						
ing	10	2'-4'	D	13	moist medium dense		Light brown fine to medium SAND, Little fine gravel, trace silt, FILL	2	24"	18
to	14			12						
20'	19	4'-6'	D	19				3	24"	16
	21			19						
	29	6'-8'	D	17				4	24"	18
	30			16						
	29	8'-10'	D	28				5	24"	9
	30			29						
	31	10'-12'	D	29				6	24"	12
	33			29						
	34	12'-14'	D	25				7	24"	12
	35			27		14.0'				
	33	14'-16'	D	23	wet medium dense		Gray-brown coarse to fine SAND, Some fine to coarse gravel, Trace silt, FILL	8	24"	12
	34			26						
	36	16'-18'	D	22				9	24"	18
	35			24						
	36	18'-20'	D	18	"	20.0'	Gray fine to coarse SAND and gravel, trace silt	10	24"	6
	15			18						
BW	10	20'-22'	D	13				11	24"	
to	9			13						
40'	8	22'-24'	D	13	"		Gray-brown coarse to fine SAND, Some silt, some fine to coarse gravel	12	24"	5
	9			14						
	10	24'-26'	D	14				13	24"	7
	9			14						
	10	26'-28'	D	13				14	24"	6
	10			15		28.0'				
	9	28'-30'	D	15	"	30.0'	Brown fine to coarse SAND & gravel, Little silt	15	24"	5
	9			14						
	10	30'-32'	D	22	"	34.0'	Gray-brown fine SAND & gravel, Some silt, boulders and weathered shale	16	24"	5
	12			23						
	10	32'-34'	D	28				17	24"	11
	15			30						
	39	34'-36'	D	60	moist very dense		Gray fine SAND, silt and weathered shale, trace fine gravel	18	24"	8
	64			78						
	89	36'-38'	D	76		38.0'		19	24"	8
	110			112						
	141	38'-39'	D	130	"	40.0'	Dark gray weathered SHALE Bottom of Boring 40.0'	20	12"	5
	131	39'-40'	D	132				21	12"	5

GROUND SURFACE TO 40' USED H/W & B/W CASING: THEN pot. of boring

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med. Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
50+	Very Dense	15-30	V-Stiff
		30+	Hard

SUMMARY
Earth Boring 40'
Rock Coring
Samples 21

HOLE NO D-21

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

Bid #_____ Pg._____

Bid #_____ Pg._____

SHEET 1 OF 1

DATE

HOLE NO. D-22

LINE & STA.

OFFSET

SURF. ELEV. 65.58 +/-

TO Comm. of Mass. MDC-Engr. Div. ADDRESS Boston, Mass.

PROJECT NAME Town Brook Flood Control LOCATION Quincy-Braintree, Mass.

REPORT SENT TO above PROJ. NO. E-444

SAMPLES SENT TO " OUR JOB NO. 6-54

GROUND WATER OBSERVATIONS

26' in casing

At _____ After _____ Hours

Piezometer - 1st @ 39'

2nd @ 29'

At _____ after _____ Hours

w/Riser pipe, lock, bentonite balls

Rods-AW	CASING	SAMPLER	CORE BAR
Type	BW	S/S	
Size I.D.	2-1/2"	1-3/8"	
Hammer Wt.	300#	140#	BIT
Hammer Fall	24"	30"	

	Date	Time
START	10/15/75	a.m.
COMPLETE	10/17/75	p.m.

TOTAL HRS.

BORING FOREMAN R. V. Long

INSPECTOR P. C. Sill

SOILS ENGR.

LOCATION OF BORING: C. sand

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 12" on Sampler	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and any unusual conditions.	SAMPLE No.	Pen	Rec
	5	0'-2'	D	7	dry		brown loamy fine SAND, little	1	24"	10"
	6			10	loose	2.0'	fine gravel, FILL			
	9	2'-4'	D	13	dry		Light brown fine SAND, little	2	24"	14"
	10			15	medium		fine gravel, trace silt, FILL			
	12	4'-6'	D	23	dense			3	24"	18"
	10			29						
	13	6'-8'	D	20				4	24"	14"
	14			28						
	10	8'-10'	D	19				5	24"	16"
	13			22						
	13	10'-12'	D	23	"			6	24"	18"
	11			24						
	13	12'-14'	D	21				7	24"	18"
	8			25						
	9	14'-16'	D	17	moist			8	24"	15"
	8			17	medium					
	10	16'-18'	D	15	dense			9	24"	13"
	11			17						
	9	18'-20'	D	13				10	24"	16"
	28			12		20.0'				
	30	20'-22'	D	34	moist		Brown fine to medium SAND,	1	24"	12"
	29			32	dense		Some fine to medium gravel,			
	30	22'-24'	D	35			Trace silt, boulders	2	24"	10"
	31			33		24.0'				
	21	24'-26'	D	50	wet		Brown fine to coarse SAND and	13	24"	7"
	20			48	dense		gravel, small boulders, trace silt			
	19	26'-28'	D	50				14	24"	8"
	18			51						
	17	28'-30'	D	15	wet			15	24"	5"
	10			13	medium	30.0'				
	9	30'-32'	D	9	dense		Brown fine to coarse SAND and	16	24"	6"
	10			10			gravel, some silt, trace shale frag-			
	9	32'-34'	D	9	"		ments	17	24"	7"
	9			11		34.0'				
	10	34'-36'	D	17			Gray-brown fine to coarse SAND,	18	24"	9"
	10			13	"		GRAVEL, SILT & SHALE			
	11	36'-38'	D	17				19	24"	10"
	39			18		38.0'				
	36	38'-40'	D	68	moist		Gray weathered SHALE	20	24"	12"
	49			119	very dense	40.0'	Bottom of Boring 40.0'			

GROUND SURFACE TO 40' USED DRY CASING: OTHER O.D. of Casing

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stff
30-50	Dense	8-15	Stff
50+	Very Dense	15-30	V. Stff
		30+	Hard

SUMMARY
Earth Boring 40'
Rock Coring
Samples 20

HOLE NO. D-

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

Bid # _____ Fig. _____

Bid Boston, Mass. Fig. _____

SHEET 1 OF 1

DATE _____

HOLE NO. D-23

LINE & STA. _____

OFFSET _____

SURF. ELEV. 41.4c M.

TO Comm. of Mass. MDC-Engr. Div. ADDRESS _____

PROJECT NAME Town Brook Flood Control LOCATION Quincy-Braintree, Mass.

ORT SENT TO above PROJ. NO. E-444

PLES SENT TO " OUR JOB NO. A-54

GROUND WATER OBSERVATIONS

At 8'-4" after _____ Hours

14' of casing

At _____ after _____ Hours

	Rods-AW	CASING	SAMPLER	CORE BAR
Type		BW	S/S	
Size I.D.		2-1/2"	1-3/8"	
Hammer Wt.		300#	140#	BIT
Hammer Fall		24"	30"	

	Date	Time
START	10/21/75	
COMPLETE	10/21/75	
TOTAL HRS.		
BORING FOREMAN	C. Koerner	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 12" on Sampler	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and any unusual conditions.	SAMPLE No.	Pen	Rec
	1	0'-2'	D	2	dry	1.0'	Brown TOPSOIL	1A	12"	12"
	2			7	loose		Brown fine SAND, some silt, some	1B	12"	5"
	3	2'-4'	D	4	dry	3.0'	fine to medium gravel	2	24"	5"
	3			7	medium		Brown fine to medium SAND,			
	8	4'-6'	D	11	dense		Little fine gravel, trace silt,	3	24"	
	13			14	"		trace coarse sand(possible fill)			
	13	6'-8'	D	15	"			4	24"	15"
	13			12	"					
	4	8'-10'	D	16	"			5	24"	6"
	4	"		3	"					
	3	10'-12'	D	2	"			6	24"	1"
	9			8	wet	13.5'				
	6	12'-14'	D	43	dense		Dark brown fine to coarse SAND,	7A	12"	5"
	14			39	wet		Little silt, trace fine gravel(slightly	7B	6"	6"
		14'-16'	D	23	very	14.0'	organic	8	24"	12"
				85	dense		Brown fine to coarse SAND, some			
						16.0'	coarse to fine gravel, little silt			
							Installed piezometer at 15'			
							5' - 2 1/2" pipe w/ cap & lock 398			

GROUND SURFACE TO 14' USED DW CASING. THEN S/S TO 16'

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

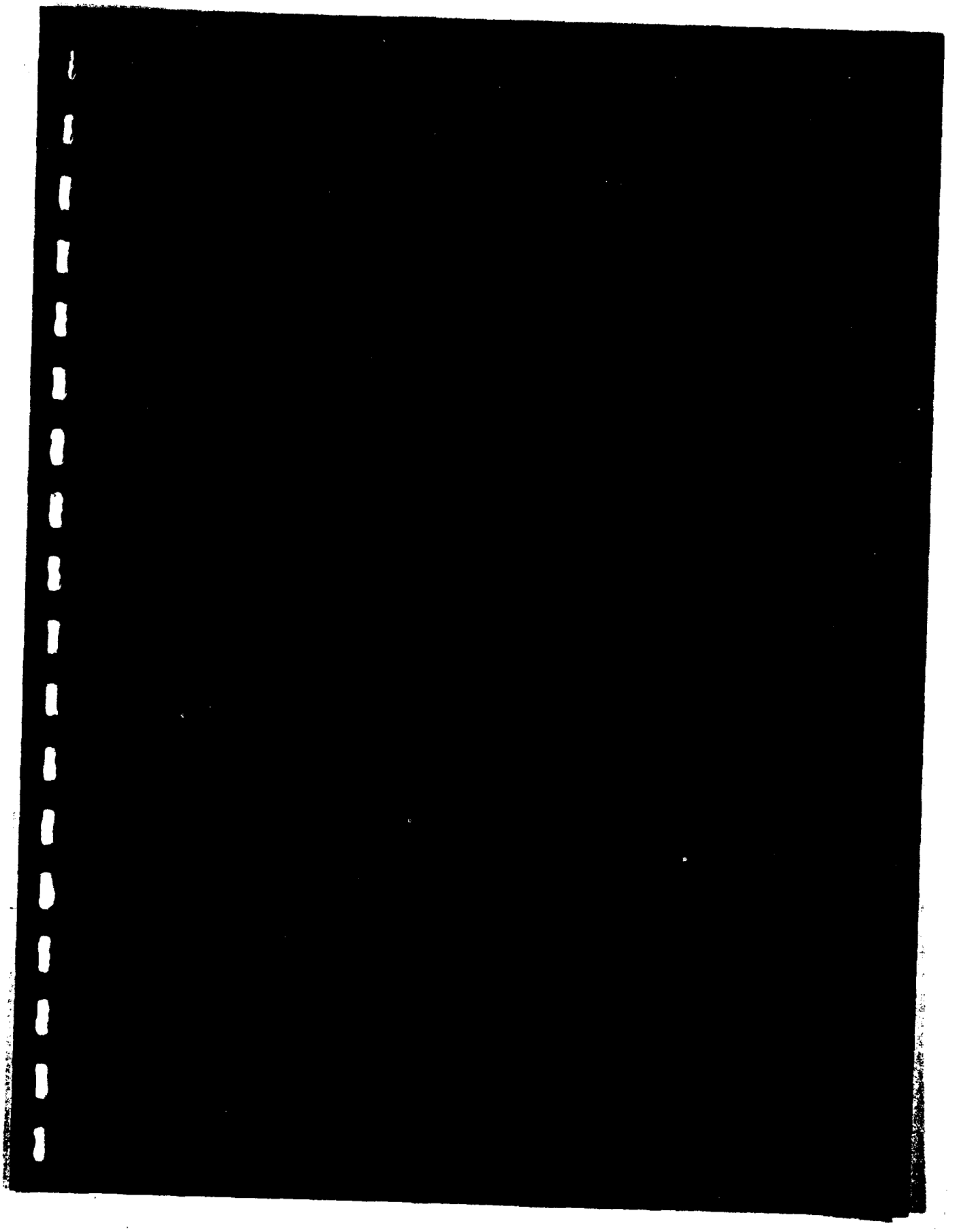
Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

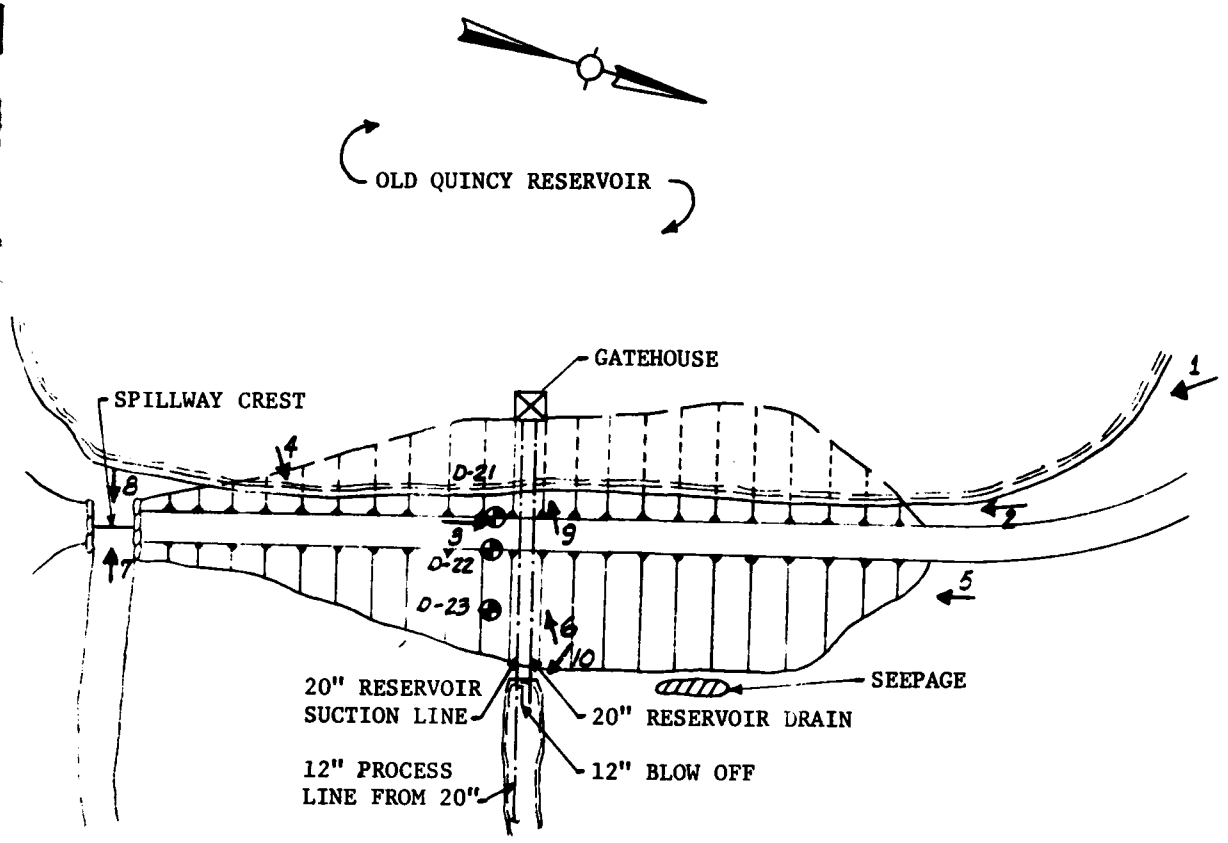
140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stff	
30-50	Dense	8-15	Stff	
50 +	Very Dense	15-30	V-Stff	

SUMMARY
Earth Boring 16'
Rock Coring _____
Samples 8

HOLE NO D-23





NOTES:

1. PLAN BASED ON DEC. 1887 PERMIT PLAN AND CDM FIELD OBSERVATIONS.
2. ← 1 DENOTES PHOTOGRAPH NUMBER AND DIRECTION OF VIEW.

(11)

CAMP DRESSER & McKEE, INC. BOSTON, MASSACHUSETTS	U.S.ARMY ENG. DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.

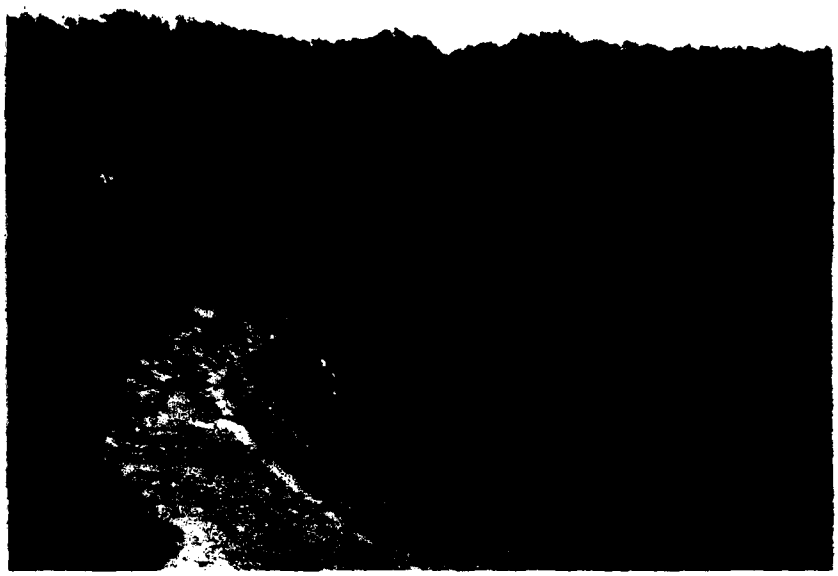
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION OF PHOTOGRAPHS

OLD QUINCY RESERVOIR MASSACHUSETTS

			Scale; Not To Scale
			Date; OCT. 1979

APPENDIX C-1



2. VIEW OF UPSTREAM FACE OF DAM FROM LEFT ABUTMENT.

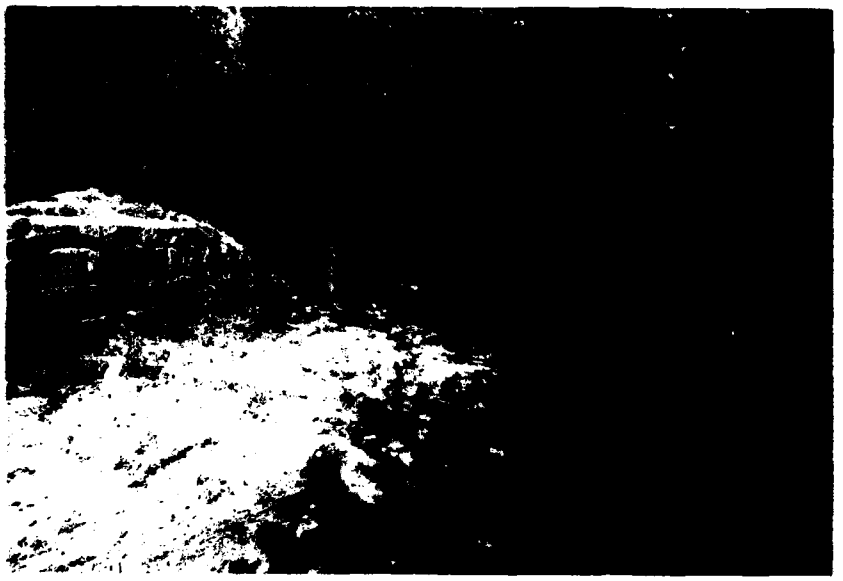
3. CREST OF DAM LOOKING TOWARDS LEFT ABUTMENT.

4. DETAIL OF UPSTREAM SLOPE PROTECTION.

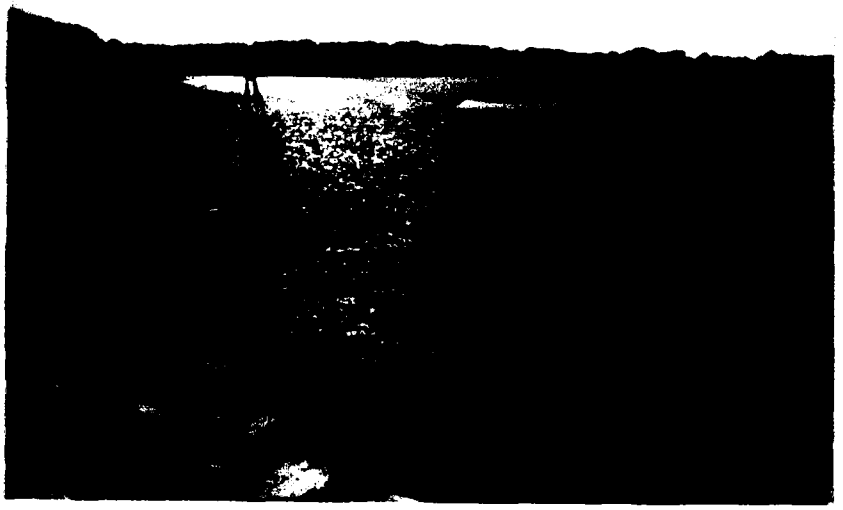
5. DOWNSTREAM FACE OF DAM FROM LEFT ABUTMENT.

6. EROSION ON DOWNSTREAM FACE AT CENTER OF DAM.

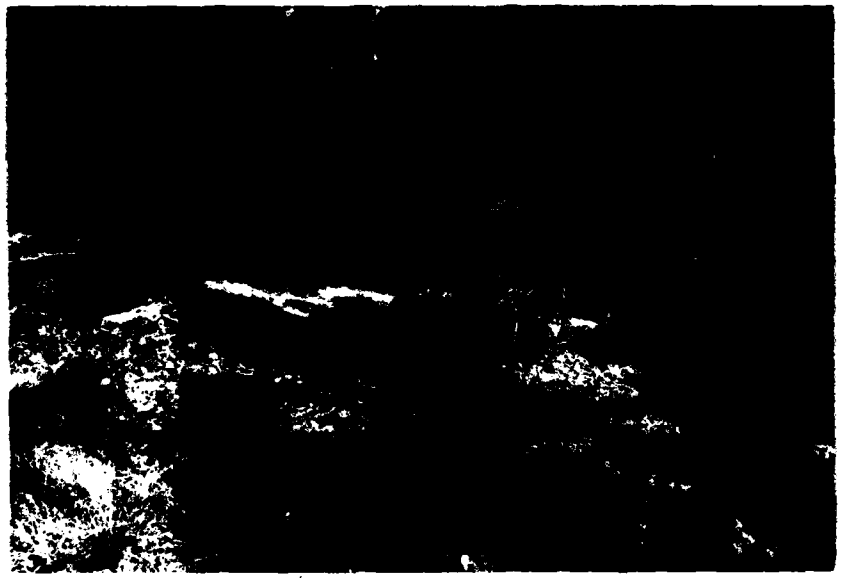
7. VIEW OF SPILLWAY CREST AND LEFT ABUTMENT LOOKING UPSTREAM.



8. VIEW OF SPILLWAY CREST AND DOWNSTREAM CHANNEL.

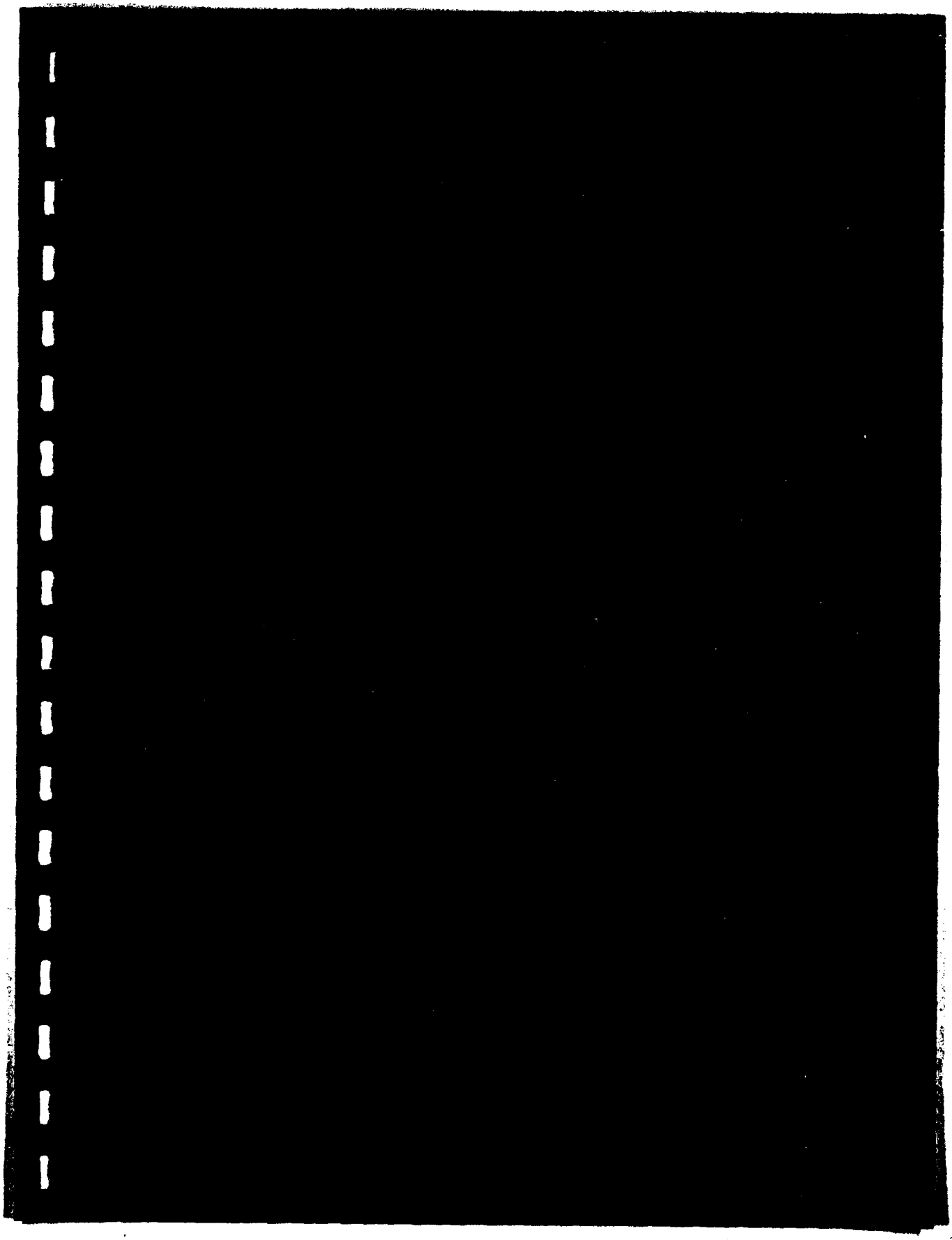


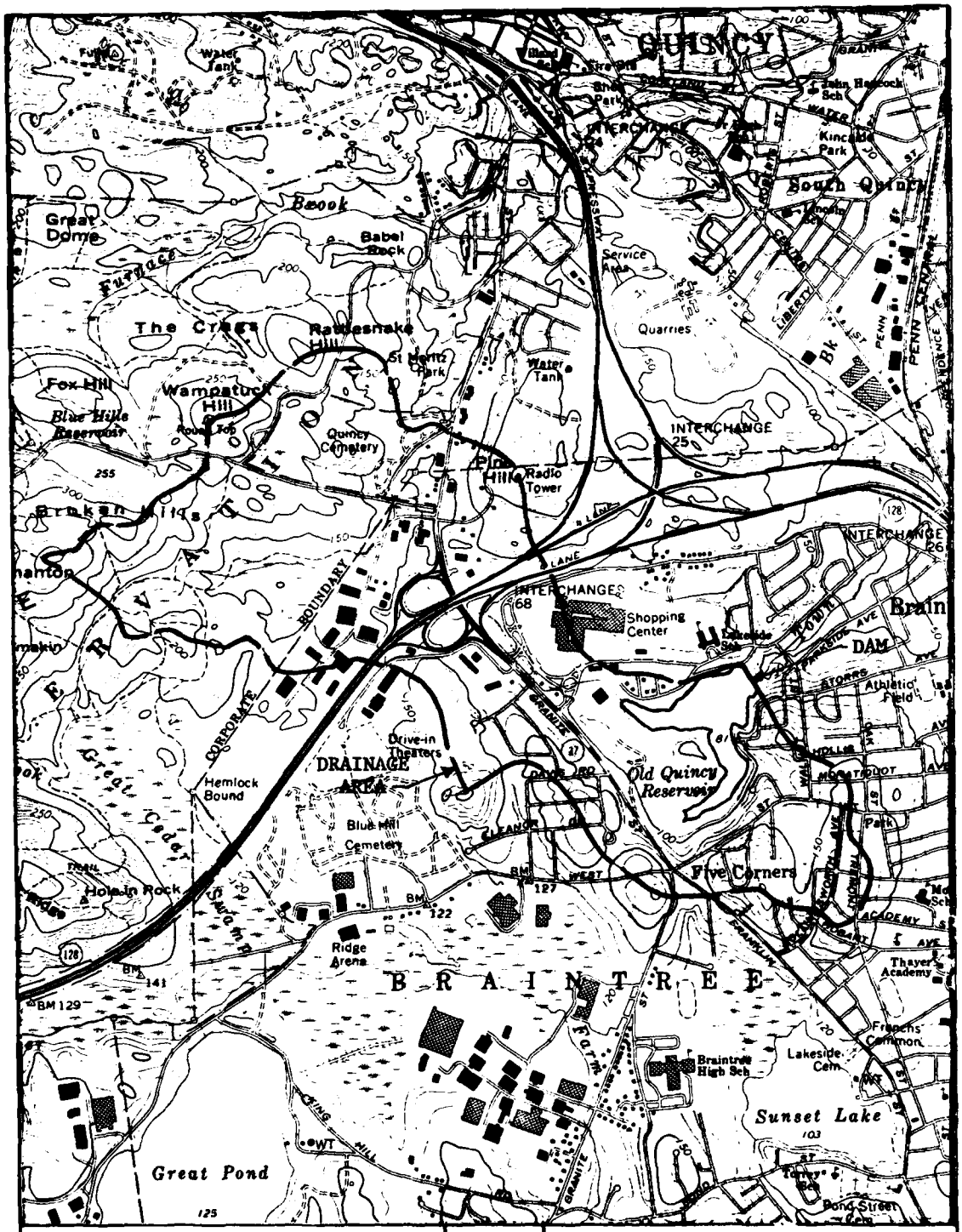
9. VIEW OF RESERVOIR AND OUTLET WORKS INTAKE TOWER FROM CREST OF DAM.



10. OUTLET WORKS GATES AT DOWNSTREAM TOE OF DAM. NEAR GATE CONTROLS 20 IN. DIA. RESERVOIR DRAIN, MIDDLE GATE CONTROLS 12-IN. DIA. BLOW OFF AND FAR GATE CONTROLS 12-IN. DIA. PROCESS LINE.

11. DOWNSTREAM FACE OF 36-IN. DIA. CULVERT WHICH CONVEYS SPILLWAY DISCHARGES THROUGH RESIDENTIAL AREA.





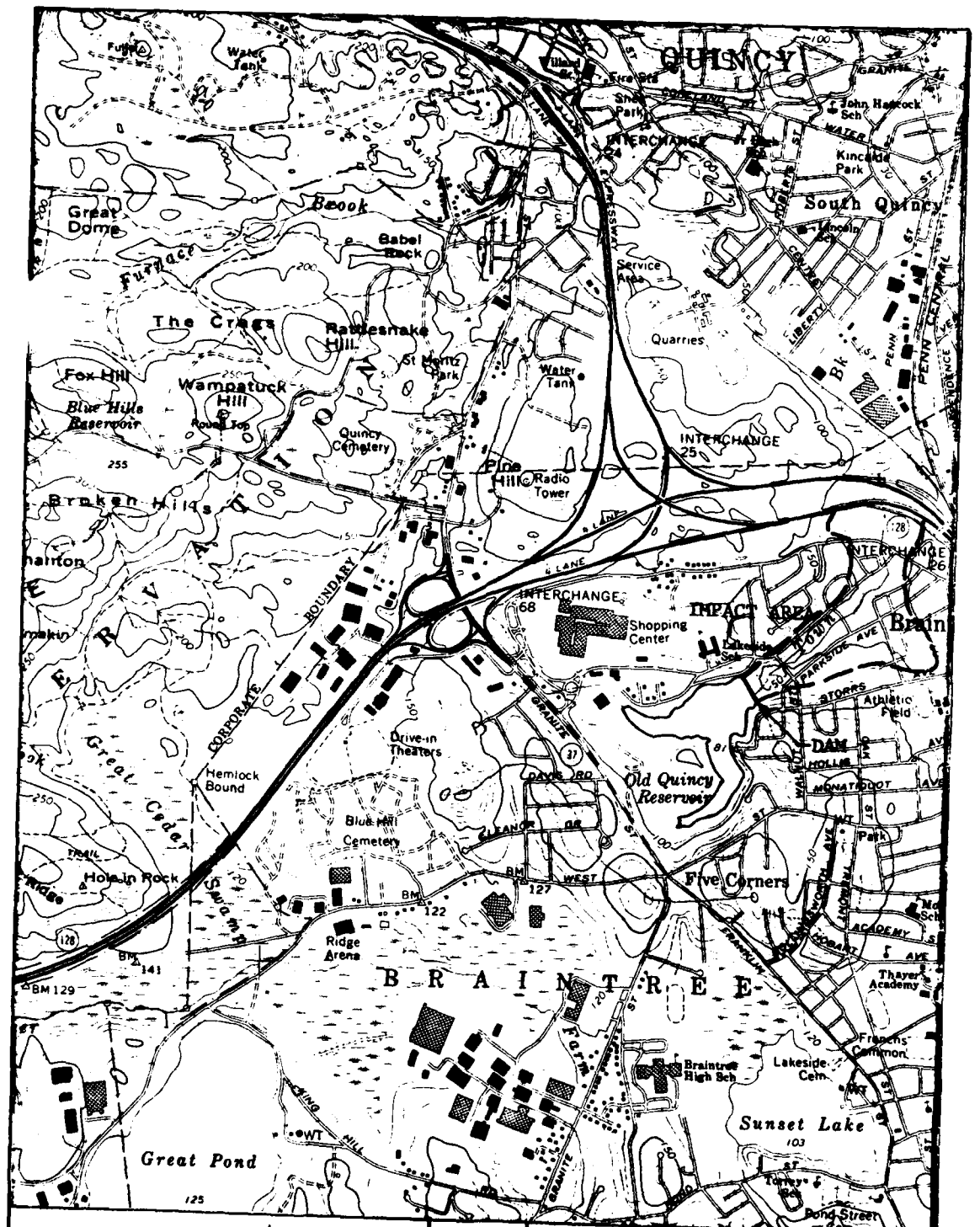
DAM OLD QUINCY RESERVOIR

IDENTIFICATION NO. MA 00827

DRAINAGE AREA MAP

APPROX. SCALE: 1" = 2000'

APPENDIX D-1



DAM OLD QUINCY RESERVOIR

IDENTIFICATION NO. MA 00827

DAM FAILURE IMPACT AREA MAP

APPROX. SCALE: 1" = 2000'

APPENDIX D-2

CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT CORPS OF ENGINEERS
PROJECT DAM INSP.
DETAIL OLD QUINCY

JOB NO. 380-6-RT-11
DATE CHECKED 10-18-79
CHECKED BY Joe A.

COMPUTED BY JED
DATE 10-11-79
PAGE NO 1

ELEVATIONS

All elevations are NGVD (MSL) based on field survey notes by M/E dated Dec. 1974 and COWI field observations of Sept. 1979.

Top of Dam: Varies - El. 86.14 at spillway abutment, Low Points (3 L.P.) - El. 84.4

Toe of Dam: El. 47.5 ±

Spillway Crest: El. 80.87, say 80.9

SURFACE AREAS

Drainage Area: 920 acres = 1.44 mi²
Area of Pond at El. 81 NGVD = 36 ac.
Area at Contour El. 90 NGVD = 102 ac.

STORAGE CAPACITIES

Spillway Crest (El. 80.9) = 552 ac-ft. (from published data)
Elev. 90.0: $552 + \left(\frac{36+102}{2}\right) \times 9.1 = 552 + 628 = 1180$ ac-ft.

Top of Dam (Elev. 84.4): $552 + \left(\frac{1180-552}{9.1}\right)(84.4-80.9) = 794$ ac-ft.

SIZE CLASSIFICATION

Hydraulic Height = 84.4 - 47.5 = 36.9, say 37 ft.
Storage at top of dam = 794 ac-ft.
∴ Size is SMALL

HAZARD CLASSIFICATION

A dam failure would inundate scores of residential homes located downstream of the dam.
∴ hazard is "HIGH"

TEST FLOOD DETERMINATION

Small size & High hazard: COE Guidelines give range of 1/2 PMF to PMF, use full PMF due to high degree of hazard.

PMF DETERMINATION

Selection of the CSM (ie. cfs/sq.mi.) for the Old Quincy Reservoir watershed is difficult due to the degree of Urbanization.

Sept. 1970 study by E.F. Childs of the COE, NED utilized the rational formula to develop flows for a 4.7 sq.mi. portion of the watershed, which includes the 1.44 sq.mi. tributary to Old Quincy Reservoir, with the following results:

Frequency (yrs.)	2	10	50	100
Discharge (cfs)	700	1,560	2,330	2,670

By plotting the above values, the 500 yr. frequency flood would be 3,450 cfs.

If the 500 yr. flood is taken to be the Standard Project Flood and the PMF as twice the SPF, then PMF = 3,450 x 2 = 6,900 cfs per 4.7 sq.mi. or 1470 CSM which is 63% of the way between Flat & Coastal and Rolling on the COE Recommended Curves for determining CSM.

From the same curves, CSM for 1.44 mi^2 at 63% between Flat & Coastal and Rolling is 1760 cfs/sq.mi.

∴ PMF Inflow = 1.44 mi^2 x 1760 CSM = 2,500 cfs

SURCHARGE - STORAGE ROUTING

Stage - Discharge Relationships are computed & plotted on the next two pages.

Q_{P_1} = Test Flood Inflow = 2,500 cfs

Surcharge$_1$ = Elev. 84.2 ; $STOR_1$ = 285 ac-ft. x $\frac{12"}{920 ac\text{-}ft.}$ = 2.93"

Q_{P_2} = 2500 (1 - 2.93/19) = 2115 cfs

Surcharge$_2$ = Elev. 84.10 ; $STOR_2$ = 219 ac-ft. x 12"/920 = 2.86"

$STOR._{AVG.}$ = (2.86+2.93)/2 = 2.895" ; Q_{P_3} = 2500 (1 - 2.895/19) = 2119 cfs

∴ TEST FLOOD OUTFLOW = 2,120 cfs @ Elev. 84.10

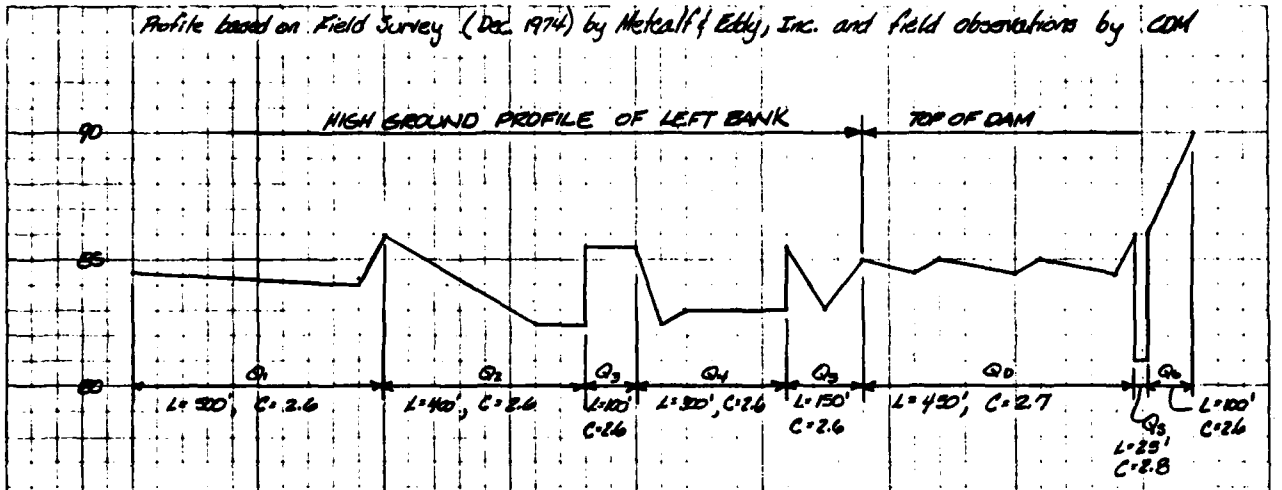
CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT ARMY CORPS OF ENGINEERS
PROJECT DAM INSP.
DETAIL OLD SQUAW CK

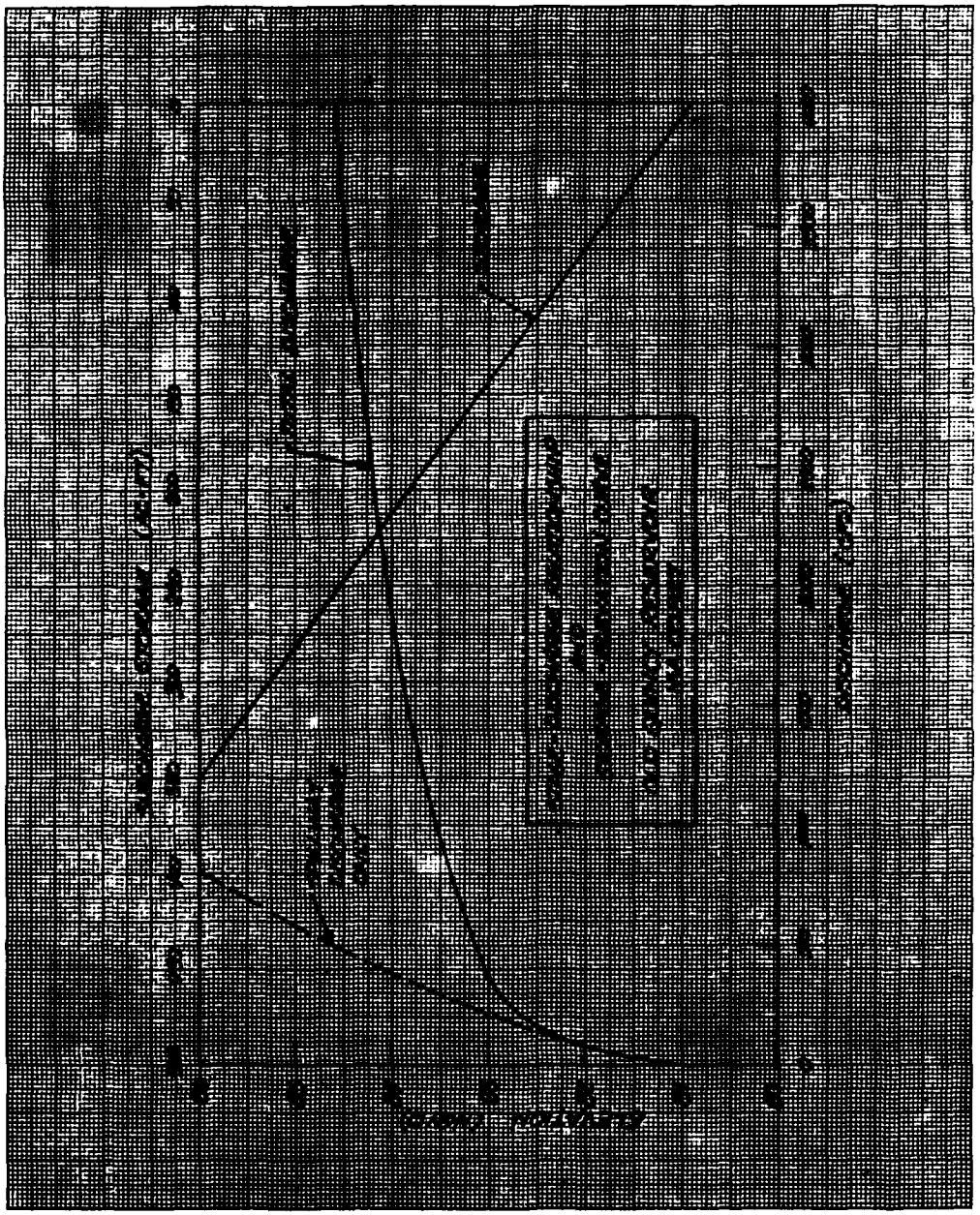
JOB NO. 320-GT-11
DATE CHECKED 10-19-79
CHECKED BY Joe M.

COMPUTED BY K.D.
DATE 10-11-79
PAGE NO 3

Profile based on Field Survey (Dec. 1974) by Metcalf & Eddy, Inc. and field observations by CDM



W.S. ELEV.	SPILLWAY	DAM	OVERBANK						TOTAL
	Q_S	Q_D	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_T
80.9	-	-	-	-	-	-	-	-	0
82.0	81	-	-	-	-	-	-	-	81
83.0	213	-	-	138	-	20	-	-	371
84.0	382	-	-	697	-	745	60	-	1,884
85.0	581	101	780	1860	-	2055	242	-	5,599
86.0	806	1380	2860	3660	92	2830	590	-	13,418



APPENDIX D-6

CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT COE | JOB NO. 350-ET-11 | COMPUTED BY JED
PROJECT DAM INSP | DATE CHECKED 10-19-79 | DATE 10-10-79
DETAIL OLD QUINCY RES | CHECKED BY Joe M. | PAGE NO 5

DAM FAILURE ANALYSIS

Dam Height = 37 ft.
Crest Length at Mid-height = 300 ft. (Scaled from Dec. 1887 Plan)

$$Q_p = 8/27\ W_b \sqrt{g}\ Y_b^{3/2}$$

$$= 8/27\ (300 \times 0.4)(32.2)^{1/2}(37)^{1.5} = 45{,}400\ cfs$$

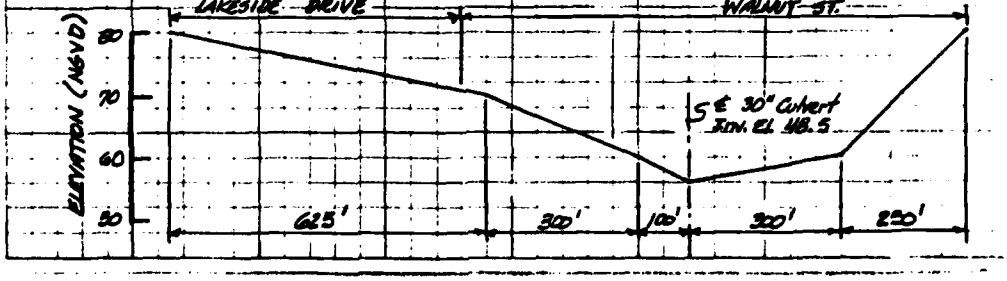
Town Brook, which constitutes the downstream channel, flows from the reservoir some 20,000 ft to the ocean at an average slope of 2.5 ft. per 1000 ft. Town Brook flows thru heavily developed sections of Braintree and Quincy where the potential for loss of life as well as for economic damages is excessively high.

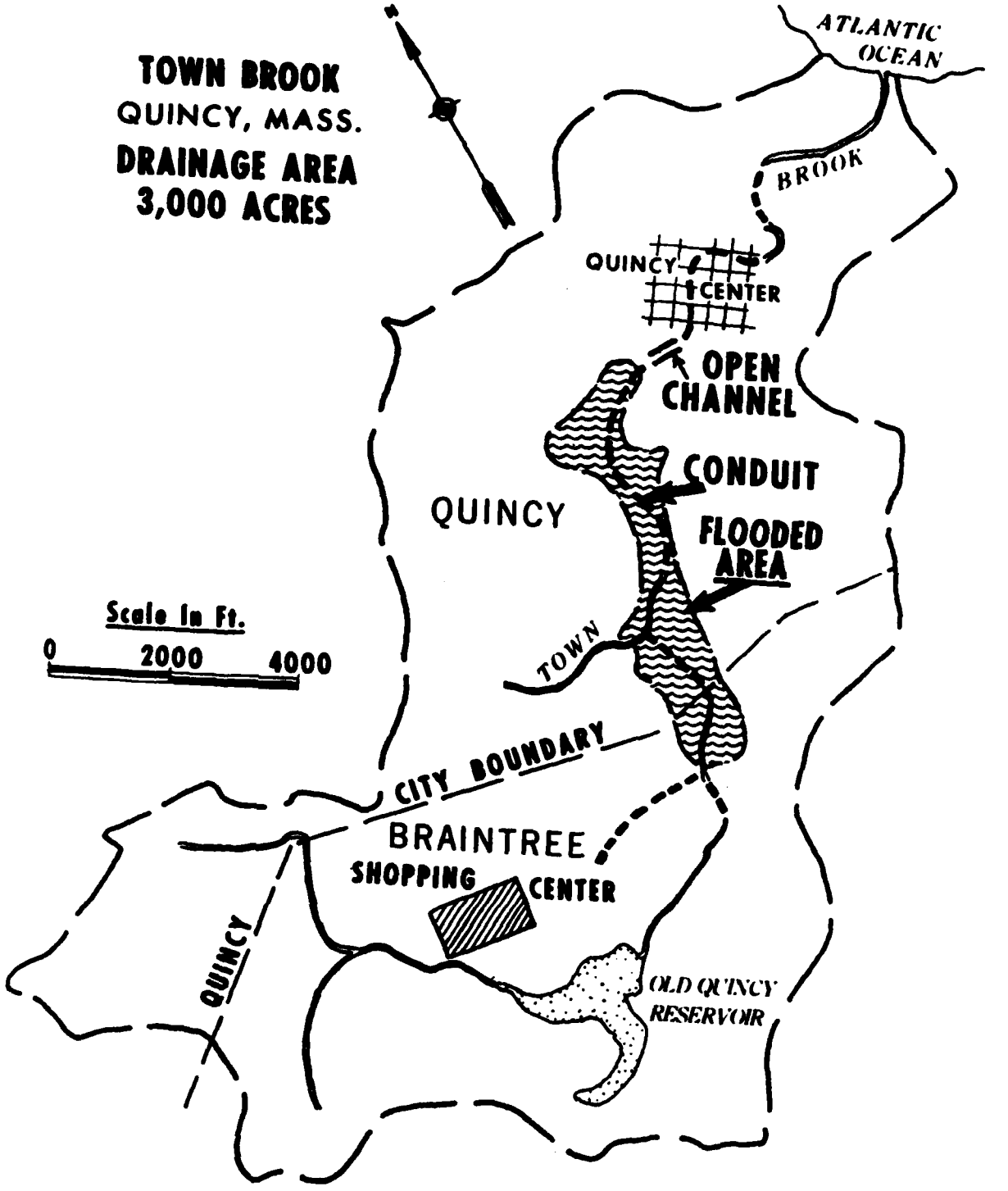
A Paper titled "Effect of Urban Expansion On Hydrologic Investigations" by Elliot F. Childs of the COE, NED, evaluated the hydrology of the watershed and emphasizes the limited hydraulic capacity of the urban drainage system which makes up Town Brook. Town Brook discharges in excess of 500 cfs result in cellar flooding and shallow inundation in the residential section of Braintree and in major damages along an 8,000 ft. long section of the brook in Quincy.

A Drainage Area Map showing some of the annual flood impact area is contained in the above ref. Paper and is shown on the next page.

The residential area of Braintree begins about 600 ft. d/s of the dam at Walnut St. The culvert beneath Walnut St. is a 30" RCP with the invert 7.5 ft. below top of Road. The overbanks of the brook are flat with homes abutting the channel.

I. Estimate depth of flood wave over Walnut St.




TOWN BROOK
QUINCY, MASS.
DRAINAGE AREA
3,000 ACRES
ATLANTIC OCEAN
BROOK
QUINCY CENTER
OPEN CHANNEL
CONDUIT
FLOODED AREA
QUINCY
TOWN
Scale In Ft.
0 2000 4000
CITY BOUNDARY
BRAINTREE
SHOPPING CENTER
QUINCY
OLD QUINCY RESERVOIR

CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT COE
PROJECT DAM INSP
DETAIL OLD QUINCY RES

JOB NO. 2904-ST-11
DATE CHECKED 10-19-79
CHECKED BY Joe A.

COMPUTED BY JED
DATE 10-10-79
PAGE NO 7

Compute Stage - Discharge using Mannings Eq., neglect culvert capacity.

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$; $n = 0.04$, $S = 0.0025$

At W.S. Elev. 60.0

$Q = \frac{1.49}{.04} (4 \times 200 \times .5 + 4 \times 100 \times .5)(800/400)^{2/3}(.0025)^{1/2} = 2,400$ cfs

$= 800$

At W.S. Elev. 65.0

$Q = \frac{1.49}{.04} (800 + 5 \times 150 \times .5 + 5 \times 75 \times .5 + 5 \times 400)(3738/625)^{2/3}(.0025)^{1/2}$

$= 3738$

$= 22,900$ cfs

At W.S. Elev. 70.0

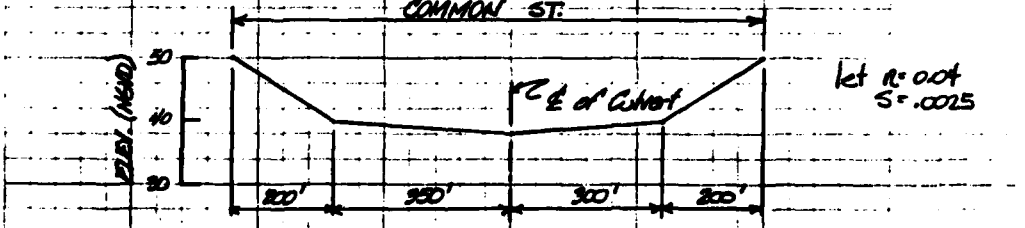
$Q = \frac{1.49}{.04} (3738 + 5 \times 180 \times .5 + 5 \times 30 \times .5 + 5 \times 625)(7363/825)^{2/3}(.0025)^{1/2}$

$= 7363$

$= 59,000$ cfs

By interpolation, stage at $Q_p = 45,400$ cfs is El. 68.1 or approx. 12.5 ft. above low point in Walnut St. A flood wave of that depth would submerge the residential homes in the area.

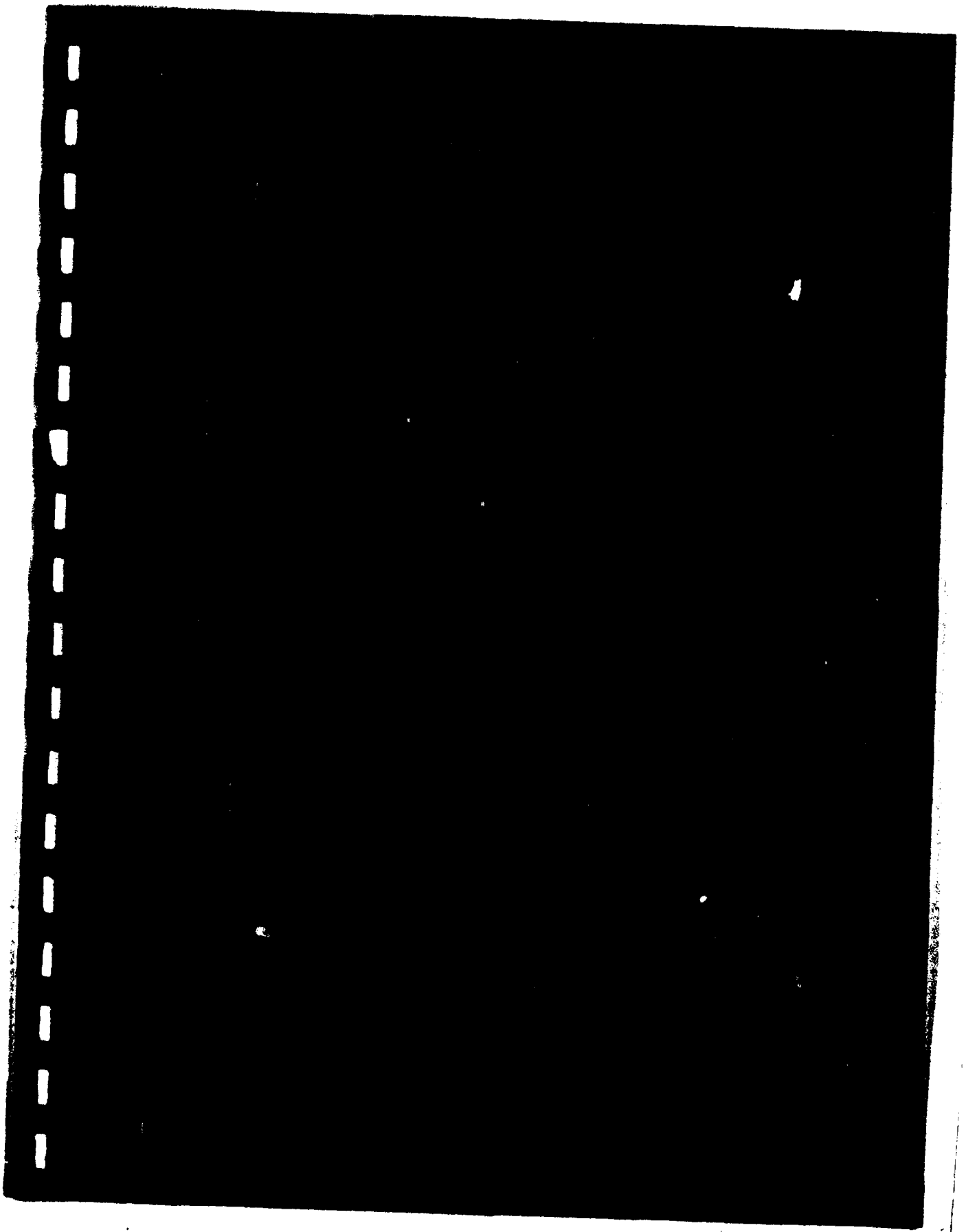
II Estimate depth of water over Common St. which is ~2,500 ft. downstream of Walnut St.



let $n = 0.04$
$S = .0025$

W.S. ELEV.	AREA (ft^2)	R	Q (cfs)
40	650	1.0	1,200
50	9150	8.21	72,200
46.2	- (by interpolation)		45,400

A dam failure would therefore destroy numerous dwellings resulting in a "HIGH" Hazard Classificatio



INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	REGION	CONG. DIST.	COUNTY	OTHER	COUNTY	OTHER DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
MA	027	NED	MA	021	11			OLD QUINCY RESERVOIR	4213.2	7101.0	26	OCT	79

REGULAR NAME	NAME OF IMPOUNDMENT
	OLD QUINCY RESERVOIR

CONG. DIST.	DAM	RIVER OR STREAM	NEAREST DOWNSTREAM CITY--TOWN--VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	TOWN BROOK	BRAINTREE	0	35000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC. HEIGHT (FT.)	HYDRAU. HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1888	8	37	37	794	552	NED	N	N	N	N	

REMARKS
23=PROCESS WATER

G/S FLAG	SPILLWAY LENGTH (FT.)	SPILLWAY TYPE	SPILLWAY HEIGHT (FT.)	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED	POWER CAPACITY PLANNED	NAVIGATION LOCKS NO.	LOCK LENGTH	LOCK WIDTH	LOCK LENGTH	LOCK WIDTH				
1	550	U	25	400												

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF QUINCY	L.A.TAYLOR	

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
CAMP DRESSER & MCKEE INC	10	SEP	79	PL92-367

REMARKS

END

DATE
FILMED

8-85