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MA NEW ENGLAND DIV APR 79

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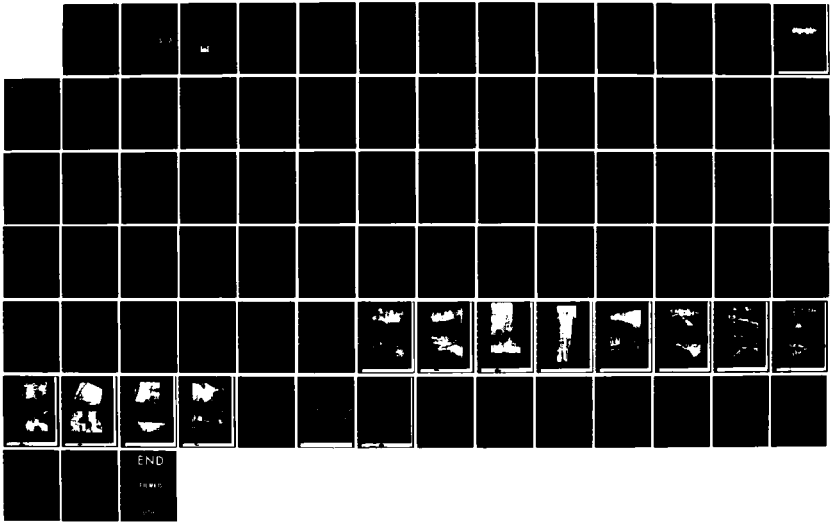

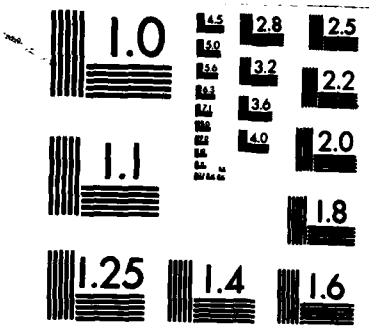

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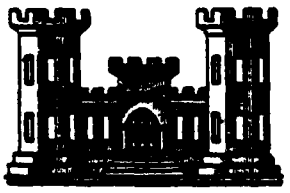
AD-A154 483

MERRIMACK RIVER BASIN
ASHLAND, MASSACHUSETTS

MILL POND DAM
MA 00436

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

APRIL, 1979

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A154 483

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00436	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Mill Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE April 1979 13. NUMBER OF PAGES 72
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

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

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Ashland , Massachusetts
Sudbury River

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

The dam is about 250 ft. long and 10 ft. high. The dam is in poor condition. It is small in size and has a hazard potential of high. As an alternative to modifying and repairing the seriously inadequate existing structure consideration should be given to replacing it with a properly designed new dam or removing the dam altogether.

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MERRIMACK RIVER BASIN
ASHLAND, MASSACHUSETTS

MILL POND DAM

MA 00436

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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

APRIL 1979

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.:	MA 00436
Name of Dam:	Mill Pond (Myrtle Street)
Town:	Ashland
County:	Middlesex
State:	Massachusetts
Stream:	Sudbury River
Date of Site Visit:	29 March 1979

BRIEF ASSESSMENT

Mill Pond Dam consists of an earth embankment with two uncontrolled concrete spillways. The total length of the dam is approximately 250 ft. and its maximum height is about 10 ft. The spillway weirs, approximately 45 and 50 ft. in length, are at a level just 2 ft. below the top of the dam. There is no low-level outlet at the dam site; a former sluice gate outlet has been blocked by concrete. There is a water supply outlet at the right abutment which passes beneath the floor of an industrial property; however, this can not be considered a regulating outlet due to the unknown configuration of its controls and conduits. The dam was probably constructed in the early 1900's to provide power for adjacent mill buildings. The impounded water is now drawn for air conditioning purposes.

Due to the extent of downstream development that would be affected in the event the dam were to fail, Mill Pond Dam is classified as having a "high" hazard potential in accordance with Corps of Engineers guidelines.

The dam is in poor condition, based on a visual examination of the structure. Several major deficiencies were noted, although there was no evidence of major settlement, overall lateral movement or other signs of impending structural failure, or other conditions which would warrant urgent remedial action.

Based on the "small" size and "high" hazard potential classifications in accordance with Corps of Engineers guidelines, the test flood for this dam is one-half the Probable Maximum Flood (1/2 PMF). Hydraulic analyses indicate that the test flood outflow of 17,400 cfs (inflow 18,560 cfs or 563 csm) would overtop the dam by about 9.7 ft. With the water level at the top of the dam, the total spillway capacity is about 660 cfs, which is only 4 percent of the test flood and thus is considered to be seriously inadequate.

Gordon-Mindick Properties, owner of the dam, should engage a registered professional engineer to examine the spillways at a time of low flow and also conduct investigations related to the spillway capacity, structural stability, repairs to the embankment and channel walls, noted seepage and lack of a reservoir drain at the site, as outlined in Section 7.2. Any necessary modifications resulting from the investigations, and remedial measures, including removing trees, brush, stumps and roots, restoring grades, repairing stone walls, removing flashboard supports and renovating the water supply outlet works, as outlined in Section 7.3, should be implemented by the Owner within one year after the receipt of this report. The Owner should also prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan.

As an alternative to modifying and repairing the seriously inadequate existing structure, consideration should be given to replacing it with a properly designed new dam or removing the dam altogether.

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

PREFACE

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

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

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

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm run-off), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential. Consideration of downstream flooding other than in the event of a dam failure is beyond the scope of this investigation.

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.

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REPRODUCED AT GOVERNMENT EXPENSE

1. Overview of Mill Pond (Myrtle Street) Dam

FILE NO. 4270 A33

DAM: Mill Pond

IDENTIFICATION NO. MA 00436

LOCATION MAP
USGS QUADRANGLE
FRAMINGHAM, MA

APPROX. SCALE: 1"= 2000'

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM
MILL POND DAM
MA 00436

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.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 28 November 1978 from Colonel Max B. Scheider, Corps of Engineers. Contract No. DACW33-79-C-0018 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/ hydrologic aspects of the Investigation.

b. Purpose of Inspection. The primary purposes of the National Dam Inspection Program are to:

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

2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Mill Pond (Myrtle Street) Dam is located on the Sudbury River immediately upstream of Myrtle Street in Ashland, Massachusetts, as shown on the Location Map, page vii. The coordinates of the dam site are approximately N42° 15.8', W71°28.1'. The Sudbury River enters the MDC Reservoir No. 2 approximately 4,500 ft. downstream of the dam. Discharge from the reservoir system continues as the Sudbury River, eventually joining the Merrimack River in Lowell via the Assabet and Concord Rivers.

b. Description of Dam and Appurtenances. The dam consists of an earth embankment on the right side (looking downstream) and, to the left, two ungated overflow spillways separated by a concrete wall. The total length of the dam is approximately 250 ft. and its maximum height is about 10 ft. There is a blocked sluice gate outlet through the earth embankment on the right, and a water supply outlet channel at the right abutment, but no low-level drain at the dam site. The general configuration of the project is shown on the "Site Plan Sketch", page C-1, and on the overview photo, page vi.

The earth embankment is approximately 115 ft. in length from the right abutment of the dam and about 6 ft. in height, relative to the downstream toe. The sloped top of the embankment is about 20 ft. in width. The downstream side and left abutment are supported in part by a vertical stone masonry wall. It appears that the upstream side is also supported in part by a stone masonry wall. Photos No. 2 through 8 in Appendix C are descriptive views of this embankment.

There may once have been a dike extending approximately 150 ft. along the shoreline beyond the left abutment of the dam, Photo No. 9. Since the area downstream of the former dike has been filled and is slightly higher than the dam embankment, this section of shoreline is not considered to be part of the present dam. The left abutment of the dam is considered to be at the unpaved road in Photo No. 10 alongside the left spillway channel.

The left (northerly) and right (southerly) spillways of the dam are approximately 45.5 and 50.6 ft. in length, respectively. Each spillway has vertical supports for flashboards on the concrete weirs. An approximately 37 ft. long concrete wall separates the two spillways. The top of this wall and most of the earth embankment (considered top of dam) is only about 2.0 ft. higher than the spillway crest elevation.

There is no low-level outlet at the dam site. A former sluice gate outlet in the embankment, Photo No. 17, has been blocked by concrete. There is a water supply outlet channel at the right abutment of the dam, Photo No. 18. The inverts of the two slide gates at the entrance of this channel are approximately 5 ft. lower than the spillway crests.

c. Size Classification. Mill Pond Dam has an estimated maximum storage capacity of 128 acre-ft. at the top of dam and a corresponding maximum hydraulic height of about 10 ft. According to guidelines established by the Corps of Engineers, a maximum storage capacity of less than 1,000 acre-ft. and a maximum hydraulic height of less than 40 ft. place this dam in the "small" size classification.

d. Hazard Classification. Based on the Phase I investigations and dam failure analysis (Section 5.1f) in accordance with Corps of Engineers guidelines, Mill Pond Dam was found to have "high" hazard potential. If the dam were to fail, an industrial property including warehouses and offices located on the right bank downstream of Myrtle Street and four houses near the Concord Street bridge would be subject to flooding. Therefore, the potential for loss of lives and extensive economic loss to industrial and residential properties is extremely high.

e. Ownership. The current owner of the dam is the partnership of Gordon-Mindick Properties, 10 Main Street, Ashland, MA 01721. Mr. J.R. Gordon, one of the two partners, represented the owner during the course of this investigation. His office phone number is (617) 881-4840.

The commercial-industrial property which includes the dam and water rights to the pond was purchased by the owner from the Lombard Company through Coville Realty Trust on 1 May 1979.

No further information regarding former owners of the dam prior to the Lombard Company was disclosed.

f. Operator. The "responsibility", but not ownership, of Mill Pond Dam was legally transferred from the Lombard Company to the Town of Ashland in 1969. Because of this arrangement, Mr. Ben Alberini, Town Surveyor, has been responsible for operation, maintenance and safety of the dam since 1969. His phone number at the Town of Ashland Highway Department is (617) 881-4697.

g. Purpose of Dam. The original purpose of the dam is unknown, but it is likely that the impounded water

was used by former factories or mills in the Gordon-Mindick Properties complex. Gordon-Mindick Properties presently draws water from the pond via the outlet channel at the right abutment for air conditioning purposes. Otherwise, the water impounded by the dam is not used for any other purposes.

h. Design and Construction History. There were no available records to indicate when, why and by whom the dam was originally constructed. The stone masonry wall construction utilized for the embankment is typical of New England dams built in the early 1900's.

i. Normal Operational Procedures. There were no formal or informal operational procedures for Mill Pond Dam.

1.3 Pertinent Data

Without more specific information, all elevations reported herein are approximate and based on the assumption that the top of the dam is at El. 190 Mean Sea Level (MSL) datum, as shown at the dam abutments on the USGS Framingham Quadrangle Map. The crest of the spillway weirs should then be at approximately El. 188.0.

a. Drainage Area. The total drainage area of the Sudbury River above Mill Pond Dam, which covers portions of the towns of Ashland, Hopkinton, Southborough, Westborough and Upton in both Middlesex and Worcester Counties, is estimated to be 33 square miles. Ground elevation in the watershed varies from a low of about 190 ft. near the dam to a high of about 700 ft. on Fay Mountain in Westborough. About 75 percent of the area consists of rolling woodlands. The remaining 25 percent consists of swamps and reservoirs, among which Whitehall, Westborough and Hopkinton are the largest and most important. Relatively small residential areas are scattered throughout, particularly in the north and eastern portions of the drainage area.

b. Discharge at Dam Site

1. Outlet works.....	Outlet channel for water supply to the adjacent industrial property
2. Maximum known flood at dam site.....	Unknown
3. Ungated spillway capacity at top of dam.....	660 cfs at El. 190.0
4. Ungated spillway capacity at test flood pool elevation.....	750 cfs at El. 199.7

5. Gated spillway capacity at normal pool elevation... Not applicable
6. Gated spillway capacity at test flood pool elevation..... Not applicable
7. Total spillway capacity at test flood pool elevation..... 750 cfs at El. 199.7
8. Total project discharge at test flood pool elevation..... 17,400 cfs at El. 199.7

c. Elevation (ft. above MSL)

1. Streambed at centerline of dam..... 180.0
2. Maximum tailwater..... Unknown
3. Upstream portal invert diversion tunnel..... Not applicable
4. Recreation pool..... 188.0
5. Full flood control pool.... Not applicable
6. Spillway crest (without flashboards)..... 188.0
7. Design surcharge - original design..... Unknown
8. Top of dam..... 190.0 (assumed)
9. Test flood design surcharge..... 199.7

d. Reservoir

1. Length of maximum pool..... 0.8 mi. (Est.)
2. Length of recreation pool.. 0.5 mi. (Est.)
3. Length of flood control pool..... Not applicable

e. Storage (acre-ft.)

1. Recreation pool..... 85
2. Flood control pool..... Not applicable
3. Spillway crest..... 85
4. Top of dam..... 128
5. Test flood pool..... 1,080

f. Reservoir Surface (acres)

1. Recreation pool..... 16.5
2. Flood control pool..... Not applicable
3. Spillway crest..... 16.5
4. Top of dam..... 26.6
5. Test flood pool..... 167

g. Dam Embankment

1. Type	Earth embankment
2. Length	Approx. 115 ft.
3. Height	Generally about 6 ft. relative to the downstream toe, 10 ft. maximum
4. Top width	Approx. 20 ft.
5. Side slopes	Top is irregularly sloped towards downstream side. Vertical stone walls on upstream and downstream sides
6. Zoning	Unknown
7. Impervious core	Unknown
8. Cutoff	Unknown
9. Grout curtain	Probably none

h. Concrete Floodwall

1. Type	Concrete wall, construction type unknown
2. Length	37 ft.
3. Height	Backfilled on both sides from about 3 ft. below top
4. Top width	1 ft. minimum
5. Side slopes	Nearly vertical
6. Zoning	Not applicable
7. Impervious core	Not applicable
8. Cutoff	Unknown
9. Grout curtain	Unknown

i. Diversion and Regulating Tunnel. Not applicable

j. Spillway

1. Type	Concrete gravity, overflow type
2. Length of weir	Right (south) spillway 50.6 ft., left (north) spillway 45.5 ft. (including the flashboard rails)
3. Crest elevation	188.0
4. Gates	None
5. U/S channel	Could not be observed

6. D/S channel..... Spillway apron has large size riprap; downstream channel banks are protected by hand placed stone masonry upstream of Myrtle Street

k. Regulating Outlets. There are no regulating outlets presently operational at this dam. There are provisions for flashboards at both spillways, but none were observed during the visual examination. About 25 ft. to the right of the southern spillway is an abandoned sluice gate outlet which is blocked up with concrete.

A water supply outlet channel with two 3 ft. wide by 8 ft. high slide gates at the entrance is located at the right abutment of the dam. The invert of the gates is about 5 ft. below spillway crest. The poor condition, configuration and nature of the controls in the drop structure and the outlets downstream of Myrtle Street would make the use of the water supply channel as a regulating outlet impractical. Furthermore, the outlet conduit passes beneath the floor of the industrial property downstream of the drop structure in a configuration which is not understood by the owner of the property and could not be visually determined during the site visit.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No design data for the original dam were located.

2.2 Construction Data

There were no construction records available related to this dam.

2.3 Operation Data

Neither the owner or the operator keeps any operation records for the dam, and stated that the facilities have not been maintained for some time. Water is drawn from the water supply outlet channel downstream of the drop structure for air conditioning purposes by the owner, Gordon-Mindick Properties. A statement regarding the presence of flashboards at the spillways appears only in one prior inspection report dated 28 August 1973. The operation of the dam is also mentioned in the 1969 Metcalf & Eddy, Inc. report, which details a number of deficiencies that were observed at that time and includes hydraulic/hydrologic calculations for the existing spillways.

2.4 Evaluation of Data

a. Availability. A list of the limited engineering data available for use in preparing this report is included on page B-1. Copies of documents from the listing are also included in Appendix B.

b. Adequacy. There was a lack of engineering data available to aid in the evaluation of Mill Pond Dam. This Phase I assessment was therefore based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement.

c. Validity. The limited information contained in the engineering data may generally be considered valid. However, the dimensions and configuration of the dam given in the 1973 state inspection report are quite approximate and should not be considered accurate.

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I examination of Mill Pond Dam was conducted on 29 March 1979. The upstream water surface elevation was approximately 0.4 ft. above the spillway weirs and 1.6 ft. below the top of the dam.

In general, the project was found to be in poor condition. Several major deficiencies which require correction were noted. The dam does not appear to have received any recent maintenance.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C. A "Site Plan Sketch", page C-1, shows the direction of view for each photograph.

b. Dam. The earth embankment right of the spillways and the left abutment of the dam are generally in poor condition. Extensive erosion of the crest and slopes, due in part to previous overtoppings of the dam, were observed. Seepage, low areas of the crest, profuse vegetation growth and other major deficiencies reported in the past ten years have not been corrected. The following specific items were noted:

1. The upstream slope, crest and downstream toe are overgrown with brush, saplings and large trees up to 1 ft. in diameter, Photos No. 2 through 7. Tree roots have grown throughout the embankment and are exposed in eroded areas, Photo No. 5.

2. The stone wall on the upstream side has several stones dislodged, resulting in an unprotected shoreline in local areas, Photo No. 2. Soil loss and erosion is evident where the stone slope protection is missing.

3. The sloping top of the embankment is eroded and rutted by runoff and unrestricted foot traffic, Photo No. 3. As can be seen on Photo No. 8, taken when the water level was about 0.3 ft. below the top of dam following a storm in January 1979, the dam was being overtopped to the left of the blocked sluice gate outlet and sandbags were resisting further overtopping

along the midsection of the embankment. Thus, the crest of the embankment is up to about 0.5 ft. low where sandbags were placed and especially left of the sluice-gate, Photo No. 7, where the erosion and reduced cross-section is greatest.

4. The stone wall partially supporting the downstream face has collapsed near the midsection of the embankment, Photo No. 6, and at two locations along the section shown on Photo No. 7. These collapses have allowed considerable loss of soil from the embankment behind the wall. Note seepage through the base of the stone wall adjacent to the spillway, Photo No. 7.

5. There are gaps between the large stones at the left abutment in front of the man in Photo No. 9. The ground surface there is approximately 0.5 ft. lower than the top of the dam. The unpaved road at the left abutment, Photo No. 10, is badly eroded, and was overtopped in January 1979.

c. Appurtenant Structures. The dam has two spillways which are separated by an "L" shaped (in plan) concrete wall. The crests of the spillway weirs are about 2 ft. below the top of the "L" shaped wall and are about 45.5 ft. long at the left (northerly) spillway and 50.6 ft. long at the right (southerly spillway). On the downstream side of the weirs, there are grouted stone cascades which start at about 3 ft. below the crest of the left weir, Photo No. 15, and about 2 ft. below the crest of the right weir, Photo No. 11. There are railroad rails, about 1 ft. high, embedded in the spillway weirs on about 6 ft. centers. Although no flashboards were observed during the visual examination, it would be reasonable to assume these rails were used for flashboard guides. Considerable debris such as a very large log, (See Photo No. 11) and other logs, branches and tires are trapped in the spillway by the rails. The view of the spillway weirs and cascades was obscured by flowing water.

The remains of stone masonry walls can be seen on both sides of the cascades and discharge channels. Except for the left wall of the right spillway discharge channel, Photos No. 12 and 13, those portions of the stone walls which are still intact are in poor condition. Water could be seen flowing from the joints at the bottom of the remains of the right wall at the right spillway cascade, Photo No. 7. The left wall of the left spillway discharge channel is partially washed out, and part of the bank is undercut by about 4 ft., Photo No. 16.

The general condition of the "L" shaped concrete wall, Photos No. 13 and 14, is good with some minor staining observed. The earth backfill on the downstream side has been washed out to about 3 ft. below the top of the wall, apparently most recently by overtopping of the wall in January 1979.

An abandoned stone masonry sluice gate outlet is located approximately 25 ft. to the right of the right spillway, Photo No. 17. Although the outlet gate has been blocked off by a concrete wall, seepage estimated at 1/2 g.p.m. is occurring around the concrete.

At the right abutment of the dam there is a 9.4 ft. wide by 8 ft. deep entrance channel which feeds through control gates to a water supply outlet channel which tapers from 7.4 ft. wide at the gates to 4.8 ft. wide at Myrtle Street. The walls of the entrance channel and the start of the outlet channel are of stone masonry and in good condition. The remains of a trash rack were observed at the pond end of the entrance channel. Bolts observed along both sides of the entrance channel indicate some type of structure may have been present over the channel at some time in the past. A twin channel concrete gate structure with two 3.2 ft. wide by 8 ft. high steel stop plates in place during the site visit controls flow to the outlet channel. The size of the guides, however, indicates that the original controls were probably wood stoplogs or gates. The condition of the concrete is good, with some minor spalling and staining observed. The entrance end of the water supply outlet channel is shown in Photo No. 20.

The outlet channel continues under Myrtle Street through a box culvert, which enters a 2-level "L" shaped concrete drop structure, Photo No. 19. There is a wooden roof constructed over the top of the upper chamber. Access to the lower chamber is through a wood plank hatch. The difference in the color of the concrete indicates that the present upper chamber of the drop structure was constructed sometime after the lower chamber. A heavy stream of water was observed flowing out of the construction joint between the two stages of construction, Photo No. 20.

Viewing the bottom of the upper chamber from within the lower chamber, a 36-in. diameter open-ended drop pipe exiting the bottom slab of the upper chamber could be seen. The pipe was closed during the examination. There is a 12 in. diameter pipe with an 8-in. reducer exiting the downstream wall of the upper chamber, Photo No. 21.

A blank flange on the 8-in. reducer was leaking very badly during the time of the site visit. A 24-in. diameter outlet pipe was observed at the bottom of the lower chamber in the downstream wall on the right side. This pipe headed off in the direction of the Gordon-Mindick Properties complex. Mr. J.K. Gordon of Gordon-Mindick Properties indicated during the site visit that some work will be done on the valves this spring, but he was not sure of the extent and nature of these repairs.

Just how the water from the drop structure flows under the industrial property is unknown; investigation within the complex disclosed water in a channel beneath the floor at two locations, but did not reveal the exact nature and configuration of the channel. The water from the outlet channel exits through two box culverts downstream of the property, Photo No. 22. The conduits are 3.5 ft. wide, and the culverts are silted up nearly to the top of the openings. Gate mounting slots were observed on the face of the culvert headwall. There was no obvious flow in the channel at the time of the site visit.

d. Reservoir Area. The Mill Pond area of the Sudbury River upstream of the dam is bordered by over 30 private residences along the right bank and is generally undeveloped along the left bank. The terrain near the river is generally flat. There is no significant probability of landslides into the reservoir affecting the safety of the dam. Sedimentation has apparently filled the approach channel to the spillways to within several inches below the weirs.

e. Downstream Channel. The section of the Sudbury River between Mill Pond Dam and the confluence with Cold Spring Brook at the upstream end of the Reservoir No. 2 is about 4,500 ft. long. Within this section, the river passes under Myrtle Street, Concord Street, Fountain Street, the New York Central Railroad, and State Route 135. Separate channels leading from each of the two dam spillways pass under Myrtle Street through two concrete bridges. The dimensions of the openings for the northern bridge are 7.8 ft. by 16 ft. wide and for the southern bridge 5.2 ft. by 25 ft. wide.

Stone masonry has been placed along the banks of the two channels upstream of Myrtle Street. The channel widths vary from about 40 ft. near the spillways to 16 ft. for the left (northern) spillway channel and to 25 ft. for the right (southern) spillway channel at the

Myrtle Street bridges. The two channels join at a point about 80 ft. downstream of Myrtle Street. Various size trees and boulders were observed on both banks of the river downstream of Myrtle Street, Photo No. 23. The left bank rises at a very steep slope to a height of about 20 ft. The right bank borders the Gordon-Mindick Properties parking area.

The relatively low lying parking area is protected against flooding by an earth dike approximately 700 ft. long, Photo No. 24. The dike has a concrete face wall. The top of the dike is estimated to be 2 ft. below the road surface elevation of Myrtle Street at the southern bridge. At the time of the site visit, flap valves were being installed on drainage outlet pipes at several points along the dike to prevent flow into the parking area.

At a distance of about 1,300 ft. downstream of Myrtle Street, the Sudbury River channel passes under Concord Street through a concrete bridge opening. The arched opening is about 30 ft. wide at the base and about 7.5 ft. high at the center. The water depth in the channel, at the time of the site visit, was 2.4 ft.

A relatively small drainage channel which is located about 50 ft. south of the river carries wasteflows from the downstream end of the water supply channel, Photo No. 22. A concrete culvert with rectangular opening of 11 ft. by 6.8 ft. carries the drainage channel under Concord Street.

The river channel on the upstream side of Concord Street is approximately 25 ft. wide. The right bank, which is at a relatively low elevation, consists of woodland. There are no dwellings or other structures within a distance of about 300 ft. The left bank rises steeply to a height of about 10 ft. There is a paved road at the top of the bank. Downstream of the Concord Street bridge there is a residential dwelling on the right bank near the bridge and three dwellings on the left bank very close to the river's edge.

3.2 Evaluation

Although portions of the dams such as the two spillways and the water supply outlet channel appear to be in good condition, the overall condition of the Mill Pond Dam project can only be considered poor, primarily because of the evidence of past overtopping, the lack of means to lower the water below the spillway crest, the deterioration of the earth embankment and left abutment and the other deficiencies noted during the site examination of 29 March 1979.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

In general, there are no formal procedures to provide routine maintenance and satisfactory operation of the dam. There is apparently some relationship between the owner and the Town of Ashland, whereby the Town has assumed "responsibility" for the dam. The extent of this responsibility was not disclosed.

4.1 Maintenance of Dam

There are no established procedures or manuals for inspection and maintenance of the dam. The deteriorated condition of the project indicates that there has not been any maintenance done on this dam for some time. The major deficiencies noted on 29 March 1979 are similar in nature to those listed in a Metcalf & Eddy report dated 16 September 1969, and it appears the recommendations outlined in that prior report were never carried out.

4.3 Maintenance of Operating Facilities

There is no established formal or informal maintenance program for the operating facility. The controls in the drop structure downstream of the outlet at the right abutment have recently been modified to protect the Gordon-Mindick Properties complex from flooding, but it is not feasible to use this outlet for regulating flow from the dam.

4.4 Description of any Warning System in Effect

There is no warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation

The owner should prepare an operations and maintenance manual for the dam. The manual should delineate the routine operational procedures and maintenance work to be done on the dam to provide satisfactory operation and minimize deterioration of the facility. For example, an annual observation and maintenance program should be established to examine the dam, control vegetation growth and maintain slopes, walls and channels.

Since failure of the dam would probably cause loss of life and extensive property damage downstream, the owner should also prepare and implement a formal emergency preparedness plan and warning system.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. The dam consists of an earth embankment with stone masonry protection on the downstream face and two spillways which are separated by a concrete wall. The original purpose of the dam was probably to provide water storage and flow regulation for power generation at the mill. Now the pond is mainly used for recreational purposes. The storage capacity of the pond is relatively small in comparison to its watershed area.

The existing swamps and reservoirs within the drainage basin will have the effect of reducing the intensity of the flood flows.

Continuous flow over the spillways was reported during the past wet season.

b. Design Data. No original hydrologic or hydraulic design data were available for this dam site.

c. Experience Data. No historical records of the maximum flows are available. The dam was overtopped during a January 1979 storm; part of the earth embankment was temporarily raised with sandbags. Significant scouring during this storm was apparent on the left bank near the spillway and on the dam embankment alongside the former sluice gate opening. The Fernwell Corporation parking lot is understood to have flooded. The operator of the dam reports that the dam has been overtopped on other occasions also.

d. Visual Observations. The Mill Pond Dam and appurtenances are in poor hydraulic condition. The left abutment of the dam was eroded several inches, probably by the overtopping during the storm of January 1979. Sandbags, which were used for local raising of the earth embankment, are still in place. On the day of the site visit, 29 March 1979, about 0.4 ft. of water was flowing over the spillways. The crest of the spillway is only about 0.3 ft. above the bottom of the approach channel which appears to be filled with sediment. The crest width of the spillway was measured to be 1.3 ft. The left (northerly) spillway was measured as 45.5 ft. in length and the right (southerly) spillway as 50.6 ft.

in length. The maximum height from the spillway crest to the top of the dam is about 2.0 ft.

The downstream face and the apron of both spillways are protected with large size riprap. Irregular positioning of the riprap on the apron and on the downstream channel was causing excessive flow turbulence. One foot high vertical supports made from railroad rails at the spillway crest were apparently intended to hold flashboards; but there were no flashboards at the time of the site visit. The supports were accumulating debris, as large as logs and tree branches, at the spillway crest.

The dam no longer has a drain outlet, as the sluice gate opening located in the earth embankment about 25 ft. south of the right wall of the right spillway has been blocked off with concrete. The invert of this former outlet was estimated to be at El. 182.3, or 5.7 ft. below the spillway crest.

A water supply channel for the adjacent industrial property is located about 90 ft. south of this plugged outlet. Most of the screen area at the intake was damaged. The channel width tapers from 7.4 ft. at the entrance to 4.8 ft. as it passes under Myrtle Street. The invert of the control gates is at approximately El. 183 or 5 ft. below the spillway crest.

Soil and pavement erosion were observed at several points along the bridge abutments on Myrtle Street.

e. Test Flood Analysis. Based upon the Corps of Engineers guidelines, the recommended test flood for "small" size and "high" hazard potential dams is within the range of 1/2 PMF to PMF (Probable Maximum Flood). The PMF was determined using Corps of Engineers Guidelines for Estimating Maximum Probable Discharge in the Phase I Dam Safety Investigations. The watershed terrain was determined to be 75 percent rolling and 25 percent flat (swamp and water surface). From this an inflow rate of 1,125 cfs per square mile was interpolated for the drainage area of 33 square miles. The resulting PMF inflow is 37,125 cfs.

It is not possible within the scope of this investigation to determine the effect of the storage in upstream reservoirs on the flood flows at Mill Pond Dam. However, it can be assumed to be significant, and possibly could reduce the test flood discharge. However,

for the purposes of this study, we are assuming that the test flood will be 1/2 PMF, which is calculated to be 18,560 cfs.

Surcharge-storage routing was performed through Mill Pond using the stage-discharge and area-volume curves shown in Appendix D. Flow through the water supply channel to the nearby industrial property was ignored for this evaluation.

The test flood outflow, estimated to be 17,400 cfs would occur when the water surface elevation in the pond is at 199.7. This is almost 10 ft. above the top of the dam. In this case, a large area upstream and downstream of the dam would be flooded. Flow would back up in the downstream channel, raising the tailwater elevation to about 197.8. It can be concluded, therefore, that the spillway and the downstream channel are inadequate to pass the test flood outflow without overtopping the dam and flooding surrounding areas.

f. Dam Failure Analysis. Based on Corps of Engineers Guidelines for Estimating Dam Failure Hydrographs, and assuming that a failure would occur along 40 percent of the length at the mid-height of the dam structure, the peak failure outflow is estimated to be 2,570 cfs. The downstream channel capacity is not adequate to carry this flow without flooding its banks to a depth of about 3 ft. Four homes which are located just downstream of the Concord Street Bridge and the Gordon-Mindick Properties complex will be flooded after the failure. Preliminary computations in relation to the dam failure analysis are shown in Appendix D. The area downstream of Concord Street was not studied. Flow over the spillway just before the failure, estimated to be 660 cfs, would be confined in the downstream channel without flooding the banks.

Therefore, it can be concluded that in the event of a dam failure, a potential for loss of lives and excessive property damage exists at this dam site and the hazard potential classification can be considered high, in accordance with Corps of Engineers guidelines.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. There is severe erosion of the crest and slopes of the earth embankment, caused in part by the dam being overtopped in the past, most recently in January 1979. Several trees that are growing on or near the embankment have root systems which extend through the embankment. These roots may actually contribute to the resistance of the embankment to breaching due to overtopping. However, decayed roots may form conduits for piping to develop, and the embankment might breach if a tree on it were uprooted. For these reasons, the embankment can only be considered marginally stable in its present condition.

The spillway weir and cascade were obscured by flowing water. However, no evidence of settlement, lateral movement or other signs of structural instability were noted. The masonry training walls downstream of the spillways were partially destroyed and those portions of the walls that remained intact, except for the left wall of the right spillway discharge channel, were greatly deteriorated.

b. Design and Construction Data. There are no design or construction records to aid in the evaluation of structural stability of the dam.

c. Operating Records. No operating records were available to aid in the evaluation of structural stability.

d. Post-Construction Changes. Although there are some indications of post-construction changes, such as the abandoned outlet, the specific nature of the changes that may have taken place is not known.

e. Seismic Stability. Mill Pond Dam is located in Seismic Zone 2, and in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination of Mill Pond Dam revealed that the structure was in poor condition. Several major deficiencies were noted, including erosion of the embankment crest and slopes, lack of a reservoir drain, low freeboard and general lack of maintenance at the project.

Based on the results of computations included in Appendix D and described in Section 5, the spillway is seriously incapable of passing the test flood, which for this structure is 1/2 PMF. The 1/2 PMF outflow of 17,400 cfs (inflow 18,560 cfs or 563 csm) would overtop the dam by about 9.7 ft. With the water level at the top of the dam, the combined spillway system can pass 660 cfs, which is only 4 percent of the test flood.

b. Adequacy of Information. This evaluation of the dam is based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement. Generally the information available or obtained was adequate for the purposes of a Phase I assessment. However, it is recommended that additional information regarding the configuration and character of the embankment and spillways, as outlined in Section 7.2, be obtained.

c. Urgency. The recommendations for additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner and completed within one year after receipt of this report.

d. Need for Additional Investigation. Additional investigations should be performed by the Owner as outlined in Section 7.2.

7.2 Recommendations

It is recommended that the Owner, Gordon-Mindick Properties, engage a registered professional engineer to undertake the following investigations:

1. Determine the dimensions and construction materials of the various portions of the dam and in particular the spillways, and evaluate the available freeboard, the structural stability under static loads, the effect of clearing trees from the embankment and the need for increasing the cross-section of the embankment. The investigation should include an assessment of seepage which was observed at the right stone abutment wall of the right spillway.

2. Perform an inspection of the spillways during no or low flow conditions.

3. Perform hydraulic/hydrologic studies to determine what alternative measures are required to significantly increase the spillway capacity at the dam.

4. Determine a practicable size and location for an outlet to lower the pond in cases of emergencies.

5. Perform an investigation of the work required in the downstream channels to reconstruct and provide structurally stable channel side walls.

The Owner should then implement corrective measures on the basis of this engineering evaluation.

7.3 Remedial Measures

The dam is generally in poor condition, and it is considered important that the following items be accomplished:

a. Operation and Maintenance Procedures. The following remedial measures should be undertaken by the Owner:

1. Clear the earth embankment of trees and brush, remove stumps and major roots and place fill to restore the embankment cross-section or add additional fill to increase the existing embankment cross-section as determined by the results of the studies recommended in Section 7.2.1. Grass cover should then be established on the embankment and mowed several times each year.

2. Replace displaced stones and repair collapsed sections of the stone masonry walls on the upstream and downstream sides of the embankment and in the left spillway discharge channel.

3. Repair upstream riprap protection and restore grade to top of dam at the left abutment.

4. Remove the flashboard supports on the spillway weirs, since they only serve to trap debris and further reduce the already grossly inadequate spillway capacity. This would also eliminate the possibility of anyone installing flashboards at the spillways.

5. Replace trash rack at entrance to water supply outlet channel.

6. Provide a more positive seal than the existing gates at the entrance to the water supply outlet channel. Stoplogs could be used as a control weir for this outlet from which Gordon-Mindick Properties draws air conditioning water.

7. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for surveillance of the dam during periods of heavy precipitation and high reservoir water levels. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure satisfactory operation and to minimize deterioration of the facility.

8. Because the dam is classified as having a "high" hazard potential, develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam. The plan should be developed in cooperation with local officials and downstream inhabitants.

7.4 Alternatives

In consideration of the major deficiencies and inadequacies of the existing dam, the Owner should consider replacing the structure with a properly designed new dam. Should the present or anticipated future need of the reservoir be limited, the Owner should also consider removing the dam altogether. Either of these alternatives would require detailed engineering studies to determine their impact on the reservoir and downstream areas.

APPENDIX A - INSPECTION CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Mill Pond

Date: 29 March 1979

Time: 1300-1600

Weather: Overcast, cool (40's F)

Water Surface Elevation Upstream: El. 188.4 (0.4 ft. above top of concrete spillway weirs)

Stream Flow: Estimated to be 60 cfs

Inspection Party:

Peter L. LeCount	- Soils/Geology
Richard A. Brown Haley & Aldrich, Inc.	
A. Ulvi Gulbey	- Hydraulic/Hydrologic
Joseph E. Downing Robert P. Howard Camp, Dresser & McKee, Inc.	- Structural/Mechanical

Present During Inspection: (Part-time)

Ben Alberini, Town Surveyor, Town of Ashland
Tom Fox, Executive Administrator, Town of Ashland
J.R. Gordon, Partner, Gordon-Mindick Properties

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Mill Pond Dam, Ashland DATE: 29 Mar. 79

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	Generally corresponds to top of "L" shaped wall between spillways assumed to be El. 190.0 MSL. Several lower areas were observed
Current Pool Elevation	Estimated to be El. 188.4, 1.6 ft. below top of dam
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Not applicable
Movement or Settlement of Crest	Not evident, somewhat irregular and sloping downstream
Lateral Movement	Local loss of stone from upstream and downstream faces
Vertical Alignment	Irregular, was locally overtopped in January 1979 storm
Horizontal Alignment	No major mis-alignment except where stone lost from faces
Condition at Abutment and at Concrete Structures	Locally low 3 - 6 in. next to spillway and old gate structure concrete
Indications of Movement of Structural Items on Slopes	Individual stone movement in both faces
Trespassing on Slopes	Much foot traffic
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Varies, grass to brambles, brush and trees to 12 in. diameter
Sloughing or Erosion of Slopes or Abutments	Erosion where was overtopped alongside old gate structure and midway along length, and around left abutment
Rock Slope Protection - Riprap Failures	Rock faces locally toppled
Unusual Movement or Cracking at or near Toes	None apparent
Unusual Embankment or Downstream Seepage	Seepage around concrete plug in old gate structure, estimated 1/2 gpm; area of stagnant, stained water across road

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Mill Pond Dam, Ashland DATE: 29 Mar. 79

AREA EVALUATED	CONDITION
Piping or Boils	None observed
Foundation Drainage Features	None known
Toe Drains	None
Instrumentation Systems	None
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Twin spillways on upstream face of dam. Channel approximately 120 ft. wide
Loose Rock Overhanging Channel	Not applicable
Trees Overhanging Channel	Not applicable. Several trees at spillway abutments
Floor of Approach Channel	Silted to within several inches below spillway weir crest
b. Weir and Training Walls	
General Condition of Concrete	"L" shaped concrete wall on pond face of dam with twin spillways in good condition. Grouted stone cascades obscured by flowing water
Rust or Staining	Minor rust and staining observed
Spalling	Minor spalling observed at spillways
Any Visible Reinforcing	None observed
Any Seepage of Efflorescence	Seepage observed in joints of the right wall of the southerly spillway cascade
Flashboards	One foot high rails observed along spillway crests at about 6 ft. centers. No flashboards observed. Debris lodged on rails
c. Discharge Channels	
General Condition	On both sides of the cascades and discharge channels are the remains

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Mill Pond Dam, Ashland DATE 29 Mar. 79

AREA EVALUATED	CONDITION
	of stone masonry walls. Except for the left wall of the southerly spillway discharge channel, the remaining walls still intact are in extremely poor condition. Banks are undercut and eroded where walls have collapsed
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Some observed over both channels
Floor of Channel	Submerged
Other	Edge of roadway to the right of the southerly spillway channel at the bridge is being washed away
OUTLET WORKS - SLUICE GATE OUTLET	
General Condition	Abandoned stone masonry outlet in fair condition. The outlet gate is blocked off with a concrete wall. Slight leakage is occurring around this wall
OUTLET WORKS - SUPPLY INTAKE, OUTLET CHANNEL, DROP STRUCTURE AND DOWN-STREAM OUTLET	
a. Supply Intake	
General Condition	9.4 ft. wide by 8.0 ft. deep intake channel which feeds a double gated concrete intake for outlet channel in good condition. Bolts are spaced along both walls
Intake Channel	Intake channel walls are of stone masonry construction in good condition
Trash Racks	Remains of a trash rack with sections missing. Racks are in fair condition

FILE NO. 4160
HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Mill Pond Dam, Ashland DATE 29 Mar. 79

AREA EVALUATED	CONDITION
Intake Structure	Twin channel concrete structure with two 3.2 ft. wide by 8 ft. high steel stop plates. Guides are for wood stoplogs. Condition of the intake is good with minor staining and spalling
b. Outlet Channel	
General Condition	Start of channel is 7.4 ft. wide at the intake structure and 4 ft. wide at Myrtle Street. Walls are stone masonry and are in good condition. Floor submerged. Channel feeds a box culvert under Myrtle Street
c. Drop Structure	
1. Concrete Structure	
General Condition	Culvert ending at two-level "L" shaped drop structure in fair condition. Different shades of concrete indicate at least two various stages of construction. Wooden roof over upper chamber in fair condition
Condition of Joints	Joints between construction stages in poor condition
Rust or Staining of Concrete	Heavy rust and staining observed
Spalling	Observed at joints between construction stages
Visible Reinforcing	None observed
Leaks in Chamber	Heavy stream of water was observed at construction joint in downstream wall
2. Mechanical	
Service Gates	Gate to 36-in. diameter drop pipe from upper chamber to lower chamber obscured from view by water in chamber. Pipe seen from lower chamber in good condition

FILE NO. 4160
HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Mill Pond Dam, Ashland DATE: 29 Mar. 79

AREA EVALUATED	CONDITION
Other Pipes	12-in. diameter pipe with a blank flanged 8-in. reducer from downstream wall. Blank flange was leaking. 24-in. pipe exists lower chamber towards building complex
d. Downstream Outlet	
General Condition	Twin box culvert through concrete headwall in good condition except the 3 ft.-6 in. wide culverts are nearly silted up. Gate mounting slots observed on headwall. No obvious flow observed at headwall

FILE NO. 4160
HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

APPENDIX B - ENGINEERING DATA

LIST OF AVAILABLE DATA
MILL POND DAM

Document	Contents	Location
State inspection reports, Dam No. 4-9-14-1	Report dated 28 August 1973, including description of dam, and report dated 10 January 1978	Mass. Dept. of Environmental Quality Engineering, Division of Waterways, 100 Nashua Street, Boston, MA 02108 and pages B-2 through B-9
Engineering report on Mill Pond Dam, Metcalf & Eddy, Inc., Engineers, Boston, MA, dated 11 September 1969	Letter report giving description, maintenance and repair items, spillway capacity and recommended outlet works at dam. Performed for the Town of Ashland at the instigation of the Middlesex County Commissioners	Mass. Dept. of Environmental Quality Engineering and pages B-10 through B-13

INSPECTION REPORT - DAMS AND RESERVOIRS

(1.) Location: ~~City~~/Town ASHLAND Dam No. 4-9-14-1

Name of Dam ~~MILL POND DAM~~ MYRTLE ST DAM Inspected by A.Z. PIZAN + F.H. PARE

Date of Inspection 8-28-73

(2) Owners: per: Assessors ✓ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact _____

	Name	St. & No.	~~City~~/Town	State	Tel. No.
1.	TOWN OF ASHLAND	MAIN ST	ASHLAND, MASS. - 01721		881-3524
2.					
3.					

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

Name	St. & No.	~~City~~/Town	State	Tel. No.
SUPT. PUBL. WKS.	CORDAVILLE RD.	ASHLAND, MASS. - 01721		881-1550

(4) No. of Pictures taken NONE

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

1. Minor ✓ 2. Moderate _____

3. Severe _____ 4. Disastrous _____

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

(6) Outlet Control: Automatic _____ Manual ✓

Operative ✓ yes: _____ no.

Comments: FLASHBOARDS CONTROL FLOW

(7) Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: LEAKS THROUGH MASONRY

DAM NO. 4-9-14-1

(8) Downstream Face of Dam: Condition: 1. Good____ 2 Minor Repairs ✓

3. Major Repairs____ Urgent Repairs____

Comments: LEAKS THROUGH MASONRY.

(9) Emergency Spillway: Condition: 1. Good____ 2. Minor Repairs____

3. Major Repairs____ 4. Urgent Repairs____

Comments: THERE IS NO EMERGENCY SPILLWAY.

(10) Water level @ time of inspection 0.5 ft. above ✓ below____

top of dam ✓ Principal spillway____

other____

(11) Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ✓

Animal Burrows and Washouts____

Damage to slopes or top of dam____

Cracked or Damaged Masonry____

Evidence of Seepage____

Evidence of Piping____

Erosion____

Leaks ✓

Trees and/or debris impeding flow____

Clogged or blocked spillway____

Other____

DAM NO. 4-9-14-1

(12.) Remarks & Recommendations: (Fully Explain)

DAM IS IN GOOD CONDITION, BUT NEEDS ROUTINE MASONRY REPAIRS.

(13.) General Condition:

1. Safe ✓
2. Minor repairs needed ✓
3. Conditionally safe - major repairs needed
4. Unsafe
5. Recommend impoundment be lower active (explain)

Recommend approval from inspection list

DESCRIPTION OF DAM
DISTRICT #4

Submitted by FRANCIS H. PARÉ & ADAM Z. PIZAN
Date 8-29-73

Dam No. 4-9-14-1
~~City~~/Town ASHLAND 01721
Name of Dam MILL POND DAM

1. Location: Topo Sheet No. 26C
Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1924 Year/s of subsequent repairs UNKNOWN

3. Purpose of Dam: Water Supply ____. Recreational ✓
Irrigation ____. Other ____

4. Drainage Area: 1 SQ. MI. 640 ACRES.

5. Normal Ponding Area: 15 acres; Ave Depth 5'
impoundment: 25 MIL gals; 75 acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir ____
i.e. summer homes etc. PERMANENT HOME & BUSINESS 50' E'LY OF SPILLWAY, MYRTLE ST.

7. Dimensions of Dam: Length 75' Max. Height 5'
Slopes: Upstream Face VERT
Downstream Face "
Width across top 5'

8. Classifications of Dam by Materials:
Earth ____. Conc. Masonary ✓. Stone Masonary ✓
Timber ____. Rockfill ____. Other ____

9. A. Description of present land usage downstream of dam: 80 % rural; 20 % urban

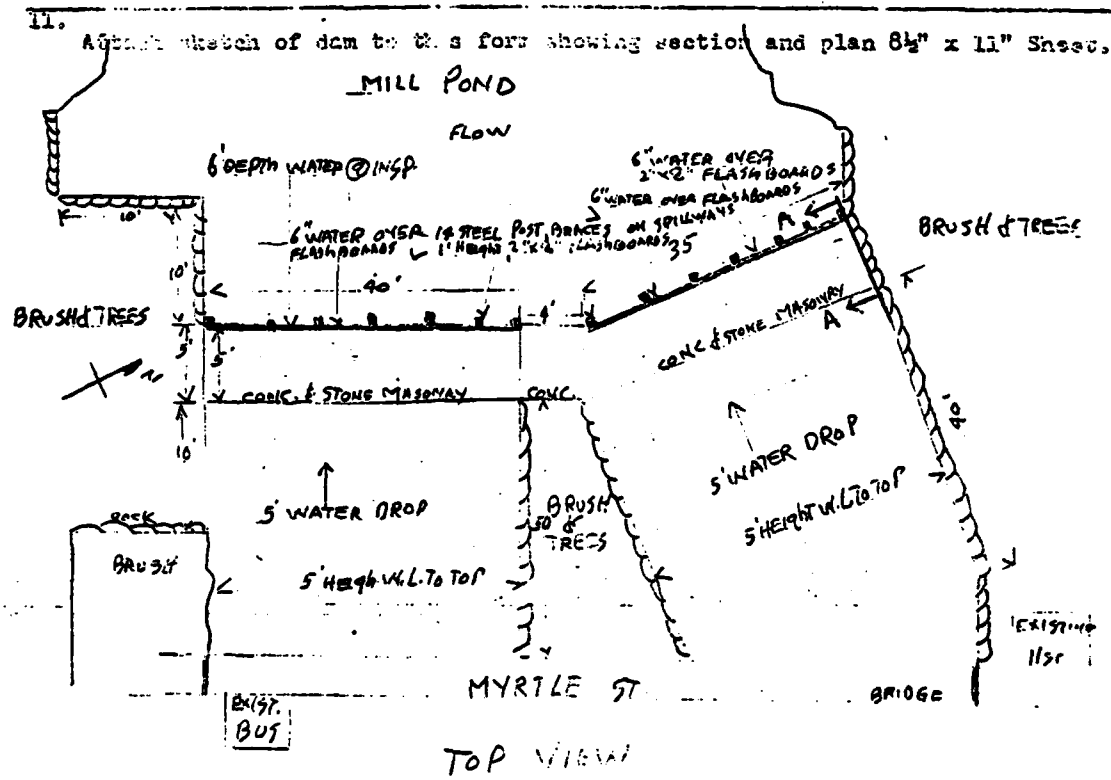
B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure no ✓ yes ____.

DAM NO. 4-9-14-1

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

No. of people EST. 50 EST 3 PERSONS PER HOME
No. of homes 10 15
No. of businesses HOME
No. of industries ____ Type ____
No. of utilities ____ Type ____
Railroads N.Y. CENTRAL, ½ MILE DOWNSTREAM, OPERATING
Other dams NONE
Other ____

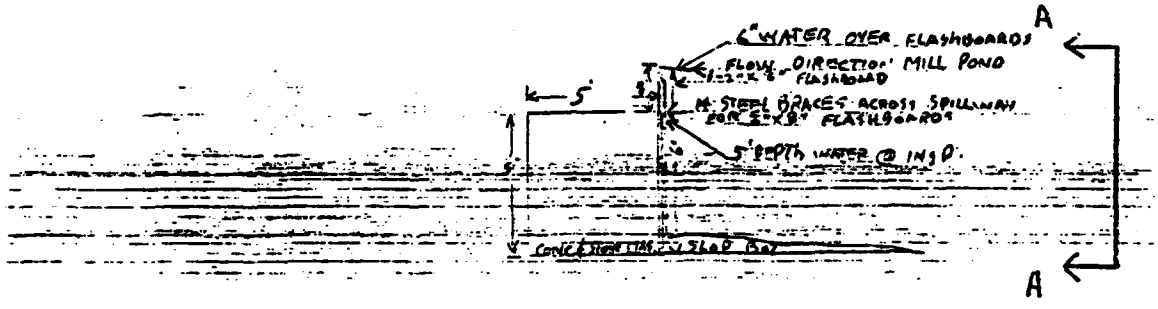
11. Attach sketch of dam to W.S form showing section and plan 8½" x 11" Sheet.



TOP VIEW

SKETCH NOT TO SCALE

4-9-14-1



X SECTION AA

SKETCH NOT TO SCALE

INSPECTION REPORT - DAMS AND RESERVOIRS

(1) Location: ~~City~~/Town Ashland Dam No. 4-9-14-1

Name of Dam Mill Pond Dam (aka The Straw) Inspected by: J. McCallum D. Murphy

Date of Inspection Jan 10 1978

(2) Owners: per: Assessers _____ Prev. Inspection 8-25-76

Reg. of Deeds _____ Pers. Contact _____

	Name	St. & No.	City/Town	State	Tel. No.
1.	Town of Ashland				881-2224
2.					
3.					

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

Name	St. & No.	City/Town	State	Tel. No.
Supt. of Public Works, Ashland				881-1550

(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 Flashboard control (out at time of inspection)

(7) Upstream Face of Dam: Condition:

1. Good _____ 2 Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments See attached report

DAM NO. 4-9-14-1

8) Downstream Face of Dam: Condition: 1. Good ____ 2. Minor Repairs ____
3. Major Repairs ✓ 4. Urgent Repa:

Comments: See attached report.

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

Comments: Abandoned sluice gate would be used in emergency or for needed repairs

(10) Water Level @ time of inspection 0.8 ft. above ✓ below ____
top of dam ____ Principal Spillway ✓
Other ____

(11) Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ✓
Animal Burrows and Washouts
Damage to slopes or top of dam
Cracked or damaged Masonry
Evidence of Seepage ✓
Evidence of Piping ✓
Erosion ✓
Leaks ✓
Trash and/or debris impending flow
Clogged or blocked spillway
Other

METCALF & EDDY INC. ENGINEERS
STATLER BUILDING · BOSTON · MASSACHUSETTS 02116
CABLE ADDRESS: "METEDD · BOSTON"
TWX 710-321-6363
(617) 423-5600

September 11, 1969

J-9227

Mr. John Shaughnessy
Middlesex County Engineer
Court House
East Cambridge, Massachusetts 02141

Dear Mr. Shaughnessy:

The writer inspected the dam across the Sudbury River (Dam V-5) in Ashland on August 11. The structure is the property of the Lombard Governor Company of Ashland. The Town of Ashland is responsible for maintenance of the dam. The inspection was made in the company of Messrs. Roger Hilton and Thomas Shaughnessy of your office and Mr. Atkinson of the Ashland Department of Public Works.

Description. The dam, location on the westerly side of Myrtle Street, forms a pool from which the Lombard Governor Company takes water for air conditioning purposes. The Town of Ashland apparently has the right to draw water from the pond for recreational purposes should a swimming pool be constructed on Town land downstream from the dam.

The dam consists of an earth embankment, approximately 150 feet long with a stone wall on the downstream side, two concrete spillways separated by a concrete abutment section, and an earth dike. A water intake for the factory is located at the southerly end of the embankment. An abandoned sluice gate opening, located about 30 feet south of the northerly end of the embankment, is blocked off with concrete.

The southerly spillway, located between a stone abutment at the northerly end of the embankment and the above mentioned concrete abutment section, is approximately 50 feet long and 2 feet deep. It is a concrete wall with earth fill on the pond side and rock fill on the downstream face. Spillway discharge flows under a highway bridge about 30 feet downstream from the spillway. Railroad steel on 6-ft. centers is embedded in the spillway crest to serve as flashboard guides. No flashboards were installed at the time of inspection.

The northerly spillway is similar in construction to the southerly spillway except that it is approximately 40 feet long and 2 feet deep. The concrete wall abutment section separating the two spillways is approximately 35 feet long and is banked on each side with earth fill. An earth dike extends northward from this spillway for approximately 150 feet.

Maintenance and Repairs. The following major deficiencies in the structure were noted:

1. Considerable leakage was observed coming through the spillway abutment at the northerly end of the embankment. The stonework showed signs of instability.

2. Brush and trees were growing on the embankment.

3. The dike was badly eroded at its junction with the northerly spillway. Flood water had apparently flowed over the dike and behind the spillway waste-way channel stone wall. Some of the stone was dislodged.

4. The railroad steel on the crests of the spillways could collect debris and reduce the spillway capacity.

The following maintenance and repair work is recommended:

a. The source of leakage through the abutment in Item 1 should be determined and the leakage eliminated. The stone abutment should be rebuilt. In order to accomplish these repairs, the water in the pond should be lowered. Since there is no drain pipe in the dam, the concrete seal in the abandoned sluiceway might be partially breached and the flow temporarily channelled to the southerly wasteway channel.

b. All brush, trees and large roots should be removed from the embankment. The continued growth of roots could result in the formation of water courses through the dam.

c. The breach in the dike should be backfilled with well compacted impervious soil up to the level of the spillway abutment wall. The stone in the wasteway channel wall should be replaced and the void behind the wall should be backfilled with compacted gravel.

d. The railroad steel in Item 4 should be removed down to crest of the spillway. It is understood that flashboards are no longer placed on the dam.

Spillway Capacity. A study was made to determine the maximum flood flow that could be reasonable expected at the dam. The application of the Kinnison - Colby Rare Flood formula indicated a maximum flood flow of 3200 cubic feet per second. The combined capacity of the two existing spillways is estimated to be approximately 300 cfs, or one-tenth the estimated possible maximum flood flow.

The spillway capacity of the dam may be increased to 3200 cfs by:

1. Raising the crests of the embankment, dike and spillway abutments 3 feet in height.

2. Raising the crests of the structures in Item 1 two (2) feet in height and adding a 30 foot length of spillway similar to the existing spillways.

Outlet Works. An outlet or blow-off pipe controlled by a valve or gate should be installed in the dam. Suitable locations for the pipe which would allow direct discharge into a spillway wasteway channel would be at the south abutment of the southerly spillway or at the junction of the northerly spillway and the dike.

The work outlined under Maintenance and Repairs should be accomplished at an early date in order to correct the weaknesses in the structure. It would be advantageous to construct the outlet pipe installation at the time of making the repairs. The recent overtopping of the dam indicates that the spillway capacity is inadequate and should be increased.

Very truly yours,

METCALF & EDDY, INC.

Gordon E. Thomas

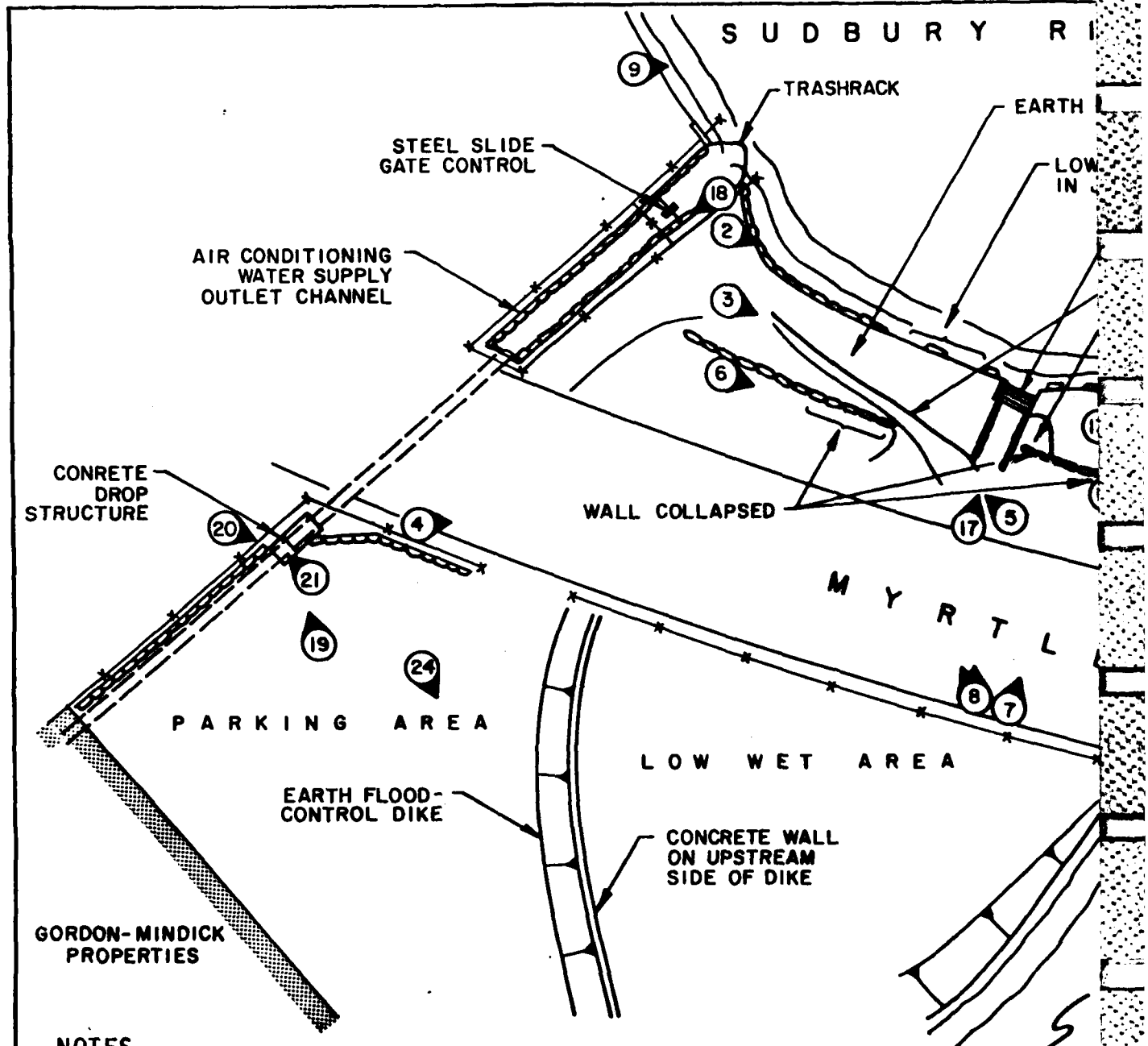
Gordon E. Thomas
Project Engineer

GET:mfh

APPENDIX C - PHOTOGRAPHS

PHOTOGRAPHS (Continued)

REPRODUCED AT GOVERNMENT EXPENSE



NOTES

1. PLAN DEVELOPED FROM FIELD OBSERVATIONS AND ROUGH MEASUREMENTS MADE ON 29 MARCH 1979.
2. PHOTO NO. 22 TAKEN AT LOCATION DOWNSTREAM OF AREA SHOWN ON THIS PLAN.

LEGEND

(4) PHOTO NO. AND DIRECTION

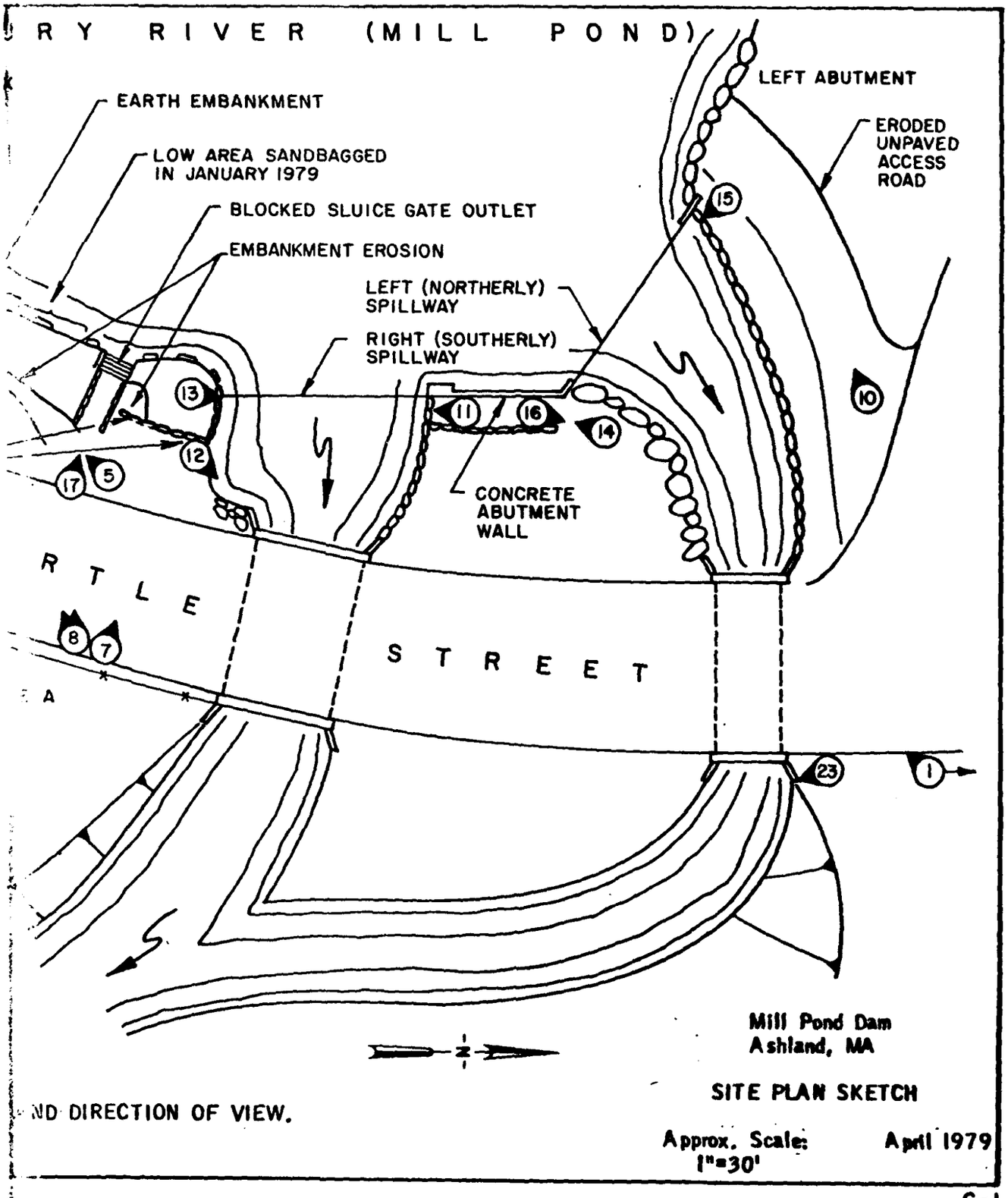
FILE NO 4270 B34

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

C-1

1 of 2

REPRODUCED AT GOVERNMENT EXPENSE



C-1

2 of 2

REPRODUCED AT GOVERNMENT EXPENSE

2. Trees and brush on upstream side and top of earth embankment

3. Eroded path on top of earth embankment

REPRODUCED AT GOVERNMENT EXPENSE

4. Overview of downstream side of earth embankment

5. Soil lost from embankment and exposed tree roots

6. Dislodged stones from wall on downstream face of embankment

7. Collapsed stone wall and eroded top of embankment

8. Earth embankment overtopped left of sluice gate outlet and sandbagged to resist further overtopping (January 1979)

REPRODUCED AT GOVERNMENT EXPENSE

REPRODUCED AT GOVERNMENT EXPENSE

9. Upstream view of river bank at and beyond left abutment of dam

10. Badly eroded unpaved road at left abutment of dam

REPRODUCED AT GOVERNMENT EXPENSE

11. Weir and trapped debris at right (southerly) spillway

12. Culvert under Myrtle Street downstream of right spillway

REPRODUCED AT GOVERNMENT EXPENSE

13. Concrete wall separating two spillways

14. Eroded earth berm on downstream side of concrete wall

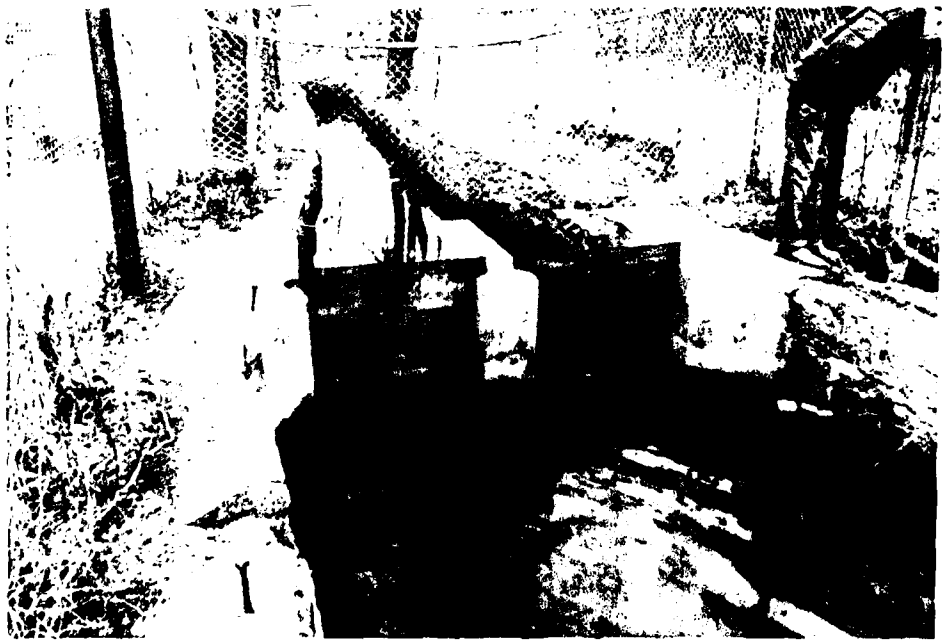
REPRODUCED AT GOVERNMENT EXPENSE

15. Weir and trapped debris at left (northerly) spillway

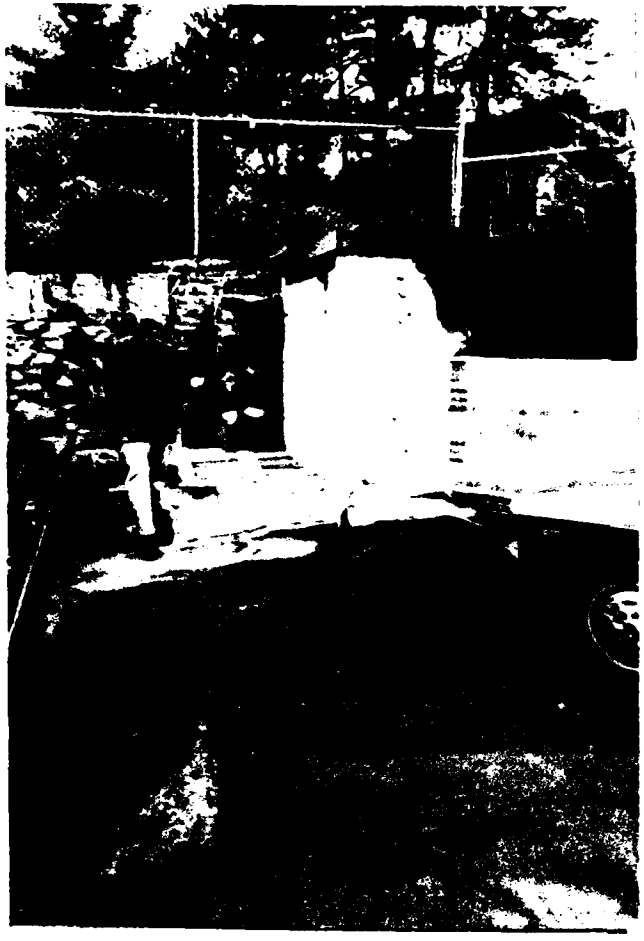
16. Bank undercut along left spillway discharge channel

REPRODUCED AT GOVERNMENT EXPENSE

17. Sluice gate outlet in earth embankment blocked by concrete



18. Steel gates at entrance of air conditioning water supply outlet channel

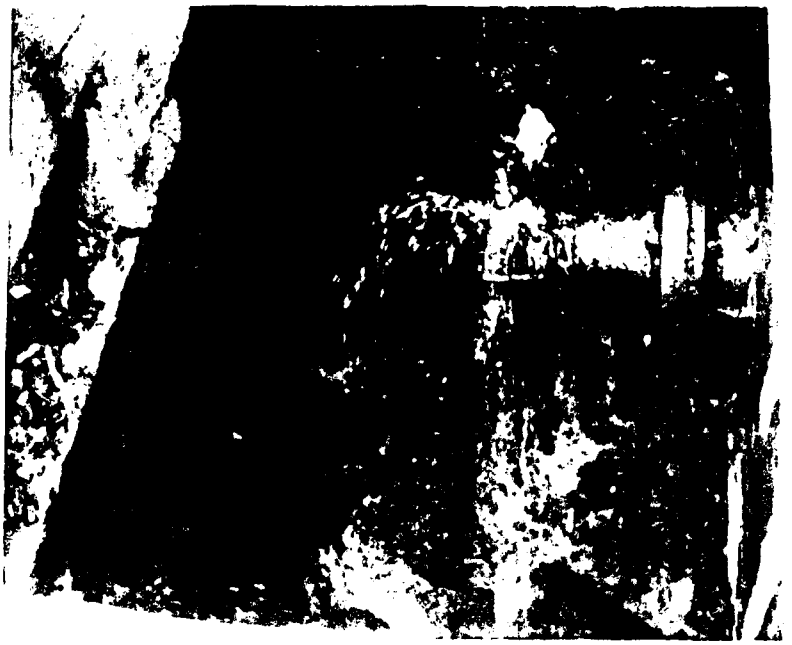


19. Concrete drop structure for water supply outlet channel

20. Leak between upper and lower chamber in drop structure

REPRODUCED AT GOVERNMENT EXPENSE

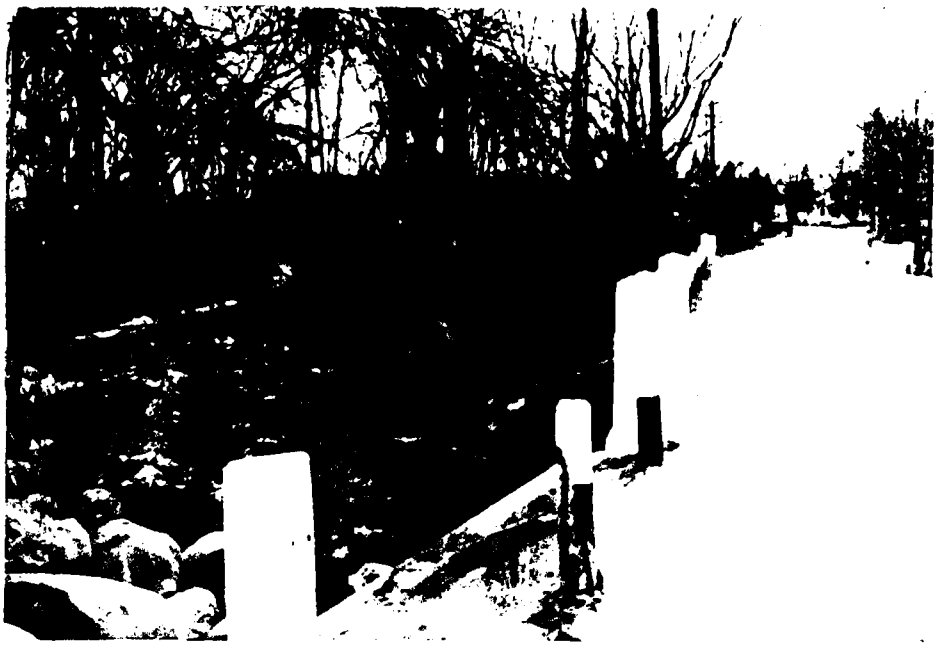
REPRODUCED AT GOVERNMENT EXPENSE



21. Leaking 12-in. supply pipe and 24-in. conduit to industrial property at bottom of lower chamber

22. Two box culvert outlets at downstream end of water supply channel from under industrial property

REPRODUCED AT GOVERNMENT EXPENSE



23. Downstream channel from left spillway culvert under Myrtle Street

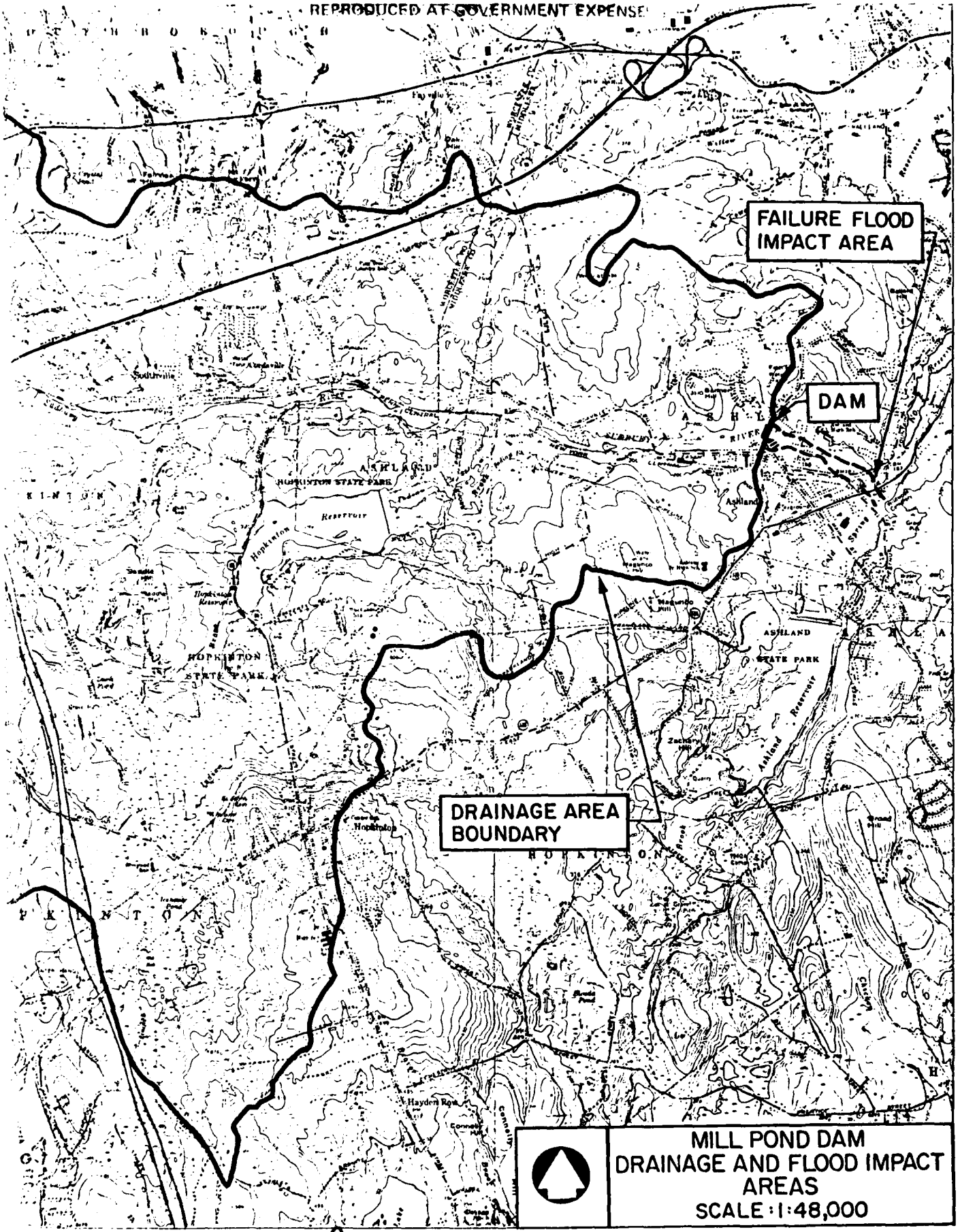
24. Earth flood-control dike along Gordon-Mindick Properties complex (January 1979)

APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

REPRODUCED AT GOVERNMENT EXPENSE

CAMP DRESSER & McKEE Inc.
Consulting Engineers
Boston, Mass.

REPRODUCED AT GOVERNMENT EXPENSE



MILL POND DAM
DRAINAGE AND FLOOD IMPACT AREAS
SCALE: 1:48,000

CAMP DRESSER & MCKEE INC. CLIENT H & A JOB NO 561-9-Rt-8 PAGE 1
PROJECT COE Dam Inspection DATE CHECKED 4/28/79 DATE 4/12/79
DETAIL Mill Pond Dam, Ashland CHECKED BY AHG COMPUTED BY JCE

Size Classification

Dam Height : El. 190.0 - 180.0 = 10 - Ft < 40'

Storage Volume : 128 ac-ft @ El. 190.0 < 1000 ac-ft

SIZE : SMALL

Hazard Potential

During a dam failure at least four houses downstream of Concord Street are expected to be subject to flooding. In addition the Factory grounds at Myrtle Street would be flooded. The hazard potential is considered high because of a potential for loss of lives and excessive residential and industrial property damages.

Test Flood Development

Size : Small ; Hazard Potential : high

$Q_p = \frac{1}{2}$ PMF to PMF

Use : $\frac{1}{2}$ PMF

Watershed Area : 33 sq mi = 21,120 acres

Peak Flow Rate = 1125 cfs / sq mi (Terrain : 75% rolling & 25% swamps & water)

PMF = 33 x 1125 = 37,125 cfs.

$Q_p = \frac{1}{2}$ PMF = 18,560 cfs.

CAMP DRESSER & MCKEE INC. CLIENT H&A JOB NO 561-9-Rt-8 PAGE 2
PROJECT COE Dam Inspection DATE CHECKED 4/28/79 DATE 4/12/79
DETAIL Mill Pond Dam, Ashland CHECKED BY AHG COMPUTED BY J.C.E.

Surcharge - Storage Routing

Q_{p_1} = 18560 cfs. ($\frac{1}{2}$ PMF → Max. Runoff = 9.5")

WSE in Pond = 200.1 (See Stage-Discharge Curve in Page D-4)

Reservoir Volume = 1180 ac-ft @ El. 200.1 (See Area-Volume Curve in page D-5)

Normal Res. Volume @ El. 188.9 = 85 ac-ft.

$STOR\ 1 = \frac{1095 \times 12}{21,120} = 0.62$ -in

$Q_{p_2} = 18560 \left(1 - \frac{0.62}{9.5}\right) = 17,354$ cfs.

WSE in Pond = 199.7 → AV = 1,070 - 85 = 985 ac-ft.

$STOR\ 2 = \frac{985 \times 12}{21,120} = 0.56$ -in

$STOR_{AV} = 0.59$ -in

$Q_{p_2} = 18560 \left(1 - \frac{0.59}{9.5}\right) = 17,410$ cfs

WSE in Pond = 199.8 AV = 1,080 - 85 = 995 ac-ft.

$STOR_3 = 0.57$ in ≈ 0.59 -in

Test Flood Outflow ≅ 17,400 cfs. @ El 199.7

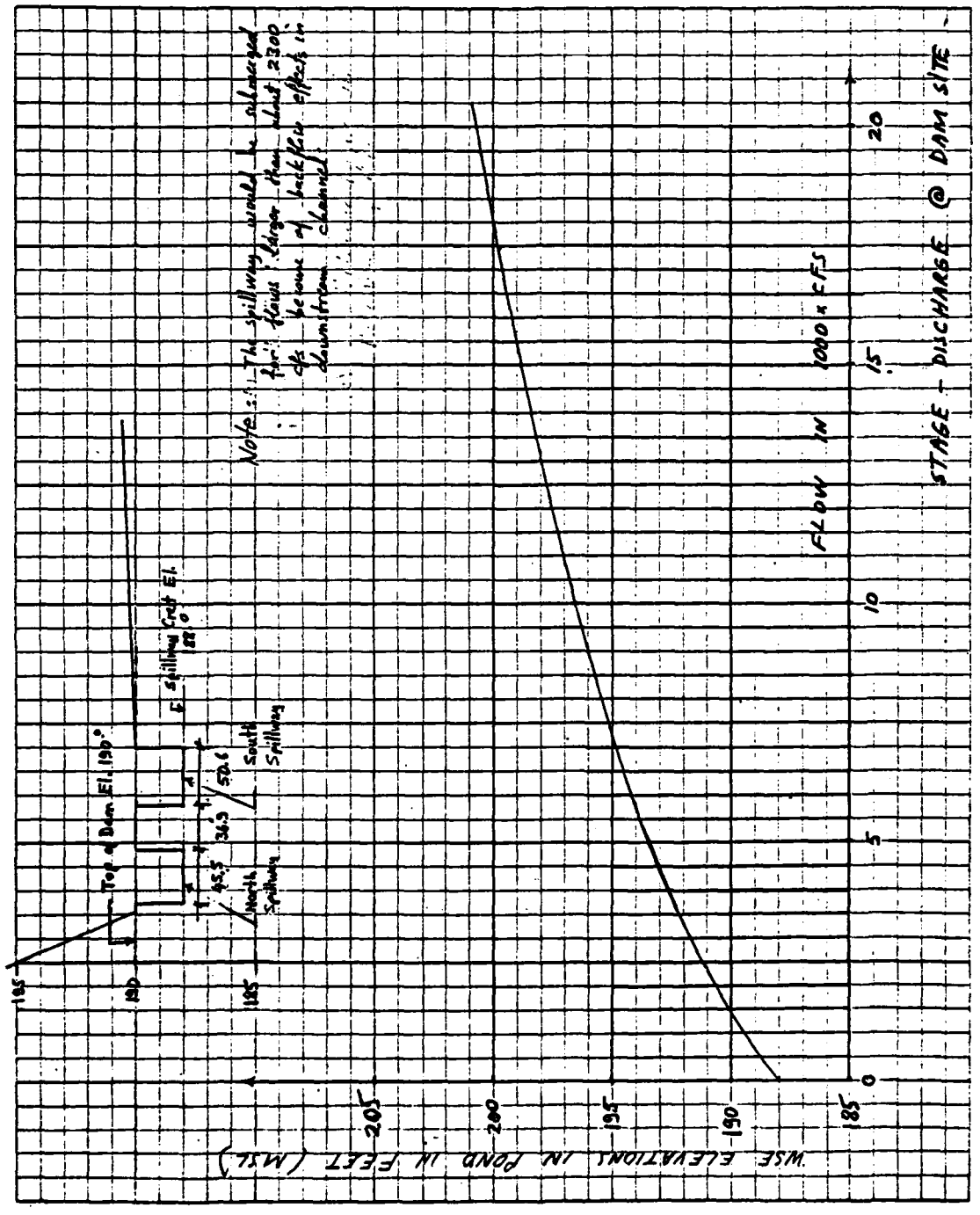
Tail Water As can be seen from the Stage-Discharge curve for the section upstream of the Myrtle St, on Page D-6, the spillway crest would be submerged by about 9.8 feet at the Test flood outflow of 17,400 cfs.

CAMP DRESSER & McKEE INC.

CLIENT H&A
PROJECT COE Dam Inspection
DETAIL MILL POND DAM - ASHLAND

JOB NO 561-9-Rt-8
DATE CHECKED 4/27/79
CHECKED BY AUG

PAGE 3
DATE 4/10/79
COMPUTED BY JCF

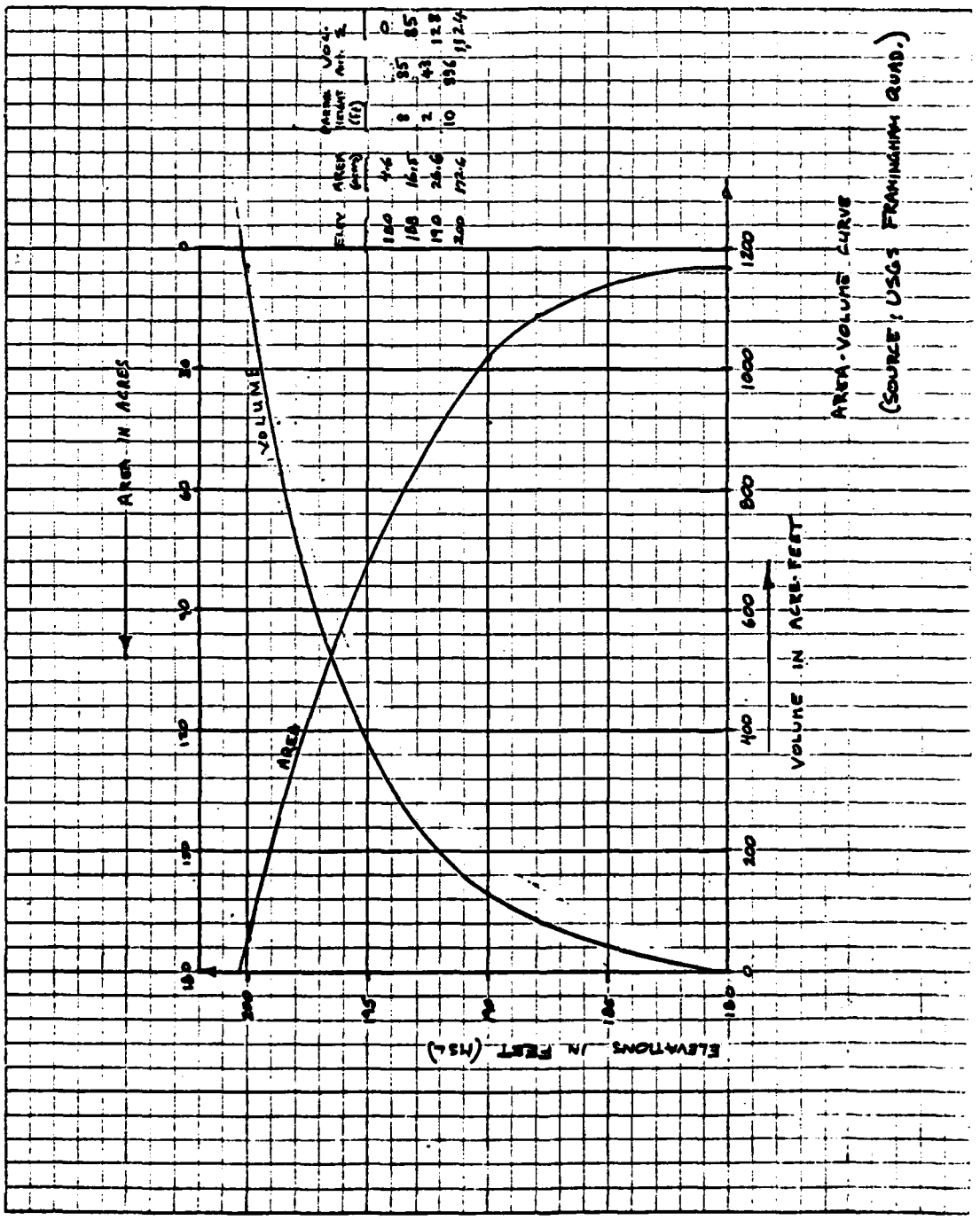


CAMP DRESSER & MCKEE INC.

CLIENT HALEY AND ALDRICH — JOB NO 561-9-RT-8 — PAGE 4

PROJECT COE DAM INSPECTION — DATE CHECKED 4/25/79 — DATE 4/11/79

DETAIL MILL POND DAM, ASHLAND — CHECKED BY ANG — COMPUTED BY NCE

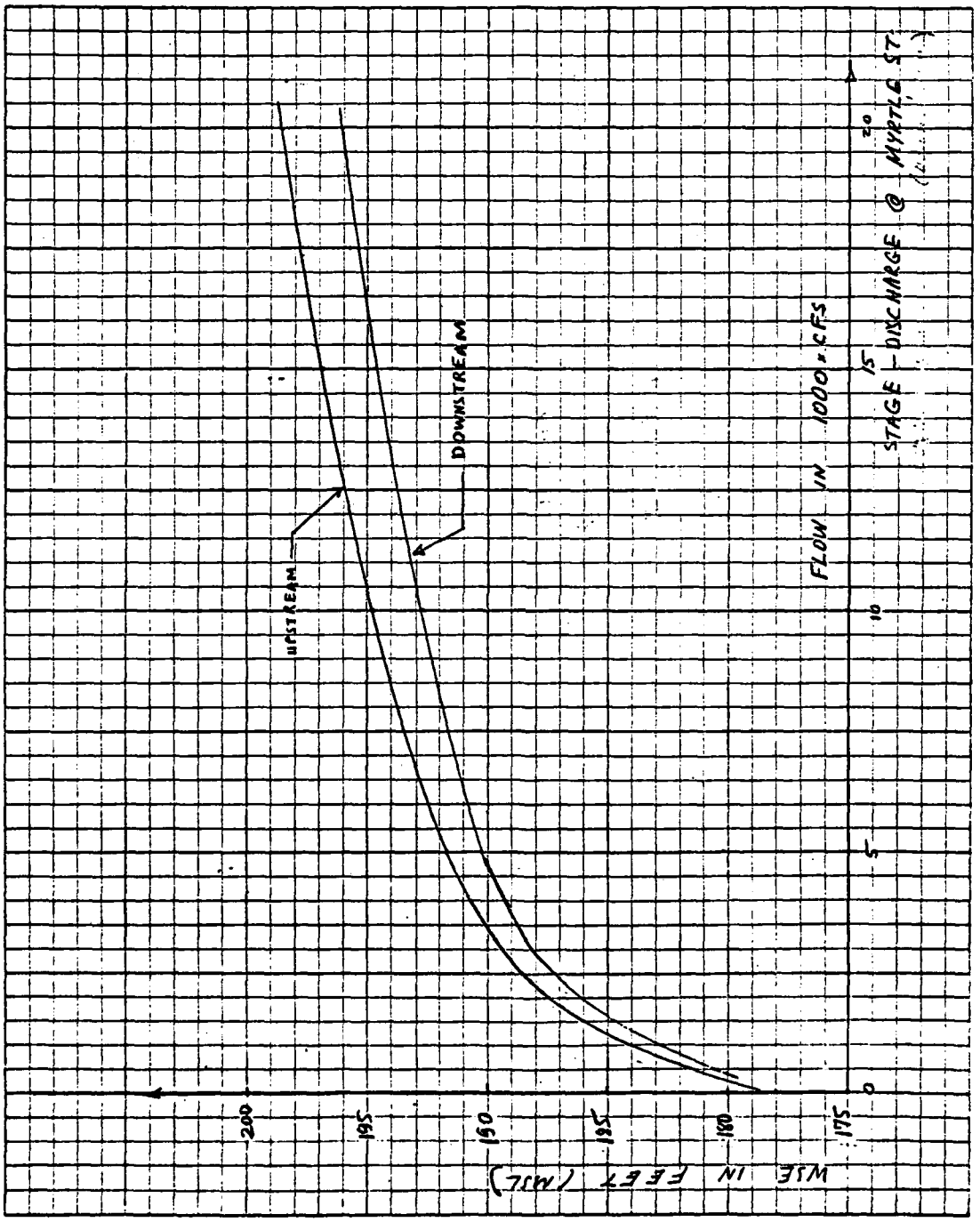


CAMP DRESSER & McKEE INC.

CLIENT H+A
PROJECT SOE Dam Inspection
DETAIL MILL POND DAM - ASHLAND

JOB NO 561-9-RI-8
DATE CHECKED 4/29/79
CHECKED BY AHG

PAGE 5
DATE 4/10/79
COMPUTED BY JGF



CAMP DRESSER & McKEE INC. CLIENT H & A JOB NO 561-9-Rt-8 PAGE 6
PROJECT COE Dam Inspection DATE CHECKED 4/28/79 DATE 4/13/79
DETAIL Mill Pond Dam, Ashland CHECKED BY AUG COMPUTED BY J C E

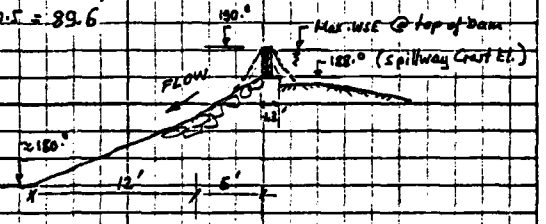
Capacity of Existing Spillways

$Q \cong 2.6\ L\ H^{3/2}$

$L = 45.5 - 6 \times 0.5 + 50.6 - 7 \times 0.5 = 89.6'$

$H = 2.0'$

$Q = 660$ cfs.



Flow over spillways during Test Flood Pool El. 199.7

Tail water El. = 197.8 ignore effect of the rails.

$\Delta H = 1.9$ Ft. $Q \cong 3.0 \times .96 \times \overline{1.9}^{3/2} \cong 750$ cfs

Conclusion: The existing spillway capacity is very small in comparison to the test flood. If the Mill Pond dam has to be maintained the spillway should be redesigned and constructed in combination with improvements to the downstream channel to increase capacity.

CAMP DRESSER & McKEE INC. CLIENT H & A JOB NO 561-9-R1-8 PAGE 7
PROJECT COE Dam Inspection DATE CHECKED 4/28/79 DATE 4/13/79
DETAIL Mill Pond Dam, Ashland CHECKED BY AUG COMPUTED BY J.C.F.

Dam Failure Analysis

Failure Flood Flow: $Q_p = \frac{8}{27} W_b \sqrt{g}\, y_o^{3/2}$

$y_o = 10$ ft.

$W_b = 0.40 \frac{150+130}{2} = 56'$

$Q_{p_1} = \frac{8}{27} 56 \cdot 5.67 \cdot 10^{3/2} = 2,975$ cfs.

Storage Volume @ El. 190.0 = 128 ac-ft.

An approximate profile along the down-stream channel is shown in Page D-9.

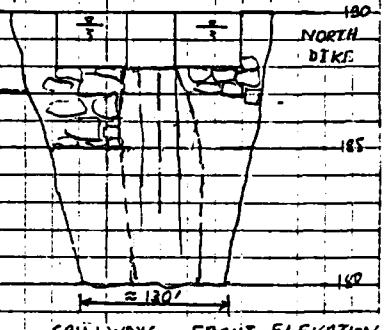
Flood flow routing for the Reach between the dam and Concord St.:

$V_1 = \frac{2000+440}{2} \times 300 + 400 \times 1000 = 766,000$ cuft
≈ 18 ac-ft.

Q_{p_2} Trial $= 2,975 \left(1 - \frac{18}{128}\right) = 2,560$ cfs. → WSE @ Concord St = 186.8

$V_2 = 17$ ac-ft. $V_{av} = 17.5$ ac-ft.

$Q_{p_2} = 2,570$ cfs.



SPILLWAYS - FRONT ELEVATION

As can be seen from the hydraulic profile the downstream channel bank would be overtopped by about 3 ft. Four houses would be subject to flooding at Concord St.: one on the right bank and the three on the left bank. These houses are occupied. The ones on the left bank are located right at the edge of the channel bank. The Factory dike on the right bank would also be overtopped and the relatively low grounds of the factory yard and the ground floor would be under water.

In the event of a dam failure, potential for loss of lives and excessive residential and industrial damages are expected to occur; therefore the hazard classification for this dam is considered to be "HIGH".

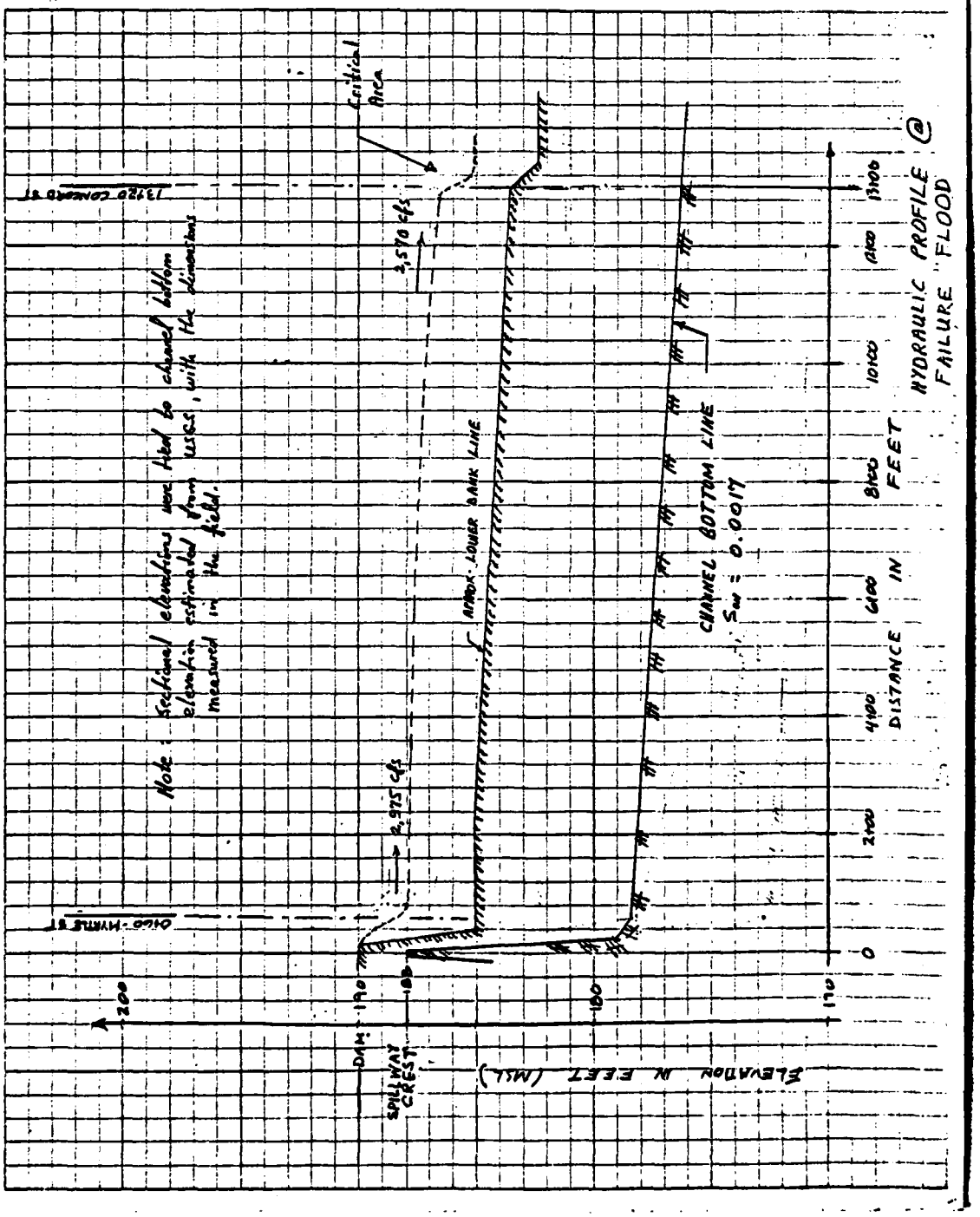
Note For the dam safety investigations, it is assumed that a failure would occur only at the dam which is under study and the other upstream and downstream facilities, such as dams and bridges, would remain intact; for example, we have not considered the effects on the dam under study which could be caused by failure of an upstream dam, especially a larger upstream dam.

CAMP DRESSER & MCKEE INC.

CLIENT HALEY AND ALDRICH — JOB NO 5741-9-RT-B — PAGE 8

PROJECT C.O.E. DAM INSPECTION — DATE CHECKED 4/23/79 — DATE 4/11/79

DETAIL SUDBURY RIVER/MILL DAM — CHECKED BY AHG — COMPUTED BY JCF



APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

FILMED

7-85

DTIC