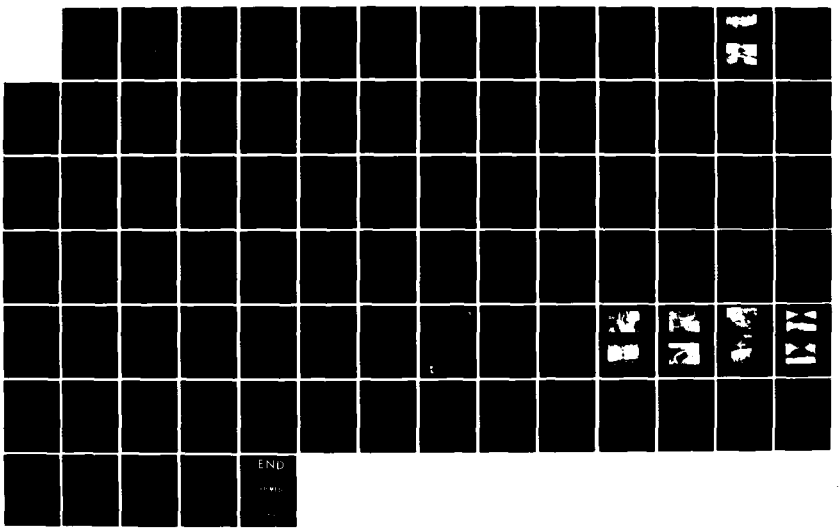
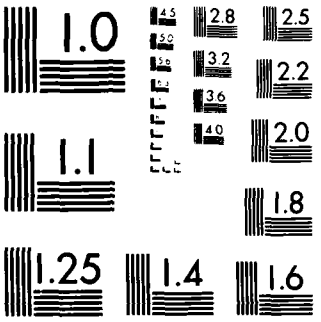
AD-A155 578 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS FOREST PARK UPPER DAM. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 79 1/1

UNCLASSIFIED F/G 13/13 NL



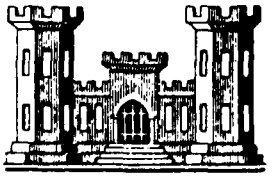


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CONNECTICUT RIVER BASIN
SPRINGFIELD, MASSACHUSETTS

FOREST PARK UPPER DAM
MA 00568

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

SEPTEMBER 1979

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00568	2. GOVT ACCESSION NO. AD-A155578	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Fprest Park Upper 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 September 1978 13. NUMBER OF PAGES 78
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,
Connecticut River Basin
Springfield, Massachusetts
Pecousic Brook

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

The dam is an earthen embankment about 450 ft. long and 23 ft. high. It is considered to be in fair condition. It is small in size with a significacnt hazard potential. An investigation is recommended to determine appropriate modifications and repairs for the protection of embankment slopes.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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

REPLY TO ATTENTION OF
NEDED

NOV 15 1973

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

Dear Governor King:

Inclosed is a copy of the Forest Park Upper 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 Springfield.

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

FOREST PARK UPPER DAM
MA 00568

CONNECTICUT RIVER BASIN
SPRINGFIELD, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00568
Name of Dam: FOREST PARK UPPER DAM
Town: CITY OF SPRINGFIELD
County and State: HAMPDEN COUNTY, MA
Stream: PECOUSIC BROOK
Date of Inspection: 14 AUGUST 1979

BRIEF ASSESSMENT

Forest Park Upper Dam is an earthen embankment approximately 450 feet long and 23 feet high, the 40 foot wide crest carries a park roadway. A semi-circular drop inlet spillway located near the center of the dam's upstream face discharges into a culvert beneath the embankment. The gated reservoir drain is incorporated in the spillway weir.

The presence of numerous trees and eroded areas on the embankment resulted in the dam being considered only in "fair" condition.

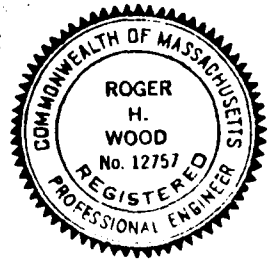
The dam is in the "small" size and the "significant" hazard classifications. In accordance with the Corps of Engineers Guidelines, the spillway test flood adopted was the ½ Probable Maximum Flood. The spillway was determined to be adequate to pass the routed test flood outflow of 1475 cfs with approximately 5.1 feet of freeboard remaining for the dam. The maximum spillway capacity with a flood stage at the top of the dam is 2160 cfs.

An investigation is recommended to determine appropriate modifications and repairs for the protection of embankment slopes. Remedial measures to be taken by the Owner include the temporary repair of eroded areas, the cleaning and repair of catch basins and drains and the repair of the spillway and outlet culvert. The Owner should develop a formal maintenance program, operational procedure, a warning system, and emergency procedures plan and should institute a program of annual technical inspection. These recommendations should be instituted by the Owner within one year of his receipt of this report.

CAMP DRESSER AND McKEE INC.

Roger H. Wood

Roger H. Wood
Vice President



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

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

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

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

APPROVAL RECOMMENDED:

[illegible] 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.

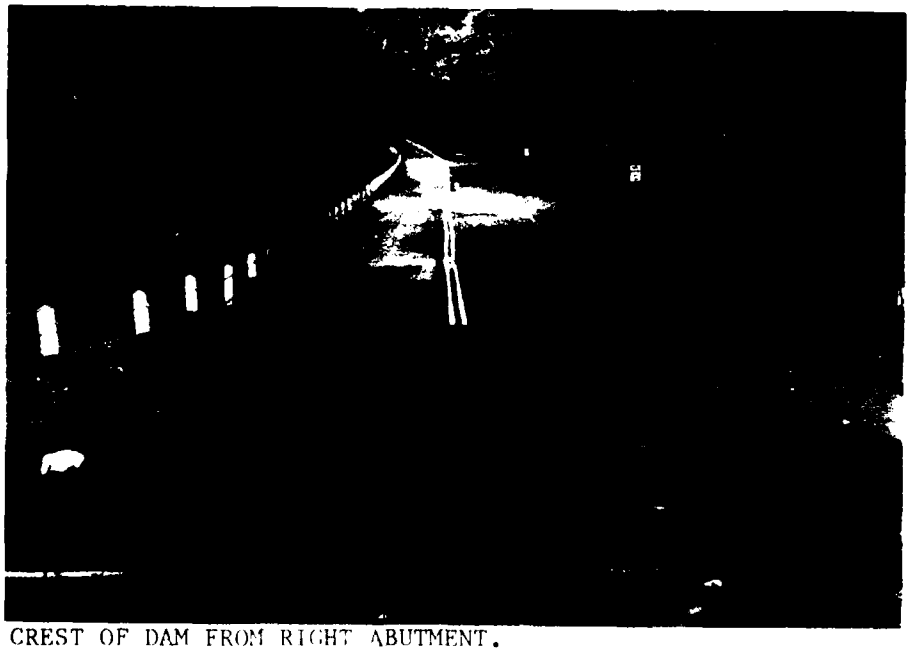
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the 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.

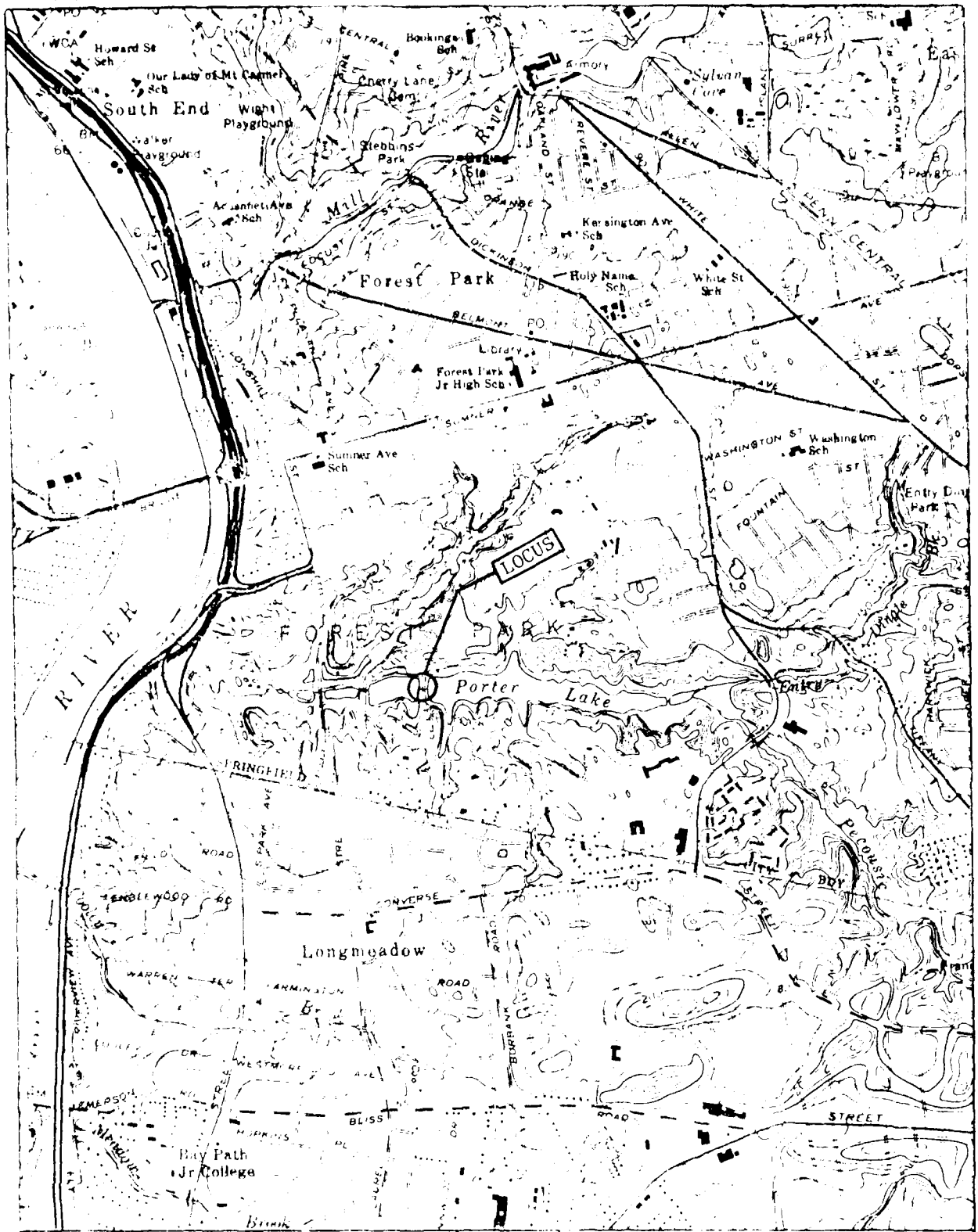
TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

1. OVERVIEW OF UPSTREAM FACE OF DAM FROM RIGHT BANK OF POND.



2 CREST OF DAM FROM RIGHT ABUTMENT.



[illegible] FOREST PARK (UPPER) AM		LOCATION MAP
[illegible]		USGS QUADRANGLE
		Springfield South, MA – CT
		APPROX. SCALE: 1" = 2000'

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

FOREST PARK UPPER DAM

MA 00568

SECTION 1: PROJECT INFORMATION

1.1 General

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

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of 27 March 1979, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-70-C-0053 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

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

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

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

1.2 Description of Project

a. Location - Forest Park Upper Dam is located at the west end of Porter Lake in Forest Park in the City of Springfield, Massachusetts, as shown on the report's Location Map. Access to the dam is by park roads, one of which is on the crest of the dam. The dam impounds the waters of Pecousic Brook, and the smaller Entry Dingle Brook to form Porter Lake. Flow from the dam enters the Connecticut River 4,000 feet away. The coordinates for the dam are 72 degrees-34.2 minutes longitude and 42 degrees-04.4 minutes latitude.

b. Description of Dam and Appurtenances - Forest Park Upper Dam consists of an earthen embankment approximately 450 feet long and 23 feet high. A paved roadway extends along the entire crest length. A drop inlet spillway with an outlet culvert structure is located near the center of the dam. A plan showing the general layout of the dam and appurtenant structures is included in Appendix B.

The crest width of the dam is approximately 40 feet. Both upstream and downstream side slopes are approximately 2 horizontal to 1 vertical. Documents included in Appendix B indicate the presence of a core wall (probably concrete) positioned beneath the upstream edge of the crest. The nature of the embankment materials is not indicated. The documents do indicate that the embankment was probably founded on clay. The upstream face of the dam at the drop inlet spillway has a vertical stone masonry wall. The dam has a crest elevation of 100.

The drop inlet spillway is constructed of stone masonry with probably a concrete foundation. The crest elevation is 92. The upstream edge of the drop inlet is formed by a semi circular weir on approximately a 32 foot radius. The ends of the weir are tied into the stone masonry upstream face of the dam with a stepped masonry wall. Discharge from the spillway is carried beneath the dam by a brick arch culvert. The width of the culvert is approximately 9 feet and it has a height of 9.5 feet, invert to crown. The crown of the culvert is on a five foot radius.

According to field observations, the reservoir drain is a 48 inch pipe valved at the front face of the drop inlet spillway weir. The valve is located at approximately the midpoint of the weir and accessible only by boat. The 48 inch pipe passes through the weir at elevation 79 and discharges into the downstream spillway pool. Water discharge by the reservoir drain is carried under the dam in the spillway discharge culvert.

c. Size Classification - The height of the dam is approximately 23 feet and the estimated storage capacity at crest elevation is 642 acre-feet. According to guidelines established by the Corps of Engineers, the dam is classified in the small category.

d. Hazard Classification - The results of the dam failure analysis indicate that the flood wave resulting from the failure of the dam embankment would cause overtopping of the Fountain Lake Dam just downstream of the Forest Park Upper Dam and cause the overtopping of Interstate Route 91 prior to the water entering the Connecticut River. While no dwellings are involved in the impact area, Forest Park has considerable recreational use. Also

Interstate Route 91 is a major north south artery with 24-hour traffic. These two factors indicate that a few lives would be placed in jeopardy by a dam failure. The dam is therefore classified in the "significant" hazard category.

e. Ownership - The dam is owned by the City of Springfield. The owner's address is: City of Springfield, 36 Court Street, Springfield, MA 00103 (Phone: 413/736-2711). Mr. Richard Wiese of the City Engineering Department is the owner representative.

f. Operator - Operation of the dam is the responsibility of the City Park Department. Mr. Richard Fitch (Phone: 413/732-2181) is the Park Department Superintendent. Mr. Al Poehlr is the Park Department Foreman in charge of Operations.

g. Purpose of Dam - Forest Park Upper Dam, is used to provide recreational pond.

h. Design and Construction History - The dam is believed to have been constructed in 1919. This date appears on the masonry at the dam and on a plan showing the details of the dam. Repairs were made to the spillway in 1965.

i. Normal Operational Procedure - There is no established routine for the operation of the dam. The dam has been inspected on approximately an annual basis by the County or State. Repairs were made to the spillway in 1965 as a result of these inspections.

1.3 Pertinent Data

Elevations given in this report are considered to be on a local datum. The elevations are those used in the prior inspection report. While these elevations are close to the National Geodetic Vertical Datum (NGVD) formerly referred to as mean sea level (MSL) as indicated by the contours on the USGS Quadrangle Springfield South, Massachusetts contours, it appears that the local datum gives elevations several feet higher than NGVD.

a. Drainage Area - The drainage area is about 5.75 square miles of varied terrain. The watershed is essentially flat. The northern section of the watershed, which cuts through the City of Springfield, is heavily developed. The remainder of the watershed varies from high density development to heavily forested areas with no development. The drainage area is about 1 percent ponded water with some additional marshy areas along the Pecousic Brook. Its length is about twice its width with an average slope of 1 percent. Both Pecousic Brook and Entry Dingle Brook discharge to Porter Lake. However, Entry Dingle Brook is essentially a tributary to Pecousic Brook, which traverses the whole length of the watershed. Side slopes to Pecousic Brook are flat to moderate.

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

(1) Outlet works size - 48 inch pipe @ El. 79
(2) Maximum known flood at damsite -- Unknown
(3) Ungated spillway capacity at top of dam 2160 cfs @ 100 elev.
(4) Ungated spillway capacity at test flood elevation 1475 cfs @ 94.9 elev.
(5) Gate spillway capacity at normal pool elevation - N/A
(6) Gated spillway capacity at test flood elevation - N/A
(7) Total spillway capacity at test flood elevation 1475 cfs @ 94.9 elev.
(8) Total project discharge at test flood elevation 1475 cfs @ 94.9 elev.

c. Elevation (ft. above local datum)

(1)	Streambed at centerline of dam	77
(2)	Test flood tailwater	91.3
(3)	Upstream portal invert diversion tunnel	N/A
(4)	Recreation pool	92.0
(5)	Full flood control pool	N/A
(6)	Spillway crest	92.0
(7)	Design surcharge (Original Design)	Unknown
(8)	Top of dam	100.0
(9)	Test flood design surcharge	94.9

d. Reservoir (miles)

(1)	Length of test flood pool	0.7
(2)	Length of recreation pool	0.7
(3)	Length of flood control pool	N/A

e. Storage (acre-feet)

(1)	Recreation pool	180
(2)	Flood control pool	N/A
(3)	Spillway crest pool	180
(4)	Top of dam	642
(5)	Test flood pool	330

f. Reservoir Surface (acres)

(1)	Recreation pool	47.5
(2)	Flood-control pool	N/A
(3)	Spillway crest	47.5
(4)	Test flood pool	56.0
(5)	Top of dam	68.0

g. Dam

(1) Type ..... Earth embankment with corewall
(2) Length ..... Approx. 450 ft.
(3) Height ..... Approx. 23 ft.
(4) Top width ..... Approx. 40 ft.
(5) Side slopes ..... 2H to 1V
(6) Zoning ..... Unknown
(7) Impervious Core..... Core wall, probably concrete
(8) Cutoff ..... Unknown
(9) Grout Curtain ..... probably none

h. Diversion and Regulating Tunnel ..... none

i. Spillway

(1) Type ..... Drop inlet with semi-circular weir
(2) Length of weir ..... 90 ft.
(3) Crest elevation 92
(4) Gates ..... None
(5) U/S Channel ..... U/S face of weir at reservoir
(6) D/S Channel ..... outlet culvert to D/S pond

j. Regulating Outlets - The only regulating outlet at this dam is a 48 inch pipeline through the spillway weir. The estimated invert elevation of this pipeline is elevation 79.0. The line is controlled by a valve on the upstream side of the weir. Access to the valve operator during normal or high reservoir levels must be by boat. Water discharged by the reservoir drain enters the downstream pool of the spillway and is carried under the dam by a brick arch culvert.

SECTION 2: ENGINEERING DATA

2.1 Design Records - The only design records located were prints of a plan of the dam dated 1919. The plan did not indicate the materials to be used for the construction of the dam embankment and core wall.

2.2 Construction Records - No construction records for the dam were located. The only reference to probable departures from the 1919 plan are contained in a state inspection report.

2.3 Operation Records - No operational records other than County and State inspection reports were located.

2.4 Evaluation

a. Availability -The document described above is available at the City Engineering Department, City of Springfield, 36 Court Street, Springfield, MA 01103.

b. Validity - While the general configuration of the dam and spillway are as shown on the design plan, field measurements and the prior State "Description of Dam" indicates some departures from the proposed structure.

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

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual examination of Forest Park Upper Dam was conducted on 14 August 1979.

In general, the earthen embankment and spillway were observed to be in fair condition. This classification is primarily based on the presence of large trees on the dam and the observed erosion of the embankment along the downstream face. The reservoir level at the time of the site examination was approximately elevation 92.

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

b. Dam - Visual observations indicate the dam embankment and spillway are in fair condition. The embankment crest has an asphalt paved roadway, about 26 feet wide as shown in Photo 2. In general, the pavement was judged to be in good condition. Some minor pavement cracking was noted. The remainder of the crest, along the pavement edges is grass and weed covered, with several worn paths and eroded patches. Curbing has been installed on the upstream side over a limited section at the center of the dam. Embankment materials exposed in the roadway area consists of approximately 12 to 18 inches of black cinders overlying light brown silty fine sand.

The upstream slope was estimated to be somewhat steeper than 2 H to 1V at several places. There is apparently no riprap or other wave protection. The downstream face of the dam appeared to be on a 2H to 1V slope. Eroded areas in this face, some up to 2.5 feet in depth, exposed a light brown silty fine sand material. One eroded area has apparently been stabilized with bricks. No evidence of seepage was noted along the downstream toe of the embankment.

Catch basins are located on both the upstream and downstream side of the crest roadway. A clay pipe which drains one of the catch basins on the downstream face near the right abutment is exposed near the toe of the downstream slope. This pipe was observed to be broken near the discharge end.

The spillway and discharge culvert appeared to be in good condition. However, a portion of the spillway weir and the invert of the discharge culvert was obscured by the flow of water.

The following specific items were noted during the site examination:

(1) The upstream and downstream slopes of the embankment are covered with dense brush and large trees as shown in Photos 1, 2, 3 and 4. One tree on the downstream face of the dam, as shown in Photo 5, is partially uprooted.

(2) Local erosion was noted on the upstream and downstream faces of the dam as well as adjacent to the roadway on the crest. Particularly noticeable were eroded areas adjacent to the spillway and at the left abutment on the upstream slope where a construction of a trail or walkway has been started. Noticeable erosion on the downstream face occurs above the outlet culvert (Photo 4), midway between the culvert and right abutment, and at the end of the broken pipe from the catch basin.

(3) The catch basin on the downstream side of the roadway near the left abutment appears to be clogged.

(4) Vegetation is present in the masonry joints of the stone masonry wall at the upstream face of the dam in the spillway area. Stones are missing from the wall at the left and right end near the base of the wall. The condition at the left end of the wall is shown in Photo 7.

(5) The mortar cap on the spillway weir is cracked and eroded as shown by the flow pattern in Photo 6.

(6) A slight growth of vines and grass at the right and left end of the spillway weir was observed. Slight seepage is present through the masonry joints at the right of the spillway weir.

(7) The mortar plaster on the underside of the culvert roof is cracked and pieces have fallen off.

c. Appurtenant Structures - The reservoir drain is controlled by a gate operator on the upstream side of the spillway. The gate is operational. Access to the gate during normal or high flows is by boat as shown in Photos 8 and 9.

d. Reservoir Area - Forest Park Upper Dam forms an impoundment called Porter Lake in Forest Park. There is no development in the vicinity of the reservoir area as shown in Photo 9, except for park facilities. There is a park concession building at the right bank just upstream of the dam. Side slopes to Porter Lake are generally flat to moderate. There appears to be no potential for landslides into the reservoir which would cause waves to overtop the dam. No conditions were noted which might result in a sudden increase in sediment load into the reservoir.

e. Downstream Channel - Porter Lake discharges over a semi-circular weir at the upstream face of the dam, into a mortar lined brick culvert under Forest Park Upper Dam and then into Fountain Lake. Fountain Lake has a similar discharge facility to a downstream pond. Water from this pond passes through two 40 inch culverts to another spillway. The spillway discharges to a brook which crosses a park roadway before entering a concrete culvert under Interstate Route 91 about 3000 feet downstream of Forest Park Upper Dam. The culvert discharges into the Connecticut River. There are no habitated structures in the vicinity of the downstream channel.

3.2 Evaluation - The general condition of the dam is fair. Although there are deficiencies which need attention, no condition which required urgent remedial action was noted.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - In general there is no written procedures for the operation of the dam.

4.2 Maintenance of the Dam - There is no established formal maintenance programs for this dam.

4.3 Maintenance of Operating Facilities - The gate at this dam receives minimum maintenance. It was found to be operating during the site examination.

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

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

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General - Forest Park Upper Dam forms an impoundment called Porter Lake. The Lake is fed by Pecousic Brook which traverses the flat, moderately develped, 5.75 square mile drainage area. At spillway crest (elev. 92.0 local datum), the reservoir storage is about 180 acre feet increasing to 642 acre feet at the top of the dam (elev. 100.0). The drop inlet type spillway, located at the upstream face of the dam near its center, has a 32 foot inside diameter to the semi-circular stone masonry weir. The weir height is approximately 14 feet. Discharge from the spillway runs through a brick culvert under the dam to Fountain Lake downstream. The brick culvert behaves as the hydraulic control for pond discharges greater than 1850 cfs. The outlet works for the project is a 48 inch pipe (field measured) which passes through the base of the weir. It has a manually operated valve at the upstream face of the weir. The dam is a high spillage low surcharge project at discharges less than 1850 cfs. It becomes a low spillage high surcharge project due to the limited capacity of the culvert for flows greater than this amount.

b. Design Data - There is no hydraulic/hydrologic design data for the dam.

c. Experience Data - No records of past floods are available for this location.

d. Visual Observations - The visual inspection of the dam was made on 14 August 1979. At that time, the average depth of water over a 40 foot length of the weir was approximately 2 1/4inches. The water depth just upstream of the spillway was approximately 15.5 feet and the minimum freeboard present at the dam was just under 8 feet. No material obstructions to flow at the spillway were observed. The weir contains no provisions for flashboards. The mortared lined brick culvert which carries the spillway discharge to Fountain Lake was in good hydraulic condition. The outlet works were partially opened by Park personnel to demonstrate that they were in operating condition.

e. Test Flood Analysis - Based on the Corps of Engineers Guidelines, the recommended test flood range for the size, small, and hazard classification, significant, is the 100 year flood to the 1/2 PMF (Probable Maximum Flood). In that there are no permanent dwellings downstream of the dam to the Connecticut River, the lower end of the test flod range was utilized. A 1/4 PMF which will give a reservoir inflow slightly in access of the 100 year flood was adopted. The test flood was calculated using the Corps of Engineers Guidelines

for estimating maximum probable discharge in Phase I Dam Safety Investigations. The watershed is flat (approximately a one percent slope) with some heavily developed areas in the northern and eastern sections. The percentage of ponded and swampy areas in the watershed is minor. Based on the watershed characteristics, the 1/4 PMF inflow rate of 290 cfs per square mile was selected for the 5.75 square mile drainage area. The resulting peak test flood inflow is approximately 1650 cfs.

The routed test flood outflow was calculated to be 1475 cfs at a stage of 94.9, neglecting the outlet works capacity. The freeboard was calculated to be 5.1 feet and the depth over the spillway weir would be 2.9 feet. The spillway capacity at the top of the dam is approximately 2160 cfs. The outlet works capacity at test flood elevation is approximately 150 cfs.

f. Dam Failure Analysis - Based on the Corps of Engineers Guidelines for estimating dam failure hydrographs and assuming that a failure would occur along 40 percent of the mid height length (180 feet) of the Forest Park Upper Dam with the water surface at the top of the dam (elevation 100.0), the peak failure outflow would be 33,400 cfs. As a result of the dam failure, the dam at Fountain Lake, approximately 800 feet downstream, would be overtopped by approximately 7 feet. The flow would then impact upon the Interstate Route 91 roadway embankment approximately 2200 feet further downstream. The roadway embankment would basically act as a dam since the capacity of the culvert is small (surface area is approximately 150 square feet) compared with the magnitude of the dam failure outflow. Assuming zero flow through the culvert at Interstate Route 91 the water surface would reach an approximate elev. of 85 at the roadway embankment and overtop it by a maximum depth of 6 feet. If the impounded pool upstream of the roadway embankment is reduced by allowing some discharge through the roadway culvert, Interstate Route 91 would probably still be overtopped. Interstate Route 91 is a major north south highway and has vehicle traffic day and night. The area adjacent to the brook downstream of Porter Lake is used extensively for recreational purposes during daylight hours. It is therefore concluded that any dam failure could place several lives in jeopardy, either within the adjacent recreational area or on Interstate Route 91. In addition, damage to Interstate Route 91 would result in economic losses due to the loss of a major north south highway in this area. The dam is therefore placed in the "significant" hazard classification.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - There was no visible evidence of dam or spillway instability during the site examination on 14 August 1979. Local severe erosion was noted on the embankment slopes. Stones were observed to be missing from the upstream vertical stone masonry wall adjacent to the spillway. These conditions should be corrective but are not considered indicative of the need for urgent remedial action relative to structural stability.

b. Design and Construction Data - Available documents indicate the geometry of the embankment and spillway, but pertinent data relative to embankment materials are unavailable. Therefore, a theoretical analysis of embankment stability is not possible. However the crest is relatively wide with respect to the height, the side slopes are not unusually steep and there were no observed visual evidence of instability. The past performance of the spillway and the condition of the masonry do not indicate instability of this structure. For these reasons, it is expected that the dam has an adequate factor of safety relative to overall stability.

c. Operating Records - There are no available operating records to aid in the evaluation of structural stability.

d. Post-Construction Changes - There are no available records of post construction changes which would affect embankment stability.

e. Seismic Stability - Forest Park Upper Dam is located in seismic zone 1 and in accordance with recommended Phase I Guidelines, does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessments

a. Condition - Visual observations indicate that the dam is in fair condition. While some deficiencies which need work were noted, no conditions which would warrant urgent remedial action were observed.

b. Adequacy of Information - The evaluation of the dam has been based on the visual examination, consideration of available records and past performance and application of engineering judgment. Generally, the information available or obtained has been adequate for the purposes of the Phase I assessment.

c. Urgency - The recommendations for remedial work outlined in Section 7.2 and 7.3 should be undertaken by the owner within one year after receipt of this report.

d. Need for Additional Investigations - An additional investigation should be performed by the owner as outlined in Section 7.2

7.2 Recommendations

It is recommended that the owner arrange for the following investigation to be undertaken by a registered professional engineer:

1. The dam requires extensive clearing and grubbing, regrading and reconstruction of the upstream and downstream slopes. Due to this and the apparent erodable silty fine sand embankment fill, an engineering investigation should be made for the removal of trees and root systems, restoration of the embankment slopes and the protection of slopes against trespass, wave action, and surface water runoff. This may require a re-evaluation of the roadway drainage system.

The owner should implement corrective measures as required based on the results of the engineering evaluation.

7.3 Remedial Measures

a. Operation and Maintenance Procedures - The following remedial work should be undertaken by the owner:

(1) Make temporary repairs to eroded areas on the dam.

(2) Clear and repair catch basins and drains.

(3) Remove vegetation from the stone masonry spillway and embankment walls.

(4) Renew the cement mortar cap at the top of the spillway weir.

(5) Replace the missing stones at the base of the vertical stone masonry wall at the front face of the dam embankment in the spillway area.

(6) Repair the mortar plaster on the underside of the discharge culvert roof.

(7) Establish a formal operational procedure and maintenance program.

(8) Develop a formal emergency procedures plan and warning system in cooperation with local officials and institute a program of annual technical inspections.

7.4 Alternatives - There are no practical recommended alternatives.

APPENDIX A
INSPECTION TEAM ORGANIZATION AND CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam

DATE: 14 August 1979

TIME: 2:00 PM

WEATHER: Overcast - Temperature in the 60's

WATER SURFACE ELEVATION UPSTREAM: Water surface Approx. at Spillway Crest Elevation.

STREAM FLOW: $Q=CHL^{1.5} = (2.9)\ (40')\ (0.19)^{1.5} = 9.5$ cfs $\pm$

INSPECTION PARTY:

1. Joseph E. Downing - CDM Hydrology/Hydraulic
2. Francis E. Luttazi - CDM Operations/Structural
3. John Critchfield - Haley & Aldrich
4. Douglas Gifford - Haley & Aldrich
5. _____

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

PRESENT DURING INSPECTION:

1. _____
2. _____
3. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam DATE: 14 August 1979
EMBANKMENT: BY: JWC & DGG

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Dense brush & large trees.
b. Sloughing or Erosion	b. Local erosion at right edge of steps at spillway.
c. Rock Slope Protection - Riprap Failures	c. None observed.
d. Animal Burrows	d. None observed.
2. Crest	2.
a. Vegetation	a. Paved roadway.
b. Sloughing or Erosion	b. Runoff from roadway along downstream edge leading to downstream slope erosion; see 3b.
c. Surface cracks	c. Minor surficial pavement cracking.
d. Movement or Settlement	d. None observed.
3. Downstream Slope	3.
a. Vegetation	a. Dense brush & large trees.
b. Sloughing or Erosion	b. Recent wash area with pocket in slope up to 2.5 ft. deep. Evidence of older wash and erosion areas; one stabilized by bricks.
c. Surface cracks	c. None observed.
d. Animal Burrows	d. None observed.
e. Movement or Cracking near toe	e. None observed.
f. Unusual Embankment or Downstream Seepage	f. None observed.
g. Piping or Boils	g. None observed.
h. Foundation Drainage Features	h. None known.
i. Toe Drains	i. None known.
4. General	4.
a. Lateral Movement	a. None apparent.
b. Vertical Alignment	b. Embankment crest nearly flat paved roadway.
c. Horizontal Alignment	c. Good.
d. Condition at Abutments and at Structures	d. Erosion at new pathway at left abutment; erosion on downstream slope above culvert; erosion at spillway; see 1b.
e. Indications of Movement of Structural Items	e. None observed.
f. Trespassing	f. Unrestricted; overgrown paths along U/S & D/S slopes.
g. Instrumentation Systems	g. None known.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam DATE: 14 August 1979

SPILLWAY: BY: E.E.I.

CHECK LIST	CONDITION
1 Approach Channel a. General Condition b. Obstructions c Log Boom etc	Note: Spillway fronts directly on lake. 1. a. Good. b. None observed. Inlet gate operator located at center of spillway approx. three feet upstream. c. None observed.
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. None. b. See "Outlet Works." c. None observed. d. None observed. e. None observed. f. None observed. g. Good. h. None observed. i. None observed. 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. Channel floor submerged. b. Semi-circular stilling basin at foot of spillway cascade. c. Submerged. d. None observed. e. None observed. f. Debris observed in stilling basin at entrance to discharge culvert. g. Good.
4. Walls a. Wall Location_____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4. a. Semi-circular arch spillway face. (1) Slight growth of vines and grass at right and left of spillway. (2) Slight seepage through joints at right of spillway. (3) Rust stains at lower right side of spillway. (4) Mortar cap cracked repeatedly to right and left of spillway. (5) Good.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam DATE: 14 August 1979

SPILLWAY: (Continued) BY: F.E.L.

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	6. Mortar cap completely eroded at middle third of spillway. Deterioration of stone masonry at lower left of spillway. 7. None observed. 8. Good
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	b. Upstream face of dam parallel to spillway arch. 1. Tufts of grass were growing from masonry joints. 2. Efflorescence observed locally over entire wall area. 3. None observed. 4. None observed. See 4b-6. 5. Good. 6. Deterioration of stone masonry observed at lower sections of wall to right and left of discharge culvert entrance. 7. None observed. 8. Fair.
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	
4. Walls a. Wall Location_____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam DATE 14 August 1979
OUTLET WORKS: BY: F.E.L.

CHECK LIST	CONDITION
1. Inlet	1.
a. Obstructions	a. None observed.
b. Channel	B. N/A. Inlet draws directly from lake.
c. Structure	c. None.
d. Screens	d. Submerged.
e. Stop Logs	e. None.
f. Gates	f. Submerged.
2. Control Facility	2.
a. Structure	a. None.
b. Screens	b. Submerged.
c. Stop Logs	c. None.
d. Gates	d. Submerged.
e. Conduit	e. Submerged.
f. Seepage or Leaks	f. None observed. Inlet and conduit submerged.
3. Outlet	3.
a. Structure	a. Concrete walled culvert with brick lined arch roof.
b. Erosion or Cavitation	b. None observed. Submerged.
c. Obstructions	c. None observed. Submerged.
d. Seepage or Leaks	d. None observed. Submerged.
4. Mechanical and Electrical	4.
a. Crane Hoist	a. None observed.
b. Hydraulic System	b. None observed.
c. Service Power	c. Manually operated turnstile type gate operator at inlet gate.
d. Emergency Power	d. None observed.
e. Lighting	e. None observed.
f. Lightning Protection	f. N/A.
5. Other	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Forest Park Upper Dam DATE: 13 August 1979

SPECIAL STRUCTURE: Spillway Discharge Culvert BY: F.E.L.

CHECK LIST	CONDITION
Culvert	Culvert is in good general structural condiiton. Mortar plaster at culvert roof has cracked and pieces have fallen away. Culvert floor submerged. No further exceptions noted.

APPENDIX B
ENGINEERING DATA

U.S. DEPARTMENT OF
FOREIGN PARTICIPATION

ALL AVAILABLE DOCUMENTS ARE INCLUDED IN APPENDIX B-1

DESCRIPTION OF DAM

DISTRICT 2

Submitted by R. C. Salls, P.E. Dam No. 2-7-281-3

Date January 29, 1974 City Springfield

Name of Dam Forest Park Upper Dam
"Porter Lake"

Location: Topo Sheet No. 12 D Base Rect. Coordinates N 393,000 E 309,400

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

On Pecousic Brook in Forest Park - Park Drive, a park road, goes over embankment.

Year built Unknown - prior to 1920 Year/s of subsequent repairs Unknown
Date 1919 on masonry
Plans dated 1919

3. Purpose of Dam: Water Supply ____ Recreational X
Flood Control ____ Irrigation ____ Other ____
Skating - Duck pond

4. Drainage Area: 5.9 sq. mi. ____ acres.
Type: City, Bus. & Ind. 10% Dense Res. 20% Suburban 50% Rural, Farm ____
Wood & Scrub Land Parks 20% Slope: Steep 20% Med. 20% Slight 60%

5. Normal Ponding Area: 30 Acres; Ave. Depth 6'
Impoundment: 58½ million gals.; 180 acre ft.
Silted in: Yes X No ____ Approx. Amount Storage Area 20%

6. No. and type of dwellings located adjacent to pond or reservoir ____
... summer homes etc. None. Lake in Forest Park
Skating Pavilion

7. Dimensions of Dam: Length 450± Max. Height 24' - downstream toe
Freeboard 8± under Fountain Lake
Slopes: Upstream Face 2:1 - Brush and trees
Downstream Face 2:1 - Brush and trees
... across top 42 ft.

Dam No. 2-7-281-3

Classification of Dam by Material:

Earth X (Embankment) Conc. Masonry _____ Stone Masonry Drop inlet and conduit

Timber _____ Rockfill _____ Other _____

Dam Type: Gravity X Straight X Curved, Arched _____ Other _____

Overflow _____ Non-overflow X

A. Description of present land usage downstream of dam:

70 % rural; 30 % urban - Railroad and highway (Park)

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure? Yes X No _____

C. Character Downstream Valley: Narrow X Wide _____ Developed _____

Rural 70% (Park) Urban 30% Highway and Railroad

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

No. of people 6 - 8

No. of homes None

No. of businesses None

No. of industries None Type _____

No. of utilities 4 Type Feed line for Longmeadow Water, Gas, Electric and Telephone

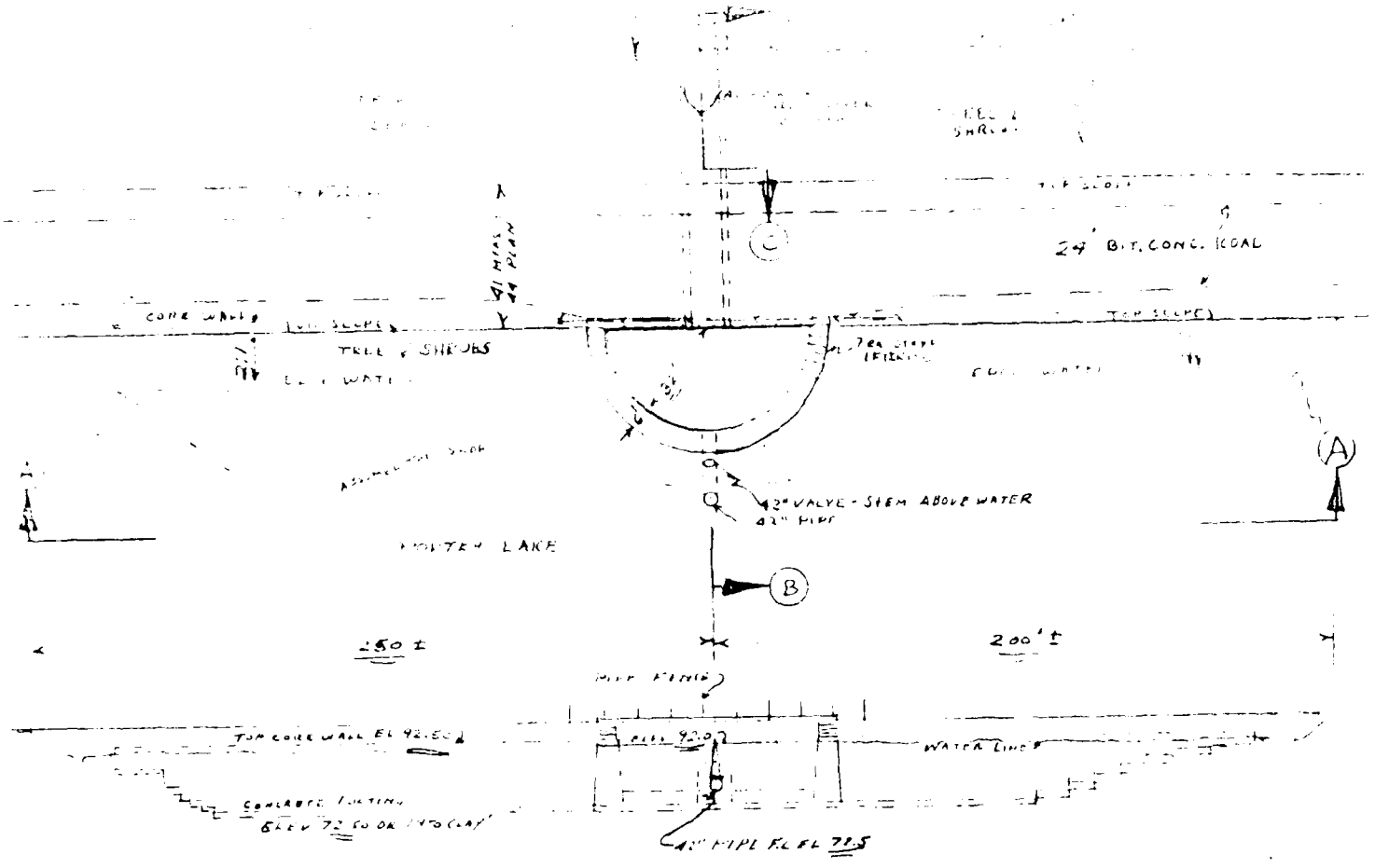
Railroads NY, NH&H Main Line

Other dams Forest Park Middle and Lower Dams Nos. 2-7-281-1 and 2

Other Rte. I-91 including portions of South End Bridge interchange. Exits #1 & 2

E. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

Check
Attachments
Profile Plan
Sketches



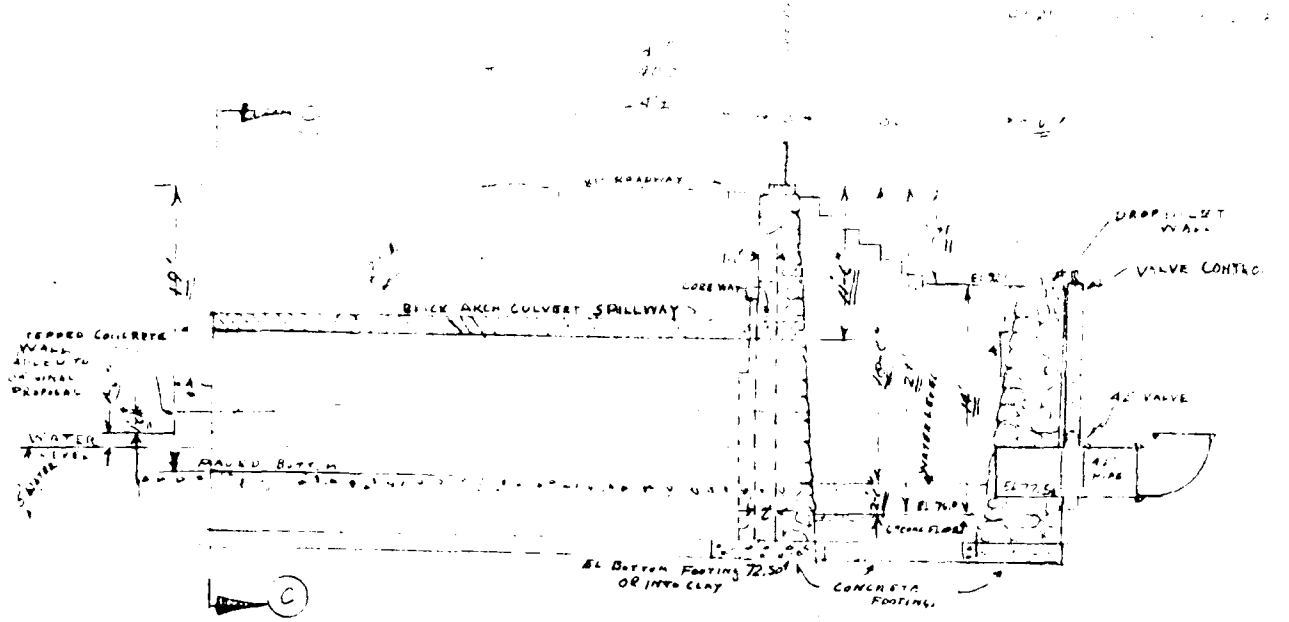
ELEVATION AA - UPSTREAM

SHEET 1 OF 3

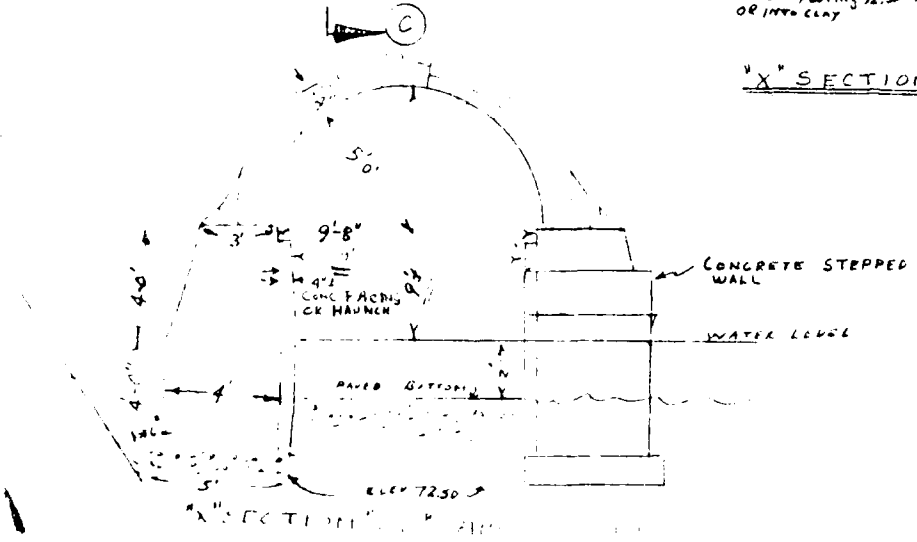
DAM NO 2-7-281-3

FOREST PARK UPPER DAM
MORTEN LAKE

APPENDIX R-4

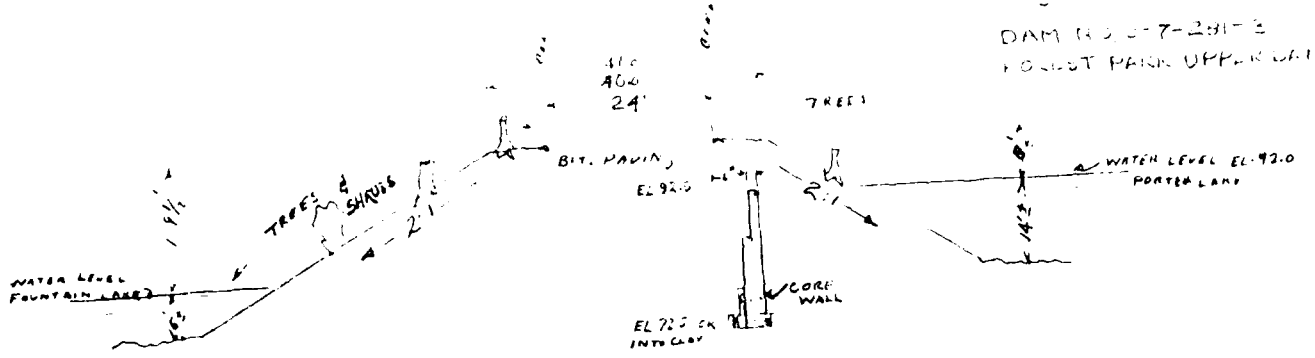


"X" SECTION "BB" THROUGH SPILLWAY & INLET



SKETCHES PREPARED FROM FIELD DATA OBTAINED - JAN 29, 1974 & PLAN ON FILE IN CITY ENGINEER'S OFFICE - DTD APR, 1919
FIELD MEASUREMENT UNDERLINED WHEN DIFFERENT FROM PROPOSED IN PLAN

APPENDIX B-5



TYPICAL "X" SECTION THROUGH EMBANKMENT


LOCUS PLAN
RIVER
Porter Lake
Forest Park
Longmeadow
Agawam

APPENDIX B-7

COPY

C.D. Springfield
March 6, 195
(1957)

The Hon. The Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

All dams in the City of Springfield were inspected one or more times during the year 1956. The following is a report on the condition of the various dams as noted during the inspections.

. . . . . .

C. Forest Park Upper Dam

This dam forms Porter Lake itself and is an earth embankment with a masonry spillway at about the central section. No damage occurred at this structure in the flood of August, 1955. In recent years it has been noted that the masonry of the spillway is becoming spalled and eroded as a result of weather and water action. This condition needs attention and the necessary maintenance work should be done in the near future to prevent further deterioration of the structure and the need for more expensive and difficult repairs at a later date.

. . . . . .

There are twenty-two dams and dam sites within Springfield that are inspected annually. Of this number, seven are municipally owned. The dam at the Watershops Pond is in addition to the above twenty-two.

Only one active dam other than the Watershops Pond Dam was seriously damaged in the flood of 1955. This dam, the lower Forest Park Dam, has been rebuilt. With the exception of the damage at the Bassette Pond Dam, other structures damaged were either abandoned or dilapidated and of little use.

Very truly yours,

George H. McDonnell
County Hydraulic Engineer

GHM/f

C.E. Springfield

Jan. 31, 1956

The Hon. the Board of County Commissioners
Hampden County Court House
Springfield, Mass.

Gentlemen:

All dams situated in the City of Springfield were inspected one or more times during the past year. The following is a report on the condition of the various dams within Springfield.

. . . . . .

C. Forest Park Upper Lake

This dam forms Porter Lake proper and the earth embankment as well as the masonry spillway are in satisfactory condition. Maintenance and repairs are needed at the masonry spillway. These repairs should be done in the near future in order to prevent more serious and expensive work being required at a later date. In recent years it has been noted that the masonry is becoming spalled and eroded. Unless corrective action is taken, the condition will become worse with the passing of time.

. . . . . .

Respectfully submitted,

George L. McDonnell
County Hydraulic Engineer.

GLMcD./mb

CE Springfield

Dec. 1, 1958

The Hon. the Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

All dams situated in the City of Springfield have been inspected one or more times during the past year. The following is a report on the condition of the various dams within Springfield.

. . . . . .

C. Forest Park Upper Dam

The embankment of this dam is satisfactory. The spillway is still in need of maintenance and repair to the masonry that is spalling and eroding. The condition appears to be getting worse and corrective action should be taken. Vegetation growing from the stone masonry should be killed. This condition has been reported before and to date, no steps have been taken to do any corrective maintenance.

. . . . . .

Respectfully submitted,

George H. McDonnell
County Hydraulic Engineer

GHM/mb

CD Springfield

Dec. 31, 1959

The Hon. the Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

All dams located within the City of Springfield have been inspected one or more times during the past year. The following is a report on the condition of the various dams situated within Springfield, as noted during various inspections in 1959.

. . . . . .

C. Forest Park Upper Dam

The masonry spillway at this structure is in need of maintenance and repairs. Weathering and water wear on the stones at the face of the spillway is growing worse. Capstones at the right end of the spillway crest will fall from the dam in the near future, unless maintenance is done at this structure.

The embankment section of this dam was found to be in satisfactory condition.

. . . . . .

Respectfully submitted

George H. McDonnell
County Hydraulic Engineer

GHM/cmb

CD Springfield
Jan. 18, 1961

The Hon. the Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

The dams situated within the City of Springfield have been inspected one or more times during the year 1960. The following is a report on the condition of the various dams within Springfield, as noted in the annual inspections and at the time of special inspections.

. . . . . .

C. Forest Park Upper Dam

Capstones at the right of the spillway masonry crest may fall as the result of weathering and water wear of supporting masonry. The masonry face of the spillway at both abutment areas will need attention soon to prevent further weathering and water erosion action and to provide proper support for the capstones.

The earth embankment of the dam is satisfactory.

. . . . . .

Respectfully submitted

George H. McDonnell
County Hydraulic Engineer

GHM/omb

CD Springfield
Dec. 12, 1961

The Hon. the Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

The dams located within Springfield have been inspected at least once during the year 1961. The following is a report on the general condition of each dam in Springfield.

. . . . . .

C. Forest Park Upper Dam

Repairs to the spillway of this dam should be done as soon as possible. Failure to make repairs and the continuation of the deterioration of the masonry of the overflow will result in loss of the capstones on the spillway and the possibility of major damage occurring to the dam. The need for repairs at this structure has been pointed out in the past and as yet, no work of a permanent nature has been done. Repairs are also needed to the masonry conduit carrying the discharge from the spillway under and thru the embankment. Erosion and wear of the masonry has grown to a point where repairs are a necessity. The embankment at this dam is in satisfactory condition.

. . . . . .

Respectfully submitted

GHM/cmb

George H. McDonnell
County Hydraulic Engineer

CD Springfield
Jan. 22, 1963

The Hon. the Board of County Commissioners
Hampden County Court House
37 Elm Street
Springfield, Mass.

Gentlemen:

All dams situated within the City of Springfield have been inspected at least once during the year 1962. The following is a report on the general condition of each dam in the City of Springfield.

. . . . . .

C. Forest Park Upper Dam

Capstones at the right end of the spillway have fallen off as predicted in the report of a year ago. More damage will be done to the spillway of this dam unless needed maintenance is done in the immediate future. For some time the fact that this dam is deteriorating has been pointed out to the officials of the Park Department. Nothing has been done as yet in the way of maintenance to prevent further deterioration. Unless maintenance is done now, more serious and costly repairs will be required in the near future and it is possible that more sections of the stone masonry of the dam will fail. The embankment of the dam is satisfactory. The spillway tube passing thru the embankment under the road should be checked thoroughly and repaired as needed.

. . . . . .

Respectfully submitted

GHM/cmb

George H. McDonnell
County Hydraulic Engineer

CD Springfield
December 10, 1964

The Hon. the Board of County Commissioners
52 State Street
Springfield, Massachusetts

Gentlemen:

Each and every dam situated within the City of Springfield has now been inspected at least once during the year 1964. The dams were inspected from time to time throughout the year and final inspections were made on December 3, 1964. The following is a report on the general conditions noted at each dam in the City of Springfield.

. . . . . .

C. Forest Park Upper Dam

This dam is in the same general condition as reported to your Board last year. Conferences in regard to this dam were held as outlined hereinbefore under the report on the Middle Dam. Cap stones at the right end of the spillway have fallen off and unless repairs are made to the spillway masonry in the very near future, it can be expected that more expensive repairs will be required at a later date.

The sidewalls of the conduit that passes thru the embankment is in poor condition particularly at about the water line. Erosion in the masonry has become quite deep. The earth embankment of the dam was found to be in satisfactory condition.

. . . . . .

Respectfully submitted,

George H. McDonnell
County Hydraulic Engineer

GHM/mg

CD Springfield
November 2, 1965

The Hon. the Board of County Commissioners
52 State Street
Springfield, Massachusetts

Gentlemen:

The undersigned has completed the inspections of all dams within the City of Springfield. Every dam within Springfield has been inspected at least once during the year 1965. The following is a report on the general condition noted at each of the dams in the City of Springfield.

. . . . . .

C. Forest Park Upper Dam

This dam is in very good condition. The stone and concrete masonry of the spillway and abutment areas has been completely repaired. Missing cap stones have been replaced.

The large arch culvert that passes thru the embankment has had the eroded side walls repaired with new concrete. At the discharge end of the culvert the side retaining walls have been rebuilt and are in excellent condition.

The embankment is in very good condition. Water level in storage was at the spillway crest. This dam was considered safe when inspected.

. . . . . .

Respectfully submitted,

George H. McDonnell
County Hydraulic Engineer

GHM/mbf

CD Springfield
December 27, 1967

The Hon. the Board of County Commissioners
52 State Street
Springfield, Massachusetts

Gentlemen:

The undersigned has completed the inspections of all dams situated within the City of Springfield. Every dam within Springfield has been inspected at least once during the year 1967. The following is a report of the general condition noted at each of the dams in the City of Springfield.

. . . . . .

C. Forest Park Upper Dam

This spillway was found to be in very good condition. The crest was okay and no flashboards were in place. Water was overflowing the spillway. Masonry repairs completed a few years ago are standing up very well.

The arch conduit through the embankment was in good condition. The concrete construction on the face of each side wall of the conduit placed at the time of the repair work a few years ago, was found to be in very good condition.

The earth embankment was satisfactory. The toe area was okay and the roadway over the top of the embankment was good.

This dam was considered safe when inspected.

. . . . . .

Respectfully submitted,

George H. McDonnell
County Hydraulic Engineer

GHM/amd

GEORGE H McDONNELL
PHILIP W SHERIDAN
EDWARD J BAYON

TIGHE & BOND CONSULTING ENGINEERS

CIVIL SANITARY AND ELECTRICAL ENGINEERING
INVESTIGATIONS REPORTS PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION AND OPERATION

BOWERS AND PEQUOT STREETS
HOLYOKE MASSACHUSETTS
TEL JEFFERSON 3-399

CD Springfield
December 2, 1969

The Honorable the Board of County Commissioners
52 State Street
Springfield, Massachusetts

Gentlemen:

The undersigned has completed the inspection of every dam situated within the City of Springfield. The dams within Springfield have been inspected at least once during the calendar year 1969. The following is a report on the general condition noted at each of the dams coming under County jurisdiction.

C. Forest Park Upper Dam

The curved spillway at this dam was noted to be o.k. Masonry was satisfactory and water level on the day of inspection was overflowing the crest. There were no flashboards on the crest. There were no flashboards on the crest.

The face of the stone wall just downstream of the spillway and on the upstream side of the embankment, as viewed from the spillway, is eroding at the lower left and a shallow cavity is forming. This condition is not bad as yet. The cavity will be observed during the inspection next year and any extension of the cavity will then be reported to your Board with a recommendation that the Park Commissioners be notified.

The embankment of the dam was o.k. Trees and brush growing from the slopes do not endanger the dam because of the great width of this embankment in relation to its shallow height. The road extending along the top of the dam is in good condition.

The arch spillway conduit and the repaired masonry walls within the conduit were all noted to be in good condition.

In the opinion of the undersigned, this dam is safe.

Respectfully submitted,

George H. McDonnell
County Hydraulic Engineer

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:

City~~Town~~ Springfield. County Hampden. Dam No. 2-7-281-3.

Name of Dam Forest Park Upper Dam "Porter Lake".

Topo Sheet No. 12 D. Coordinates: N 393,000 (Mass. Rect.), E 309,400.

Inspected by: R. C. Galls, P.E., On Jan. 29, 1974. Date Last Inspection Dec. 2, 1969

2. OWNER/S: As of November 1942

per: Assessors X, Reg. of Deeds ____, Prev. Insp. ____, Per. Contact X.

1. Park Commission
City of Springfield - Park Dept., Forest Park Office, Springfield, Mass.
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.

Albert Poehler
Deputy Supt. for Maintenance, Park Dept., Forest Park Office, Springfield, Mass.
Name | St. & No. | City/Town | State | Tel. No.

4. DATA:

No. of Pictures Taken None. Sketches See description of Dam.
Plans, Where In Springfield City Engineer's Files - 1919 Plan.

5. DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor ____.
2. Moderate X.
3. Severe ____.
4. Disastrous ____.

Comments: Large culvert under Route I-91 should accommodate released impoundment

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

6. OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: In center of dam - stone masonry with concrete veneer.

Controls_____, TYPE:_____.

Automatic_____. Manual_____. Operative Yes_____, No_____.

Comments:_____.

No. 2 Location and Type: In bottom center of drop inlet arch wall - 42" drawdown pipe through well screw operated 42" valve.

Controls Yes, Type:_____.

Automatic_____. Manual_____. Operative Yes X, No_____.

Comments: Gate block just beyond drop inlet wall in pond. Opened in last 5 years per employee Park Dept.

No. 3 Location and Type:_____.

Controls_____, Type:_____.

Automatic_____. Manual_____. Operative Yes_____, No_____.

Comments:_____.

Drawdown present Yes X, No_____. Operative Yes X, No_____.
Comments: See No. 2 above - size and elev. pipe from 1919 plan.

7. DAM UPSTREAM FACE: Slope 2:1, Depth Water at Dam 10 Stone.

Material: Turf_____. Brush & Trees X. Rock fill___. Masonry___.Wood___.

Other_____.

Condition: 1. Good_____. 3. Major Repairs_____.

2. Minor Repairs X. 4. Urgent Repairs_____.

Comments: General brush, numerous trees 4" to 24" diameter trees on slope south of drop inlet. Vertical stone masonry face wall north of drop inlet.

8. DAM DOWNSTREAM FACE: Slope 2:1.

Material: Turf_____. Brush & Trees X. Rock Fill_____. Masonry_____. Wood_____.

Other_____.

Condition: 1. Good_____. 3. Major Repairs_____.

2. Minor Repairs X. 4. Urgent Repairs_____.

Comments: General brush - numerous trees 4" to 24" diameter. Erosion around outlet of brick arch. Bit. roadway on top embankment - surface erosion on slopes where berms broken.

(9.) EMERGENCY SPILLWAY: Available No. Needed _____.

Height Above Normal Water _____ Ft.

Width _____ Ft. Height _____ Ft. Material _____.

Condition: 1. Good _____. 3. Major Repairs _____.

2. Minor Repairs _____. 4. Urgent Repairs _____.

Comments: _____

_____.

(10.) WATER LEVEL AT TIME OF INSPECTION: 7± Ft. Above _____. Below X.

Top Dam X F.L. Principal Spillway _____.

Other _____.

Normal Freeboard 7 Ft.

(11.) SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment Yes - see Items 7 and 8.

Animal Burrows and Washouts None located.

Damage to Slopes or Top of Dam Yes - see #8 above.

Cracked or Damaged Masonry Yes. On south end upstream head wall spalled away 6 to 8" deep. Horizontal crack in top brick arch culvert, entire length.

Evidence of Seepage Unknown. Back water Fountain Lake 5 ft. above toe slope.

Evidence of Piping Unknown. Back water Fountain Lake 5 ft. above toe slope.

Leaks Unknown.

Erosion See Item 8.

Trash and/or Debris Impeding Flow None.

Clogged or Blocked Spillway No.

Other _____

DAM NO. 2-7-281-3

12. OVERALL CONDITION:

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

   Recommend removal from inspection list_____.

---

13. REMARKS AND RECOMMENDATIONS: (Fully Explain)

This earth embankment dam has existed for at least fifty-five years and possibly longer. The date 1919 is inscribed on the masonry of the downstream outlet structure. It impounds a rather large lake "Porter Lake in Forest Park." Porter Lake Drive, a paved park roadway, runs across the embankment. The side slopes have considerable surface erosion where the berm of the roadway are broken allowing the surface runoff to concentrate. This erosion is particularly noticeable in the vicinity of the downstream end of the spillway conduit.

The large stone masonry semicircular drop inlet located near the center of the dam was in satisfactory condition at the time of inspection. Water was flowing over the crest and was 2½ feet deep on the bottom of the inlet. The stone wall forming the embankment side of the drop inlet and head wall for the brick arch culvert is spalled and a portion of the face, roughly 6 feet by 8 feet, has fallen away to a depth of 6 to 8 inches. There appears to be seepage thru the wall here from the embankment behind.

The 10 foot brick arch culvert spillway conduit from the drop inlet through the embankment has good alignment and grade. Concrete haunches at the base of the sidewall appear to be of fairly recent origin and prevent wear along the water line of the culvert. There is a horizontal crack the entire length of the culvert at the crown of the arch but there is no noticeable displacement in the structure.

No evidence of seepage or leakage through the earth embankment was found but the back water from the impoundment of the middle dam was in some places five foot deep at the toe of this embankment.

Because of the width and massive nature of the embankment, the growth of trees and brush on the slopes should not affect the stability of the embankment as a whole.

RCS/JS/vk

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:

City/Town Springfield. County Hampden. Dam No. 2-7-201-3

Name of Dam Forest Park Upper Dam "Porter Lake".

Topo Sheet No. 12 D. Mass. Rect. Coordinates: N 393,000, E 309,400.

Inspected by: Harold T. Shumway, On Feb.9,1976. Date Last Inspection 1/29/74

2. OWNER/S: As of February 9, 1976

per: Assessors____, Reg. of Deeds____, Prev. Insp. X, Per. Contact X.

1. Park Commission City of Springfield, Park Dept., Forest Park Office, Springfield, Mass.
   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.

Albert Poehler
Deputy Supt. for Maintenance, Park Dept., Forest Park Office, Springfield, Mass
Name | St. & No. | City/Town | State | Tel. No.

4. DATA:

No. of Pictures Taken None. Sketches See description of Dam.
Plans, Where In Springfield City Engineer's Files - 1919 Plan.

5. DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor_____.
2. Moderate X.
3. Severe_____.
4. Disastrous_____.

Comments: 58 ± million gallons impoundment - could damage 2 dams downstream plus other park facilities.

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

6. OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: Center of dam - stone masonry arced D.I. spillway with concrete veneer - outlet is 9'W.x 7½'H. arched brick culvert.

Controls none TYPE: _____.

Automatic____. Manual____. Operative Yes____, No____.

Comments: Most of veneer has peeled away from stone masonry wall on inside of drop inlet.

No. 2 Location and Type: In bottom center of arced D.I. - 42" dia. drawdown pipe

Controls yes, Type: Screw operated 42" gate valve.

Automatic____. Manual X. Operative Yes X, No____.

Comments: Gate block just upstream of drop inlet wall. - Controls operable per Park Dept. personnel.

No. 3 Location and Type: _____.

Controls____, Type: _____.

Automatic____. Manual____. Operative Yes____, No____.

Comments: _____.

Drawdown present Yes X, No____. Operative Yes____, No____.
Comments: See No. 2 above.

7. DAM UPSTREAM FACE: Slope 2:1, Depth Water at Dam 10'.

Material: Turf X. ~~Brush~~ Trees X. Rock fill____. Stone Masonry X. Wood____.

Other Vertical stone masonry facewall north of drop inlet.

Condition: 1. Good____. 3. Major Repairs____.

2. Minor Repairs X. 4. Urgent Repairs____.

Comments: Concrete veneer on inside of drop inlet peeled on 80% of surface. Numerous 6" to 28" trees growing on slope. Minor erosion from surface run-off from roadway along top of dam.

8. DAM DOWNSTREAM FACE: Slope 2:1.

Material: Turf X. Brush & Trees X. Rock Fill____. Conc. Masonry X. Wood____.

Other _____.

Condition: 1. Good____. 3. Major Repairs____.

2. Minor Repairs X. 4. Urgent Repairs____.

Comments: Medium brush growth - many trees of various sizes - Erosion gullies in several areas where roadway berm is broken away allowing surface run off to wash down the slope.

(9.) EMERGENCY SPILLWAY: Available No . Needed No .

Height Above Normal Water Ft.

Width Ft. Height Ft. Material

Condition: 1. Good . 3. Major Repairs .

2. Minor Repairs . 4. Urgent Repairs .

Comments: Drop inlet and arched culvert appear to have been adequate to carry runoff for many years - top of embankment is a paved roadway 7 feet above normal water level.

(10.) WATER LEVEL AT TIME OF INSPECTION: 6 3/4 Ft. Above . Below X .

Top Dam X F.L. Principal Spillway .

Other .

Normal Freeboard 7 Ft.

(11.) SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment yes - see items #7 and #8

Animal Burrows and Washouts None noted

Damage to Slopes or Top of Dam yes-small erosion gullies from surface/ runoff.

Cracked or Damaged Masonry Most of concrete veneer on inside surface of arched culvert runs entire length of culvert. yes-drop inlet gone - crack in top of brick

Evidence of Seepage None found

Evidence of Piping None found

Leaks None found

Erosion yes - erosion gullies on both upstream and downstream slopes.

Trash and/or Debris Impeding Flow None found

Clogged or Blocked Spillway None found

Other .

DAM NO. 2-7-281-3

(12.) OVERALL CONDITION:

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

   Recommend removal from inspection list_____.

(13.) REMARKS AND RECOMMENDATIONS: (Fully Explain)

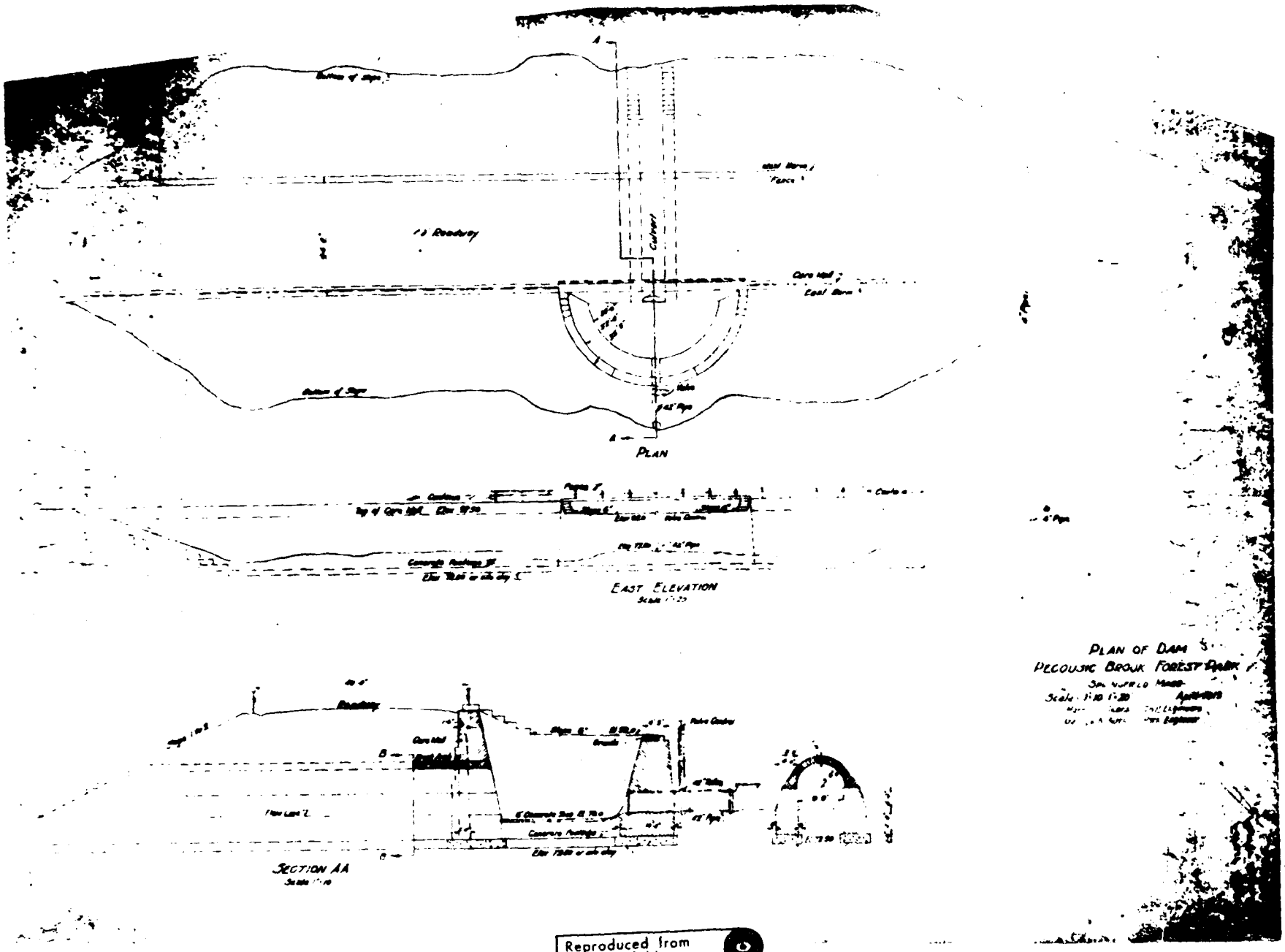
Most of the brush growth on the upstream slope appears to have been removed, with only an occasional shrub remaining. Many trees of 6 inch to 20 inch diameter were noted growing along slope but due to the width of embankment these trees do not appear to pose a hazard to safety of dam. Minor erosion along slope from surface runoff was noted. The concrete veneer on the inside wall of drop inlet has peeled off over approx. 80% of surface. This veneer appeared to be mostly of aesthetic value and does not affect the stability of drop inlet. The horizontal crack in the crown of the arched culvert noted in last inspection is still evident but grade and alignment of culvert appear good.

On the downstream slope a brush growth was noted along with numerous trees of various sizes. Erosion gullies were noted in areas where roadside berm at top of slope was broken, allowing concentrations of surface water to course down the slope. These gullies are still of minor size but repairs now would prevent further erosion of slope. These conditions were noted in last inspection of January 29, 1974 and do not appear to have been corrected since then.

No evidence of seepage or leaks were found but the backwater from impoundment of the middle dam covered toe of slope to a depth of 2' to 3' all along bottom of embankment.

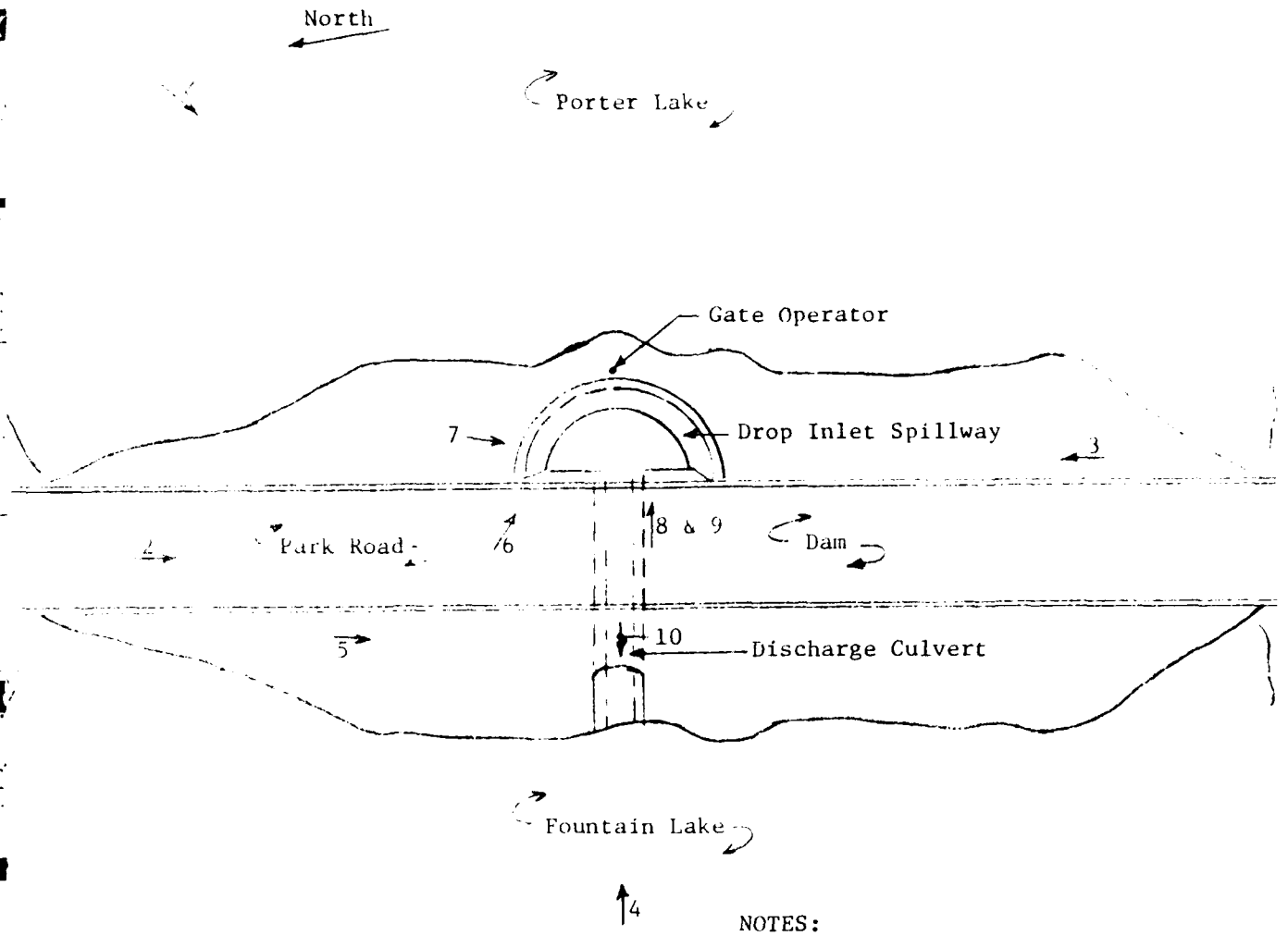
Dam appeared to be safe and sound at time of inspection with only minor repairs listed above noted.

HTS/bk



APPENDIX C

SELECTED PHOTOGRAPHS OF PROJECT



NOTES:

1. PLAN BASED ON APRIL 1919 DESIGN DRAWINGS AND CDM FIELD OBSERVATIONS.
2. ← 1 DENOTES PHOTOGRAPH NUMBER AND DIRECTION OF VIEW.

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

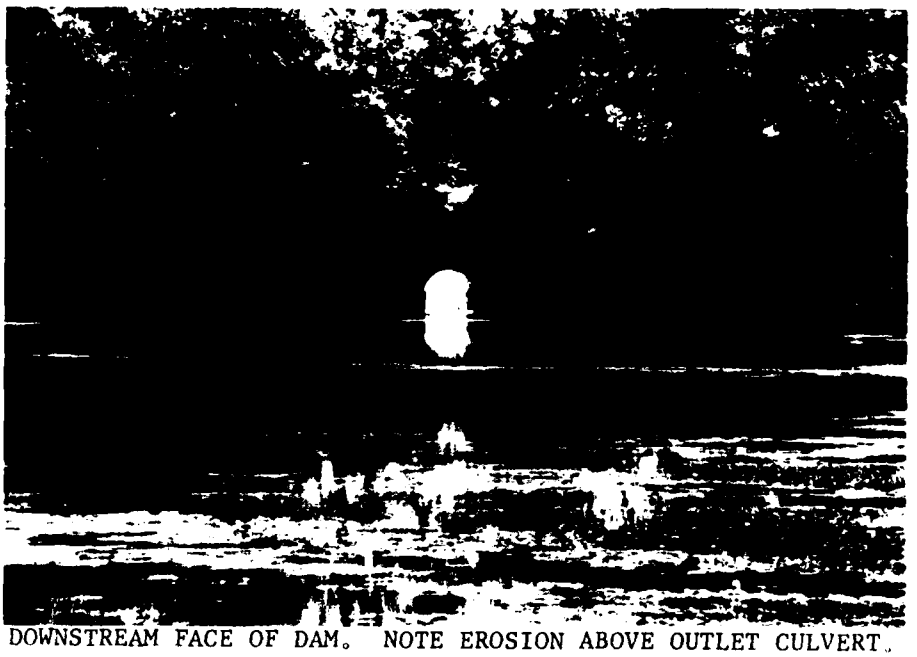
LOCATION OF PHOTOGRAPHS

FOREST PARK UPPER DAM — SPRINGFIELD, MASSACHUSETTS

Scale: Not To Scale

Date: Sept. 1979

3. UPSTREAM FACE OF DAM FROM LEFT ABUTMENT.



4. DOWNSTREAM FACE OF DAM. NOTE EROSION ABOVE OUTLET CULVERT.

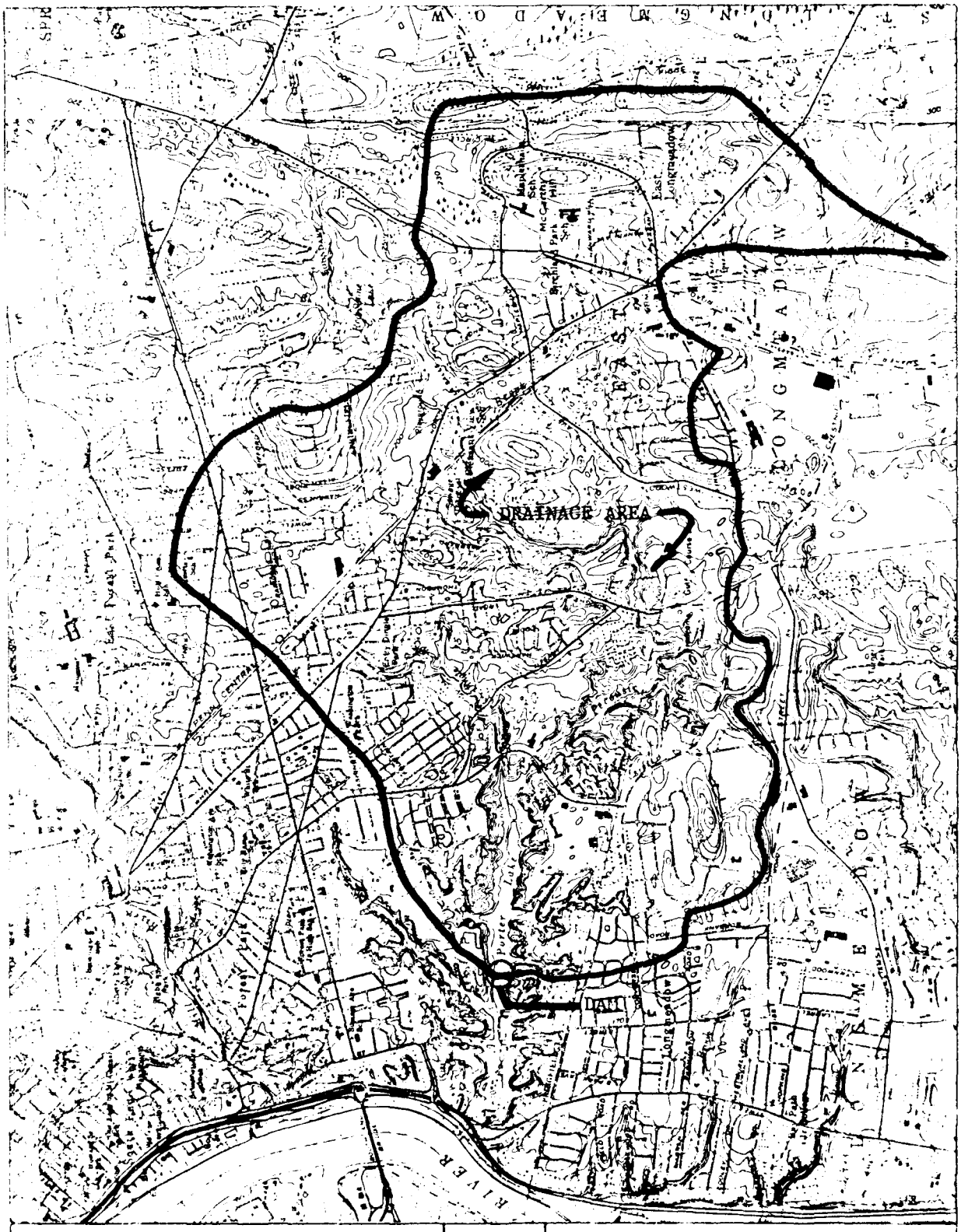
PARTIALLY UPROOTED TREE ON DOWNSTREAM FACE OF DAM

OVERVIEW OF SPILLWAY AT UPSTREAM FACE OF DAM

[illegible] AT UPSTREAM FACE OF DAM AT SPILLWAY AREA AND ENTRANCE TO OUTLET CULVERT.

RESERVOIR DRAIN OPERATOR UPSTREAM OF SPILLWAY. NOTE [illegible] AT BOTTOM RIGHT OF PHOTO.

OVERVIEW OF UPSTREAM POND WITH PORTION OF SPILLWAY CREST AND [illegible] GRATE OPENINGS IN FOREGROUND



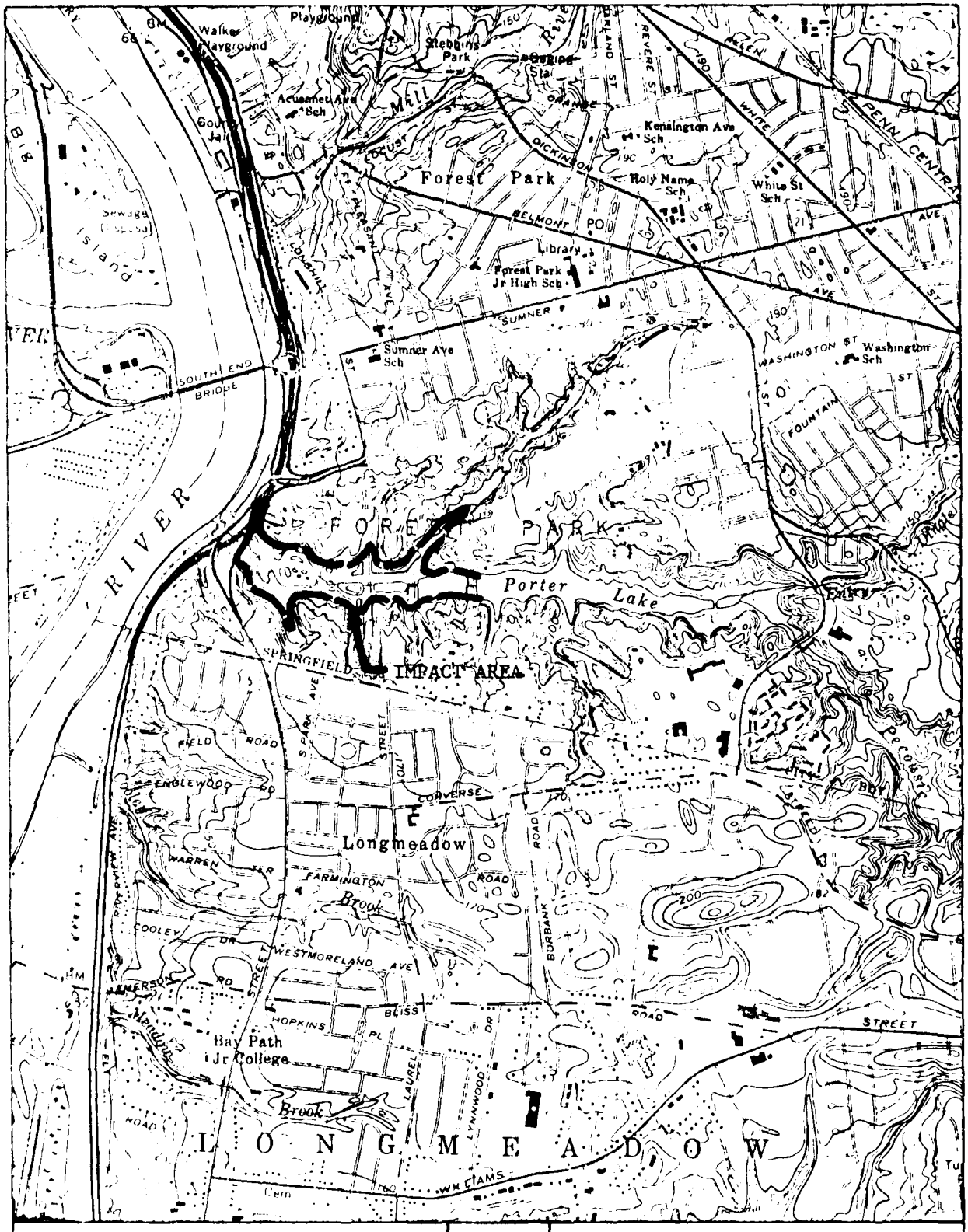
FOREST PARK UPPER DAM

LOCATION NO. MA 00568

DRAINAGE AREA MAP

APPROX. SCALE: 1" = 3125'

APPENDIX D-1



DAM FOREST PARK UPPER DAM

IDENTIFICATION NO. MA 00568

DAM FAILURE
IMPACT AREA MAP

APPROX. SCALE: 1" = 2000'

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass

CLIENT COE
PROJECT Dam Inspection
DETAIL Forest Park Upper Dam

JOB NO 380-6-RT-7
DATE CHECKED 9-17-79
CHECKED BY JED

PAGE 1
DATE 8-16-79
COMPUTED BY I.R.A

ELEVATIONS

Spillway Crest	92.0
U/S Culvert Invert	78.0
D/S Culvert Invert	78.0
Toe of Dam	77.0
Crest of Dam	100.0

AREAS

Drainage Area = 3682 acres = 5.75 sq. mi. of which 1 percent is artificially ponded water

Water Surface Areas:

@ Elevation 90.0 → 42.2 acres
" " 92.0 → 47.5 acres (Spillway Crest)
" " 100.0 → 68.0 acres
" " 110.0 → 90.9 acres

VOLUMES

From State Description of Dam

@ Spillway Crest Elevation (92.0) = 58.5 Million Gallons
= 180 acre-feet

@ Elevation 100 = $180 + \left(\frac{47.5+68.0}{2}\right) \times 8 = 642$ ac-ft

@ Elevation 110 = $642 + \left(\frac{68+90.9}{2}\right) 10 = 1936$ ac-ft

TEST FLOOD DETERMINATION

The dam size is "small" based on a height of 23 feet and a storage of 642 ac-feet. The hazard is "significant" based on the "Dam Failure Analysis" shown on page .

Therefore, based on NED Corps of Engineers Guidelines, the Test Flood for Forest Park Upper Dam is:

Test Flood = 100 yr to 1/2 PMF

Adopted Test Flood = 1/4 PMF

The drainage area is 5.75 square miles of varied topography. The northwest section cuts through the city of Springfield which is heavily developed and flat. The remainder of the watershed is also flat but much less developed and heavily forested in sections. Determine the magnitude of the test flood based on a point 1/3 the way between the "Flat & Coastal" and the "Rolling" curves presented in the NED Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations" March 1978.

$$\text{Test Flood} = 1/4\,PMF = 1/4\left(1150\,\frac{cfs}{sq.mi.} \times 5.75\ sq\ mi\right) = 1,653\ cfs$$

say 1,650 cfs

STAGE-DISCHARGE RELATIONSHIP + TAILWATER ANALYSIS

The spillway discharge is heavily influenced by tailwater due to the limited capacity of the culvert under the dam which must carry the spillway discharge. The culvert discharge is somewhat influenced by tailwater from a dam-culvert located about 600 feet downstream which is also influenced by a downstream dam. Thus, the tailwater analysis will be done in conjunction with the stage-discharge relationship.

A plan and a "SECTION" sketch of the Forest Park (upper) Dam and the downstream hydraulic control is shown on the next page. Also shown is the profile of the Forest Park (Upper) Dam.

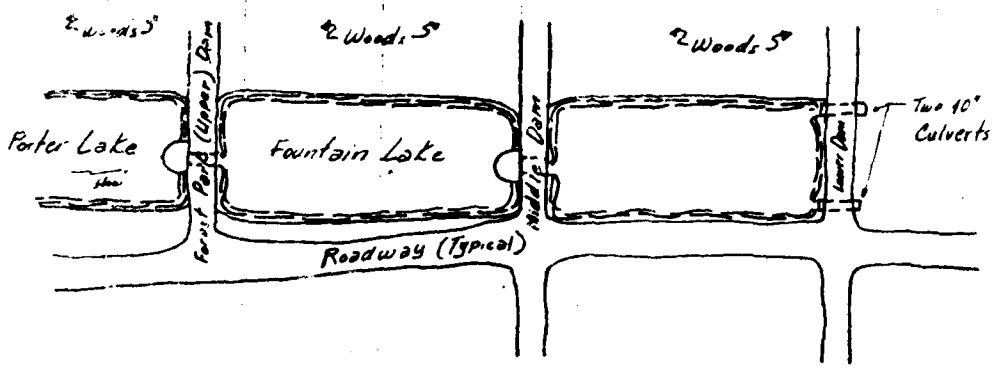
The profile of the middle dam or Fountain Lake Dam is shown on page 4.

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

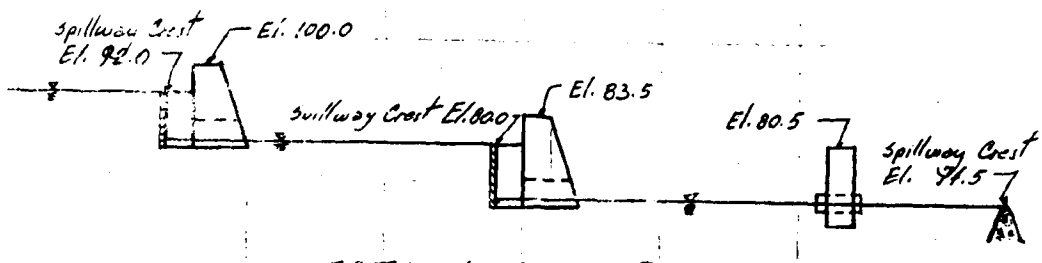
CLIENT COE
PROJECT Dam Safety Insp
DETAIL Forest Park (Upper) Dam

JOB NO 380-6-RT-6
DATE CHECKED 9-17-79
CHECKED BY JED

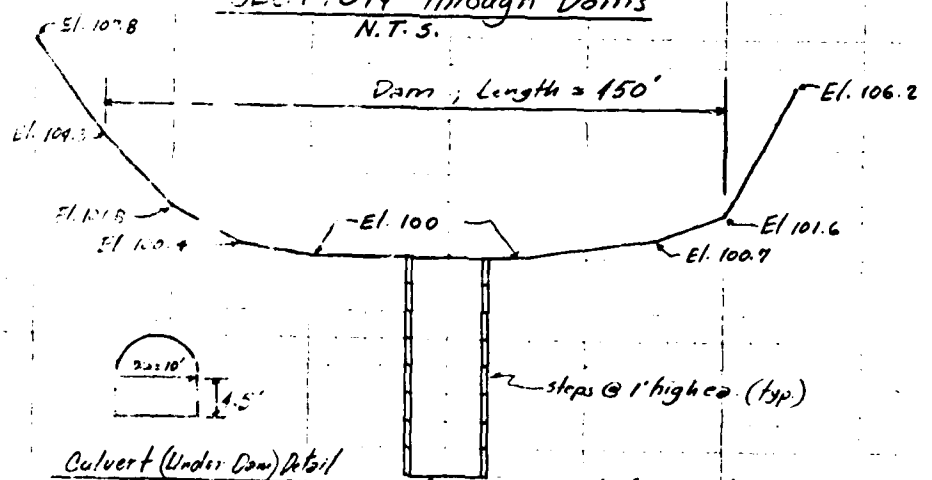
PAGE 3
DATE 9-5-79
COMPUTED BY Joe H.



PLAN of Forest Park (Upper) Dam and Lower Ponds and Dams
N.T.S.



SECTION Through Dams
N.T.S.



Culvert (Under Dam) Detail

Effective spillway weir length varies with height due to steps

PROFILE of Forest Park (Upper) Dam
Scale: Hor. 1" = 100', Vert. 1" = 5'

APPENDIX D-5

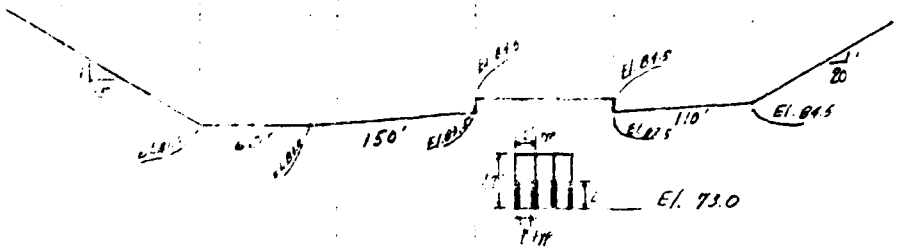
CAMP DRESSER & McKEE
Environmental Engineers
Boston Mass

CLIENT COE
PROJECT Dam Safety Insp
DETAIL Forest Park (Upper) Dam

JOB NO 330-6-RF-7
DATE CHECKED 9-17-79
CHECKED BY JED

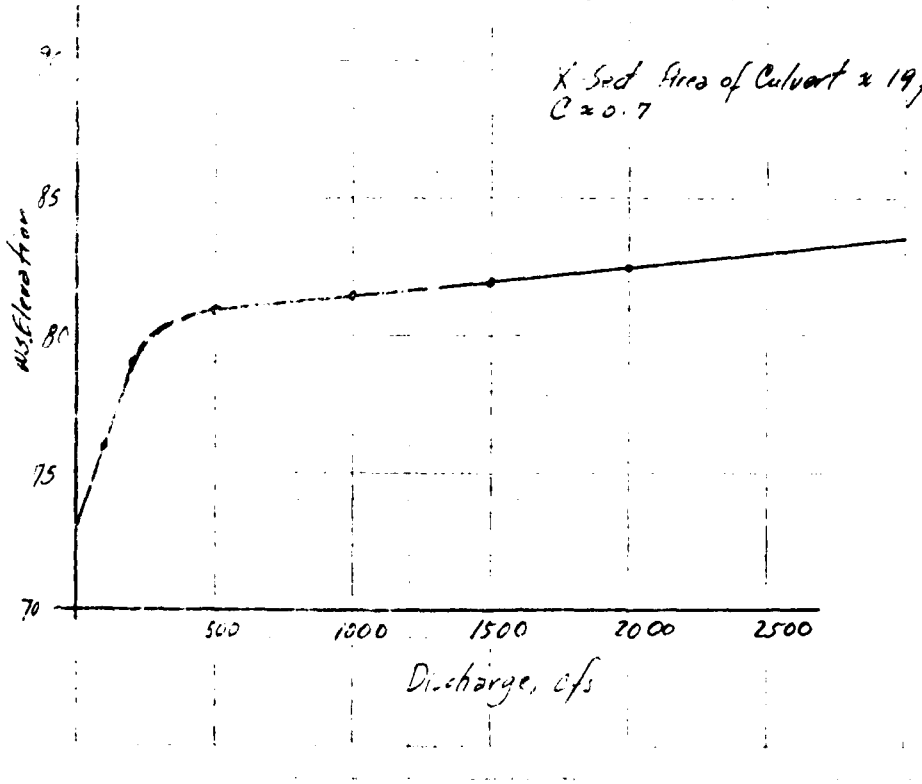
PAGE 4
DATE 9-5-79
COMPUTED BY Joe H.

Profile of Middle Dam (Not To Scale)



Determine backwater profile for the dam system:

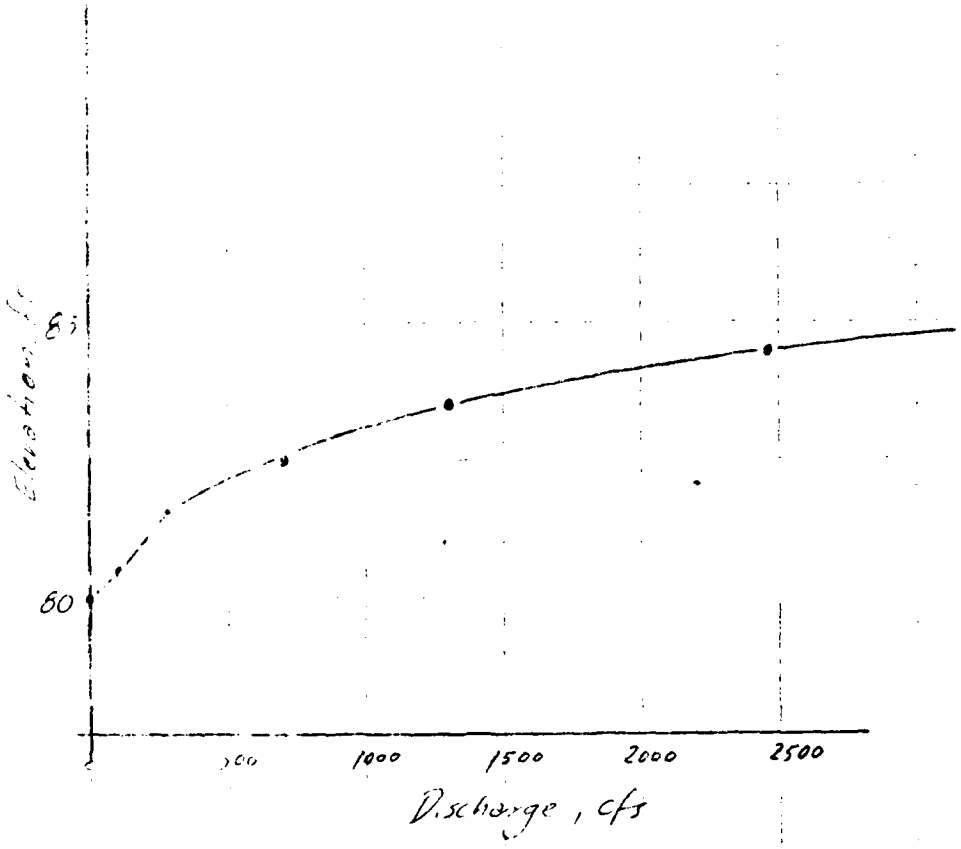
Estimated Rating Curve for LOWER DAM



Rating Curve for Middle Dam

- Culvert X-Sect Area = 22 sq. ft.
- C value for culvert = 0.85
- Over-the-road discharge based on geometry shown on page 4 and a weir coeff of 2.8

W.S. El.	Culvert Discharge	Weir Discharge	Total Discharge
80.5	100	0	100
81.6	190	100	290
82.5	185	515	700
83.5	185	1120	1305
84.5	185	2250	2435



[illegible] Relationship for Forest Park (UPPER) Dam

Upstream W.S. El. (N.G.V.D.)	Spillway Discharge C	L	Q_s	Culvert Discharge[1] Q_c	Actual Total Discharge cfs
[illegible]			ZERO		ZERO
[illegible]	[illegible]	[illegible]	83		83
[illegible]	[illegible]	96	248		248
[illegible]	[illegible]	94	798		798
[illegible]				1800	1475 (interpolated)
[illegible]	[illegible]	96	(1646×0.93)[2]		1533
[illegible]				1850	1850
[illegible]				1900	1900
[illegible]				2000	2000
[illegible]				2100	2100
[illegible]				2150	2150

[illegible] of Roadway Elevation (see page 3)

Notes:

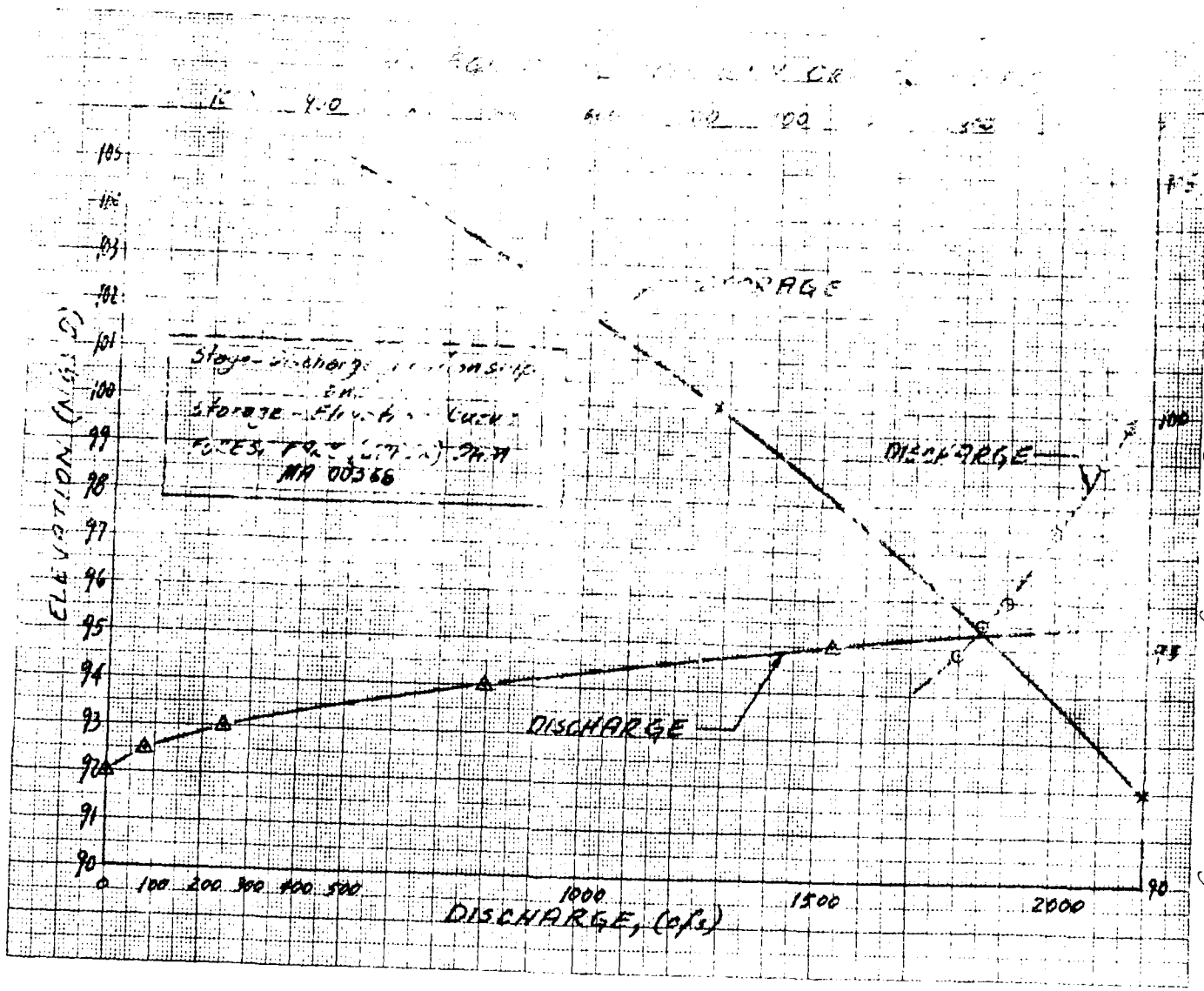
1. Culvert Discharge, $Q_c = CA\sqrt{\dfrac{2g\Delta h}{1 + \dfrac{29C^2n^2L}{R^{4/3}}}}$

where $C = 0.85$; $A = 84$ sq. ft., $R = \frac{84}{35}$

$n = 0.013$; $L \approx 90$ ft

Q = cfs is chosen to solve for Δh

2. The factor of 0.93 accounts for the fact that the spillway is [illegible] flooded by tailwater at [illegible] discharge [illegible] stage


ELEVATION (MSL)
DISCHARGE, (c.f.s.)
DISCHARGE
DISCHARGE
105
104
103
102
101
100
99
98
97
96
95
94
93
92
91
90
0
100
200
300
400
500
1000
1500
2000

SURCHARGE-STORAGE ROUTING

1/2 Test Flood Inflow, Q_{P_1} = 4650 cfs (see page 2 for Test Flood Determination)

Surcharge Height to pass Q_{P_1} is El. 95.10

$STOR_1 = \frac{\text{Surcharge Storage}}{\text{Drainage Area}} = \frac{162 \text{ acre-ft} \times 12 \text{"/ft}}{3682 \text{ acres}} = 0.528$ inches

Probable Maximum Runoff, $Q_{P_1} = Q_{P_1}\left(1 - \frac{STOR_1}{4.75}\right) = 1{,}650\left(1 - \frac{0.528}{4.75}\right) = 1467$ cfs

Surcharge Height to pass Q_{P_2} is elevation 94.9

$STOR_2 = \frac{152 \times 12}{3682} = 0.495$ inches

$STOR_{AVG} = \frac{0.528 + 0.495}{2} = 0.51$ inches

$Q_{P_3} = 1{,}650\left(1 - \frac{0.51}{4.75}\right) = 1{,}473$, say 1,475 cfs

Surcharge Height to pass Q_{P_3} is elev. 94.9

Test Flood Inflow = 4,650 cfs

Routed Test Flood Outflow = 1,475 cfs

Surcharge El. to Pass Routed Test Flood Outflow = 94.9

Test Flood Tailwater Elevation = 91.3 at U/S end of spillway conduit.

OTHER KEY DISCHARGES

Spillway discharge at top of Dam = 2,160 cfs (interpolated) (Top of Dam @ elev. 100.0)

Spillway discharge at Test Flood El. (94.9) = 1,475 cfs.

Outlet Works Capacity at Test Flood El. = $Q = CA\sqrt{2g\Delta h}$

where $C = 0.8$; $A = \frac{\pi D^2}{4} = \pi \frac{4^2}{4} = 12.6$ sq. ft; $\Delta h = 94.9 - \left(83.8 + \left(\frac{1500}{0.85 \times 84}\right)^2 \frac{1.1}{64.4}\right)$
$= 94.9 - 91.3$

$Q = 0.8 \cdot 12.6\sqrt{64.4 \times 3.6} = 153$ cfs say 150 cfs

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT COE JOB NO 380-6-RT-7 PAGE 9
PROJECT Dam Inspection DATE CHECKED 9-17-79 DATE 8-16-79
DETAIL Forest Park Upper Dam CHECKED BY JED COMPUTED BY JRA

DAM FAILURE ANALYSIS

Forest Park (Upper) Dam is an earth embankment project.

Assume that in the event of a failure, 40 percent of the width of the dam measured at the mid-height of the dam would fail.

Based on COE guidelines, the dam failure outflow would be:

$$Q_p = \frac{8}{27}(32.2)^{0.5}(Y_o)^{1.5}(W_b) = \text{cfs}$$

where: Y_o = height of dam measured from D/S of toe of dam to crest of dam = 23 ft

W_b = 40 percent of dam width measured at mid-height
= 450 x 0.4 = 180 ft

$$\therefore Q_p = \frac{8}{27}(32.2)^{1/2}(23)^{1.5}(180)$$

$$= 33,380 \text{ cfs}$$

say 33,400 cfs

CAMP DRESSER & McKEE INC.

CLIENT COE
PROJECT Dam Inspection
DETAIL Forest Park Upper Dam

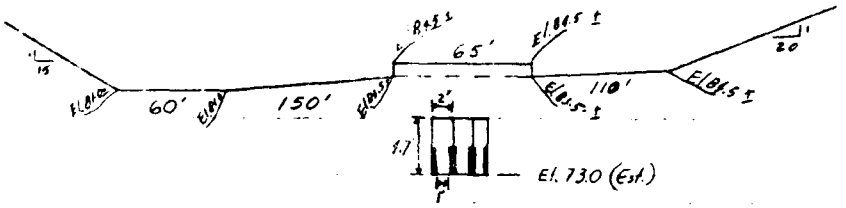
JOB NO 360-6-RT-7
DATE CHECKED 9-17-79
CHECKED BY JED

PAGE 10
DATE 8-16-79
COMPUTED BY IRA

REACH 1: Upper Forest Park (Porter Lake) Dam to Middle Dam also known as Fountain Lake Dam.

Estimated X-Section Profile:

Note. All Elev. are Estimated.



Pool	Orifice flow, cfs C = 0.7	Weir Flows, cfs C = 2.8	Total Flow, cfs.
88.5	350	20,200	20,550
??	400	50,200	50,600

Pool at top of dam ≈ 90.6', which is equivalent to 7± feet of water over the Centerline

With 20 inch water flowing over the dam, the dam would probably fail and increase the dam failure outflow downstream by about 7,000 cfs $(8/27(32.2)^{1/2}(10)^{1.5}(325x0.4))$

Reach 2: Middle Dam to Interstate 91 Highway Embankment

The culvert under the highway flowing into the Connecticut River has dimensions of 12'x16'. It has very small relative capacity, therefore the highway embankment will basically act as a dam storing the water contained in the Upper and Middle reservoirs.

- Compute Storage in the Upper and Middle dams at time of failure. Assume WSEL at crest of dam in each reservoir.

Storage in Upper Dam:

WSEL, ft	Area, acres	Storage, acre-ft.
Spillway Crest (EL 92.0), Based on State Insp. Report		180
100	68	$180 + \left(\frac{68+47.5}{2}\right) \times 8 = 642$ ac-ft

∴ With WSEL at Crest of Dam (WSEL 100.0), Storage = 642 ac-ft

Storage in Middle Dam:

WSEL, ft	Area, acres	Storage, acre-ft
(Spillway Crest (EL 73.0))	4.8	$4.8 \times 3.5 \cong 17$
90	7.2	$17 + 6 \times 10 = 77$
100	8.5	$77 + 7.9 \times 10 = 156$

∴ With WSEL at Crest of Dam (WSEL 81.0), Storage ≅ 23 ac-ft.

reach 2 (cont.)

- Compute Storage Potential U/S of Interstate 91 Highway Embk. and D/s of Middle Dam.

WSEL, ft	Area, acres	Storage, ac-ft
60	1.8	1.8X3 = 5.5
70	14.5	5.5+(8.2x10) = 88
80	28.5	88+21.5x10 = 303
90	47	303+37.8x10= 681

Total Storage U/s of Interstate 91 Highway Embankment:

WSEL, ft	Storage in Upper Reservoir, acft	Storage in Middle Dam, acft	Storage D/s of Middle Dam and U/s of I-91 Embk, acft	Total Storage
70	-0-	-0-	88	88
80	7	17	303	327
90	106	77	681	864

Assuming that the volume of water which will have drained to the Connecticut River, D/s of the Rt. 91 embankment, before the water reaches a pseudo equilibrium state at the U/s face of the roadway embankment is negligible, then we can determine a maximum water surface elevation at the embankment.

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

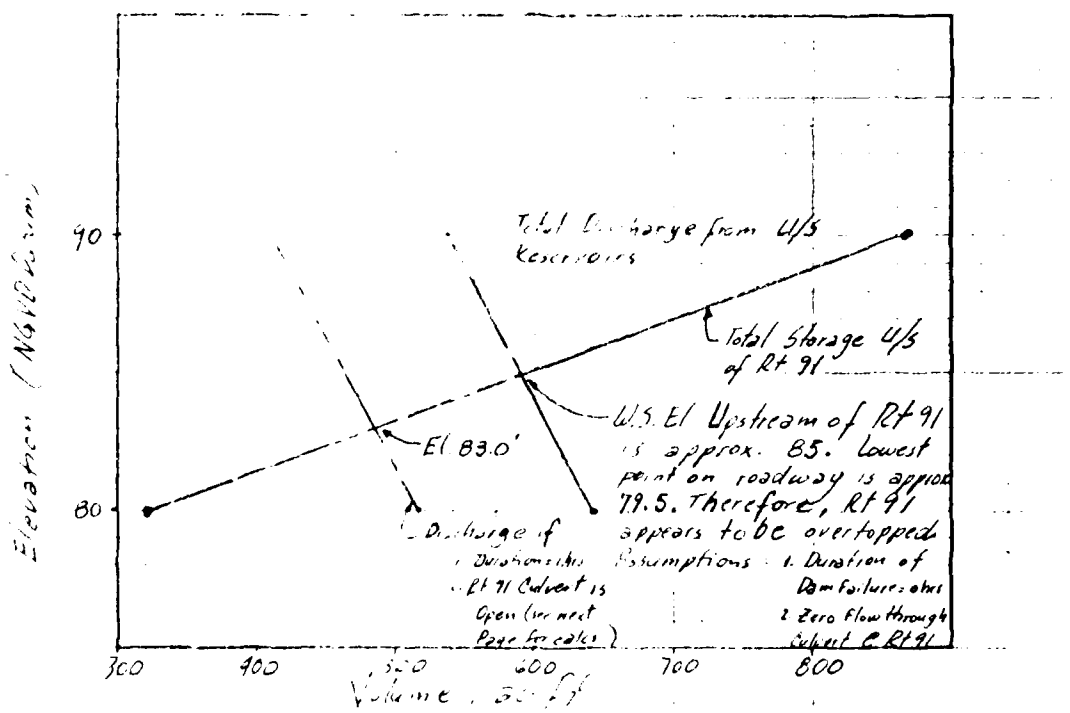
CLIENT COE
PROJECT Dam Inspection
DETAIL Great Park Dam (Upper)

JOB NO 380-6 CT-7
DATE CHECKED 9-17-79
CHECKED BY JED

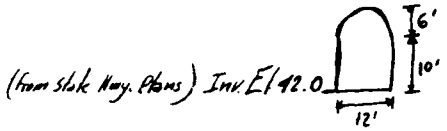
PAGE 13
DATE 6-16-79
COMPUTED BY IRA

Total Volume of Discharge from Reservoirs U/S of Rt 91
Assuming all Dams were Breached

W.S. El in Reservoir	Upper Reservoir	Middle Reservoir	Total
100	0	0	0
90	536	0	536
80	633	6	641
72	642	23	665



The ponded water surface elevation of 85' U/S of Rt 91 assumes zero discharge through the Rt 91 culvert sketched below for the duration of the dam failure:



Culvert Opening @ Rt. 91
N.T.S.

NOW,

Assuming that:

1. Dam Failure Duration = 1 hr
2. Average Velocity through Culvert is 10 fps

then, Volume discharged to the Connecticut River for duration of failure

$$V = Q \cdot t = (10 \text{ fps} \times 150 \text{ ft sq.}) \, 3600 \text{ sec} \times \frac{\text{ac}}{43560 \text{ ft}^2}$$

$$= 124 \text{ ac-ft}$$

Such a volume reduction would drop the W.S. El. at the U/S face of Rt 91 to El 83.0 or about 2' drop per hr. of dam failure duration.

It appears that Rt 91 would probably be overtopped by 3 or more feet of water which would endanger users of the highway. Users of the park would also be endangered. Economic losses would be significant.

∴ Hazard is "significant"

APPENDIX E
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTIFICATION NUMBER	DIVISION	STATE	COUNTY	CONG. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
MA	[illegible]	NED	MA	013	02				FOREST PARK UPPER DAM	4204.4	7234.2	24	SEP	79

POPULAR NAME	NAME OF IMPOUNDMENT
PORTER LAKE DAM	PORTER LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	PECOUSIC BROOK	SPRINGFIELD	0	168785

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)
REPGOT	1919	3	24	23	642	180

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	

REMARKS
PI=WITH COREWALL

U/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	450	U	90	2160												

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF SPRINGFIELD		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
CAMP DRESSER + MCKEE	14	AUG	79	PUBLIC LAW 92-367

REMARKS
32-SPILLWAY WIDTH INCREASES TO 114-FT AT TOP OF DAM

END

FILMED

8-85

DTIC