

MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

PHOTOGRAPH THIS SHEET

AD-A 154 431

DTIC ACCESSION NUMBER

II

LEVEL

1

INVENTORY

MA-00800

DOCUMENT IDENTIFICATION

April 1979

**DISTRIBUTION STATEMENT A**

Approved for public release;  
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR

NTIS  GRA&I

DTIC  TAB

UNANNOUNCED

JUSTIFICATION

BY

DISTRIBUTION /

AVAILABILITY CODES

DIST

AVAIL AND/OR SPECIAL

A-1

DISTRIBUTION STAMP

DTIC  
COPY  
INSTRUCTIONS  
3

DTIC  
EXCISE  
JUN 3 1985  
S D

DATE ACCESSIONED

DATE RETURNED

85 6 3 027

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NO.

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDAC

**AD-A154 431**

**TAUNTON RIVER BASIN  
FREETOWN, MASSACHUSETTS**

**FORGE POND DAM  
MA 00800**

**PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM**



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

**APRIL 1979**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA00800	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Forge Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE April 1979
		13. NUMBER OF PAGES 65
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report)  UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Taunton River Basin Freetown, Massachusetts Assonet River-tributary of the Taunton River		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  The dam is a former mill pond dam about 330 ft. long. It has a maximum height of about 8 ft. Past inspection records and the lack of operating and maintenance procedures, there are several deficiencies which must be corrected to assure the continued performance of the dam. Generally, the dam is in poor condition. It is small in size with a hazard potential of high.		

FORGE POND DAM

MA 00800

TAUNTON RIVER BASIN  
FREETOWN, MASSACHUSETTS

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION  
PROGRAM

NATIONAL DAM INSPECTION  
PROGRAM  
PHASE I INSPECTION REPORT  
BRIEF ASSESSMENT

Identification No.: MA 00800

Name of Dam: Forge Pond Dam

Town: Freetown

County and State: Bristol County, Massachusetts

Stream: Assonet River - tributary of the Taunton River

Date of Inspection: December 14, 1978

Forge Pond Dam is a former mill pond dam about 330 feet long. The dam has a maximum height of about 8 feet, and the crest varies from elevation (El) 40.8 to 42.4. It is comprised of 230 feet of earth embankment and about 100 feet of dry-stone masonry, including the spillway and outlet structures. The spillway is an ungated, flat-crested weir about 40 feet long. The crest of the spillway is at El 39.7. There are two outlets at the dam. The primary outlet is a concrete sluiceway containing stop logs. A second auxiliary outlet is a concrete sluiceway leading to a 54-inch diameter pipe. The auxiliary outlet is missing a control gate and is blocked. The discharge channel is stone lined and covered with some brush and debris.

Based upon the visual inspection of the site, past inspection records and the lack of operating and maintenance procedures, there are severe deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is in "poor" condition.

The following signs of distress were observed at the dam: severe leakage through the masonry walls at both spillway abutments and west of the auxiliary outlet structure, seepage at three separate locations near the downstream toe of the earth embankment, voids and undermining of the dry-stone masonry sections of the dam, wooden planks blocking the auxiliary outlet pipe, insufficient freeboard on the dam, and a lack of riprap on the upstream slope of the dam. In addition,

FORGE POND DAM

other maintenance functions such as control of vegetation, filling of holes in the earth slopes, and clearing of debris from the discharge channels have not been undertaken.

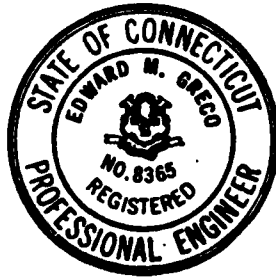
Based on Corps of Engineers' guidelines, the dam has been classified as "small" and in the "high" hazard category. Accordingly, a test flood equal to one-half the probable maximum flood (PMF) was used for this analysis. Hydraulic analyses indicate that the spillway and the primary outlet can discharge a combined flow of only 150 cfs (cubic feet per second) when the water surface is at El 40.8, which is the low point on the crest of the dam. A test flood outflow (one-half PMF) of 4,250 cfs with the pond at El 44.9 will overtop the dam by about 4.1 feet. The spillway and the primary outlet can discharge only 4 percent of the test flood without overtopping the dam. Recent overtopping of the dam occurred in August 1978 and January 1979. Sandbags were placed along portions of the crest in an attempt to prevent overtopping.

It is recommended that the Owner immediately remove the stop logs in the primary outlet and the planks blocking the auxiliary outlet, and lower the pond to El 33.1. The Owner should also employ the services of a qualified consultant to evaluate the stability of the dam, the severe leakage through the masonry sections of the dam, and the seepage at the toe of the earth embankment. The consultant should also conduct a detailed hydraulic and hydrologic investigation to determine procedures for increasing the discharge capacity of the dam and appurtenances. In addition, it is recommended that the Owner accomplish the following: repair the auxiliary outlet, install riprap on the upstream slope of the dam, selectively clear the dam of trees, roots and brush to 25 feet downstream of the toe, and remove fallen trees and brush from the discharge channel. The Owner should also implement systematic programs of inspection, maintenance, surveillance and warning.

The recommendations and remedial measures outlined above and in Section 7 should be implemented by the Owner within one year of receipt of this Phase I Inspection Report. An alternative to the recommendations and remedial measures would be to drain the reservoir and breach or remove the dam. However, it was reported that residents in the area surrounding

FORGE POND DAM

Forge Pond have shallow water supply wells which "dry out" at low pond levels. Therefore, draining the reservoir and breaching or removing the dam could have a serious impact on these local residents.



A handwritten signature in cursive script that reads "Edward M. Greco".

Edward M. Greco, P.E.  
Project Manager  
Metcalf & Eddy, Inc.

Connecticut Registration  
No. 08365

Approved by:

A handwritten signature in cursive script that reads "Stephen L. Bishop".

Stephen L. Bishop, P.E.  
Vice President  
Metcalf & Eddy, Inc.

Massachusetts Registration  
No. 19703



FORGE POND DAM

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

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

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

SAUL C. COOPER, Member  
Chief, Water Control Branch  
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR  
Chief, Engineering Division

FORGE POND DAM

## PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

FORGE POND DAM

## TABLE OF CONTENTS

	<u>Page</u>
BRIEF ASSESSMENT	
PREFACE	
OVERVIEW PHOTOGRAPHS	111
LOCATION MAP	v
REPORT	
SECTION 1 - PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	5
SECTION 2 - ENGINEERING DATA	10
2.1 General	10
2.2 Construction Records	10
2.3 Operating Records	10
2.4 Evaluation	10
SECTION 3 - VISUAL INSPECTION	11
3.1 Findings	11
3.2 Evaluation	14
SECTION 4 - OPERATING PROCEDURES	15
4.1 Procedures	15
4.2 Maintenance of Dam	15
4.3 Maintenance of Operating Facilities	15
4.4 Description of Any Warning System in Effect	15
4.5 Evaluation	15
SECTION 5 - HYDRAULIC/HYDROLOGIC	16
5.1 Evaluation of Features	16

FORGE POND DAM

TABLE OF CONTENTS (Continued)

	<u>Page</u>
SECTION 6 - STRUCTURAL STABILITY	20
6.1 Evaluation of Structural Stability	20
SECTION 7 - ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES	22
7.1 Dam Assessment	22
7.2 Recommendations	23
7.3 Remedial Measures	23
7.4 Alternatives	24

APPENDIXES

APPENDIX A - PERIODIC INSPECTION CHECKLIST	
APPENDIX B - PLANS OF DAM AND PREVIOUS INSPECTION REPORTS	
APPENDIX C - PHOTOGRAPHS	
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	

FORGE POND DAM

**OVERVIEW  
FORGE POND DAM  
FREETOWN, MASSACHUSETTS**



**UPSTREAM VIEW**

**OVERVIEW  
FORGE POND DAM  
FREETOWN, MASSACHUSETTS**



**DOWNSTREAM VIEW**



NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT  
FORGE POND DAM

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. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.
- b. Purpose:
- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
  - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
  - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location. The dam is located on the Assonet River, at the Village of Assonet, in the Town of Freetown, Bristol County, Massachusetts (see

FORGE POND DAM

Location Map and Figure D-1, Drainage Area Map). The Assonet River is a tributary of the Taunton River.

- b. Description of Dam and Appurtenances. Forge Pond Dam consists of earthfill and dry stone masonry embankment sections, a concrete capped, dry stone masonry spillway, and two outlet structures (see Figures B-1 and B-2).

The embankment of the dam section has a maximum height of 8 feet. It consists of two sections; the right section extends about 165 feet north of the auxiliary outlet and the left section extends south about 60 feet from the primary outlet to the retaining wall for the New York, New Haven and Hartford Railroad. The right embankment has the remains of a fieldstone wall along the downstream face. The crest of the dam averages 15-foot wide, and its elevation varies from El 40.8 to El 42.4. The upstream face of the dam slopes at 6.5:1 (horizontal:vertical) and the downstream face of the right embankment is a vertical, dry-stone masonry wall. The downstream face of the left embankment slopes at 3.5:1 and is covered with vegetation. The right and left abutments tie into natural ground and the railroad retaining wall respectively.

The spillway has an ungated, flat-crested weir constructed of dry-stone masonry capped with concrete. The crest is 40 feet long and at El 39.7. The right spillway abutment is constructed similarly to the spillway, and is about 1 foot higher than the weir. The left spillway abutment consists of a dry-stone masonry wall filled with soil to approximately 6 inches above the weir. The remaining portion of the dam between the right earth embankment and the auxiliary outlet is also a dry stone masonry section. At the spillway, the discharge channel is about 70 feet wide including a 15-foot wide primary outlet channel, with an invert at El 32.4. The channel is stone-lined and carries flow beneath the embankment of the Forge Road which is about 70 feet downstream of the spillway.

FORGE POND DAM

There are two outlets for the dam, which previously had gatehouses. The primary outlet is a 4-foot wide, concrete sluiceway containing stop logs set at El 39.6. It appears that the stop logs can be removed with some difficulty to the invert of the sluiceway at El 33.1. The flow discharges into the spillway channel.

The auxiliary outlet appears to be older and was apparently designed to direct flow into a former mill race. The auxiliary outlet is a 5-foot wide concrete sluiceway containing stop logs and leads to an outlet pipe 54 inches in diameter. The discharge pipe has an invert at El 33.1. The outlet has been boarded up at the downstream end of the sluiceway. The mill race has an invert at El 31.4 at the outlet. The mill race consists of vertical, dry-stone masonry walls.

- c. Size Classification. Forge Pond Dam is classified in the "small" category since it has a maximum height of 8 feet and a maximum storage capacity of 144 acre-feet.
- d. Hazard Classification. Two houses, one located on Mill Street and the other on Forge Road are immediately downstream of the dam. However, these houses are built on higher ground and would be subject only to minor flood damage. The embankment of Forge Road, located between these houses and the dam, would slow and constrict a flood wave if the dam failed. The Winslow and Tisdale Dams are located 2,300 and 4,500 feet downstream, respectively. Two factories and the Village of Assonet are also located downstream.

The two dams at Locust Street and in the village would reduce the flooding, however, loss of several lives and extensive damage to factories and dwellings could occur. The specific effect of the failure of Forge Pond Dam on the downstream dams cannot be determined without more detailed hydraulic studies. If the failure of Forge Pond Dam results in major overtopping or failure of the downstream dams, many dwellings in the Village of Assonet could be affected. Therefore, the dam has been placed in the "high" hazard category.

FORGE POND DAM

- e. Ownership. The water rights to the dam are owned by Mr. Andre J. Fournier, Trustee of Fournier-Jade Realty Trust, 17 Mill Road, New Bedford, Massachusetts 02745. The property where the dam is located is owned by Mr. Oliver Jackson, 42 Forge Road, Assonet, Massachusetts 02702. Permission to enter the property and inspect the dam was obtained from Mr. Oliver Jackson (617-644-5506) and Mr. Andre J. Fournier (617-995-9953), respectively.
- f. Operators. There are no known operators of this dam. Mr. Fournier, Owner, indicated he frequently visits the site.
- g. Purpose of Dam. The original purpose of the dam is reported to be for a mill. The Owner indicated that the present use is as a storage dam for a mill 2,300 feet downstream. The mill has a turbine at the Winslow Dam which is not presently in use. According to Mr. Fournier, he intends to replace the existing Forge Pond Dam and install a small turbine at the site. The pond is also used for recreational activities.
- h. Design and Construction History. It is reported that the dam at Forge Pond was built between 1700 and 1710. There are no known design, construction or repair plans, specifications or computations available from the Owner, County, or State offices.

During this inspection of the dam, it was noted that sand bags and a sand berm had been placed on the crest of the embankment. Conversations with Mr. Fournier indicated this was done without his authorization.

- i. Normal Operational Procedure. There are no normal operational procedures at the dam. The spillway and primary outlet structure are presently controlling the pond level. The spillway for Forge Pond Dam is ungated and flows are unrestricted. The stop logs and guides on the outlet are damaged, apparently by fire and vandalism, and appear to be inoperable.

FORGE POND DAM

At the present time, the auxiliary outlet structure has been boarded up. According to Mr. Fournier this was done without his authorization about three years ago to maintain the pond level at a higher elevation for upstream recreational purposes.

### 1.3 Pertinent Data

- a. Drainage Area. Forge Pond has a drainage area of approximately 20.6 square miles (13,184 acres). A map of the drainage area is shown in Figure D-1. The area is largely undeveloped, wooded and swampy. Quaker Brook and Cedar Swamp River drain into Forge Pond. There are four cranberry bogs also located within the drainage area. The area is mostly gently rolling with moderately steep slopes on the outlying hills. The New York, New Haven and Hartford Railroad extends in a north-south direction through the middle of the drainage area.
- b. Discharge. Forge Pond discharges over an ungated spillway and over the stop logs of a concrete sluiceway (primary outlet). The spillway has a flat-crested weir which is 40 feet wide and at El 39.7. The discharge channel is about 55 feet wide with flat earth slopes. The channel leads to two rectangular culverts beneath Forge Road located approximately 70 feet downstream. The culverts have minimum dimensions (at the downstream end) of 8.4 feet wide by 9.5 feet high and 7.4 feet wide by 9.4 feet high, with inverts at El 30.0 (downstream end).

The concrete sluiceway (primary outlet) is 4 feet wide with stop logs set at El 39.6. Discharge is to a 15-foot wide channel with earth slopes leading to a third culvert beneath Forge Road. The culvert which is rectangular and stone-lined is 4.5 feet high and 4.5 feet wide with an invert at El 31.8 (downstream end).

There is also a stone-lined, rectangular discharge channel downstream of the auxiliary outlet which is inoperable. The outlet is a 54-inch pipe with an invert at El 33.1. The

FORGE POND DAM

channel is about 8 feet wide and leads to a fourth culvert 5.5 feet wide and 9.5 feet high beneath Forge Road. The invert of the culvert is at El 30.0.

Downstream of Forge Road, discharge flows in the Assonet River, which becomes tidal about 1 mile downstream, and eventually drains into the Taunton River. The Winslow and Tisdale dams are located 2,300 and 4,500 feet downstream respectively. The Village of Assonet straddles the river about 5,000 feet downstream.

The spillway and the primary outlet structure can discharge an estimated 135 and 15 cfs, respectively, with the water surface at El 40.8 which is the low point on the crest of the dam. During the test flood (one-half PMF), the peak discharge would be 4,250 cfs with the pond at El 44.9. The crest of the dam would be overtopped by about 4.1 feet. The spillway and primary outlet can discharge only 4 percent of the test flood before the dam is overtopped.

The maximum flood level at the dam is unknown. Past inspection records have recorded that the dam was overtopped on March 20, 1968, June 23, 1972, January 14, 1974, January 7, 1978 August 7, 1978 and January 26, 1979.

- c. Elevation (feet above Mean Sea Level (MSL)).  
A benchmark was established at El 48.0 on top of the retaining wall for the New York, New Haven and Hartford Railroad (see Figure B-1). This elevation was based upon a benchmark shown on the United States Geological Survey (USGS) topographic map (1975).

- (1) Top dam: 40.8 to 42.4
- (2) Test flood pool: 44.9
- (3) Design surcharge: Unknown
- (4) Full flood control pool: Not applicable (N/A)

FORGE POND DAM

- (5) Recreation pool: 39.6 (primary outlet)
- (6) Spillway crest (ungated): 39.7
- (7) Upstream portal invert diversion tunnel:  
N/A
- (8) Streambed at centerline of dam: 32.4
- (9) Maximum tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 4,500 feet
- (2) Length of recreation pool: 4,500 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge (see Appendix D):  
886 (Net) at El 44.9
- (2) Top of dam: 144
- (3) Flood control pool: N/A
- (4) Recreation pool: 114
- (5) Spillway crest: 114

f. Reservoir Surface (acres)

- (1) Top dam: 47.3
- (2) Test flood pool (see Appendix D): 440
- (3) Flood-control pool: N/A
- (4) Recreation pool: 47.3
- (5) Spillway crest: 47.3

g. Dam

- (1) Type: earthfill and dry-stone masonry
- (2) Length: 330 feet

FORGE POND DAM

- (3) Height: 8 feet
- (4) Top width: 15 feet
- (5) Side slopes: upstream - 6.5:1  
downstream - 3.5:1 to  
vertical stone wall
- (6) Zoning: Unknown
- (7) Impervious core: Unknown
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

1. Spillway

- (1) Type: flat-crest
- (2) Length of weir: 40 feet
- (3) Crest elevation: 39.7
- (4) Gates: None
- (5) Upstream channel: bottom is gravel fill
- (6) Downstream channel: gravel, cobble and boulder covered
- (7) General: Four culverts under Forge Pond Road approximately 70 feet downstream of the dam. Three at the bridge: 5.5 feet wide by 9.5 feet high, 8.4 feet wide by 9.5 feet high, 7.4 feet wide by 9.4 feet high; and one east of the bridge: 4.5 feet square (dimensions taken at downstream side of bridge).

- j. Regulating Outlets. There are two regulating outlets at the dam. The primary outlet structure, a concrete sluiceway with stop logs, is located at the east abutment of the spillway. The stop logs appear to be inoperable. At the present time, the top of the stop logs is at El 39.6, which is only 0.1 foot below the crest of the spillway. If the stop logs could

FORGE POND DAM

be removed from the sluiceway, this would form a low level outlet at El 33.1 which is the invert of the sluiceway.

The auxiliary outlet structure, located at the west abutment of the spillway, has been boarded up. The outlet consists of a concrete sluiceway leading to a pipe 54 inches in diameter. The invert of the outlet pipe is at El 33.1. Past inspection records revealed that a slide gate was used to control this facility, however, the slide gate and its operating mechanism have been removed.

FORGE POND DAM

SECTION 2  
ENGINEERING DATA

- 2.1 General. There are no known plans, specifications or computations available from the Owner, County or State offices relative to the design, construction, or repair of this dam.

The only available data is from previous County inspection reports and field notes taken by Massachusetts Department of Public Works personnel.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Division of Waterways and the Department of Public Works.

- 2.2 Construction Records. There are no as-built drawings for the dam, spillway or outlet structures.
- 2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.
- 2.4 Evaluation
- a. Availability. Due to the age of this dam, there is very limited engineering data available.
  - b. Adequacy. The lack of detailed hydraulic, structural and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on review of visual inspection, past performance history and engineering judgment.
  - c. Validity. Comparison of the available previous inspection reports with the field survey conducted during the Phase I inspection indicates that the available information is valid.

FORGE POND DAM

SECTION 3  
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Forge Pond was performed on December 14, 1978. A copy of the inspection checklist is included in Appendix A. Earlier inspection reports by Hayden, Harding and Buchanan, Inc. of Boston, Massachusetts for the Bristol County Commissioners are included in Appendix B. Notes from more recent field inspections by the Massachusetts Department of Public Works, District 6 personnel are also included in Appendix B.
  
- b. Dam. Forge Pond Dam is a former mill pond dam which has a recorded history of overtopping. The dam is in poor condition. Erosion is evident at several locations on the dam embankment and on both sides of the primary and auxiliary outlet structures. It is known from previous inspection reports that flow has flanked these structures several times. The top of the earthen embankment has layers of sandbags which are badly deteriorated and a sand berm. These were both placed by Freetown personnel and volunteers during the period of heavy rainfall recorded in August 1978. In one location the sandbags are stacked approximately 4 feet high and capped with an old millstone. Seepage was observed at six separate locations; three at the toe of the westerly earthen embankment, one in each spillway abutment and one in the section of the dam just west of the auxiliary outlet structure (shown on Figure B-1). The seepage in the latter three locations was actually leakage through the dry-stone masonry wall about 1 foot below the crest. The water at each of the former three seepage locations was clear, however, there was a small delta of sand at each location. The zone of seepage at each location was approximately 1 foot in diameter.

FORGE POND DAM

Several cavities were observed in the stone wall on both sides of the auxiliary outlet structure. The stone masonry is mostly dry joint with vines growing in it. The cavities were probably formed when the water flanked the structure and undermined loose stone. The largest cavity, 18 inches deep was observed on the right side of the auxiliary outlet structure. At this same location, it appears that precast concrete vehicular stop logs were recently placed to fill a gap in the wall.

The right side of the primary outlet structure which is also the spillway abutment consists of a stone wall filled with soil. The wall has several dislodged and missing stones. Most of the remaining wall is dry joint with some recently placed mortar patches. Three vertical rods were observed sticking out of the top of the stone wall, indicating that a concrete apron may have capped the spillway abutment at one time. Partially flushed sandbags were observed on top of the wall.

A hole approximately 4 inches in diameter and 2 feet long was observed on the embankment, half-way up the downstream slope about 20 feet left of the primary outlet structure. The hole did not appear to be that of a burrowing animal. A 2-foot high stone wall is located at the toe of the downstream slope of the embankments. Stone which had been dislodged from the wall was observed at the base of the wall. There was evidence of soil erosion from behind the wall where stones were removed.

The earth embankments are generally covered with trees and saplings. An exception to this is the crest of the west embankment which is relatively clear of trees. Debris, brush and downed trees cover the upstream slope and crest of the easterly embankment. A cluster of large trees is situated at each spillway abutment.

- c. Appurtenant Structures. The spillway consists of a dry joint masonry wall capped with a concrete apron and is generally in fair condition. The spillway is an ungated, flat-crested weir about 40 feet long. The spillway

FORGE POND DAM

crest is at El 39.7. The concrete apron is cracked, spalled, stained and partially eroded. Loose rock and trees overhang the spillway discharge channel. Within and just to the west of the spillway channel are the remains of the foundation piers of an old mill. The approach channel is free of obstacles and debris.

The primary outlet structure is in poor condition. The concrete sidewalls including the intake wing walls are deteriorated, spalled and eroded, especially at the water line and the downstream end of the left wall. One vertical crack was observed in the right sidewall. The timber vertical guides for the stop logs were damaged apparently by fire. These guides were reinforced recently with a framework of vertical braces with two sets of compression struts. One set of struts is located under the discharge water level. The stop logs show some deterioration and appear to be swollen in the guides. The removal of a stop log would appear to be very difficult. The primary outlet structure discharges to a separate stone lined channel which carries flow under the Forge Road embankment. This channel joins the Assonet River approximately 100 yards downstream of Forge Road.

The auxiliary outlet structure is also in poor condition. It consists of a concrete intake structure leading to a 54-inch diameter outlet pipe. The remains of a wooden platform apparently constructed for a slide gate is located above the intake structure. The slide gate and mechanism are no longer present. The concrete sidewalls were cracked, spalled, stained and deteriorated. The stop log keyways on the inside of the concrete sidewalls are deteriorated. The concrete walls appear to have been placed directly on a dry joint stone wall, as cobble-size stones are embedded at the base of the sidewalls. Water was observed leaking between the right sidewall and the bottom of the dry-stone masonry section of the embankment. The downstream end of the intake structure is boarded up and covered with a sheet of rubber. However, there is a small amount of leakage into the

FORGE POND DAM

outlet pipe. The pipe is rusted and deteriorated. The discharge channel is a stone-lined channel formerly used as a mill race. There are dislodged rocks and trees overhanging the raceway. A fallen tree and some debris were also observed in the raceway.

- d. Reservoir Area. The area around Forge Pond is sparsely developed except the east shore where two new housing developments have been built. The drainage area consists mostly of swamps, wooded areas and hills. The average slope of the drainage area is less than one percent.
- e. Downstream Channel. Discharge from the dam flows in three downstream channels which lead to four rectangular culverts beneath Forge Road. The floors of the channels are lined with stone, and the sides are made of stone or earth. Below the road, this discharge flows downstream in the Assonet River. There are numerous trees overhanging the discharge channels. Some trees are rooted into the stone sidewalls, and one has fallen into the channel below the auxiliary outlet. These trees have branches dropping into the channels, which could result in debris blocking the openings beneath Forge Road. Brush is also growing in the downstream channels, and some stones have fallen out of stone sidewalls.

3.2 Evaluation. The above findings indicate that the dam is in poor condition, and there are several deficiencies which require attention. Recommended measures to improve these conditions are stated in Section 7.3.

FORGE POND DAM

## SECTION 4

### OPERATING PROCEDURES

- 4.1 Procedures. There are no operating procedures performed at this dam.
- 4.2 Maintenance of Dam. The dam is not maintained. Seepage is occurring at the toe of the earth embankment and through the walls of the dry-stone masonry sections. Erosion of the embankment has occurred due to overtopping and poor maintenance. There are several trees growing on the dam, and there is no riprap protection on the upstream slope.
- 4.3 Maintenance of Operating Facilities. The primary outlet structure is damaged apparently by fire and vandalism. The stop logs are frozen in their guides and therefore inoperable. The auxiliary outlet structure has been blocked for about three years reportedly without authorization of the Owner. The slide gate and operating mechanism for the auxiliary outlet have been removed.
- 4.4 Description of Any Warning System in Effect. There are no warning systems in effect at this dam.
- 4.5 Evaluation. There are no operating, maintenance or warning systems in effect at Forge Pond Dam. This is extremely undesirable considering the number of times the dam has previously overtopped and the fact that it is in the "high" hazard category. A program of operation and maintenance for this dam should be implemented as recommended in Section 7.

FORGE POND DAM

## SECTION 5

### HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

- a. General. Forge Pond has a tributary drainage area of 20.6 square miles (13,184 acres), with about 20 percent of the area in ponds and swamps. The area is largely undeveloped and wooded. The average basin slope was estimated at 0.5 percent. Due to the low-lying topography in the drainage area, an increase of 1 foot in the level of the pond results in an increase of about 100 acre-feet of storage above El 41.0 (see page D-3 in Appendix D).

Forge Pond Dam is an earthfill and dry-stone masonry dam with a maximum height of 8 feet. The spillway is an ungated, flat-crested weir, about 40 feet long with a crest at El 39.7. Pond levels are controlled by the spillway and by stop logs in the easterly concrete sluiceway (primary outlet). The stop logs are very difficult to remove. The top of the stop logs is at El 39.6. The westerly sluiceway (auxiliary outlet) has been blocked and abandoned. This sluiceway leads to an outlet pipe with an invert at El 33.1. The pond level could be lowered further if the planks blocking the outlet were removed.

- b. Design Data. There are no hydraulic or hydrologic computations available for the design of this dam.
- c. Experience Data. Hydraulic records are not available for this dam. Past inspection reports indicate that the dam was overtopped on March 20, 1968, June 23, 1972, January 14, 1974, January 7, 1978, August 7, 1978, and January 26, 1979. The existing sand bags and sand berm were placed on the crest of the dam by Freetown personnel and volunteers during the period of heavy rainfall recorded in August 1978. During that storm, a dam upstream on a cranberry bog failed. A copy of special precipitation data collected on this

FORGE POND DAM

storm for the Massachusetts area is attached in Appendix D. The greatest single accumulation reported was 14.25 inches in the Town of Lakeville, Massachusetts which is within this drainage area and within 1-1/2 miles of Forge Pond Dam.

- d. Visual Observations. The spillway consisting of a dry joint masonry wall capped with a concrete apron is generally in fair condition. The concrete apron is cracked, spalled, stained and partially eroded. The ungated spillway has no provisions for flashboards. The crest is a flat-crested weir emptying into a stone-lined discharge channel. The discharge channel is filled with some boulders and has trees overhanging it. The spillway approach channel is unobstructed. However, there are two clusters of large trees overhanging both ends of the spillway.

There are two outlets at the dam. Both are concrete sluiceways. The easterly sluiceway (primary outlet) contains stop logs which are damaged and inoperable. However, the water continues to flow over the stop logs and discharges into the spillway channel.

The westerly sluiceway (auxiliary outlet) has an outlet pipe which is 54 inches in diameter. The slide gate and operating mechanism are no longer present. The outlet was recently boarded up and covered with a sheet of rubber.

- e. Test Flood Analysis. Forge Pond Dam has been classified as a "small" size dam of "high" hazard potential. According to the Corps of Engineers' guidelines, a test flood within the range of one-half to the full probable maximum flood (PMF) should be used for evaluating the capacity of the spillway and dam. For this preliminary investigation, the one-half PMF was used.

The PMF rate was determined to be 500 cfs per square mile. This calculation is based on the average slope of the drainage area of 0.5 percent, the pond-plus-swamp area to drainage area ratio of 19.6 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum

FORGE POND DAM

Probable Flood Peak Flow Rates (dated December 1977). Applying the one-half PMF to the 20.6 square mile drainage area results in a calculated peak flood flow of 4,740 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 4,250 cfs (206 cfs per square mile), with a water surface at El 44.9. This assumes the auxiliary outlet is inoperable.

The hydraulic analysis indicates that the spillway and primary outlet can discharge a combined flow of 150 cfs when the water surface is at El 40.8 which is the low point on the crest of the dam. The spillway alone can discharge 135 cfs with the water at the same elevation. The combined discharge is only 4 percent of the outflow test flood. The maximum head on the crest during peak outflow would be 4.1 feet, with a discharge of 21.2 cfs per foot of width. At critical flow the depth would be 2.4 feet with a velocity of 8.8 feet per second.

If the upper 2 feet of stop logs were removed from the primary outlet structure, the pond level could be lowered 1 foot in about 18.6 hours starting from El 39.6.

- f. Dam Failure Analysis. Assuming a failure of the dam with the water surface at El 40.8, which is the low area on the crest of the dam, the peak discharge flood flow would be about 1,450 cfs. At El 40.8, the spillway and the primary outlet would be discharging 150 cfs, creating a downstream water depth of about 1 foot. Failure of the dam would result in a wave that would be impeded by the Forge Road embankment, thereby causing a backwater just below the dam to a depth of 5.5 feet. The low point on the crown of Forge Road is at El 40.5. With the entire dam removed and the pond at El 40.8 the constriction of the roadway would limit outflow to about 2,530 cfs. It is estimated that it would take about 2.7 hours to drain the pond.

An alternative dam failure analysis was considered assuming the water surface at El 42.4,

FORGE POND DAM

which is the approximate low point on top of the sandbags. The peak discharge flood flow would be about 4,490 cfs which includes 880 cfs discharging from the spillway and the primary outlet. Prior to failure the discharge of 880 cfs would produce a flow with a channel depth of about 4 feet. Failure of the dam would result in a pool overtopping Forge Road with a water elevation of 42.5. A total of 4,300 cfs would discharge over Forge Road producing a downstream water depth of about 9 feet. It is estimated that it would take about 2.0 hours to drain the pond.

Downstream of Forge Road, two homes are located along the river, however, these are built on higher ground and would be subject only to minor flood damage. Winslow Dam and an adjacent factory are located 2,300 feet downstream. Winslow Dam could mitigate the effect of the failure wave; however, it would probably be overtopped and the adjacent factory would be damaged. Tisdale Dam located 4,500 feet downstream would also mitigate flooding. However, during a period of heavy rainfall in January 1979 when Forge Pond Dam was overtopped, Winslow Dam was also overtopped, and the pond level was 6 inches below the crest of the dam at Tisdale Dam. The specific effect of the failure of Forge Pond Dam on the downstream dams cannot be determined without more detailed hydraulic studies. If the failure results in sudden major overtopping or failure of the downstream dams, many dwellings in the Village of Assonet could be affected.

FORGE POND DAM

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Forge Pond Dam is based on the visual inspection conducted on December 14, 1978. A detailed discussion of the visual inspection is given in Section 3, Visual Inspection. Based on this inspection, the dam is judged to be in poor condition. Severe leakage through the dam occurs at both spillway abutments and through the stone wall west of the auxiliary outlet structure. Seepage was observed at three locations at the downstream toe of the earth embankment and also at a location west of the auxiliary outlet structure. This seepage indicates a hazard to the stability of the dam. Severe erosion has dislodged some masonry, leaving portions of the stone wall partially supported. The largest cavity, which is 18-inches deep was observed on the west side of the auxiliary outlet structure.
- b. Design and Construction Data. Discussions with the Owner, County and State personnel indicate that there are no available plans, specifications or computations on the design, construction or repair of the dam. Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.
- c. Operating Records. There is no instrumentation of any type in Forge Pond Dam, and no instrumentation was ever reportedly installed. The performance of this dam under prior loading can only be inferred from physical evidence at the site.
- d. Post-Construction Changes. There are no as-built drawings available for Forge Pond Dam. Based on visual evidence, the dam appears to have been repaired at several locations. However, there are no records of when or how these repairs were made.

FORGE POND DAM

- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis at this time.

FORGE POND DAM

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment

- a. Condition. Based upon the visual inspection of the site, past inspection records and the lack of operational and maintenance procedures, there are severe deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in "poor" condition. Several significant signs of distress were observed at the site: severe leakage through the stone walls at both spillway abutments and west of the auxiliary outlet structure, upward seepage at three locations near the downstream toe of the earth embankment, cavities and undermining of the dry stone masonry, inadequate freeboard on the dam, lack of riprap on the upstream slope of the dam, and blockage of the auxiliary outlet structure. In addition, other maintenance functions such as control of vegetation, filling of holes in the earth slopes, and clearing debris from the downstream channels should be undertaken.

Hydraulic analyses indicate that the spillway and the primary outlet structure can discharge a flow of 150 cfs with the water surface at El 40.8 which is the low point on the crest of the dam. An outflow test flood of 4,250 cfs (one-half PMF) will overtop the dam by a maximum of 4.1 feet. The spillway and the primary outlet structure can discharge only 4 percent of the test flood without overtopping the dam.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based primarily on the visual inspection, past performance and engineering judgment.
- c. Urgency. The recommendations and remedial measures outlined below should be implemented

FORGE POND DAM

by the Owner within one year after receipt of this Phase I Inspection Report.

- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are outlined below in Section 7.2, Recommendations.

7.2 Recommendations. In view of the concerns over the continued performance of the dam, it is recommended that the Owner employ the services of a qualified consultant to:

- a. evaluate the stability of the dam,
- b. evaluate seepage at the downstream toe of the dam and through the masonry sections, and
- c. conduct a detailed hydraulic and hydrologic investigation to determine procedures to increase the discharge capacity of the dam and appurtenances. The Owner should implement the results of this investigation.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

### 7.3 Remedial Measures

- a. Operating and Maintenance Procedures. The dam and appurtenant structures are in poor condition and are not adequately maintained. It is recommended that the Owner accomplish the following:
  - (1) immediately remove the stop logs in the primary and auxiliary outlet structures and lower the pond to El 33.1. The pond should be maintained at this level until the above recommendations and following remedial measures are completed.
  - (2) repair outlet structures and masonry portions of the dam based on the recommendations of a qualified consultant.
  - (3) Install riprap on the upstream slope of the dam.

FORGE POND DAM

- (4) Selective clearing of trees and roots and removal of all brush should be implemented on the dam and within 25 feet of the downstream toe. All stumps and roots removed should be backfilled with select material. The discharge channel should also be kept clear of fallen trees and brush.
- (5) Implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.
- (6) periodic technical inspections of this dam should be continued on an annual basis
- (7) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.

7.4 Alternatives. An alternative to implementing the recommendations and remedial measures listed above would be to drain the reservoir and breach or remove the dam. However, it was reported that residents in the area surrounding Forge Pond have shallow water supply wells which "dry out" at low pond levels. Therefore, draining the reservoir and breaching or removing the dam could have a serious impact on those residents.

FORGE POND DAM

APPENDIX A  
PERIODIC INSPECTION  
CHECKLIST

FORGE POND DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT Forge Pond Dam

DATE December 14, 1978

TIME 8:00 am

WEATHER 20°F Partly Cloudy

W.S. ELEV. 40.4\* U.S. 33.7 DN.S.

\* Assumed benchmark El 48.0 from USGS topo quad at the top of masonry wall for Railroad embankment

PARTY:

- 1. L. Branagan
- 2. M. Larson
- 3. W. Checchi
- 4. H. Lord
- 5. D. Cole
- 6. J. Risitano
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
- 10. \_\_\_\_\_

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam</u>	<u>J. Risitano and M. Larson</u>	
2. <u>Outlet Works</u>	<u>L. Branagan, J. Risitano and M. Larson</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Dam NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Varies from 40.8 to 42.4
Current Pool Elevation	40.4
Maximum Impoundment to Date	unknown
Surface Cracks	none visible
Pavement Condition	grassed slopes
Movement or Settlement of Crest	irregular (both sides)
Lateral Movement	none except stone wall at toe of earthen embankment
Vertical Alignment	relatively flat some irregularities
Horizontal Alignment	straight except on left side where it dog legs toward Pond
Condition at Abutment and at Concrete Structures	left: trees, sand bags and masonry wall for R.R.; right sand berm and bags, trees and relatively flat
Indications of Movement of Structural Items on Slopes - none	at structures; concrete apron heavily eroded, dry-stone masonry section, stones dislodged, cavities, undermined areas, vines with steep to vertical slopes.
Trespassing on Slopes	entirely on crest
Sloughing or Erosion of Slopes or Abutments	heavy erosion on right embankment same on left embankment
Rock Slope Protection - Riprap Failures	none visible
Unusual Movement or Cracking at or near Toes	none visible
Unusual Embankment or Downstream Seepage	3 separate locations at the toe of the right embankment; none on the left embankment
Piping or Boils	water clear at the seepage zones some sand noted
Foundation Drainage Features	none visible
Toe Drains	none visible
Instrumentation System	none visible

## PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
PROJECT FEATURE Dam (continued) NAME J. Risitano  
DISCIPLINE Geotechnical NAME \_\_\_\_\_

## Additional Notes:

1. Dry-stone masonry section west of auxiliary outlet structure: recent repair precast concrete stoplogs used to fill a gap, sand bags on top of concrete apron, a 3 foot diameter granite grinding wheel where this section abuts the earthen embankment, evidence of recently applied mortar, cavity 1 1/2 feet deep in face of masonry section and leakage thru this section about 1 foot below pond surface. Foundation piers of old mill structure downstream of this section.
2. Westerly earthen embankment: vertical stone wall at toe, several stone dislodged appears dry, sand bag piled 3 high at crest, sand bags terminate into a sand berm at the abutment and trees on crest and downstream slopes.
3. Easterly spillway abutment: dry-stone masonry section filled with soil, water flowing over flushed out sand bags, heavy erosion at spillway and primary outlet structure, heavy leakage adjacent side wall of structure, downstream face a vertical stone wall with evidence of some recently placed mortar (patches), large trees where abutment meets spillway, 3 vertical reinforcing bars

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Dam (continued) NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

Additional Notes continued:

3. (cont.) are located at the top of the stone wall indicating that it may have carried a concrete apron on top of this section and water was observed exiting the bottom of the downstream stone face of this abutment.
4. Easterly earthen embankment: sand bags blocking heavily eroded area adjacent primary outlet structure, debris and downed trees at upstream face, no slope protection, trees on crest and downstream slope, a hole about 4 inches in diameter and 2 feet deep was observed half way up the downstream slope, <sup>20 ft. east of primary outlet structure</sup> a dry-stone masonry wall about 2 feet high is located at the toe of the downstream slope and abutting the masonry wall of the railroad embankment.

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam  
 PROJECT FEATURE Spillway  
 DISCIPLINE Geotechnical

DATE December 14, 1978  
 NAME J. Risitano  
 NAME \_\_\_\_\_

AREA EVALUATED	CONDITION	
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>		
a. Approach Channel	<i>Submerged concrete capped no obstacles; concrete eroded</i>	
General Condition		
Loose Rock Overhanging Channel		<i>none</i>
Trees Overhanging Channel		<i>2 clusters of trees one on each abutment</i>
Floor of Approach Channel		<i>steep</i>
b. Weir and Training Walls	<i>right training wall consisted of concrete apron; none on left</i>	
General Condition of Concrete		<i>cracked spalled and partially eroded</i>
Rust or Staining		<i>both</i>
Spalling		<i>same</i>
Any Visible Reinforcing		<i>none visible</i>
Any Seepage or Efflorescence		<i>none visible</i>
Drain Holes		<i>none</i>
c. Discharge Channel	<i>two; stone island in center</i>	
General Condition		<i>fair</i>
Loose Rock Overhanging Channel		<i>small and large overhanging both channels</i>
Trees Overhanging Channel		<i>same as above</i>
Floor of Channel		<i>stone lined</i>
Other Obstructions		<i>left channel debris, vines and downed trees</i>

*Note: downstream face of wier dry-stone masonry*

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Primary Outlet Structure NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	<i>concrete wing walls line the intake channel</i>
a. Approach Channel	
Slope Conditions	<i>submerged</i>
Bottom Conditions	<i>same as above</i>
Rock Slides or Falls	<i>none</i>
Log Boom	<i>none</i>
Debris	<i>very little at water surface</i>
Condition of Concrete Lining	<i>deteriorated, cracked and spalled at water level</i>
Drains or Weep Holes	<i>none</i>
b. Intake Structure	<i>none</i>
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Auxiliary Outlet Structure NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	Submerged but appears clear
Slope Conditions	Submerged
Bottom Conditions	Submerged
Rock Slides or Falls	none visible
Log Boom	none
Debris	none
Condition of Concrete Lining	concrete capped vertical dry-stone masonry wall
Drains or Weep Holes	none
b. Intake Structure	
Condition of Concrete	poor: deterioration <sup>and spalling</sup> cracking
Stop Logs and Slots	vertical slot deteriorated

Note: wooden platform above and at upstream end of structure

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Primary Outlet Structure NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	<i>two concrete side walls</i>
General Condition of Concrete	<i>Poor to very poor spalled and erode inside and out</i>
Rust or Staining on Concrete	<i>both</i>
Spalling	<i>considerable</i>
Erosion or Cavitation	<i>heavy downstream of stop logs</i>
Cracking	<i>one vertical and transverse crack on right side wall</i>
Alignment of Monoliths	<i>not apparent</i>
Alignment of Joints	<i>not apparent</i>
Numbering of Monoliths	<i>not apparent</i>

- Note 1. existing stop log vertical guides recently reinforced with a framework consisting of vertical members and two sets of compression struts (one set under water)*
- 2. anchor bolts present at top of walls indicating gate houses were present at one time*
  - 3. Heavy erosion and deterioration of foundation of left side wall foundation downstream end.*

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Auxiliary Outlet Structure NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General Condition of Concrete	<i>very poor</i>
Rust or Staining on Concrete	<i>both on d/s face and side walls</i>
Spalling	<i>heavy at bottom of d/s face</i>
Erosion or Cavitation	<i>some deterioration</i>
Cracking	<i>horizontal on downstream face and side walls</i>
Alignment of Monoliths	<i>good; some efflorescence</i>
Alignment of Joints	<i>good</i>
Numbering of Monoliths	<i>at least four</i>

- Notes:
1. Outlet - 54 inch diameter pipe
  2. no valve or valve mechanism present
  3. Outlet pipe boarded up with planks covered with a sheet of rubber. some leakage thru outlet pipe
  4. Exposed rock, cobbles and boulders embedded in concrete side walls
  5. Water leaking through the dry-stone masonry section of the dam where it meets the bottom, right, upstream portion of the sidewall of the structure

PERIODIC INSPECTION CHECK LIST

PROJECT Forge Pond Dam

DATE December 14, 1978

PROJECT FEATURE Primary Outlet Structure

NAME J. Risitano

DISCIPLINE Geotechnical

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	} <i>Note: same as Transition and outlet conduit</i>
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel <u>flow split between two channels (see notes)</u>	
Loose Rock or Trees Overhanging Channel	<i>both channels and downed trees on spillway channel</i>
Condition of Discharge Channel	<i>primary outlet structure channel good; spillway channel poor</i>

*Notes: flow is divided between the spillway channel and the primary outlet structure discharge channel which angles off to the left forming a separate channel. This channel is about 50 feet east of the Forge Road Bridge. This channel rejoins the river about 100 yards downstream of Forge Road. Both channels are stone lined.*

PERIODIC INSPECTION CHECK LIST

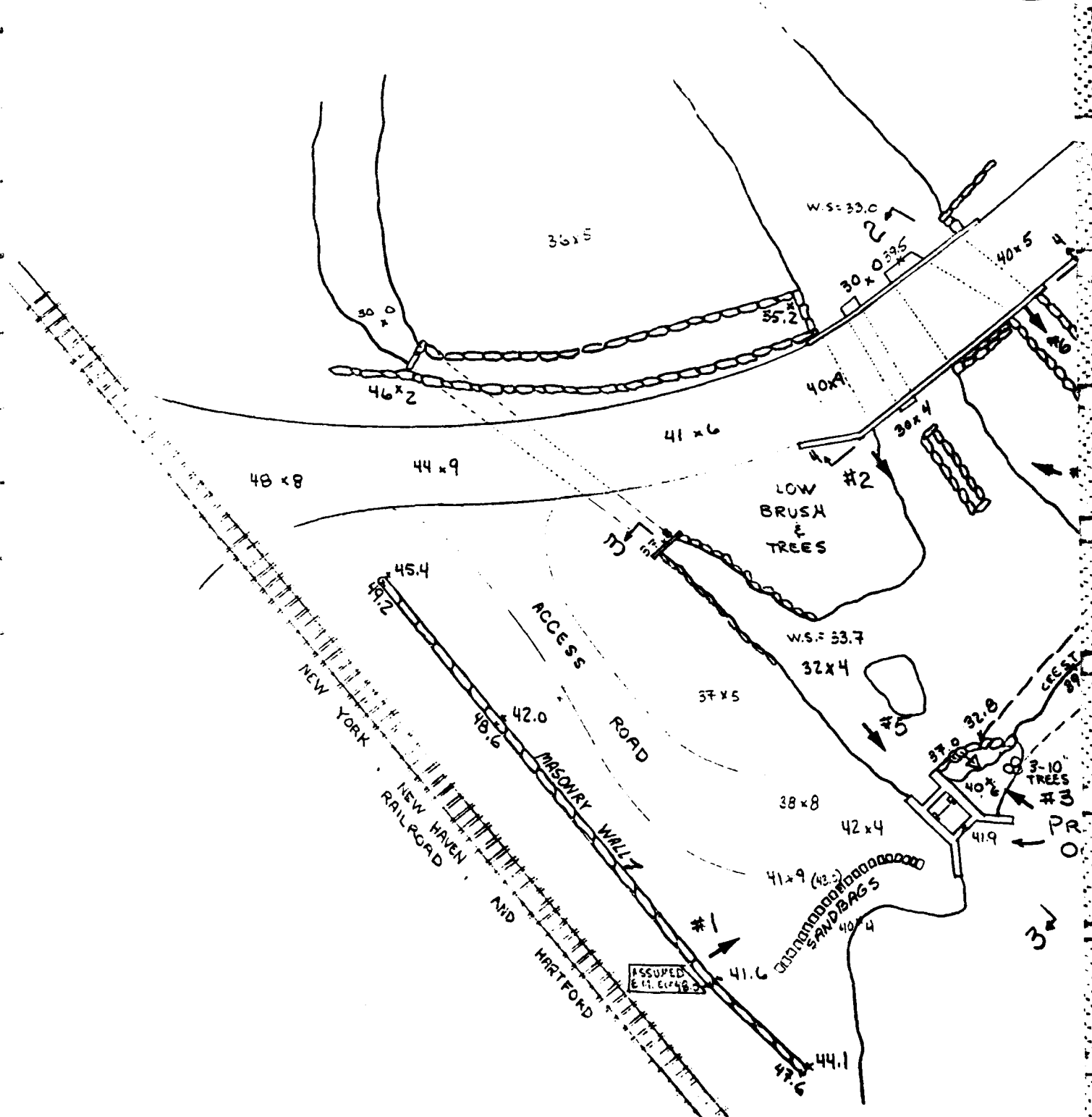
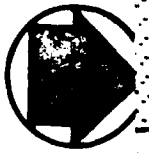
PROJECT Forge Pond Dam DATE December 14, 1978  
 PROJECT FEATURE Auxiliary Outlet Structure NAME J. Risitano  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	} Note: same as Transition and outlet conduit
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	8' wide mill raceway stone lined
Loose Rock or Trees Overhanging Channel	both plus a downed sapling and some debris
Condition of Discharge Channel	fair

APPENDIX B  
PLANS OF DAM AND PREVIOUS  
INSPECTION REPORTS

	<u>Page</u>
Figure B-1, Plan of Dam	B-1
Figure B-2, Sections through Dam	B-2
Previous Inspections (1959-1978)	B-3
Letter from Freetown Board of Selectmen Requesting Inspection by Massachusetts Department of Public Works	B-10
Massachusetts Division of Waterways Order for Alterations and Repairs	B-11

FORGE POND DAM

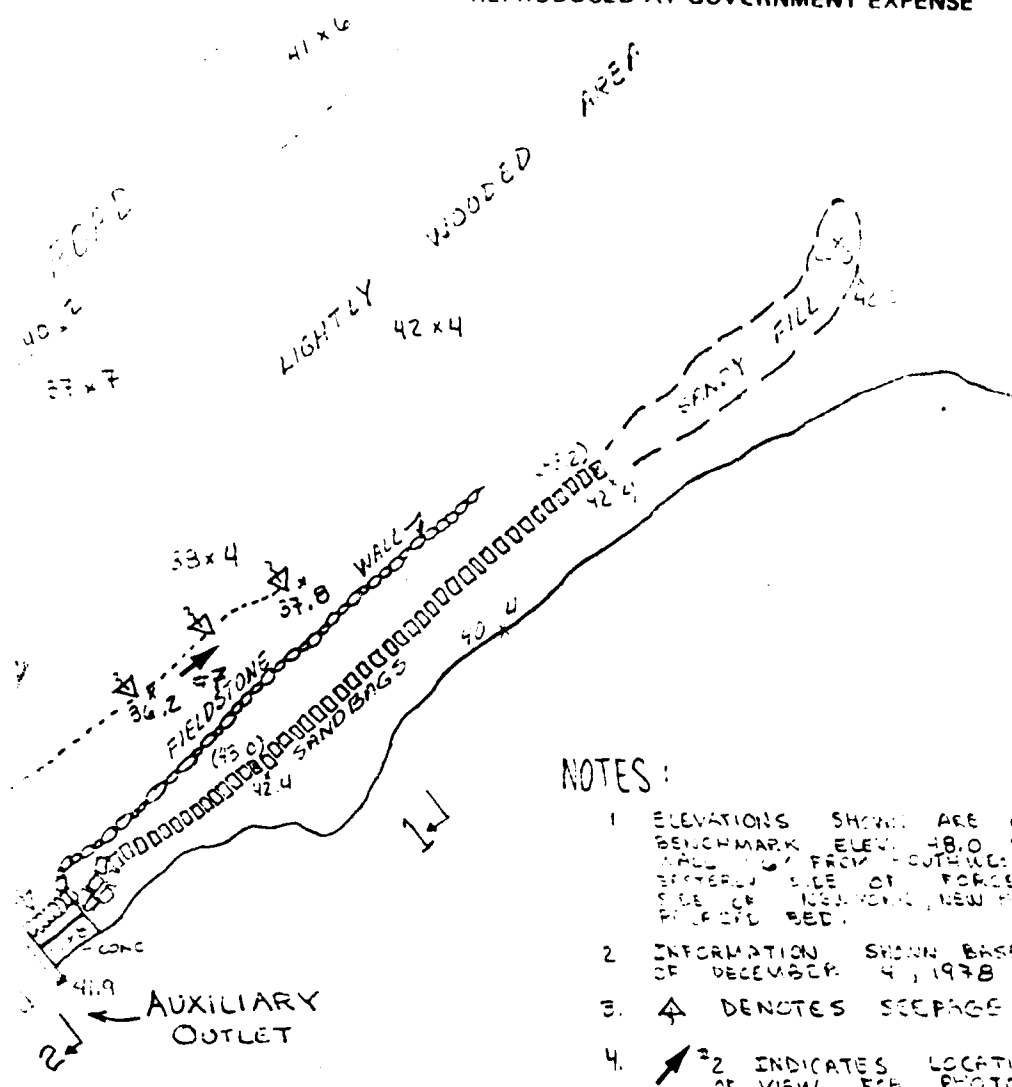


METCALF & EDDY, INC.

①



43 x 9



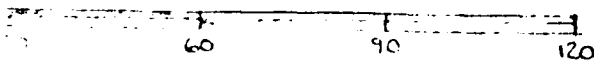
NOTES:

1. ELEVATIONS SHOWN ARE REFERENCED TO ADJACENT BENCHMARK ELEV. 48.0 (MSL) TOP OF MASONRY WALL 6' FROM SOUTHWESTERN END OF WALL, EASTERN SIDE OF FORGE ROAD, NORTHEASTLY SEE OF NEW YORK, NEW HAVEN, AND HARTFORD RAILROAD BED.
2. INFORMATION SHOWN BASED ON FIELD SURVEY OF DECEMBER 4, 1938
3.  $\nabla$  DENOTES SEEPAGE
4.  $\nearrow$  2 INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS
5. SEE FIGURE B-2 FOR SECTIONS THROUGH DAM
6. (43.0) INDICATES TOP OF SANDBAG ELEV.

FORGE POND

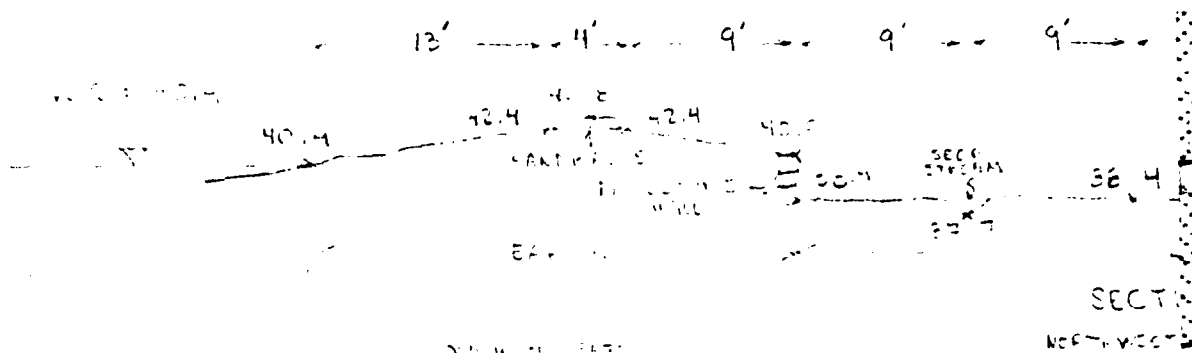
FER SURFACE ELEV. = 40.4

SCALE IN FEET

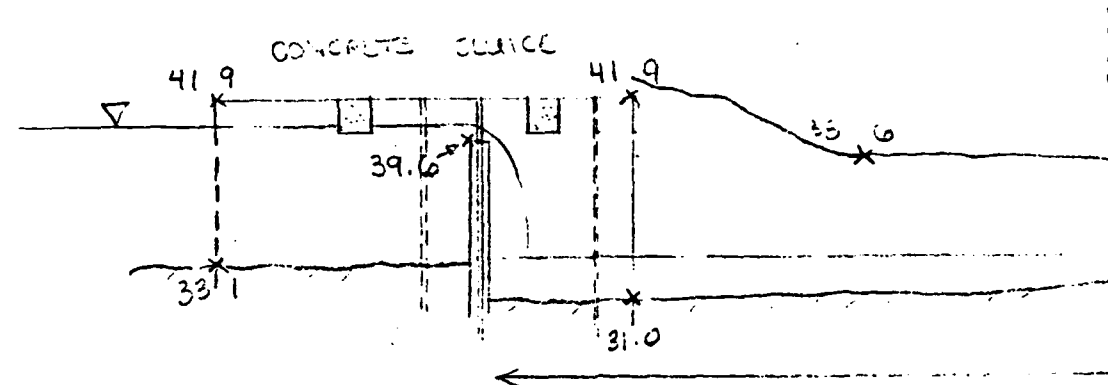
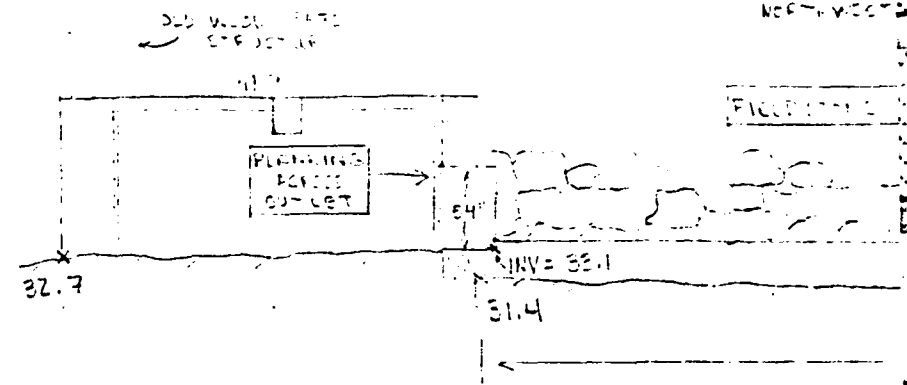


3

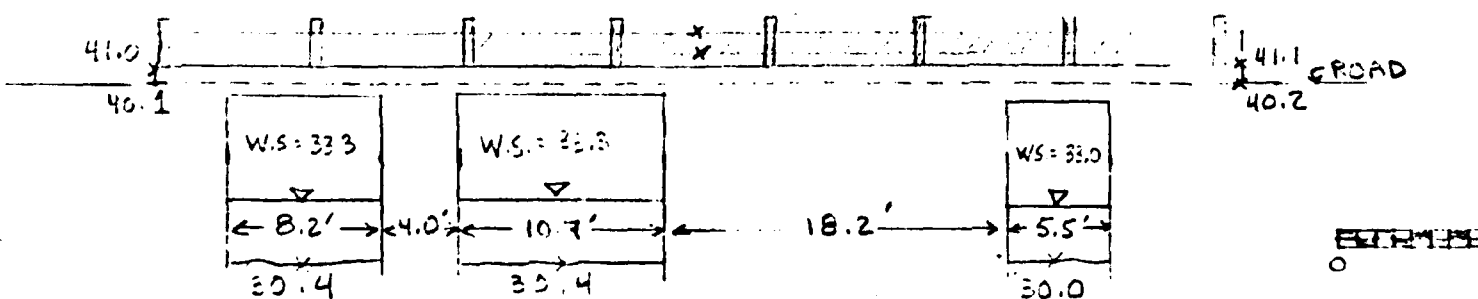
MEICALL & EDDY, INC. 2011 1/2 ST. BRIDGE, MA	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS BOSTON, RI
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
FORGE POND DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY ASSONET RIVER	MASSACHUSETTS
SCALE: 1" = 30'	DATE: MARCH, 1970



W.C. = 43.0



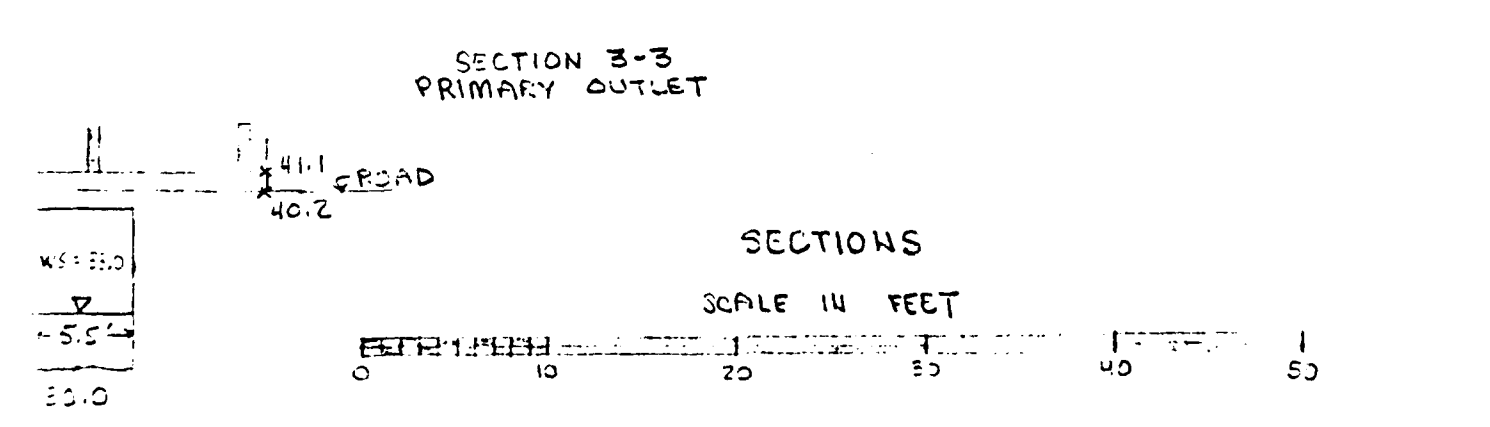
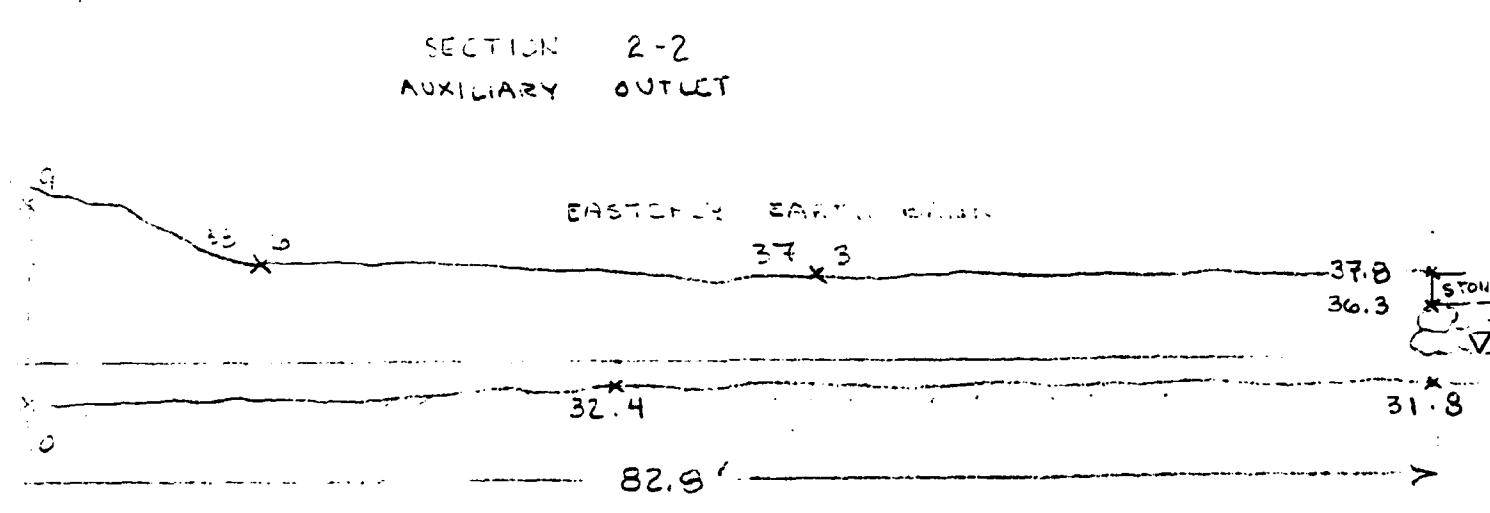
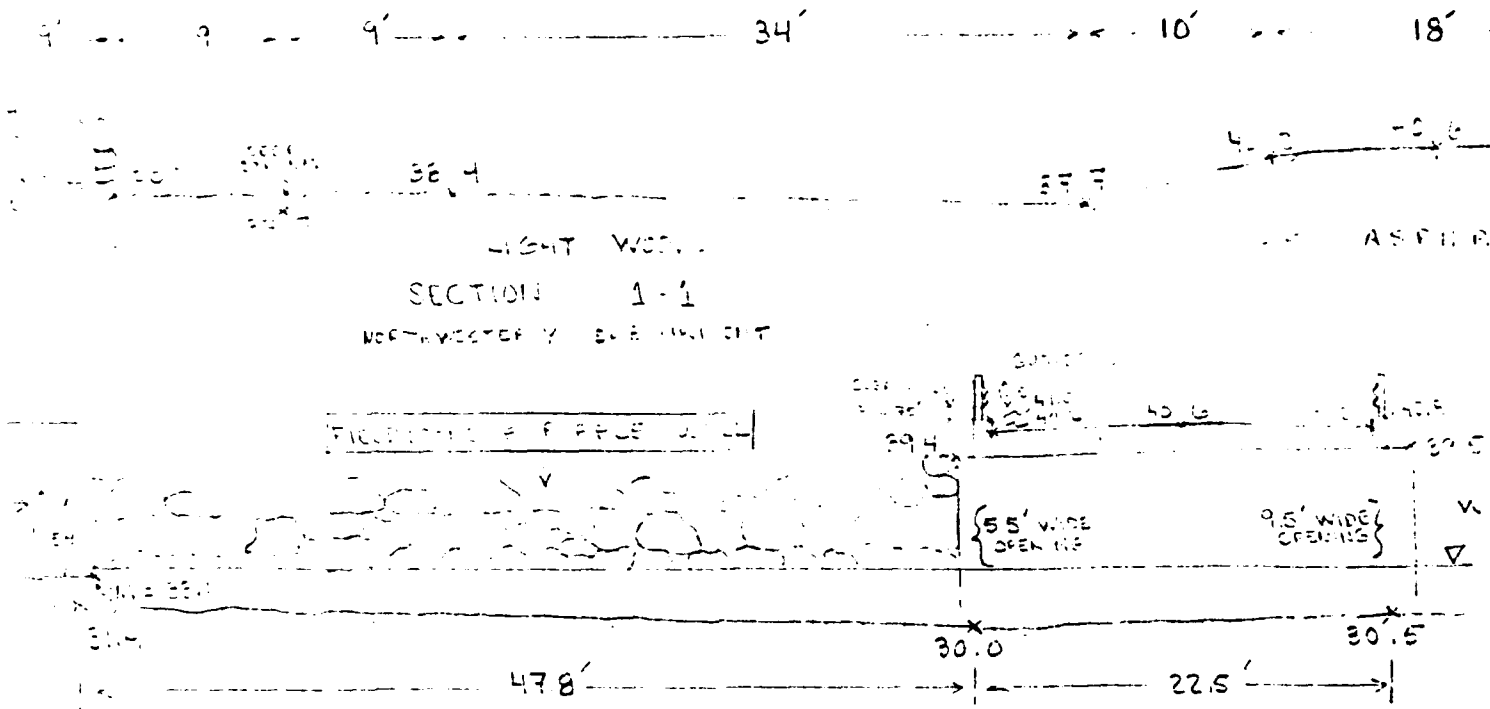
TOP GUARDRAIL = 43.0  
BOT. GUARDRAIL = 41.8



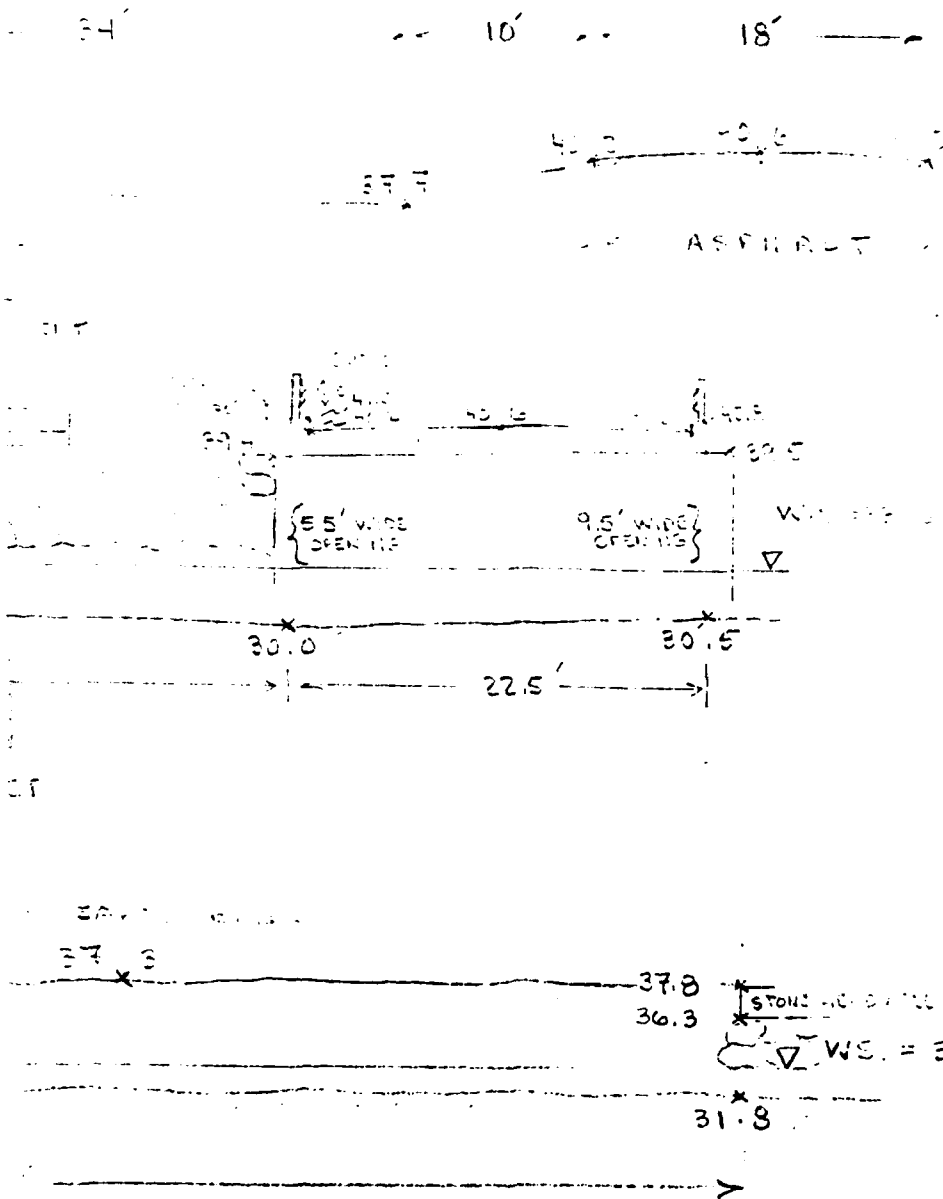
TRILF & EDDY, INC.

SECTION 4-4  
ROADWAY ELEVATION  
(UPSTREAM)

①

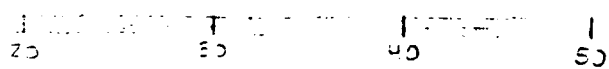


(2)



SECTIONS

SCALE IN FEET



METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS BALTIMORE, MD.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
FORGE POND DAM	
FIGURE B-2 SECTIONS THROUGH DAM	
TRIBUTARY ASSONET RIVER	MASSACHUSETTS
SCALE: 1" = 10'	DATE: MARCH, 1979

(3)

# BRISTOL COUNTY, MASS. DATA SHEET & INSPECTION FORM FOR DAMS

Town <u>Freetown</u>	Date of Inspection <u>1/16/59</u>
Dam No. <u>4</u>	Inspected By <u>JM</u>
Stream <u>Assonet River</u>	Organization <u>Hayden, Harding &amp; Richman, Inc.</u>
Location: USGS Quad <u>Assonet</u> Lat <u>41° 40' -10"</u> Long <u>71° 03' -15"</u>	
Reference: <u>Forge and Mill Street</u>	
Owner of Dam <u>Monument Mfg. Co.</u>	Function of Dam <u>Storage</u>

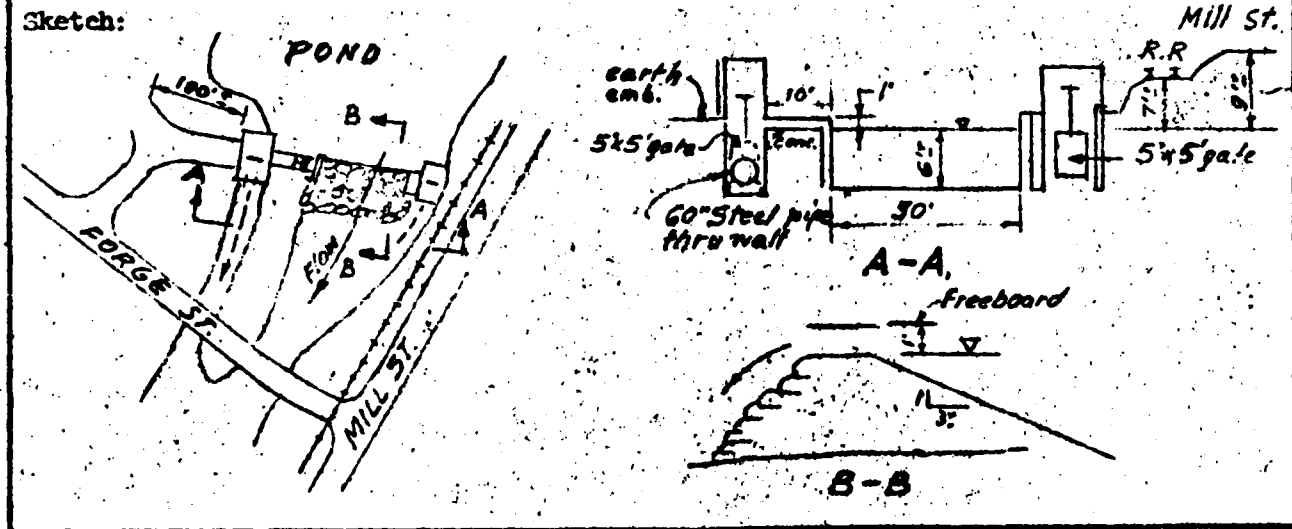
Drainage Area 21.8 sq. miles Character of D.A. \_\_\_\_\_

Flood of Record (date) \_\_\_\_\_ Discharge (or high water elevation) \_\_\_\_\_  
 Minor Flood = 850 cfs; Major Flood = 1480 cfs; Base = 2530 cfs; Maximum = 11,000 cfs

General Description of Dam and Discharge Control: Earth embankment, field stone spillway, 2-3' x 5' gates in gate houses

neglect spillway - no freeboard low tail water.

Estimated Discharge Capacity: use 4' head, Q = 550 cfs (2 gates) (approx.)



Remarks and Recommendations: <b>Never any flooding per Mr. Copeland, Mgr. Monument Mfg.</b> Determine design flood If required, increase discharge provisions	General Condition Good Fair x Poor
B-3	FORGE POND DAM
	<b>Priority 2</b>

# BRISTOL COUNTY, MASS. INSPECTION REPORT & DATA FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS  
BY HAYDEN, HARDING & BUCHANAN, INC., BOSTON, MASS.

Owner: Mr. Rudnick Monument Mfg. Co.

His Address: \_\_\_\_\_

Function of Dam: Storage

Location & Access: Forge and Mill streets

USGS Quad: Assonet lat. 41° 43' (long) 71° 03' 15"

Drainage Area: 21.8 sq. mi.; Ponds: \_\_\_\_\_ ac.; Res. @ dam: \_\_\_\_\_ ac.

Character of B.A.: \_\_\_\_\_

Estimated Spillway neglected since there is no free Discharge Board.

Capacity: Using 4' head C = 550± cfs (2 gates)

General Description of Dam and Discharge Control: Earth embankments, field stone spillway, 2 - 5' x 5' gates in gate houses.

Dam No. Fr - 4

Town: Freetown

Stream: Assonet

Pond: \_\_\_\_\_

Date: May 12, 1965

By: WHO & JUV

CONDITION RATING

Structural: Fair

Hydraulic: Fair

General: Fair

PRIORITY: Important 1

KINNISON-COLEY FLOODS

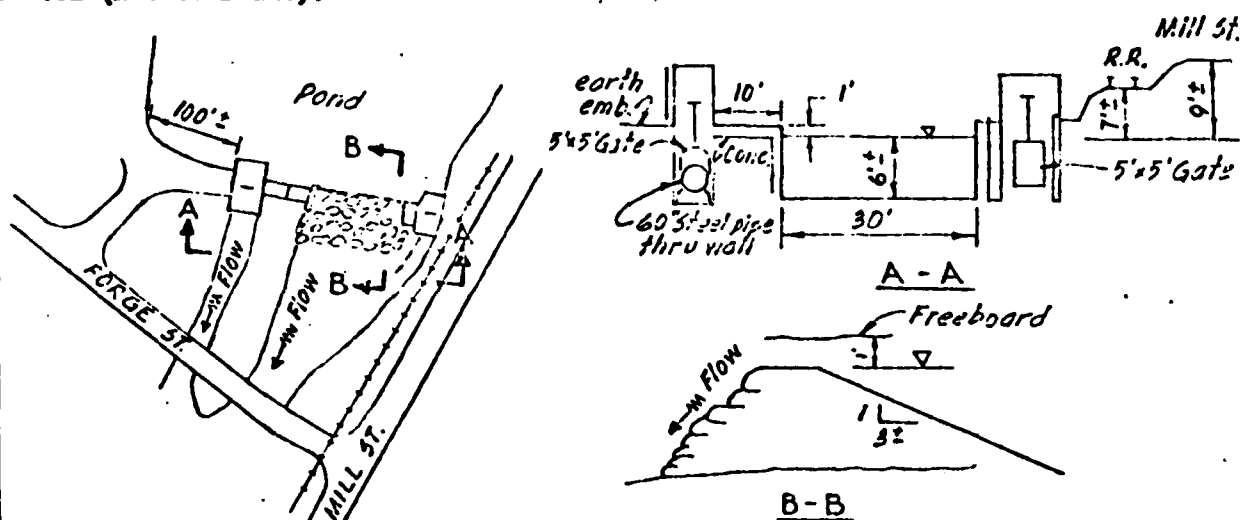
Minor: 850 cfs

Major: 1460 cfs

Rare: 2530 cfs

Maximum: 11,000 cfs

Sketch (Not to Scale):



Remarks and Recommendations: Never any flooding per Mr. Copeland, Manager Monument Mfg. Determine design flood, appears to require increased discharge provisions. Requires additional freeboard

\*Change Priority to 1 4-1-68

Re-inspection	Date	By	Comment
	6/21/67	WEL	See correspondence-Caused trouble in May storm
	3-20-68	WEL	Did top even with most logs out.
	6-23-72	AHL	BOTH SLUICWAYS FLANKED
	1-14-74	AHL	E'LY SLUICWAY FLANKED
	1-7-78	AHL	OVER TOPPED

Dam No. Fr - 4

**BRISTOL COUNTY, MASS.  
INSPECTION REPORT FOR DAMS**

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS  
BY UNIVERSAL ENGINEERING CORP., BOSTON, MASS.

DAM NO. Fr. - 4  
TOWN: Freetown

INSPECTION DATE	REMARKS & RECOMMENDATIONS
7-14-70	<p><u>Sluices</u> - The stop logs are in place. At present there is a very low flow over and between the stop logs and no available freeboard. The gates are inoperable, there is considerable spalling and erosion of the concrete sluice walls and serious leakage through the walls. The timber stop log guides have been badly damaged by fire. There is considerable evidence of flanking of the northerly abutment of the northerly sluice and both sides of the southerly sluice.</p> <p><u>Spillway</u> - There is a moderate flow over the crest and the pond is at nearly full capacity. An increase in pond level of approximately 6" would flank both sluices and overtop the dike. There is considerable leakage through the masonry face of the spillway. Flooding could easily cause enough erosion adjacent to the sluices to completely breach the spillway. There is moderate flow in the channel downstream of the spillway. The culverts under Forge Road, approximately 100 feet downstream of the spillway, appear to be inadequate and conceivably will back up during heavy flows.</p> <p><u>Recommendations</u> - The structural and hydraulic conditions are critical. Recommend the complete reconstruction of this dam and examination of the culverts in conjunction with recommendations for Dam No.'s Fr. 1, 2, 3, and 5. See reports for these dams and letter to County Commissioners dated August 13, 1970.</p>

Supplement to original report and data by Hayden, Herding & Buchanan, Inc.

DAM NO. Fr. 4

Jack Deuce Fri 2:30 P.M 6-23-72

Freetown Dam No 6-3-102-4

Mr Fournier is owner.

Al. Loundsbury from Dist 6 called regarding above numbered dam in Freetown.

The dam has been flanked and water passing around structure. Emergency condition may develop if additional rainfall occurs.

Town has notified him, he has attempted to notify owner (Fournier) but has not been successful.

Town will watch condition; if it worsens they will notify him who in turn will alert you.

J. J. H.

Called Al 1:30 pm Mon 6/26/72

To tell him that Mr. Fournier's Tel. No. is 995-6493 @ home

(NEW BEDFORD)

999-6147

995-9289

644-5765

} Business

Al not in office - Left message for him to return the call.

② Shephard Pond - Canton??

John D. -- Over

June 23, 1972: 1:10 p.m. - Rec'd call from J. Simmons - Hwy Surv. - Frankton  
 Forge Pond Dam - water cutting thru dam.  
 1:30 p.m. Met J.S. at site - northerly sluiceway flanked - 2' dmt.  
 Danger of dam overtopping - S'ly sluiceway flanked.  
 water at n'ly sluic going thru earth embankment - heavy  
 strss - Joe S. will check; advise if condition worsens -  
 forecast of heavy rain

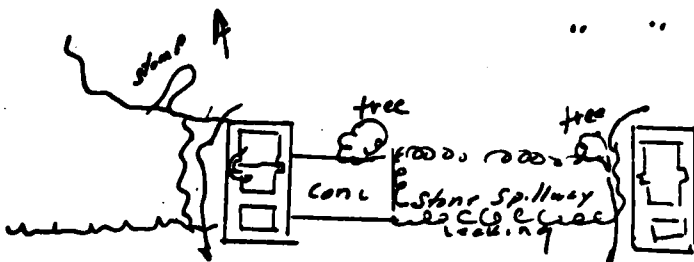
2:15 p.m. - Call alleged owner - Fournier - 985-6493 - Not in -  
 told Mrs. F. he should check dam; make emergency  
 repairs as soon as possible.

2:25 p.m. - Called Town - check & advise.

2:27 p.m. - Called Wkt. - Jack Hannan - Arrived

2:55 p.m. - Advised N. Diogoli, Jim MacDonald, Wilt Kelley

3:55 p.m. at Site - Nothing done - Downstream dams cresting  
 high. At n'ly sluiceway: From top wall to water 8'  
 " " " to 2nd concrete spillway 5"  
 " " " to Stalogs 19"



4:05 Back at office

4:55 p.m. Started AM Corr.

June 27, 1972 - 9:00 a.m. Call from John Piasczyk - Owner Fournier was in on June 25, 1972  
 outlined steps to repair. Nos: 990-6147, 995-9289, 600-5765

9:35 a.m. at Dam - water level down (did not get forecasted rain) No  
 further Erosion

water Level

Proble

DATE	Water level w/ly Sluiceway to water	
June 22, 1972	8"	
June 27, 1972	14"	
June 30, 1972	16"	
July 6, 1972	17"	
July 11, 1972	19"	No Flow over spillway
July 13, 1972	19"	" " " "
July 19, 1972	21"	" " " "
July 25, 1972	19"	Trickle
Aug. 7, 1972	20"	No flow over spillway
Aug 14, 1972	21"	" " " "
Aug 17, 1972	20"	" " " "

June 30, 1972 1:30 at Dam No Further erosion

July 6, 1972 - 10:30 am same as 6/30/72

July 11, 1972 - 10:30 am. at Dam - No flow thru eroded area  
" " " " over spillway

water coming thru star sp.

July 18, 1972 11:25 am - Switchboard rec'd call from Andre J. Fournier  
tell him Day: 999-6147 - After L - 999-9287

AHL out

July 20, 1972 called 999-6147 - Mr. F out in left word Arthur  
told me

July 25, 1972 2:14 at Site - Trickle over approx 30' spillway  
extensive leaking still, sily end masonry spillway

Aug. 7, 1972 - Still leaking spillway  
- gully stone - flashboards leaking badly - light flow -  
w/ly sluice - w.l. to top fib. 4 1/2"

Aug 10, 1972 - same cond.

1972 - Trickle at washed area - leaking more - Spillway

(OVER)

Jan 10, 1974 - Rain - water flanking - west side S'ly sluice  
w.l. at 'stump' area of previous erosion; flanking  
abt 2' from top S'ly embankment slope.  
Repairs to eroded area - conc posts etc.

Aug 8, 1978 - Advised in field by PH CARR DAM OVERTOPPED  
Yesterday. - Visited site 4 PM water contained by  
sand bags - fireman at site said <sup>embankment</sup> dam breached -  
w.l. over top of conc walls of N'ly sluice - water  
appears to have flanked westerly end of embankment

Aug 10, 1978 Call from Joe Tagallo - Div. WW.

Meeting at site 8/14/78 1:30 PM w/ Rep Pack.

Note area posted - Name appears to be

Jackson - Assnat

9/1/78 10:5 PM at site.

Noted flow at Base of stone wall 70'± west of w'ly sluice  
(Clear water.)

Moderate flow over spillway

1' FB at sluice, 3' FB at embankment

2" flow under boards w'ly sluice - Looks in Boards  
boards appear to be vertically fixed.

Boulders (fallen) in bed of w'ly outfall

9/5/78 Advised Mike Pucillo.

815876

6-3-102-4



# TOWN OF FREETOWN

OFFICE OF THE

## BOARD OF SELECTMEN

TOWN HALL 3 NORTH MAIN STREET  
ASSONET, MASSACHUSETTS 02702

August 9, 1978

DEPARTMENT OF  
ENVIRONMENTAL QUALITY ENGINEERING  
DIVISION OF WATERWAYS

Department of Public Works  
Office of the Commissioner  
100 Nashua Street  
Boston, MA 02114

RECEIVED AUG 14 1978

*J. Iaigo/lo*

Referred To \_\_\_\_\_  
Report back to \_\_\_\_\_  
File \_\_\_\_\_

OFFICE OF THE  
COMMISSIONER

78 AUG 10 AM 11 46

RECEIVED  
COM. OF MASS. D.P.W.

Dear Sir:

In accordance with Chapter 253, Section 45 (as amended, 1970), the Freetown Board of Selectmen hereby requests that the Commissioner of Public Works causes an examination to be made of the Forge Pond Dam, off Forge Road in Assonet as soon as practicable. This request is being made because of the apparently weakened condition of this dam which occurred on August 6th and 7th. According to the records of the Freetown Assessors office the owner of this dam is Fournier-Jade Realty Trust, A. J. Fournier, Trustee, 17 Mill Road, New Bedford, MA.

Your immediate attention to this urgent matter is appreciated.

FREETOWN BOARD OF SELECTMEN

*Marianno Rezendes, Jr.*

Marianno Rezendes, Jr., Chairman

*Frederick C. Bohler*

Frederick C. Bohler

*Robert S. Dorsey*

Robert S. Dorsey

RSD/lab

August 23, 1978

Fournier-Jade Realty Trust  
A.J. Fournier, Trustee  
17 Mill Road  
New Bedford, MA 02745

Dear Sir:

An on-site inspection of Forge Pond Dam was made in the Town of Freetown on August 14, 1978 by the Division of Waterways.

The inspection revealed that the dam was in a precarious state of disrepair. The records kept by the Massachusetts Department of Public Works indicated a need for repairs as far back as 1972. It was quite obvious that no repairs of the structure had been made. The only attempt to reinforce the structure was the placement of sand bags to avert a washout of the structure during the recent heavy rainfall in the southeast part of the state.

This letter is to advise you that you must avail yourself of the services of a Professional Engineer to make a study of the status of the dam and what can be done to repair the dam. This has to be done as soon as possible.

One of the immediate steps that has to be taken is the removal of the asphalt paper that blocks one of the sluiceways in the structure.

This office expects a response to this letter indicating what action will be taken by your company, not later than September 2, 1978. If you have any questions regarding this situation, please call 727-4799 and ask for Mr. Joseph C. Iagallo.

Very truly yours,

  
John J. Hannon, P.E.  
Chief Engineer

JCI:fns

cc: Board of Selectmen, Freetown  
Senator Mary L. Fonseca  
Representative Raymond S. Peck

APPENDIX C  
PHOTOGRAPHS

FORGE POND DAM



**NO. 1 VIEW OF DAM CREST AND EAST ABUTMENT**



**NO. 2 VIEW OF SPILLWAY FROM FORGE ROAD BRIDGE**

FORGE POND DAM



**NO. 3 EROSION OF SOIL AND DETERIORATION OF CONCRETE TRAINING WALL BETWEEN PRIMARY OUTLET STRUCTURE AND SPILLWAY**



**NO. 4 VIEW OF UNDERMINER TRAINING WALL AND CONCRETE APRON ON RIGHT SIDE OF AUXILIARY OUTLET STRUCTURE**

FORGE POND DAM



**NO. 5 PRIMARY OUTLET STRUCTURE**



**NO. 6 VIEW OF AUXILIARY OUTLET STRUCTURE  
FROM FORGE ROAD BRIDGE**

FORGE POND DAM



**NO. 7 SEEPAGE AT TOE OF WEST EARTHEN EMBANKMENT**



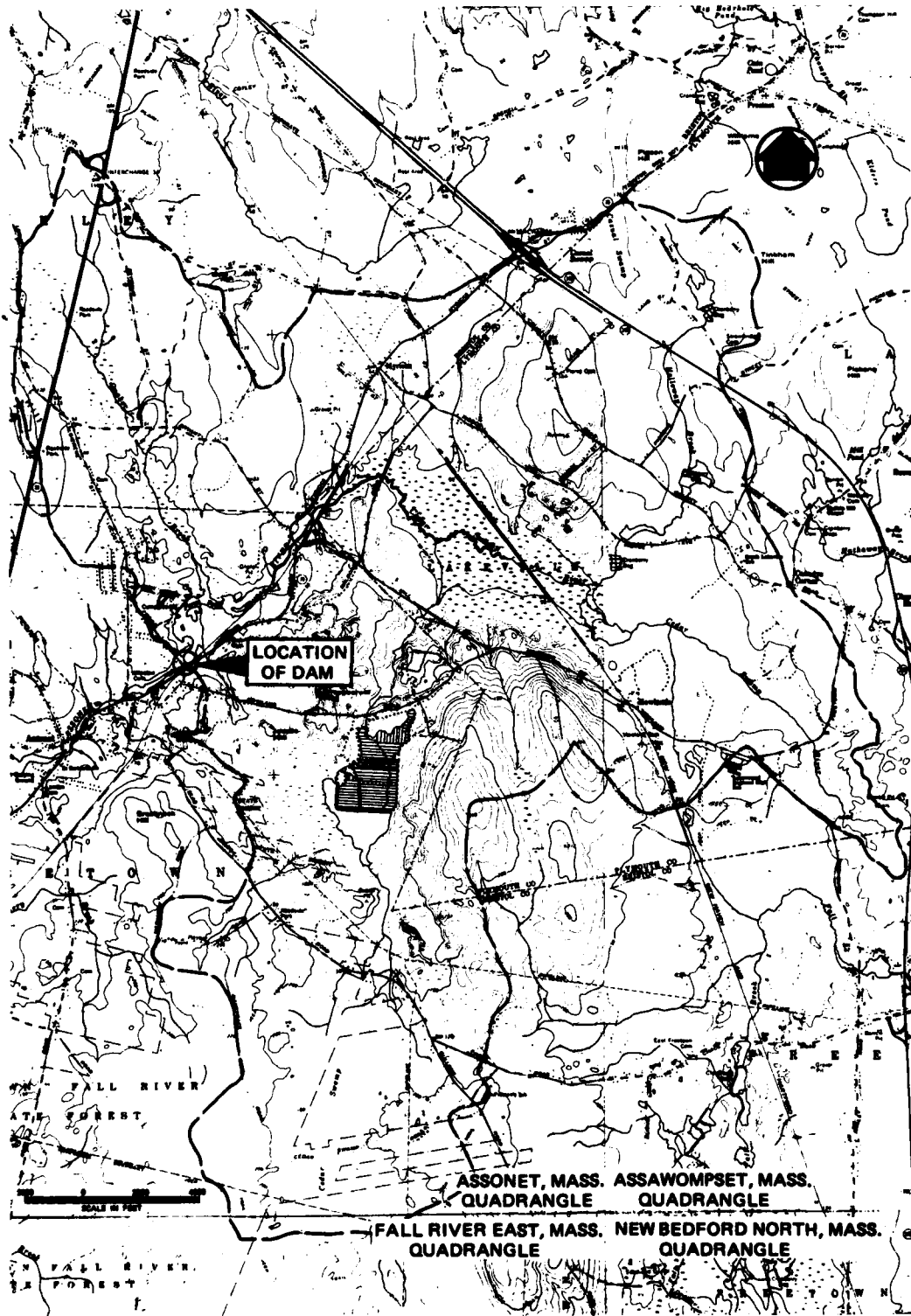
**NO. 8 VIEW OF FORGE ROAD BRIDGE DOWNSTREAM OF DAM**

FORGE POND DAM

APPENDIX D  
HYDROLOGIC AND HYDRAULIC  
COMPUTATIONS

	<u>Page</u>
Figure D-1, Drainage Area Map-Forge Pond Dam	D-1
Hydrologic and Hydraulic Computations	D-2
Special Regional Precipitation Data	D-10

FORGE POND DAM



**FIG. D-1 DRAINAGE AREA MAP - FORGE POND DAM**

**I** Test Flood, Storage & Storage Functions

1- Total Drainage Area - 20.6 mi<sup>2</sup>

2- Pond(s) Area: 0.102  
 Swamp(s) Area: 3.930  
Total Area Ponds & Swamps: 4.032

% Ponds & Swamps =  $\frac{4.032}{20.6} = 19.6\%$

3-  $\frac{125-45}{15200} = .526\%$ ;  $\frac{120-45}{28800} = .260\%$  } Say Ave Slope = 0.5%  
 $\frac{250-45}{32900} = .623\%$

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be slightly below "Flat & Coastal" and taken at 500 c.f.s./mi<sup>2</sup>  
 Size Class: Small ; Hazard Pot.: High ; Spill. Des. Flood: 1/2 to Full PMF  
 Use: Test Flood = 1/2 PMF

5- Test Flood Inflow = 1/2 (500) .92(20.6) = 4740 c.f.s.  
 Note: 0.92 is reduction due to size of D.A. > 10 mi<sup>2</sup>

6- Pond Storage  
 The pond area is 0.0745 sq. mi. at elev. 39.6 ±  
 Based on a const. area, storage increases at 47.3 ac. feet per foot of depth increase.

7- Spillway crest elev. is 39.7 & sluice crest elev. is 39.6

8- Storage Functions are based on  $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$   
 S<sub>out</sub> = Storage Vol. in Reservoir related to final Q<sub>out</sub> in terms of inches of rain over the drainage area.

$S(\text{in inches}) = 12 D \left( \frac{0.074}{20.6} \right) = .043 D$  R = 6hr rain of storm.  
 D = Storage depth in feet above spillway crest to reservoir

9- Storage Functions: (Test Flood & 1/2 PMF - if needed)

$F_{TF} = 4740$	$- 542 S =$	$-$	$D$
$F_{1/2 PMF} = F_{TF}$	$-$	$S =$	$D$

see **II**

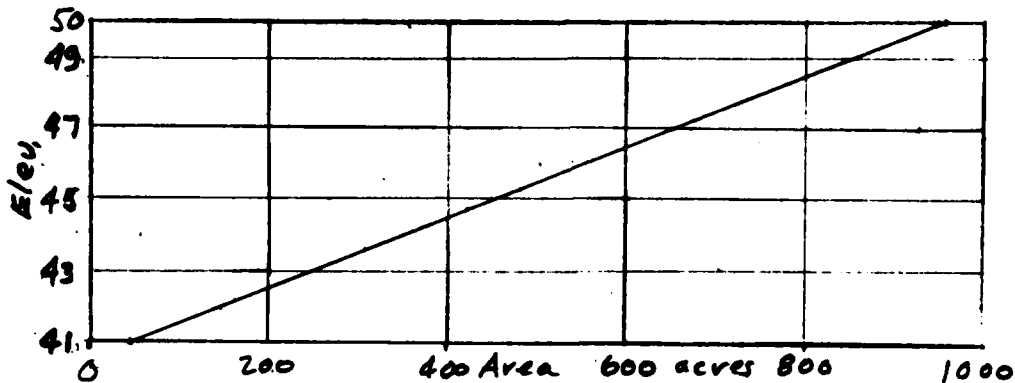
METCALF & EDDY, ENGINEERS

**II Alternative Evaluation of "S" (See Sheet 1)**

Area Storage at Elev. 50 : (M. & E. El.  $\approx$  U.S.G.S. El.)  
 $.074 + .065 + .291 + .048 + .122 + .121 + .075 + .700 = 1.496 \text{ mi}^2 = 957 \text{ ac.}$

Area Storage at Elev. 41 : (Assumed pond el. @ time of U.S.G.S. mapping)  
 $.074 + 0 = 47 \text{ ac.}$

Note: Following uses M. & E. Elev. - assumed 1.4' lower than U.S.G.S. Elev.



$$S (\text{inches}) = \text{Stored Vol. in Res. (ac.ft.)} \left[ \frac{12}{\text{Drain Arm (acres)}} \right]$$

Level	Area	Inch Storage (ac.ft.)	Storage (ac.ft.) "S"	F <sub>FF</sub> (c.f.s)
41	47	97.5	30*	
42	148	198.5	127.5	
43	249	299.5	326	0.30 4579
44	350	400.5	625.5	0.57 4431
45	451	501.5	1026	0.93 4233
46	552	603.0	1927.5	1.39 3986
47	654	704.5	2130.5	1.94 3689
48	755	805.5	2895	2.58 3341
49	856	906.5	3640.5	
50	957		4547	

\* Storage bet. spillway crest at 39.6 ft el. 41 taken as  $\frac{1}{2} (1.4') 47 = 82.9 \sim$  Say 30 ac.ft.

**III** Discharge Ratings

A - Sluice

Crest El. 39.6, Width 4', Use Williams & Hagen, "Hydr Tables",  $\gamma_p = 30$   
 Pg. 76

Pond Elev.	40	41	42	43	44	45	46	47
q	0.87	5.48	12.24	20.63	30.42	41.47	53.51	65.36
Q <sub>A</sub>	3.5	20	50	80	120	170	210	260

Hydr. action similar to orifice - use above values - minor error

B - Spillway

Width - 40'±, Crest El. 39.7±, Use "Hydr. Tables" times a factor of 0.95 due to broken condition of crest.

Pond Elev.	40	41	42	43	44	45	46	47
q	.58	4.91	11.48	19.73	29.37	40.30	52.34	64.13
Q <sub>B</sub>	20	190	440	750	1120	1530	1990	2440

C - Crest Flows

Ref. V.T. Chow, "Open Chan Hydr." pg 52 - use:  $q = 2.55 (H)^{1.5}$   
 Q<sub>1</sub> - misc, lowest non overflow sections - elev 40.8 - EL<sub>2</sub> = 47'  
 Q<sub>2</sub> - Top of 2 sluices - crest elev. 41.9 - EL<sub>2</sub> = 19'  
 Q<sub>3</sub> - Top of sandbags - elev. 42.8± - EL<sub>2</sub> = 165'

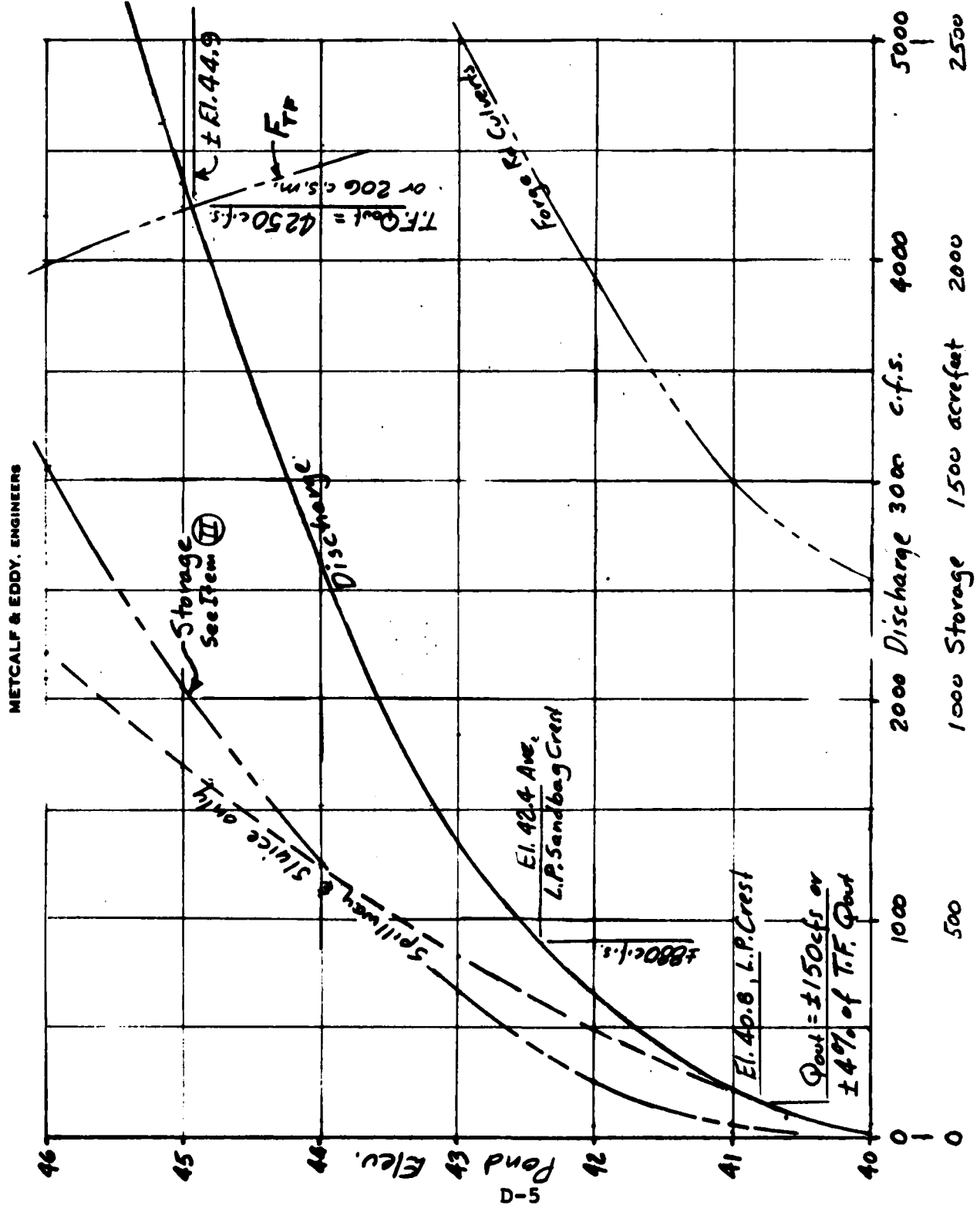
Pond Elev.	41	42	43	44	45	46	47
Q <sub>1</sub>	10	160	390	690	1030	1420	1850
Q <sub>2</sub>	-	0	60	150	260	400	560
Q <sub>3</sub>	-	-	40	550	1370	2400	3620
ΣQ <sub>c</sub>	10	160	490	1390	2660	4220	6030

**IV** Maximum Crest Flow Conditions

Max Hd = 44.9 - 40.8 = 4.1',  $q = 21.2$  cfs/ft.  
 As "Critical" Flow -  $y_c = 2.4$  ft. &  $V_c = 8.8$  fps

METCALF & EDDY, ENGINEERS

Ⓡ Discharge, Storage & Storage Function



METCALF & EDDY, ENGINEERS

D-5

**VI** Forge Road - Hydraulic Capacity

A. Culverts - Assume entrance control - Ref. V.T. Chow, "Op. Chan. Hyd." pg 418

- 1- 5.5' wide x 9.8' hi - inv. elev. 30.0 - most westerly culvert - for  $Q_1$
- 2- 8.4' " x 9.8' " - " " 30.0 "  $Q_2$
- 3- 7.4' " x 9.4' " - " " 30.1 (Say 30.0) "  $Q_3$
- 4- 4.5' " x 4.5' " - " " 31.8 - most easterly culvert "  $Q_4$

For Culverts 1, 2 & 3: (Inv. El. 30.0 ±)

H/d	0.8	0.9	1.0	1.25	1.5	2.0
$Q_1$	360'	440'	490'	660'	800'	940'
$Q_2$	550'	670'	760'	1000'	1220'	1430'
$Q_3$	480'	590'	670'	890'	1080'	1260'
$\Sigma Q$	1390	1700	1920	2550	3100	3630 ✓
Water Elev.	37.6	38.6	39.5	41.9	44.2	49.0 ✓

For Culvert 4: (Inv. El. 31.8)

H/d	0.8	0.9	1.0	1.25	1.5	2.0	3.0
$Q_4$	100'	120'	140'	170'	200'	240'	320'
Water Elev.	35.4	35.9	36.3	37.4	38.6	40.8	45.3 ✓

B - Cross Crown Flow - Use  $q = 2.55 H^{1.5}$  - Ref. V.T. Chow, "Op. Chan. Hyd." pg 52

- $Q_1$  for 100' @ elev 40.6 ±
- $Q_2$  " 95' @ " 41.6 ±
- $Q_3$  " 110' @ " 43 ±

Water Elev	41	42	43	44
$Q_1$	60'	420'	950'	1600'
$Q_2$	-	60'	400'	900'
$Q_3$	-	-	-	280'
$\Sigma Q$	60	480	1350	2780 ✓

Note: Above plotted on **V**

**(VII) Failure of Dam - Case A**

Peak Failure Flow:

Pond Elevation - 40.8 ± Low Pt on crest  
 Toe Elevation - 32.4  
 $Y_0 = 8.4 \text{ ft.}$

Dam Length Subject to Breaching = 80 (bet. conc. spill.)  
 $W_0 = 40\% (80) = 32'$

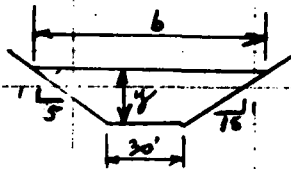
$Q_P = 1.68 W_0 (Y_0)^{1.5} = 1.68 (32) (8.4)^{1.5} = 1300 \text{ cfs}$

With Pond @ El. 40.8,  $Q_{out} = 150 \text{ cfs}$ ; Total disch is 1450 cfs

Storage Volume Released:

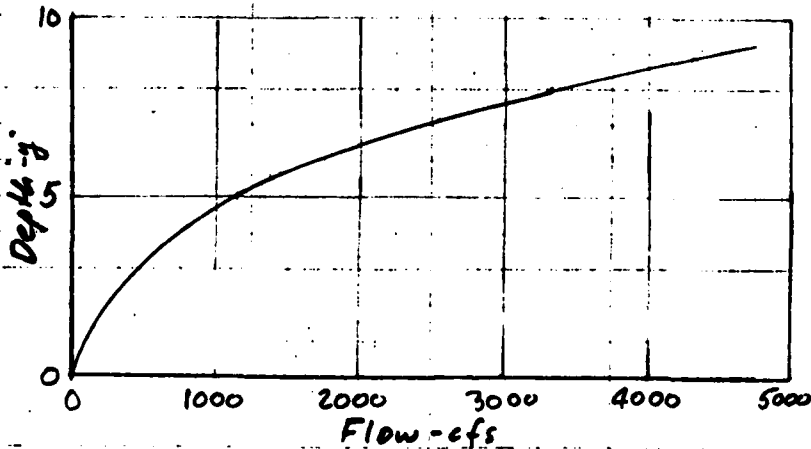
Storage Above Spillway 30 = 30 ac. ft.  
 Storage Below Spillway  $\frac{1}{3} (7.2) 47.3 =$  114 "  
 $S = \text{Total Storage} =$  144 "

Channel Hydraulics:



Est.  $S = \frac{3}{1000} = .003$ ;  $W \propto b$ ,  $b = 30 + 20y$   
 $A = 30y + \frac{1}{2} (20y) y = 30y + 10y^2$ ;  $n = .06$   
 $V = \frac{1.49}{.06} R^{2/3} (.003)^{1/2} = 1.36 R^{2/3}$

y	A	b	V	Q
5	400	130	2.88	1150
10	1300	230	4.32	5610
8	880	190	3.78	3330



Channel Depth ± 5.5 ft.  
 for 1450 cfs.  
 & ± 7 ft. for 2530 cfs\*

\* Forge Rd controls disch.  
 with pond @ el. 40.8

Time to Drain:

$\frac{43500 (144)}{3600 (\frac{1}{2}) (1300)} = 2.7 \text{ Hours.}$

**(VII)** Failure of Dam CASE B

Peak Failure Flow:

Pond Elevation - 42.4 ± top of sandbags

Toe Elevation - 32.4

$Y_0 = 10.0$

Dam Length Subject to Breaching = 170

$W_0 = 40\% (170) = 68 \text{ ft}$  - westerly earth embank.

$Q_{P1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (68) (10)^{1.5} = 3610'$

With pond @ el. 42.4,  $Q_{out} = 880 \text{ cfs}$ . ∴ Total failure flow = 4490 cfs

Storage Volume Released:

Storage Above Spillway: (Item 12) = 787 ac. feet

Storage Below Spillway:  $\frac{1}{3} (7.2) \pm 7.3 = \frac{114}{3}$  "

$S = \text{Total Storage} = \underline{301}$  " "

Channel Hydraulics:

See Pg. 6 & 4

Discharge Rate

4490 cfs requires a water elev. of 42.5 to cross Forge Rd.  
 Using the pond elev. of 42.4, only ± 4300 cfs can cross Forge Rd.

A flow of 4300 cfs produces a destr. channel depth of ± 9 ft. Flow prior to failure of 880 cfs requires a channel depth of ± 4 ft.

Time to Drain:

$\frac{43500 (301)}{3600 (\frac{1}{2}) (3610)} = 2.0 \text{ Hours.}$

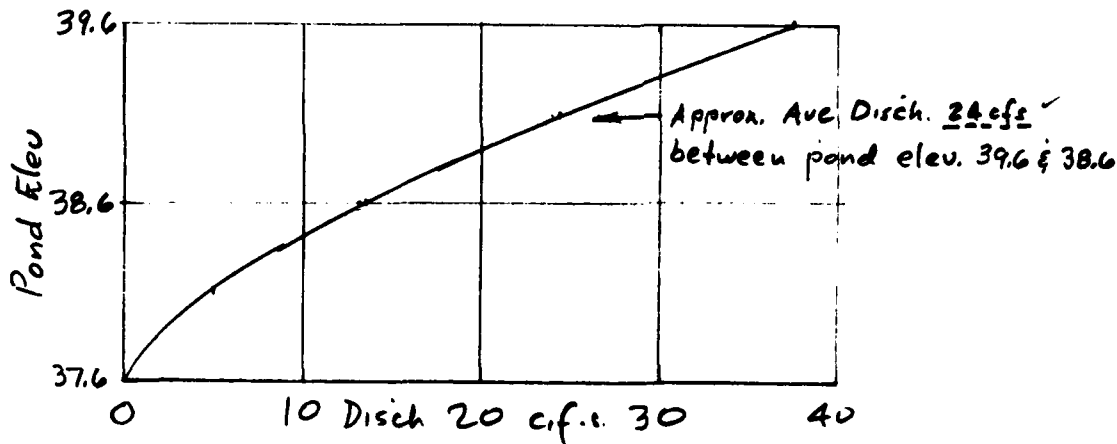
METCALF & EDDY, ENGINEERS

VIII Pond Draw Down

No valved low level outlet occurs at dam.  
 Pond level could be lowered by removing stoplogs  
 in sluiceway outlet, by-hand.

Assume, that the top 2 feet of stoplogs can be  
 removed & that the initial pond elevation is 39.6  
 New stoplog crest elev. 37.6; width is 4'  
 Calc. similar to Item III-A

Pond Level	39.6	39.1	38.6	38.1
Q	9.32	6.09	3.33	1.20
Φ	37.3	24.4	13.3	4.8



Pond area 47.3 acres at elev. 41±. Assume area reduces  
 linearly to zero at elev. 38.4. Est. storage between 39.6 & 38.6  
 becomes:  $\frac{1}{2}(34.1 + 39.6) = 36.9$  ac.ft.

Time to lower pond 1 foot =  $\frac{36.9 (43560)}{24 (3600)} = 18.6$  hours

\* Based on above assumptions

NEW ENGLAND - AUGUST 1978

SPECIAL WEATHER SUMMARY

Temperatures averaged from near to moderately above normal. Rainfall varied from extremely light in southeastern Maine to locally extremely heavy in parts of Massachusetts and Rhode Island and locally also in Vermont. \* See accompanying maps for August total rainfall.

HEAVY LOCAL RAINS OF AUGUST 6-8, 1978

Rain occurred daily in the first week of August in the Massachusetts-Rhode Island area, culminating with a three-day episode on the 6th-8th of

occurrences of localized very heavy thunder-showers. The accompanying map, displaying the three-day totals in inches, is based upon both official and apparently reliable unofficial gage records. The greatest single accumulation reported was 14.25 inches at Lakeville, MA. Of this, 8.40 inches fell in the 24 hours ending on the 7th. This equals the 24-hour record rainfall for Boston, MA, set August 18-19, 1955, and exceeded the maximum amount to be expected once in 100 years at any given point in this area. These rains caused considerable local flooding.

Robert E. Lautzenheiser, State Climatologist  
for Mass. New England Climatic Service, 35  
Arcadia Ave., Reading, MA 01867

Dr. James M. Havens, State Climatologist for  
Rhode Island, University of Rhode Island,  
Kingston, RI 02881

The help of Mr. John Kelly, of Peace Dale,  
RI, in furnishing supplemental records for  
Rhode Island, is gratefully acknowledged.

FORGE POND DAM





APPENDIX E

INFORMATION AS CONTAINED IN THE  
NATIONAL INVENTORY OF DAMS

FORGE POND DAM

**END**

**FILMED**

**6-85**

**DTIC**