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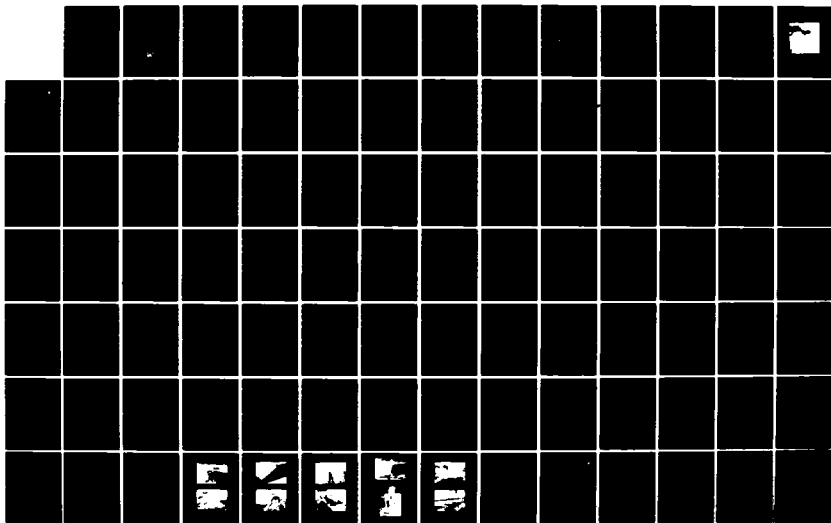
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NEW ENGLAND DIV JUN 80

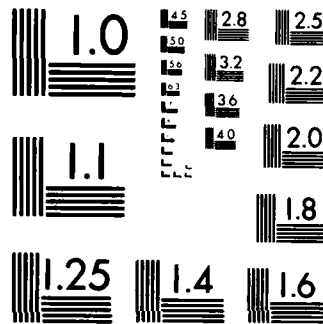
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MERRIMACK RIVER BASIN
WESTMINSTER , MASSACHUSETTS

CROCKER POND DAM
MA 00638

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is a 520 ft. long earthfill embankment. There are deficiencies which must be corrected to assure the continued performance of the dam. Generally the dam is in fair condition. The dam has been classified as intermediate in size with a high hazard potential.		



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

REPLY TO
ATTENTION OF:
NEDED

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

Accession For	
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MAY 19 1981



Dear Governor King:

Inclosed is a copy of the Crocker Pond Dam (MA-00638) 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, James River - Massachusetts, Inc., P.O. Box 310, Fitchburg, Massachusetts 01402.

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,

C.E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CROCKER POND DAM

MA 00638

MERRIMACK RIVER BASIN
WESTMINSTER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00638

Name of Dam: Crocker Pond

Town: Westminster

County and State: Worcester County, Massachusetts

Stream: Whitman River, tributary of the Nashua River

Date of Inspection: May 6, 1980

Crocker Pond Dam is a 520-foot long earthfill dam built in 1933 for storage. The facility has a maximum height of 38.5 feet and includes a spillway, flood gate, gate house and outlet structures. The top of the dam is at Elevation (El) 758.5 (National Geodetic Vertical Datum of 1929). The spillway is a concrete ogee weir, 120-feet long (including the closed flood gate), with the crest at El 750.5. There are five separate outlets for the dam, an 8-foot wide by 12-foot high flood gate, which when closed is part of the spillway; a 42-inch diameter main low level outlet; a 24-inch diameter auxiliary low level outlet; a 3-foot square drain; and a 3-foot square trash chute.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based on the visual inspection of the site and a review of the available data. Generally the dam is in fair condition.

The following deficiencies were observed at the site: spalled, cracked and deteriorated concrete on the east and west approach channel sidewalls, the spillway face, the sidewall between the spillway and the flood gate, the east and west sidewalls of the spillway, and the west face of the gate house; burrow holes and foot paths on the downstream face of the dam; missing stones along the downstream bench of the east section of the dam; logs and debris caught on the spillway weir and trees overhanging the west side of the downstream channel.

Based on Corps of Engineers' guidelines, the dam has been classified on the intermediate size and high hazard categories. A test flood equal to the full probable maximum flood (PMF) was used

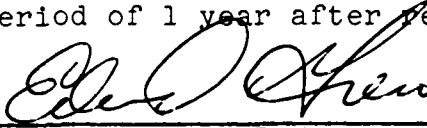
CROCKER POND DAM

to evaluate the capacity of the spillway. The drainage area for Crocker Pond is 20.0 square miles. The test flood inflow is calculated to be 19,500 cubic feet per second (cfs). The test flood outflow is 18,450 cfs with no flashboards in place, which results in a pond level at El 760.7. The test flood outflow is 18,550 cfs with flashboards in place, which increases the pond level to El 762.3. This assumes that the flood gate remains closed during the test flood. The test flood would overtop the dam by 2.2 feet with no flashboards in place and 3.8 feet with flashboards in place. Hydraulic analyses indicate that the spillway without flashboards can discharge 10,500 cfs, or 57 percent of the test flood outflow before the dam is overtopped.. With flashboards, the spillway can discharge 6,300 cfs or 34 percent of the test flood outflow before the dam is overtopped. This assumes that the flood gate remains closed during the test flood.

It is recommended that the Owner employ a qualified registered professional engineer to conduct a more detailed hydraulic and hydrologic study of the spillway; evaluate the deterioration of the concrete on the spillway face, the east and west sidewalls, and the west face of the gate house; and examine the spillway under a no flow condition. The owner should remove the flashboards from the spillway until the investigations are completed. In addition, the Owner should repair the deficiencies listed above, as described in Section 7.3. The Owner should also implement a program of annual technical inspections, a plan for surveillance of the dam during and after periods of heavy rainfall, and a plan for notifying downstream residents in the event of an emergency at the dam.

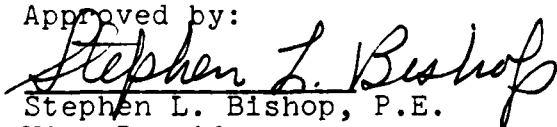
The measures outlined above and in Section 7 should be implemented by the Owner within a period of 1 year after receipt of this Phase I Inspection Report.




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

Massachusetts Registration
No. 29800

Approved by:

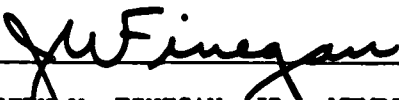

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.



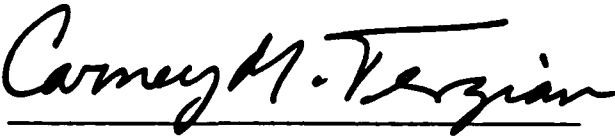
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CROCKER POND DAM

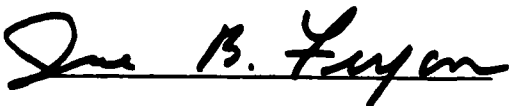
This Phase I Inspection Report on Crocker Pond Dam (MA-00638) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.


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


ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division

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, surface 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 will 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.

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

CROCKER POND DAM

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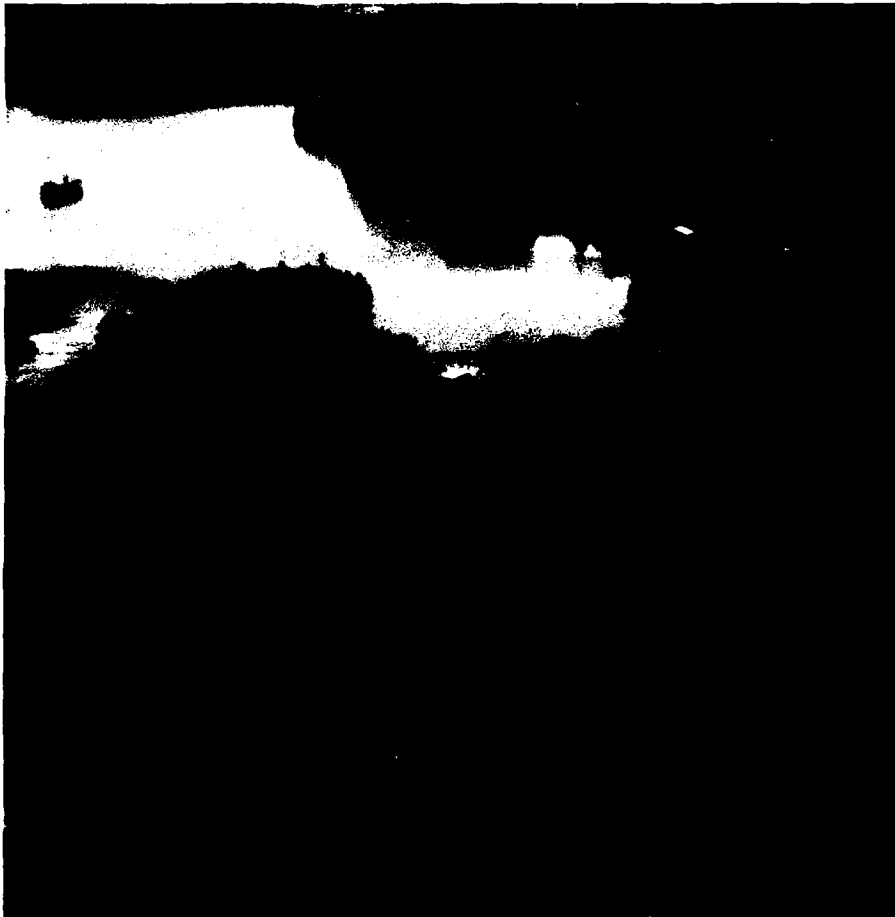
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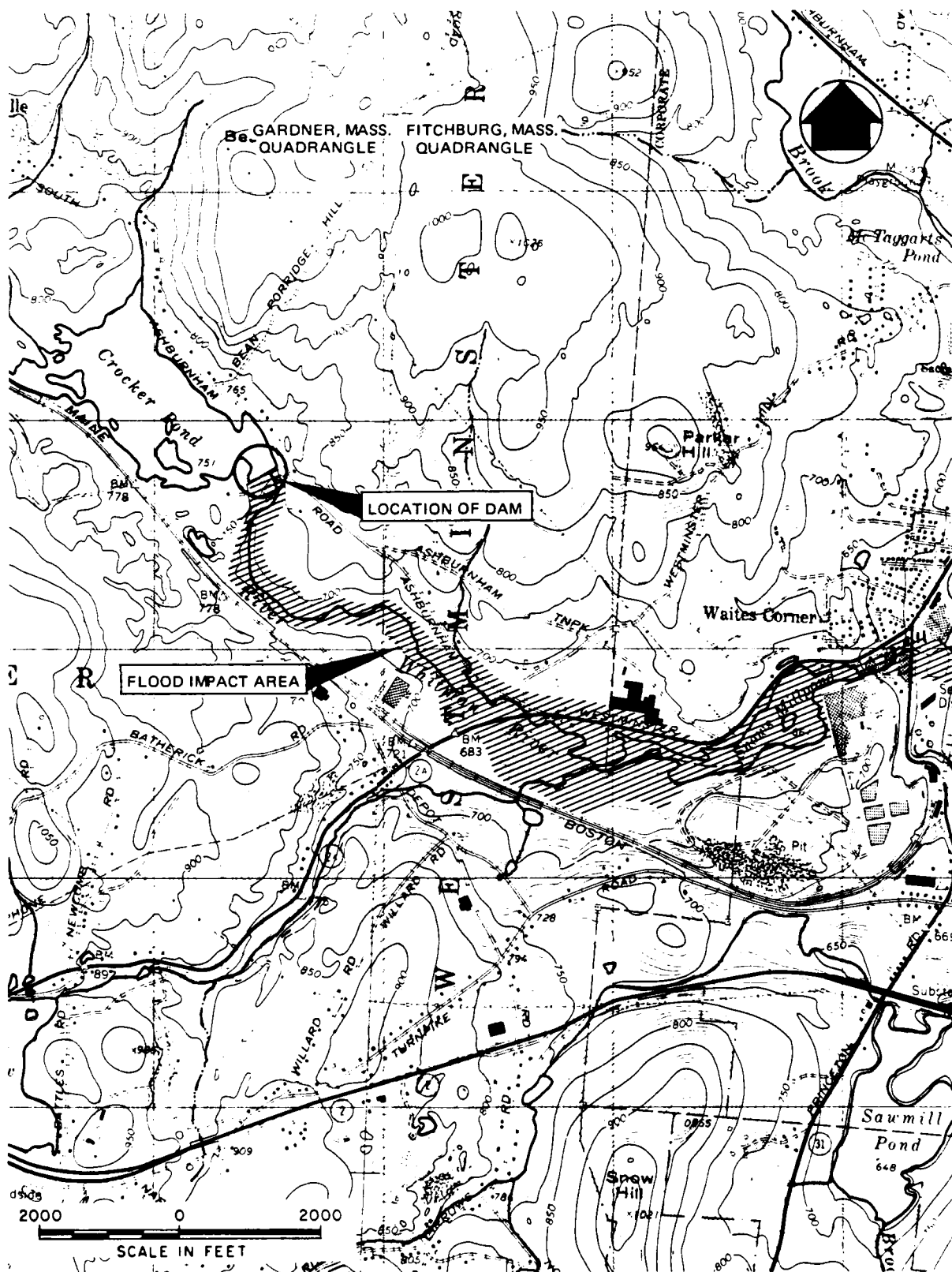
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CROCKER POND DAM

OVERVIEW
CROCKER POND DAM
WESTMINSTER, MASSACHUSETTS





LOCATION MAP - CROCKER POND DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

CROCKER 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 33-80-C-0054, dated April 18, 1980, 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 quickly initiate 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 Whitman River, about 2.1 miles upstream of the confluence with the Nashua River, in the Merrimack River Basin. The dam is in the Town of Westminster, Worcester County, Massachusetts (see Location Map). The coordinates of this location are Latitude 42 deg. 34 min. north and Longitude 71 deg. 53 min. west.

CROCKER POND DAM

- b. Description of Dam and Appurtenances. Crocker Pond Dam is a 520-foot long, earthfill dam with a maximum height of 38.5 feet (see Plan of Dam and Sections in Appendix B and photographs in Appendix C). The top of the dam is 10 feet wide and is at El 758.5. A gate house is located on the top of the dam. The upstream face is riprapped and is a 2.5:1 (horizontal:vertical) slope which changes to a 3:1 (horizontal:vertical) slope below El 738.5. The downstream face is a 1.75:1 grass covered slope to a 2.5-foot wide bench at El 738.5 which then changes to a 2:1 (horizontal: vertical) slope. Available drawings indicate that the dam is a zoned embankment with a concrete central core wall (see Figure B-2). The drawings also show that the spillway and approximately 130 feet of the core wall are founded on bedrock, while the remainder of the core wall is founded in earth (fine sand). Previous inspection reports dated September 8 to December 9, 1932 indicate that the spillway is founded on bedrock with "veins, holes and cracks in the ledge grouted with cement." The drawings do not show a cutoff trench below the base of the dam.

The spillway, which is located near the center of the dam, is a 120-foot long, concrete weir (including the closed flood gate). The approach channel consists of concrete sidewalls. The floor was submerged. Wooden flashboards 1.8 feet high are mounted with steel pins on the crest of the spillway.

The crest of the spillway is at El 750.5, and the top of the flashboards is at El 752.3. The length of the flashboards available for discharge is 120 feet (including the flood gate).

The discharge channel below the spillway is 130 feet wide. The east side is a 6-foot high vertical dry stone masonry wall for a distance of approximately 60 feet downstream. The west side is a natural earth slope. The floor of the channel which is exposed bedrock with several large detached blocks, slopes at approximately 6 percent.

There are five separate outlets for the dam; a flood gate, main low level outlet, auxiliary low level outlet, drain, and trash chute. Table B-1 in Appendix B describes each outlet in detail. Figure B-5 is a schematic drawing showing the location and elevation of each outlet.

CROCKER POND DAM

- c. Size Classification. Crocker Pond Dam has a maximum height of 38.5 feet and a maximum storage capacity of 1,835 acre-feet. The storage capacity places the dam in the "intermediate" size category which ranges from 1,000 to 50,000 acre-feet.
- d. Hazard Classification. There are approximately 3 to 5 houses, 1 school, and 5 factories located along the stream downstream of the dam (see Flood Impact Area shown on the Location Map). The foundations of these structures are approximately 5 feet above the floor of the stream. Failure of the dam would produce a flood wave 14 feet high. In the event of a complete failure of the dam, more than a few lives could be lost and an appreciable amount of property damage could occur. Accordingly, the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by James River - Massachusetts, Inc., P.O. Box 310, Fitchburg, Massachusetts 01420. Mr. Norman Burt (telephone 617-343-3051) granted permission to enter the property and inspect the dam.
- f. Operator. The dam is operated by personnel from James River - Massachusetts, Inc.
- g. Purpose of the Dam. The water in Crocker Pond is used as storage for process water for paper mills owned by James River - Massachusetts, Inc., which are located about 2 miles downstream.
- h. Design and Construction. Construction of the present Crocker Pond Dam was completed in 1933.

Drawings dated June 1932 through August 1933 and prepared by Howard M. Turner, Consulting Engineer are available. The drawings show that the dam was constructed essentially as it appears today.

Previous inspection reports indicate that the dam has been maintained in good condition. Repairs have been made such as replacing the flashboards.

- i. Normal Operating Procedures. Personnel from James River - Massachusetts, Inc. reportedly visit the dam once a month. At that time, they check for vandalism and clear any debris from the spillway. The flashboards are operated as needed to increase storage. The main and auxiliary low level outlets were last operated in July 1980 when the pond was lowered to provide water to Snows

CROCKER POND DAM

Mill Pond. A private contractor clears brush and trees from the slope and discharge channel yearly.

1.3 Pertinent Data

- a. Drainage Area. The approximately 12,815-acre (20.0-square mile) drainage area consists of hilly land (see Figure D-1 in Appendix). The drainage area includes drainage from Westminster Pond and Lake Wampanoag. About 7.5 percent of the drainage area is ponds and swamps. In general, the undeveloped portions of the drainage area consist of 90 percent woodland, and 10 percent open fields. Light residential development occurs on the east side of the reservoir, and the Whitmanville district of Westminster lies upstream of the reservoir.
- b. Discharge. Discharge from Crocker Pond Dam flows over the flashboards on the spillway and into an exposed bedrock discharge channel. Water also discharges from the outlets into the discharge channel.
 - (1) Outlets:
 - (a) Flood Gate: Size 8 ft x 12 ft
Invert El 746.0
Discharge capacity at top of dam -
1,050 cfs
 - (b) Main Outlet: Size 42-in. dia.
Invert El 731.5
Discharge capacity at top of dam -
320 cfs
 - (c) Auxiliary Outlet: Size 24-in. dia.
Invert El 731.8
Discharge capacity at top of dam -
90 cfs
 - (2) Maximum known flood at damsite: unknown
 - (3) Ungated spillway capacity with the water level at top of dam (closed flood gate):
 - (a) No flashboards: 10,500 cfs at El 785.5
 - (b) Flashboards: 6,300 cfs at El 758.5
 - (4) Ungated spillway capacity at test flood elevation (closed flood gate):

CROCKER POND DAM

- (a) No flashboards: 15,250 cfs at El 760.7
 - (b) Flashboards: 11,250 cfs at El 762.3
- (5) Gated spillway capacity at normal pool elevation: N/A
- (6) Gated spillway capacity at test flood elevation: N/A
- (7) Total spillway capacity at test flood elevation (closed flood gate):
 - (a) No flashboards: 15,250 cfs at El 760.7
 - (b) Flashboards: 11,250 cfs at El 762.3
- (8) Total project discharge at top of dam elevation:
 - (a) No flashboards: 10,500 cfs at El 758.5
 - (b) Flashboards: 6,300 cfs at El 758.5
- (9) Total project discharge at test flood elevation (closed flood gate):
 - (a) No flashboards: 18,450 cfs at El 760.7
 - (b) Flashboards: 18,550 cfs at El 762.3
- c. Elevation (feet above National Geodetic Vertical Datum of 1929 (NGVD)). A benchmark was established at El 750.5 on the crest of the spillway. This elevation was obtained from drawing No. 2 by Howard M. Turner, Consulting Engineer (see Figure B-2).
 - (1) Streambed at toe of dam: 720.0
 - (2) Bottom of cutoff: N/A
 - (3) Maximum tailwater: unknown
 - (4) Normal pool: 750.5
 - (5) Full flood control pool: N/A

CROCKER POND DAM

- (6) Spillway crest: 750.5
Top of flashboards: 752.3
Flood gate invert: 746.0
- (7) Design surcharge (Original Design): unknown
- (8) Top of dam: 758.5
- (9) Test flood surcharge: with flashboards - 762.3
without flashboards -
760.7

d. Reservoir (Length in feet)

- (1) Normal pool: 3,000
- (2) Flood control pool: N/A
- (3) Spillway crest pool: 3,000
- (4) Top of dam: 3,000
- (5) Test flood pool: 3,000

e. Storage (acre-feet)

- (1) Normal pool: 1,027 at El 750.5
- (2) Flood control pool: N/A
- (3) Spillway crest pool: 1,027 at El 750.5
- (4) Top of dam: 1,835 at El 758.5
- (5) Test flood pool: with flashboards: 2,219
at El 762.3
without flashboards:
2,057 at El 760.7

f. Reservoir Surface (acres)

- (1) Normal pool: 101
- (2) Flood control: N/A
- (3) Spillway crest: 101

CROCKER POND DAM

*(4) Test flood pool: 101

*(5) Top of dam: 101

g. Dam

(1) Type: Earthfill

(2) Length: 520 ft

(3) Height: 38.5 ft

(4) Top Width: 10 ft

(5) Side Slopes: 2.5:1 and 3:1 upstream
1.75:1 and 2:1 downstream

(6) Zoning: central concrete core wall with pervious fill

(7) Impervious Core: concrete core wall

(8) Cutoff: N/A

(9) Grout Curtain: N/A

(10) Other: N/A

h. Diversion and Regulating Tunnel: N/A

i. Spillway

(1) Type: concrete ogee weir

(2) Length of weir: 120 feet (including closed flood gate)

(3) Crest elevation:

(a) without flashboards: El 750.5

(b) without flashboards: El 752.3

(4) Upstream channel: concrete sidewalls

(5) Downstream channel: exposed bedrock with several large detached blocks

*Based on the assumption that the surface area will not significantly increase with changes in pool elevation from 750.5 to 762.3.

CROCKER POND DAM

j. Regulating Outlets (see Table B-1, page B-42)

Flood Gate:

- (1) Invert El: 746.0
- (2) Size: 8 ft. x 12 ft.
- (3) Description: wooden gate
- (4) Control Mechanism: slide gate

Main Low Level Outlet:

- (1) Invert El: 731.5
- (2) Size: 42-in. dia.
- (3) Description: steel pipe
- (4) Control Mechanism: sluice gate

Auxiliary Low Level Outlet:

- (1) Invert El: 731.8
- (2) Size: 24-in. dia.
- (3) Description: cast-iron pipe
- (4) Control Mechanism: sluice gate

Mud Gate:

- (1) Invert El: 726.5
- (2) Size: 3 ft. x 3 ft.
- (3) Description: concrete conduit
- (4) Control Mechanism: sluice gate

Trash Chute:

- (1) Invert El: 753
- (2) Size: 3 ft. x 3 ft.
- (3) Description: concrete opening
- (4) Control Mechanism: plate or hatch cover.

CROCKER POND DAM

SECTION 2

ENGINEERING DATA

- 2.1 General. The engineering data available for this Phase I inspection include drawings dated June 1932 to August 1933 prepared by Howard M. Turner, Consulting Engineer (see Figures B-1 through B-4). The drawings were obtained from the Worcester County Engineering Department. There are no other drawings, specifications, or computations available from the Owner, State, or County agencies. Copies of previous inspection reports dated 1924 to 1968, prepared by the Worcester County Engineering Department are included in Appendix B. The most recent inspection was conducted in 1976 by the Massachusetts Department of Public Works. A copy of that report is also given in Appendix B.

We acknowledge the assistance and cooperation of personnel from the Massachusetts Department of Environmental Quality Engineering, Division of Waterways; the Massachusetts Department of Public Works; and the Worcester County Engineers Office. In addition, we acknowledge the assistance of Mr. Norman Burt and Mr. Leo Collette, of James River - Massachusetts, Inc., who provided information on the history and operation of the dam.

- 2.2 Construction Records. There are no construction records or as-built drawings available for the dam or appurtenances. Previous inspection reports by the Worcester County Engineering Department provided some construction information, and a summary of repairs and post construction changes at the site.
- 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. There are limited engineering data available for this dam.
 - 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 the visual inspection, past performance history, and engineering judgment.
 - c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the available information is valid.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The Phase I inspection of the dam at Crocker Pond was performed on May 6, 1980. A copy of the inspection checklist is included in Appendix A. Previous inspections were conducted by the Worcester County Engineering Department from 1924 to 1968, and by the Massachusetts Department of Public Works in 1976. Copies of these reports are given in Appendix B. Selected photographs taken during our visual inspection are included in Appendix C.

b. Far. The dam is an earthfill structure, and includes a spillway, flood gate, gate house, and outlet structures.

There was no evidence of seepage on the downstream slope or toe of the embankment.

A rut approximately 1 foot wide was observed along the crest of the east section of the dam (see Photo No. 2 and 5). Within this rut, brick masonry is exposed.

No sloughing or erosion was visible on the slopes or abutments of the dam. A few stones were missing along the downstream bench of the east section.

The riprap on the upstream face of the embankment appears to be intact. Grass was observed between the riprap above the water line.

Three utility poles exist on the downstream face of the dam (two on the west section and one on the east section), (see Photo No. 1).

Some trespassing was observed on the embankment. The crest of the east section has minor ruts along the exposed brick. This is apparently due to traffic to and from the gate house. Many footprints were observed on the west section, as was one footpath along the west sidewall. Five to ten animal burrows were observed along the downstream face of the west section.

c. Appurtenant Structures. The approach channel consists of concrete sidewalls. The floor of the approach channel was submerged and not visible. The concrete on the west sidewall is spalled, with minor efflorescence (see Photo

CROCKER POND DAM

No. 7). The concrete on the east sidewall is in good condition, with the exception of a minor vertical crack approximately 3 feet long and 0.5 inches wide near the gate house (see Photo No. 3).

The spillway is a concrete ogee weir with 1.8 feet of flashboards and concrete sidewalls (see Photo No. 6 and 7). There is a flood gate between the spillway and the gate house (see Photo No. 8). At the time of the inspection, water was discharging over the spillway, so the weir, flashboards, and downstream toe could not be examined, although some spalling on the weir face was partially visible (see Photo No. 7). The concrete on the sidewall between the spillway and the flood gate has some spalling where the sidewall meets the spillway (see Photo No. 8). There is no access to the flashboards which would permit removal of the boards during periods of high flow. The crest of the spillway contained some wood debris. The concrete on the east sidewall has a large diagonal crack approximately 15 feet long and 0.5 inches wide with some spalling and minor efflorescence (see Photo No. 6). The concrete on the west sidewall has a large diagonal crack approximately 10 feet long and 0.5 inches wide with some spalling and minor efflorescence (see Photo No. 7). A large area of severe spalling and efflorescence of the concrete can be seen.

As shown in Photo No. 6 and 8, the gate house consists of a concrete substructure, with brick masonry walls and a wood frame and slate roof.

The concrete is in fair condition. It appears to be a monolithic pour with no joints. There is a large vertical crack approximately 12 feet long and 0.5 inches wide with some spalling and efflorescence of the concrete on the west face of the gate house (see Photo No. 6). The concrete also has some minor surface spalling. Some staining of the concrete adjacent to the ironworks can be seen. The brickwork appears to be in good condition, with no visible joints or missing bricks, as does the wood frame and slate roof. The operating equipment is in fair condition with surface rusting and pitting.

Five separate outlets were visible during the inspection (see Photo No. 8). These include a flood gate, main low level outlet, auxiliary low level outlet, drain, and trash chute. Table B-1 in Appendix B describes each outlet in detail. Figure B-5 is a schematic drawing showing the location and elevation of each.

- d. Reservoir Area. The reservoir area is lightly developed. The Whitmanville district of Westminster is located on the upstream side of the reservoir. Residential development is located on the east side of the reservoir.

Most of the land is hilly with wooded slopes. There is a slight potential for future development in the reservoir area.

- e. Downstream Channel. Both the spillway and outlet discharge into the downstream channel. The vertical dry stone masonry wall that forms the east side of the channel appears to be intact (see Photo No. 9), as does the natural earth slope that forms the west side of the channel (see Photo No. 7). The floor of the channel is exposed bedrock with several large detached blocks (see Photo No. 7 and 9).

Trees overhang the west side of the channel (see Photo No. 7).

About 140 feet downstream of the dam, a bridge restricts the discharge from the dam. Water flows under the bridge in four openings, each approximately 23 feet wide by 10 feet high. Only three openings (the two easterly openings and the extreme westerly opening) appear to be open to flow. The other opening appears to be blocked by exposed bedrock (see Photo No. 10).

Water then flows approximately 1.25 miles downstream to Snows Mill Pond.

- 3.2 Evaluation. The visual inspection indicates that the dam is in fair condition. There are some deficiencies which must be corrected to assure the continued performance of this dam. Measures to improve this condition are stated in Section 7.3.

SECTION 4
OPERATING AND MAINTENANCE
PROCEDURES

4.1 Operating Procedures

- a. General. According to representatives of James River - Massachusetts, Inc., the standard procedure for operating the dam is to operate the flashboards as needed to increase storage. The main and auxiliary low level outlets are opened as needed to provide water to Snows Mill Pond.
- b. Warning System. There is no warning system in effect at this dam. According to the representatives of James River - Massachusetts, Inc., a warning system is being planned for future implementation.

4.2 Maintenance Procedures

- a. General. The dam is generally adequately maintained. James River - Massachusetts, Inc. is responsible for maintenance of the facility. Periodic inspections by the Worcester County Engineering Department have been conducted in the past. Typical maintenance procedures have included clearing bush and trees from the slope and discharge channel, clearing debris from the spillway and outlets, and replacing the flashboards.
- b. Operating Facilities. Maintenance of the operating facilities at the dam consists of visiting the dam monthly to check for vandalism and to clear debris from the spillway. In 1979, the flashboards were reportedly replaced. A private contractor clears brush and trees from the slope and discharge channel yearly. The operating condition of the outlet works is reportedly checked periodically by the Owner.

- 4.3 Evaluation. There is a program for maintaining the embankment and appurtenant structures in good operating condition. However, there is no program of regular technical inspections; a plan for surveillance of the embankment during and after periods of heavy rainfall, nor an emergency warning system in effect. This is extremely undesirable, considering that the dam is in the high hazard category. These programs should be implemented, as recommended in Section 7.3.

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SECTION 5

EVALUATION OF HYDRAULIC/ HYDROLOGIC FEATURES

- 5.1 General. Crocker Pond Dam has a 20.0-square mile drainage area, about 7.5 percent of which is ponds and swamps (see Figure D-1, Drainage Area Map). The land is hilly, and lightly developed.

There are two dams upstream of Crocker Pond that provide additional storage within the watershed.

Crocker Pond has a surface area of approximately 101 acres, and a maximum storage capacity of 1,835 acre-feet at El 758.5.

See Table B-1 in Appendix B for discharge information for each outlet.

- 5.2 Design Data. There are no hydraulic or hydrologic computations available for the design of the spillway at Crocker Pond Dam.
- 5.3 Experience Data. According to a previous inspection report dated September 29, 1924, the original dam at this location was "abandoned and partially washed out." There is no record of overtopping of the present dam, which was constructed in 1933. Representatives from James River - Massachusetts, Inc. indicated that the dam was never overtopped.
- 5.4 Test Flood Analysis. Crocker Pond Dam has been classified in the "intermediate" size and "high" hazard categories. According to the Corps of Engineers' guidelines, a test flood equal to the full PMF (Probable Maximum Flood) should be used to evaluate the capacity of the spillway.

The PMF rate for the Crocker Pond Dam watershed was calculated to be 975 cfs per square mile of drainage area. This calculation is based on the average slope of 1.85 percent in the drainage area, the pond-plus-swamp area to drainage area ratio of 7.5 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). For this analysis, the peak flow rate was determined to be somewhat above the guide curve for flat and coastal topography.

Applying the full PMF rate to the 20.0-square mile drainage area results in a peak test flood inflow of 19,500 cfs. (Note that the peak test flood outflow of 12,000 cfs from

CROCKER POND DAM

Westminster Pond Dam would reach Crocker Pond several hours after the peak runoff from the intervening area.) By adjusting the test flood inflow for surcharge storage, the peak test flood outflow was calculated to be 18,450 cfs (922.5 cfs per square mile) with no flashboards in place, and 18,550 cfs (928 cfs per square mile) with flashboards in place. This assumes that the flood gate remains closed during the test flood.

Without flashboards, the pond level would rise to El 760.7. With flashboards, the pond would rise to El 762.3. This assumes that the flood gate remains closed during the test flood. This is based on the absence of a full-time attendant at the site and the lack of emergency procedures during a flood.

Using one-half the PMF rate, the peak test flood inflow is 9,750 cfs. The peak test flood outflow is 8,950 cfs with the pond at El 757.8.

Hydraulic analyses indicate that the spillway without flashboards can discharge 10,500 cfs or 57 percent of the test flood outflow with the pond at El 758.5, which is the low point on the top of the dam. With flashboards, the spillway could discharge 6,300 cfs, or 34 percent of the outflow before the dam is overtopped. This assumes that the flood gate remains closed during the test flood.

Table 5-1 below summarizes the discharge from the pond during the test flood, assuming that the flood gate remains closed.

- 5.5 Dam Failure Analysis. The peak discharge rate due to failure of the dam was calculated to be 22,500 cfs with the pond at El 758.5, which is the low point on the top of dam. This calculation is based on a maximum head of 38.5 feet and an assumed 140-foot wide breach occurring in the east section of the embankment. Failure of the dam would produce a downstream flood wave 15.5 feet deep as compared to channel flow 12 feet deep prior to failure.

The peak discharge rate due to failure of the dam was calculated to be 17,270 cfs with the pond at El 752.3, which is the top of the flashboards. This calculation is based on a maximum head of 32.3 feet and an assumed 140-foot wide breach occurring in the east section of the embankment. Failure of the dam when not discharging would produce a downstream flood wave 14 feet deep as compared to no channel flow prior to failure.

CROCKER POND DAM

TABLE 5-1. DISCHARGE DATA DURING
TEST FLOOD

	Flashboards in place	Flashboards removed
Maximum height of water above dam, ft:	3.8	2.2
Discharge over spillway, cfs:	11,250	15,250
Discharge over dam, cfs:	7,300	3,200
Depth of water over dam at critical flow, ft:	2.2	1.29
Velocity at critical flow, fps:	8.5	6.4

There are approximately 3 to 5 houses, 1 school, and 5 factories located along the stream downstream of the dam. The foundations of these structures are approximately 5 feet above the floor of the stream. Discharge due to failure of the dam could result in overflowing of the channel farther downstream. Due to the configuration of the channel, little attenuation of the flood flow is expected. It is likely that failure of the dam would result in appreciable property damage and loss of more than a few lives in developed areas downstream of the dam. Accordingly, the dam has been placed in the "high" hazard category.

SECTION 6

STRUCTURAL STABILITY

- 6.1 Visual Observations. The evaluation of the structural stability of Crocker Pond Dam is based on a review of previous inspection reports, a review of available drawings, and the visual inspection conducted on May 6, 1980.

As discussed in Section 3, Visual Inspection, the dam is in fair condition. Concrete was spalled, cracked and deteriorated on the east and west approach channel sidewalls, the spillway face, the sidewall between the spillway and the flood gate, the east and west sidewalls of the spillway, and the west face of the gate house. Five to ten animal burrows and a footpath were observed along the downstream face of the dam. There were missing stones along the downstream bench of the east section of the dam. Some logs and debris were caught on the spillway weir. Trees were overhanging the west side of the downstream channel.

- 6.2 Design and Construction Data. Construction of Crocker Pond Dam was completed in 1933. Computations for design of the dam, spillway and outlet are not available.

Drawings dated June 1932 to August 1933 prepared by Howard M. Turner, Consulting Engineer show the proposed construction of the dam (see Figures B-1 through B-4). The drawings show that the dam is a zoned earthfill embankment, with a concrete central core wall. The drawings also show that the spillway and approximately 130 feet of the core wall are founded on bedrock, while the remainder of the core wall is founded in earth (fine sand). Previous inspection reports dated September 8 to December 8, 1932 indicate that the spillway is founded on bedrock with "veins, holes and cracks in the ledge grouted with cement". The remaining earthfill consists of riprap overlying an 18-inch gravel layer on the face of the upstream section, overlying sand, and fine material against the upstream face of the core wall, followed by sand and gravel and coarse material on the downstream section, and a coarse gravel and rockfill toe as shown on the drawings. The drawings do not show a cutoff trench below the base of the dam. The side slopes of the embankment are 2.5:1 upstream and 1.75:1 downstream. The upstream slope changes to 3:1 below El 738.5. A 2.5-foot wide bench exists on the downstream slope at El 738.5. The downstream slope then changes to 2:1 below El 738.5.

Specifications for construction of the dam are not available.

CROCKER POND DAM

There is no information on the shear strength or permeability of the soil and/or rock materials of the embankment.

- 6.3 Post-Construction Changes. Since the original construction of the dam, few repairs have been made. The flashboards were reportedly placed in 1979.
- 6.4 Seismic Stability. The dam is located in Seismic Zone No. 2, and in accordance with Corps of Engineers' guidelines does not warrant further seismic analysis at this time.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. As a result of the visual inspection, the review of available data, and limited information on operation and maintenance, the dam is considered to be in fair condition. The following deficiencies must be corrected to assure the continued performance of this dam: spalled, cracked and deteriorated concrete on the east and west approach channel sidewalls, the spillway face, the sidewall between the spillway and the flood gate, the east and west sidewalls of the spillway, and the west face of the gate house; animal burrows and footpaths on the downstream face of the dam; missing stones along the downstream bench of the east section of the dam; logs and debris caught on the spillway weir; and trees overhanging the west side of the downstream channel.

The sluice gates on the low level outlets are reportedly operable, and the outlets are not blocked.

The peak test flood (full PMF) outflow is estimated to be 18,450 cfs with the pond at El 760.7 (assuming the flashboards are removed) and is estimated to be 18,550 cfs with the pond at El 762.3 (assuming the flashboards are in place). This assumes that the flood gate remains closed during the test flood. The test flood would overtop the low point on the dam by 2.2 feet with the flashboards removed and by 3.8 feet with the flashboards in place. Hydraulic analyses indicate that the spillway without flashboards can discharge 10,500 cfs or 57 percent of the test flood outflow before the dam is overtopped. With the flashboards in place, the spillway can discharge 6,300 cfs or 34 percent of the test flood outflow before the dam is overtopped. This assumes that the flood gate remains closed during the test flood. This is based on the absence of a full-time attendant at the site and the lack of emergency procedures during a flood.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of this dam is based on a review of the available data, the visual inspection, past performance and engineering judgment.

CROCKER POND DAM

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

7.2 Recommendations. It is recommended that the Owner employ a qualified registered engineer to provide the following services:

- a. Evaluate the deterioration of the concrete on the spillway face, the east and west sidewalls, and the west face of the gate house; and examine the spillway under a no flow condition.
- b. Perform a detailed hydrologic/hydraulic analysis to evaluate the discharge capability of the spillway and the overtopping potential of the dam.
- c. The Owner should remove the flashboards from the spillway until the hydrologic/hydraulic analysis is completed.

The Owner should implement the recommendations of the Engineer.

7.3 Remedial Measures

- a. Operating and Maintenance Procedures. It is recommended that the Owner accomplish the following:
 - (1) Selectively clear trees, brush and roots to a distance of 25 feet from the toe of the dam. All stumps and roots removed should be backfilled with select material.
 - (2) Consideration should be given to relocating the three utility poles from the downstream face of the dam, and to backfilling the holes with select material.
 - (3) Repair all spalled, cracked and deteriorated concrete on the east and west approach channel sidewalls, the spillway face, the sidewall between the spillway and the flood gate, the east and west sidewalls of the spillway, and the west face of the gate house in accordance with the recommendations of the Engineer.
 - (4) Replace missing stones on the downstream bench of the east embankment.
 - (5) Fill in and reseed all animal burrows and footpaths on the downstream slope of the dam.

CROCKER POND DAM

- (6) Remove all brush, trees, debris and loose stone in the floor of the spillway discharge channel.
- (7) Remove logs and debris caught on the spillway weir.
- (8) Maintain all low level outlets in operating condition.
- (9) Institute a definite plan for surveillance of the dam and spillway during and after periods of heavy rainfall and a plan to warn people in downstream areas in the event of an emergency at the dam.
- (10) Implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances and be supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in compliance with all applicable State regulations. The maintenance program should include removal of any debris caught on the spillway weir to prevent clogging of the spillway.
- (11) Institute a program of technical inspections on an annual basis.

7.4 Alternatives. There are no practical alternatives to the above recommendations.

APPENDIX A
PERIODIC INSPECTION CHECKLIST

CROCKER POND DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT CROCKER POND DAM

DATE May 6, 1980

TIME 10:00 to 16:00

WEATHER 60°F Sunny

W.S. ELEV 752.5 U.S. 720± DN.S.

PARTY:

1. <u>L. Taverna (Metcalf & Eddy -</u>	<u>Geotechnical)</u>
2. <u>S. Nagel (Metcalf & Eddy -</u>	<u>Geotechnical)</u>
3. <u>W. Diesl (Metcalf & Eddy -</u>	<u>Geotechnical)</u>
4. <u>W. Checchi (Metcalf & Eddy -</u>	<u>Geotechnical)</u>
5. <u>L. Branagan (Metcalf & Eddy -</u>	<u>Hydraulics)</u>
6. <u>M. Nowak (Metcalf & Eddy -</u>	<u>Hydraulics)</u>
7. <u>E. Greco (Metcalf & Eddy -</u>	<u>Geotechnical)</u>

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam</u>	<u>L. Taverna/S. Nagel</u>	
2. <u>Spillway</u>	<u>L. Taverna/S. Nagel/L. Branagan</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECK LIST

PROJECT CROCKER POND DAM

DATE May 6, 1980

PROJECT FEATURE Dam Embankment

NAME L. Taverna

DISCIPLINE Geotechnical

NAME S. Nagel

u/s = upstream

L/S = Lefthand Side

d/s = downstream

R/S = Righthand Side

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	Earthfill dam with core wall. (Telephone poles on R/S & L/S d/s slopes.)
Crest Elevation	
Current Pool Elevation	752.5
Maximum Impoundment to Date	752.5
Surface Cracks	None visible
Pavement Condition	No pavement
Movement or Settlement of Crest	None visible at R/S. Appears core wall is exposed at L/S
Lateral Movement	None visible
Vertical Alignment	O.K., Straight
Horizontal Alignment	O.K., Straight
Condition at Abutment and at Concrete Structures	L/S & R/S abutments tie into hillside. L/S embankment ties into Gate House R/S embankment ties into sidewall of spillway.
Indications of Movement of Structural Items on Slopes	None visible.
Trespassing on Slopes*	L/S crest has rutting at core wall. R/S has many footprints, one path along sidewalk.
Sloughing or Erosion of Slopes or Abutments	No sloughing or erosion visible. Few stones missing along L/S, d/s bench.
Rock Slope Protection - Riprap Failures	Riprap intact, grass grows between rocks above water line.
Unusual Movement or Cracking at or near Toes	None visible.
Unusual Embankment or Downstream Seepage	None visible.
Piping or Boils	None visible.
Foundation Drainage Features	None visible.
Toe Drains	None visible.
Instrumentation System	None

*5 to 10 Gopher holes along R/S, d/s embankment

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PERIODIC INSPECTION CHECK LIST

PROJECT CROCKER POND DAM

DATE May 6, 1980

PROJECT FEATURE Spillway

NAME L. Taverna/S. Nagel

DISCIPLINE Geotechnical/Hydraulics

NAME L. Branagan

L/S = Lefthand Side

R/S = Righthand side

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	Concrete sidewalls, floor not visible.
a. Approach Channel	
General Condition	Some spalling & efflorescence on R/S sidewall, L/S sidewall good, floor not visible.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Not visible, submerged.
b. Weir and Training Walls	Ogee weir, 2 ft. of flashboards in spillway, concrete sidewalls.
General Condition of Concrete	Diagonal crack on L/S sidewall. Diagonal crack on R/S sidewall. Severe spalling on R/S sidewall.
Rust or Staining	None visible.
Spalling	Some spalling at diagonal cracks on L/S & R/S sidewalls. Severe spalling on R/S sidewall, spalling on weir face, 1" tol. 5
Any Visible Reinforcing	Not visible
Any Seepage or Efflorescence	No seepage. Efflorescence at diagonal cracks on L/S & R/S sidewalls. Much efflorescence on R/S sidewall.
Drain Holes	None visible
c. Discharge Channel	L/S has vertical dry stone masonry wall R/S is natural slope, floor is exposed bedrock.
General Condition	Masonry wall is good. Floor is exposed bedrock with several large detached blocks.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Few trees on R/S. No trees on L/S.
Floor of Channel	Exposed bedrock
Other Obstructions	Bridge with 4 boxes. Only 3 opened to flow.

PERIODIC INSPECTION CHECK LIST

PROJECT CROCKER POND DAM DATE May 6, 1980
 PROJECT FEATURE Intake Channel and Intake Structure NAME L. Taverna
 DISCIPLINE Geotechnical NAME S. Nagel

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	Not visible, submerged.
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT CROCKER POND DAM
 PROJECT FEATURE Outlet Structure and Outlet Channel
 DISCIPLINE Geotechnical

DATE May 6, 1980
 NAME L. Taverna
 NAME S. Nagel

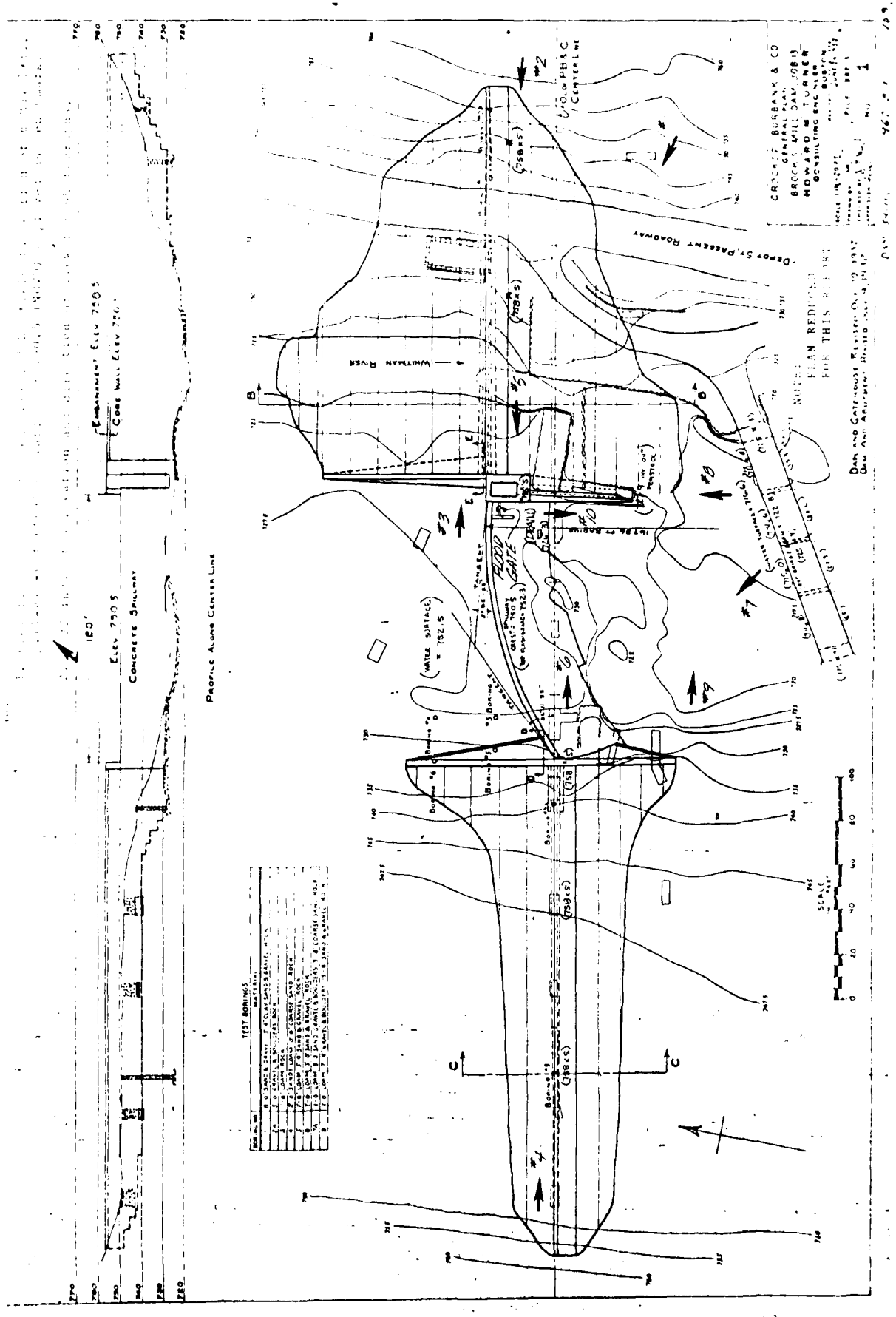
AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	Discharges through a 42-inch pipe, and 2-3'x3' openings, into discharge channel.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

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
Figure B-3, Headgates and Details	B-3
Figure B-4, Flood Gate	B-4
Figure B-5, Schematic of Outlet Structures	B-5
File Card for Crocker Pond Dam from Worcester County Engineer's Office	B-6
Previous Inspection Reports Dated 1924 through 1968 by Worcester County Engineer's Office	B-7
Dated April 7, 1976 by Massachusetts Department of Public Works	B-35
Table B-1, Dam Outlets	B-42

CROCKER POND DAM



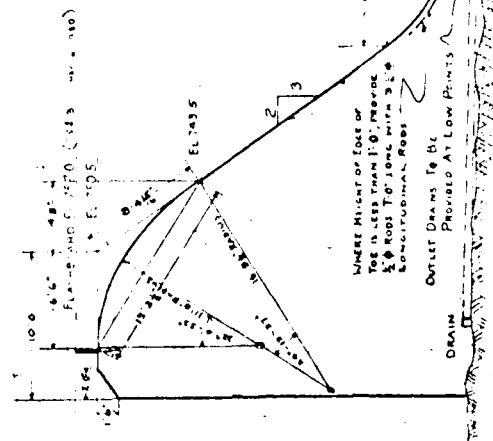
TEST BORINGS

No.	Location	Depth	Remarks
1	Upstream of Dam	100'	Gravel and sand
2	Upstream of Dam	100'	Gravel and sand
3	Upstream of Dam	100'	Gravel and sand
4	Upstream of Dam	100'	Gravel and sand
5	Upstream of Dam	100'	Gravel and sand
6	Upstream of Dam	100'	Gravel and sand
7	Upstream of Dam	100'	Gravel and sand
8	Upstream of Dam	100'	Gravel and sand
9	Upstream of Dam	100'	Gravel and sand
10	Upstream of Dam	100'	Gravel and sand
11	Upstream of Dam	100'	Gravel and sand
12	Upstream of Dam	100'	Gravel and sand
13	Upstream of Dam	100'	Gravel and sand
14	Upstream of Dam	100'	Gravel and sand
15	Upstream of Dam	100'	Gravel and sand
16	Upstream of Dam	100'	Gravel and sand
17	Upstream of Dam	100'	Gravel and sand
18	Upstream of Dam	100'	Gravel and sand
19	Upstream of Dam	100'	Gravel and sand
20	Upstream of Dam	100'	Gravel and sand
21	Upstream of Dam	100'	Gravel and sand
22	Upstream of Dam	100'	Gravel and sand
23	Upstream of Dam	100'	Gravel and sand
24	Upstream of Dam	100'	Gravel and sand
25	Upstream of Dam	100'	Gravel and sand
26	Upstream of Dam	100'	Gravel and sand
27	Upstream of Dam	100'	Gravel and sand
28	Upstream of Dam	100'	Gravel and sand
29	Upstream of Dam	100'	Gravel and sand
30	Upstream of Dam	100'	Gravel and sand
31	Upstream of Dam	100'	Gravel and sand
32	Upstream of Dam	100'	Gravel and sand
33	Upstream of Dam	100'	Gravel and sand
34	Upstream of Dam	100'	Gravel and sand
35	Upstream of Dam	100'	Gravel and sand
36	Upstream of Dam	100'	Gravel and sand
37	Upstream of Dam	100'	Gravel and sand
38	Upstream of Dam	100'	Gravel and sand
39	Upstream of Dam	100'	Gravel and sand
40	Upstream of Dam	100'	Gravel and sand
41	Upstream of Dam	100'	Gravel and sand
42	Upstream of Dam	100'	Gravel and sand
43	Upstream of Dam	100'	Gravel and sand
44	Upstream of Dam	100'	Gravel and sand
45	Upstream of Dam	100'	Gravel and sand
46	Upstream of Dam	100'	Gravel and sand
47	Upstream of Dam	100'	Gravel and sand
48	Upstream of Dam	100'	Gravel and sand
49	Upstream of Dam	100'	Gravel and sand
50	Upstream of Dam	100'	Gravel and sand
51	Upstream of Dam	100'	Gravel and sand
52	Upstream of Dam	100'	Gravel and sand
53	Upstream of Dam	100'	Gravel and sand
54	Upstream of Dam	100'	Gravel and sand
55	Upstream of Dam	100'	Gravel and sand
56	Upstream of Dam	100'	Gravel and sand
57	Upstream of Dam	100'	Gravel and sand
58	Upstream of Dam	100'	Gravel and sand
59	Upstream of Dam	100'	Gravel and sand
60	Upstream of Dam	100'	Gravel and sand
61	Upstream of Dam	100'	Gravel and sand
62	Upstream of Dam	100'	Gravel and sand
63	Upstream of Dam	100'	Gravel and sand
64	Upstream of Dam	100'	Gravel and sand
65	Upstream of Dam	100'	Gravel and sand
66	Upstream of Dam	100'	Gravel and sand
67	Upstream of Dam	100'	Gravel and sand
68	Upstream of Dam	100'	Gravel and sand
69	Upstream of Dam	100'	Gravel and sand
70	Upstream of Dam	100'	Gravel and sand
71	Upstream of Dam	100'	Gravel and sand
72	Upstream of Dam	100'	Gravel and sand
73	Upstream of Dam	100'	Gravel and sand
74	Upstream of Dam	100'	Gravel and sand
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99	Upstream of Dam	100'	Gravel and sand
100	Upstream of Dam	100'	Gravel and sand

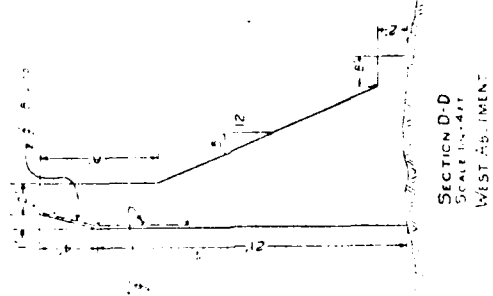
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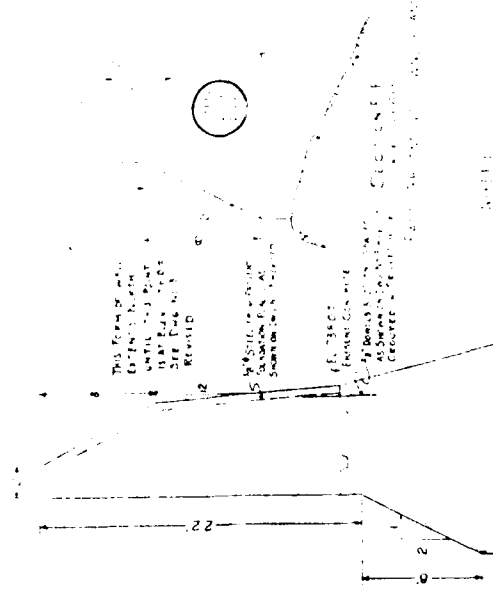
SECTION B-B
SCALE 1"=40'
EAST ELEVATION



SECTION A-A
SCALE 1"=40'
SPILLWAY

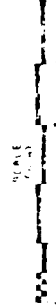


SECTION D-D
SCALE 1"=40'
WEST ABUTMENT



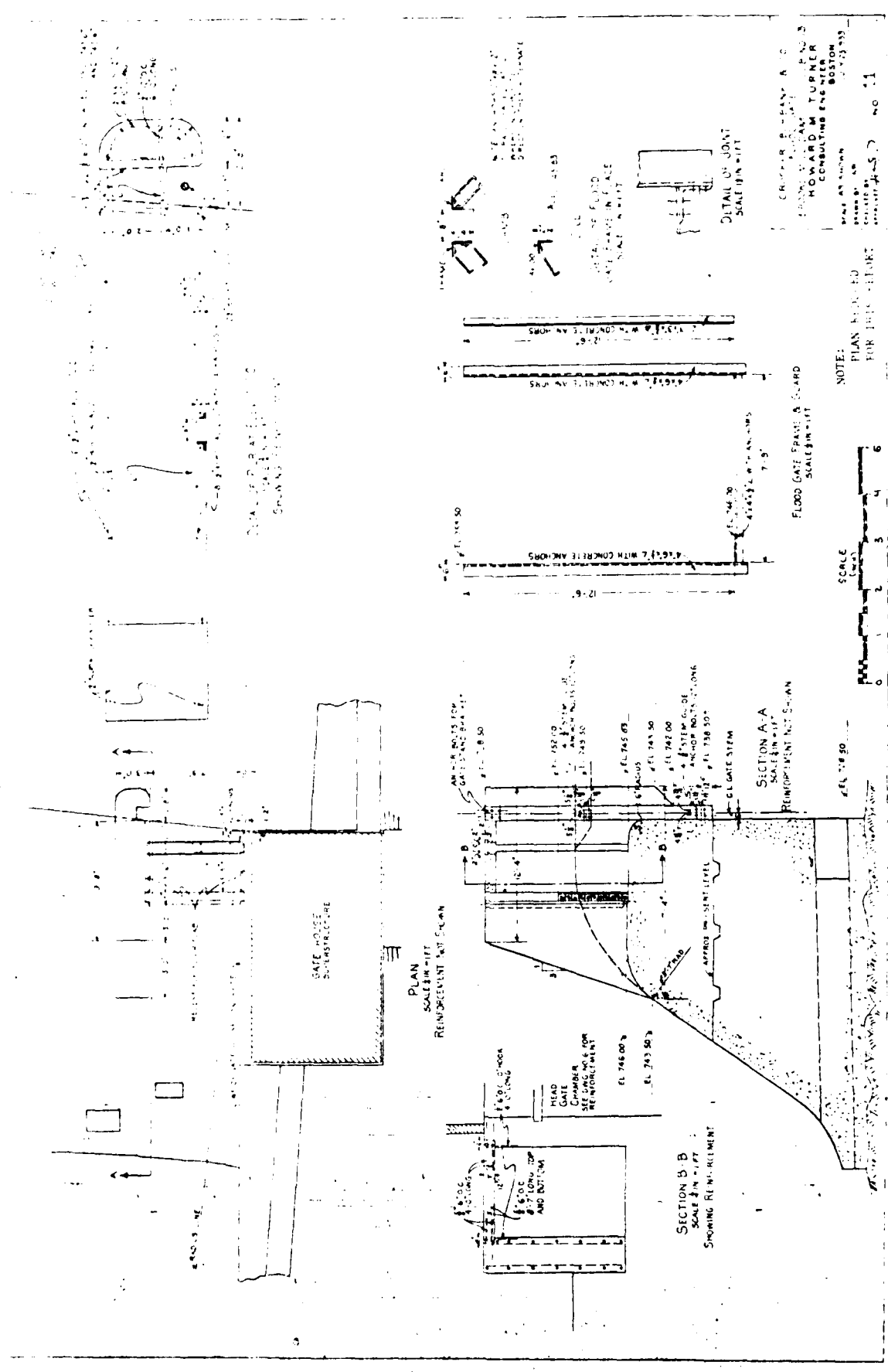
SECTION E-E
SCALE 1"=40'
EAST ABUTMENT

NOTE FOR LOCATIONS OF SECTIONS SEE PLAN NO. 1



NE REMAINS WILL REMAIN FOR 1913
PREPARED BY
DRAWN BY
CHECKED BY
NO. 2

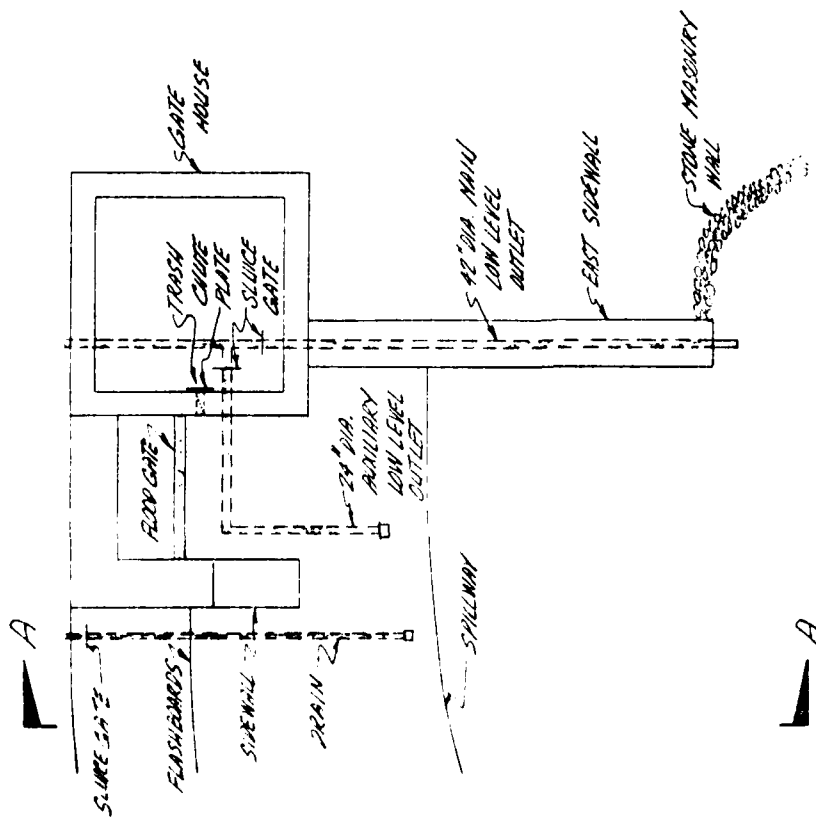




NOTE: PLAN REJECTED FOR THIS REPORT

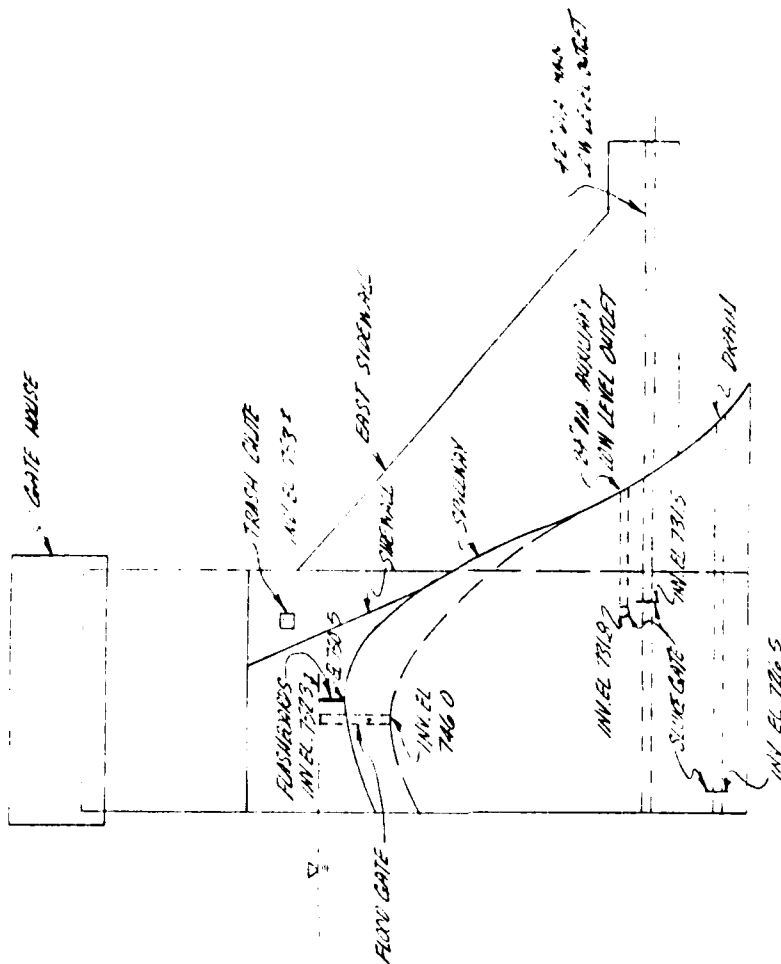
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PLAN OF OUTLET STRUCTURES
N.T.S.

SECTION A-A



PROFILE OF OUTLET STRUCTURES
SECTION A-A
N.T.S.

DATE	10/10/50
BY	W. H. HARRIS
CHECKED BY	W. H. HARRIS
APPROVED BY	W. H. HARRIS
NATIONAL PROGRAM OF INSPECTION OF GOVERNMENT DAMS	
PROJECT NO. 100-100000-100000	
PAGE 1-1	

TOWN OR CITY **WESTMINSTER** DECREE NO.

PLAN NO.

DAM NO. **58 - 11**LOCATION **SOUTH ASHBURNHAM ROAD****BROOKS MLL**

C. C. DOCKET NO.

DESCRIPTION OF DAM

po **Concrete**
 Length **515'**
 Height **30.5' (Top of Spillway) 39.5' (Top Emb.)**
 Thickness top **9'**
 " bottom **26' (Reinf. with steel dowels 3' 0" OC)**
 Downstream Slope **Loamed and seeded (Box sand and gravel)**
 Upstream " **Sand, 18" Gravel, 18" Paving.**
 Length of Spillway **120'**
 Size of Gates **4' 6" x 5' 0"**
 Location of Gates **West end of spillway.**
 Flashboards used **El. Top Spillway 751.6**
 Width Flashboards or Gates
 Dam designed by **Howard M. Turner.**
 " constructed by **Crocker Burbank**
 Year constructed **1933**

GENERAL REMARKS

Inspected: **Aug. 9, 1933** **L. O. Marden**
 " **June 24, 1933** " "
 " **July 20, 1933** " "
 " **Dec. 15, 1934** " "
 Orig plan traced: **Feb 1940 - E.C.C. Checked - 3-21-40 - L.O.M. Notboitt**
 Owned by **The Crocker - Burbank Co. Fitchburg Mass**
Asac.

1936 Flood 753.6

DESCRIPTION OF RESERVOIR & WATERSHED

Name of Main Stream **Whitman River.**
 " " any other Streams
 Length of Watershed
 Width " "
 Is Watershed Cultivated
 Percent in Forests
 Steepness of Slope
 Kind of Soil
 No. of Acres in Watershed
 " " " " Reservoir
 Length of Reservoir
 Width " "
 Max Flow Cu. Ft. per Sec.
 Head or Flashboards-Low Water
 " " " " -High "

1937 36 M

GENERAL REMARKS

Inspected: **June 21, 1932** by **L. O. Marden**
 " **30** " " "
 " **Aug. 10** " " "
 " **Sept. 8** " " "
 " **Oct. 17** " " "
 " **July 8** " " "
 " **May 17, 1933** " " "
 " **Dec. 8, 1932** " " "
 of **Loam. W. W.**

Class

(over)

2 - Library Bureau 10-97200

58-11

Inspected: **Oct. 6, 1938** - **L. H. Spottard**
 Patrol : **Mar. 16, 1939** - **M. F. Hunt**
 " : **April 2, 1940** - **L. O. M.** water down - no hazard.
 Inspected: **Dec. 9, 1942** **E.C.C.**
 " **Jan. 29, 1944** **E.C.C.**
 " **Nov. 20, 1946** - **L.O.M.**
 " **Dec. 21, 1948** "
 " **Mar. 15, 1951** "

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date Sept. 29, 1924 Dam No. 59-11

Town Westminster Location Whitman River. - S. Ashburnham Road.

Owner _____ Use abandoned.

Material and Type Rubble wall-earth embankment. part washed out.

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____

Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____

Width Flashboards carried _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway _____

Condition _____

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES _____ Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

WHEEL _____ Kind _____ Size _____ Rated H. P. _____

Location _____ Ave. Head _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Prof. Turner - consulting eng. ^{Inspection of Dams, Reservoir Dams, and Reservoirs.}

Inspected by L. O. Marden Date June 21, 1932 Dam No. 59-11

Town Westminster Location Brooks Mill Privelege.

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Inspected proposed foundation.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.
Messrs. Turner, Crocker and

Inspected by L. O. Marden Date June 30, 1932 Dam No. 59-11

Town Westminster Location Brooks Mill Privelege.

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. O. Marden Date Aug. 10, 1932 Dam No. 59-11

Town Westminster Location

Owner Crocker Burbank & Co. Assoc. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment. El. Crest. El. Apron. El. Streambed

Width top Abutment. Width top Crest. Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition

EMBANKMENT—Length overall Feet

El. Top. El. Natural Ground. Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Constructing core wall on west side of dam.

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. O. Marden Date Sept. 8, 1932 Dam No. 59-11

Town Westminster Location

Owner Crocker Burbank Co. Use Under construction.

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway Granite. Cleaning out veins of clay.

Condition Believe strata of ledge and schist.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Part being constructed on west side of spillway.

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. O. Marden Date Oct. 17, 1932 Dam No. 59-11

Town Westminster Location

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway Ledge

Condition Spillway foundation spots in ledge being cleaned out; holes drilled and cracks filled with cement.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden & G. Classon Date Dec. 8, 1932 Dam No. 59-11

Town Westminster Location Brook Mill privilege.

Owner Crocker Burbank Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Concrete foundation completely in ledge. All porous spots and holes grouted. East abutment part constructed. West completed.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition West embankment completed except rip-rap.

GATES Location

Size Kind El. Flowline

Condition Not constructed

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure None.

Recent Repairs and Date None.

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

CROCKER POND DAM

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O.Marden & Ralph Marble Date 5-17-33 Dam No. 59-11

Town Westminster Location Brooks Mill Privilege

Owner Crocker-Burbank Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Constructing oge type concrete wasteway
OK

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Constructing core wall and embankment
OK

GATES Location

Size Kind El. Flowline

Condition OK

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure None

Recent Repairs and Date Under construction

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

CROCKER POND DAM

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 6-22-33 Dam No. 59-11

Town Westminster Location Brooks Mill Privilege

Owner Crocker-Burbank Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Pouring concrete - wasteway sections OK

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Constructing core wall - embankment OK

GATES Location

Size Kind El. Flowline

Condition Completed

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure None

Recent Repairs and Date OK

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF SUFFOLK MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, and Reservoirs.

Inspected by L. O. Marden Date 7-20-33 Dam No. 59-11

Town Westminster Books Mill Privilege

Owner Crocker-Burbank Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Cleanout Pipe

Kind of Foundation under Spillway

Condition Under construction Concrete being poured OK

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Up Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Core-wall and embankment under construction OK

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure None

Recent Repairs and Date Under construction

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 8-9-1933 Dam No. 59-11

Town Westminster Location Whitman River.

Owner Crocker Burbank & Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition One more section to pour- remainder completed-

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall practically completed Riprap

Material in Embankment Foundation

Condition westerly embankment completed- easterly embankment about 85. pefcent complete.

GATES Location

Size Kind El. Flowline

Condition good

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none

Recent Repairs and Date under construction.

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 12-15-1934 Dam No. 59-11

Town Westminster Location

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition OK

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition OK

GATES Location

Size Kind El. Flowline

Condition OK

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure OK

Recent Repairs and Date none

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by W. F. Hunt Date Mar. 16, 1934 Dam No. 59-11

Town Westminster Location Brooks Mill

Owner..... Use.....

Material and Type.....

Dam Designed by..... Constructed by..... Year.....

SPILLWAY

El. top Abutment..... El. Crest..... El. Apron..... El. Streambed.....

Width top Abutment..... Width top Crest..... Width bottom Spillway.....

Width Flashboards carried..... Kind Flashboards.....

El. Flowline Cleanout Pipe..... Size and Kind Cleanout Pipe.....

Kind of Foundation under Spillway.....

Condition Water 2'± below crest. Sinc set 10"-12" flashboards on
all water now going through gates.

EMBANKMENT

El. Top..... El. Natural Ground..... Width Top.....

Width of Bottom..... Upstream Slope..... Downstream Slope.....

Kind of Corewall..... Riprap.....

Material in Embankment..... Foundation.....

Condition Round Meadow Pond - Westminster
No water over spillway - Gate open

GATES..... Location.....

Size..... Kind..... El. Flowline.....

Condition.....

WHEEL..... Kind..... Size..... Rated H. P.....

Location..... Ave. Head.....

Evidence of Leaks in Structure.....

Recent Repairs and Date.....

Topography of Country below Dam.....

Nature of Buildings and Roads below Dam.....

Number Acres in Pond..... Drainage Area in Square Miles.....

Discharge in Second Feet per Square Mile.....

Estimated Storage Million Cubic Feet.....

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by L. O. Marden Date 4-1-1940 Dam No. 59-11
.....

Town WEST MINSTER Location Brooks Mill Privilege

Owner Crocker-Burbank Co. Use _____

SPILLWAY

El. top abutment _____ El. Crest _____ El. Apron _____ El. St. Bed _____

Width top Abut. _____ Width top Crest _____ Width bottom Sp. way _____

Width flashboards _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Pipe _____

Kind of Foundation under Spillway _____

Condition water down in pond at least 8 feet.

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Borrom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES

Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Number Acres in Pond _____ Drainage Area in Sq. Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by E. C. Corcoran Date Dec. 9, 1942 Dam No. 59-11

Town Westminster Location Whitman River
Owner Crocker-Burbank Co. Use Power - Washing Paper
Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed
Width top Abutment Width top Crest Width bottom Spillway
Width Flashboards carried 8" Kind Flashboards
El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe
Kind of Foundation under Spillway
Condition Good

EMBANKMENT

El. Top El. Natural Ground Width Top
Width of Bottom Upstream Slope Downstream Slope
Kind of Corewall Riprap
Material in Embankment Foundation
Condition Good

GATES Closed - Good Location
Size Kind El. Flowline
Condition

WHEEL Kind Size Rated H. P.
Location Ave. Head
Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by E C Corcoran Date 1/29/44 Dam No. 59-11

Town Westminster Location No. Branch Reservoir

Owner Crocker-Sumner Co Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried 24" Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition A

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition A

GATES

Location

Size Kind El. Flowline

Condition A (open)

WHEEL

Kind

Size

Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure Arthur J. Fontaine lives in

John's House

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

✓
WORCESTER COUNTY ENGINEERING DEPT.
WORCESTER, MASS.

DATE Nov. 20, 1946

SUBJECT: Dam No. 59-11 Westminster - inspected by LOM
TO Nashua River Res. Area

Spillway OK

Embr OK

gates OK

No leaks visible

CAR USED

CAR MILEAGE

END TRIP

BEGIN TRIP

TRIP MILES

B-22

SIGNATURE

CR. JOHN F. W. LAM

TOWN Westminster

59-11

DAM NO.

LOCATION So. Ashburnham Rd

STREAM Whitman R

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Crocker-Burbank Co. Assoc PLACE Fitchburg USE storage

INSPECTED BY LOM DATE Nov. 20, 1946

TYPE OF DAM earth concrete CONDITION good

SPILLWAY

FLASHBOARDS IN PLACE none RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

EMBANKMENT

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

GATES

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

LEAKS

HOW SERIOUS none visible

DATE

COUNTY ENGINEER

TOWN Westminster

DAM NO. 59-11

LOCATION Brooks Mill Privilege

STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Cracker-Burboank PLACE Fitchburg

USE Storage

INSPECTED BY LOM

DATE Dec 21, 1948

TYPE OF DAM

CONDITION

GOOD

SPILLWAY

FLASHBOARDS IN PLACE

None

RECENT REPAIRS

None

CONDITION

Good

REPAIRS NEEDED

EMBANKMENT

RECENT REPAIRS

CONDITION

REPAIRS NEEDED

GATES

RECENT REPAIRS

CONDITION

REPAIRS NEEDED

LEAKS

HOW SERIOUS

DATE

COUNTY ENGINEER

TOWN Westminster

DAM NO. 59-11

LOCATION Brooks Mill Pond

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Crocker Burbank Co PLACE Fitchburg USE Storage

INSPECTED BY LOM - Steve Ford DATE March 15 1951

TYPE OF DAM _____ CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE Yes RECENT REPAIRS None

CONDITION Good

REPAIRS NEEDED None

EMBANKMENT

RECENT REPAIRS None

CONDITION Good

REPAIRS NEEDED None

GATES

RECENT REPAIRS None

CONDITION Good

REPAIRS NEEDED None

LEAKS

HOW SERIOUS None visible

DATE Mar 15, 1951

L.O. Marden
COUNTY ENGINEER

TOWN Westminster

DAM NO. 59-11

LOCATION Brooks Mill Privilege-Northeast Turnpike
Branch

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nashua River Res Co. PLACE Fitchburg USE storage

INSPECTED BY L.O. Marden-S. Foss DATE 1952

TYPE OF DAM _____ CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE none RECENT REPAIRS _____

CONDITION good

REPAIRS NEEDED none

EMBANKMENT

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

GATES

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

LEAKS

HOW SERIOUS none visible.

DATE _____

COUNTY ENGINEER

TOWN Westminster

DAM NO. 59-1

LOCATION

STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Crocker-Burbank & Co. Assoc. PLACE Fitchburg USE

INSPECTED BY Lom DATE 56

TYPE OF DAM CONDITION

SPILLWAY

FLASHBOARDS IN PLACE RECENT REPAIRS

CONDITION OK

REPAIRS NEEDED

EMBANKMENT

RECENT REPAIRS

CONDITION OK

REPAIRS NEEDED

GATES

RECENT REPAIRS

CONDITION OK

REPAIRS NEEDED

LEAKS

HOW SERIOUS

DATE 56

Lom
COUNTY ENGINEER

59-11

WORCESTER COUNTY ENGINEERING DEPT.
WORCESTER, MASS.

DATE _____

SUBJECT: Flood Patrol

TO Crocker Burbank Co - employee

59-11 Brooks Mill Pond

Mar 1, 1958 water 53" below crest of dam.

Mar 10, 1958 " 54" " " " "

CAR USED
CAR MILEAGE
END TRIP
BEGIN TRIP
TRIP MILES

SIGNATURE

TOWN Westminster

DAM NO. 59-11

LOCATION Whitman River

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Cracker Burbank Co PLACE _____ USE _____

INSPECTED BY F. C. Corcoran DATE Apr 4, 1958

TYPE OF DAM _____ CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE 24" RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

EMBANKMENT

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

GATES

RECENT REPAIRS _____

CONDITION Gate open (water Down)

REPAIRS NEEDED _____

LEAKS

HOW SERIOUS _____

DATE _____

COUNTY ENGINEER

TOWN Westminster DAM NO. 59-11
LOCATION Westerly side of S. Ashburnham R. STREAM Whitman River
"Brooks Mill Pond" or "Crocker Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Weyerhaeuser Co. Inc. Place Fitchburg Use Storage Pond
Inspected by F.E.P. - WOL. - Tony Kubec Date Nov. 9, 1964
Type of Dam Earth and concrete Condition Good

SPILLWAY

Flashboards in Place 22" of boards Recent Repairs _____
Condition Good
Repairs Needed The pins and pin boards will be replaced in 1965.
The capacity is 360 M. Gals.

EMBANKMENT

Recent Repairs _____
Condition Good condition
Repairs Needed There is riprap on the upstream slope.

GATES

Recent Repairs _____
Condition Good
Repairs Needed The gate is now wide open.

LEAKS

How Serious No leaks.

DATE: _____ County Engineer

TOWN Westminster

DAM NO. 57-11

LOCATION South Ashburnham Rd

STREAM Whitman River

"Crocker Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by Whitman Associates, Inc. Place Fitchburg Use Storage Pond

Inspected by W. C. Crocker Date Oct 26, 1967

Type of Dam Earth-filled - Concrete Condition Good condition

SPILLWAY

Flashboards in Place 26' x 3' boards Recent Repairs

Condition Good spillway is in good condition

Repairs Needed Reinforcement in balance top of boards

EMBANKMENT

Recent Repairs

Condition Good condition

Repairs Needed

GATES

Recent Repairs

Conditions Good condition

Repairs Needed Gate has pedestal base - hinges not visible

to test gate base

LEAKS

How Serious No leaks were visible

DATE:

County Engineer

TOWN Westminster DAM NO. 59-11

LOCATION Brooks Mill or Crocker Pond STREAM Whitman River

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by _____ Place _____ Use _____

Inspected by M.E. Hunt Date Nov 15, 1968

Type of Dam _____ Condition _____

SPILLWAY 1.5 ft permanent boards?

Flashboards in Place _____ Recent Repairs _____

Condition 8"-10" water held by boards

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition OK

Repairs Needed _____

GATES

Recent Repairs _____

Condition OK

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer _____

INSPECTION REPORT & DATA FOR DAMS

Owner: Weyerhaeuser Co. Inc.
 His Address: Fitchburg
 Function of Dam: Storage

Location & Access: S.W. of Ashburnham Rd.
0.3 Mile S.E. of Bean Hill Rd.
 USGS Quad. Gardner 19 Lat. 42-34-10 Long. 71-52-55
 Drain. Ar.: 19.5 Sq. Mi. Ponds: ac.; Res. @ dam:
 Character of D.A.:

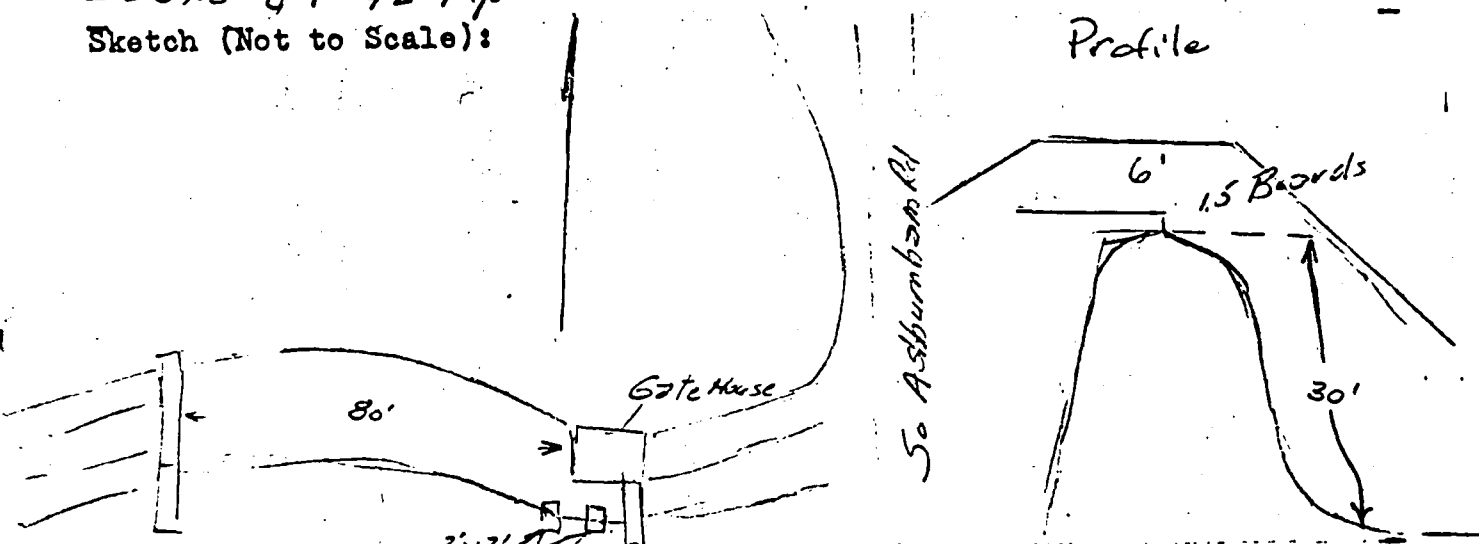
Dam No. 332-11
 Town: Westminster
 Stream: Whitman River
 Pond: Crocker Pond
 Date: 2-24-72
 By: Eaton & Cary
 CONDITION RATING
 Structural: Good
 Hydraulic: 80 X 75
 General: Good
 PRIORITY: *

Estimated
 Discharge:
 Capacity:

General Description of Dam and Discharge Control:

Earth dam riprapped on pond face with curved concrete
spillway. 15 boards in place. Locked gate house with 3 outlets
2-3' x 3' & 1-42" pipe

Sketch (Not to Scale):



Remarks and Recommendations:

* Some spalling of ^{42"} concrete in spillway.

Date 2-24-72 By Eaton & Cary Comment

Dam No. 3-14-332-11

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town WESTMINSTER Dam No. 3-14-332-11
 Name of Dam Crocker Pond Inspected by Regan, RIZKALL
 Date of Inspection 4/7/76

2. Owner/s: per: Assessors _____ Prev. Inspection ☒

Reg. of Deeds _____ Pers. Contact _____

1. Weyerhaeuser Co. Inc. 545 Westminster Rd. Fitchburg
 Name _____ St. & No. _____ City/Town State Tel. No. _____
 Att: Bill Baker - Water Control Division.

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.

Name: _____ St. & No.: _____

City/Town: _____ State: _____ Tel. No.: _____

4. No. of Pictures taken _____

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

1. Minor _____ 2. Moderate _____

3. Severe ☒ 4. Disastrous _____

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

6. Outlet Control: Automatic _____ Manual ☒

Operative ☒ yes; _____ No.

Comments:

7. Upstream Face of Dam: Condition:

1. Good ☒ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

onComments:

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____
 3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

9. Emergency Spillway:

Condition: 1. Good _____ 2. Minor Repairs ✓
 3. Major Repairs _____ 4. Urgent Repairs _____

Comments: MINOR SPALLING OF CONCRETE @
NUMEROUS LOCATIONS ON CONC. OGIVE AND
BOTH CHEEK WALLS

10. Water Level at time of inspection: 9'± ft. above ✓ below _____
 top of dam Emb. principal spillway _____
 other _____

11. Summary of Deficiencies Noted:

- a) Growth (Trees and Brush) on Embankment _____
- b) Animal Burrows and Washouts _____
- c) Damage to slopes or top of dam _____
- d) Cracked or Damaged Masonry MINOR SPALLING (See (9) Above)
- e) Evidence of Seepage ✓ MINOR Seepage emerging From Downstream
END OF West Cheek WALL.
- f) Evidence of Piping _____
- g) Erosion _____
- h) Leaks (See "E" Above)
- i) Trash and/or debris impeding flow _____
- j) Clogged or blocked spillway _____
- k) Other _____

12. Remarks & Recommendations: (Fully Explain)

The Cutoff Provided by The brick Core Wall in The Easterly Embankment is Virtually Perfect. No leakage or saturation was noted @ The downstream Toe.

Nearly as good is The Cutoff Provided by The Westerly emb. Core Wall, The only leakage being a light flow emerging from the downstream end of The West Cheek wall. The only other deficiency noted was minor spalling at numerous locations on The OGIVE Spillway and Cheek walls

13. Overall Condition:

1. Safe ✓
2. Minor repairs needed ✓
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)
Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3Submitted by W. Regan Dam No. 3-14-332-11Date 4/12/76 City/Town WestminsterName of Dam Crocker Pond1. Location: Topo Sheet No. 19C (GARDNER QUAD)

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

2. Year built: 1924 ^{Prior To} Year/s of subsequent repairs ^{Some} 1933 1939 3. Purpose of Dam: Water Supply _____ Recreational ☒ _____
Irrigation _____ Other ☒ Storage4. Drainage Area: 20 ± sq. mi. _____ acres5. Normal Ponding Area: 100 ± acres; Ave. depth N/AImpoundment: N/A gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir

8 ± ^{Year Round} Residences i.e. summer homes, etc. _____7. Dimensions of Dam: Length 500' ± Max. Height 45' ±Slopes: Upstream Face 1½:1Downstream Face 1½:1Width across top 10' ±

8. Classification of Dam by Material:

Earth ☒ Conc. Masonry ☒ Stone Masonry ☒Timber _____ Rockfill _____ Other Brick Core Wall

9. A. Description of present land usage downstream of dam:

50 % rural; 50 % urban.B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no ☒.

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

See Note
Below

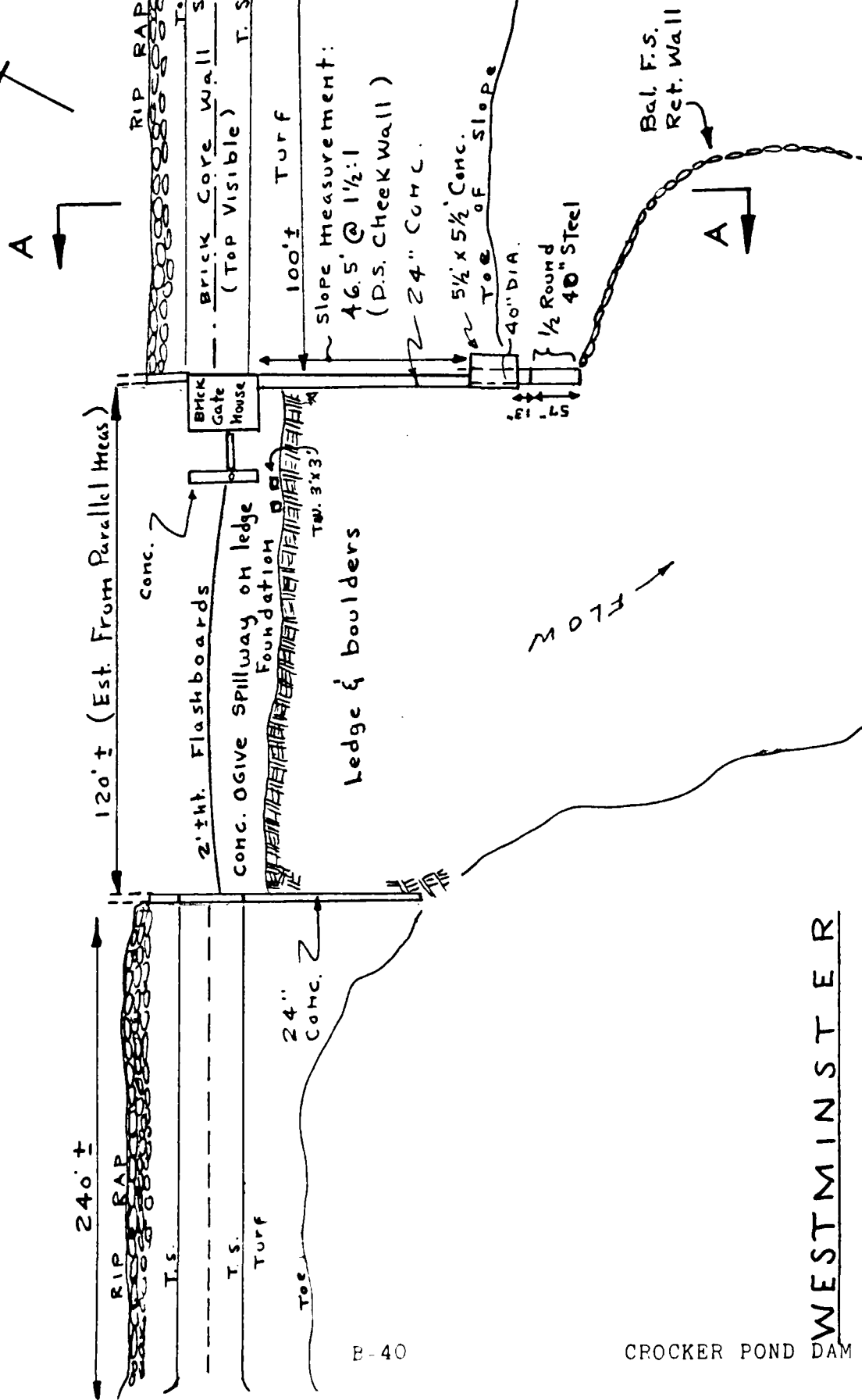
No. of people _____.
 No. of homes _____.
 No. of Businesses _____.
 No. of industries _____ Type _____
 No. of utilities _____ Type _____
 Railroads _____.
 Other dams _____.
 Other _____

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

12. How to Locate: W.G. on Rte 2A, Turn Rt. onto Ashburnham Rd. 0.6± mi. beyond Fitchburg/Westminster Line. Travel 1± mi To Dam adjacent To Lt. Side of Rd.

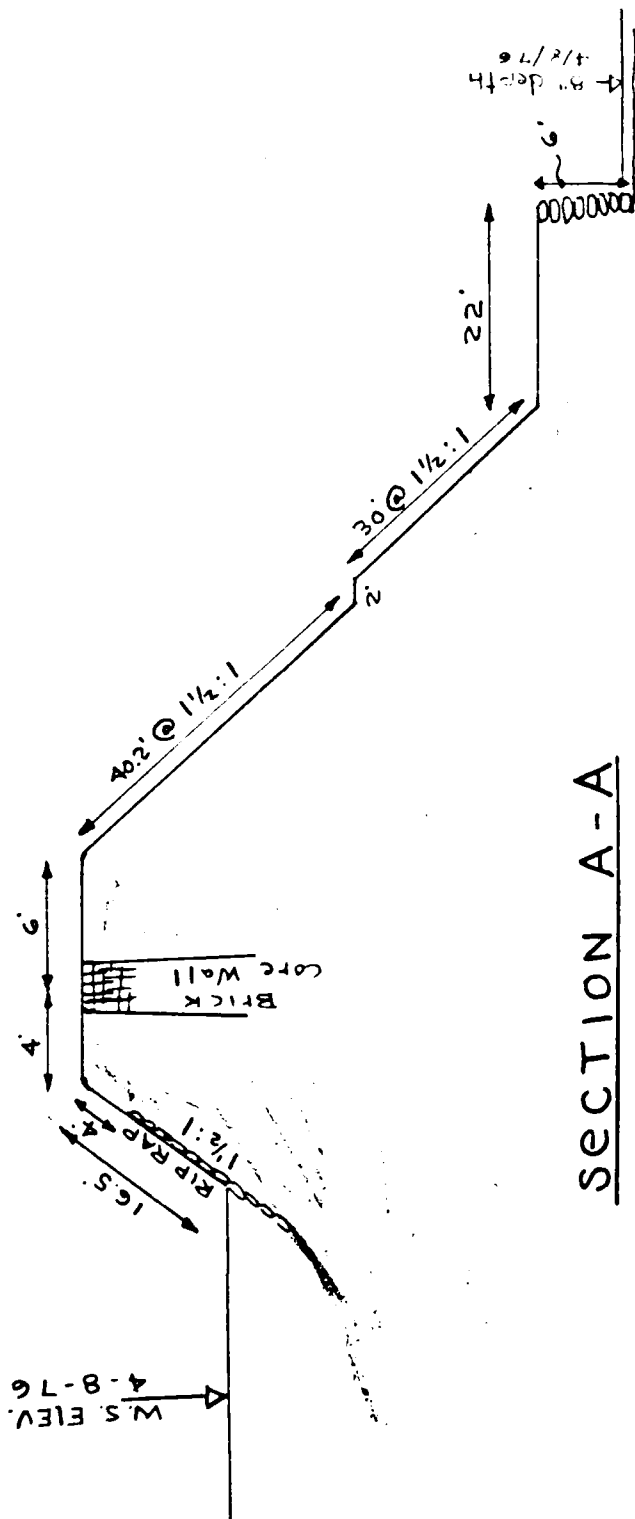
Note (10): In The unlikely Event of Complete failure, The Rte 2A Bridge and all utilities on & under 2A would be blown away. AN ENORMOUS Amount of Property Damage would Probably result in The Waite's Corner Section of Fitchburg. There is Some Small Possibility of loss of life There. Further minor To Moderate Property damage Could occur Down stream Along The NASHUA River.

CROCKER POND



WESTMINSTER

DAM No. 3-14-332-11



SECTION A-A

WESTMINSTER

DAM No. 3-14-332-11

TABLE B-1

CROCKER POND DAM OUTLETS

OUTLET	FLOOD GATE	MAIN LOW LEVEL OUTLET	AUXILIARY LOW LEVEL OUTLET	MUD GATE	TRASH CHUTE
Size	8'x12'	42" Dia.	24" Dia.	3'x3'	3'x3'
Material	Wooden Gate	Steel Pipe	Cast Iron Pipe	Concrete Conduit	Concrete Opening
Location	Between Spillway And Gate House	East Sidewall	Gate House And Spillway	Spillway	Gate House
Invert at Upstream End	746.0	731.5	731.8	726.5	753
Control Mechanism	Slide Gate	Slide Gate	Slide Gate	Slide Gate	Plate or Hatch Cover
Control Mechanism Location	Sidewall Between Spillway And Floodgate	Gate House	Gate House	Sidewall Between Spillway And Floodgate	Gate House
Discharge Location	Spillway Face	Downstream Channel	Spillway Face	Spillway Face	Spillway Face
Operable	*Yes	*Yes	*Yes	*Yes	*Yes
Last Operated	Unknown	July 1980	July 1980	Unknown	Unknown
Deficiencies at Time of Inspection	Could Not Be Examined, Water Dis- charging over Top of Gate	Clear of Debris, No Flow	Could Not Be Examined, Water Dis- charging Over Face of Opening	Could Not Be Examined, Water Dis- charging Over Face of Opening	Clear of Debris, No Flow

*Reported by Owner

TABLE B-1 (CONTINUED)

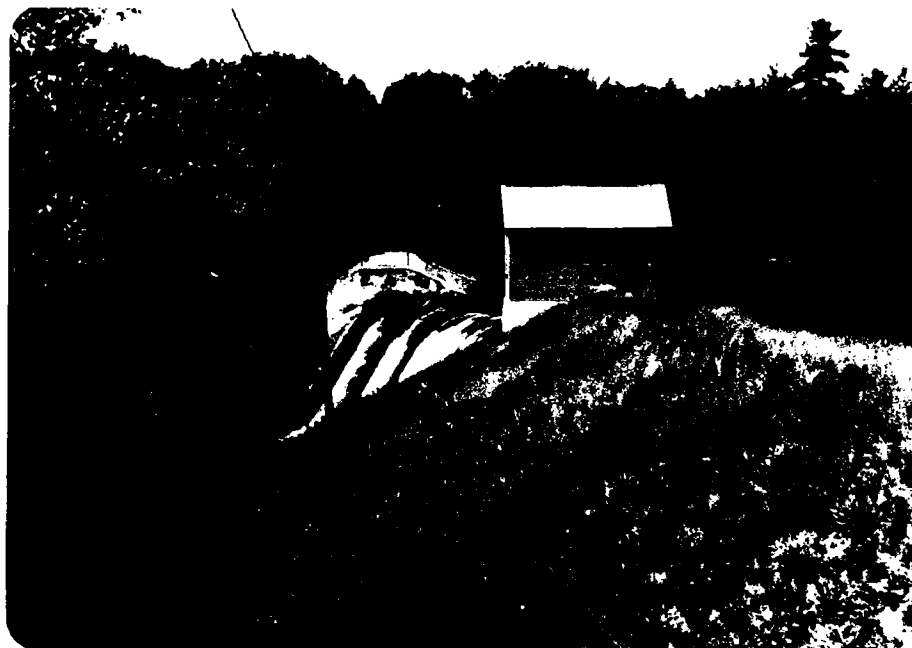
OUTLET	FLOOD GATE	MAIN LOW LEVEL OUTLET	AUXILIARY LOW LEVEL OUTLET	MUD GATE	TRASH CHUTE
No Flash- Boards				Not Applicable	Not Applicable
Discharge Capacity (cfs)	200	270	73		
Pond Elev.	750.5	750.5	750.5		
Time to Lower Pond 1 Foot (hrs.)	6.1	4.5	16.7		
Flash- Boards				Not Applicable	Not Applicable
Discharge Capacity (cfs)	340	285	77		
Pond Elev.	752.3	752.3	752.3		
Time to Lower Pond 1 foot (hrs.)	3.6	4.3	15.9		

APPENDIX C

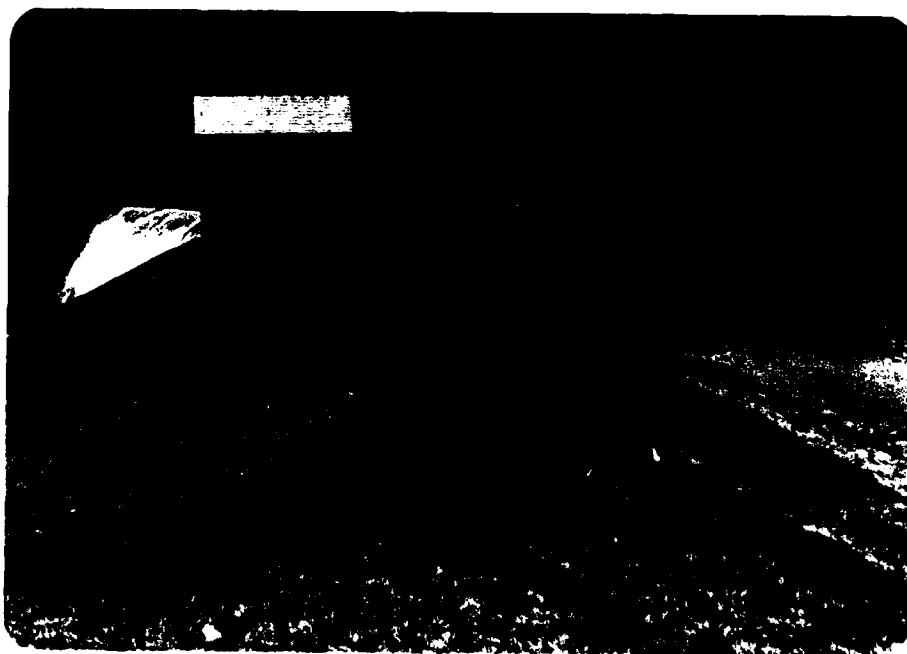
PHOTOGRAPHS

Note: Location and direction of photographs shown on Figure B-1
in Appendix B.

CROCKER FOND DAM



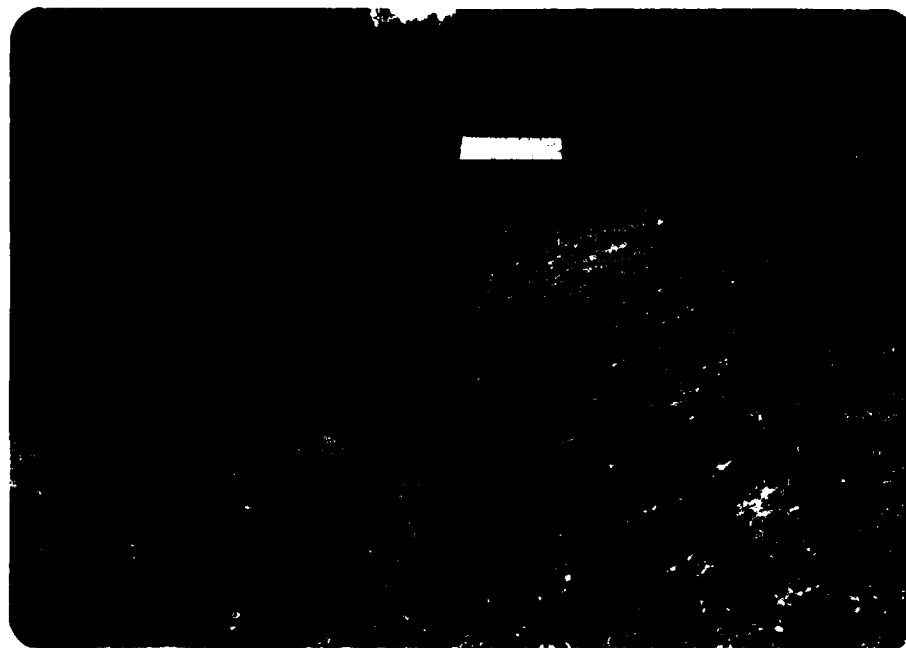
NO. 1 VIEW OF DOWNSTREAM SIDE - EAST SECTION



NO. 2 VIEW OF CREST - EAST SECTION



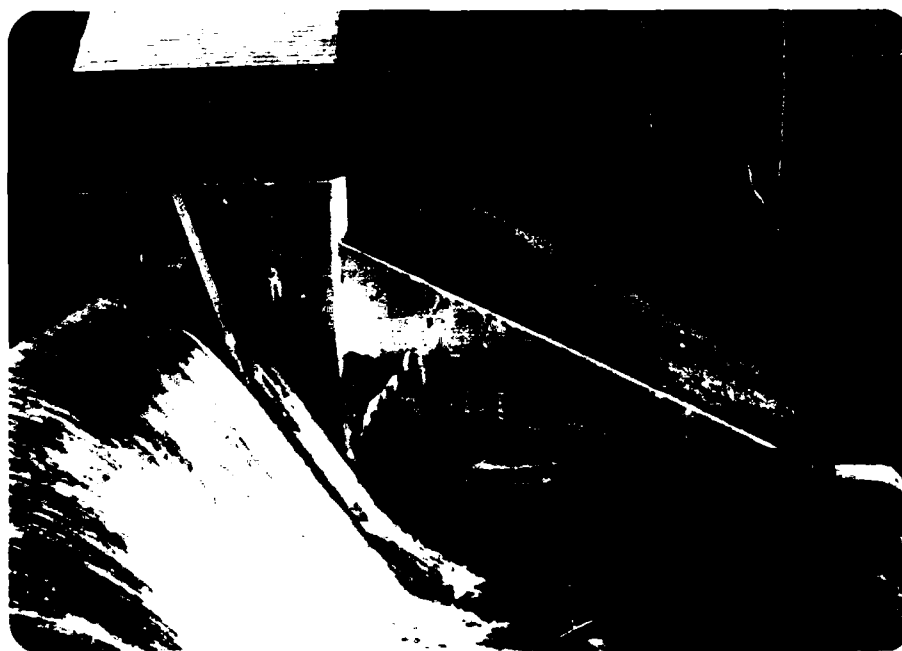
NO. 3 VIEW OF UPSTREAM FACE, EAST SECTION



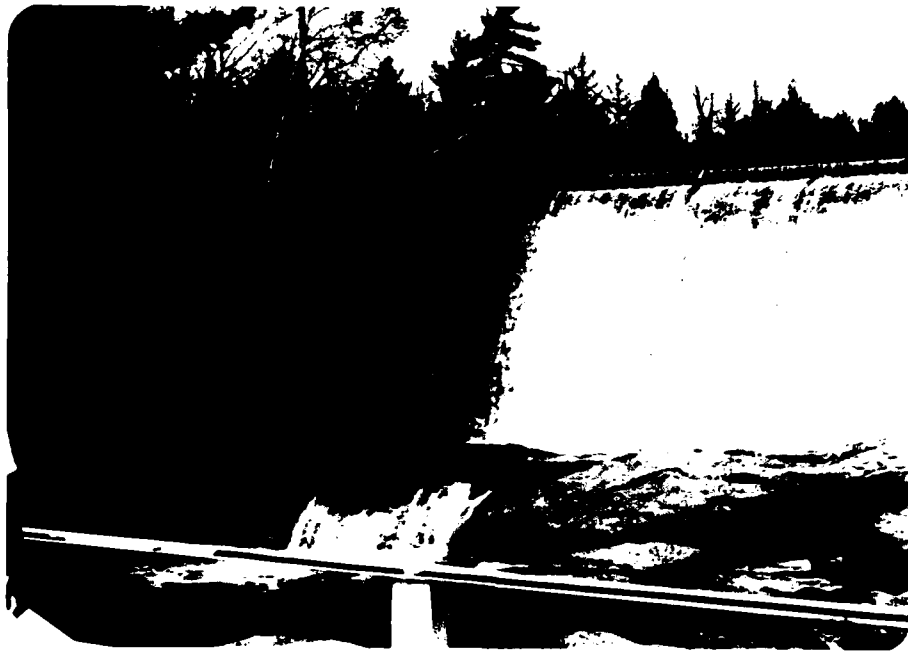
NO. 4 VIEW OF UPSTREAM FACE, WEST SECTION



NO. 5 VIEW OF EXPOSED CORE WALL



NO. 6 VIEW OF GATEHOUSE AND EAST SIDEWALL OF SPILLWAY



NO. 7 VIEW OF SPILLWAY AND WEST SIDEWALL



NO. 8 VIEW OF OUTLET STRUCTURES



NO. 9 VIEW OF DISCHARGE CHANNEL



NO. 10 VIEW OF DOWNSTREAM CHANNEL

APPENDIX D
HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

	<u>Page</u>
Figure D-1, Drainage Area Map	D-1
Hydrologic and Hydraulic Computations	D-2

I Test Flood, Storage & Storage Function

1- Total Drainage Area - 20.0 mi²

2- Pond(s) Area: 0.61
 Swamp(s) Area: 0.83
Total Area Pond(s) & Swamp(s): 1.50

% Ponds & Swamps = $\frac{1.5}{20.0} = 7.5\%$

3- $\frac{1305-750.5}{38200} = 1.45\%$; $\frac{1343-750.5}{26300} = 2.25\%$ } Say Ave Slope = 1.85%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be Semiurban area Flat & Coastal and taken at 975 c.f.s./mi²
 Size Class: Intermed.; Hazard Pot.: High; Spill. Des. Flood: Full PMF
 Use: Test Flood = Full PMF

5- Test Flood Inflow = $(975) 20.0 = 19500 \text{ cfs.}$ *

* Note: Westchester T.F. 5-400 + 12000 cfs. would result in a peak several times greater than the peak runoff from the interval.

6- Pond Storage

The pond area is 0.16 sq. mi. at elev. 751.
 Based on a const. area, storage increases at 101 ac. feet per foot of depth increase.

7- Spillway crest elev. is 750.5

8- Storage Functions are based on $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$

S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area.

$S(\text{in Inches}) = 12 D \left(\frac{.16}{20.0} \right) = .096 D$; $R = 6 \text{ hr rain of Storm}$

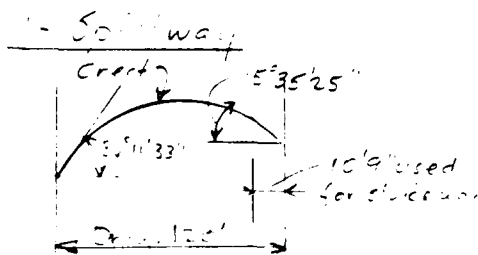
D = Storage depth in feet above spillway crest in reservoir

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

$F_{TF} = 19500 - 1026 S = 19500 - 98 D$

$F_{1/2 PMF} = 9750 - 1026 S = 9750 - 98 D$

II Discharge Ratios



Original crest length = 122'
 Used for sluiceway = 10.7'
 Spillway length = 111.25'
 $Q \approx 4 h^{1.5}$, Crest el. 750.5

Pond El.	752	754	756	758	758.5	760	762	761
Q_1	820	2910	5740	9140	10070	13030	17350	15140

2-Sluiceway (From 5926)

Crest el. 745.83, broad crest, 7.75' wide, $g = 3.0 h^{1.5}$
 (closed sluice top el. 752±; $Q_2' = 3.33(7.75) h^{1.5} = 25.8 h^{1.5}$)

Pond El.	750	751.8	752	754	756	758	758.5	760	761	762	763	764
Avg. No. Flows	200	340	360	540	750	980	1650	1240	1370	1510	1650	1800
Q_2'	—	—	—	70	210	380	430	580	700	820	940	1070

Lower Pool 12' No Flows - 6 hrs or 36 min. With Flows - 3.6 hrs or 216 min.

3-Peristock

Note: This discharge < 5% of T.F. and not included on (III) or (IV)
 42" dia, ± 54' long, exit at el. 729.7, 1-circuit, 1-bend entrance

$$h = \frac{V^2}{2g} \left[0.2 + 1.0 + 0.2 + \frac{54}{3.5} (0.16) \right] = 1.65 \frac{V^2}{g}; V = 6.0 \sqrt{h}, Q_3 = 66.2 \sqrt{h}$$

Pond El.	751.3	752.3	756	758	758.5	760	762	750.5	749.5
H	21.6	22.6	26.3	27.3	28.8	30.7	32.7	30.5	29.5
Q_3	280	290	310	320	320	340	340	270	270
	Avg 285					Avg 270			

4-Crest Flow

el. crest 758.5, length 40', $g = 2.5 h^{1.5}$

Pond El.	760	762	761	763	764
Q_4	1870	6650	4030	9740	13160

5-Spillway with Flashboards

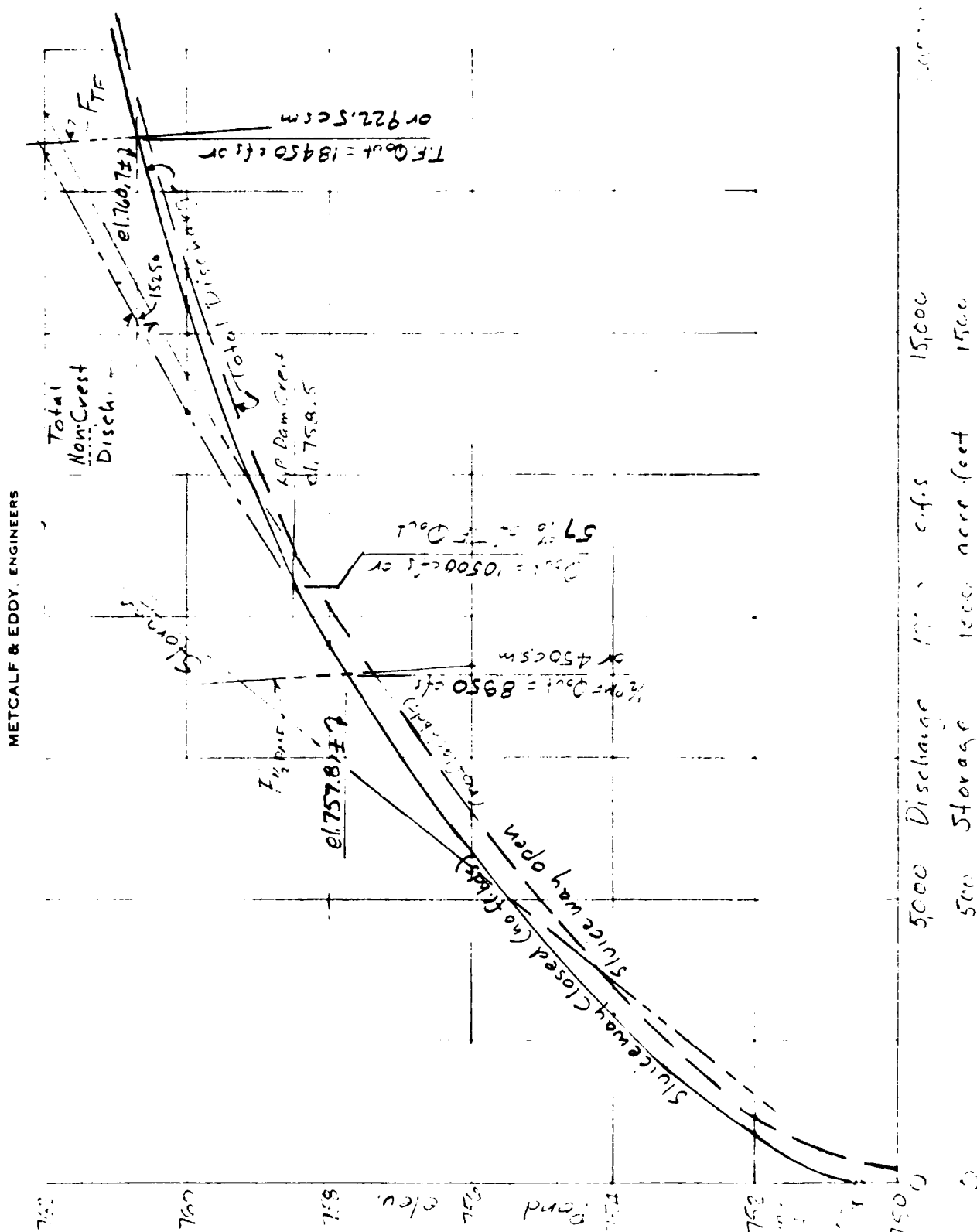
Use William's Flashboard Hydr. Tables - length 100' - 100' - 100'

Pond El.	754	756	758	760	762	763	764
Q_5	810	2610	5010	7490	9970	11280	12400

(+ time to trap)

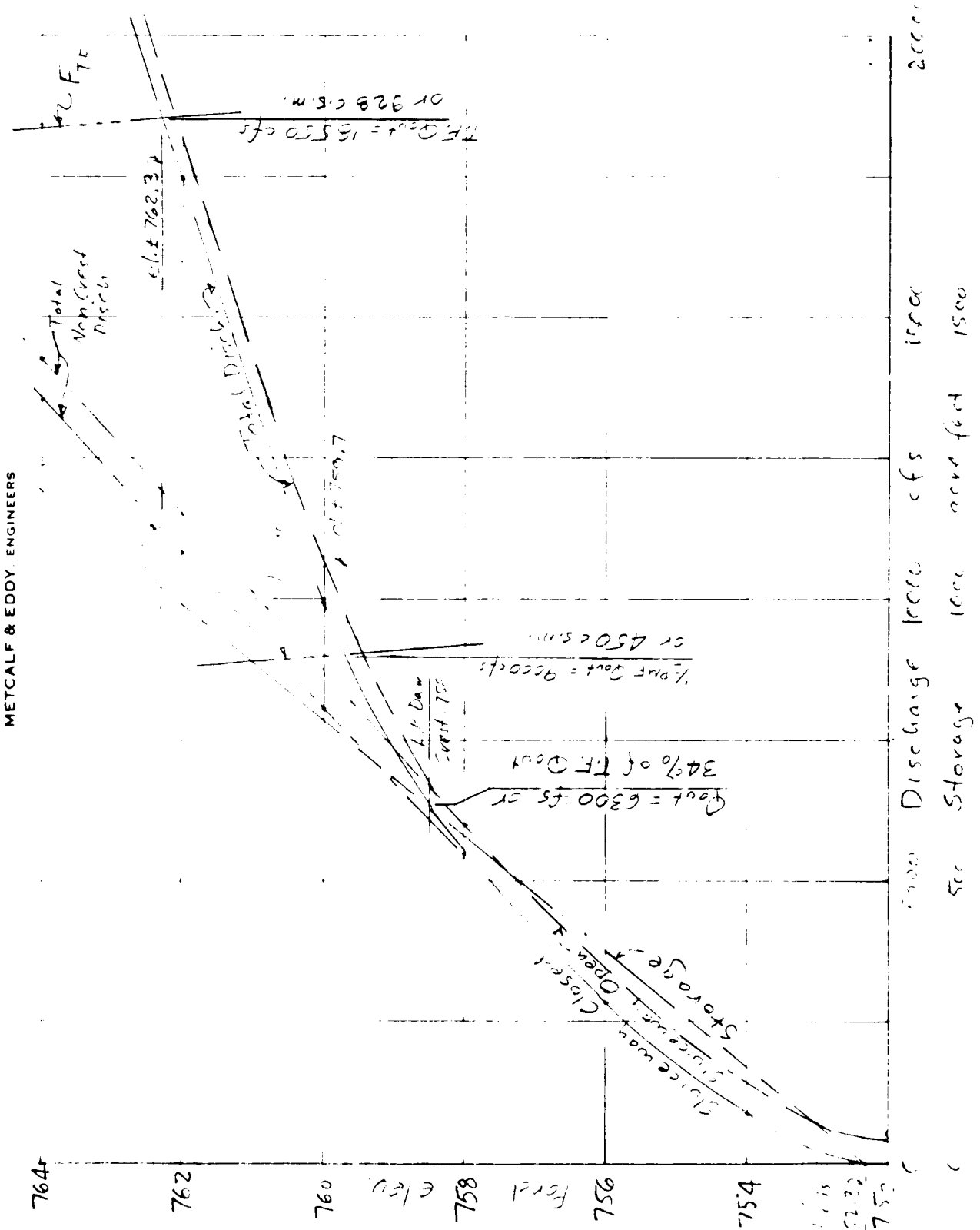
Project Valleyview of New Bedford Dam Acct No 3023 Page 3 of 7
 Subject Warecester County, Mass Comptd By LEB Date 5/2/80
 Detail CROCKER POND Ckd By M. Howard Date 6/16/80

III Discharge, Storage & Storage Function vs Pond Elevation - 1/2 Sluiceway open



Project State of Va. Fed. Dams Acct No 6926 Page 4 of 7
 Subject Warrenton County, Ms. C Comptd By LEB Date 6/16/80
 Detail CROCKER POND Chd By M. Flourek Date 6/16/80

IV Discharge, Storage & Storage Function vs Pond Elev. - WITH F.L. 752.32



AD-A155 343

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
CROCKER POND DAM (MA (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV JUN 80

2/2

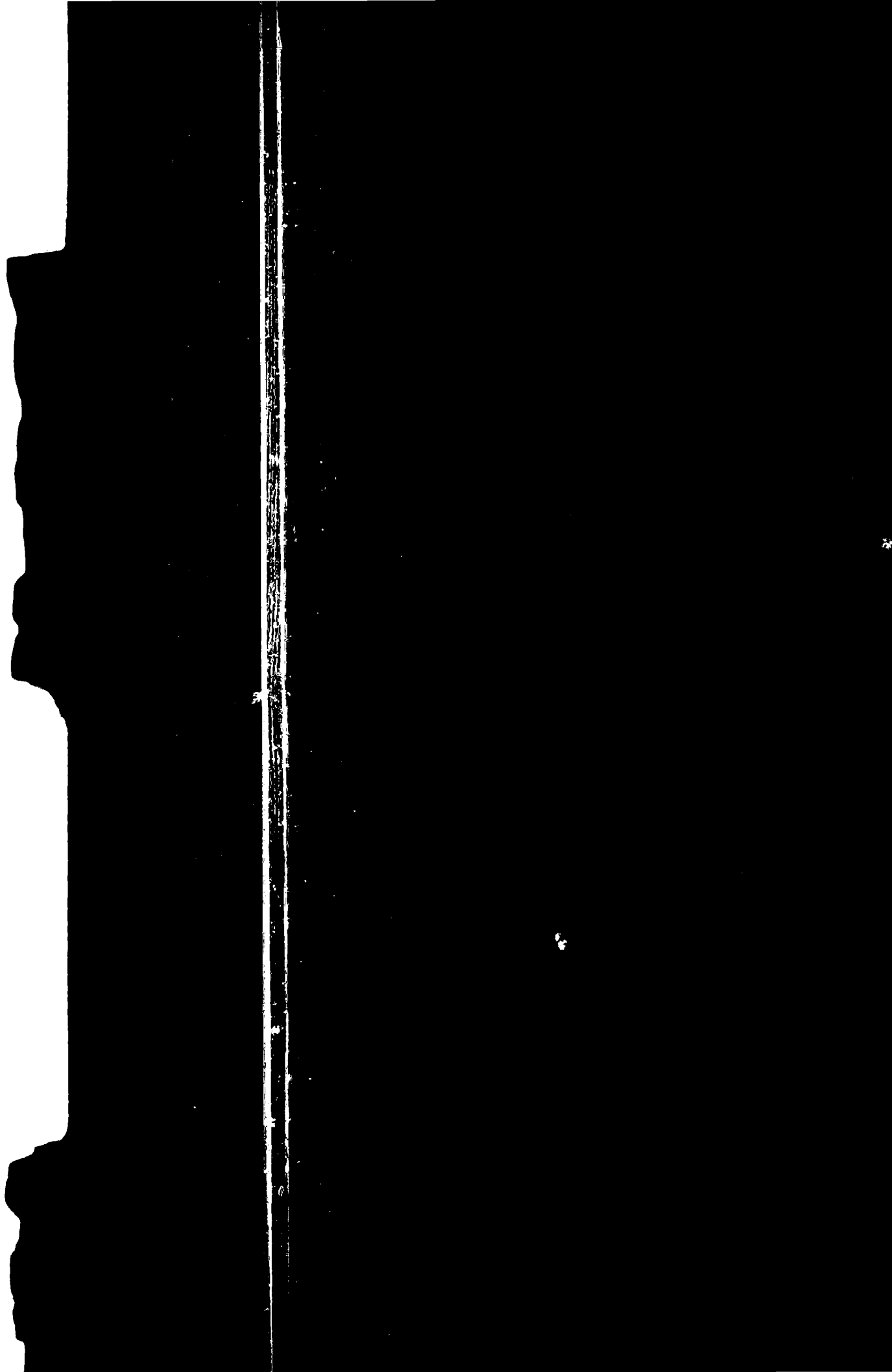
UNCLASSIFIED

F/G 13/13 NL

END

FORM 1

ONE



(V) Test Flood Crest Flow (Sluice Gate Closed)

1 - NO FLASHBOARDS:

Test Flood Elev. - 760.7
 Low Pt. on Crest - 758.5
 Max. Head 2.2 feet

$$\text{Crest Flow} - \text{cfs/ft.} = q = 2.55(2.2)^{1.5} = 8.32$$

Where flow is critical: $y_c = 1.29 \text{ ft.}$; $V_c = 6.4 \text{ fps}$

2 - WITH FLASHBOARDS:

Test Flood Elev. - 762.3
 Low Pt. on Crest - 758.5
 Max. Head 3.8 feet

$$\text{Crest Flow} - \text{cfs/ft.} = q = 2.55(3.8)^{1.5} = 18.9 \text{ cfs}$$

Where flow is critical: $y_c = 2.2 \text{ ft.}$; $V_c = 8.5 \text{ fps}$

(VI) Low Level Outlets

(a) 24" Outlet

Description: $\pm 21'$ of 24" ϕ $\pm$ elev. 732.29, one 90° bend

$$H_d = \frac{V}{g} \left[0.5 + 1.0 + 0.4 + \frac{2.1}{2} (0.018) \right] = 2.1 \frac{V}{2g}; V = 5.54 \sqrt{H}, Q = 17.4 \sqrt{H}$$

Water Elev	752.3	751.3	750.5	749.5
Head	20.0	19.0	18.2	17.2
Q	78	76	74	72

Ave. Q over 12" range = 77 cfs with Flashbds 73 cfs No Flashbds

1 - No Flashboards

$$\text{Time to lower water 12"} = \frac{43560(101)}{3600(73)} = 16.7 \text{ hours or } 1004 \text{ min.}$$

2 - WITH Flashboards

$$\text{Time to lower water 12"} = \frac{43560(101)}{3600(77)} = 15.9 \text{ hours or } 952 \text{ min.}$$

(b) Penstock (see (II)-3)

1 - No Flashboards

$$\text{Time to lower water 12"} = \frac{43560(101)}{3600(270)} = 4.5 \text{ hours or } 272 \text{ min.}$$

2 - WITH Flashboards

$$\text{Time to lower water 12"} = \frac{43560(101)}{3600(285)} = 4.3 \text{ hours or } 257 \text{ min.}$$

(c) Mudvalve

Assumed to be inoperative



Failure of Dam

Peak Failure Flow:

Pond Elevation - 758.5 (L.P. Crest)

Toe Elevation - 720 ±

$$Y_0 = 38.5 \text{ ft}$$

Dam Length Subject to Breaching = 140' (East of Pond)

$$W_0 = 40\% (140) = 56 \text{ ft}$$

$$Q_P = 1.68 W_0 (Y_0)^{1.5} = 1.68 (56) (38.5)^{1.5} = 22,500 \text{ cfs}$$

Ongoing discharge 11120 cfs - assume this becomes zero, as failure flow increases above.

Storage Volume Released:

Storage Above Spillway - 101 (8) = 808 ac. ft

Storage Below Spillway - 101 (30) = 1027 " "

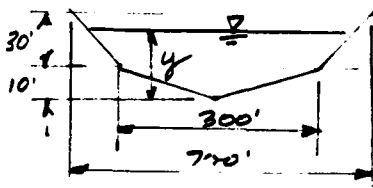
$$S = \text{Total Storage} = \frac{1835}{1.835} \text{ " "}$$

Channel Hydraulics:

$$S = \frac{30}{2500}; n = 0.10; V = 1.632 R^{4/3}$$

$$A_1 = 15y^2 \text{ (At } y=10 = 1500 \text{ ft}^2\text{)}, A_2 = \frac{1}{3}[20y^2 + 500y - 2500]$$

$$P_1 = 30.06y; P_2 = 165.6 + 13.5(y)$$



y	A	P	V	Q
5	375	150.3	3.00	1130
10	1500	300.6	4.76	7150
15	3167	368.1	6.85	21700
16	3540	381.6	7.21	25500
12	2127	327.6	5.68	12100

Failure, as above, would increase flow depth downstream from ± 12 feet to ± 15.5 feet



Failure of Dam - when not discharging

Peak Failure Flow:

Pond Elevation - 752.3 (top of flashboards)

Toe Elevation - 720.0

$$Y_0 = 32.3$$

Dam Length Subject to Breaching = 140'

$$W_0 = 40\%(140) = 56$$

$$Q_{P_1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (56) (32.3)^{1.5} = \underline{17270 \text{ cfs}}$$

Continuing Spill. Disch.: 0 cfs

Peak Failure Flow: 17270 cfs

Storage Volume Released:

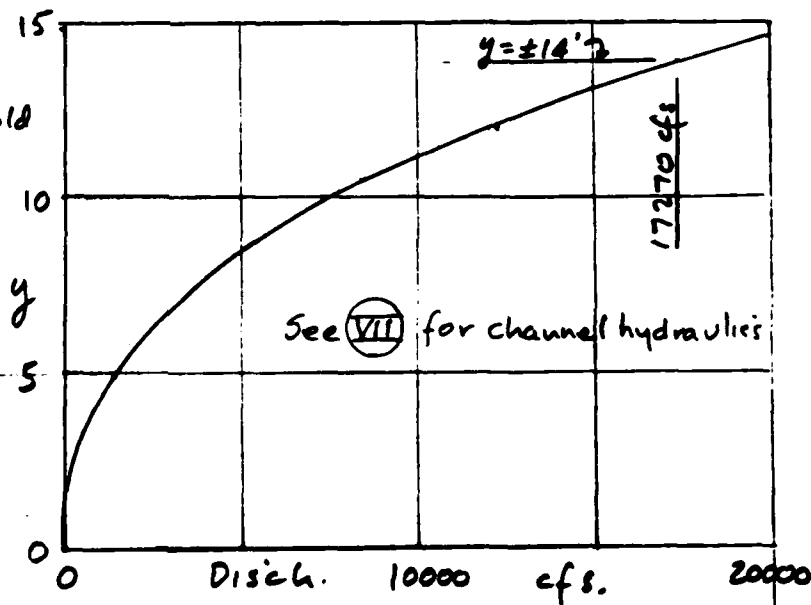
$$\text{Storage Above Spillway } 1.0(101) = 182 \text{ ac ft.}$$

$$\text{Storage Below Spillway } \frac{1}{3}(30.5)(101) = \underline{1026 \text{ " "}}$$

$$\text{Total Storage } \underline{1208 \text{ " "}}$$

Channel Hydraulics:

Failure, as above, would increase flow depth downstream from 0' to $\pm 14'$.



APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

CROCKER POND DAM

INVENTORY OF DAMS IN THE UNITED STATES

STATE	DIVISION	COUNTY	DIST.	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
WA	03P	NED	44	02	CROCKER POND DAM	4232.1	7152.9	04AUG80

POPULAR NAME	NAME OF IMPONDMENT
HOODS MILL DAM	CROCKER POND

REGION	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST. FROM DAM (MI.)	POPULATION
01 09	WHITMAN RIVER	WESTMINSTER	2	4525

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STURGEON GENERAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES (ACRE-FT.)	MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)
WE	1933	U	59	39	1835	1027	

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

REMARKS
23 STORAGE

DIST	HAS LENGTH TYPE	SPILLWAY	VOLUME OF DAM (CY)	MAXIMUM DISCHARGE (CFS)	POWER CAPACITY (KW)	INSTALLED PROPOSED	NO. OF LOCKS	NAVIGATION LOCKS
1	520 U	120	10500	36000				

OWNER	ENGINEERING BY	CONSTRUCTION BY
JAMES RIVEN - MESS., INC.	HOWARD M. TURNER	UNKNOWN

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
WETCALF & EDDY INC	06MAY80	PL 92-367

REMARKS
33- WITHOUT FLASHBOARDS

END

FILMED

8-85

DTIC



