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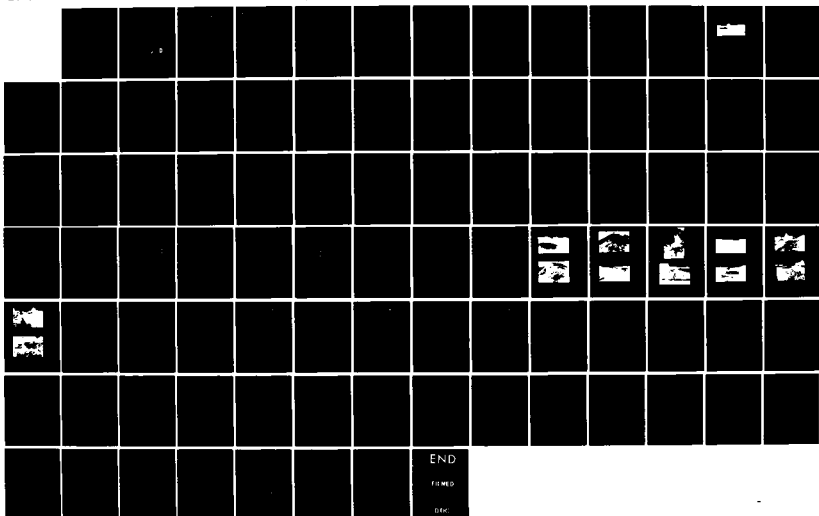
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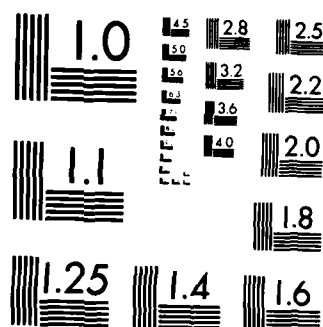
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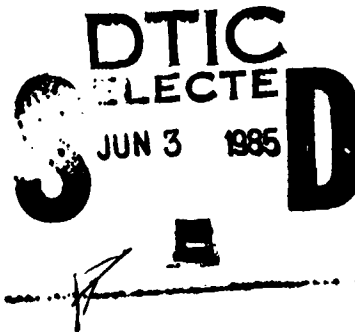
CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

AD-A154 526

STONY BROOK RESERVOIR DAM
MA 00293

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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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, Charles River Basin Weston, Massachusetts Stony Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This dam is a 830 foot long, 32 foot high earth dam with a 40 foot wide stone masonry spillway near its right. The dam is in fair condition. The size of the dam is intermediate and the hazard classification is high. Also various remedial measures should be taken by the owner.		



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

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

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

Dear Governor King:

I am forwarding to you a copy of the Stony Brook 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 Cambridge, 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

CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

STONY BROOK RESERVOIR DAM
MA 00293

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

JUNE 1979

STONY BROOK RESERVOIR DAM
MA 00293

CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00293
Name of Dam: STONY BROOK RESERVOIR DAM
Town: WESTON AND WALTHAM
County and State: MIDDLESEX COUNTY, MA
Stream: STONY BROOK
Date of Inspection: 8 NOVEMBER 1978

BRIEF ASSESSMENT

Stony Brook Reservoir Dam is a 830 foot long, 32 foot high earth dam with a 40 foot wide stone masonry spillway near its right abutment. An earth dike approximately 400 feet long extends from the dam along the west side of the reservoir. Water supply intakes and a low flow outlet are controlled from the gatehouse near the right end of the dam.

The dam is in fair condition. There is evidence of former sloughing and erosion at the downstream toe of the embankment and local erosion and displacement of riprap at the upstream face. Overtopping of the dam was indicated when the spillway was checked against the test flood.

Based on the size, intermediate, and hazard classification, high in accordance with the Corps of Engineers Guidelines, the spillway test flood is the Probable Maximum Flood (PMF). The test flood peak outflow was estimated to be 8,400 cfs and would result in overtopping the dam by approximately 2.0 feet. Hydraulic analysis indicates that the spillway, with flashboards removed, will only pass 1,850 cfs or 22 percent of the test flood. However, with the wasteway open, the combined capacity of the spillway and wasteway is 3,280 cfs or 39 percent of the PMF. The opening of the wasteway will reduce the overtopping to 1.7 feet.

Recommended additional investigations by the Owner include a detailed hydrologic-hydraulic study of spillway capacity, an investigation of the seismic stability of the dam and an investigation of potential seepage at the downstream slope. Recommended remedial measures include the cutting of brush and weeds on the dam, spillway and low flow discharge channel, the repair of local eroded areas and displaced riprap at the upstream face of the dam, the establishment of vegetation on bare areas, the repointing of joints at the spillway and gatehouse, the repair of an inoperative intake, the development of a formal maintenance program, operational procedure, emergency procedures plan and warning system and the instituting of a program of annual technical inspections. The recommendations and remedial measures should be undertaken by the Owner within one year of receipt of the report.

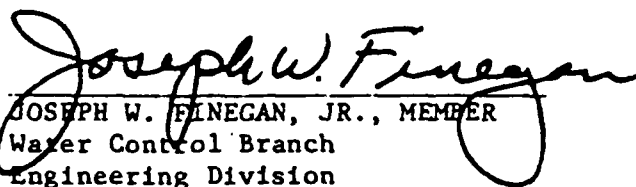
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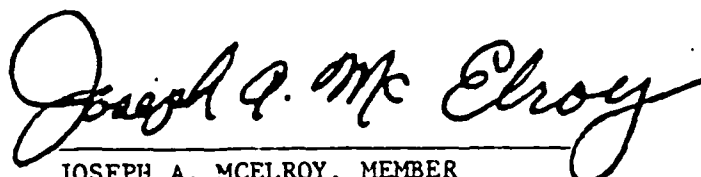
Roger H. Wood

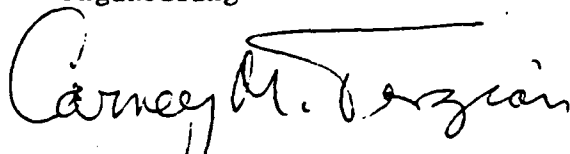
Roger H. Wood
Vice President



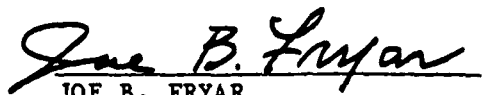
This Phase I Inspection Report on Stony Brook Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment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


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


JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design 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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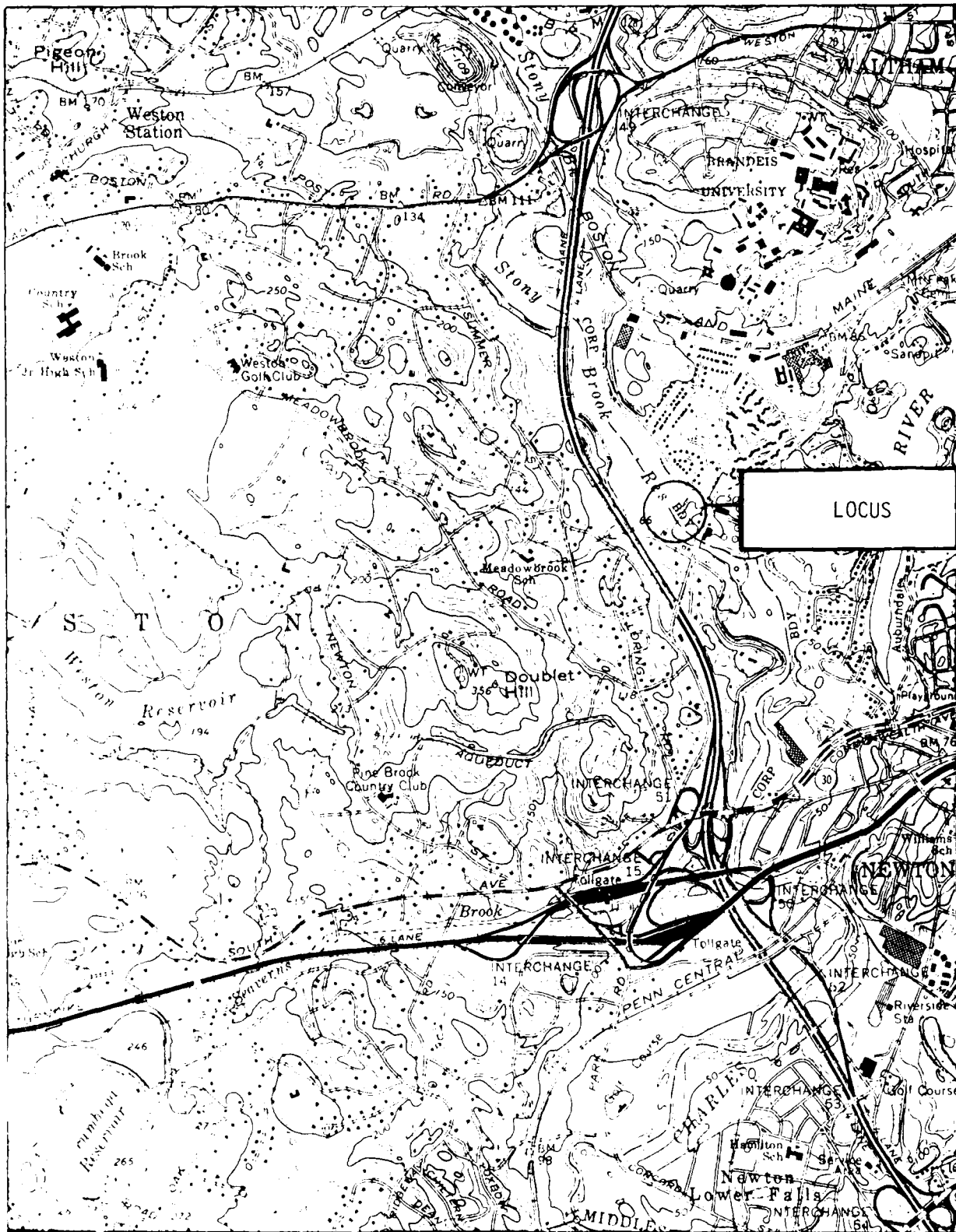
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1. OVERVIEW OF DAM AND SPILLWAY FROM RIGHT ABUTMENT.
(MARCH 1979)



DAM STONY BROOK RESERVOIR

IDENTIFICATION NO. MA 00293



LOCATION MAP
USGS QUADRANGLE

NATICK, MASS.

APPROX. SCALE: 1" = 2000'

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observation - There was no visible evidence of dam, spillway or dike instability during the site examination on 8 November 1978. The observed eroded areas at the crest and downstream toe of the dam showed no evidence of active soil movement, and are not considered to pose an immediate hazard to the stability of the embankments. However, it should be noted that the reservoir level was about 18 feet below the top of the embankment at the time of the observations, with the result that the forces tending to cause instability were much lower than design levels.
- b. Design and Construction - There are neither complete design drawings nor construction data which would detail the embankment cross sections or the physical properties of the materials in the embankments. Thus, theoretical analyses of the structural stability of the embankments and spillway are not possible.

The riprapped upstream slope is relatively steep, but the dam and dike embankments have had a long period of service. The spillway is a relatively low structure. In the absence of seepage or erosion problems, the embankments would be expected to be adequately stable under static loading conditions. In the absence of observed indications of movement of portions of the spillway, it would also be expected to be adequately stable under static loading conditions.

- c. Operating Records - No operating records other than inspection reports by the State and records of reservoir water levels were located.
- d. Post-Construction Changes - Without complete detailed design or "as-built" drawings the extent of post-construction changes to the dam and dike embankments is not known.
- e. Seismic Stability - Stony Brook Reservoir Dam is located in Seismic Zone 3. Pertinent data needed for a theoretical seismic stability analysis of the embankments and spillway are not available. Therefore, the stability of the structures during an earthquake is unknown.

Approximately 6 residential structures are located within this area, as shown on the Dam Failure Impact Area Map presented in Appendix D, which would experience considerable water depths. There is no residential development between South Street and the confluence of Stony Brook with the Charles River, which would be flooded by a failure of the dam. The potential loss of life would be high and accordingly this dam is classified as having a "high" hazard potential. Considerable overland flow will occur to the left of the South Street Culvert.

- d. Visual Observation - At the time of inspection on November 8, 1978, the water surface elevation for the Stony Brook Reservoir was substantially below the spillway crest elevation. The spillway and downstream channel appear to be in good hydraulic condition. Flashboards were in place, raising the spillway crest elevation from 69.8 to 72.2. Present Water Department practice is to remove the flashboards in late fall and reinstall them in the spring (March 1 to April 1) as soon as the runoff from snowpack and spring flows has occurred.
- e. Test Flood Analysis - Based upon Corps of Engineers Guidelines, the recommended test flood for the size (intermediate) and hazard potential (high) is a full PMF (Probable Maximum Flood). The PMF was checked using the Corps of Engineers Guideline curves for "Estimating Maximum Probable Discharges" in the Phase I, Dam Safety Investigations. The watershed was determined to be very flat. Approximately 30 percent of the 23.6 sq. mi. drainage area is tributary to Hobbs Brook Reservoir.

Flow from the Hobbs Brook watershed was then routed through Hobbs Brook Reservoir and the peak inflow rate of 2,780 cfs reduced to a maximum outflow of 2,290 cfs. This outflow hydrograph was then combined with a comparable storm hydrograph for the Stony Brook portion of the total watershed and this summation hydrograph routed through Stony Brook Reservoir. The routing indicated that there is virtually no reduction of the peak inflow rate of 8,400 cfs into Stony Brook Reservoir and as a result, water level in the reservoir will rise to Elev. 77.7, thus overtopping the dam by 1.7 ft.

An analysis was also conducted to determine the impact of the test flood with the wasteway tunnel assumed fully open as an auxiliary spillway. It was found that the maximum water level in the reservoir would be lowered 0.3 ft. while the duration that the dam would be overtopped would decrease from more than 50 hours to about 40 hours.

- f. Dam Failure Analysis - Based on Corps of Engineers Guidelines for Estimating Dam Failure hydrographs and assuming that the breach width would be 40 percent of the dam with the water level at the top of the dam (elev. 76.0), the failure would result in a peak outflow of 74,900 cfs. This flow will result in considerable flooding downstream, especially between the dam and South Street, approximately 450 feet downstream. Ground elevations in parts of this area are below El. 50. Due to constrictions caused by South Street, the estimated water surface at South Street prior to failure of the dam is elevation 53. This assumes a full spillway discharge with no flashboards as well as full discharge through the wasteway tunnel. Following the assumed dam failure, the water level at South Street will approach elev. 61, an increase in flooding depths of approximately 8 feet.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. General - The Stony Brook Reservoir Dam is located on Stony Brook on the boundary between the Town of Weston and the City of Waltham. The dam is an earth fill structure having a maximum height of approximately 32 feet and a total length of approximately 890 feet. The spillway has a maximum width of 40 feet and is approximately 26 feet above the downstream stream bed. The dam creates an impoundment of approximately 57 acres and an estimated total storage capacity of 1,060 acre-feet at a spillway crest elevation of 69.8. The pool at the top of dam (approx. elev. 76.0) comprises approximately 62 acres and an estimated total storage capacity of 1,530 acre-feet.
- b. Design Data - No hydraulic/hydrologic design data were located for this dam. All hydraulic and hydrologic criteria used in this report were developed by utilizing the USGS quadrangle maps, flood records, and other data gathered for this investigation.
- c. Experience Data - There is no evidence that any severe flooding has occurred at the Stony Brook Reservoir Dam. The highest flood flow on record according to the City of Cambridge is the August 1955 flood. During this period the water level rose from elev. 65.96 on August 17 to elev. 73.56 on August 21. This elevation is approximately 4 feet above the spillway crest. However, flashboards were in place and resulted in a higher water level than would have otherwise been recorded. Actual flow rates were not obtainable. During a brief period, the water level in the reservoir was kept at a higher level than at present, and high wave action caused a slight scour at one location. The water level was lowered and no serious overtopping occurred.

The highest water level ever observed at the dam occurred during the March 17-19, 1968 storm when a small section of the embankment about 15-20 ft. in length just east of the gatehouse was topped by water flowing 4-6 inches deep over this slightly lower section, despite the use of sandbags during the peak levels of the flood. It is not known what depth of flashboards, if any, were in place during this storm, but the wasteway tunnel reportedly was not used as an auxiliary spillway in an attempt to lower the water level.

During late January, 1979 two storms occurred (Jan. 21st and Jan. 25th) which caused the water level in the reservoir to rise to spillway level and begin spilling over the concrete crest. Operational procedure has resulted in the flashboards having been removed in late fall and included the operation of the tunnel wasteway to a partially open position, thereby minimizing the duration or period that spillage occurred at the dam.

SECTION 4: OPERATIONAL PROCEDURES

- 4.1 Procedures - Although there is an informal routine for the operation of the dam, there is no written procedure. Since 1978, the procedure has been to remove the flashboards in late fall and to replace same in the spring after melting of the snowpack and high water levels associated there with have passed. The wasteway tunnel is also used as necessary to provide additional spillway or release capacity during periods of high water when flow over spillway exceeds 2-3 ft.
- 4.2 Maintenance of Dam - The dam and dike embankments appear to have received routine maintenance in the past, although the presence of stumps, uncut brush, and eroded areas indicates that the maintenance is not up to date.
- 4.3 Maintenance of Operating Facilities - The maintenance of the operating facilities is performed primarily on a demand basis. There is no written formal procedure established for the maintenance of the operating facilities. The operating facilities are primarily for the transmission of water to the City of Cambridge and are operated as a part of performing this task.
- 4.4 Description of any Warning System in Effect - There is no formal established warning system or emergency preparedness plan in effect for this structure.
- 4.5 Evaluation - This dam is kept under observation by City employees. In general, the maintenance on this dam is being attended to although there were areas observed during the site examination which require attention.

A formal Operations and Maintenance Manual and a formal warning system or emergency preparedness plan should be established for this dam.

The City's consultant periodically provides guidance towards operation and maintenance.

- c. Appurtenant Structures - The stone masonry spillway is in good condition. Some of the masonry joints in the spillway weir as shown in Photo 11 have experienced a loss of mortar and need repointing. The flashboards at the weir crest are in good condition and require no corrective action at present. The spillway discharge channel has some vegetation in the form of brush present as shown in Photos 11 and 12. The masonry side walls need repointing as shown in Photo 13. The pedestrian bridge over the spillway is in good condition.

The gatehouse is in generally good condition. The brickwork needs repointing to minimize future deterioration. Only one intake was found to be inoperative at the gatehouse. However, there are two alternate operable intakes present. The low flow discharge channel as shown in Photo 12 is ponding water, and contains random stones and uncut brush and weeds.

The dike shown in Photo 7 is in good condition, with no major deficiencies noted.

- d. Reservoir Area - The reservoir as shown in Photos 7 and 8 is surrounded by moderate to steeply sloped hills. There is no development along the banks of the reservoir, except for a portion of Route 128 which bisects the northwestern portion of the reservoir. Observation of the conduit beneath Route 128 indicates that there should be adequate capacity to convey test flood flows without appreciable constriction.
- e. Downstream Channel - Flow from the spillway passes through a stone masonry discharge channel to a pond on the north side of South Street. The flow then passes through a twin barrel culvert in good condition, located at South Street approximately 450 feet from the dam. Downstream of the bridge is the remains of an abandoned dam. Approximately 750 feet further downstream, flow from Stony Brook enters the waters of the Charles River.

3.2 Evaluation

Except for the items noted in the visual examination, the Stony Brook Reservoir dam, spillway, gatehouse and dike appear to be in satisfactory condition. The previously cut stumps and the brush are not considered to compromise the integrity of the dam, and it is understood that the crest erosion occurred when the reservoir was maintained at a higher level than is current practice. The erosion or sloughing at the downstream berm could possibly be an indication of seepage problems during high water levels. However, according to the dam tender, it occurred during the March 17-19, 1968 storm when the dam was briefly overtopped. The remaining items noted are considered minor and could be taken care of in the maintenance program.

SECTION 3: VISUAL INSPECTION

3.1 Findings

- a. General - The Phase I visual examination of the Stony Brook Reservoir Dam was conducted on 8 November 1978.

In general, the earth embankment is in fair condition while the spillway and gatehouse were observed to be in good condition. The reservoir level at the time of the inspection was approximately 10 feet below the weir crest.

Visual inspection checklists for the site visit are included in Appendix A and selected photographs are given in Appendix C.

- b. Dam - The earth embankment is generally in fair condition. There is no visual evidence of significant settlement or lateral movement, or major seepage, but there has been local erosion of the crest and downstream slope.

The following specific items were noted:

- (1) Much of the dam embankment surface has been mowed, but there is considerable growth of brush and trees toward the left abutment and on the downstream face below the berm, as shown in Photos 4 and 5. Large old stumps, cut flush with the ground surface, are evident in the downstream face. A growth of brush is developing in the upper part of the upstream riprap of the dam, as shown in Photo 3. Small stumps indicate that this brush has been cut previously.
- (2) There has been local erosion of the dam embankment along the upper edge of the upstream riprap, as shown in Photos 2 and 3. This erosion has cut back into the crest, and appears to have caused some loss of stone from the upper edge of the riprap.
- (3) There is also apparent erosion or sloughing of the toe of the downstream dam slope at the berm, over a distance of approximately 70 ft. to the left of the gatehouse, as shown in Photo 5. Material has been deposited on the berm and there is a 2 foot high scarp at the toe of the slope. At the time of the site examination there was no water flow evident, but there was a hole extending 4.5 feet back into the scarp at one point as shown in Photo 6.
- (4) The main dam has a bare footpath worn along the length of the crest, as shown in Photo 4.

SECTION 2: ENGINEERING DATA

2.1 Design Records

A portion of the original design drawings for the facility are available.

2.2 Construction Records

No records of the original construction other than a portion of the design drawings were located.

2.3 Operation Records

No operational records other than water transmission line flow records and former County and State inspection reports were located.

2.4 Evaluation

- a. Availability - The records are generally available at Cambridge Water Board, Cambridge Water Filtration Plant, 250 Fresh Pond Parkway, Cambridge, Massachusetts 02138.
- b. Validity - Recorded information is in good agreement with existing conditions observed during the site examination.
- 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.

- j. Regulating Outlet - There is a 5-ft. by 10-ft. high wasteway tunnel with arch top to the left of the spillway. The invert elevation of the gate is approximately at elevation 42.5. Original intent for this outlet was to provide water to Stony Brook during periods of no flow over the spillway. Controls for the outlet are located in the brick building adjacent to the spillway.

(5) Test flood pool-----1,670 (Est.)

f. Reservoir Surface (acres)

(1) Normal pool-----57 (Est.)

(2) Flood-control pool-----N/A

(3) Spillway crest-----57 (Est.)

(4) Test flood pool-----63 (Est.)

(5) Top dam-----62 (Est.)

g. Embankment

Dam

Dike

(1) Type	Gravel fill	Probably gravel fill, with stone masonry downstream face
(2) Length	Approx. 830 ft.	Approx. 400 ft.
(3) Height	Approx. 32 ft.	Est. 4 to 5 ft. maximum
(4) Top width & Elevation	20 ft. @ El 62	Est. 15 ft. @ El 62
(5) Side slopes	1-1/2:1 U/S & 2:1 D/S	Approx. 2:1 U/S, vertical D/S
(6) Zoning	Homogeneous	Probably homogeneous
(7) Impervious core	Stone masonry wall	Unknown
(8) Cutoff	Apparent sheeting below core wall	Unknown
(9) Grout curtain	Probably none	Probably none

h. Diversion and Regulating Tunnel ----- NONE

i. Spillway

(1) Type----- Broad crested stone masonry

(2) Length of weir----- 40 ft.

(3) Crest elevation----- 69.8 (Est.)

(4) Gates----- Flashboards to 72.2
(removed in fall - replaced in spring)

(5) U/S Channel----- Unobstructed approach from reservoir

(6) D/S Channel----- Stone masonry channel approx. 58 ft. wide and
180 ft. long at an 18% slope

- (4) Ungated spillway capacity at test flood elevation.
2,880 cfs at elevation 78.0 (Flashboards removed)
- (5) Gated spillway capacity at normal pool elevation---1,250 cfs at
Elev. 69.8
- (6) Gated spillway capacity at test flood elevation ---1,250 cfs at
Elev. 78.0
- (7) Total spillway capacity at test flood elevation.
4,400 cfs at elevation 77.7 (wasteway open)
1,520 cfs at elevation 78.0 (wasteway closed)
- (8) Total project discharge at test flood elevation.
8,400 cfs at elevation 78.0 (wasteway closed) 77.7 (wasteway open)

c. Elevation (ft. above MSL)

- (1) Streambed at centerline of dam-----44.0 (Est.)
- (2) Test flood tailwater-----53.8
- (3) Upstream portal invert diversion tunnel-----N/A
- (4) Normal pool-----69.8
- (5) Full flood control pool-----N/A
- (6) Spillway crest-----69.8 (72.2 with Flashboards)
- (7) Design surcharge (Original Design)-----Unknown
- (8) Top of dam-----76.0
- (9) Test flood design surcharge-----78.0

d. Reservoir

- (1) Length of test flood pool-----1.2 miles
- (2) Length of normal pool-----1.1 miles
- (3) Length of flood control pool-----N/A

e. Storage (acre-feet)

- (1) Normal pool-----1,060 (Est.)
- (2) Flood control pool-----N/A
- (3) Spillway crest pool-----1,060 (Est.)
- (4) Top of dam-----1,530 (Est.)

- d. Hazard Classification - The results of the dam failure analysis indicate that a minimum of 6 homes would be affected by the flood wave and the potential loss of life would be greater than 10 persons. Consequently, the dam is the "high" hazard classification.
- e. Ownership - The dam and reservoir are owned by the City of Cambridge. The owner is represented by Mr. J. H. Seites, Superintendent of the Water Department, Office of the Water Board, 250 Fresh Pond Parkway, Cambridge, Massachusetts 02138 (phone: (617) 864-5300).
- f. Operator - Mr. Joseph Libitz, Caretaker, 1 Gatehouse Lane, Weston, Massachusetts 02193 (phone: (617) 891-7388) is assigned responsibility for operation of the dam.
- g. Purpose of the Dam - Stony Brook Reservoir Dam is part of the water supply system for the City of Cambridge, Massachusetts.
- h. Design and Construction History - The Stony Brook Reservoir Dam was constructed in 1887. While a portion of the original drawings were located, no other information on the construction was found. Observations of the dam indicated little or no major modification has been made to the facility.
- i. Normal Operational Procedures - Maintenance at the dam is performed on a routine schedule. There is a caretaker permanently assigned to the reservoir who has responsibility for the operation of the sluice gate controls and weir flashboards on an as need basis.

1.3 Pertinent Data

Elevations given in this report are on National Geodetic Vertical Datum (NGVD) formerly referred to as Mean Sea Level (MSL). The elevation assigned to the spillway crest was taken from City of Cambridge documents.

- a. Drainage Area - The dam impounds waters of Stony Brook in the Town of Weston and City of Waltham. The total watershed above the dam is 23.6 square miles of which 7.1 square miles contributes flow initially to Hobbs Brook Reservoir. The outflow from Hobbs Brook Reservoir joins Stony Brook and thence into Stony Brook Reservoir.
- b. Discharge at Dam Site - There is no recorded information for discharge at the dam site.
 - (1) Outlet works size: 5 ft. wide by 10 ft. high wasteway tunnel with arch top culvert at approximate elevation 42.5
 - (2) Maximum known flood at damsite -----In excess of
Elev. 76.0 on
March 20, 1968
 - (3) Ungated spillway capacity at top of dam.
1,850 cfs at elevation 76.0 (Flashboards removed)

- b. Description of Dam and Appurtenances - Stony Brook Reservoir Dam consists of a 830 ft. long earth dam, with a gatehouse and over-flow spillway structure at the right end, and a low earth dike extending from the right end of the dam along the west side of the reservoir.

The dam embankment is approximately 32 ft. high, with a 20 ft. wide crest and basic upstream and downstream slopes of 1.5 to 1 and 2 to 1 (horizontal to vertical), respectively. Drawings show the embankment to be constructed to gravel with a stone masonry core wall that extends through underlying "blue gravel" to a sand stratum. There is also an indication of sheeting extending down from the core wall foundation into the sand.

The upstream slope of the dam has riprap from about 2 ft. below the crest down at least to 18 ft. below the crest. Below this elevation, the drawings show a berm and a flatter earth slope without riprap. The crest and downstream slope of the embankment are grass-covered. There is a 20 ft. wide berm near the bottom. Below this downstream berm, cobble and boulder slope protection extends down to standing water at the toe.

The spillway is 40 ft. long and has provisions for flashboards between elevation 69.8 to elevation 72.2. Downstream of the spillway is a stone masonry channel approximately 58 feet wide and 4.5 feet deep. The average slope of this channel is approximately 18 percent. Adjacent to the spillway on the left embankment there is a stone and brick structure that contains the operating controls for three outlets from the reservoir. One control is for a 5 foot wide and 10 foot high intake sluice gate to allow discharge into Stony Brook during low flows. The cuivert invert is at approximately elevation 42.5. The two other controls are for 36" diameter and 30" diameter water mains respectively that transmit water from Stony Brook Reservoir to Fresh Pond Reservoir and the City of Cambridge water treatment plant.

The dike that parallels Gatehouse Lane to the right of the spillway has a maximum height of only 4 or 5 feet. The sloping upstream face is protected by riprap similar to that on the main dam, while the vertical downstream face and a short upstream wall at the spillway are of mortared stone masonry. The crest of the dike has a grass cover.

- c. Size Classification - The height of the dam is approximately 32 feet and the estimated storage capacity is 1,530 acre-feet at top of dam. According to guidelines established by the Corps of Engineers, the height of the dam is in the small category whereas the storage capacity is in the intermediate category. Therefore, the dam is classified in the intermediate category.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
STONY BROOK RESERVOIR DAM
MA 00293

SECTION 1: PROJECT INFORMATION

1.1 General

- a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

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 letters of 12 July 1978 and 23 October 1978 from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for 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 - Stony Brook Reservoir Dam is located on Stony Brook approximately 1,200 feet above the confluence with the Charles River. The dam is located on the boundary of the Town of Weston and the City of Waltham. The spillway and gatehouse are located on the Southwest end of the dam and accessible via Gatehouse Lane, in the Town of Weston, as shown on the report's location map.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition - The visual examination of the Stony Brook Reservoir dam, spillway and dike did not reveal any evidence of failure or conditions which would warrant urgent remedial treatment. However, because of the need for maintenance and additional investigation that is outlined hereinafter, the project is considered to be in only fair condition.
- b. Adequacy of Information - The limited available information, in conjunction with visual examination at the site, has been sufficient for the purpose of this Phase I investigation, but it does not permit detailed evaluation of stability or seepage potential.
- c. Urgency - The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken within one year of receipt of the report by the owner.
- d. Need for Additional Investigations - Additional investigations should be performed by the owner as outlined in the following section.

7.2 Recommendations

It is recommended that the owner engage a registered professional engineer to perform the following additional investigations:

- (1) Investigate the area of sloughing and erosion at the downstream toe of the dam embankment during high reservoir levels to determine if there is any indication of seepage problems. If there is seepage, the investigation should be extended to the development of remedial measures.
- (2) Investigate the seismic stability of the dam embankment.
- (3) A detailed hydrologic-hydraulic investigation to determine the adequacy of the spillway and any necessary modifications to provide adequate capacity.

7.3 Remedial Measures

- a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the owner, in addition to the investigations outlined in Section 7.2, to correct deficiencies noted during the visual examination:
- (1) Clear brush from the entire surface of the dam and dike embankments, spillway discharge channel and low flow discharge channel, and cut grass and weeds on the embankments at least once a year.
 - (2) Restore local eroded areas in the dam embankment, re-establish vegetative cover, and replace riprap stone as necessary. Work at the downstream toe would be subject to the results of the investigation under Section 7.2
 - (3) Repoint stone masonry at the spillway weir, side walls and apron. Repoint gatehouse brickwork.
 - (4) Repair the presently inoperative intake
 - (5) Develop a formal maintenance program, operational procedure, emergency procedures plan and warning system in cooperation with downstream officials.
 - (6) Institute a program of annual technical inspections.

7.4 Alternatives - There are no recommended alternatives.

APPENDIX A
INSPECTION TEAM ORGANIZATION AND CHECK LIST

Page No.

VISUAL INSPECTION PARTY ORGANIZATION

A-1

VISUAL INSPECTION CHECK LIST

Embankment - Main Dam
Spillway - Check List
Outlet Works - Check List

A-2
A-3,4
A-5

VISUAL INSPECTION PARTY ORGANIZATION
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir

DATE: 8 November 1978

TIME: 1:30 p.m.

WEATHER: Overcast, 50-55°

WATER SURFACE ELEVATION UPSTREAM: Elev. 68.68 (Cambridge Datum)

STREAM FLOW: No discharge

INSPECTION PARTY:

1. Robert P. Howard - CDM - Structural/Operations
2. Francis E. Luttazi - CDM - Structural/Operations (Ass't)
3. Charles E. Fuller - CDM - Hydraulic/Hydrology
4. Joseph E. Downing - CDM - Hydraulic/Hydrology (Ass't)
5. Peter L. LeCount - Haley and Aldrich - Soils
6. _____

PRESENT DURING INSPECTION:

1. William Brennan, City of Cambridge
2. _____
3. _____
4. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir

DATE: 8 November 1978

EMBANKMENT: Main Dam

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows 2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement 3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains 4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	1. a. Scattered brush & stumps to 4 in. dia. in top 10 ft. of slope. b. Top 2 to 3 ft. of much of dam length above riprap, eroded 2 to 3 ft. into embankment. c. Riprap generally intact, local minor loss at top adjacent to erosion. d. None observed 2. a. Grass except along path b. Erosion above riprap has cut into upstream corner of crest. c. None observed d. None observed 3. a. Generally grass, except brush beyond fence near left abutment and between berm and water at toe. Scattered stumps to 36 in. dia. remain flush with main slope. b. 2 ft. high eroded scarp along approx. 70 ft. of toe of main slope above berm and near gate house; apparent deposited soil on berm. c. None observed d. Poss. 4.5 ft. deep burrow in eroded scarp. e. None observed f. No significant indication of seepage along downstream shoreline. g. None observed - h., i. None known 4. a. None evident - b., c. Appears good d. No indication of problems e. None observed f. Is minor problem for dam tender g. None known

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam

DATE: November 8, 1978

SPILLWAY: _____

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1. a. Good to Excellent b. None c. None
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids or Erosion i. Visible Reinforcement j. General Struct. Condition	2. a. Wooden flashboards and supports are in good condition. b. See Outlet Works c. None d. None - Water level was far below overflow crest. e. Minor staining f. None g. Good, some joints need regrouting h. None i. N/A j. Good
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3. a. First ten feet downstream of the spillway crest appears to have been grouted heavy stone riprap. Most of grout has been washed away. b. None c. Placed heavy stone riprap channel bottom in good condition. d. Minor bush growth in channel. Heavy bush growth at channel exit. e. None observed f. None g. Good
4. Walls a. Wall Location-Left & Right (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement	4. a. (1) None observed (2) None observed (3) None observed (4) None observed (5) The joints, in general, are in good condition. Joints need repointing. (6) None observed (7) N/A

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam

DATE: November 8, 1978

SPILLWAY: _____

CHECK LIST	CONDITION
(8) General Struct. Condition	(8) Good - Last section of left wall downstream has been dislodged.
5. Pedestrian Bridge	5.
a. Steel Support	a. Good
b. Wood Plank Deck	b. Good
c. Railing	c. Good

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam

DATE: November 8, 1978

OUTLET WORKS: _____

CHECK LIST	CONDITION
1. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates 2. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks 3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks 4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	1. a. None observed b. Submerged c. Grouted stone walls are in good condition. Joints need repointing in some areas. d. Reinforcing bar trash rack in excellent condition. e. None f. None 2. a. Super structure in good condition. Joints in brick work need repointing. b. Two mechanical screens in good working condition. c. None d. Three sluice gates to draw water from three levels. Two in good operating condition, one could not be opened. One sluice gate to outfall channel in good operating condition. e. Submerged f. None observed 3. a. Vaulted tunnel of grouted stone joints need repointing. b. None observed. Channel floor submerged. c. Outfall channel cluttered with vegetation and stones. d. None observed. Channel floor submerged. 4. a. None b. None c. From power line - OK d. None e. Good f. None observed

APPENDIX B
LIST OF AVAILABLE DOCUMENTS AND
PRIOR INSPECTION REPORTS

		<u>Page No.</u>
<u>LIST OF AVAILABLE DOCUMENTS</u>		B-1
<u>PRIOR INSPECTION REPORTS</u>		
<u>Date</u>	<u>By</u>	
January 2, 1973	Mass. Dept. of Public Works	B-2,3,4
January 2, 1974	Mass. Dept. of Public Works with Description of Dam	B-5,6,7,8
<u>DRAWINGS</u>		
<u>No.</u>	<u>Title</u>	
1754	Cross Section of Proposed Dam	B-9
1756	Gatehouse Cross Sections and Details	B-10
1757	Miscellaneous Elevations	B-11
1764	Elevations and Details of Gatehouse	B-12

LIST OF DOCUMENTS

STONY BROOK RESERVOIR DAM

DOCUMENT

LOCATION

- | | |
|---|---|
| 1. Report on Needed Improvements to the
Cambridge Water System, July 1970. | City of Cambridge
Water Department
250 Fresh Pond Parkway
Cambridge, MA 02138 |
| 2. Miscellaneous References (see note
below) | City of Cambridge
City Hall Engineering
Office
795 Massachusetts Ave.
Cambridge, MA 02139 |

Note: An index was obtained listing descriptive titles of over 250 references pertaining to Stony Brook Reservoir dating back to 1887. A search was made for approximately 20 percent of the drawings which were deemed relevant based on their descriptive titles. Only one third of these could be located of which one half were found to be useful. Four pertinent drawings are included in Appendix B of this report.

OK
FILE *LCY*

INSPECTION REPORT - DAMS AND RESERVOIRS

(1.) Location: City/Town WESTON

Dam No. 4-9-333-1

Name of Dam STONY BROOK RES. DAM

Inspected by A. Z. PIZAN &

D. KILPATRICK
Date of Inspection 1-2-73

(2) Camera: periscope REFUSED ✓ Prev. Inspection

Reg. of Deeds Pers. Contact

1. CITY OF CAMBRIDGE, 250 FRESH POND HWY, CAMBRIDGE, MASS. - 02140 864-5300
Name St. & No. City/Town State Tel. No.

2.
Name St. & No. City/Town State Tel. No.

3.
Name St. & No. City/Town State Tel. No.

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

SAME
Name St. & No. City/Town State Tel. No.

(4) No. of Pictures taken NONE

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

1. Minor

2. Moderate

3. Severe ✓

4. Disastrous

*This rating may change as I find the changes (future development)

(6) Outlet Control: Automatic ✓ Manual

Operative ✓ Test No.

(7) In stream ✓

-2-

DAM NO. 4-9-333-1

(8) Downstream Face of Dam: Condition: 1. Good ☒ 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

(9) Emergency Spillway: Condition: 1. Good ☒ 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

(10) Water level @ time of inspection _____ ft. above 0.2' below _____
top of dam _____ Principal spillway ☒
other _____

(11) Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ☒
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 debris impeding flow _____
Clogged or blocked spillway _____
Other _____

(12) Remarks & Recommendations: (Fully Explain)

DAM IS IN GOOD CONDITION.

(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 _____

DESCRIPTION OF DAM
DISTRICT 4

Submitted by E. KILPATRICK & A. Z. PIZAN
Date 1-2-79

Dam No. 4-9-333-1
City/Town WESTON
Name of Dam STONY BROOK RES. DAM

1. Location: Topo Sheet No. 260
Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.
2. Year built: 1887 Year/s of subsequent repairs _____
3. Purpose of Dam: Water Supply ☒ Irrigation _____
Recreational _____ Other _____
4. Drainage Area: 1 NO SQ. MI. 640 ACRES.
5. Normal Ponding Area: 57 acres: Ave. Depth 12
impoundment: 228 MIL. gals; 684 acre ft.
6. No. and type of dwellings located adjacent to pond or reservoir
i.e. summer homes etc. 1 PUMP HOUSE
7. Dimensions of Dam: Length 1500' Max. Height 40'
Slopes: Upstream Face 4:1
Downstream Face 2:1
Width across top 20'
8. Classifications of Dam by Material:
Earth ☒ Concrete Masonry _____ Stone Masonry _____
Masonry _____ Rockfill _____ Other _____
9. A. Description of present land usage downstream of dam: 75 rural;
25 urban
B. In case a storage area or flood plain downstream of dam which could
be damaged by flood water in the event of a low dam failure
is ☒ _____



10. OVERVIEW OF SPILLWAY APPROACH CHANNEL AND INLET TO GATE HOUSE.



11. OVERVIEW OF SPILLWAY WEIR FROM RIGHT DOWNSTREAM CHANNEL WALL.



8. OVERVIEW OF DAM AND RESERVOIR FROM ROUTE 128 EMBANKMENT.



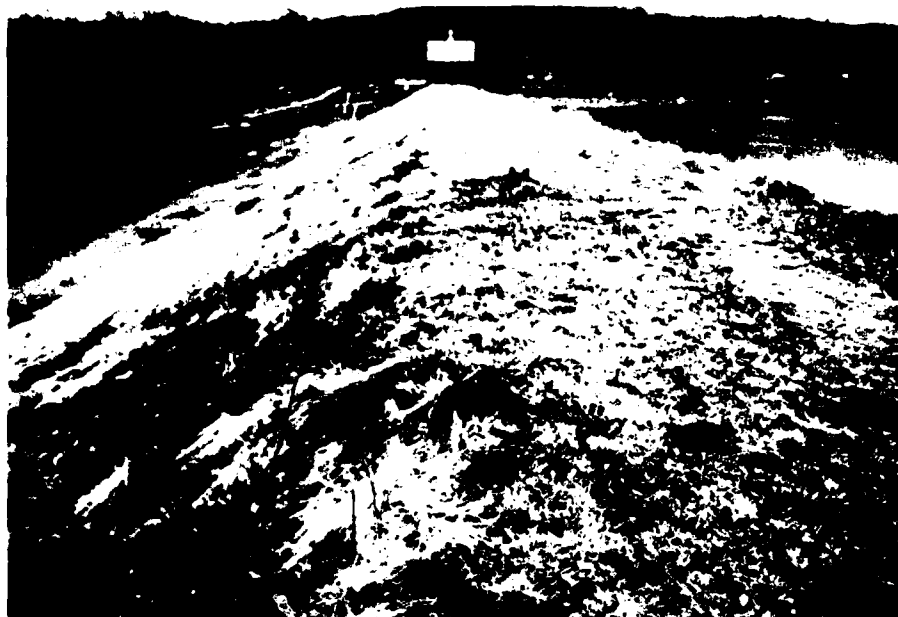
9. CHANNEL AND DEVELOPMENT DOWNSTREAM OF DAM.



6. RULE EXTENDING 4.5 FEET INTO HOLE AT TOE OF DAM.
SEE PHOTO 5 FOR LOCATION OF ERODED AREA.



7. OVERVIEW OF DIKE ON RIGHT BANK FROM RIGHT SPILLWAY
ABUTMENT. ROUTE 128 EMBANKMENT IS IN BACKGROUND.



4. DOWNSTREAM EDGE OF DAM CREST FROM LEFT ABUTMENT. NOTE CUT-OFF STUMPS IN FOREGROUND AND PATH ALONG CREST.



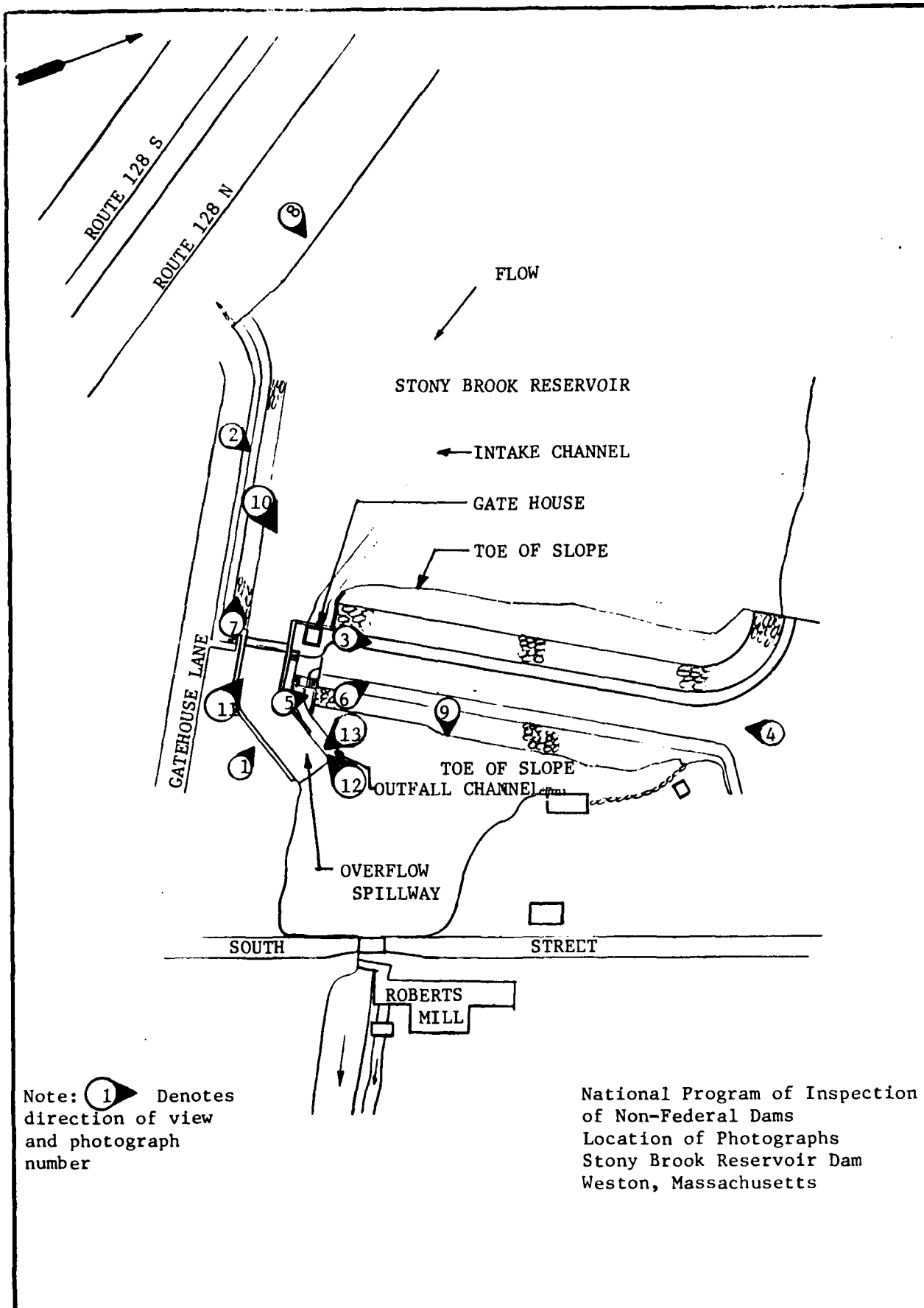
5. DOWNSTREAM FACE OF DAM SHOWING ERODED AREA AT TOE.



2. UPSTREAM FACE OF DAM FROM RIGHT BANK.



3. EROSION OF UPSTREAM EDGE OF DAM CREST NEAR GATE HOUSE.



APPENDIX C

SELECTED PHOTOGRAPHS OF PROJECT

LOCATION PLAN

Page No.

Location of Photographs

C-1

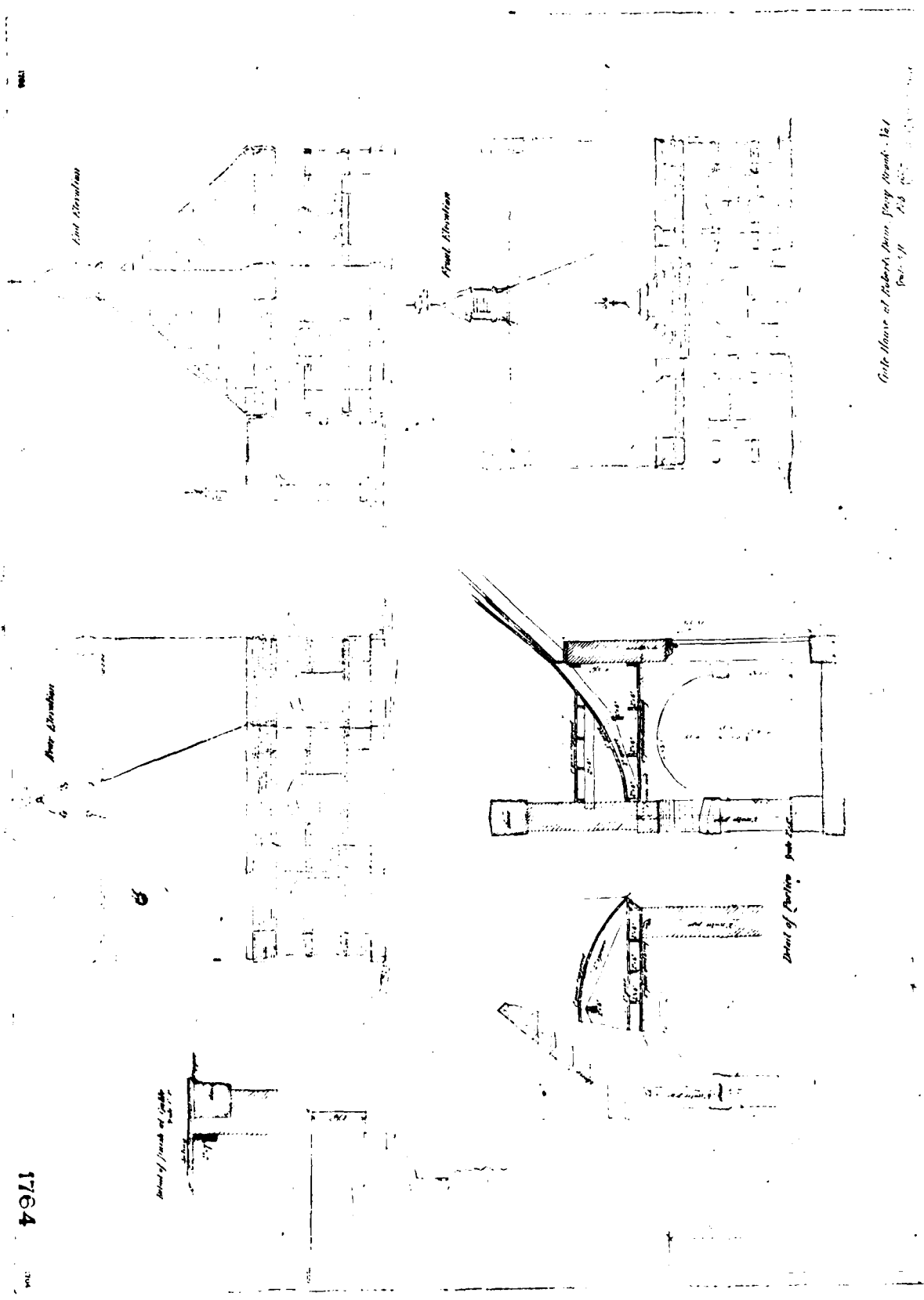
PHOTOGRAPHS

No.

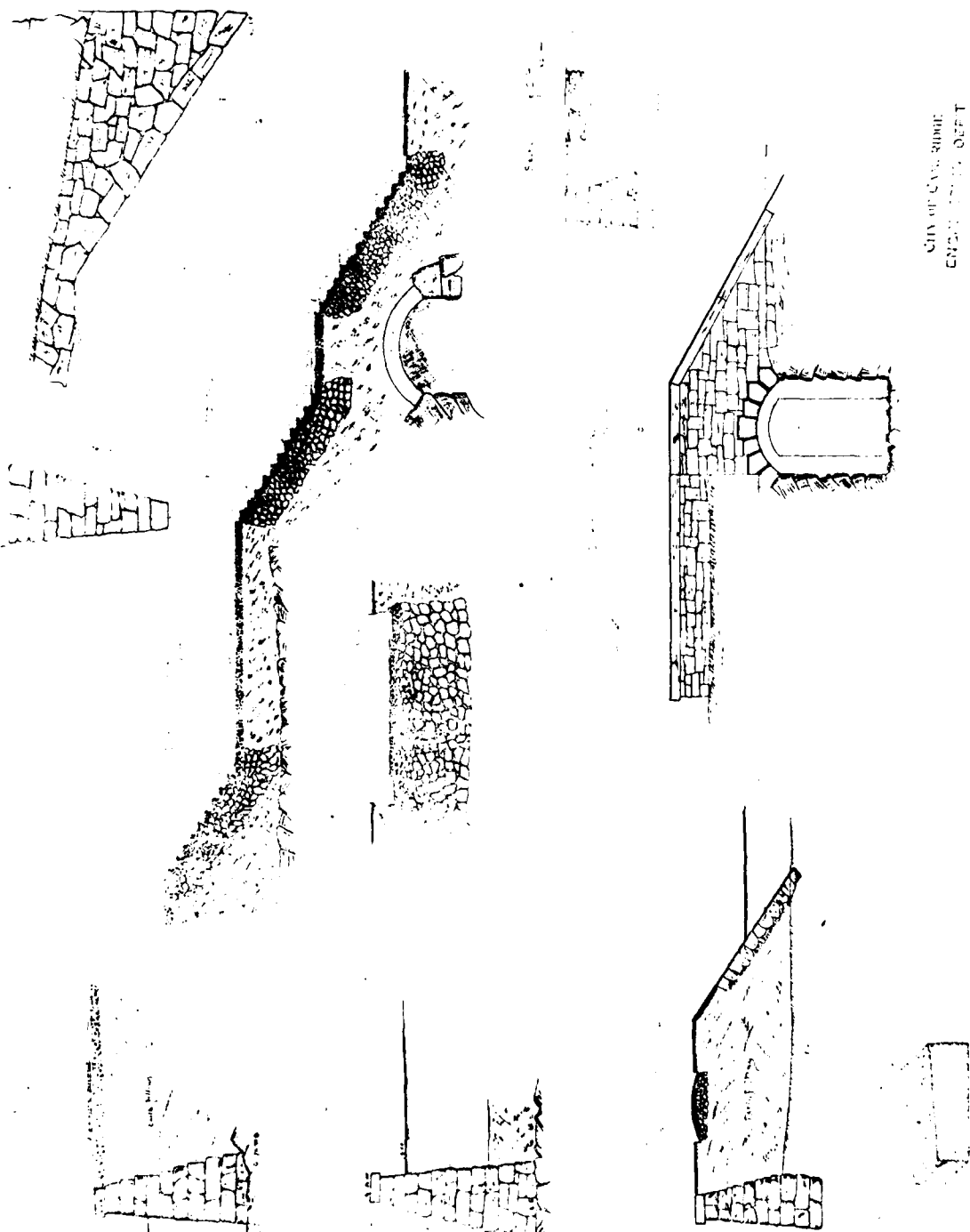
Title

Page No.

- | | | |
|-----|--|-----|
| 1. | Overview of Dam and Spillway From Right Abutment | iv |
| 2. | Upstream Face of Dam From Right Bank | C-2 |
| 3. | Erosion of Upstream Edge of Dam Crest Near Gate House | C-2 |
| 4. | Downstream Edge of Dam Crest From Left Abutment | C-3 |
| 5. | Downstream Face of Dam Showing Eroded Area at Toe | C-3 |
| 6. | Rule Extending 4.5 Feet Into Hole at Toe of Dam | C-4 |
| 7. | Overview of Dike on Right Bank From Right Spillway Abutment | C-4 |
| 8. | Overview of Dam and Reservoir From Route 128 Embankment | C-5 |
| 9. | Channel and Development Downstream of Dam | C-5 |
| 10. | Overview of Spillway Approach Channel and Inlet to Gate House | C-6 |
| 11. | Overview of Spillway Weir From Right Downstream Channel Wall | C-6 |
| 12. | View of Reservoir Outlet Tunnel and Gate House From Spillway Discharge Channel | C-7 |
| 13. | End of Spillway Right Channel Wall | C-7 |



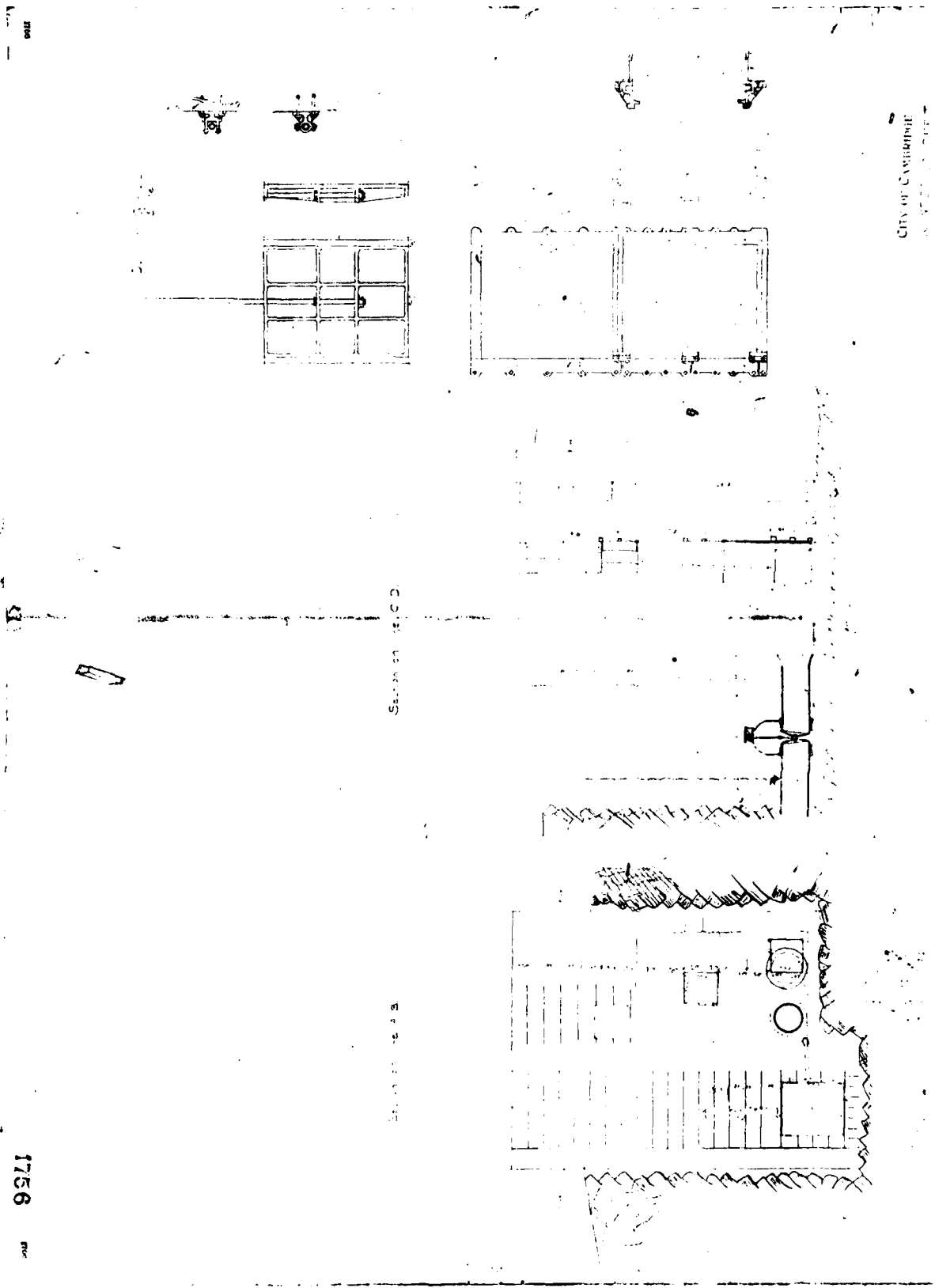
Castle of St. George, Edinburgh. No. 1
 Scale: 1/4" = 1 ft.



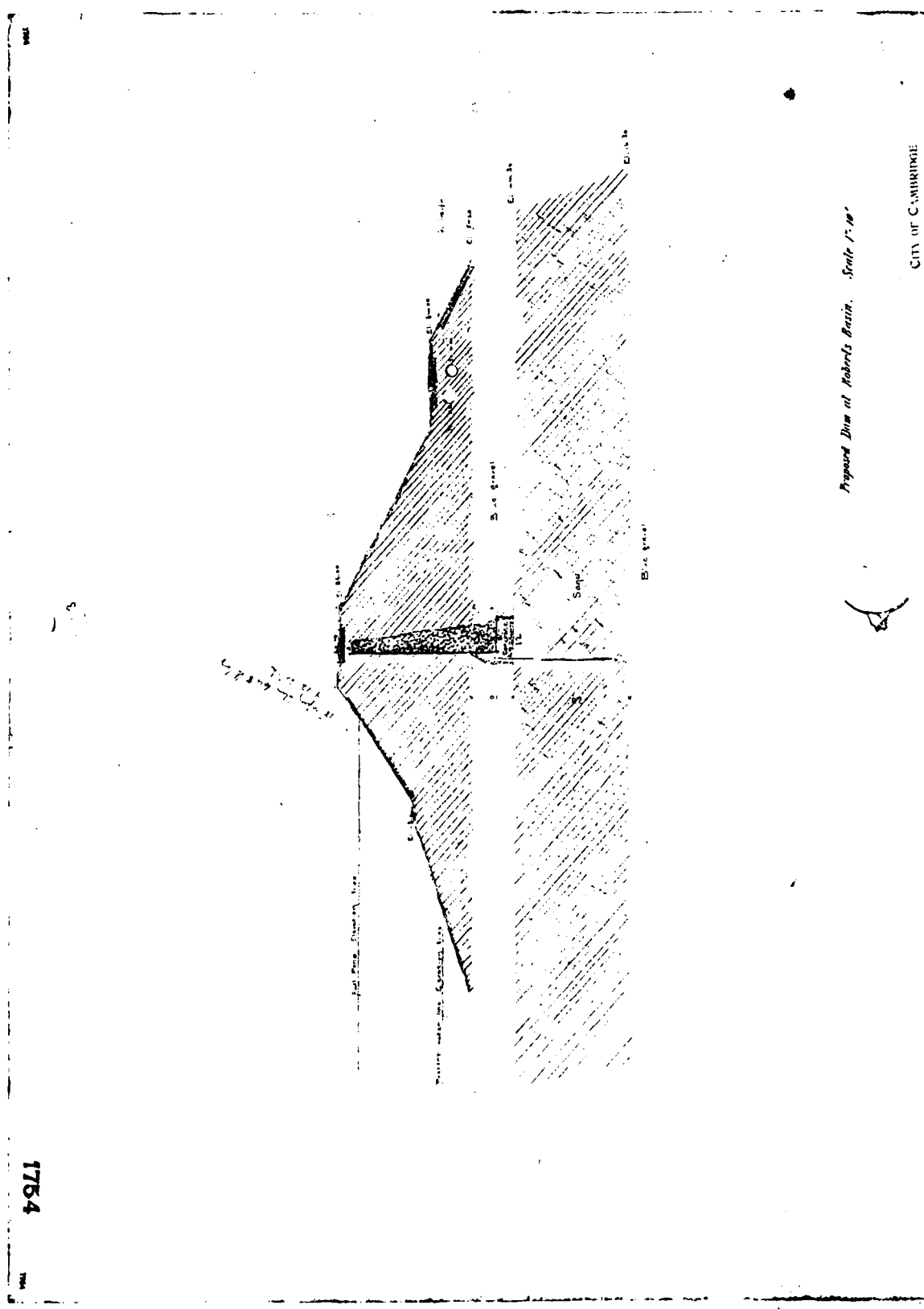
CITY OF COLUMBIA
ENGINEERING DEPT

7160

1756



CITY OF CAMBRIDGE



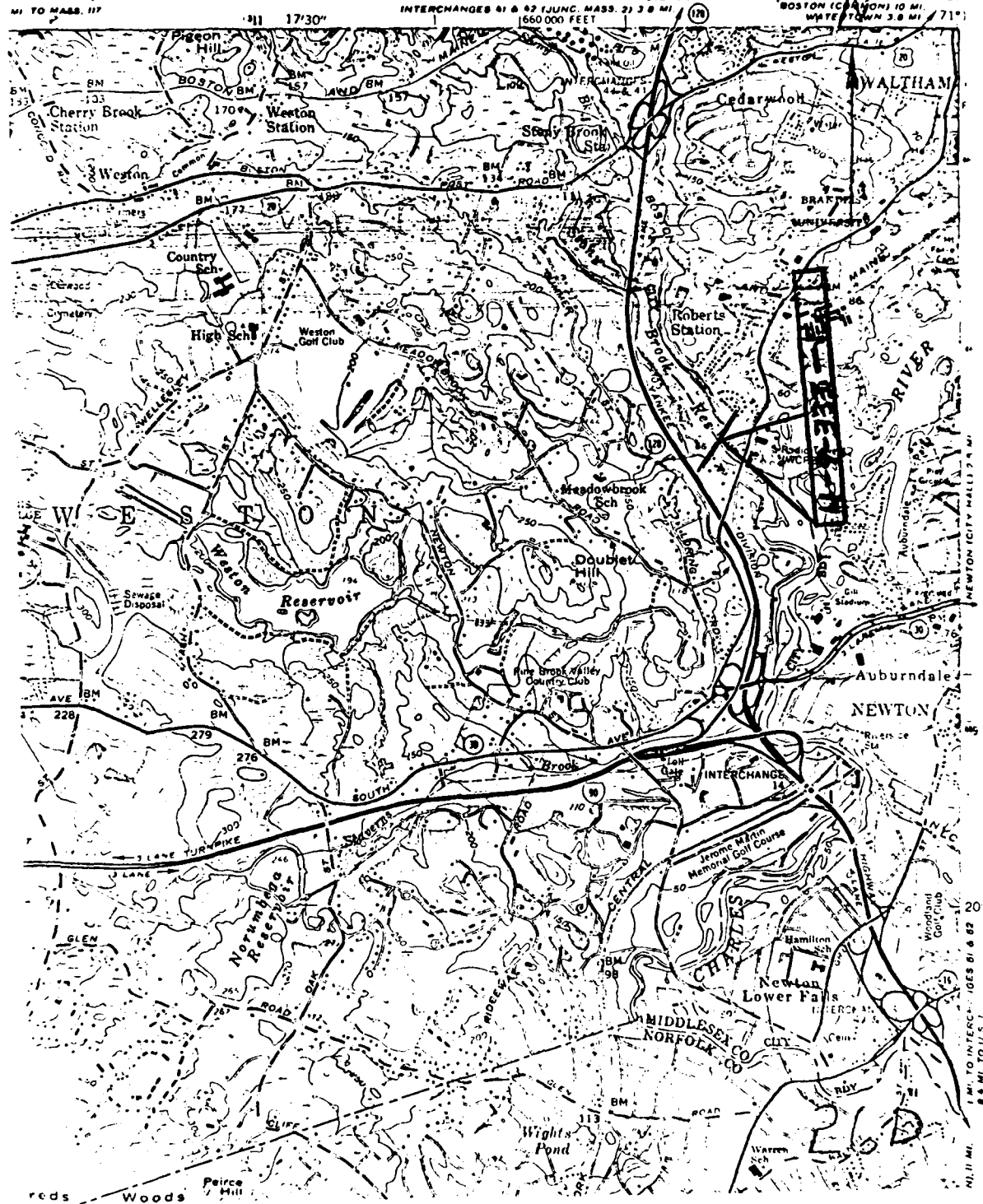
Proposed Dam at Robert's Basin. Scale 1"=10'

CITY OF CAMBRIDGE

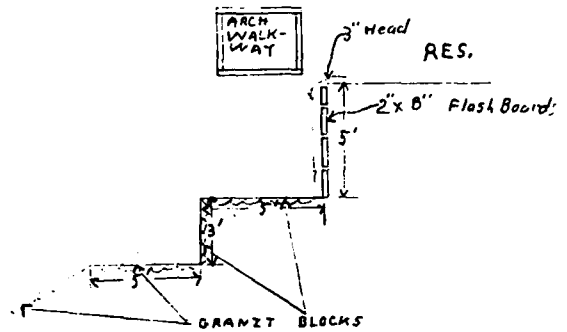
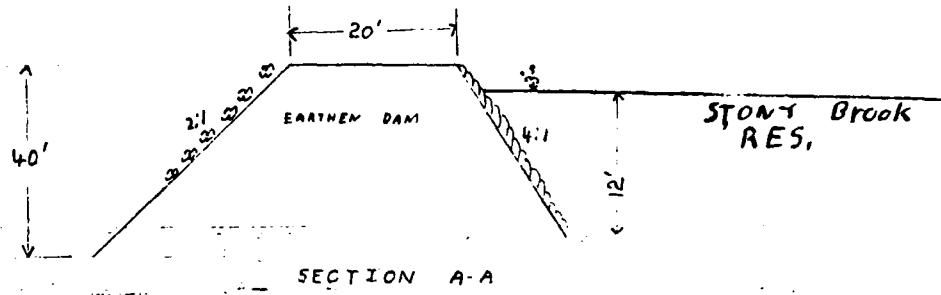
CHUSETTS
IBLIC WORKS
MI TO MASS. 117

NATICK QUADRANGLE
MASSACHUSETTS

7.5 MINUTE SERIES (TOPOGRAPHIC)



4-9-333-1



SECTION B-B

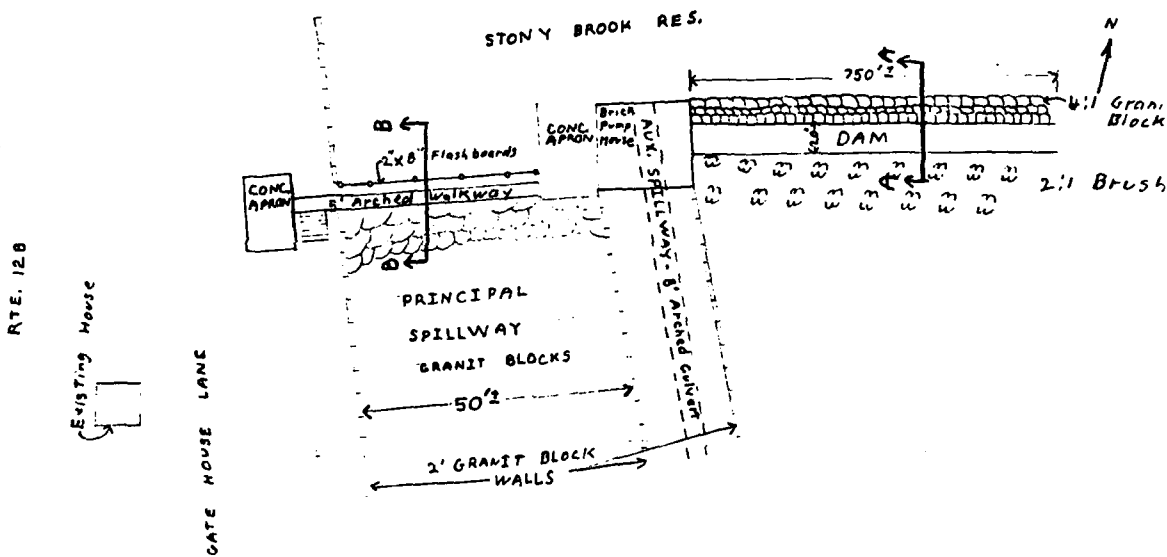
NOT TO SCALE

DAM NO. 4-9-333-1

10. Risk to life and property in event of complete failure.

No. of people	18	
No. of homes	6	
No. of businesses	1	
No. of industries		Type
No. of utilities		Type
Railroads		
Other dams		
Other		

Architect sketch of dam to be in form showing section and plan 8 1/2" x 11" Sheet



NOT TO SCALE



12. VIEW OF RESERVOIR OUTLET TUNNEL AND GATE HOUSE FROM SPILLWAY DISCHARGE CHANNEL.



13. END OF SPILLWAY RIGHT CHANNEL WALL. NOTE OPEN MASONRY JOINTS.

APPENDIX D

OUTLINE OF DRAINAGE AREA AND
HYDRAULIC COMPUTATIONS

Page No.

OUTLINE OF DRAINAGE AREA

Drainage Area Map

D-1

COMPUTATIONS

Drainage Area, Misc. Details

D-2

Dam Failure Analysis

D-3

Size Classification, Hazard Potential and

Test Flood Determination

D-12

Elevations and Storage Determination

D-15

Flood Routing, PMF

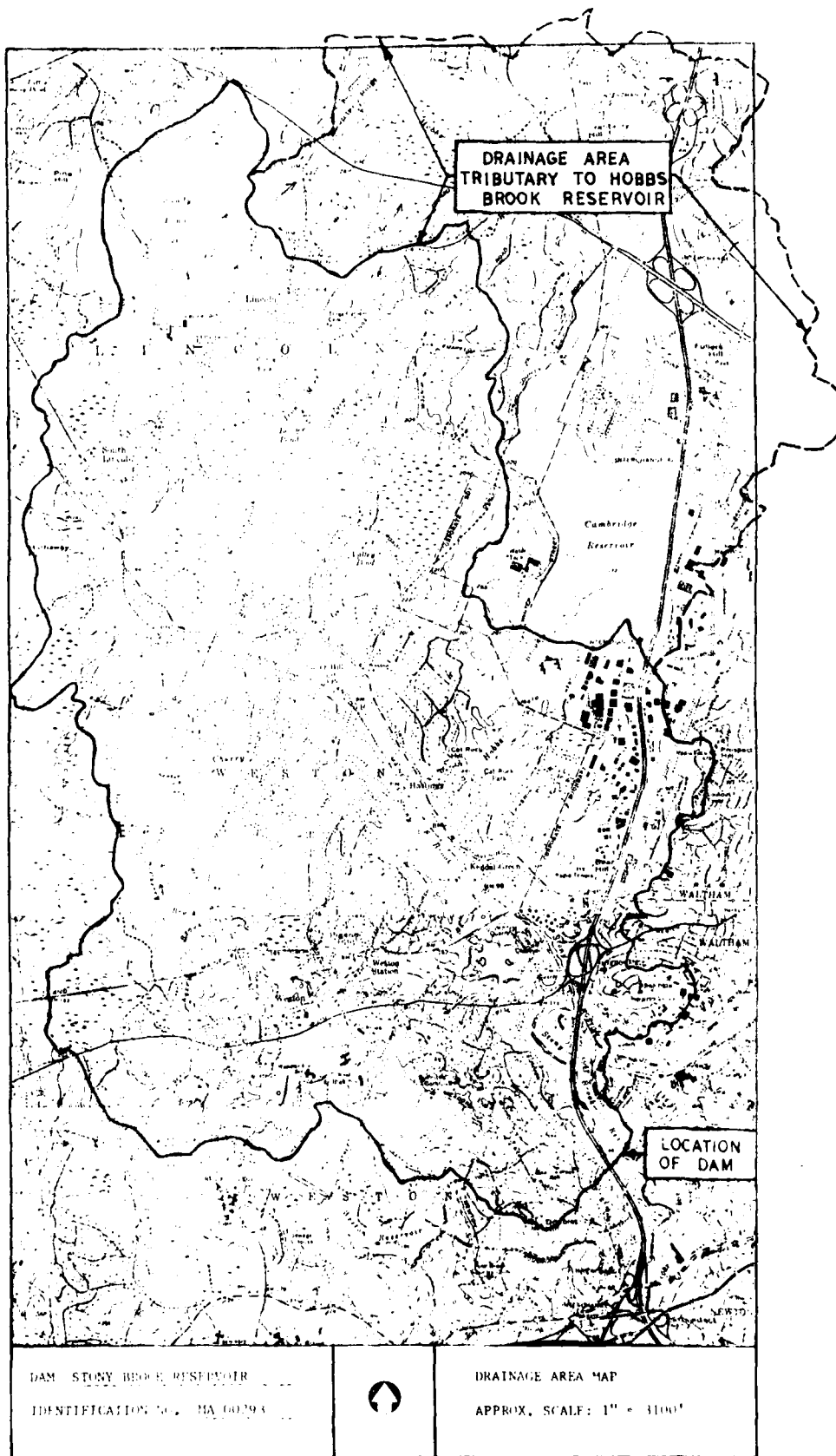
D-17

Tailwater Analysis

D-29

Dam Failure Impact Area Map

D-31



Misc. Details- Stony Brook Reservoir.

Capacity = 346 mg @ El. 80.66 (Cambridge Datum) - Spillw.
or 69.82 (USGS Datum)

with flashboards

405 mg @ El. 83.06 (Cambridge Datum)
or 72.22 (USGS Datum)

Drainage Area = 16.50 mi.²

Year Constructed = 1887

Normal Ponding Area = 57 acres

Average Depth = 12'

Length of Dam = 910' Total

Max Ht. 32'

Spillway Crest L = 39.9' total

Avg. Dam Elev. = 86.80 (Comb. Datum) or 75.96 (USGS)

Toe Dam = 54.6 (Comb. Datum) or 43.96 (USGS)

CLIENT C of E
 PROJECT Stony Brook
 DETAIL Dam Fail. Proj
JOB NO 380-5-13DATE CHECKED 6-8CHECKED BY WAXPAGE 2DATE 7/11/79COMPUTED BY WAX

Dam Failure Analysis

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

Dam Length = 590' (Assume left embankment only)

$$Y_o = 75.96 - 43.96 = 32.0'$$

$$W_b = .4 (590') = 236' \text{ say } 240'$$

$$Q_p = \frac{8}{27} \times 240' \times \sqrt{32.2} \times 32.0'^{3/2}$$

73,045 cfs

plus water over spillway

Spillway L = 40.0' less 7 uprights each .5' wide

$$\therefore L = 36.5' \quad H = 75.96 - 69.82 \text{ (flushboards out)}$$

$$C = 3.33 \quad = 6.14$$

$$Q = 3.33 \times 36.5 \times 6.14^{3/2}$$

$$= 1849 \text{ cfs}$$

$$\text{Total } Q = 73,045 + 1849 = 74,894 \text{ cfs}$$

Flow at South Street Bridge

From USGS Quad sheet

Roadway elev. at the bridge is approx. 5.7

Stream invert = approx 48.4

When the W.S. is at the top of the culvert, there will be additional flow over the low portions of the roadway.

WS 1' over top culvert El. 55.4

Culv flow

$$Q = CA\sqrt{2gh}$$

$$= .8 \times 199.2 \times \sqrt{64.4 \times 1} = 1279 \text{ cfs}$$

Weir flow

$$Q = C \times L \times H^{3/2}$$

Where C = 2.5 L = Weir length H = avg. ht over road

three sections

$$\textcircled{1} L = 120 \quad H = 1.70$$

$$Q = 2.5 \times 120 \times 1.7^{3/2} = 665.0 \text{ cfs}$$

$$\textcircled{2} L = 685 \quad H = 3.4$$

$$Q = 2.5 \times 685 \times 3.4^{3/2} = 10,736 \text{ cfs}$$

$$\textcircled{3} L = 840 \quad H = 1.70$$

$$Q = 2.5 \times 840 \times 1.7^{3/2} = 1330 \text{ cfs}$$

Total Flow with WS Elev. 55.4 = 14,010 cfs

CLIENT C of E
PROJECT Stony Brook
DETAIL Dam Fail Anal

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WS at El. 56.0

Pressure flow $h_t = 1.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 1.6}$$

$$= 1618 \text{ cfs}$$

Weir flow

① $L = 145' \quad H = 2.0$

$$Q = 2.5 \times 145 \times 2^{1.5} = 1025 \text{ cfs}$$

② $L = 685' \quad H = 4$

$$Q = 2.5 \times 685 \times 4^{1.5} = 13,700 \text{ cfs}$$

③ $L = 290' \quad H = 2$

$$Q = 2.5 \times 290 \times 2^{1.5} = 2050 \text{ cfs}$$

Total Flow with W.S. @ El. 56 = 18,393 cfs

W.S. at El. 57

Pressure flow $h_t = 2.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 2.6}$$

$$= 2062 \text{ cfs}$$

Weir flow

① $L = 160' \quad H = 2.5$

$$Q = 2.5 \times 160 \times 2.5^{1.5} = 1581 \text{ cfs}$$

② $L = 685' \quad H = 5.0$

$$Q = 2.5 \times 685 \times 5^{1.5} = 19,146 \text{ cfs}$$

③ $L = 360' \quad H = 2.5$

$$Q = 2.5 \times 360 \times 2.5^{1.5} = 3,558 \text{ cfs}$$

Total Flow with W.S. = 57 = 26,347 cfs

WS at El. 58

Pressure flow $h_t = 3.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 3.6} = 2426 \text{ cfs}$$

Weir flow

$$\textcircled{1} L = 200' \quad H_t = 3.0'$$

$$Q = 2.5 \times 200 \times 3.0^{1.5} = 2598 \text{ cfs}$$

$$\textcircled{2} L = 685' \quad H_t = 6.0'$$

$$Q = 2.5 \times 685 \times 6.0^{1.5} = 25,168 \text{ cfs}$$

$$\textcircled{3} L = 490' \quad H_t = 3.0'$$

$$Q = 2.5 \times 490 \times 3.0^{1.5} = 6365 \text{ cfs}$$

$$\text{Total flow with w.s. @ El. 58.0} = 36,557 \text{ cfs}$$

WS at El. 59

Pressure flow $h_t = 4.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 4.6} = 2743 \text{ cfs}$$

Weir flow

$$\textcircled{1} L = 230' \quad H_t = 3.5'$$

$$Q = 2.5 \times 230 \times 3.5^{1.5} = 3765 \text{ cfs}$$

$$\textcircled{2} L = 685' \quad H_t = 7.0'$$

$$Q = 2.5 \times 685 \times 7.0^{1.5} = 31,715 \text{ cfs}$$

$$\textcircled{1} L = 540' \quad H_t = 2.5'$$

$$Q = 2.5 \times 540' \times 2.5^{3/2} = 8840 \text{ cfs}$$

$$\text{Total } Q \text{ at El } 57.0 = 47,063 \text{ cfs}$$

WS at El. 60

Press. flow $H_t = 5.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 5.6} = 3026 \text{ cfs}$$

Weir flow

$$\textcircled{1} L = 280' \quad H_t = 4.0'$$

$$Q = 2.5 \times 280 \times 4.0^{3/2} = 5600 \text{ cfs}$$

$$\textcircled{2} L = 685' \quad H_t = 8.0'$$

$$Q = 2.5 \times 685 \times 8^{3/2} = 38,750 \text{ cfs}$$

$$\textcircled{3} L = 630' \quad H_t = 4.0'$$

$$Q = 2.5 \times 630 \times 4^{3/2} = 12,600 \text{ cfs}$$

$$\text{Total } Q \text{ with w.s. at El } 60 = 59,976 \text{ cfs}$$

WS at El. 61

Press. flow $H_t = 6.6$

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 6.6} = 3285 \text{ cfs}$$

Weir flow

$$\textcircled{1} L = 300' \quad H_t = 4.5'$$

$$Q = 2.5 \times 300 \times 4.5^{3/2} = 7160 \text{ cfs}$$

$$\textcircled{2} L = 685' \quad H_t = 9.0'$$

$$Q = 2.5 \times 685 \times 9^{3/2} = 46,238 \text{ cfs}$$

$$\textcircled{3} L = 660' \quad H_t = 4.5'$$

$$Q = 2.5 \times 660 \times 4.5^{3/2} = 15,750 \text{ cfs}$$

CLIENT Cof E
 PROJECT Stony Brook Anal
 DETAIL Dam Tail Area

JOB NO 380-5-13
 DATE CHECKED 6-22
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 DATE 8-1-13
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Total Q with w.s. @ El 61 = 72,433

WS at El. 61.5

Proc. flow Ht = 7.1

$$Q = .8 \times 199.2 \times \sqrt{64.4 \times 7.1} = 3408 \text{ cfs}$$

Weir flow

$$\textcircled{1} L = 310 \quad h_t = 4.25'$$

$$Q = 2.5 \times 310 \times 4.25^{3/2} = 8023 \text{ cfs}$$

$$\textcircled{2} L = 685 \quad h_t = 9.5'$$

$$Q = 2.5 \times 685 \times 9.5^{3/2} = 50,144 \text{ cfs}$$

$$\textcircled{3} L = 680 \quad h_t = 4.75'$$

$$Q = 2.5 \times 680 \times 4.75^{3/2} = 17,600 \text{ cfs}$$

Total Q with ws @ El 61.5 = 79,125 cfs

W.S. Elev. at South St. prior to failure:

¹ Spillway Capacity at top of dam = 1850 cfs

² Wasteway tunnel capacity fully open = 1430 cfs
 3280 cfs

³ W.S. Elev. at South St. for 3280 cfs = Elev. 53

Notes: 1. from page 13

2. from page

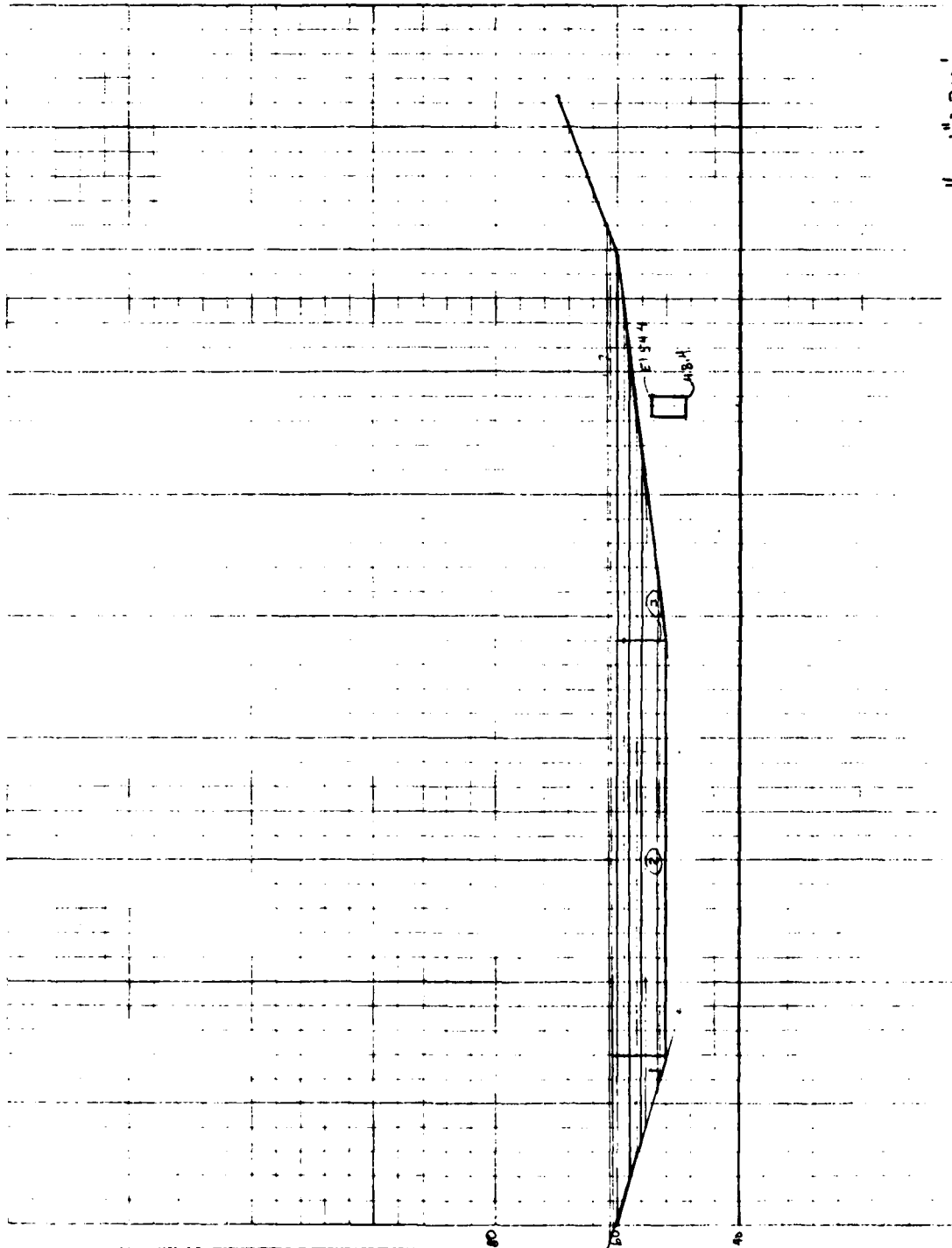
3. from page 9

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PROJECT Stony Brook
DETAIL Dam Feil Anal

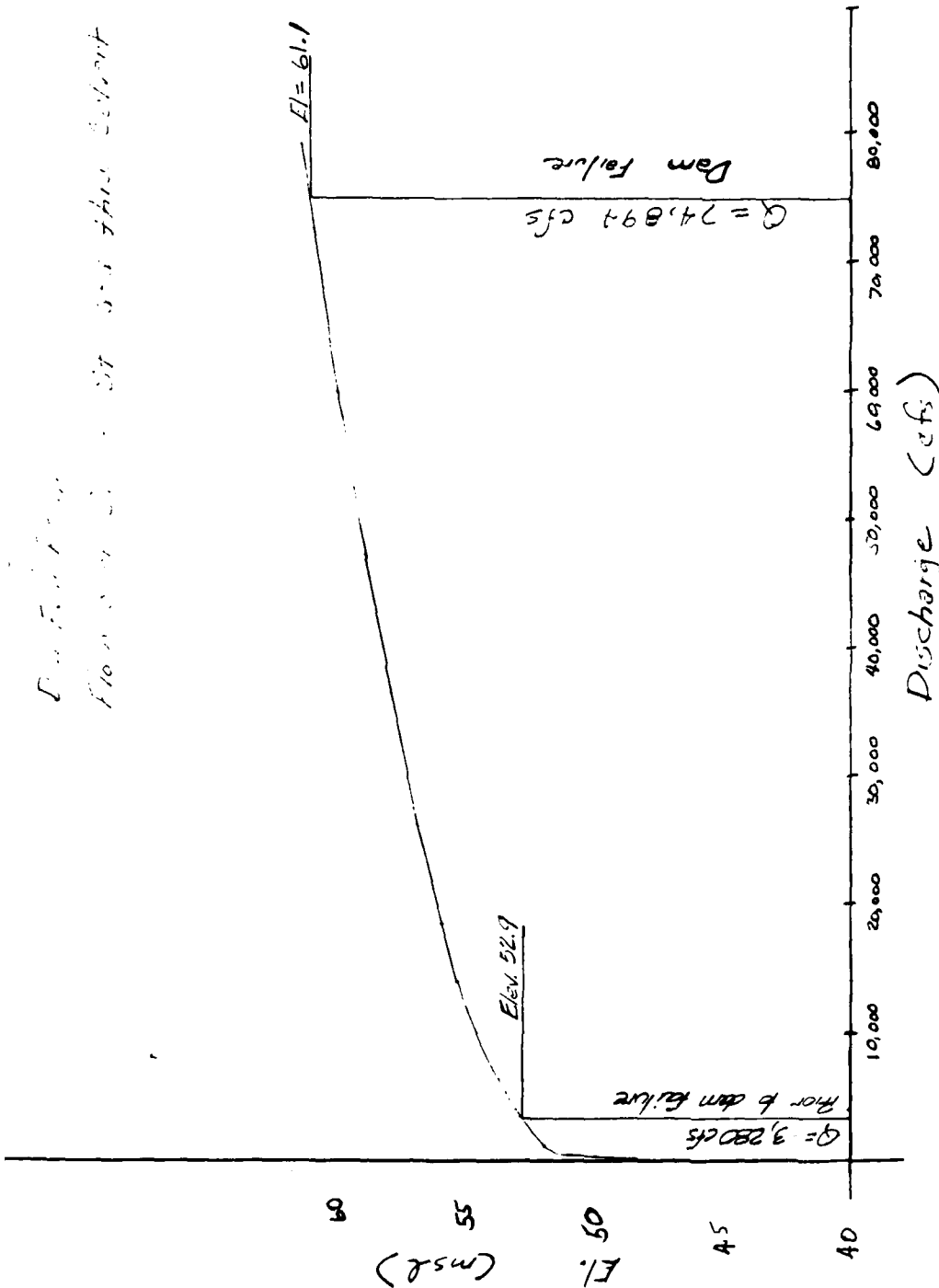
JOB NO 380 5-13
DATE CHECKED 6 Jun 79
CHECKED BY WAK

PAGE 8
DATE 8 May 79
COMPUTED BY WAK



Hor 1" = 200'
Vert 1" = 20'

CLIENT CofE JOB NO 380-5-13 PAGE 7
 PROJECT Stony Brook DATE CHECKED 6-6-79 DATE 7/7/79
 DETAIL Sanitary Sewer CHECKED BY WAL COMPUTED BY WAL



With a Q of approximately 74,900 cfs and the geographical configuration of the downstream topography, the water surface will rise to approximately El. 61.1. South St., approximately 450' downstream of Stony Brook Dam has a culvert approximately 6.0' high by 34' wide, with a 1 foot center wall. Due to the large volume of water resulting from a dam failure, the amount of flow passing through the culvert will be somewhat insignificant. The majority of the flow will pass over the roadway, with a large amount passing to the left of the culvert. It is apparent from the dam failure analysis that should the dam fail, serious downstream flooding will occur, especially along South Street north of the existing culvert.

Between the dam and South St., several homes have been constructed. Should the dam fail, the homes will be seriously inundated!

Approx. W.S. Elev. at South St. prior to dam failure is elev. 53. Failure of the dam would result in an 8-ft. rise in water depth over South St.

CLIENT C of E JOB NO. 380-S-13 PAGE 11
PROJECT Stony Brook DATE CHECKED 6-22 DATE 10/12/79
DETAIL Hazard Class CHECKED BY WAK COMPUTED BY WAK

Size Classification

Storage at top of dam = 1531.4 ac-ft

$$H_t = 75.96' - 43.96' = 32.0'$$

Based on storage, this dam is placed in
the INTERMEDIATE category.

Hazard Classification

Loss of life - More than a few

∴ HIGH

Economic loss - Appreciable

∴ SIGNIFICANT

USE HIGH

Spillway Design Flood

Hazard = HIGH, Size = INTERMEDIATE

$Q_{Test} = PMF$

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Boston, Mass.

CLIENT
PROJECT
DETAIL

Camp & Engineers 2001
Stony Brook Reservoir
Flood Rating

JOB NO.
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530-5-15
7/20/79
JED

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7/20/79
J. J. Jones

Stony Brook Reservoir - Flood Rating

Time No.	Observed Inflow (cfs)	Average Inflow (cfs)	$\frac{S-Q}{ST-2}$	$\frac{S+Q}{ST+2}$	Head above Spillway Crest (ft.)	Water Surface Elev. (ft.)	Q Cfs
0	0	0			0	69.82	0
4 hrs.	45	22	54.0	76.0	4.39	71.12	16,354
8	96	70	53.4	123.4	0.45	71.21	5,400
12	140	115	56.7	204.7	0.73	71.25	7,100
16	234	187	132.9	317.8	1.09	71.91	13,000
20	510	372	186.0	553.0	1.56	71.28	38,200
24	908	712	165.4	874.4	1.75	71.57	92,600
28	1800	1354	-52.9	1211.1	2.02	71.84	164,000
32	5160	3120	-357.4	347.4	6.48	76.30	3,956
36	7420	6525	-479.3	594.6	7.75	77.57	80,020
40	8280	7395	-225.5	5630	7.66	77.48	77,700
44	8350	8515	-209.1	6284	7.91	77.73	77,700
48	7830	8085	-256.9	5516	7.61	77.43	75,110
52	6970	7345	-199.2	5403	7.58	77.34	75,100
56	6240	6605	-190.3	4702	7.23	77.05	60,000
60	5430	5835	-135.3	4430	7.11	76.93	50,000
64	4480	4,955	-118.3	3768	6.71	76.53	44,000
68	3520	4,420	-664.0	3536	6.36	76.19	39,130
72	2840	3,120	-352.0	2789	5.51	75.55	30,000
76	2320	2,520	-237.5	2342.5	4.53	74.55	20,000
80	1910	2,115	-246.7	1868.3	3.45	73.27	17,100
84	1660	1,735	-272.4	1512.6	2.59	72.41	13,000
88	1420	1,510	-315.5	1224.5	1.96	71.78	10,200
92	1220	1,320	-315.5	1020.5	1.53	71.65	11,000
96	1040	1,150	-160.4	934.6	1.83	71.65	11,000
100	1000	1,040	-149.6	890.4	1.76	71.58	9,500
104	920	960	-74.4	885.6	1.76	71.53	9,500
108	870	845	-71.0	824.0	1.72	71.54	8,400
112	820	845	-26.5	813.5	1.72	71.54	8,400
116	780	800	-22.6	777.4	1.70	71.52	7,500
120	740	760	+7.1	767.1	1.63	71.45	5,800

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Environmental Engineers
Boston, Mass.

CLIENT Cape of Engineers Inc. JOB NO 330-5-13
PROJECT Shaw Brook Dam DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY MD

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DATE July 20, 1979
COMPUTED BY CE

Shaw Brook Dam - Flood Routing

Water Surface Elev.	Head at Spillway (ft.)	Calculated Q (cfs)	Calculated Outflow Q (cfs)	Storage, S, (acre-ft.)	S	$S - Q$	$S + Q$
69.82	0	0	0	0	27	27	27
70.32	0.5	40.4	40.4	38.2	115.6	90.7	155.9
70.82	1.0	114.6	114.6	76.4	231.1	173.9	325.4
71.32	1.5	214.6	214.6	114.7	347.0	241.7	488.7
71.82	2.0	324.2 + 1319 = 1643	153.0	462.8	-354.7	1284.2	
72.32	2.5	461.7 + 1336 = 1798	191.2	576.7	-320.6	1171.4	
72.82	3.0	618.3 + 1353 = 1971	229.4	693.9	-271.6	1078.4	
73.32	3.5	791.1 + 1369 = 2160	267.7	809.9	-270.2	1039.7	
73.82	4.0	984 + 1386 = 2370	305.9	925.3	-259.7	2110.	
74.32	4.5	1174 + 1401 = 2575	344.2	1041.2	-246.3	2258.	
74.82	5.0	1375 + 1417 = 2792	382.4	1156.3	-239.2	2553.	
75.32	5.5	1587 + 1433 = 3020	420.7	1272.6	-237.9	2758.	
75.82	6.0	1808 + 1449 = 3257	459.9	1389.2	-241.3	2917.	
75.96	6.14	1871 + 1453 = 3324	469.6	1420.5	-241.5	3051.	
76.0	6.16	1905 + 1455 = 3360	472.7	1429.9	-250.1	3110.	
76.5	6.68	2283 + 1471 = 4354	511.0	1575.8	-631.2	3723.	
77.0	7.18	4395 + 1487 = 5882	549.3	1661.6	-1277.4	4605.	
77.5	7.68	6273 + 1503 = 7776	587.7	1777.8	-2110.	5666.	
78.0	8.18	8450 + 1520 = 9970	626.0	1895.6	-3201.	6279.	

Note:

Assume wastewater tunnel is operated as an overflow spillway.

as follows:

Water
Surface
Elev.

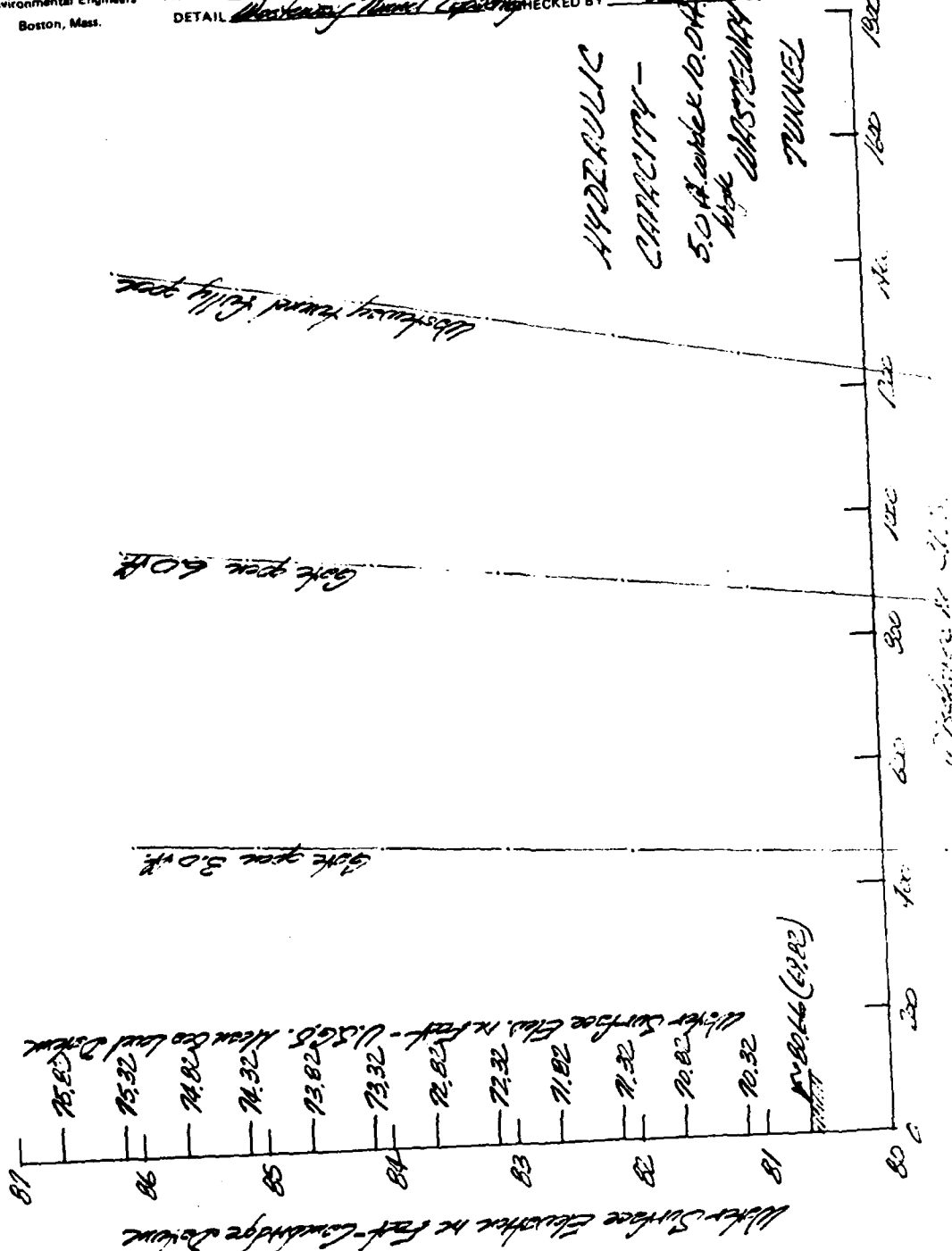
64.32-71.32 Gate closed

Above El. 71.32 Gate fully open

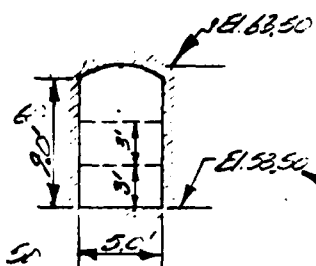
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Environmental Engineers
Boston, Mass.

CLIENT Cape of Engineers Inc. JOB NO. 30-5-15
PROJECT Washbury Tunnel DATE CHECKED 7/20/79
DETAIL Washbury Tunnel CHECKED BY JED

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DATE 7/20/79
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Consider hydraulic capacity of 50' wide x 10' high working spillway
 due to a supplemental spillway



$L = 60 \text{ ft.}$ (Channel bed)
 Note: See Drawing measurements indicating $L = 60 \text{ ft.}$
 Spillway crest to prevent outlet of cascades.
 Elev. 81.0, Spillway crest or flow line p.p.
 $-22.5'$
 Elev. 58.7 least outlet in cascade

$\text{Area} = 9.5(5.0) = 47.5'$
 $\text{WD} = 5.0 + 5.5 = 10.5'$
 $R = 1.6667$

$Q = C_1 \sqrt{H} = 0.77(47.5)^{1/2} = 5.0 \text{ ft.}$

Water Surface Elev. (Channel Bottom)	Head on spillway feet	Discharge with head feet gpm	Discharge with head feet gpm	Gate opening Head on spillway feet	Discharge with head feet gpm $C = 0.77$	Gate opening Head on spillway feet	Discharge with head feet gpm $C = 0.77$
64.5	1.0 ft.	301.166	634 gpm	8.0 ft.	262.206	5.0 ft.	42.631
65.5	2.0	425.9		9.0	278.1	6.0	52.1
66.5	3.0	541.6		10.0	293.1	7.0	62.1
67.5	4.0	642.3	12.68	11.0	307.4	8.0	72.1
68.5	5.0	738.7		12.0	321.1	9.0	82.0
69.5	6.0	837.6		13.0	334.2	10.0	92.1
70.5	7.0	936.7		14.0	346.8	11.0	102.1
71.5	8.0	1031.7		15.0	359.0	12.0	112.1
72.5	9.0	1123.4	19.02	16.0	370.8	13.0	122.1
73.5	10.0	1211.3		17.0	382.2	14.0	132.1
74.5	11	1293.2		18	393.0	15	142.1
75.5	12	1368.8		19	404.0	16	152.1
76.5	13	1437.8		20	414.8	17	162.1
77.5	14	1501.5		21	424.5	18	172.1
78.5	15	1560.0		22	434.5	19	182.1
79.5	16	1613.5		23	444.5	20	192.1
80.5	17.5	1660.0	26.53	24.5	453.9	21.5	202.1
81.5	18.0	1708.0		25.0	463.4	22.0	212.1
82.0	18.5	1755.0		25.5	470.1	22.5	222.1
82.5	19.0	1800.0		26.0	476.6	23.0	232.1
83.0	19.5	1843.0		26.5	482.1	23.5	242.1
83.5	20.0	1884.0	28.36	27.0	487.1	24.0	252.1
84.0	20.5	1923.0		27.5	491.6	24.5	262.1
84.5	21.0	1960.0		28.0	496.1	25.0	272.1
85.0	21.5	1996.0		28.5	500.5	25.5	282.1
85.5	22.0	2030.0		29.0	504.8	26.0	292.1
86.0	22.5	2063.0	30.06	29.5	509.1	26.5	302.1

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CLIENT Cops of Engineers & Inc. Inc. JOB NO. 34-5-13
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY JED

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DATE 7/20/79
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Stony Brook Reservoir - Flood Routing

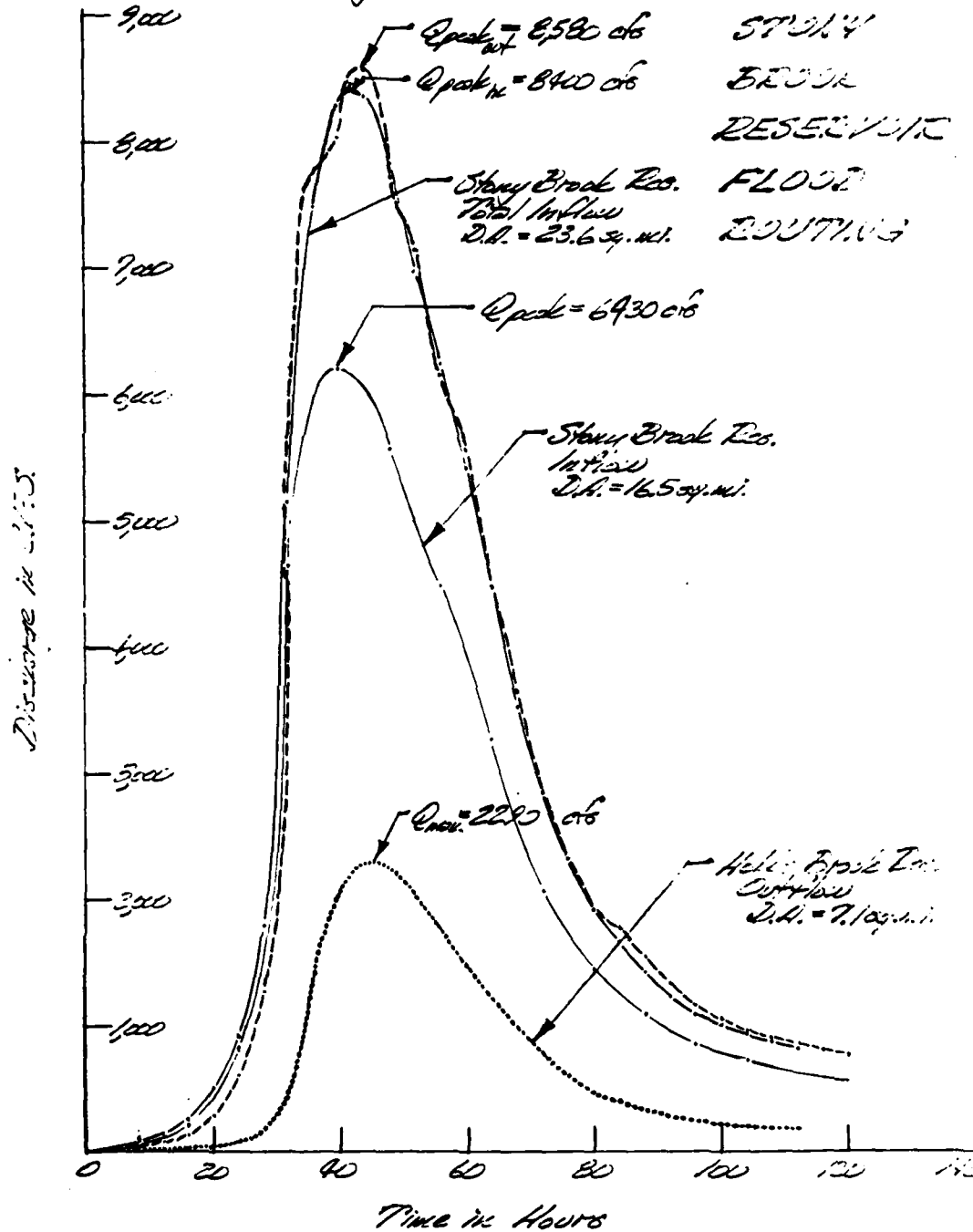
Time No.	Observed Inflow (cfs)	Average Inflow (cfs)	$\frac{S - Q}{\Delta T - 2}$	$\frac{S + Q}{\Delta T + 2}$	Head above Sill (ft)	Water Surface Elevation (ft)	Storage (acre-ft)
0	0	0			0	6.52	
4 hrs.	45	22	54.0	76.0	2.53	72.10	
8	96	70	53.1	123.4	2.45	72.29	34.5
12	140	116	86.7	204.7	2.73	72.30	71.5
16	234	187	130.8	317.8	1.29	72.1	130.4
20	510	372	183.0	558.0	1.81	71.65	211.1
24	908	700	277.5	982.9	2.86	71.22	
28	1800	1354	391.6	1735.6	4.75	70.57	
32	5160	3490	431.7	3442	7.20	70.04	
36	7490	6325	-600.6	5724	8.02	71.54	
40	8280	7885	-2012.9	5872	8.08	71.92	
44	8350	8315	-2132.1	5123	8.21	72.33	
48	7820	8085	-2543	5700	8.01	72.35	
52	6970	7395	-1994.8	5400	7.88	72.10	
56	6240	6605	-1757.1	4854	7.65	72.49	
60	5430	5835	-1311.3	4523	7.49	72.31	
64	4450	4955	-1052.9	3921	7.20	72.12	
68	3520	4000	-532.7	3431	6.93	72.75	
72	2940	3180	-321.9	3006	6.66	76.42	
76	2320	2590	121.1	2702	6.44	75.22	
80	1910	2115	230.0	3395	6.19	75.1	
84	1660	1785	469.4	2254	5.92	75.74	
88	1420	1540	483.4	2023	5.40	75.22	
92	1230	1325	477.2	1802	4.90	74.72	
96	1080	1155	466.4	1621	4.48	74.50	
100	1000	1040	453.5	1493.5	4.13	74.20	
104	920	960	440.9	1400.9	3.96	73.78	
108	870	895	431.3	1326.3	3.79	73.41	
112	820	845	425.1	1272.1	3.65	73.17	
116	780	800	420.0	1220.0	3.53	73.55	
120	740	760	415.5	1175.5	3.43	73.25	

Data entered by hand

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CLIENT Cape of Endicott Dam Corp. JOB NO. 340-25-15
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY JED

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DATE Jan 5, 1980
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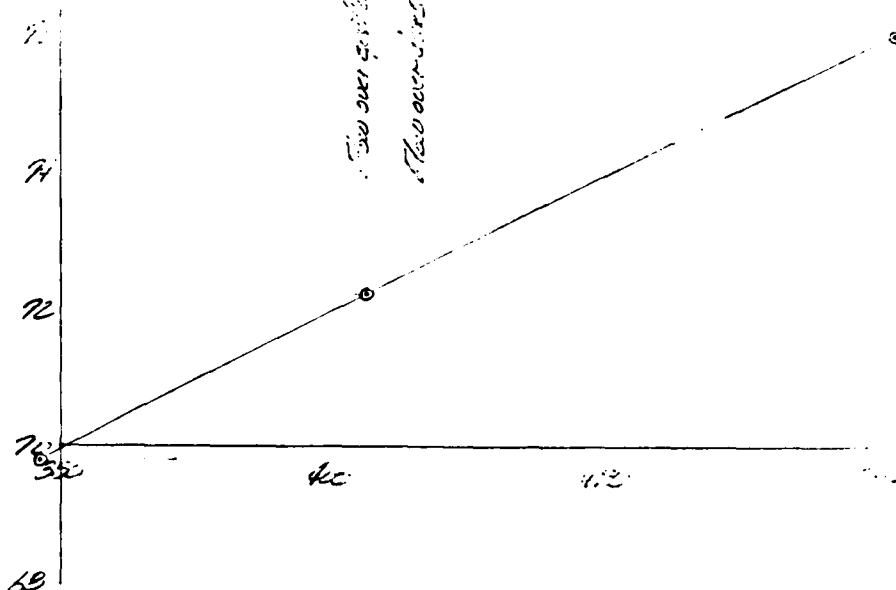
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CLIENT Cape of Engineers Inc. Inc. JOB NO. 320-5-13
PROJECT Shaw's Pond Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY MD

PAGE 5
DATE 10/1/79
COMPUTED BY Q. J. J.

Shaw's Pond Reservoir - Flood Routing $\Delta T = 240 \text{ min.}$

Curve 1-2.5	Water Surface Elev.	Head on Spillway (ft.)	Calculated Discharge Q (cfs)	Storage, S, Corresponding spillway (acre-ft.)	$\frac{S}{\Delta T}$	$\frac{S}{\Delta T} - \frac{Q}{\Delta T}$	$\frac{S}{\Delta T} + \frac{Q}{\Delta T}$
C	69.62	0	0	0			
3.13	70.32	0.5	40.4	32.2	115.6	95.4	155.3
3.14	70.82	1.0	114.6	76.1	311.1	172.2	321.1
3.14	71.32	1.5	210.6	114.7	347.0	241.7	411.7
3.20	71.82	2.0	324.2	153.0	412.2	322.7	472.7
3.26	72.32	2.5	441.7	191.0	578.4	348.5	528.5
3.31	72.82	3.0	616.2	229.4	693.9	354.7	608.7
3.37	73.32	3.5	741.1	267.7	808.9	414.2	658.2
	73.82	4.0	967.1	305.9	925.5	458.3	718.3
	74.32	4.5	1174.1	344.2	1041.2	458.2	788.2
	74.82	5.0	1375.1	382.4	1156.9	469.3	858.3
	75.32	5.5	1587.1	420.7	1272.6	479.1	928.1
	75.82	6.0	1809.1	458.9	1388.3	494.2	998.2
3.37	75.96	6.14	1871.1	468.6	1420.5	495.0	1000.0
	76.0	6.18	1880+1871=1875	472.7	1429.4	477.4	1000.0
	76.5	6.62	2151+1875=2305	511.0	1515.3	104.3	1000.0
	77.0	7.18	2574+2305=4879	548.3	1661.6	-535.4	1000.0
	77.5	7.69	2818+4879=7697	587.7	1777.3	-1359.7	1000.0
	78.0	8.18	2972+5572=8544	626.0	1863.5	-2331.7	1000.0



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PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Field Logging - Hobbs Bridge CHECKED BY MD

PAGE 4
DATE 7/20/79
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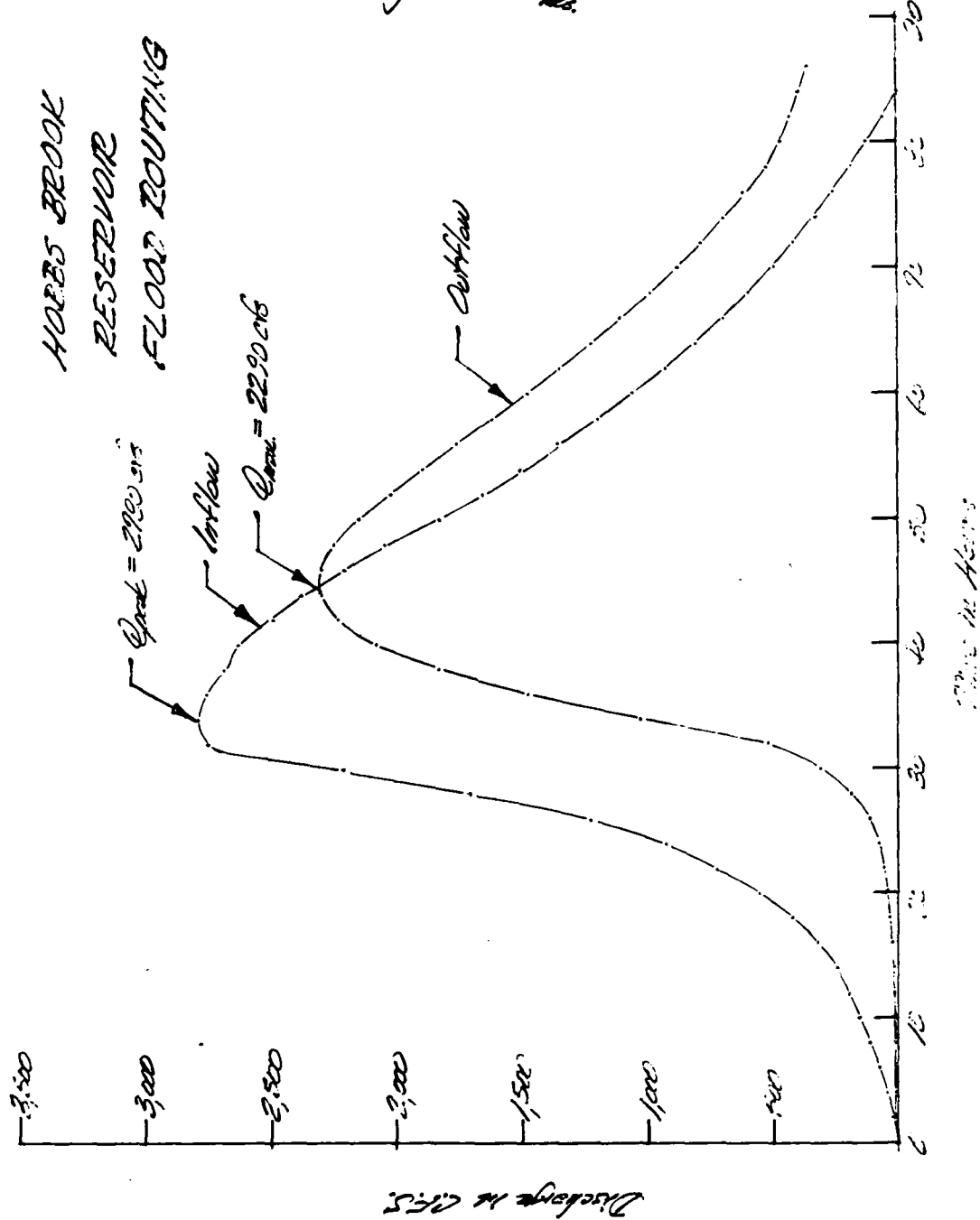
Hobbs Brook Reservoir - Field Log

Time No.	Observed Water (cfs)	Average Water (cfs)	$\Sigma - Q$ AT (cfs)	$\Sigma + Q$ AT (cfs)	Head above Spillway Crest (ft.)	Water Depth Elev. (ft.)	Water Depth Elev. (ft.)
0	0	0					
2 hrs.	30	10	974.1	934.1	0.50	179.50	9.25
4	50	20	971.4	1026.4	0.306	179.50	10.15
6	80	65	993.4	1058.4	0.32	179.52	10.58
8	120	100	1044.3	1144.3	2.55	179.55	12.4
10	160	140	1130	1270	0.31	179.31	14.6
12	200	180	1254	1434	0.44	179.44	17.6
14	250	235	1415	1610	0.50	179.50	21.5
16	320	335	1619	1804	0.50	179.50	24.5
18	420	510	1877	2247	0.63	179.63	32.6
20	550	435	2212	2697	0.81	179.91	45.7
22	700	635	2651	3286	0.81	179.81	51.5
24	920	820	3207	4047	1.22	180.22	62.5
26	1290	1095	3970	5055	1.52	180.52	77.5
28	1700	1455	4951	6436	1.92	180.52	94.7
30	2200	1950	6251	8201	2.43	181.45	105
32	2740	2470	7613	10363	3.03	182.22	111
34	2980	2720	9856	12616	4.28	183.28	121.9
36	2950	2780	11,599	14,363	5.17	184.17	142.3
38	2680	2715	12,893	15,603	5.81	184.81	157.1
40	2630	2650	13,780	16,430	6.32	185.22	170
42	2450	2435	14,355	16,910	6.46	185.46	175.5
44	2370	2450	14,124	17,114	6.56	185.56	177.5
46	2200	2565	14,825	17,110	6.50	185.50	177.5
48	2040	2120	14,822	16,942	6.48	185.48	177.5
50	1820	1930	14,706	16,636	6.32	185.32	178.5
52	1650	1735	14,496	16,231	6.12	185.12	178.5
54	1500	1575	14,213	15,793	5.90	184.50	177.5
56	1350	1425	13,912	15,337	5.67	184.27	175.5
58	1180	1270	13,587	14,857	5.42	184.42	161.0
60	1050	1130	13,245	14,365	5.17	184.17	142.0
62	920	985	12,894	13,879	4.95	183.95	125.5
64	800	820	12,542	13,402	4.68	183.68	121.5
66	680	745	12,186	12,981	4.44	183.44	108.8
68	580	640	11,835	12,475	4.20	183.20	95.0
70	490	540	11,483	12,033	3.97	182.97	87.0
72	410	450	11,161	11,611	3.75	182.75	78.1
74	320	365	10,831	11,186	3.53	182.53	65.2
76	250	285	10,505	10,790	3.31	182.31	60.4
78	180	215	10,187	10,402	3.10	182.10	51.8
80	120	150	9,882	10,032	2.85	181.85	46.5
82	60	90	9,570	9,660	2.84	181.84	45.3
84	0	30	9,231	9,261	2.73	181.73	3.93
86	0	0	8,868	8,823	2.62	181.62	55.3

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CLIENT Corps of Engineers Damages JOB NO. 38-5-15
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing Hobbs Brook CHECKED BY ED

PAGE 3 of 3
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CLIENT Cape of Engineers - Dan Lugo JOB NO 332-5-15
PROJECT Holbrook Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing - Holbrook Brook Res. CHECKED BY MD

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DATE 7/20/79
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Holbrook Brook Reservoir - Flood Routing $\Delta T = 60 \text{ min.}$

<u>Water Surface Elev.</u>	<u>Reservoir Area (acres)</u>	<u>Calculated Outflow Q (cfs)</u>	<u>Calculated Storage S (ac-ft)</u>	<u>S</u> <u>ΔT</u>	<u>S</u> <u>$\Delta T - \frac{Q}{2}$</u>	<u>S</u> <u>$\Delta T + \frac{Q}{2}$</u>
179.0		0	0	0		
179.5		21.2	270.1	5253	3257.6	3292.3
180.0		59.9	543.2	6573	6545	6601
180.5		110.1	816.4	9870	9825	9921
181.0		189.9	1226.6	13770	13701	13839
181.5		320.1	1368.8	16562	16402	16722
182.0		498.5	1642.1	19942	19725	20159
183.0		892	1924	23324	22555	24093
184.0		1373	2204	26663	25922	27304
185.0		1939	2493	30044	29095	31053
186.0		2565	2762	33420	32133	34347
187.0		3251	3040			

$\Delta T = 12 \text{ min.}$

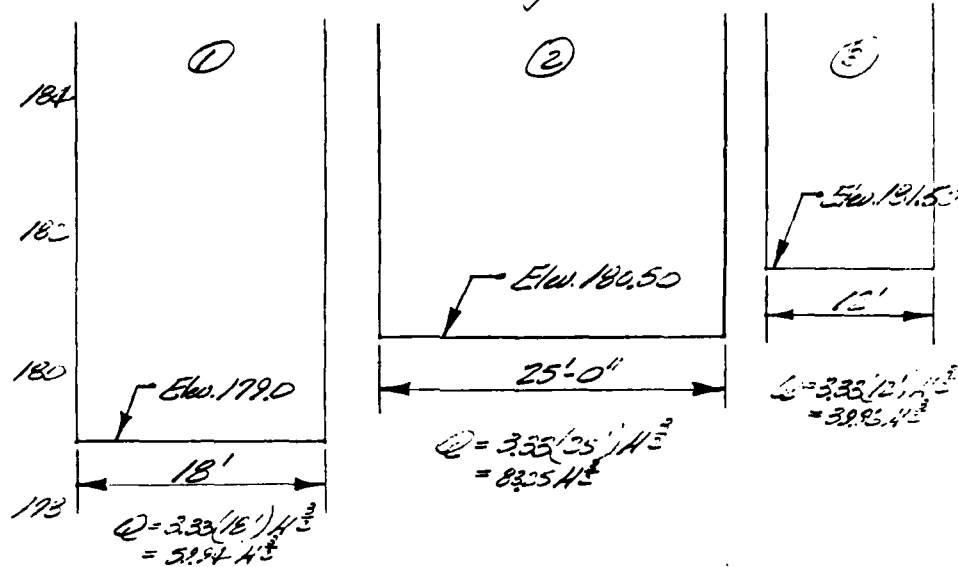
<u>Water Surface Elev.</u>	<u>Reservoir Area (acres)</u>	<u>Calculated Outflow Q (cfs)</u>	<u>Calculated Storage S (ac-ft)</u>	<u>S</u> <u>ΔT</u>	<u>S</u> <u>$\Delta T - \frac{Q}{2}$</u>	<u>S</u> <u>$\Delta T + \frac{Q}{2}$</u>
179.0		0	0			
179.5		21.2	270.1	1634.1	1625.5	1642.7
180.0		59.9	543.2	3268.5	3253.7	3283.3
180.5		110.1	816.4	4903.9	4884.9	4922.9
181.0		189.9	1226.6	6640	6611	6669
181.5		320.1	1368.8	8381	8341	8421
182.0		498.5	1642.1	9971	9932	10010
183.0		892	1924	11640	11590	11690
184.0		1373	2204	13334	13273	13397
185.0		1939	2493	15022	14953	15091
186.0		2565	2762	16710	16629	16791
187.0		3251	3040			

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CLIENT Cops of Engineers & Inc. Inc. JOB NO 34-5-13
PROJECT Hobbs Brook Reservoir DATE CHECKED 7/20/79
DETAIL Hydrology - Post Flood Computations CHECKED BY JED

PAGE 1
DATE July 7
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Hobbs Brook Reservoir Spillway



Water Spill. Elevation	H_1	Q_1	H_2	Q_2	H_3	Q_3	13.41 / 1000
179.0	0	0					0
179.5	0.5	21.246					21.246
180.0	1.0	59.9					59.9
180.5	1.5	110.1	0	0			110.1
181.0	2.0	169.5	0.5	21.246			181.0
181.5	2.5	236.9	1.0	83.2	0	0	320.1
182.0	3.0	311.5	1.5	152.9	0.5	141.248	494.5
183.0	4.0	480	2.5	329.1	1.5	73.4	892
184.0	5.0	670	3.5	545	2.5	152.0	1285
185.0	6.0	891	4.5	795	3.5	261.7	1492
186.0	7.0	1110	5.5	1074	4.5	381.	2000
187.0	8.0	1356	6.5	1340	5.5	515.	2500

CLIENT COE
 PROJECT Story Brook
 DETAIL Test Flood Data

JOB NO. 330-5-13
 DATE CHECKED 7-23-79
 CHECKED BY Miller

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 DATE 12-1-79
 COMPUTED BY JE

TEST FLOOD DEVELOPMENT

Test flood = PMF

Based on data used to develop COE Guideline Index for estimating Maximum Anticipated Flood Peak Flow Rates, for the characteristics of the Story Brook watershed, select a CSM value between the plot of the Peter River - Souders River and Indiana Brook - Charles River. This gives a value of 390 cfs/mi² for a 23.6 mi² D.A. This is somewhat less than the Guidelines "Flat & Control" curve and is considered representative of the Story Brook watershed.

Peak inflow to Hebb's Brook Reservoir:

$$71 \text{ sq. mi.} \times 390 \text{ CSM} = 27690 \text{ cfs.}$$

Peak inflow to Story Brook Reservoir is the combination of the outflow from Hebb's Brook and the inflow from the 16.5 mi² watershed D.A.

Peak inflow contribution from 16.5 mi² D.A.:

$$16.5 \text{ sq. mi.} \times 390 \text{ CSM} = 6435 \text{ cfs.}$$

The following pages show the routings through Hebb's & Story Brook Reservoirs

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CLIENT

PROJECT

DETAIL

C. of E.
Story Brook
Star-Disch-El.

JOB NO 380-5-13

DATE CHECKED

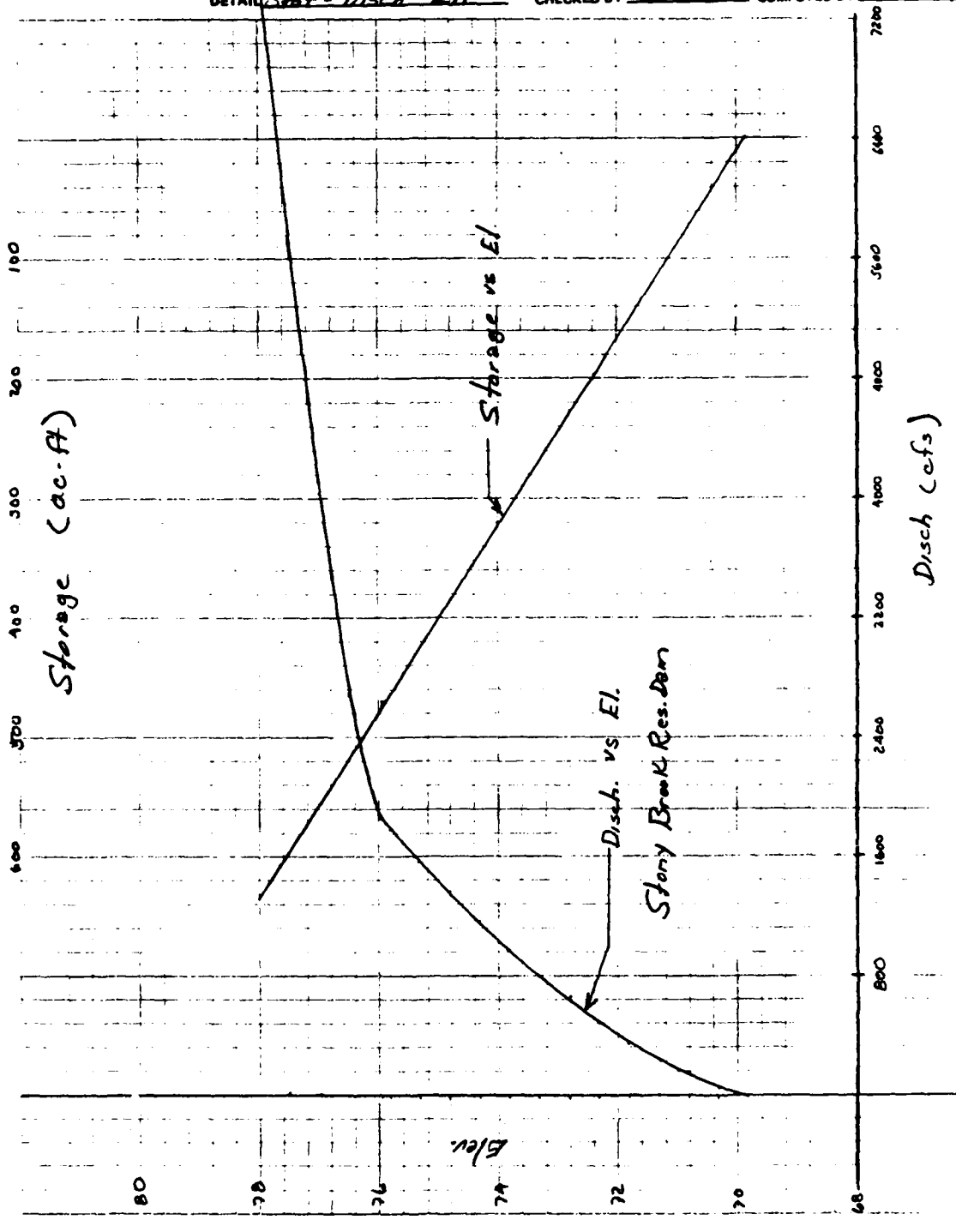
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14
11/17/12
WAT



Stage-Discharge - Spillway Assume No Flashboard

$$L = 36.5' \quad C = 3.33$$

Elev.	Spillway		Dam		TOTAL Q (cfs)
	Ht (ft)	Q (cfs)	Ht (ft)	Q (cfs)	
69.82	0	0			
70.32	.5	43.0			
70.82	1.0	121.5			
71.32	1.5	223.3			
71.82	2.0	343.8			
72.32	2.5	480.4			
72.82	3.0	631.6			
73.32	3.5	795.9			
73.82	4.0	972.4			
74.32	4.5	1160.3			
74.82	5.0	1358.9			
75.32	5.5	1567.8			
75.82	6.0	1786.3			
75.96	6.14	1849.2	0	0	1849.2
76.46	6.64	2079.6	0.5	603.7	2683.3
76.96	7.14	2318.9	1.0	1708.0	4026.9
77.46	7.64	2566.7	1.5	3137.8	5704.5
77.96	8.14	2822.0	2.0	4531.0	7353.0

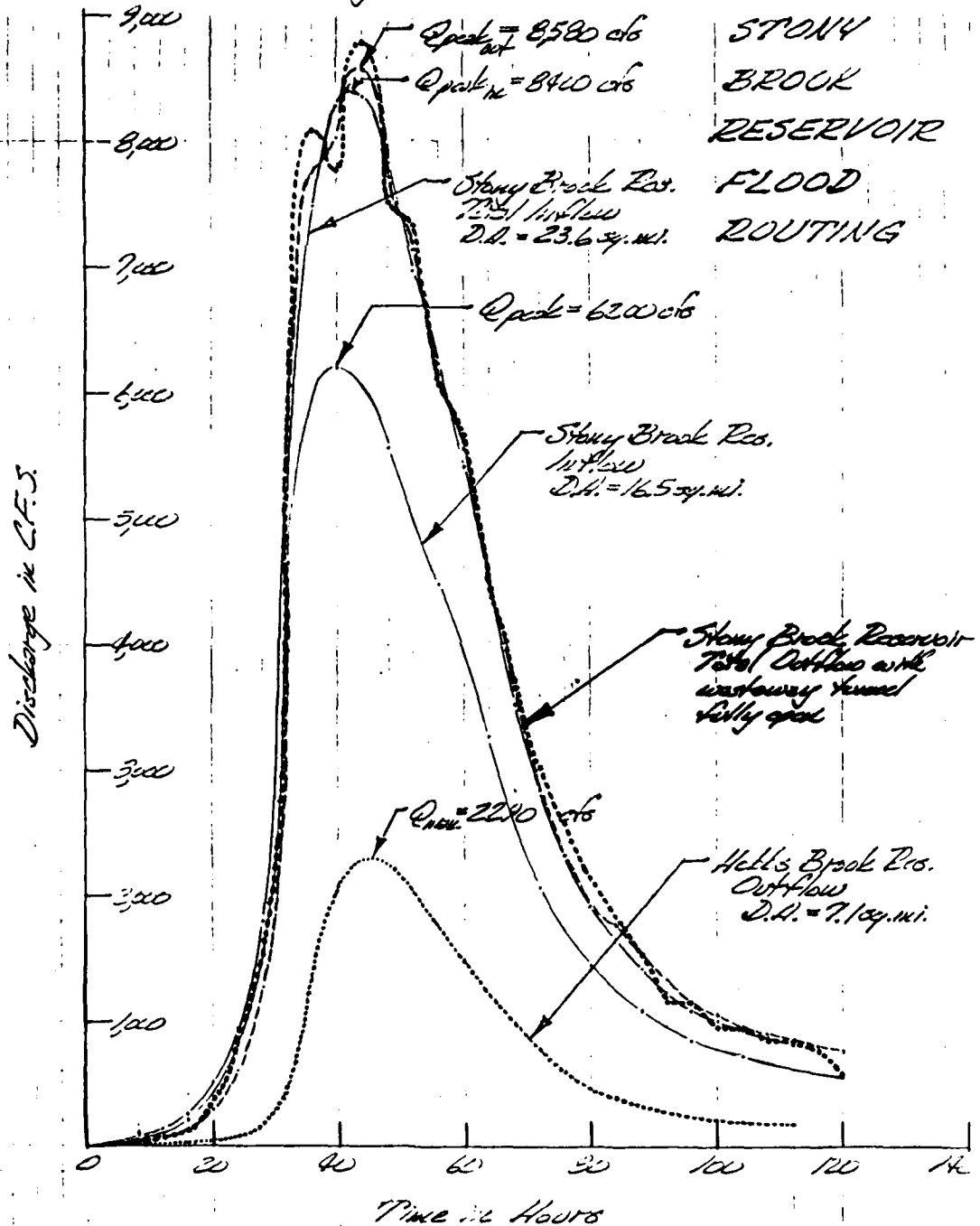
Storage:

$$\begin{aligned}
 @ \text{El. } 69.82 &= 346 \text{ mg} = 1061.8 \text{ ac-ft} \\
 @ \text{El. } 72.22 &= 405 \text{ mg} = 1242.9 \text{ ac-ft} \\
 @ \text{El. } 75.96 &= 499 \text{ mg} = 1531.4 \text{ ac-ft}
 \end{aligned}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \Delta = 181.1 \text{ ac-ft} \\ \Delta = 288.5 \text{ ac-ft} \\ E = 470 \text{ ac-ft} \end{array}$$

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CLIENT: Stony Brook Reservoir JOB NO: 100-113
PROJECT: Stony Brook Reservoir DATE CHECKED: 7/20/79
DETAIL: Flood Routing CHECKED BY: JED

PAGE: 12 of
DATE: July 21, 1979
COMPUTED BY: Miller



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CLIENT C. of E
PROJECT Story Brook
DETAIL Test Flood

JOB NO 300-5-13
DATE CHECKED 6-2-79
CHECKED BY WAP

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DATE 11/28/79
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From Corps of Engineers Guidelines, the MPF for the inflow to Story Brook will be 390 cfs / sq. mi.

$$D.A. = 16.5 \text{ mi}^2$$

$$PMF = 16.5 \times 390 = 6435 \text{ cfs inflow.}$$

Surcharge - Storage

$$Q_p = 6435 \text{ cfs}$$

$$\text{Surch. Ht} = 77.7'$$

$$\text{Stor. @ Elev. 77.7} = 610 \text{ ac-ft}$$

$$R.O. = \frac{610}{53.3 \times 16.5} = .69''$$

$$Q_{p2} = 6435 \times \left(1 - \frac{.69}{19.0}\right)$$

$$= 6204 \text{ cfs}$$

$$\text{Surch. Ht} = 77.60'$$

$$\text{Stor. @ Elev. 77.6} = 605 \text{ ac-ft}$$

$$Q_R = 6200 \text{ cfs}$$

$$Q_{in} = 6435 \text{ cfs}$$

$$Q_{out} = 6200$$

A flow of 6200 cfs will result in a height of flow at Elev. 77.60, or approx. 1.6 feet over the top of the dam.

Tailwater Analysis

$$Q_{out} = 8400 \text{ cfs}$$

As indicated in the dam failure analysis, the ws elevation for a Q of 74,895 cfs would be approximately 61.1. With a Q_{out} of only 8400 cfs, the ws. would obviously be below 57.7, and therefore the dam as such would not be submerged.

Downstream Effects of PMF

$Q_T = 8400 \text{ cfs}$ Must pass this flow
South St. Culvert.

Establish Rating Curve for culvert on South St.

$$Inv. \text{ culv.} = 48.4'$$

$$W = 33.2' \quad \text{max ht} = 6.0'$$

$$\text{Assume } ws = 50.0$$

$$d = 1.6$$

$$Q = \frac{1.49}{.015} \times 1.46^{2/3} \times .002^{1/2} \times 53.12$$

$$R = \frac{33.2 \times 1.6}{33.2 + 1.6} = \frac{53.12}{36.4} = 1.46$$

$$= 99.3 \times 1.29 \times .0447 \times 53.12 = 304.2 \text{ cfs}$$

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CLIENT C. of E
PROJECT Stacy Brook
DETAIL Test flood

JOB NO 380-5-12
DATE CHECKED 6-4-77
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PAGE 17
DATE 1472177
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Assume w.s. = 52.0' $d = 3.6$ $R = \frac{119.5}{40.4} = 2.96$

$$Q = 99.3 \times 2.96^{2/3} \times .0447 \times 119.5$$

$$= 1093.5 \text{ cfs}$$

Assume w.s. = 53.0 $d = 4.6$ $R = \frac{152.72}{42.4} = 3.60$

$$Q = 99.3 \times 3.6^{2/3} \times .0447 \times 152.72 = 1592 \text{ cfs}$$

plus weir flow over South St

$$\text{Set } \textcircled{1} Q = 2.5 \times 40 \times 1.5^{1/2} = 35.4 \text{ cfs}$$

$$\textcircled{2} = 2.5 \times 68.5 \times 1^{1/2} = 1712.5 \text{ cfs}$$

$$\textcircled{3} = 2.5 \times 60 \times 1.5^{1/2} = 53.0 \text{ cfs}$$

$$\text{Total } Q = 3392.9 \text{ cfs}$$

Assume w.s. = 53.5 $d = 5.1$

$$R = \frac{169.32}{43.4} = 3.9$$

$$Q = 99.3 \times 3.9^{2/3} \times .0447 \times 169.32$$

$$= 1862 \text{ cfs}$$

plus weir flow

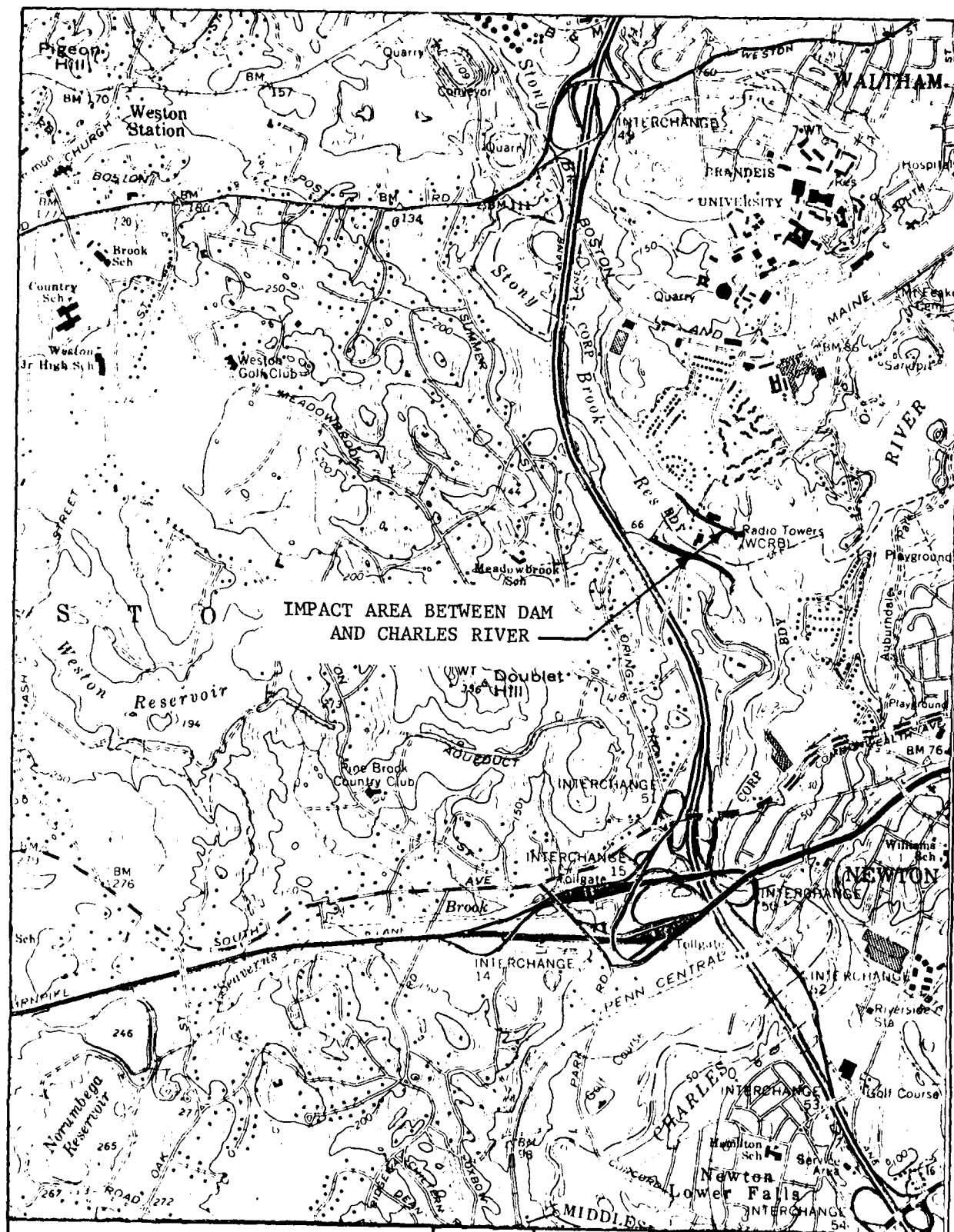
$$\textcircled{1} Q = 2.5 \times 50 \times 1.73^{1/2} = 81.2$$

$$\textcircled{2} Q = 2.5 \times 68.5 \times 1.5^{3/2} = 3146.0$$

$$\textcircled{3} Q = 2.5 \times 100 \times 1.75^{3/2} = 162.4$$

$$\text{Total} = 5251.6 \text{ cfs}$$

From Rating Curve on Page 9, the Q_{out} of 5400 cfs will produce a w.s. elevation of 54.9' msl.



DAM STONY BROOK RESERVOIR

IDENTIFICATION NO. MA 00293



DAM FAILURE
IMPACT AREA MAP

APPROX. SCALE: 1" = 2000'

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

FEDERAL BUREAU OF SURVEY		UNITED STATES GEOLOGICAL SURVEY		REPORT DATE	
PROJECT NAME	STATE	COUNTY	COORDINATES	DAY	MO YR
STONY BROOK RESERVOIR DAM	CT	NEW HAVEN	42 21.3 71 15.9	22	JUN 77

POPULAR NAME		NAME OF DAM/PROJECT	
STONY BROOK		STONY BROOK RESERVOIR	
RIVER OR STREAM		NEAREST DOWNSTREAM CITY-TOWN VILLAGE	
STONY BROOK		STONY BROOK	
POPULATION		POPULATION	
0		0	

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STORAGE CAPACITY (ACR)	RELEASING CAPACITY (ACR)	DESIGN FLOOD (CFS)	DESIGN FLOOD DATE	DESIGN FLOOD YEAR
CONCRETE	1987	5	32	32	1500	1960	1960

REMARKS		REMARKS	

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF NEW HAVEN		
DESIGN	REGULATORY AGENCY	OPERATION
	CONSTRUCTION	MAINTENANCE
INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
CLARK & SUGAR M. O'NEILL INC	8/10/70	PL 92-557

REMARKS	

END

FILMED

7-85

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