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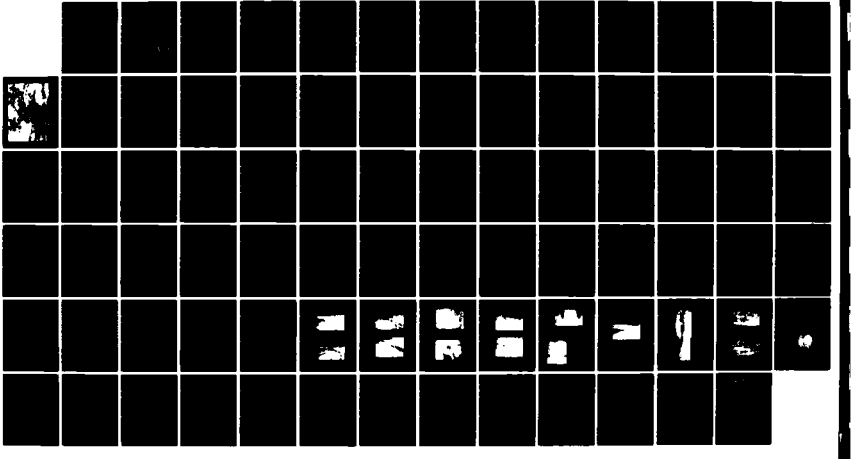
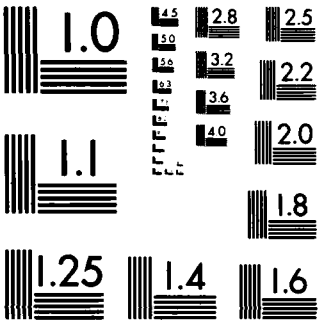


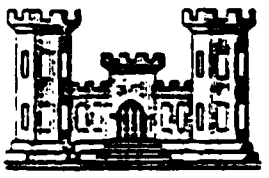


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

MERRIMACK RIVER BASIN
BURLINGTON, MASSACHUSETTS

MILL POND RESERVOIR MAIN DAM
MA 01121

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

JANUARY 1980

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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
Burlington, Massachusetts
Maple Meadow Brook

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

The dam is comprised of a 1300 ft. long, 49.5 ft. high earth fill embankment having a concrete core wall. The dam has a size classification if intermediate and a hazard potential classification of high.The dam is generally in good condition, however no record of seismic analysis, was made available. The overall rating of the dam is fair.

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
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REPLY TO
ATTENTION OF:
NEDED

MAR 21 1980

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

Dear Governor King:

Inclosed is a copy of the Mill Pond Reservoir Main Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, town of Burlington.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,

Max B. Scheider

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM
PHASE I INVESTIGATION REPORT
BRIEF ASSESSMENT

Identification No.: MA 01121

Name of Dam: Mill Pond Reservoir Main Dam

Town: Burlington

County and State: Middlesex County, Massachusetts

Stream: Maple Meadow Brook

Date of Inspection: December 5, 1979

The dam is comprised of a 1,300 foot long, 49.5 foot high earth fill embankment having a concrete core wall. The reservoir is a pump storage facility, having no inlet stream or spillway. The dam was completed in 1973 and has always been owned and operated by the Town of Burlington as a part of their water supply system. There is a North and a South Dike located on the western shore of the reservoir. These dikes have a separate Phase I Report See Mill Pond Reservoir North and South Dikes MA 01122 and MA 01123.

A limited number of engineering plans and correspondence was available for review. The adequacy of the dam was primarily evaluated by visual inspection, available plans and correspondence, past performance history and sound engineering judgement.

The dam has a size classification of intermediate and a hazard potential classification of high. Based upon Corps Guidelines, the test flood, PMF, will produce a peak inflow of 600 cfs from the 128 acre drainage area. To prevent the dam being overtopped, all of the 19 inches of runoff from the drainage area

must be retained within the reservoir. Between the design high water level, elevation 144, and the top of dam, elevation 147.5, there is 221 acre-feet of available storage. This capacity is sufficient to store all the runoff, 203 acre-feet, from the drainage area. There will be no test flood outflow. The dam will not be overtopped.

The dam is in generally good condition, however no record of seismic analysis, if performed, was made available. Since the dam is located near the boundry of seismic zones 2 and 3, a seismic analysis should be made. Due to the preceding and observed seepage, the overall rating of the dam is fair.

It is recommended that the Owner engage a qualified registered professional engineer to perform a seismic stability analysis of the dam and to monitor the observed seepage.

The following remedial measures should be instituted by the Owner: grass and brush on the dam should be cut and maintained; animal burrows should be filled-in and prevented from reoccuring; trespassing on the dam should be prevented; a formal warning system for the downstream impact area should be developed and the dam should be inspected once every year by a qualified registered professional engineer.

The recommendations and remedial measures should be implemented by the Owner within one year after receipt of this Phase I Investigation Report.

Ronald H. Cheney

Ronald H. Cheney, P.E.
Vice President

Hayden, Harding & Buchanan, Inc.
Boston, Massachusetts

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

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to

assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I 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 aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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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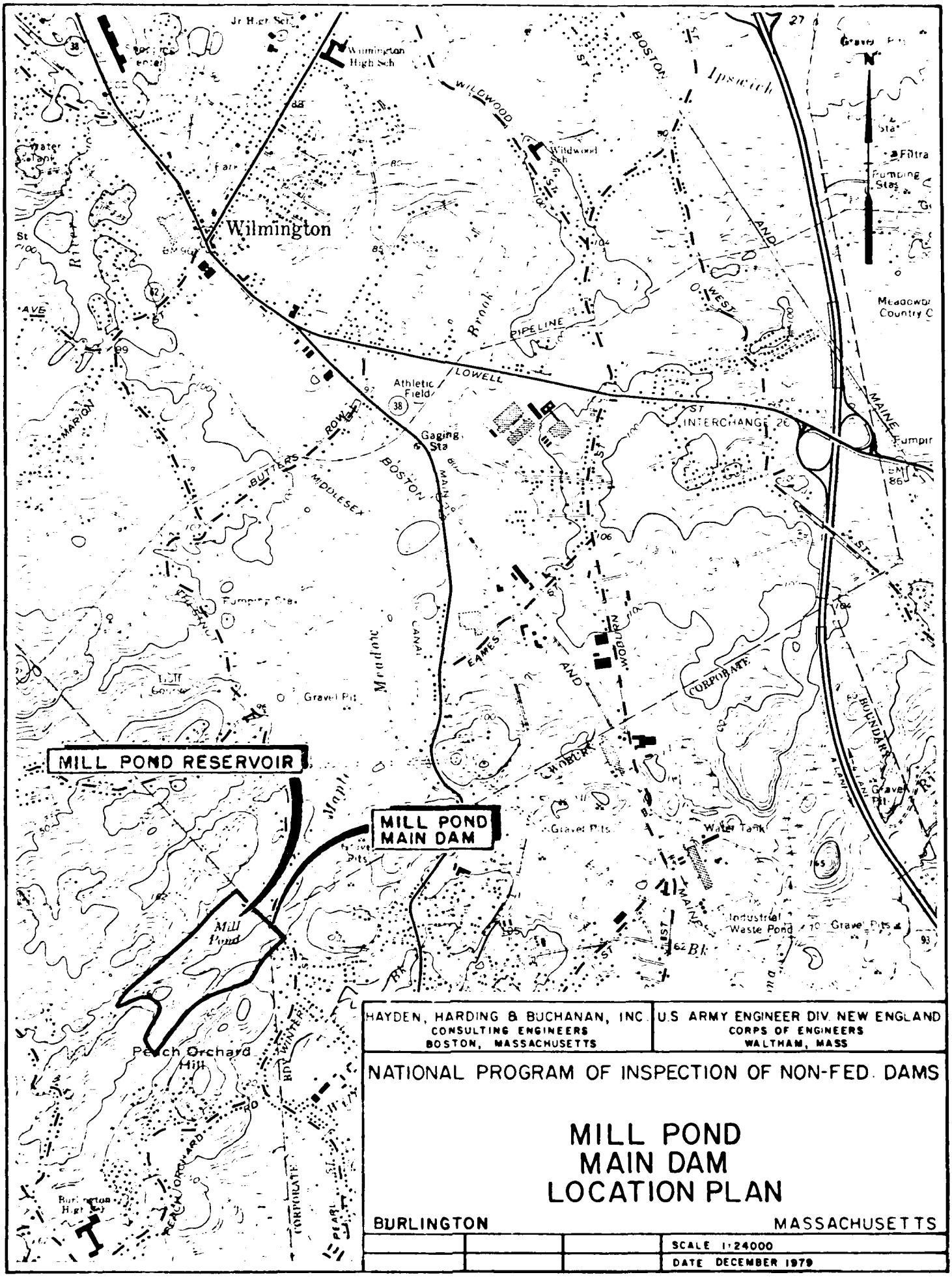


HAYDEN, HARDING & BUCHANAN, INC. CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MILL POND MAIN DAM LOCATION PLAN

BURLINGTON MASSACHUSETTS

SCALE 1:24000

DATE DECEMBER 1979

PHASE I
NATIONAL DAM INSPECTION PROGRAM

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. Hayden, Harding & Buchanan, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued Hayden, Harding & Buchanan, Inc. under a letter of 24 October 1979 from William E. Hodgson Jr., Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0006 has been assigned by the Corps of Engineers for this work.

b. Purpose

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

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

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

1.2 Description of Project

a. Location

Mill Pond Reservoir Main Dam is located in the Town of Burlington in Middlesex County, Massachusetts. The reservoir impounds water pumped from the Shawsheen River located approximately 3 miles north of the reservoir. The reservoir is located just to the southwest of the intersection of the Wilmington-Woburn-Burlington town lines as shown on the Wilmington, Massachusetts Quadrangle having the approximate coordinates of North 42°30'53", West 71°10'12".

b. Description of Dam and Appurtenances

The Mill Pond Reservoir Main Dam is a 1300± foot long 50.0 foot high (hydraulic height) earth embankment dam containing a concrete corewall, and a gated intake structure. The dam has a crest width of approximately 20 feet. The upstream slope is riprapped on a 2½ Hor.:1 Vert. slope (photograph 11). The downstream slope is turf lined and sloped at 2½ Hor.:1 Vert. (photograph 12). The concrete corewall has a thickness of 1.25 feet and a length of 1,256 feet. The elevation of the top of the corewall is 145.0.

The concrete intake structure (see Appendix B) is a 10 foot square, 49 foot deep well having three intakes (photograph 1). The lowest intake at invert elevation 99.33 is a 16 inch diameter ductile iron pipe connected to a concrete headwall structure located 52 feet upstream. The intermediate intake has a gated 16 inch diameter opening at invert elevation 123.33. The high intake is a gated 16 inch diameter opening at invert elevation

133.33. The intake structure outlets are two 16 inch ductile iron pipes which converge to one line approximately 10 feet downstream of the toe. The combined line then enters the water treatment plant (photograph 12). There is a 16 inch bypass line located approximately 5 feet downstream from the convergence of the two 16 inch lines that allows water to be fed directly into a 48 inch drain line. Treated water from the plant enters the town water system through a 12 inch distribution main.

There are 2 earth dikes located at the western side of the reservoir. (See Dam Safety Report MA 01122 & MA 01123 for North and South Dikes.) The North Dike has a hydraulic height of 20± feet and a length of 370± feet. The South Dike has a hydraulic height of 39± feet and a length of 400± feet. Both dikes have turfed downstream slopes at 2 Hor.:1 Vert., and riprapped upstream slopes at 2 Hor.:1 Vert. There are 2 small brooks which drain the areas in front of these dikes. Water collected by the brooks travels through a headwall and gate structure at each dike, and then below the reservoir through two drain lines (24" at North Dike and 42" at South Dike) which converge at approximately the center of the reservoir into a 48 inch line. This line continues below the dam embankment and exits into a downstream brook located approximately 350 feet downstream of the crest. There is a gate valve for this line located at the downstream embankment toe (photograph 12) as well as the gates previously mentioned at each dike.

The reservoir is fed by water collection from the Shawsheen River. Water is pumped through a 24 inch diameter transmission line

which inlets through a headwall structure located near the North Dike.

Plan drawings indicate a drainage system on the downstream side of the dam of 8" porous pipe next to the core wall and 6" porous pipe at the toe. The porous pipe is led to manholes at the toe, which are connected by 12" solid wall reinforced concrete pipe. The water from this system along with the water collected from a subdrain system for the water treatment plant site, is collected in 2-24 inch pipes which exit into the downstream brook (photograph 9).

c. Size Classification

The dam is classified as intermediate based on its hydraulic height of 49.5± feet and storage capacity of 1,746 acre feet.

d. Hazard Classification

The dam has a high hazard potential classification. Based upon Corps Guidelines, the failure discharge would be 117,100 cfs. Two impact areas, with residential structures are developed. Along Winter Street, Willow Brook and Main Street, at least 35 homes could be damaged by floodwater reaching depths of 5 to 15 feet. Along Maple Meadow Brook, flood stage could reach 24 feet. At least 30 homes or more could be damaged.

e. Ownership

The dam has always been owned by the Town of Burlington.

f. Operator

The dam is maintained and operated by the Town of Burlington Water Department. Mr. William Keene is the designated caretaker.

The mailing address is Town of Burlington Water Treamtment Plant, Winter Street, Burlington, Massachusetts 01803 (telephone 617-272-3956).

g. Purpose of Dam

The purpose of the dam has always been water supply.

h. Design and Construction History

The dam was designed by Whitman & Howard Inc. of Wellesley, Massachusetts in 1970. The construction contract for the dam was advertised in October 1970. Construction of the dam began in 1971 and was completed in 1973. Van D. Lambert Excavating, Inc. was the contractor.

i. Normal Operational Procedures

The caretaker regulates the inflow into the reservoir, attempting to maintain the water elevation at 144. The quantity of flow of the Shawsheen River also dictates when and what quantity he can pump. The pumps are located in Billerica, along the Shawsheen River on Cook Street. Normally one of the 3 intakes at the reservoir intake structure is left open. The caretaker alternates the intakes according to the observed water quality. The two 16 inch outlets are normally left open. Water is gravity fed into the plant, where it is treated and then pumped into the town system.

1.3 Pertinent Data

a. Drainage Area

Mill Pond is located in an upland area. It was formed by constructing earth embankments across three valleys. Its

drainage area is about 0.2 square miles (128 acres) including reservoir area. The area around the reservoir is undeveloped wooded land.

To the southwest of the reservoir there are two swampy drainage areas which contribute runoff to the South Dike and North Dike intake structures. This runoff flows into pipes which pass beneath the two dikes and join together below the reservoir. A single pipe then extends along the bottom of the reservoir and beneath the main dam. This pipe discharges into the outlet brook about 350 feet downstream of the main dam, at Winter Street. See the drainage area map in Appendix D, photographs in Appendix C, and drawings in Appendix B.

b. Discharge at Damsite

1. Outlet Works

There are two 16 inch diameter cast iron outlet pipes for water supply. At the intake structure the inverts are at elevation 99.33. At the downstream toe of dam, the inverts are at elevation 91.75. Both pipes are used for water supply to the water treatment plant, located at the downstream toe of the main dam.

Record construction plans indicate that both 16 inch pipes are joined together into one 16 inch pipe which can be used as a main drain. It could by-pass the water supply system, and discharge water into the 48 inch diameter drain pipe, which carries runoff water from the 24 in. North Dike and 42 inch South Dike intake pipes. The invert of the 48 inch pipe is 92.20, at the main dam valve chamber.

2. Maximum Known Flood at Damsite

The dam was completed in 1973. There are no available records of maximum flood at the damsite. United States Weather Bureau records indicate that from August 16 to 20, 1955, ten to fourteen inches of rainfall occurred in the general location of the project.

3. Ungated Spillway Capacity

The reservoir is a pump-storage water supply project. The project has no spillway or other outlet works except the two 16 inch diameter pipes at the water supply intake structure. Discharge through the intake structure would be controlled at the treatment plant by water demand within the water system. If the treatment plant were bypassed and the 16 inch pipe was used to drain water directly into the 48 inch drain pipe, the 16 inch pipe could have a maximum capacity of about 3 mgd, with water at the top of dam and test flood level of elevation 147.5. The normal high water level is at elevation 144 or less. The capacity of the 16 inch pipe is normally less than 3 mgd.

c. Elevation (ft. above NGVD - approximate only)

(1) Streambed at toe of dam ---------- 92± Pipe outlet at Winter Street, 350 feet away from toe of dam.

(2) Bottom of cutoff ---------- 72±

(3) Maximum tailwater ---------- none

(4) Recreation pool ---------- N/A

(5) Full flood control pool ---------- N/A

(6) Spillway crest (gated) ---------- no spillway

(7) Design surcharge (Original Design) ----- 144.0

(8) Top of dam ---------- 147.5

(9) Test flood surcharge ---------- 147.3

d. Reservoir (Length in feet)

(1) Normal pool ---------- 2300 (water supply)

(2) Top of dam ---------- 2325

(3) Test flood pool ---------- 2325

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

(5) Spillway crest pool ---------- N/A

e. Storage (acre-feet)

(1) Normal pool ---------- 1525 (water supply)

(2) Test flood pool ---------- 1710

(3) Top of dam ---------- 1746

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

(5) Spillway crest pool ---------- N/A

f. Reservoir Surface (acres)

(1) Normal pool ---------- 53± (water supply)

(2) Test flood pool ---------- 74±

(3) Top of dam ---------- 74±

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

(5) Spillway crest ---------- N/A

g. Dam

(1) Type ---------- gravity, earth embankment

(2) Length ---------- 1300'

(3) Height ---- 75'± (structural) 50'± (hydraulic)

(4) Top Width ---------- 20'

(5) Side Slopes ----- u.s. and d.s. 2½ Hor.:1 Vert.

(6) Zoning ---------- not indicated

(7) Impervious Core ------- 1'-3" concrete corewall

(8) Cutoff -------- 1'-3" concrete corewall to rock

(9) Grout curtain ---------- not indicated

h. Diversion and Regulating Tunnel ---------- none at this project

i. Spillway ---------- none at this project

j. Regulating Outlets

There are three regulating inlets at the intake structure. Each is a 16 inch diameter pipe inlet. Each inlet has a bar screen at the intake and a manually controlled valve inside the intake structure. The inlets are at invert elevation 99.33, 123.33 and 133.33.

On the outlet side of the intake structure, there are two manually controlled valves. These are used to regulate flow through two, 16 inch diameter outlet pipes which carry water to the treatment plant. The outlet pipes are at invert elevation of 99.33.

Near the treatment plant, the two 16 inch outlet pipes are joined together into one 16 inch pipe which continues to the plant. The plant draws water from the reservoir to meet the demand within the distribution system. Water in the single 16 inch pipe can also be diverted to the 48 inch diameter pipe which carries runoff water from the 24 and 42 inch pipes located at the North and South Dikes, and thus function as a draw down.

SECTION 2

ENGINEERING DATA

2.1 Design Data

The dam was designed by Whitman & Howard, Inc. Consulting Engineers, Wellesley, Massachusetts, in 1970. The facility was designed as part of a water supply project. Design calculations for this project were not made available. However, construction drawings and contract specifications were provided.

2.2 Construction Data

Construction for the dam was undertaken in 1971 and completed in 1973. The contractor was Van D. Lambert Excavating, Inc. Daily reports and/or records of construction activity were not made available.

2.3 Operation Data

The facility is operated by the Town of Burlington Water Department. It is a pump storage project with a high water elevation of 144. The reservoir is operated at elevation 144 or less. Due to water demand, variation in the water level is frequent. An operations manual for this project was not made available.

2.4 Evaluation of Data

a. Availability

As built plans of the dam and associated structures and contract specifications were obtained from Whitman & Howard, Inc., Consulting Engineers, who were the designers of this facility. Additional engineering data pertaining to the design was not made available for inclusion within this report. Some correspondence

pertaining to the construction of the facility was obtained from the Department of Environmental Quality Engineering, Division of Waterways, Boston Office. Construction correspondence or daily reports kept during construction were not made available.

b. Adequacy

Indepth engineering data was not provided and does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, can not be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, the available as-built drawings, and sound engineering judgement.

c. Validity

The visual inspection of this facility showed no reason to question the validity of the information supplied on the as-built plans.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

At the time of inspection the reservoir water elevation was about 137.5 ft. (NGVD) which is about 10 ft. below the top of the dam. According to design drawings, full reservoir level is at elevation 144 ft. The dam is not an on-stream structure; the reservoir is filled with water pumped from the Shawsheen River in Billerica, Massachusetts.

b. Dam

The dam is an earth embankment about 50 ft. in height (hydraulic) and about 1,300 foot long with a concrete core wall resting on bedrock. The majority of the embankment portion of the dam rests on soil. The dam contains an outlet pipe for water supply and does not have a spillway.

The upstream slope is covered with riprap in good condition as shown in photographs 1 & 2.

The crest of the dam is about 20 ft. wide and covered with grass. Pathways on the crest indicative of trespassing were observed, as shown in photographs 1 & 2. Small trees and brush were observed on the upstream side of the crest in several locations. No evidence of cracking or misalignment of the crest that could be attributed to embankment movement was observed.

The downstream slope is covered with long grass and brush, as shown in photographs 3 & 4. The surface of the slope is lumpy.

Several animal burrows were observed on the downstream slope. The burrow observed at the lowest elevation (about 4 ft. higher than the downstream toe and at about Sta. 7+65) is shown in photograph 5.

Plan drawings indicate a drainage system on the downstream side of the dam consisting of 8" porous pipe next to the core wall and 6" porous pipe at the toe. The porous pipe is led to manholes at the toe, which are connected by 12" solid wall reinforced concrete pipe. All water from the drainpipes end up flowing through the left most manhole (Manhole No. 1 at about Sta. 11+00) where it is directed to underground pipes which lead to Maple Brook. The amount of water flowing out of Manhole No. 1 is shown in photograph 6. An "as-built" drawing dated November 1973 indicates a total of six manholes along the downstream toe. All manholes except No. 4 were found and opened. Attempts to find Manhole No. 4 by probing with pick axes were unsuccessful.

A wet area, about 60 by 20 ft. in size, was observed at the downstream toe, as shown in photograph 7. The left edge of the wet area was about 96 ft. right of the outlet control valve on the downstream slope.

A small area of standing water, about 3 ft. by 3 ft., was observed at the downstream toe about 20 ft. right of Manhole No. 3 (numbering system shown on "as-built" drawing dated November 1973) as shown in photograph 8.

Six groundwater wells were observed in the dam, three along the crest and three along the toe. Water level measurements in the walls were not made at the time of inspection. Records of past well measurements available at the Burlington Department of Public Works were not reviewed.

c. Appurtenant Structures

The dam does not contain a spillway. It is a pump storage facility. The intake structure, service bridge and footing were all observed to be in good condition. The screen on the outlet structure was not bolted in place and had debris behind it.

d. Reservoir Area

There are no indications of instability along the banks of the reservoir in the vicinity of the dam.

e. Downstream Channel

Discharge pipes which supply water to the downstream channel are shown in photograph 9. According to plan drawings, the largest pipe in the above photograph is the outfall for water which enters the intake pipes of the north and south dikes on the opposite side of the reservoir. The small pipe to the left of the large pipe (shown on the far right in the photograph) carries water from the drainage system of the dam and water from subdrains downstream of the dam.

The downstream channel is shown in photograph 10. No significant obstructions were observed in the downstream channel, however, thick vegetation lines both sides of the channel.

3.2 Evaluation

A large wet area and a small area of standing water were observed at the downstream toe. This seepage does not represent an immediate stability problem but should be observed periodically, as recommended in Section 7.

No record of seismic analysis made by conventional equivalent static load methods, if performed, was made available.

Because of the preceding along with the observed wet area, and small area of standing water, the overall rating of the dam is fair.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General

The Mill Pond Dam is a portion of the facility which provides a reservoir for water supply purposes. Water from the Shawsheen River is pumped into the reservoir and stored until required by demand. It is then gravity fed into the treatment facility, treated, and pumped into the Town's distribution system.

b. Description of Warning System

There are no warning systems associated with this facility.

4.2 Maintenance Procedures

a. General

The Town of Burlington Water Department is responsible for the maintenance of the facility. The designated caretaker is Mr. William Keene. Those structures related to the water supply purpose of the facility are checked on a daily or weekly basis, and maintenance is performed at regular intervals or as required. The dam and its associated structures are visually inspected at least weekly by employees of the Water Department.

b. Operating Facilities

As the project is used for water supply purposes, the operating facilities related to this usage are continually monitored and maintenance is performed regularly. Other facilities, such as the drain pipe, intake structures and the 24 inch inlet pipe to the reservoir, are inspected a minimum of once a week to

insure their proper operation. According to Water Department personnel all gates are operational. The intake gates at the intake structure are used regularly. The bypass gate, the gates at the dikes and the 16 inch outlet control were last operated about 1974. Personnel regularly monitor the observation wells and seepage collection system.

4.3 Evaluation

The operating personnel regularly inspect or operate various functioning features of the project. Grass and brush should be regularly cut and maintained to facilitate inspection of the embankment. Numerous animal burrows should be filled-in and prevented from reoccurring. The project should be inspected once every year by a qualified registered professional engineer who can identify conditions of concern which if left unchecked could jeoparidize the safety of the dam.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Mill Pond Reservoir is located in Burlington, Massachusetts, near the Town of Wilmington and the City of Woburn. The project is a pump storage water supply facility with a very small, natural drainage area of 0.2 s.m. (128 acres).

The dam and the two dikes which form the reservoir block-off three valleys which drain 0.7 s.m. (448 acres) of swamp area. Two outlet brooks from this swamp area flow into culverts at the dikes and then join into one 48 inch pipe below the reservoir. This single pipe passes beneath the dam and discharges at Maple Meadow Brook.

The dam has no spillway. Water is discharged through an intake structure into two, 16 inch water supply pipes. These pipes are connected to the water treatment plant, at the downstream toe of the dam. See Appendixes B, C and D for engineering drawings, photographs and hydraulic calculations.

5.2 Design Data

Hydraulic/hydrologic criteria used for the design of this project was not made available for review and inclusion in this report.

5.3 Experience Data

The project was completed in 1973. It is a pump storage water supply facility having a 128 acre drainage area. The design

high water level is at elevation 144. The normal operating water level is constantly changing and is kept at or below elevation 144. There are no records of flooding experience or the occurrence of overtopping of the dam, since it was constructed.

The United States Weather Bureau records indicate that 10 to 14 inches of rainfall occurred in the general location of the dam between August 17 to 20, 1955.

5.4 Test Flood Analysis

The dam has an intermediate size classification and a high hazard potential. Based upon Corps Guidelines, the test flood would equal the PMF. The PMF inflow from the 0.2 s.m. drainage area is 600 cfs. The dam has no spillway to discharge water which cannot be stored in the reservoir.

The design high water level in the reservoir is at elevation 144 (see photograph 1). This would provide about 221 a-f of storage to the top of dam at elevation 147.5. The PMF, 19 inches of runoff from the 128 acre drainage area, would require 208 a-f of storage above elevation 144 to prevent overtopping of the dam. Assuming that the water level is kept at elevation 144 or less, the dam would not be overtopped by PMF storm conditions.

5.5 Dam Failure Analysis

The Mill Pond Dam was assumed to have failed with the water level at the top of dam, elevation 147.5. The highest portions (over 40± feet) of dam (see photograph 12) extend over a length of about 500 feet. The hydraulic height of the dam is 49.5 feet. Using Corps Guidelines, the resulting failure outflow is 117,100 cfs.

The impact area is separated into two sections which follow Maple Meadow Brook (photograph 13) and Willow Brook (photograph 14). Along Maple Meadow Brook there is substantial residential development. Much of this development has occurred since the dam was constructed. At least 65 homes would be damaged by dam failure flood water.

Within the first 1000 foot reach of the Maple Brook outlet channel, the flood stage would be about 23 to 24 feet. Flood stage just prior to dam failure would not be significant as the drainage area contributing base flow is very small. About 15 homes would receive damage from 23 to 24 feet of flood water. The other 15 homes could be damaged by 5 to 10 feet of flood water.

Beyond the first 1000 foot reach, the outlet brook enters a wide swamp flood plain area. Flood stage would be reduced to 16 feet or less as the water is dispersed over the wider areas of the flood plain. Almost all homes are along the perimeter of the swamp. Depending on exact ground elevations flood damage to homes in this area could be several feet.

Along the Willow Brook impact area, near Winter Street, initial flood stage, within the first 500 feet of channel, will be about 15 feet. The outlet valley is narrow in this area. Continuing past Winter Street the valley leads into Willow Brook which flows towards Main Street (Rte. 38). Flood stage near Rte. 38 could be 5 feet. At least 35 homes in this area could be damaged by flood water. Most of these homes are located near the perimeter of the impact area and damage could be caused by flood water depths of 5 feet.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The visual observation did not disclose any immediate stability problems. However, the following may lead to instability of the dam:

1. increases in seepage through the dam
2. animal burrows through the downstream slope

6.2 Design and Construction Data

Information on the design and construction of the dam can be obtained from "as-built" drawings dated November 1973. These drawings indicate that the earth embankment has side slopes of 2.5 Hor.:1 Vert. and consists of "compacted glacial till and/or pervious fill." The core wall consists of a 1'3" wide reinforced concrete wall on a 3'3" wide footing resting on bedrock. The footing is stepped to follow the contours of the bedrock surface. The core wall is 1,250± ft. long and has a maximum height of about 72 ft.

Logs of 28 borings made at the dam location are available. These borings were made to refusal which varied from a depth of 0 ft. to 18 ft.; rock coring was not performed.

6.3 Post Construction Changes

An underground pumping system was installed at the downstream toe near the right abutment to control seepage beneath the dam in this area. Water from the pumping system is led to Manhole No. 6.

Observation wells in the dam were also installed.

6.4 Seismic Stability

The dam is located near the boundary of Seismic Zone 2 and 3 and in accordance with the recommended Phase I guidelines warrants seismic analysis. No record of seismic analyses made by conventional equivalent static load methods, if performed, were made available.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the visual inspection and available records, the dam is judged to be in generally good condition. However, due to the current lack of seismic analysis and the observed seepage conditions, the dam is rated as fair.

According to the Owner, seepage conditions are being monitored by an outside consultant.

b. Adequacy of Information

The information made available and the visual inspection are adequate for a Phase I level of investigation.

c. Urgency

The recommendations and remedial measures presented in Sections 7.2 and 7.3 should be implemented within one year after receipt of this Phase I Investigation Report by the Owner.

7.2 Recommendations

a. In accordance with recommended Phase I guidelines, the dam should be analyzed for seismic stability. A qualified registered professional engineer should perform the seismic stability analysis.

b. It is recommended that the Owner engage a qualified registered professional engineer to investigate the downstream wet area and area of standing water, if these areas are not currently being monitored.

7.3 Remedial Measures

a. Grass on the crest and downstream slope should be cut as a part of routine maintenance.

b. Animal burrows should be filled with relatively pervious and non-erodable soil. Trespassing on the crest and downstream slope should be prevented and grassy vegetation re-established in barren areas.

c. The dam should be inspected once every year by a qualified registered professional engineer.

d. The screen at the outlet structure should be bolted in place. Debris behind the screens should be removed and periodically maintained in the future.

e. The Owner should develop a formal warning system for downstream areas in case of any emergency.

7.4 Alternatives

There are no practical alternatives for this dam.

APPENDIX A

INSPECTION CHECKLIST

INSPECTION AND FIELD REVIEW
PARTY ORGANIZATION

PROJECT: MILL POND MAIN DAM

DATE: Nov. 2, 1979

TIME: 8 am

WEATHER: Clear & Cool

W.S. ELEV.: 137.5 U.S. - D.S.

PARTY:

1. R. Cheney, HHB
2. D. Vine, HHB
3. D. LaGatta, GEI
4. T. Keller, GEI
5. F. DiPietro, HHB*
6. M. Angieri, HHB*
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Embankment Dam	D. LaGatta, T. Keller	
2. Intake-Outlet Works	R. Cheney, M. Angieri, D. Vine	
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

*Performed inspection on December 4, 1979.

2

PERIODIC INSPECTION CHECKLIST

PROJECT MILL POND MAIN DAM — DATE November 2, 1979

PROJECT FEATURE Embankment — NAME D. LaGatta, T. Keller

DISCIPLINE Geotechnical Engineer — NAME M. Angieri, R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	147.50 (from Whitman & Howard)
Current Pool Elevation	137.5±
Maximum Impoundment to Date	1525± a-f (at elev. 144)
Surface Cracks	None of significance.
Pavement Condition	No pavement.
Movement or Settlement of Crest	None of significance.
Lateral Movement	None of significance.
Vertical Alignment	No vertical misalignment observed.
Horizontal Alignment	No horizontal misalignment observed.
Condition at Abutment and at Concrete Structures	Good.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	Several footpaths on downstream slopes.
Sloughing or Erosion of Slopes or Abutments	Animal holes on downstream slope.
Rock Slope Protection - Riprap Failures	Riprap in good condition.
Unusual Movement or Cracking at or Near Toe	None observed.
Unusual Embankment or Downstream Seepage	Most significant seepage indicated by 60' x 20' wet area downstream of toe, right of intake control valve.
Piping or Boils	None observed.
Foundation Drainage Features	Porous piping system provides drainage immediately downstream of core wall.
Toe Drains	Porous piping system provides drainage of toe.
Instrumentation System	Six piezometers; 3 at crest and 3 at toe.
Vegetation	Grass is long on downstream slope.

MILL POND MAIN DAM	Nov. 2, 1979
Dike	R. Cheney
Structural Engineer Geotechnical Engineer	D. LaGatta

	See separate report for North and South Dikes. (MA 01122 & MA 01123)

4

MILL POND MAIN DAM — DATE November 2, 1979

FEATURE Outlet Works-Intake Structure — NAME R. Cheney

DISCIPLINE Structural Engineer — NAME M. Angieri

Hyrdraulic/Hyrdologic Engineer

AREA EVALUATED	RECOMMENDATION
a. INTAKE AREA - INTAKE CHANNEL AND INTAKE STRUCTURE	No approach channel.
a. Approach Channel	
Slope conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Seepage or Leakage	
b. Intake Structure	Reinforced Concrete
Condition of Concrete	good
Trash Racks and Slots	none has 3 gated inlets

	MILL POND MAIN DAM		November 2, 1979
	Control Tower		R. Cheney
DISCIPLINE	Structural Engineer Geotechnical Engineer	NAME	D. Vine

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	No control tower at this project.
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Emergency System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

6

NAME OF DAM: MILL POND MAIN DAM DATE:

INSPECTION FEATURE: Transition & Conduit NAME: R. Cheney

DISCIPLINE: Structural Engineer NAME: D. Vine

Geotechnical Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	None at this project.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Monitoring of Monoliths	

	MILL POND MAIN DAM		November 2, 1979
	Outlet Works		R. Cheney
DISCIPLINE	Structural Engineer		D. Vine

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	**The outlet structure** is the ungated concrete headwall located 350' downstream of the dam (photograph 9). The concrete was in good condition. The screen on the 48" pipe was not bolted in place. Trash and debris was observed behind the screens.
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	None which would restrict flow.
Condition of Discharge Channel	Fair to Good

PERIODIC INSPECTION CHECKLIST

8

NAME OF DAM: MILL POND MAIN DAM — DATE: November 2, 1979

PROJECT FEATURE: Spillway Weir & Channels — NAME: R. Cheney

DISCIPLINE: Structural Engineer — NAME: D. Vine

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	None at this project.
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

9

PERIODIC INSPECTION CHECKLIST

PROJECT MILL POND MAIN DAM DATE November 2, 1979

PROJECT FEATURE Service Bridge NAME R. Cheney

DISCIPLINE Structural Engineer NAME D. Vine

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	**The service bridge is a prestressed concrete beam in good condition.**
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

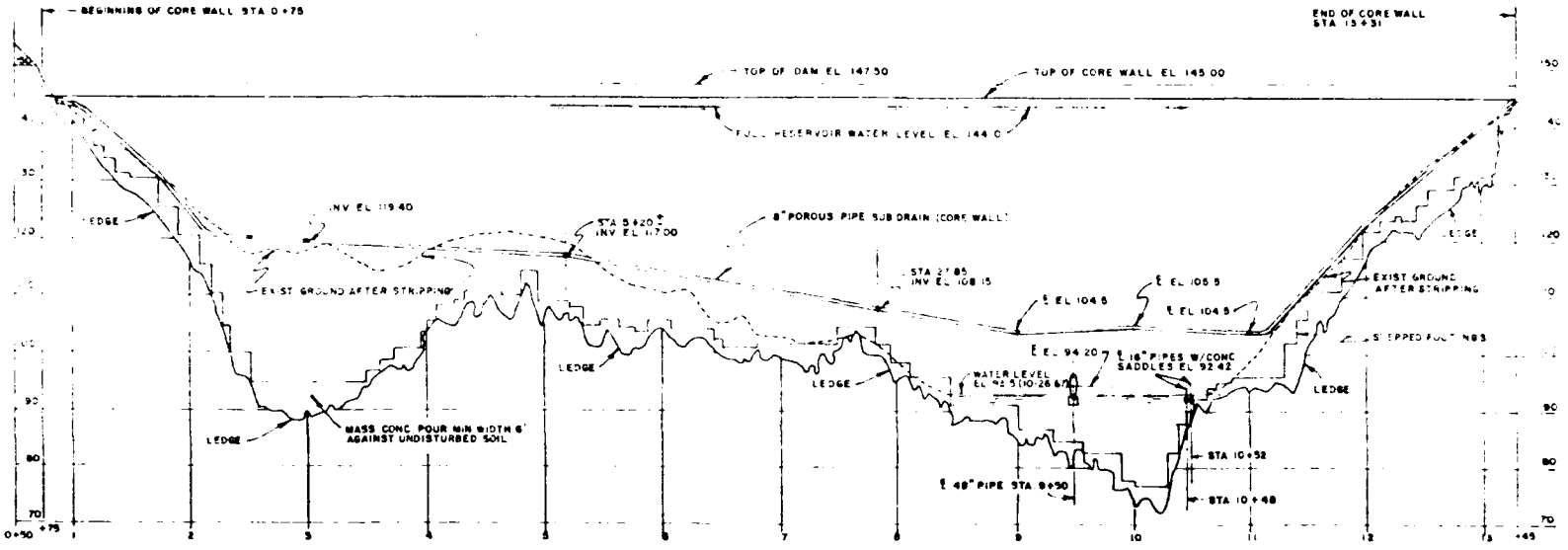
ENGINEERING DATA

LIST OF ENGINEERING DATA

1. As Built Plans
2. Construction Specifications & Test Boring Logs
3. Limited Pre-Construction Correspondence

Items 1 & 2 are available at Whitman & Howard, Inc., Wellesley, Massachusetts.

Item 3 is available at Department of Environmental Quality Engineering, Division of Waterways, 100 Nashua Street, Boston, Massachusetts.



PROFILE OF DAM

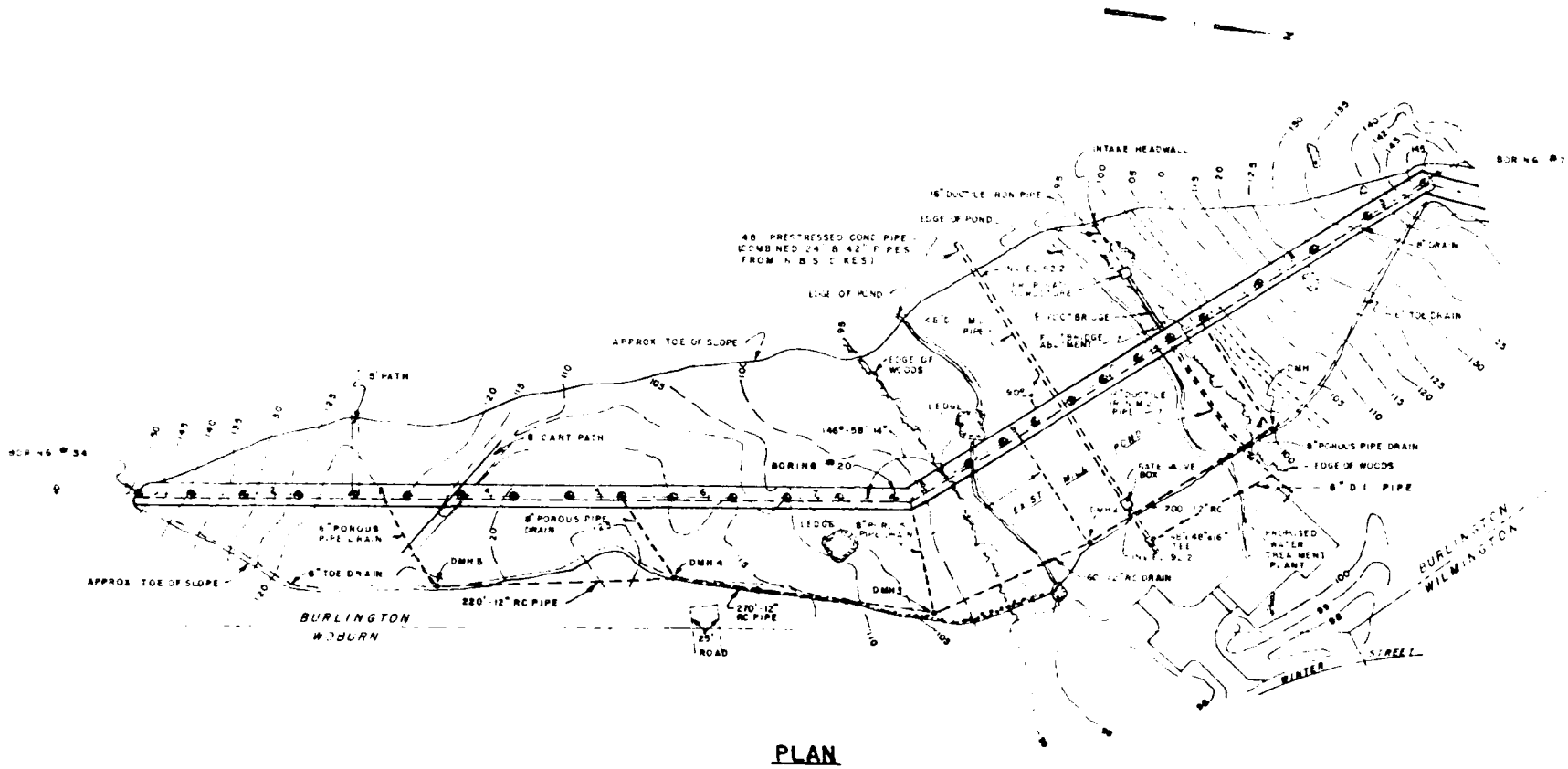
NOTE:
TAKEN FROM PLANS BY WHITMAN & HOWARD INC
DATED OCT 1970

HAYDEN HARDING & BUCHANAN CONSULTING ENGINEERS BOSTON MASSACHUSETTS	ARMY ENGINEER DIV NEW ENG CORPS OF ENGINEERS WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PROFILE
MILL POND MAIN DAM

BURLINGTON



PLAN

HEADWALL

BROOK

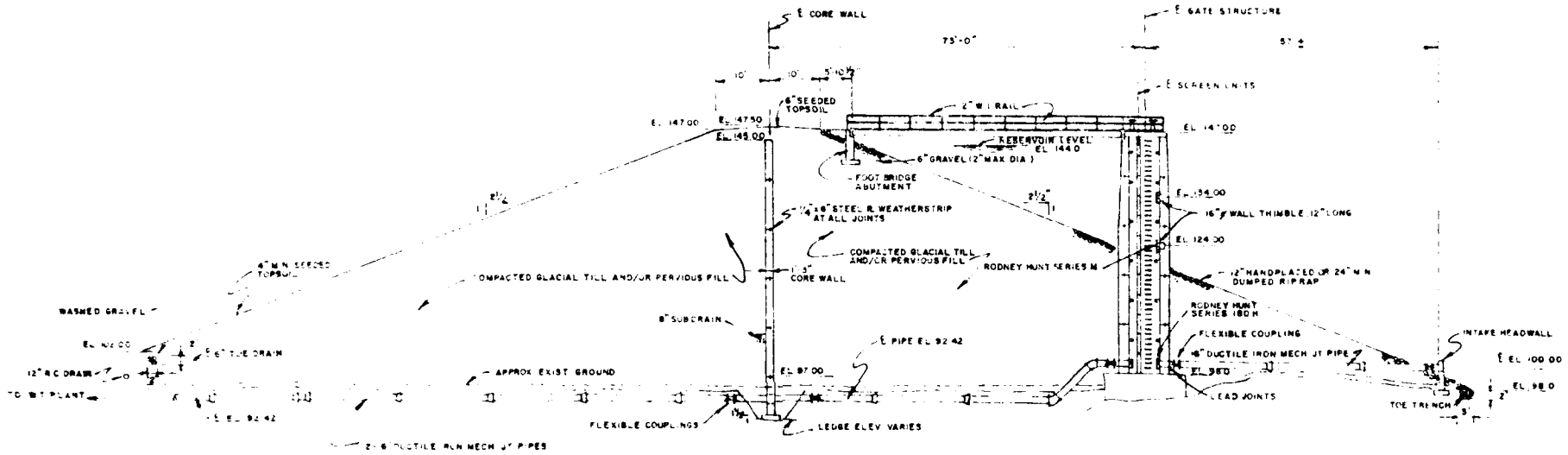
HAYDEN HARDING & BUCHANAN, INC. CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

MILL POND
MAIN DAM

BURLINGTON

NOTE:



SECTION THROUGH DAM AT GATE STRUCTURE

ANDREW HARDING & B. CHAMAN, INC. CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MILL POND
MAIN DAM SECTION

Section 24. BORINGS AND SOUNDINGS

The following boring logs are included herewith under this contract:

A. North Dike

Boring No. 1 through 5.

B. South Dike

Boring No. 1 through 7.

C. Dam

Boring No.7 through 34.

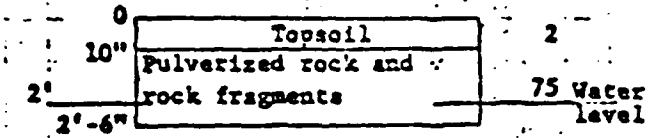
These logs are shown on the following pages 24-2 to 24-16.

John J. Doyle
56 Martin Road
Milton, Mass.

Whitman & Howard, Inc.
Boston, Massachusetts

Burlington, Massachusetts
North Dike

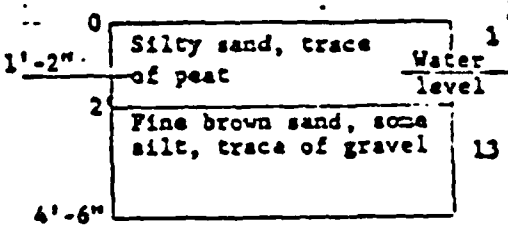
Boring No. 1
Sta. 2+00



Refusal at 2'-6"

3/12/68

Boring No. 2
Sta. 2+50

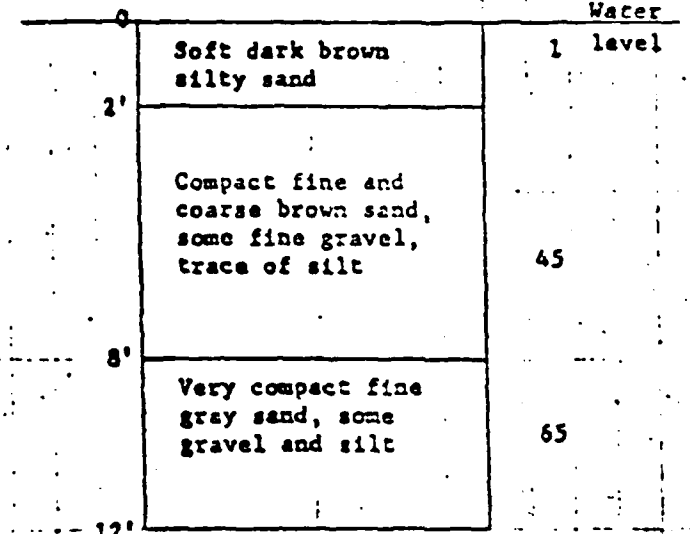


Refusal at 4'-6"

Made 3 additional trials in this area with deepest penetration 2'-6" - could be boulders

3/12/68

Boring No. 3
Sta. 3+00



J. McCue

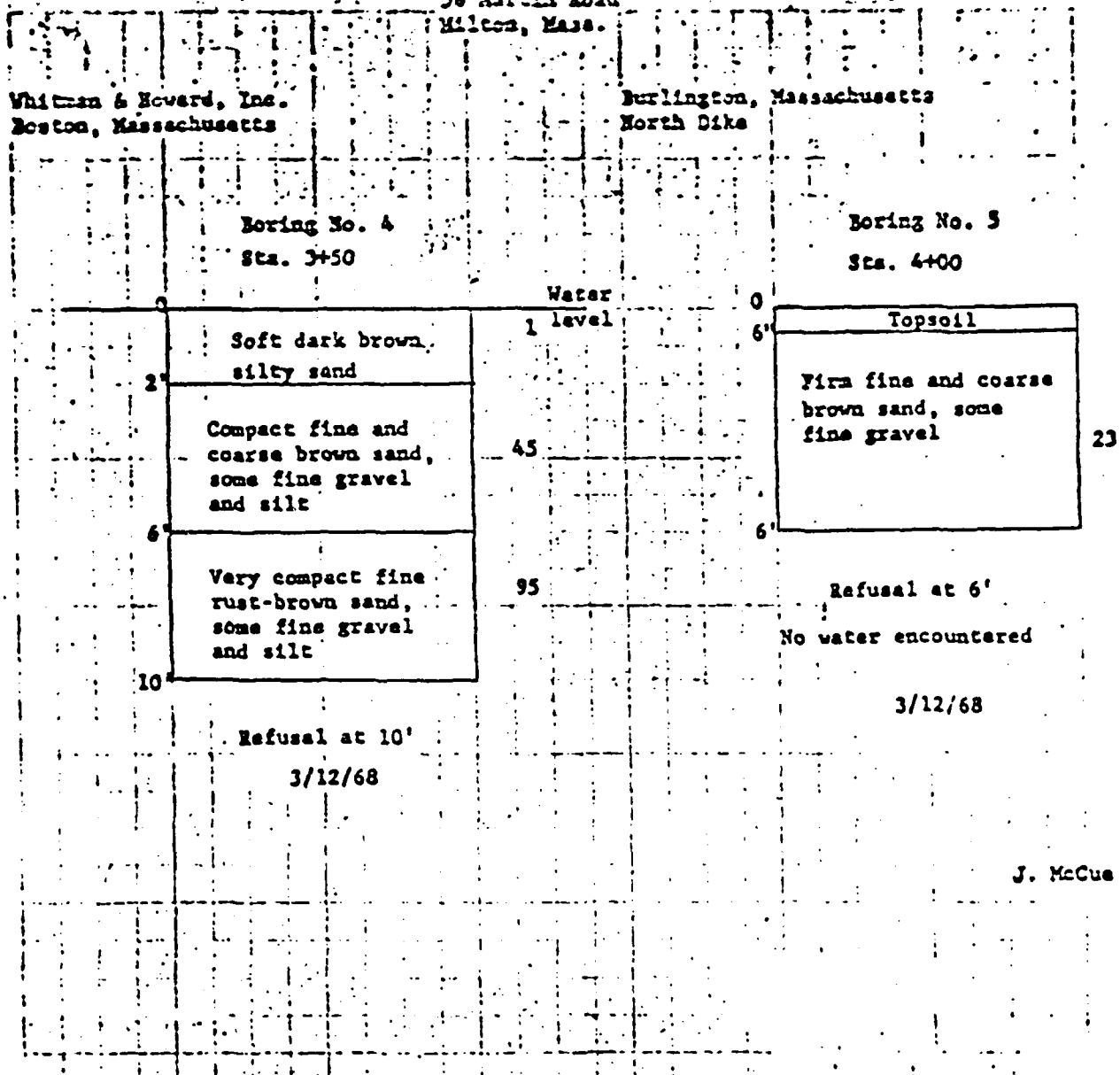
Refusal at 12'

3/12/68

John J. Boyle
56 Martin Road
Milton, Mass.

Whitman & Howard, Inc.
Boston, Massachusetts

Burlington, Massachusetts
North Dike



J. McCue

John J. Boyle
56 Martin Road
Milton, Mass.

Whitman & Howard, Inc.
Boston, Massachusetts

Burlington, Massachusetts
South Dike

Boring No. 1
Sta. 1+00

0
6" Topsoil
Very fine brown sand and silt
3'-6"
Fine & coarse brown sand, some fine gravel
4'-6"

Refusal at 4'-6"
No water encountered

3/9/68

Boring No. 2
Sta. 1+54

0
Fine dark brown silty sand and fine sharp gravel
1'-6"

Refusal at 1'-6"
Ledge all over area
No water encountered

3/9/68

Boring No. 3
Sta. 2+10

0 Water level
Peat
1'-8"
Fine gray sand, some silt
4'
Fine brown sand, some fine gravel & silt
6'-6"

Refusal at 6'-6"

3/9/68

Boring No. 4
Sta. 2+50

6" 0
Peat
Water level
1'-6"
Fine brown sand, some silt, trace of fine gravel
5'

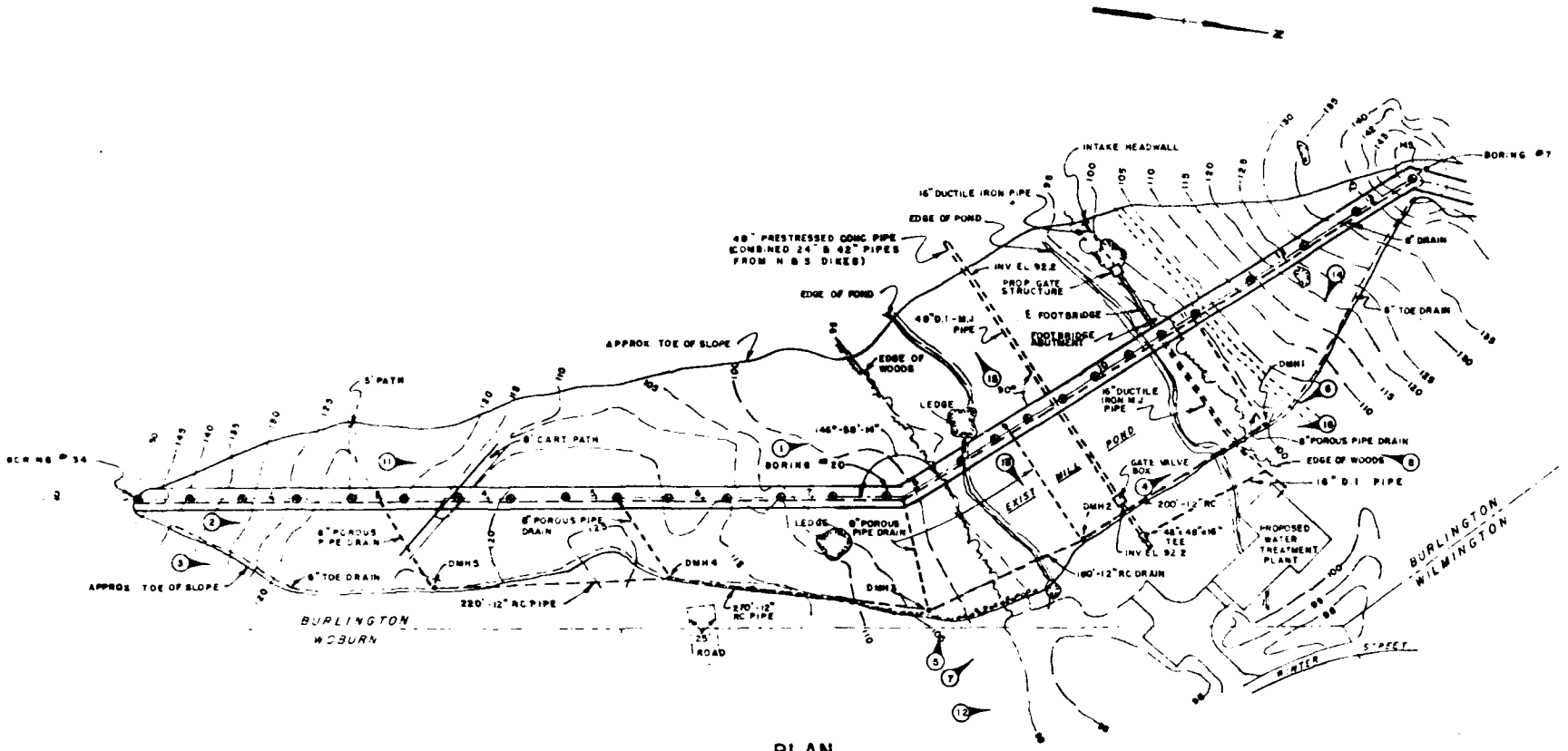
Refusal at 5'
Boring made near brook

3/9/68

J. McCue

APPENDIX C

PHOTOGRAPHS



PLAN

HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

MILL POND
MAIN DAM
PHOTO LOCATIONS

BURLINGTON MASSACHUSETTS

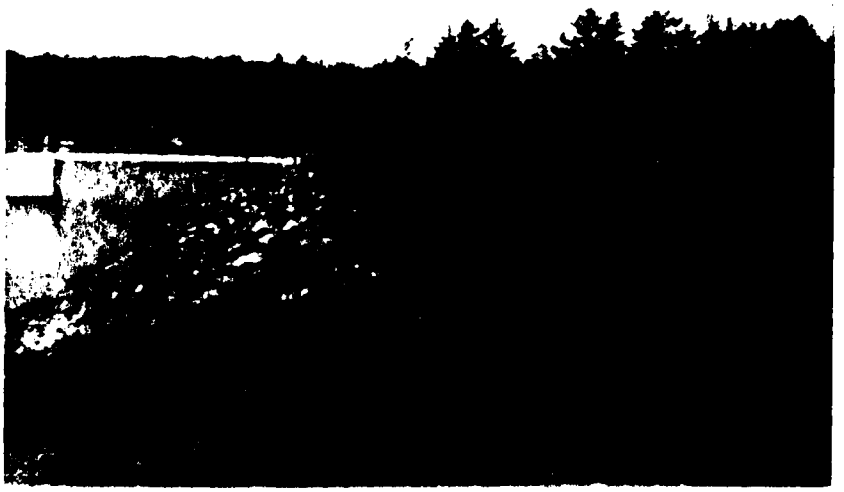


PHOTO NO. 1 - View along the crest of the Main Dam showing the intake structure. Note the water marks on the concrete structure. The water marks approximate elevation is 144, the design high water level.

PHOTO NO. 2 - Crest of Dam as viewed from right abutment.

PHOTO NO. 3 - Downstream slope of dam as viewed from mid-height near the right abutment.

PHOTO NO. 4 - Downstream slope of Dam looking toward the left abutment as viewed from mid-height near the control valve.

PHOTO NO. 5 - View of animal burrow on downstream slope approximately 4 ft. higher than toe and approximately 20 ft. right of Manhole No. 3. Scale was pushed into hole a distance of 2 ft.

PHOTO NO. 6 - Close up of Photo No. 16. Shows the weir used to measure ground water seepage.

PHOTO NO. 7 - Wet area about 60 ft. by 20 ft. at downstream toe.

PHOTO NO. 8 - Small area of standing water at downstream toe about 20 ft. right of Manhole No. 3.

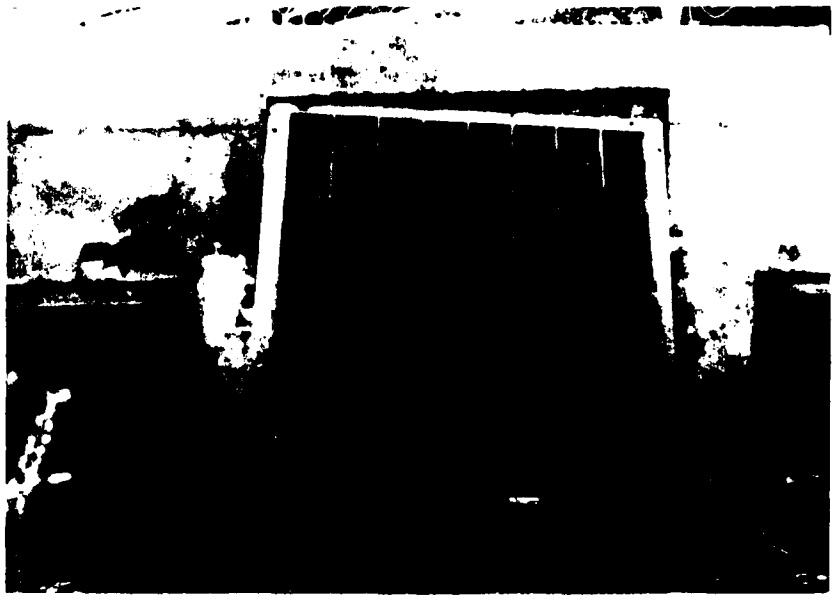


PHOTO NO. 9 - This Photo shows the outlet structure for the 48 inch drain pipe. This pipe carries runoff from the north and south dike valleys. The two smaller pipes are outlets for surface and subsurface drains along the downstream toe of Dam. This structure is about 350 ft. downstream of the Dam, on Maple Meadow Brook.

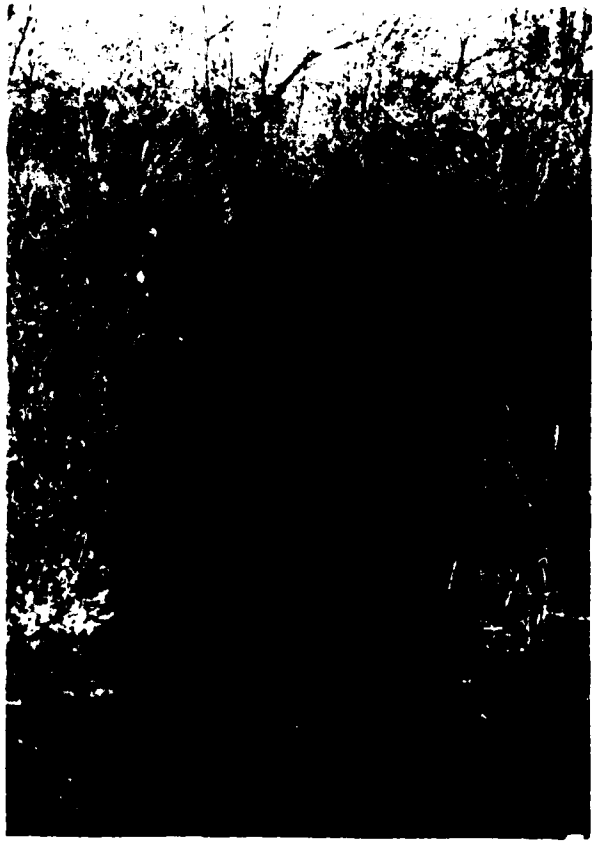


PHOTO NO. 10 - Downstream channel as viewed from discharge pipes shown in Photo No. 9.

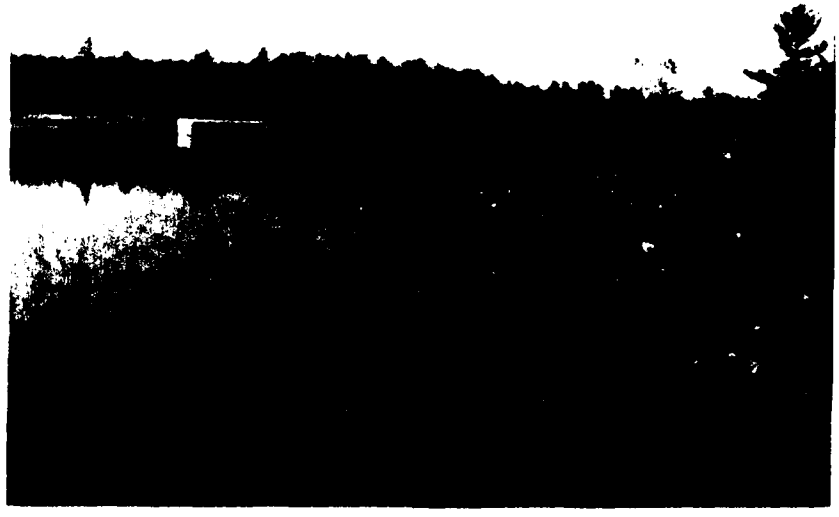


PHOTO NO. 11 - View along crest of Main Dam. The crest length is about 1300 ft. Note location of intake structure. Water Treatment Plant is downstream of the toe of dam near the intake structure location.

PHOTO NO. 12 - This shows the downstream face of the Dam near the Treatment Plant. This section of the Dam is about 600 ft. long. The gate valve handle (at the left center) controls flow from the 48 inch drain pipe which carries storm water runoff from the drainage areas upstream of the north and south dikes, to Maple Meadow Brook.

PHOTO NO. 13 - View of the immediate downstream area showing the Water Treatment Plant and the Maple Meadow Brook Dam Failure Impact Area. Many of the homes, upper right side of photo, are at higher elevations than those in the immediate downstream area.

PHOTO NO. 14 - View of the right side immediate downstream area. Upper right side of photo shows the beginning of the Winter Street-Willow Brook-Route 38 Dam Failure Impact Area.

PHOTO NO. 15 - View of Mill Pond Reservoir taken from Main Dam. Note the north (right side) and the south (left side) dikes in the background. There is a separate Dam Safety Report for the dikes.

PHOTO NO. 16 - Manhole No. 1, View of Weir and 12 inch diameter outlet pipe. See Photo No. 6.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

JOB NO. 79.206.1
DATE 11-9-79
BY MLA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO. D2
JOB Dams
SUBJECT Mill Pond
CLIENT COE

Main Dam

Mill Pond dam - built 1973.
Designed by Whitman & Howard.

Height of Main Dam (147.5 to 98) = 49.5'±

Height of North Dike 20'±
South Dike 39'±

Water flows towards dikes to intake structures, enters pipe lines & flows below & out-of reservoir.

Storage Capacity of Dam 1,746 a-f

Size Class: Intermediate.

drainage area = 0.2± s.m 128± a.
"mountainous".

Hazard Potential: High.

Test Flood: PMF.

Inflow = 3000 csm × 1 × 0.2 = 600 cfs

Outflow = 0 (pump storage) no spillway

Reservoir can retain PMF inflow w/o over-topping, if initial level is 144± or less.

Dam failure will impact over 50 homes and over 20 other buildings

JOB NO. 79.206
DATE 11-9-79
BY N/A
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO D 3
JOB Dams
SUBJECT Mill Pond
CLIENT COE

Main Dam

Storage Capacity

ELEV	AREA acres	AVE A.	D ft.	Stor	Accum Stor
147.5	73.5	63.15	3.5	221.0	1745.6
147.0				189.5	
144.0	52.8	34.65	44	1524.6	1524.6
100.0	16.5	—	—	—	—

TEST FLOOD OUTFLOW

Main dam has no spillway, it is a pump-storage facility. There is NO "OUTFLOW". With reservoir level at elev. 144.0, determine the change in water level elev due to test flood. Will reservoir hold 19" of runoff from 128 acres?

$128. a \times \frac{19''}{12''} = 203$ a-f which is less than 221 a-f of storage between elevs. 147.5 (top of dam) to 144.1 (design high water level).

PMF storm level is 147.25±.

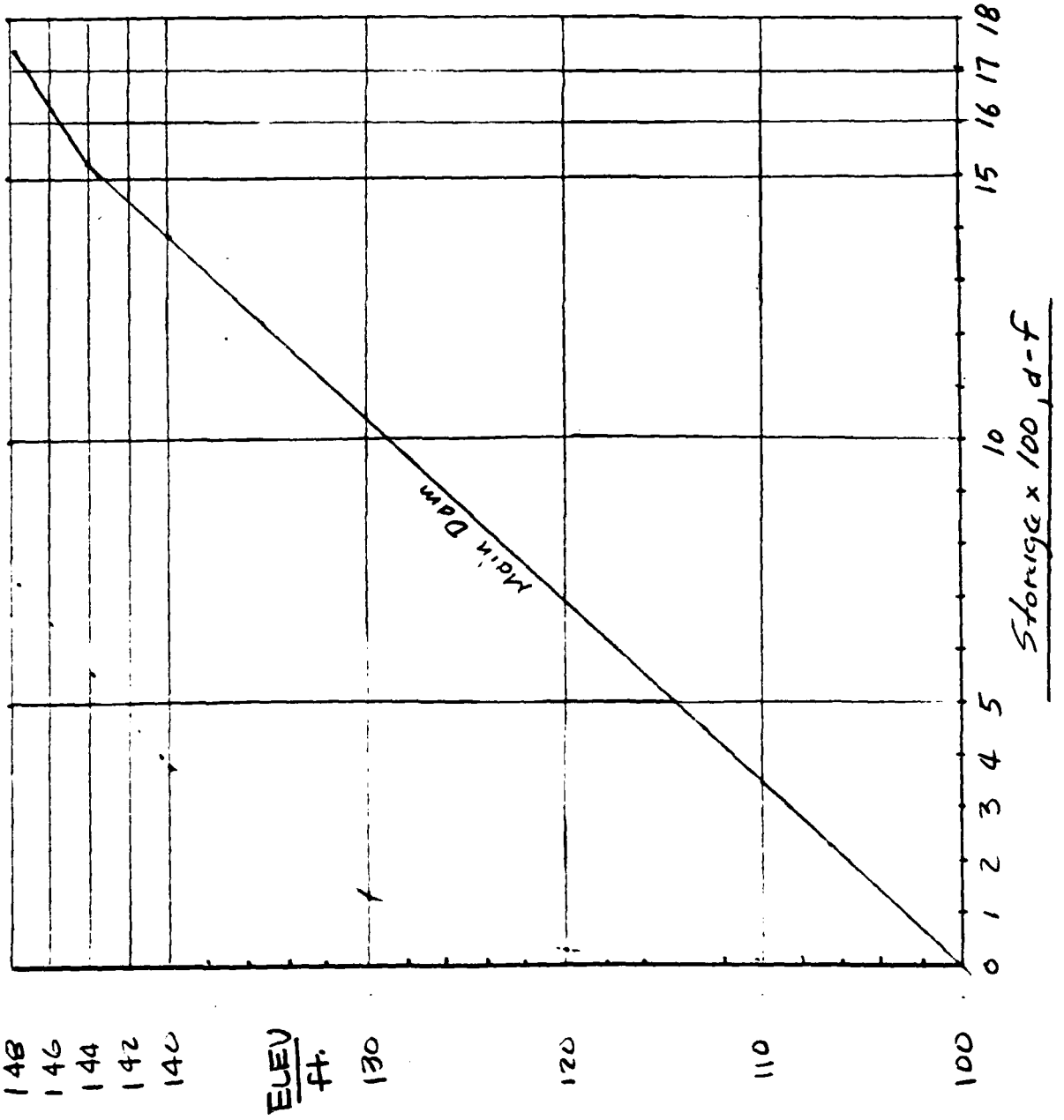
½ PMF Inflow = 300 cfs Storage = 102 a-f
Elev = 145.5 dam is not overtopped.

JOB NO. 79.206
DATE 11-9-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO. D 4
JOB DAMS
SUBJECT MILL POND
CLIENT COE

STAGE STORAGE



JOB NO. 79.206
DATE 11-13-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO. D 5
JOB Dams
SUBJECT Mill Pond
CLIENT CoE

Failure Discharge

$$Q_F = \frac{8}{27} \times (0.4 \times 500') \times \sqrt{32.2} \times (49.5')^{1/2}$$

$$Q_F = 117{,}100 \pm cfs$$

$Q_{P_1} = 117{,}100$ ± d = 24.

$Q_{P_2} = 117{,}100 \left(1 - \frac{92}{1745}\right) = 110{,}800$ ±

$El_2 = 23.25$ $V_2 = 89$ a-F Vave = 91 ±.

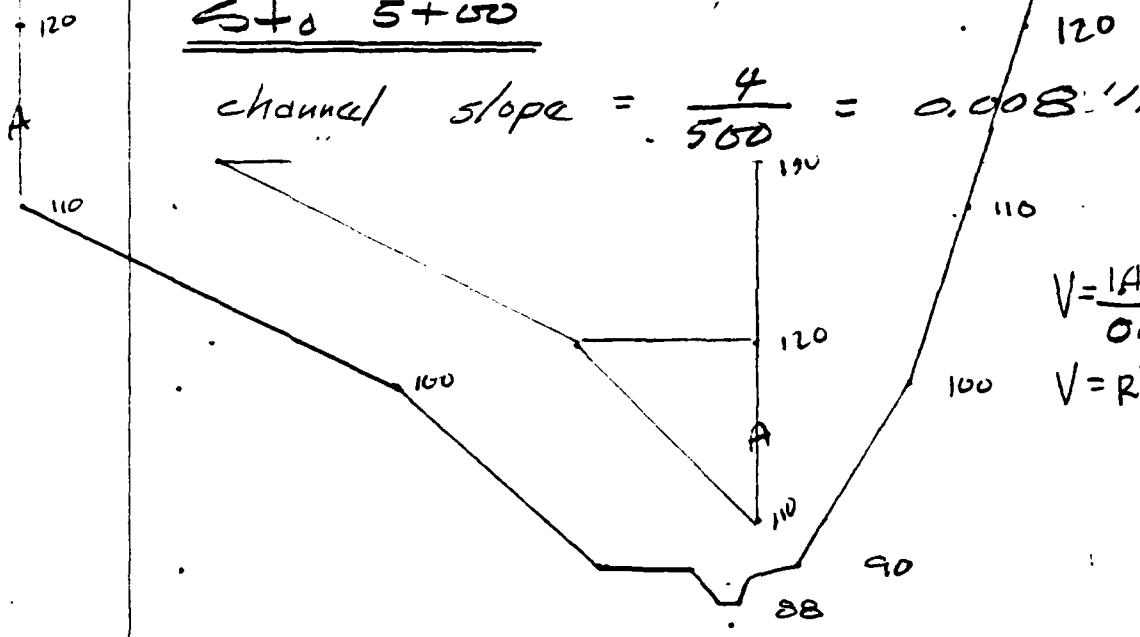
$Q_{P_3} = 117{,}100 \left(1 - \frac{91}{1745}\right) = 111{,}000$ ± cfs

El = 112 ±

JOB NO. 79.206.1
DATE 11-9-79
BY mA
CHKD BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO D-6
JOB Dams
SUBJECT Mill Pond
CLIENT COE



Sta 5+00

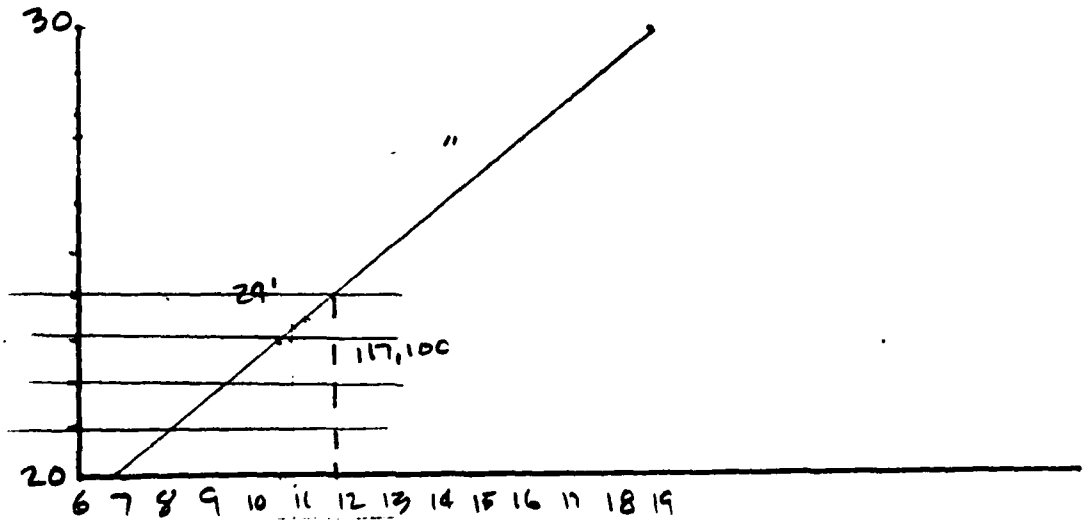
channel slope = $\frac{4}{500} = 0.008$ ft/ft

10 ↑ → 100

$V = \frac{1.486}{0.06} R^{2/3} (.008)^{1/2}$

$V = R^{2/3} (2.215)$

D	WP	A	$R^{2/3}$	F'	V	Q	ELEV
10	285	1,975	3.67	2.215	8.1	16,000±	100
20	525	6,025	5.13	"	11.4	68700±	110
30	660	11,875	6.9	"	15.3	181,700	120



HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

Std 10+00

Outlet channel indentical to Std 5+00

Q_{P_1} = 111,000 cfs Elev = 87

d_1 = 23.5 $Vol_1 = 8075 \times \frac{50}{43560} = 93\pm$

$Q_{P_2} = 111{,}000\left(1 - \frac{93}{1745}\right) = 105{,}106$ cfs

d_2 = 23 Vol_2 = 89

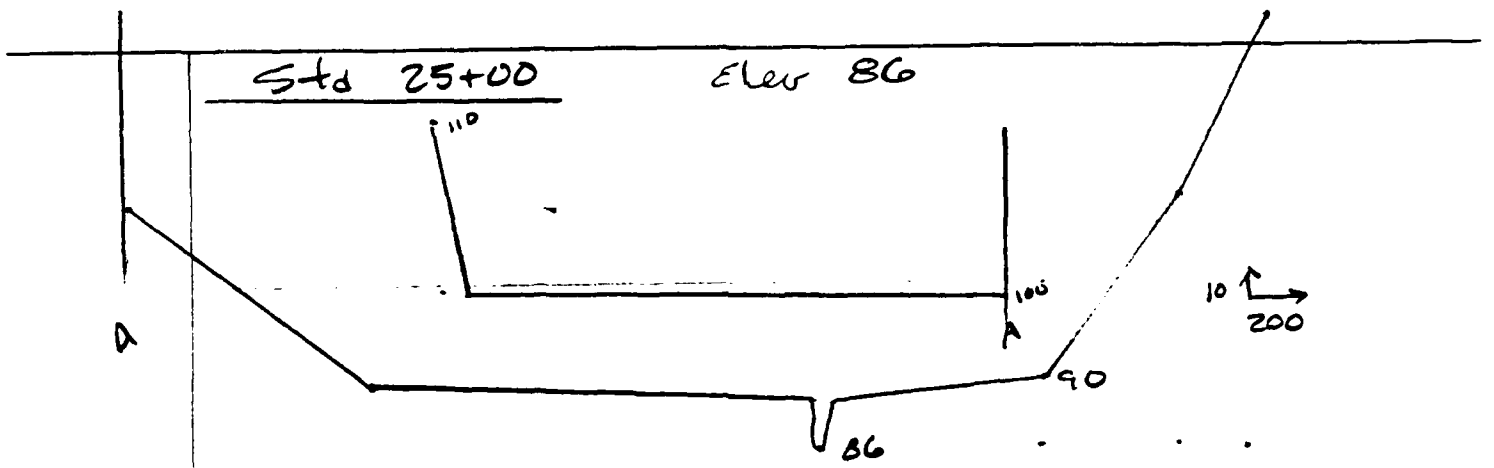
$Q_{P_3} = 111000\left(1 - \frac{91}{1745}\right) = 105{,}211$ cfs

Elev = 111 ± Q_{P_3} = 105,200 ±. cfs

JOB NO. 79.206
DATE 11-28-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

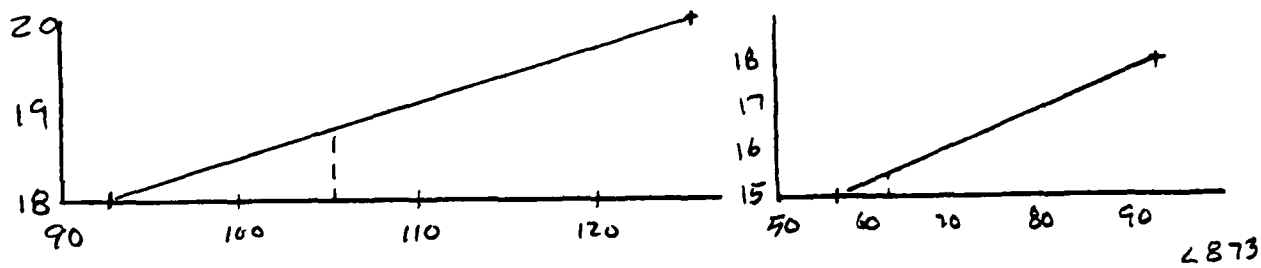
SHEET NO. 28
JOB DAMS
SUBJECT Mill Pond
CLIENT COE



$S = \frac{10}{5800} = 0.0017$ ft/ft

$n = 0.06$ $\quad V = \frac{1.486}{.06}(R^{2/3})(.0017)^{1/2} = R^{2/3}(1.028)$

D	WP	A	$R^{2/3}$	1.028	V	Q	EL
5	500	2200	2.7	1.028	2.77	6100	95
10	600	4950	4.1	"	4.23	20900	100
15	1800	13950	3.94	"	4.05	56550	105
20	1900	22950	5.3	"	5.46	125235.	110
18	1900	19150	4.7	"	4.8	92566.	108



∠873

$Q_{P_1} = 105200$ cfs $\quad d_1 = 18.75 \quad V_0/_1 = \frac{20575}{93560}(1500) = 709$

$Q_{P_2} = 105200\left(1 - \frac{709}{1745}\right) = 62457 \quad d_2 = 15.5 \quad V_2 = \frac{14850}{\quad} = 511$

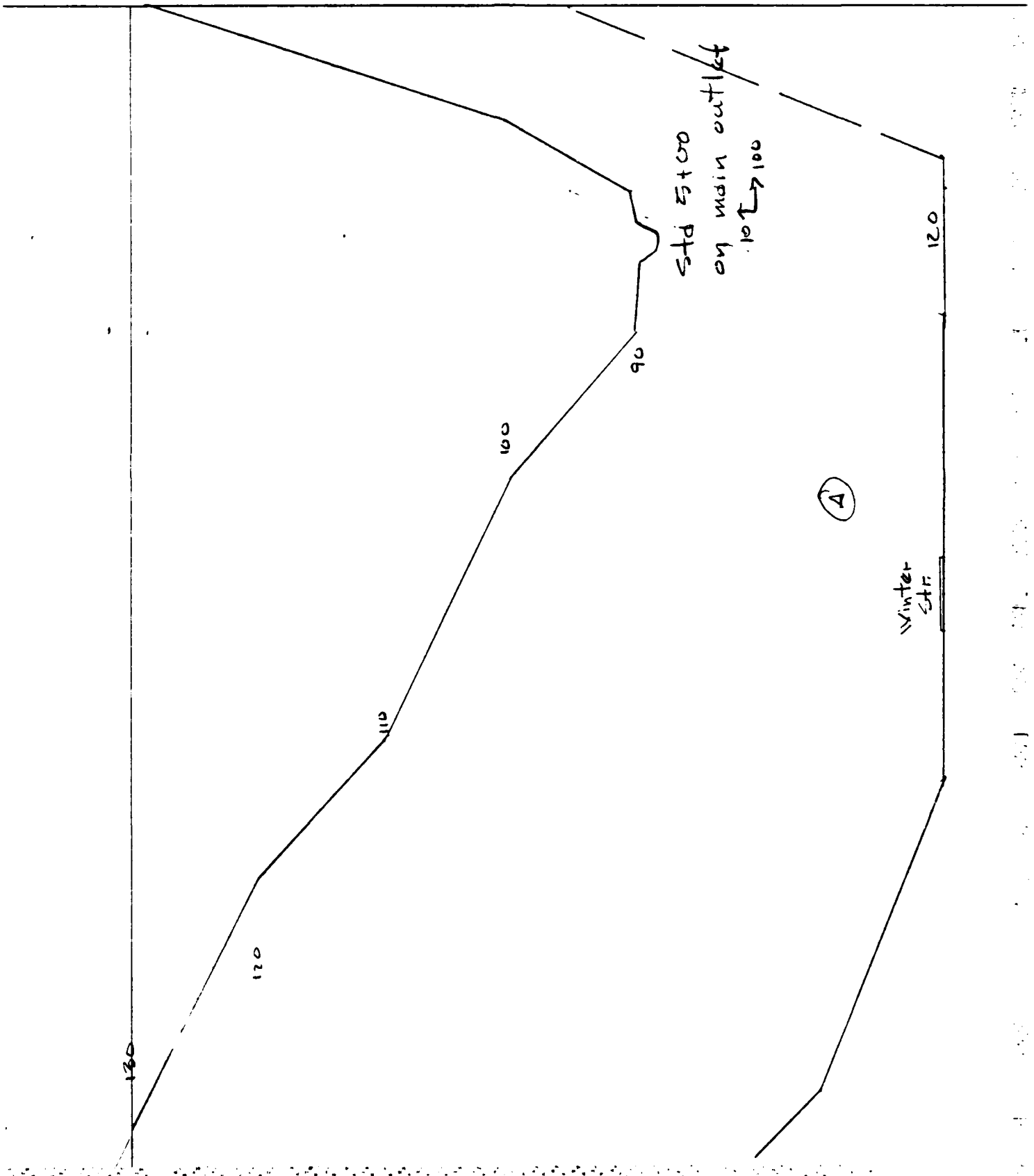
$Q_{P_3} = 105200\left(1 - \frac{610}{1745}\right) = 68425$

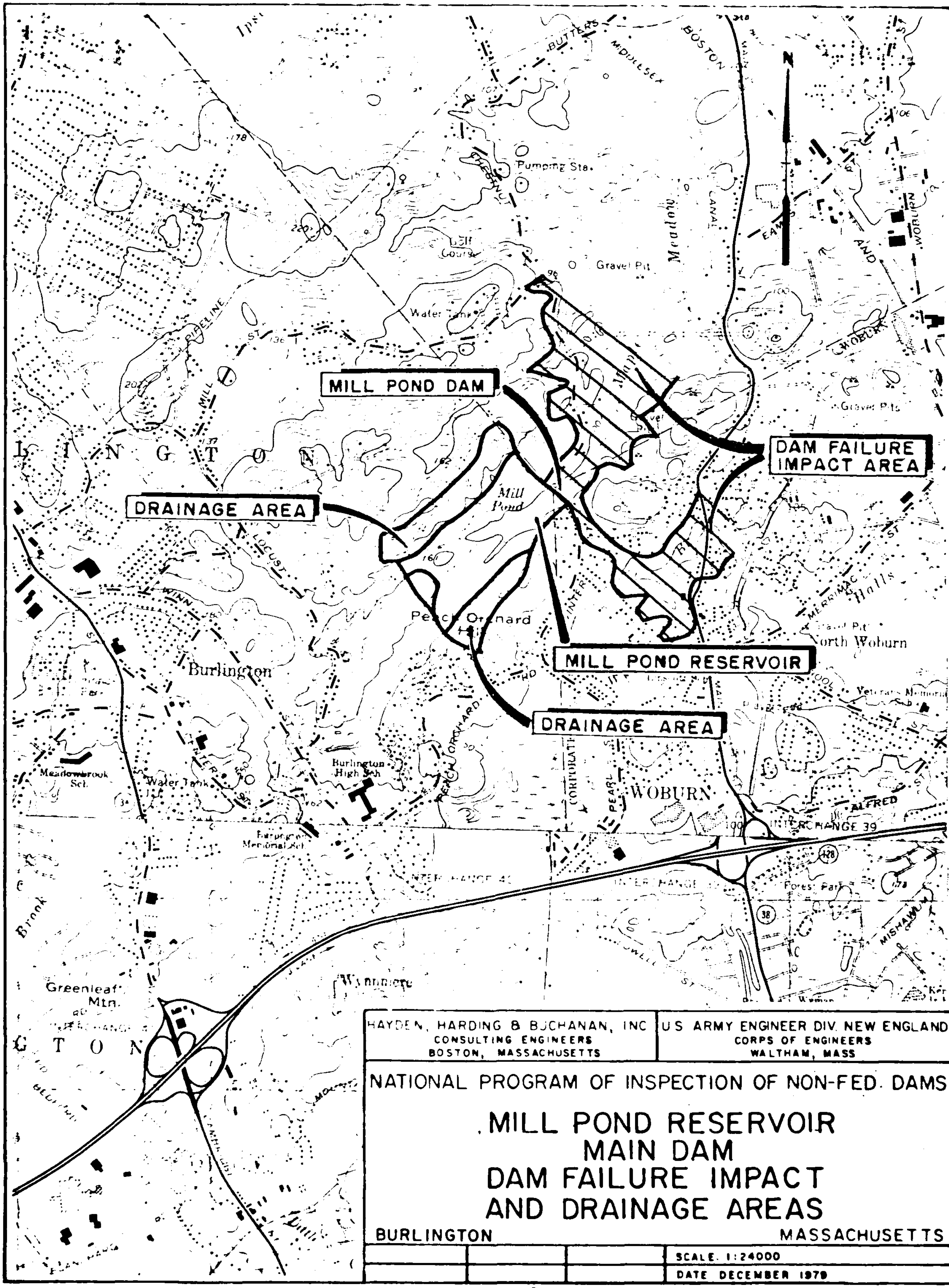
Elev = 16 + 90 = 106'

JOB NO. 79.206.1
DATE 11-13-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON — WEST HARTFORD

SHEET NO. D9
JOB Dams
SUBJECT Mill Pond
CLIENT COE





HAYDEN, HARDING & BUCHANAN, INC
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MILL POND RESERVOIR MAIN DAM DAM FAILURE IMPACT AND DRAINAGE AREAS

BURLINGTON MASSACHUSETTS

SCALE 1:24000

DATE DECEMBER 1979

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
MA	1121	NED	MA	017	07				MILL POND RESERVOIR MAIN DAM	4230.8	7110.2	28DEC79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	MILL POND RESERVOIR

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	06	MAPLE MEADOW BROOK	WOBURN	0	37400

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(28) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPGOT	1973	S	75	50	1746	1525	NED	N	N	N	N	

(29) REMARKS
21 REINF CONC CORE WALL 17 WATERS PUMPED FROM SHAWSHEEN

(30) D/S HAS	(31) SPILLWAY CREST LENGTH	(32) SPILLWAY TYPE	(33) SPILLWAY WIDTH (FT.)	(34) MAXIMUM DISCHARGE (FT.)	(35) VOLUME OF DAM (CY)	(36) POWER CAPACITY INSTALLED (MW)	(37) POWER CAPACITY PROPOSED (MW)	(38) NAVIGATION LOCKS NO	(39) LENGTH (FT.)	(40) WIDTH (FT.)	(41) LENGTH (FT.)	(42) WIDTH (FT.)	(43) LENGTH (FT.)	(44) WIDTH (FT.)	(45) LENGTH (FT.)	(46) WIDTH (FT.)
1	1300	N			250000											

(47) OWNER	(48) ENGINEERING BY	(49) CONSTRUCTION BY
TOWN OF BURLINGTON	WHITMAN + HOWARD, INC.	VAN LAMBERT CONSTRUCT CO

(50) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(51) INSPECTION BY	(52) INSPECTION DATE DAY | MO | YR	(53) AUTHORITY FOR INSPECTION
HAYDEN, HARDING + BUCHANAN, INC.	02NOV79	P.L. 92-367

(54) REMARKS

END

FILMED

7-85

DTIC