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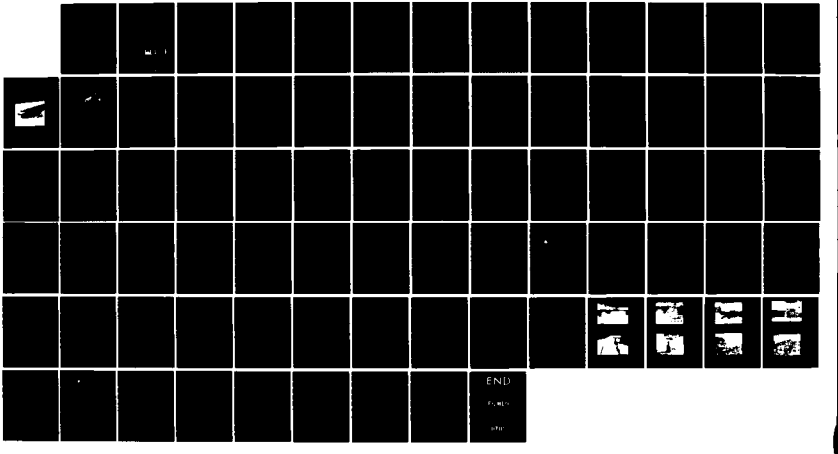

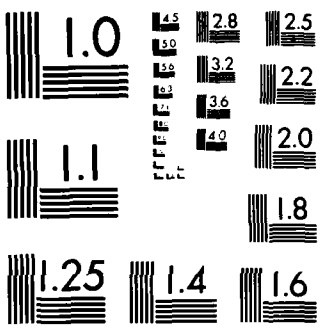

QUINEBAUG RIVER BASIN
SOUTHBRIDGE, MASSACHUSETTS

COHASSE BROOK RESERVOIR DAM
MA 00694

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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Quinebaug River Basin
Southbridge, Massachusetts
Cohasse Brook-A tributary of Quinebaug River

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

The dam is a 760 ft. long, 60 ft. high earthfill dam. The dam is in good condition. There are maintenance and minitoring needs that need to be performed to assure the continued performance of the dam. It has a hazard classification of high.

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

REPLY TO
ATTENTION OF:
NEDED

JUL 16 1979

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

Dear Governor King:

I am forwarding to you a copy of the Cohasse Brook Reservoir 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, Southbridge Water Supply Company, 70 Foster Street, Southbridge, Massachusetts 01550.

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 yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

COHASSE BROOK RESERVOIR

MA 00694

QUINEBAUG RIVER BASIN
SOUTHBRIDGE, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00694

Name of Dam: Cohasse Brook Reservoir

Town: Southbridge

County and State: Worcester County, Massachusetts

Stream: Cohasse Brook - A Tributary of Quinebaug River

Date of Inspection: November 20, 1978

Cohasse Brook Reservoir Dam is a 760-foot long, 60-foot high earthfill dam built in 1968. The zoned embankment has a core of impervious fill and a cutoff trench into bedrock. A 5-foot high dike, 280-feet long is located about 250 feet southeast of the east end of the dam. The spillway is a 40-foot long ungated ogee weir with a rectangular concrete stilling basin with baffle blocks at the toe. The spillway, which is located on the west abutment, has a crest elevation (El) of 632.0. The stilling basin discharges into a trapezoidal channel lined with stone riprap for a length of about 160 feet. A gate house is located on the upstream face of the dam. Flow through two 16-inch diameter intakes and a 30-inch drain conduit is controlled by gate valves operated from the first floor of the gatehouse. The outlet from the gatehouse is through a 30-inch pipe located at the bottom of the gatenouse. This outlet is also controlled by a gate valve. A 20-inch pump suction line extends from the gatehouse to a pumping station just downstream of the dam on the west side of Cohasse Brook. The 30-inch outlet conduit terminates at a small concrete headwall at the downstream toe in-the middle of the dam.

The dam is in good condition. However, there are maintenance and monitoring needs that must be performed to assure the continued performance of this dam.

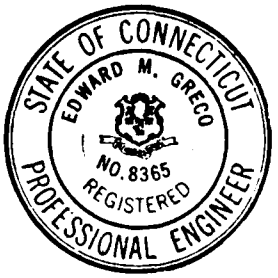
This conclusion is based on the visual inspection at the site and the available engineering and maintenance data. According to the Corps of Engineers' guidelines for the classification of hazard potential, it has been classified in the "high" hazard category.

The following visible signs of distress were noted at the site: slight seepage at one small area at the downstream toe of the dam, disintegration of some stone riprap in the spillway discharge channel and on the upstream slope of the dam, minor accumulation of brush, logs and stones in the spillway stilling basin, loss of joint filler in the spillway concrete joints, and small trees and brush growing on the dike.

Hydraulic analyses indicate that the spillway, without flashboards, at the dam can discharge a flow of 3,580 cubic feet per second (cfs) with the water surface at El 639.9 which is the low point on the crest of the dike. An outflow test flood (full probable maximum flood or PMF) of 2,600 cfs at El 638.4 will not overtop the dam. The low point on the crest of the dam is El 640.9. With the flashboards in place, the spillway can discharge the outflow test flood without overtopping the dam. However, overtopping of the dike by 0.4 foot will occur.

It is recommended that the Owner accomplish the following: repair erosion at various locations on the embankment, monitor the rate of seepage in the seepage area in the stone gutter at the toe of the dam and take appropriate action if the rate substantially increases, clear accumulated rock and other debris from the spillway stilling basin, clean accumulated logs and bushes from the spillway channel, and remove all trees and brush on the upstream face, downstream face and crest of the dike. The Owner should also continue the systematic program of inspection and maintenance.

The above recommendations and remedial measures should be implemented by the Owner within a period of two years after receipt of this Phase I Inspection Report.



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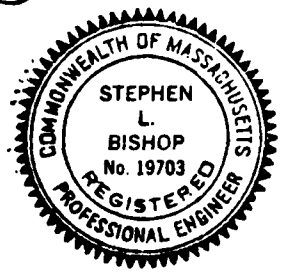

This Phase I Inspection Report on Cohasse Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and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

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

COHASSE BROOK RESERVOIR

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2.3 Operating Records. Daily operating records are taken by the Superintendent's staff and maintained in the Southbridge office of the Southbridge Water Supply Company.

2.4 Evaluation

a. Availability. There is considerable engineering data available.

b. Adequacy. A definitive but limited review was made of the hydraulic, soils, structural and construction data. Therefore, the evaluation of the adequacy of this dam is based on review of this data, available drawings, visual inspection, past performance history and engineering judgment.

c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the information is valid.

SECTION 2

ENGINEERING DATA

2.1 General. There are 25 sheets of drawings available from the design engineer's office, Metcalf & Eddy, Engineers. These include four sheets, dated March, 1966, of preliminary design details and 21 sheets, dated August, 1966, which show details of the proposed construction of Cohasse Brook Reservoir Dam. Three of the latter 21 drawings are included in Appendix B. Specifications, computations and test results relative to the design and construction of the dam were found in the engineer's office. Visual observations during inspection, review of previous inspection reports, review of construction reports, and conversations with the Owner and with personnel from Town, State and County agencies provided the remainder of the data for this evaluation.

We acknowledge the assistance and cooperation of personnel from the Massachusetts Department of Public Works, Messrs. Willis Regan and Raymond Rochford, and personnel of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways, Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office, Messrs. John O'Toole, Joseph Brazauskas, and Mr. Wallace Lindquist - recently retired from County service.

Mr. Chester Spielvogel, Treasurer and Superintendent, Southbridge Water Supply Co., granted permission to enter the property and inspect the dam. Mr. Maurice Contois of his staff provided assistance to access during the inspection.

2.2 Construction Records. There are no as-built drawings available for this dam, only the proposed construction drawings. Records of inspection and tests made during construction were reviewed. A review of these drawings and records indicates the dam generally was built in accordance with the available drawings.

(6) Downstream channel: Stilling basin and baffle blocks are concrete. Trapezoidal stone-lined spillway channel at end of stilling basin extends 160 feet downstream; leads to a stream, waterfalls and merging with Cohasse Brook.

i. Regulating Outlets. The regulating outlet at the dam is a 30-inch diameter prestressed concrete cylinder drain pipe located in the center of the dam. The pipe is about 300 feet long from toe to toe. On the upstream side of the reservoir, there are two 16-inch diameter intake pipes in addition to the lower drain line. The three inlets to the gatehouse are controlled by gate valves on the inside upstream face. Two more valves, located inside the gatehouse on the drain line, allow water to be drained from either the drain line or from the gatehouse. The drain outlet is in the concrete headwall works at the toe of the dam. There is also a sixth gate valve in the gatehouse which allows flow to be diverted through a 20-inch prestressed concrete cylinder pipe to the pumping station. Water is pumped overland to Reservoir No. 4 through a 16-inch cast-iron transmission main. The 30-inch pipe drain has a capacity of 150 cfs (76.5 cfs per square mile). The reservoir surface can be lowered 1 foot in four hours at El 632.0 which is the crest elevation of the spillway. All six gate valves have valve operating mechanisms located on the first floor of the gatehouse.

g. Dam

(1) Type - Main dam: Zoned earthfill
- Dike section: earthfill

(2) Length - Main dam: 720 feet
- Dike section: 280 feet

(3) Height - Main dam: (maximum) 60 feet
- Dike section (maximum) 5 feet

(4) Top width - Main dam: 22 feet
- Dike section: 12 feet

(5) Side slopes - Main dam: downstream 2:1;
upstream 2.5:1
- Dike section: downstream 2:1;
upstream 2.5:1

(6) Zoning: Main dam (see Figure B-5)

(7) Impervious core: Main dam (see Figure B-5)

(8) Cutoff: Placed at bottom of impervious core. Narrows down to 8-foot width with vertical sides from top of bedrock to firm bedrock. Trench key for most of the length of the dam.

(9) Grout curtain: None

h. Spillway

(1) Type: Ogee crest

(2) Crest length: 40 feet

(3) Crest elevation: 632.0 (assumed bench-mark)

(4) Gates: None, flashboards 23 inches high when used in spring.

(5) Upstream channel: Approach channel is lined with riprap up to concrete weir.

(5) Recreation pool: N/A

(6) Spillway crest (ungated): 632.0

(7) Upstream portal invert diversion tunnel: N/A

(8) Stream bed at centerline of dam: 580.0

(9) Tailwater: 580.5 (water in downstream channel)

d. Reservoir

(1) Length of maximum pool: 4,800 feet

(2) Length of recreation pool: N/A

(3) Length of flood control pool: N/A

e. Storage (acre-feet)

(1) Test flood surcharge: 346 at El 638.4

(2) Top of dam: 1,300

(3) Flood control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 830

f. Reservoir Surface (acres)

*(1) Top dam: 54

*(2) Test flood pool: 54

(3) Flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 54

*Based on the assumption that the surface area will not significantly increase with changes in pond elevation from 632.0 to 641.8.

30 feet wide at the base and extends for about 160 feet beyond the end of the stilling basin. The channel is lined to the top with stone riprap and contains some brush and logs along the bottom. A small pool of water at the toe of the slope in the center of the main dam at the headwall structure discharges into a separate channel known as Cohasse Brook. The brook with the waterfalls joins with Cohasse Brook approximately 150 feet downstream of the dam. At the time of inspection, the drain gate valve was closed and about a 1/4 inch deep flow was observed at the outlet works pipe. Cohasse Brook flows into Wells Pond. Below Wells Pond, Cohasse Brook flows through the developed residential area of Southbridge.

The spillway, without flashboards, can discharge a maximum of 3,580 cfs when the water surface is at El 639.9 which is the low point on the crest of the dike. The outflow test flood (the PMF) is 2,600 cfs at water surface El 638.4, and will not overtop the dam or dike. With flashboards in place, the spillway can discharge the outflow test flood without overtopping the dam. However, overtopping of the dike by 0.4 foot will occur.

The maximum recorded flood level at the dam, which occurred in 1973, was El 634.2 which corresponds to 3 inches over the top of the flashboards in 1973.

c. Elevation (feet above Mean Sea Level (MSL)). A benchmark was established at El 632.0 on the crest of the spillway. This elevation was estimated from a United States Geological Survey (USGS) topographic map.

(1) Top dam - Main dam: 640.9 to 641.8
Dike section: 639.9 to 640.1

(2) Test flood pool: 638.4

(3) Design surcharge (original design): Unknown

(4) Full flood control pool: Not Applicable (N/A)

i. Normal Operating Procedures. Under normal conditions, the gate valves in the outlet structure are closed. Occasionally, when the water level rises over the spillway, the outlet drain valves are opened to discharge water from the bottom of the reservoir. The intake gate valves are normally opened. When water is needed in the lower reservoirs in the Southbridge system, the gate valve from the pump suction line is opened and the water is pumped to Reservoir No. 4 through a 16-inch pipeline. During pumping operations, the water passes through screens located in the gatehouse. In 1978, the pump was operated on about five separate occasions to verify it was in operating condition. The combined pump operating time for last year was less than one day. All gate valves in the outlet structure are operable.

The spillway for Cohasse Dam is ungated. At the time of inspection, flashboard rods were in place but without flashboards. The flashboards that are used are reportedly 23 inches high. The flashboards are usually placed in the spring and removed in the fall, typically from April through August.

1.3 Pertinent Data

a. Drainage Area. The drainage area for Cohasse Brook Reservoir is estimated to be 1,254 acres (1.96 square miles). Cohasse Brook flows from the south through undeveloped woodland and swamp. There is no residential development on the reservoir and only a few homes are located in the drainage area.

b. Discharge at the Dam Site. Uncontrolled discharge at the dam site flows over the 40 foot long concrete ogee weir at the west end of the dam, through a concrete stilling basin with baffle blocks and into a stone-lined trapezoidal channel. The channel then discharges at a right angle into a unnamed brook with a waterfall which merges downstream with Cohasse Brook. The stilling basin is rectangular and terminates with two rows of concrete baffle blocks at the downstream end. The channel is

d. Hazard Classification. Downstream of the dam is Wells Pond with a dam. The shoreline area of Wells Pond is undeveloped. The Cohasse Country Club is too high to be affected in the event of failure of the dam. The developed portion of the Town of Southbridge is downstream of Wells Pond. The brook passes for more than 1 mile through dense residential areas before reaching the Quinebaug River. In the event of overtopping and complete failure of the dam, more than a few lives could be lost and excessive property damage could occur. Accordingly, the dam has been classified in the "high" hazard category.

e. Ownership. The dam and dike are located on property owned by the Southbridge Water Supply Company, 70 Foster Street, Southbridge, Massachusetts 01550. Mr. Chester Spielvogel, Treasurer and Superintendent (617-764-3207) granted permission to enter the property and inspect the dam and dike. The dam and dike have been owned by the Southbridge Water Supply Company since their construction in 1968.

f. Operators. The Southbridge Water Supply Company employs a full time caretaker who serves as the operator of the dam. Access to the site is restricted by a chainlink fence with a locked road gate and a second locked cable across the entrance road.

g. Purpose of the Dam. The dam was built to provide, and presently serves as, a water supply to the Town of Southbridge.

h. Design and Construction History. This dam was constructed in 1967 and 1968. A complete set of drawings, dated 1966, are on file at the office of Metcalf & Eddy. Construction reports are also available in the same office. The only inspection report on file is dated February 12, 1973, and described the dam and dike as being in excellent condition (see Appendix B). At that time, the water level was about 9 feet below the top of the dam and there was no evidence of seepage.

is reduced to a 24-inch diameter line at the same elevation through the gatehouse and contains three gate valves. The three valves allow drainage of the reservoir and/or gatehouse. The size of the drain line increases to 30 inches just downstream of the gatehouse and continues to the concrete headwall located at the toe of the downstream slope near the center of the main embankment. The invert of the outlet pipe is at El 580.6. The outlet channel is lined with stone riprap for a distance of about 160 feet downstream of the headwall structure. This channel is also Cohasse Brook. The sixth valve in the gatehouse structure can divert flow to a 20-inch diameter pump suction line that extends to a pumping station just downstream of the dam on the west side of Cohasse Brook. The centerline elevation of this line is 583.08. Screens are installed in the gatehouse to prevent fish and debris from entering the distribution system. A water level gage located in the gatehouse indicated the water level was about 11 feet below the first floor slab.

The pumping station is a one-story high concrete block structure with brick facing and a reinforced concrete substructure. One pump is located in the basement. Water can be pumped from Cohasse Reservoir to Reservoir No. 4 through a 16-inch line.

A dike, which is located southeast of the dam, is about 280 feet long and has a maximum height of 5 feet. The dike is an earthfill embankment. The upstream slope is 2.5:1 and is covered with riprap and some small trees, brush and logs. The downstream slope is 2:1 and is covered with grass and brush. About 50 feet north of the right abutment, bedrock is exposed near the downstream toe. The crest of the dike varies from El 639.9 to 640.1.

c. Size Classification. Cohasse Brook Reservoir Dam is classified in the "intermediate" category since it has a maximum height of 60 feet and a maximum storage capacity of 1,300 acre-feet.

The concrete spillway consists of two vertical training walls containing a concrete ogee crest weir and concrete stilling basin with baffle blocks. The crest of the spillway is at El 632.0. There are six flashboard rods about 2 feet high on the spillway crest. The side walls of the spillway are 9 feet above the crest. There are seven weep holes exposed at the base of each training wall. The length of the concrete section from the upstream edge of the spillway crest to the end of the stilling basin is 82.8 feet. An underdrain system beneath the basin concrete floor slab consists of 8-inch vitrified clay open joint pipe placed in a layer of pervious crushed stone overlying bedrock. The pipe drains to an 8-inch cast-iron pipe that discharges in the stone gutter about midheight on the intersection between the dam and left abutment. The spillway discharges into a channel that extends about 160 feet down to a brook which cascades over a waterfall and then flows into Cohasse Brook. The spillway channel is trapezoidal shaped, 30 feet wide at the bottom with side slopes of 1.5:1. The channel is lined with riprap for the full width and height. A 40-foot long prestressed concrete bridge spans the spillway channel. At each end of the bridge, a 10-foot long approach slab is supported on the top of the training wall and adjacent backfill.

The gatehouse is located near the center of the dam (see Figure B-1). It is constructed of reinforced concrete except the superstructure which is concrete block with brick facing. It contains six operable gate valves with valve stems extending to six operating mechanisms mounted on the first floor. On the upstream side of the gatehouse there are three conduits indicated on the drawings extending into the reservoir (see Figures B-6 and B-7). These conduits consist of a 30-inch drain with a centerline El 583.25, a 16-inch intake with centerline El 590.50, and a second 16- inch intake with centerline El 618.25. A gate valve is located at each end of the 16-inch intake line just inside the gatehouse. These valves allow water intake from the reservoir at different levels. The 30-inch drain line

Town of Southbridge, Worcester County, Massachusetts (see Location Map and Drainage Area Map).

b. Description of Dam and Appurtenances. Cohasse Brook Reservoir Dam is an earthfill dam with a maximum height of 60 feet (see Plan of Dam and Sections, Figures B-1 through B-7). The dam and spillway are about 760 feet long and the spillway is 40 feet wide. The embankment is founded on bedrock with a cutoff trench key 8 feet wide extending to variable depths to firm bedrock along some of the dam. The zoned embankment consists entirely of earth fill with a central impervious core 8 feet wide at the top increasing in width at the base. Adjacent to both sides of the impervious core is random pervious fill which in turn is covered on both the upstream and downstream faces to El 632.0 with pervious fill zones. According to the drawings, organic and other deletericus soil was stripped at the foundation level within the random pervious and pervious fill zones. A 2-foot thick screened gravel drainage blanket extends for the full width at the base of the downstream pervious fill zone. Drawings indicate (see Figure B-4) that there is an 8-inch vitrified clay pipe with open joints within the drainage blanket along the toe of the entire length of the main embankment. This underdrain pipe discharges adjacent to the two side walls of the outlet structure near the center of the dam. The crest of the dam is about 22 feet wide and the elevation varies from 640.9 to 641.8. A paved road is located on the crest, with an access bridge spanning the spillway on the west abutment. The upstream slope is 2.5:1 and is covered with riprap. The downstream slope is 2:1 and is covered with grass. An asphalt paved road descends along the downstream slope resulting in a 20-foot wide berm. A stone-lined gutter is located along the downstream intersection between the dam and natural ground, and along the uphill side of the road on the downstream slope of the dam. A slight knoll near the east end of the dam serves as a turning point for the embankment which angles off to the southeast. This latter portion of the dam has a maximum height of only 4 feet.

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

COHASSE BROOK RESERVOIR

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 Divison of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.

b. Purpose:

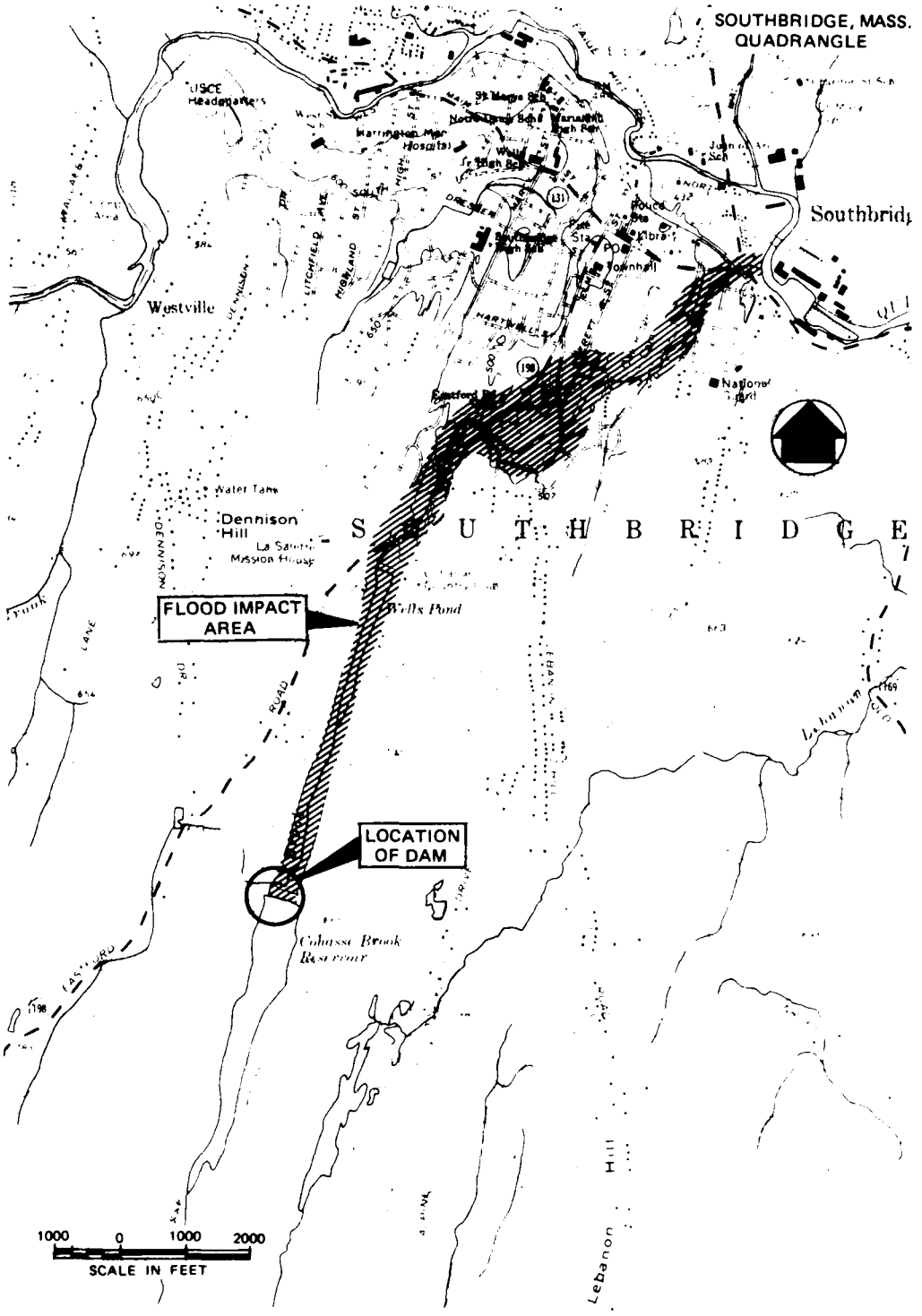
(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

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

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

1.2 Description of Project

a. Location. The dam is located on Cohasse Brook, a tributary of the Quinebaug River, in the



LOCATION MAP – COHASSE BROOK RESERVOIR DAM

OVERVIEW
COHASSE BROOK RESERVOIR DAM
SOUTHBRIDGE, MASSACHUSETTS

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase I Inspection of the dam and dike at Cohasse Brook Reservoir was performed on November 20, 1978. A copy of the inspection check list is in Appendix A. A previous inspection of this dam was made in 1973 by the Massachusetts Department of Public Works, and a copy of that report is included in Appendix B.

b. Dam. In general, the dam is in good condition. Minor seepage was observed in several areas. About 1 gpm of water was observed flowing from a side drain located about midheight of the stone gutter adjacent to the left abutment. This location corresponds with the drain which discharges from the spillway channel underdrain system. A small amount of water was observed flowing in the stone-lined gutter at the toe of the dam about 50 feet east of the outlet works. Water was also observed flowing from an 8-inch pipe about 60 feet north of the same outlet works. There is a small pool in Cohasse Brook in the immediate vicinity of the concrete outlet works at the downstream toe. The area is covered with riprap adjacent to the outlet walls. The exposed ends of two 8-inch clay tile toe drains were broken. These drains are located on each side of the concrete training walls. About 0.1 gpm flow was observed from the west drain and about 1 gpm from the east drain. Although the base of the riprap in this area was partially submerged, seepage was observed through the riprap on both sides of the outlet works. A flow of about 1 gpm was estimated discharging from each side. Seepage was also observed through some large stones piled in the area immediately north of the pumping station pavement and on the east steep stone face abutment immediately north of the dam. The downstream face is covered with a growth of grass and the upstream slope is covered with a

layer of riprap. Some weathered or disintegrated stones were found throughout the exposed riprap.

There is a longitudinal crack in the asphalt pavement on the crest along most of the length of the main dam. It varies in width from hairline to about 0.6 inch and is located about 2 feet or so in from the downstream edge of the pavement. Grass is growing through some of the wider cracks. There is no perceptible differential settlement across the cracks, and the uniform location of these cracks suggests a construction paving joint. There is also a transverse crack about 0.6 inch wide across the asphalt pavement. This crack is located about 15 feet east of the east bridge abutment. A transverse crack was observed, in the pavement at each end of the spillway access bridge, corresponding with the ends of the concrete slab. There is a slight depression of the pavement in front of the gatehouse on the north half of the crest. There is also some erosion of the north edge of the roadway shoulder from the middle of the dam to the left abutment, and along some of the edge of the road and lined gutter on the downstream berm of the dam.

In general, the dike is in fair condition. The dike is partially covered with brush and trees. The upstream slope of the dike is protected by riprap, however, some stones have disintegrated. The reservoir level was several feet below he upstream toe of the dike. Therefore, there was no opportunity to determine if there was any seepage through the dike.

c. Appurtenant Structures. The concrete in the spillway channel and bridge is in good condition. In general, there is slight spalling of the concrete in the channel bottom up to the high water mark, including the surface of the ogee weir. There is one large surface spall at the top of the east training wall next to the south edge of the bridge deck. There is minor cracking on the top of the west training wall. Some expansion joint filler material is

missing in the training walls and in the two vertical joints exposed in the ogee weir. Leakage was observed discharging from the downstream vertical joints. At the time of the inspection, a very small amount of water was flowing over the spillway. Although flashboards were not in place, there are six rods on the crest which allow flashboards to be placed to a height of 23 inches above the crest. There are several stones, up to 2 feet in size, in the bottom of the stilling basin. Two rows of concrete baffle blocks are located at the downstream end of the stilling basin. A few small logs, leaves and debris have collected in the stilling basin. The seven drainholes at the base of each training wall were dry but show some efflorescence. Minor efflorescence has also occurred near the bottom of the east training wall. Some erosion of soil has occurred in the northwest corner next to the bridge and training wall. Some water was observed flowing from the outlet pipe for the spillway underdrain system. The spillway channel is stone lined and is located immediately downstream of the concrete stilling basin. The spillway channel is relatively clear except for a few bushes and logs in the bottom of the channel. Some of the stone riprap has disintegrated, particularly on the west slope of the channel. The concrete access bridge spans the full width of the channel. The channel training walls also serve as abutments for the bridge. There are four horizontal weep holes, two at each end of the bridge, that penetrate the bridge curbing.

The gatehouse structure is in good condition. The inlets and six gate valves are not visible since the structure was filled with water to an elevation of about 11 feet below the first floor. The exterior concrete has some spalling below the high water mark. The visible metal braces used for support of the valve stem extensions inside the gatehouse are rusted. Valve operating mechanisms are mounted on the first floor. All gate valves are reported operable. There is no cracking or spalling of the superstructure brick exterior.

The outlet headwall is in good condition. The outlet from the gatehouse is a 30-inch diameter prestressed concrete cylinder drain pipe which is recessed into a vertical concrete headwall which extends into two vertical concrete training walls. There is slight spalling of the concrete on the downstream edge of the training walls of the outlet structure at the present water level. At the time of inspection, water, about 1/4 inch deep, was flowing out of the drain pipe at a rate estimated to be about 1 gpm.

The pumping station is in good condition. There is one pump in the structure with space and piping available for a second pump. The pump was last operated in August, 1978, when new packings were installed.

d. Reservoir Area. There is no residential, commercial, or industrial development around the shore of Cohasse Brook Reservoir. The area is heavily wooded and hilly with slopes averaging 3 percent. The shoreline is well maintained.

e. Downstream Channel. The discharge from the spillway channel flows into a unnamed stream then over a waterfall and into Cohasse Brook. Cohasse Brook then flows into Wells Pond and then on through the developed portion of the Town of Southbridge.

3.2. Evaluation. Although the dam appears to be in good condition, there are several deficiencies which require attention. Recommended measures to improve these conditions are included in Section 7.

SECTION 4

OPERATING PROCEDURES

4.1 Procedures. Under normal conditions, the 30-inch drain valve and the pump suction valve are closed. When water is in demand in Reservoir No. 4, the pump suction valve is opened and water is pumped into the 16-inch diameter cast-iron transmission main. In 1978, the pump was operated on about five separate occasions to determine that the pump was operable. This amounted to less than a total combined pump operating time of 24 hours. All six valves in the gate house are operable. Flashboards are placed on the spillway crest each year during spring and then removed in the fall. Occasionally, when the reservoir water level rises over the spillway or flashboards, the 30-inch outlet drain valve is opened to discharge water at the bottom of the reservoir into Cohasse Brook.

4.2 Maintenance of Dam. The dam is generally well maintained. The caretaker reportedly visits the dam each and every day of the year and briefly inspects the dam during each visit. Repair work is done as the need arises. The grass on the downstream slope is cut several times during the summer.

4.3 Maintenance of Operating Facilities. The operating facilities are well maintained, as evidenced by the condition of the spillway, gatehouse, outlet works and pumping station. The valves and stems were inspected during the summer of 1978 when the gate house was drained. Flow over the spillway is controlled only to the extent that flashboards are used. The facilities are also checked by the caretaker during his daily visit.

4.4 Description of Any Warning System in Effect. There is a warning system in effect at the dam. However, there are no written procedures for the warning system. We understand through verbal discussion that the system consists of a 24-hour radio call system between the caretaker's truck, the office of the Southbridge Water Supply Company and the home of the superintendent. The superintendent can be contacted by the public at his home

by telephone. In the event of an emergency, the superintendent can then call local officials. The amount of rainfall is recorded every 24 hours. When the amount exceeds 1/2 inch, the gage is read every six hours. The dam is also inspected concurrently at least every six hours during such inclement weather conditions. If water level in the reservoir is relatively high during a hurricane or hurricane warning, the reservoir level may be lowered by opening the drain outlet valves.

4.5 Evaluation. An operating program has been developed for establishing a constant supply of water to the Southbriddge Water Supply Company. Some additional maintenance should be implemented and the emergency warning procedures should be placed in writing, considering that the dam is in the "high" hazard category. Recommendations for a more thorough maintenance program are included in Section 7.3.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Cohasse Brook Reservoir Dam is a 60-foot high-earthfill dam built in 1968. The zoned embankment has a core of impervious fill. A 5-foot high dike, 240 feet long, is located southeast of the dam. The spillway is a 40-foot long, ungated ogee weir with a rectangular concrete stilling basin at the toe.

The dam was built to serve as storage for a water supply to the Town of Southbridge. It is located on Cohasse Brook.

b. Design Data. Hydraulic computations are available at the design engineer's office. A review of those computations reveals the design crest elevation of the weir was 631.6 (design drawings show 632.0), the maximum discharge rate-was 1,600 cfs, with a water surface at El 636.7.

c. Experience Data. Daily records of air temperature, water level and rainfall are maintained by the Southbridge Water Supply Company. When rainfall exceeds 1/2 inch, the rain gage is read every six hours. The maximum recorded level in the reservoir was 26 inches above the spillway or El 634.2 when flashboards, 23 inches high, were in place. Since the lowest point on the dike is 639.9, there has been no overtopping of either the dike or dam.

d. Visual Observations. Discharge from Cohasse Brook Reservoir is over the spillway located on the west end of the main dam. The spillway is a 40-foot long ogee-type weir.

The concrete spillway is in good condition and includes two rows of concrete baffle blocks at the downstream end.

e. Test Flood Analysis. The PMF rate was determined to be 1,550 cfs per square mile. This calculation is based on the average drainage area slope of 3 percent, the pond-plus-swamp area to drainage area ratio of 12 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December, 1977). Applying the full PMF to the 1.96 square miles of drainage area results in a calculated peak flood of 3,100 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 2,600 cfs, with a water surface at El 638.4.

Hydraulic analyses indicate that the spillway without flashboards can discharge a total of 3,580 cfs at El-639.9 which is the low point on the top of the dike. Therefore, the spillway can discharge the full test flood without overtopping the dam or dike. The low point on the top of the dam is at El 640.9. There will be a freeboard of about 1.5 feet on the dike and about 2.3 feet on the dam, assuming wave action is negligible. With the flashboards in place, the spillway can discharge the outflow test flood without overtopping the dam. However overtopping of the dike by 0.4 foot will occur.

f. Dam Failure Analysis. The hydraulic computations indicate the maximum calculated impounded water level is 638.4, or 2.3 feet below the crest of the dam. In the event the dam fails under peak outflow conditions, the initial outflow would be in the order of 61,900 cfs, including 2,600 cfs through the spillway. Failure of the dam would produce a flood wave 27 feet high at a point 6,500 feet downstream of the dam, as estimated using the Corps of Engineers criteria. This distance corresponds to the developed area of the Town of Southbridge.

Downstream of the dam is Wells Pond with a dam, and the developed area of the Town of Southbridge downstream of Wells Pond. Since the latter is a highly developed residential area, a large number of homes, in excess of 10, would be impacted by the calculated flood wave.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The evaluation of the structural stability of the dam is based on the visual inspection conducted on November 20, 1978, and review of the plans and data as referenced in Section 2, Engineering Data. As discussed in Section 3, Visual Inspection, the embankment of the dam is generally in good condition.

Based on these observations, the embankment of the dam is not a potential hazard.

b. Design and Construction Data. The information listed in Section 2, Engineering Data, represents the available design and construction data. Design computations for the dam were located. Limited information exists on the type, shear strength and permeability of the soil and/or rock materials.

c. Operating Records. There is no evidence that any type of instrumentation has ever existed at Cohasse Brook Reservoir Dam except for one observation well located northeast of the pumping station, well beyond the toe of the dam. The performance of the spillway and dam under prior loading can only be inferred from physical evidence at the site.

d. Post-construction Changes. There are no recorded changes after 1968.

e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS
AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Based upon a review of available drawings, the visual inspection of the site and limited operational or maintenance information, there are maintenance and monitoring needs that must be performed to assure the continued performance of this dam. Generally, the dam is considered to be in good condition. However, several signs of distress were observed at the site: slight settlement of the downstream side of the crest of the dam in front of the gatehouse, disintegration of some stone riprap on the upstream face of the dam and spillway channel, accumulation of brush, logs and stones in the spillway stilling basin, accumulation of brush and logs in the spillway channel, loss of joint filler material on the ogee spillway crest and the vertical spillway training walls, seepage from the lined stone gutter east of the outlet works, and a growth of trees and brush on the dike.

Hydraulic analyses indicate that the spillway, without flashboards, can discharge a flow of 3,580 cfs with the water surface at El 639.9 which is the low point on the crest of the dike. The low point on the crest of the dam is El 640.9. An-outflow test flood at 2,600 cfs (full PMF) will not overtop the dam or dike. With the flashboards in place, the spillway can discharge the outflow test flood without overtopping the dam. However, overtopping of the dike by 0.4 foot will occur.

b. Adequacy of Information. The detailed design and construction data did allow for a definitive review. The evaluation of the adequacy of this dam and dike is based on review of available drawings, design computations, construction reports, visual inspection, past performance history and engineering judgment.

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

d. Need for Additional Investigation. No additional investigations to further assess the dam are recommended at this time.

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

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The dam and spillway are adequately maintained. However, it is recommended that the Owner accomplish the following:

(1) monitor the seepage in the stone gutter at the toe of the dam, located about 50 feet east of the concrete outlet works. If the seepage rate substantially increases with time, appropriate action may then be necessary;

(2) fill in small settled area with asphalt on crest of dam downstream of gatehouse;

(3) repair and replace joint filler material on spillway crest and in spillway training walls;

(4) clean accumulated rock and other debris from the spillway stilling basin;

(5) clean accumulated logs and bushes from the spillway channel;

(6) fill in eroded areas along edge of crest of dam and at northwest corner of bridge and spillway training wall, cover with loam and then seed;

(7) repair or replace missing or dislodged stone in stone gutter along road located on downstream face of dam;

(8) remove all trees and brush from the upstream face, downstream face and crest of the dike;

(9) replace disintegrated stone riprap on the upstream face of the dam and spillway discharge channel;

(10) institute a written definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff. The existing system is not described in writing. The flashboards should be removed prior to periods of unusually heavy rains and/or runoff.

(11) continue the systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances and be supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in compliance with all applicable State regulations;

(12) technical inspection of this dam should be continued on a biennial frequency.

7.4 Alternatives. There are no alternatives.

APPENDIX A

PERIODIC INSPECTION
CHECKLIST

COHASSE BROOK RESERVOIR

PERIODIC INSPECTION

PARTY ORGANIZATION

NAME COHASSE BROOK RESERVOIR DATE November 20, 1978

TIME 9:00 A.M.-1:30 P.M.

WEATHER Clear, 40°F.

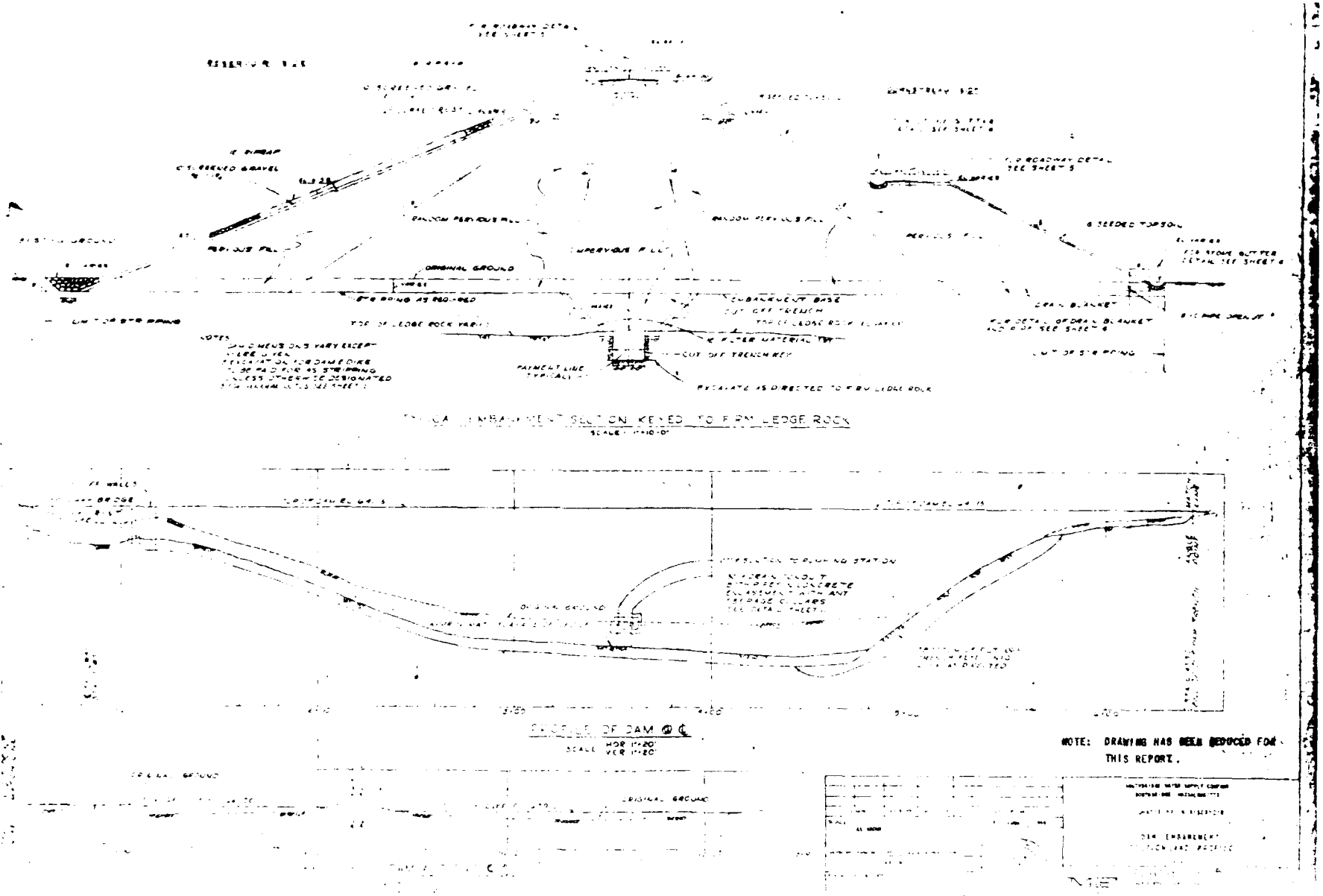
W.S. ELEV. 632.0* 580.5

*Assumed benchmark elevation 632.0 on top of spillway weir-from USGS topographic quadrangle.

Michael Larson		6.	
Henry Lord		7.	
David Cole		8.	
William Checchi		9.	
		10.	

PROJECT FEATURE	INSPECTED BY
Dam	Larson
Spillway	Branagan

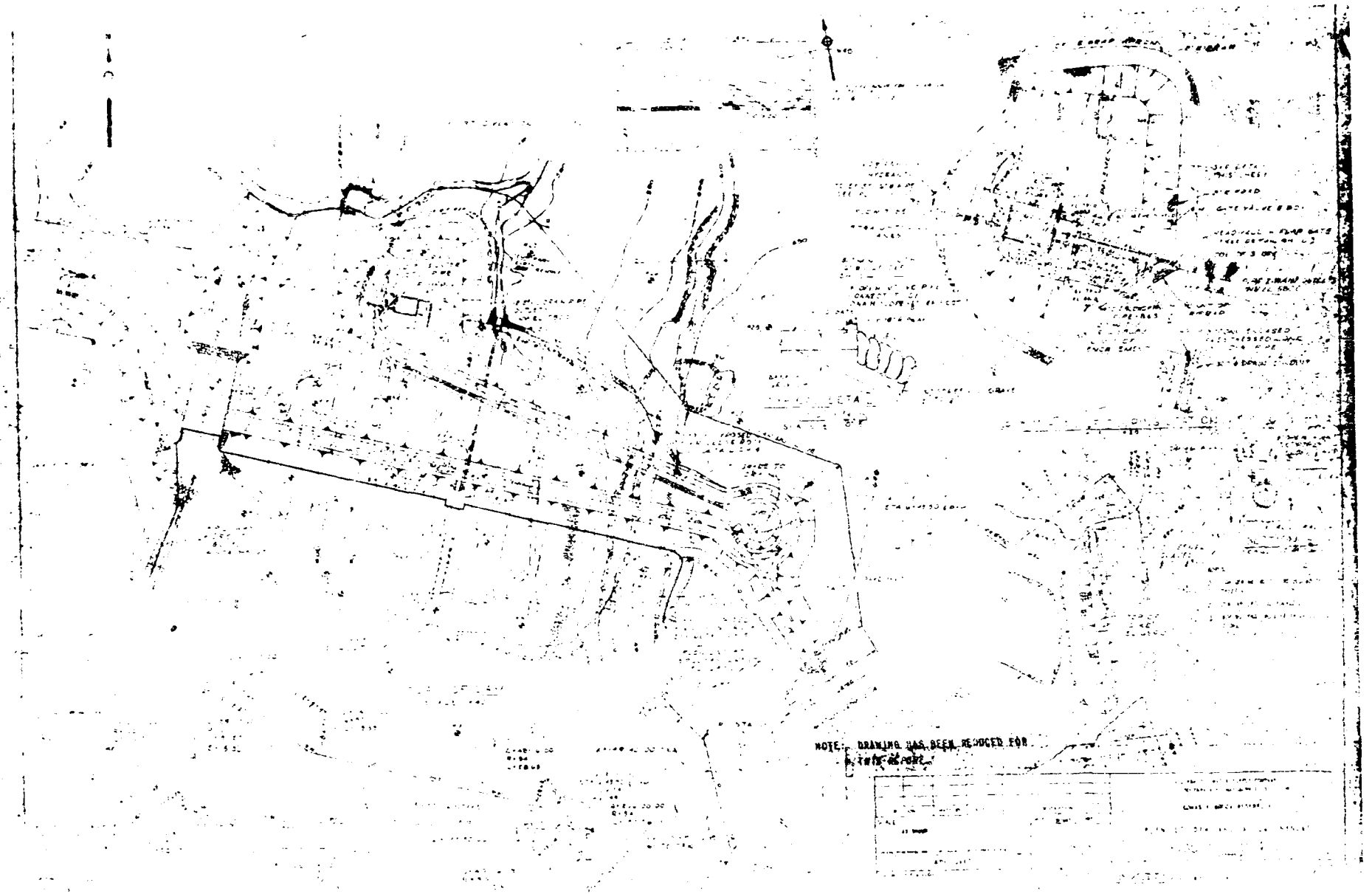
A-1 A-8



TYPICAL EMBANKMENT SECTION KEYED TO FIRM LEDGE ROCK

PROFILE OF DAM ℄

NOTE: DRAWING HAS BEEN REDUCED FOR THIS REPORT.



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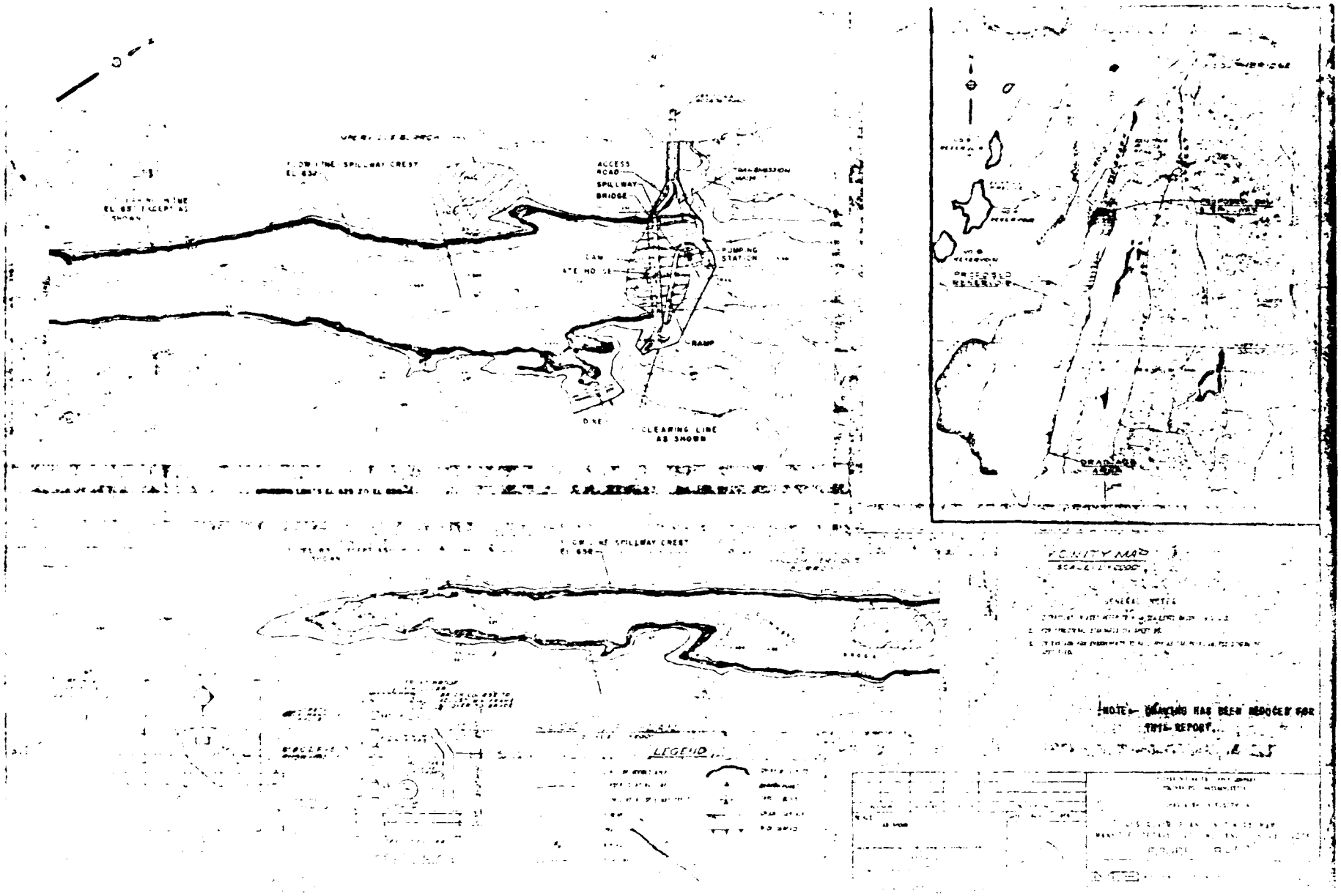
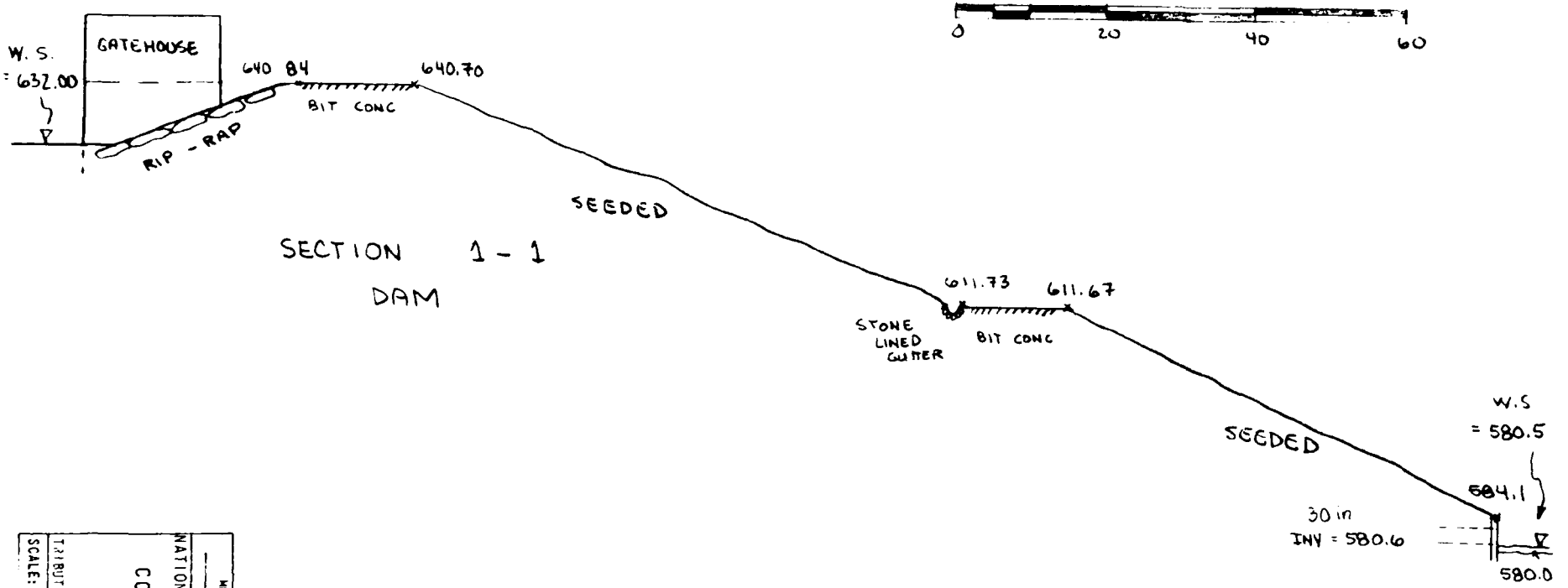
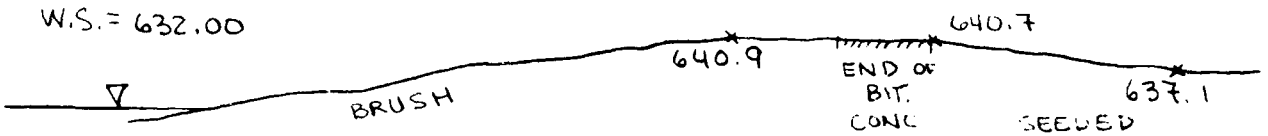

ACCESS ROAD
SPILLWAY BRIDGE
PUMPING STATION
RAMP
CLEARING LINE AS SHOWN
VICINITY MAP
NOTE - DRAWING HAS BEEN REDUCED FOR THIS REPORT.



SECTION 1 - 1

DAM



SECTION 2 - 2

EASTERLY EMBANKMENT

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

COHASSE BROOK RESERVOIR DAM

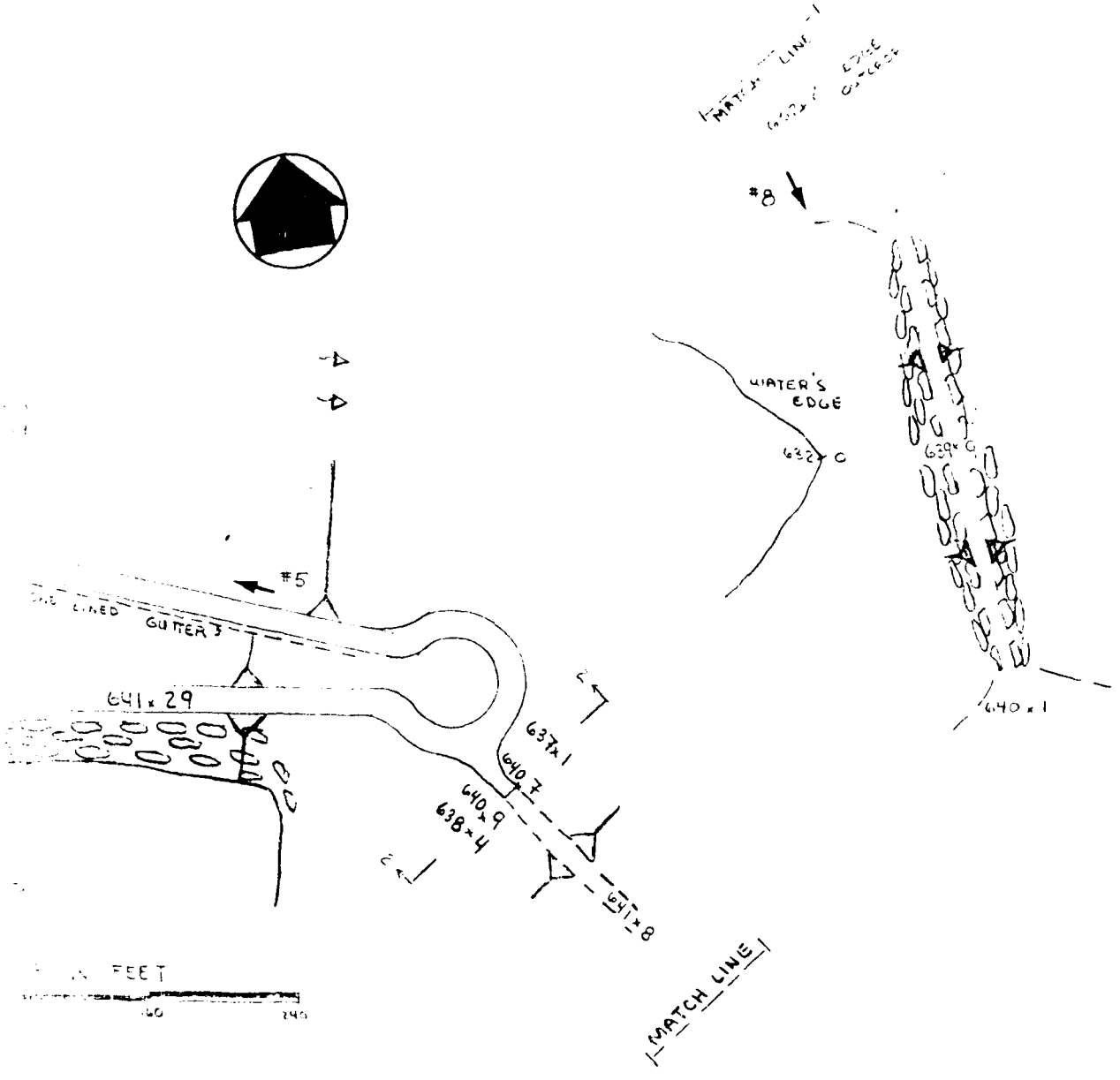
FIGURE B-2 SECTIONS THROUGH DAM

TRIBUTARY QUINEBAUG RIVER — MASSACHUSETTS

SCALE: 1" = 20' — DATE: JANUARY, 1979

METCALF & EDDY, INC. ENGINEERS BOSTON, MASS.

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



...MED BENCHMARK ELEV = 632.00 (MSL) ON SPILLWAY CREST
... OF NOVEMBER 20, 1978 ; AND CONTRACT 1966-W1
... METCALF & EDDY INC., AUGUST, 1966

...TION OF VIEW FOR PHOTOGRAPHS

METCALF & EDDY, INC.
U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MA

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

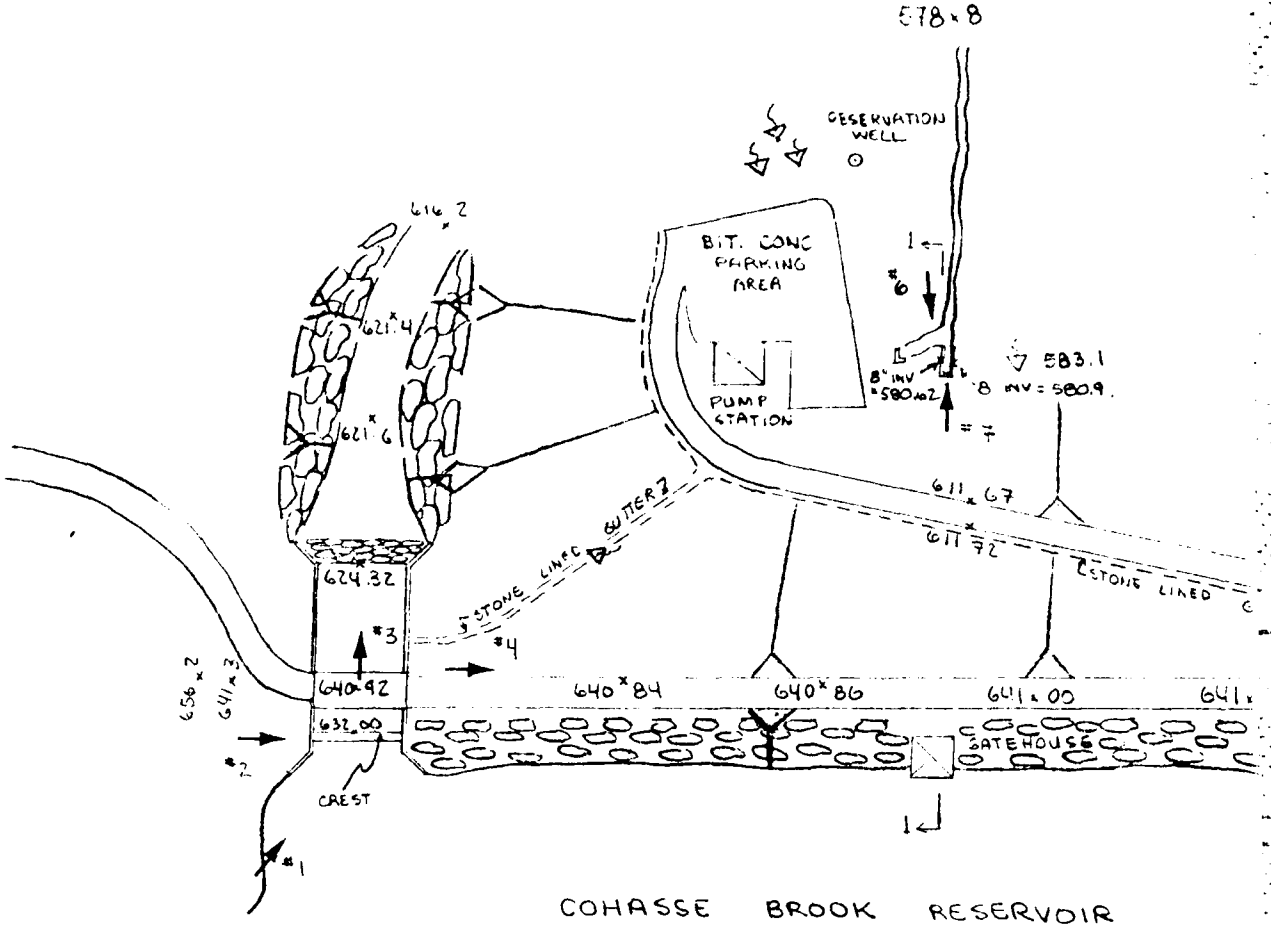
COHASSE BROOK RESERVOIR DAM

FIGURE B-1 PLAN OF DAM AND DIKE

TRIBUTARY QUINEBAUG RIVER — MASSACHUSETTS

SCALE: 1" = 80'

DATE: JANUARY, 1979



COHASSE BROOK RESERVOIR

WATER SURFACE = 632.0

NOTES:

1. ELEVATIONS SHOWN ARE REFERENCED TO ASSUMED DA
2. INFORMATION SHOWN BASED ON FIELD SURVEY OF NOV
   "COHASSE RESERVOIR AND APPURTENANT WORK"
3. ⇩ DENOTES SEEPAGE
4. ↗ #2 INDICATES LOCATION AND DIRECTION OF

METCALF & EDDY, INC.

APPENDIX B

PLANS OF DAM AND PREVIOUS
INSPECTION REPORT

		Page
Figure B-1	Plan of Dam and Dike	B-1
Figure B-2	Sections of Dam and Dike	B-2
Figure B-3	Cohasse Brook Reservoir, Reservoir Plan and Vicinity Map	B-3
Figure B-4	Cohasse Brook Reservoir, Plan of Dam and Appurtenances	B-4
Figure B-5	Cohasse Brook Reservoir, Dam Embankment Section and Profile	B-5
Figure B-6	Cohasse Brook Reservoir, Intake and Outlet Sections and Details	B-6
Figure B-7	Cohasse Brook Reservoir, Gate House and Pumping Station Piping Plans and Sections	B-7
Inspection by Massachusetts Department of Public Works, dated February 12, 1973		B-8

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Spillway Bridge NAME M. Larson

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
~~OUTLET WORKS - SERVICE BRIDGE~~ SPILLWAY- ACCESS BRIDGE	
a. Super Structure	Reinforced concrete
Bearings	None visible
Anchor Bolts	None visible
Bridge Seat	None visible
Longitudinal Members	Concrete
Under Side of Deck	Concrete
Secondary Bracing	None
Deck	Asphalt paved
Drainage System	Four weep holes
Railings	~~Pipe railings both sides, painted,~~ good condition
Expansion Joints	None visible
Paint	On pipe railings
b. Abutment and Piers	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Left side - abutment Right side - embankment
Condition of Seat and Backwall	Good. Transverse cracks in asphalt pavement at each end of deck at interface with soil subgrade.

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Spillway NAME M. Larson

DISCIPLINE Hydraulic NAME L. Branagan

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Two concrete inlet wing walls extend into reservoir.
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None-a few logs and branches on top of riprap on left bank
Floor of Approach Channel	Submerged-only last 5' visible, floor covered with leaves.
b. Weir and Training Walls*	Concrete sidewalls.Concrete ogee weir-flow over full width, no flashboards..
General Condition of Concrete	Walls-good condition.One crack in top of west wall at south end of bridge. Some expansion joint filler material is missing
Rust or Staining	Weir & bottom - good condition
Spalling***	Yes-up to high water mark in channel & channel bottom, & high water mark on inlet walls.
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Effl.at weep holes. Also at base of east training wall underneath north side of bridge.**
Drain Holes	Yes-at base of training walls D/S of weir Seven on each side of channel, all dry.
c. Discharge Channel	Trapezoidal shaped, about 160' long.
General Condition	Bottom & sides lined with stone riprap. Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Some of stone lining has weathered & disintegrated,particularly on west slope for about 100'
Other Obstructions	Some bushes and logs in bottom, slight movement of stone on side slopes.

*Concrete lined channel terminates with 2 rows of jump blocks.Few small logs, leaves and debris in blocks, several stones up to 2 ft. size in channel.

**At two vertical joints in D/S weir face, filler has eroded or is missing, maybe some water leakage.

***Slight pitting on weir face.Spalling up to high water mark on inlet walls & conc.channel.One spall on top of east wall next to S.edge of Brg.deck.

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Outlet Works NAME M. Larson

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	Below high water mark
Spalling	Slight spalling at high water mark
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None visible
Condition at Joints	N/A
Drain Holes	N/A
Channel	
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good - lined with riprap, clear of debris. Flowing water is clear.

Note - Refer to page A-2, Instrumentation System, Observation well is located northeast of pump station and west of Cohasse Brook, with the following surveyed information;

Elevation of ground surface = 586.1
Elevation of top of pipe = 586.81
Elevation of bottom of pipe = 582.06
Elevation of water level = 583.56

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Outlet Works NAME M. Larson

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Superstructure is concrete block faced with brick. Remainder is reinforced concrete.
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Not visible
Spalling	Below high water mark on outside
Visible Reinforcing	None visible
Rusting or Staining of Concrete	Below high water mark on outside and inside of tower
Any Seepage or Efflorescence	None
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate	None visible. Water level inside tower was 48'-7" on 60' long tankometer
Cracks	None visible
Rusting or Corrosion of Steel	Visible braces for valve stem extensions are rusted.
b. Mechanical and Electrical	
~~Air Vents~~ Valves	All six valves are operable.
~~Float Wells~~ Screens	Screens used when valve opened to pump house
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Outlet Works NAME M. Larson

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Not visible
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	Refer to outlet works - control tower
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

PROJECT FEATURE Dike embankment NAME M. Larson

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	Varies from 639.9 to 640.1
Current Pool Elevation	632.0
Maximum Impoundment to Date	634.2
Surface Cracks	None visible
Pavement Condition	Not applicable (N/A)
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Level
Horizontal Alignment	Straight
Condition at Abutment and at Concrete Structures	Left abutment-bedrock outcrop Right abutment-earth &few stones, some exposed bedrock about 50 ft.north of rt. abutment at D/S toe
Indications of Movement of Structural Items on Slopes	No structural items
Trespassing on Slopes	Footpath on crest
Sloughing or Erosion of Slopes or Abutments	None visible
Rock Slope Protection - Riprap Failures	U/S slope covered with riprap & some small trees,brush & logs.Some rocks have weathered (disintegrated).
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	None visible
Piping or Boils	None visible
Foundation Drainage Features	None visible
Toe Drains	None visible
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT COHASSE BROOK RESERVOIR DATE November 20, 1978

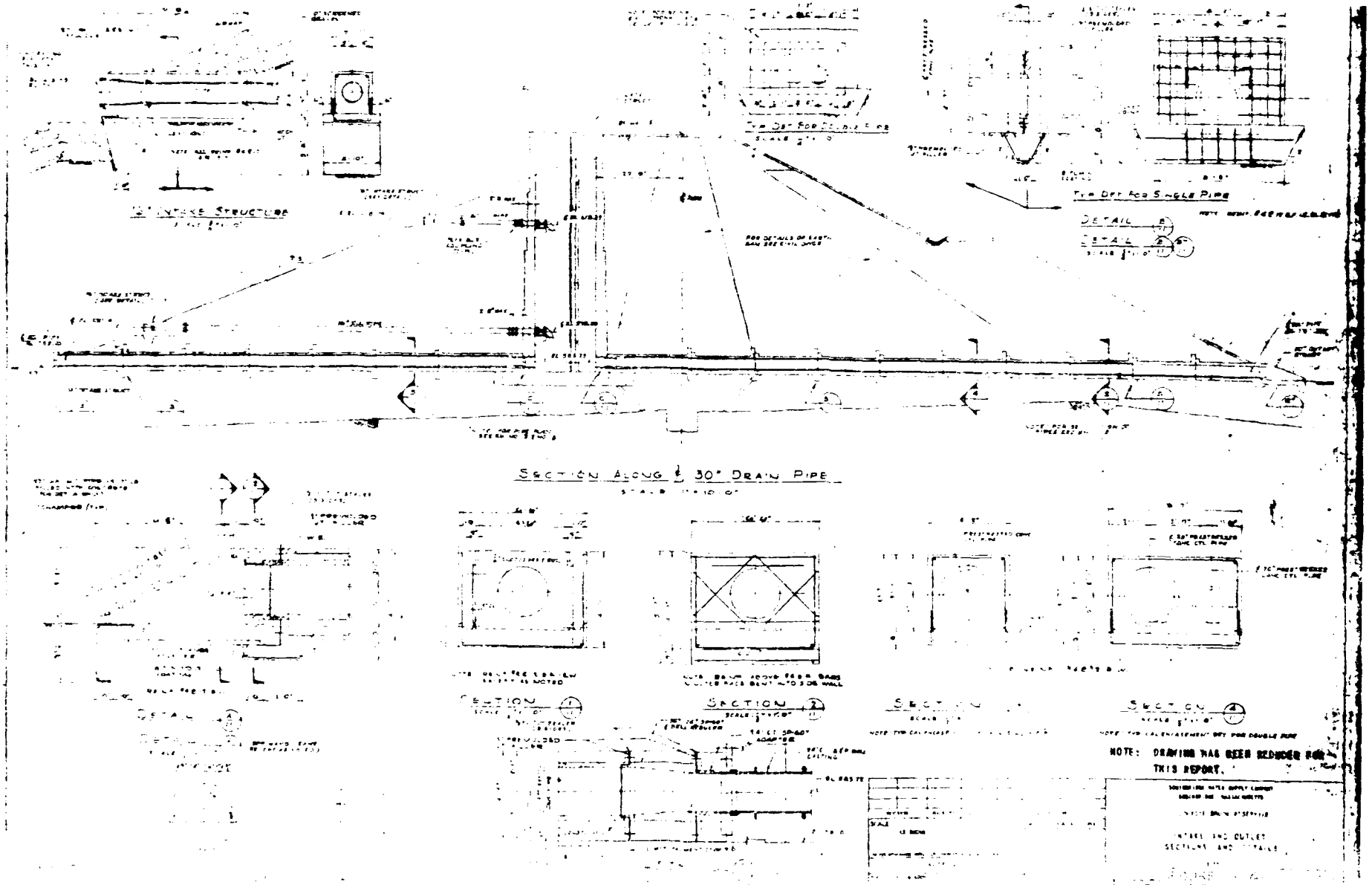
PROJECT FEATURE Dam Embankment NAME M. Larson

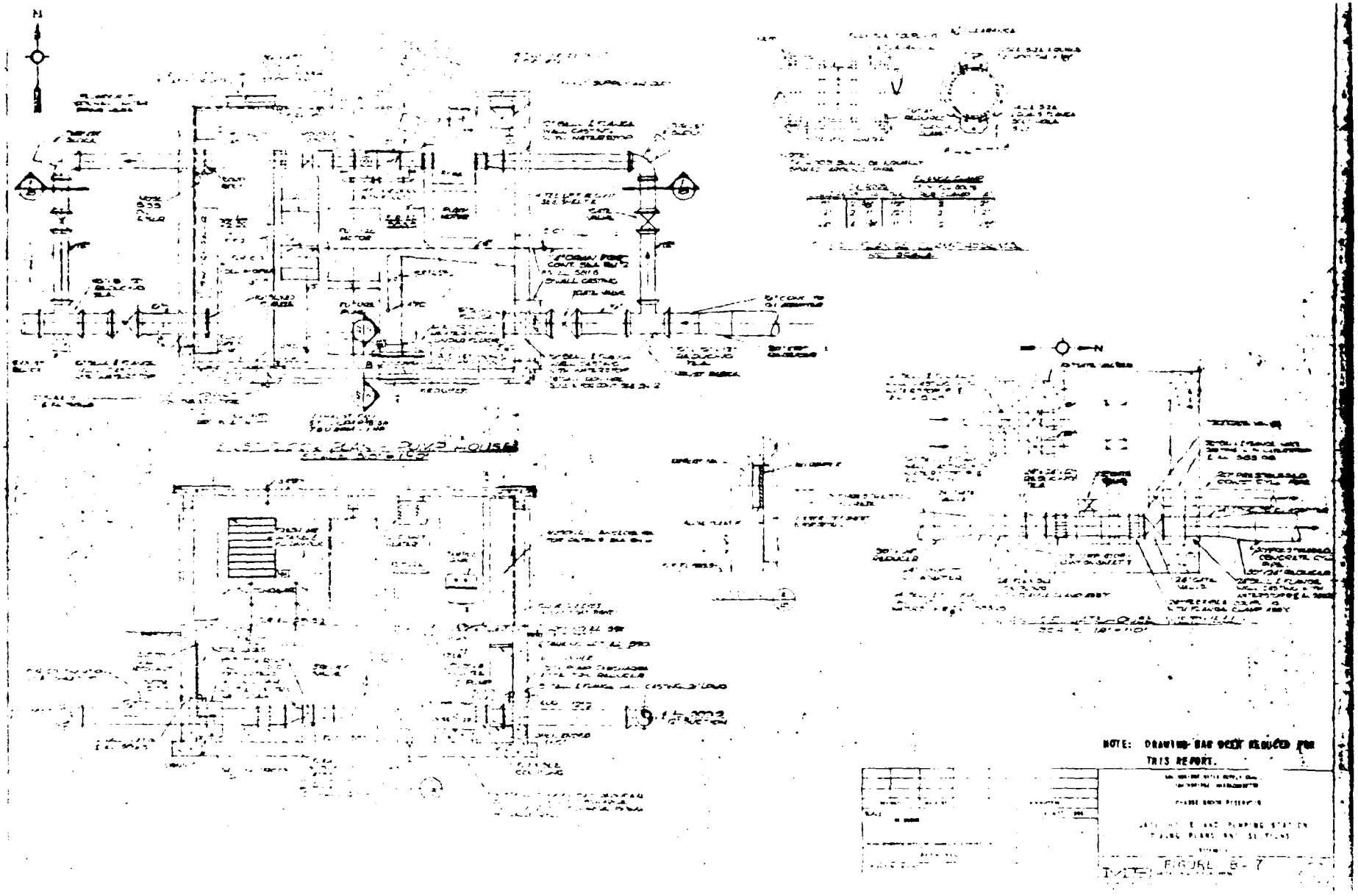
DISCIPLINE Geotechnical NAME

Note: U/S = Upstream; D/S = Downstream

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT Crest Elevation	Crest-paved asphalt road, including bridge over spillway Varies from 640.7 to 641.8
Current Pool Elevation	632.0
Maximum Impoundment to Date	634.2
Surface Cracks	Longitudinal cracking and one transverse crack on crest, transverse cracks at br.abut
Pavement Condition	Fair, grass growing through longitudinal cracks
Movement or Settlement of Crest	None visible, except for localized pavement depression on D/S edge of pave.at gate house
Lateral Movement	None visible
Vertical Alignment	Level
Horizontal Alignment	Straight, with an angle to southeast near right abutment
Condition at Abutment and at Concrete Structures	Right abutment-bedrock outcrops Left abut.-bedrock outcrops above road
Indications of Movement of Structural Items on Slopes	No structural items
Trespassing on Slopes	None - site fenced off
Sloughing or Erosion of Slopes or Abutments	No sloughing.Slight erosion on D/S face near center and left half at top of slope, middle of D/S slope,& along road edges on road onD/S slope,including stone lined gutter.
Rock Slope Protection - Riprap Failures	U/S slope covered with riprap.Some stone is disintegrated throughout riprap.Few logs & small bushes on U/S slope.
Unusual Movement or Cracking at or near Toes	None visible.
Unusual Embankment or Downstream Seepage	Slight flow from the following: about mid-height of stone lined ditch at left abut. contact, at toe about 50 ft.east of outlet headwall,both tile toe drains & riprap near outlet headwall,stones north of PP.Sta.,
Piping or Boils	steep face of bedrock outcrop on rt.abut.
Foundation Drainage Features	None visible
Toe Drains	8"v.c.p.toe drain &stone gutter along full length of dam
Instrumentation System*	Two 8"v.c. pipes exit next to outlet training walls. One observation well NE of PP Sta.

*See note on page A-6.


SECTION ALONG ℄ 30" DRAIN PIPE
SECTION 1
SECTION 2
SECTION 3
SECTION 4
NOTE: DRAWING WAS REDUCED FOR THIS REPORT.



NOTE: DRAWING HAS BEEN REDUCED FOR THIS REPORT.

FIGURE B-7

CK FILE

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: ~~City~~/Town SOUTHBRIDGE Dam No. 3-14-278-19

Name of Dam COHASSE RESERVOIR Inspected by P. MARK R. MICHALD

Date of Inspection 2-12-73

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

Reg. of Deeds _____ Pers. Contact ✓

1. SOUTHBRIDGE WATER SUPPLY Co. 70 FOSTER ST SOUTHBRIDGE, MA. 01550
   Name St. & No. City/Town State Tel. No.
2. _____
   Name St. & No. City/Town State Tel, No.
3. _____
   Name St. & No. City/Town State Tel. No.

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

Name: St. & No.:

City/Town: State: Tel.No.:

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:

7. Upstream Face of Dam: Condition:

1. Good ✓ 2. Minor Repairs _____

3. Major Repairs ___ 4. Urgent Repairs ___

.onComments:

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs ____ 4. Urgent Repairs _____

Comments:

9. Emergency Spillway:

Condition: 1. Good _____ 2. Minor Repairs _____

3. Major Repairs ____ 4. Urgent Repairs _____

Comments:

10. Water Level at time of inspection: 9 ft. above ____ below ✓

top of dam ✓ principal spillway _____

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment NONE

Animal Burrows and Washouts NONE

Damage to slopes or top of dam NONE

Cracked or Damaged Masonry NONE

Evidence of Seepage NONE

Evidence of Piping NONE

Erosion NONE

Leaks NONE

Trash and/or debis impeding flow No

Clogged or blocked spillway No

Other NONE

DAM NO. 3-14-378-17

12. Remarks & Recommendations: (Fully Explain)

THIS DAM & RELATED DIKE WERE FOUND TO BE IN EXCELLENT CONDITION AND IS VERY WELL MAINTAINED BY THE WATER COMPANIES FORCES

13. Overall Condition:

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

   Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3

Submitted by [illegible] Dam No. 3-14-372-19

Date 2-12-73 ~~City~~/Town SOUTHBRIDGE

Name of Dam COHASSE RESERVOIR

1. Location: Topo Sheet No. 18D

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

2. Year built: 1968 Year/s of subsequent repairs _____

3. Purpose of Dam: Water Supply ✓ Recreational _____

   Irrigation _____ Other _____

4. Drainage Area: 1.9 sq. mi. _____ acres

5. Normal Ponding Area: 75 acres; Ave. depth _____

   Impoundment: 225,000,000 gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir GATE HOUSE i.e. summer homes, etc. _____

7. Dimensions of Dam: Length 750' Max. Height 60'

   Slopes: Upstream Face 2.5:1

   Downstream Face 2:1

   Width across top 22'

8. Classification of Dam by Material:

   Earth ✓ Conc. Masonry ✓ Stone Masonry _____

   Timber _____ Rockfill _____ Other _____

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

   100 % rural; _____ % urban.

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

DAM NO. 3-14-278-19

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

No. of people NONE.

No. of homes NONE.

No. of Businesses NONE.

No. of industries NONE. Type _____

No. of utilities WATER CO. PUMP HOUSE. Type _____

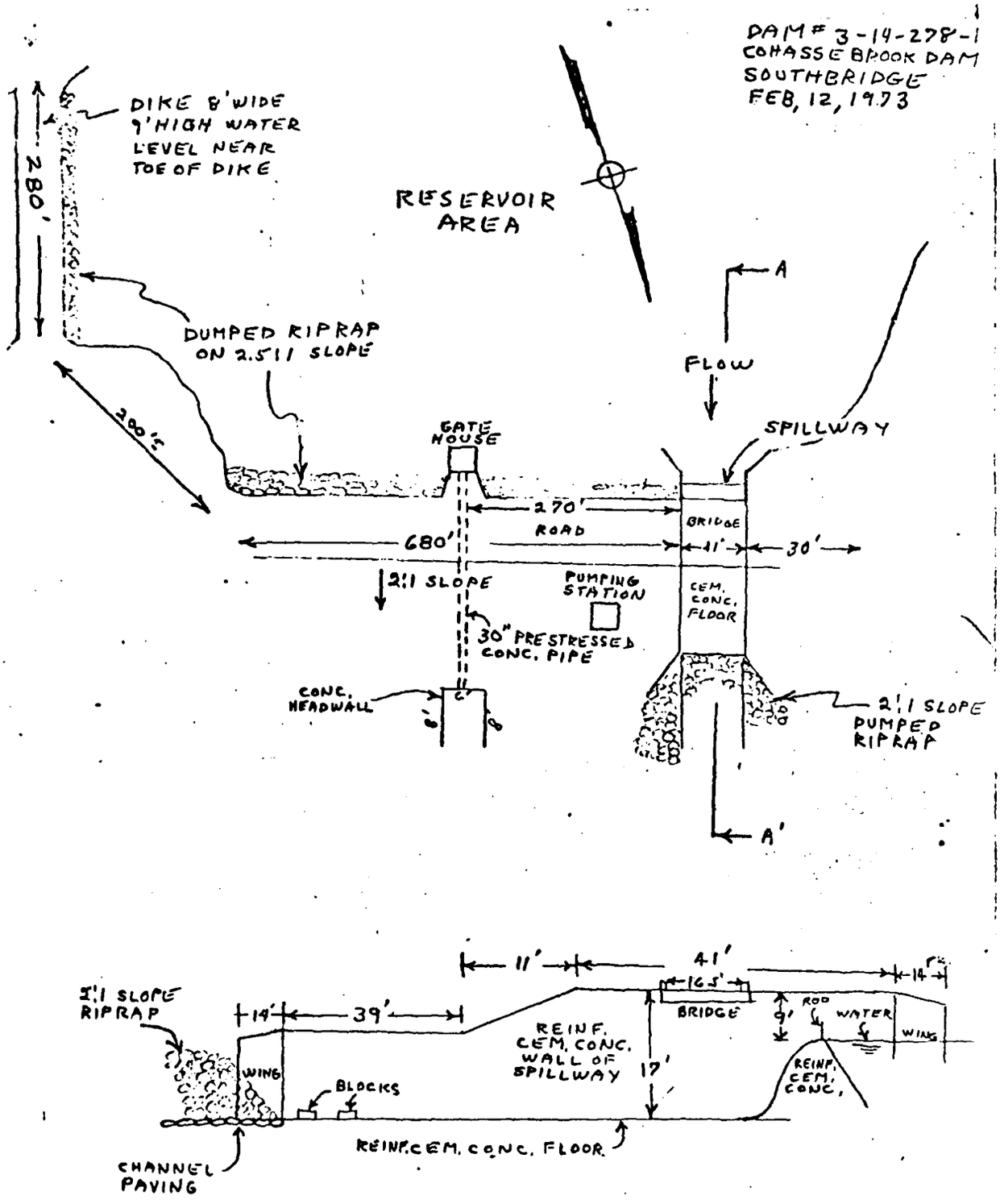
Railroads NONE.

Other dams 3-14-278-13.

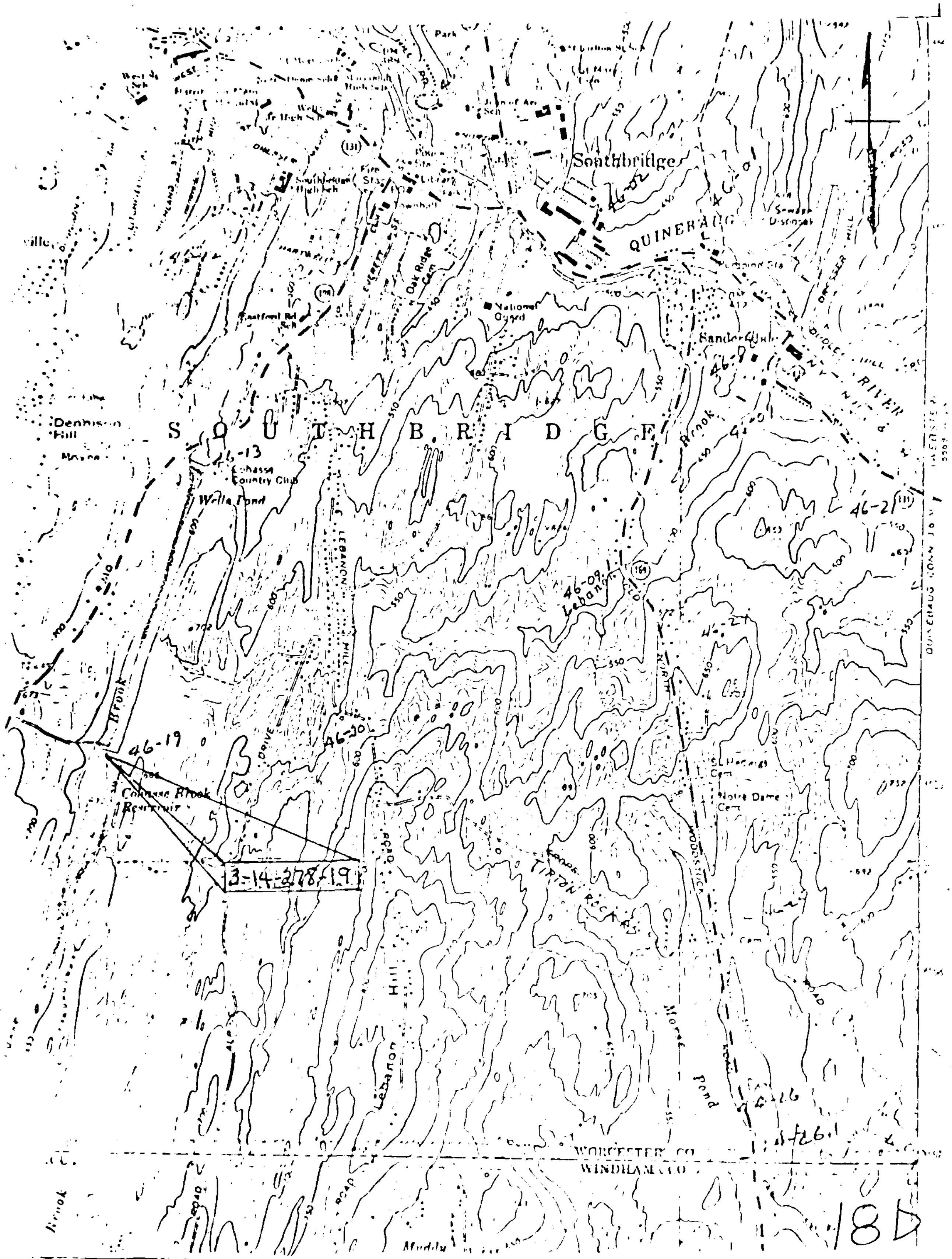
Other NONE.

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

12. How to Locate: FROM THE INTERSECTION OF RTE. 198 & DENNISON RD., 500' SOUTH ON RTE. 198 TAKE LT. AT OILED GRAVEL RD., THRU PASTURE, TO WATER WORKS GATE & DAM SITE.


DAM # 3-14-278-1
COHASSE BROOK DAM
SOUTHBRIDGE
FEB, 12, 1973
DIKE 8' WIDE
9' HIGH WATER
LEVEL NEAR
TOE OF DIKE
280'
RESERVOIR
AREA
A
FLOW
DUMPED RIPRAP
ON 2.5:1 SLOPE
200'
GATE
HOUSE
SPILLWAY
270'
BRIDGE
ROAD
680'
41'
30'
2:1 SLOPE
PUMPING
STATION
CEM.
CONC.
FLOOR
30" PRESTRESSED
CONC. PIPE
CONC.
HEADWALL
2:1 SLOPE
DUMPED
RIPRAP
A'
11'
41'
14'
16.5'
2:1 SLOPE
RIPRAP
14'
39'
BRIDGE
9'
ROD
WATER
WING
REINF.
CEM. CONC.
WALL OF
SPILLWAY
17'
WING
BLOCKS
REINF.
CEM.
CONC.
REINF. CEM. CONC. FLOOR
CHANNEL
PAVING

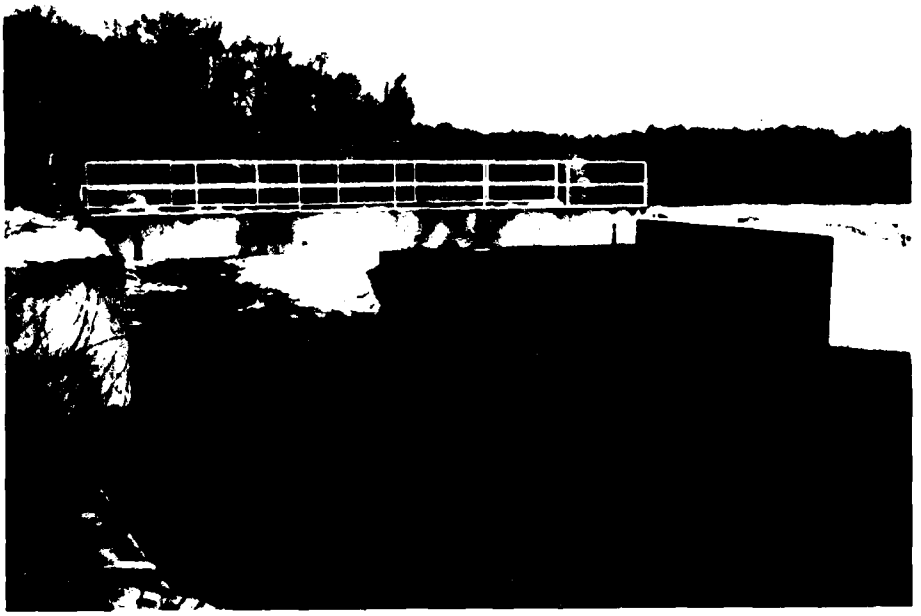
SECTION A-A'


Southbridge
QUINEBAUG
S O U T H B R I D G E
Denhison Hill
Cohasse Country Club
Wells Pond
Cohasse Brook Reservoir
3-14-278-19
46-19
46-20
46-13
46-09
46-21
46-27
National Guard
Oak Ridge Cem
Sandersdale
RIVER
Brook
Lebanon
Lebanon Hill
TIPTON ROCKS
St Hedwigs Cem
Notre Dame Cem
WOODSTOCK
Morse Pond
WORCESTER CO
WINDHAM CO
Muddy
18D

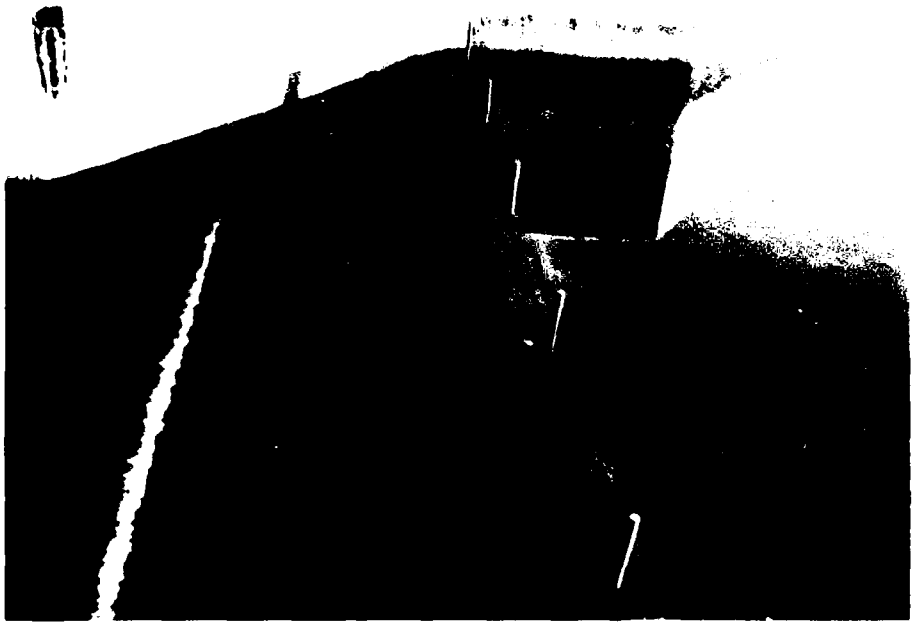
APPENDIX C

PHOTOGRAPHS

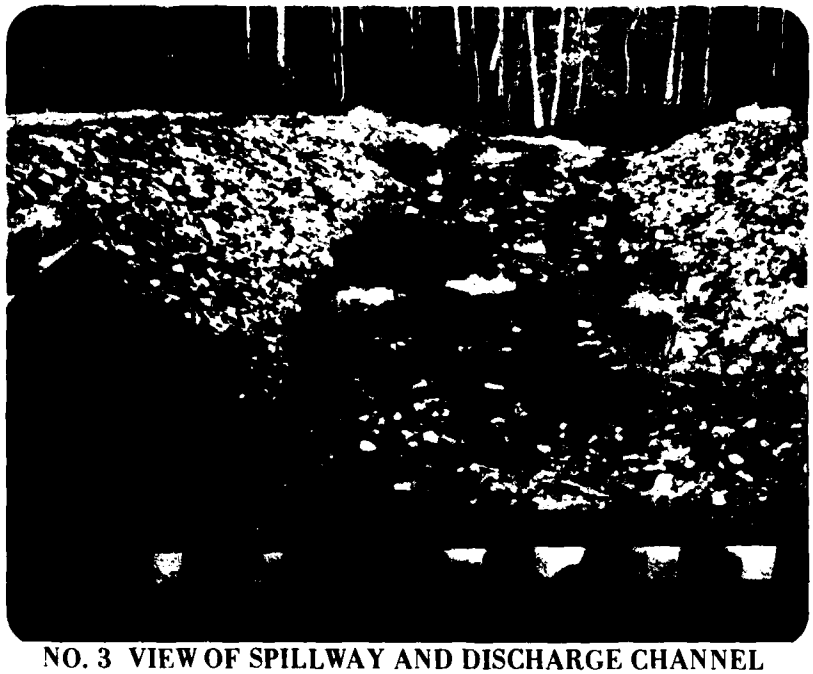
COHASSE BROOK RESERVOIR



NO. 1 VIEW OF SPILLWAY

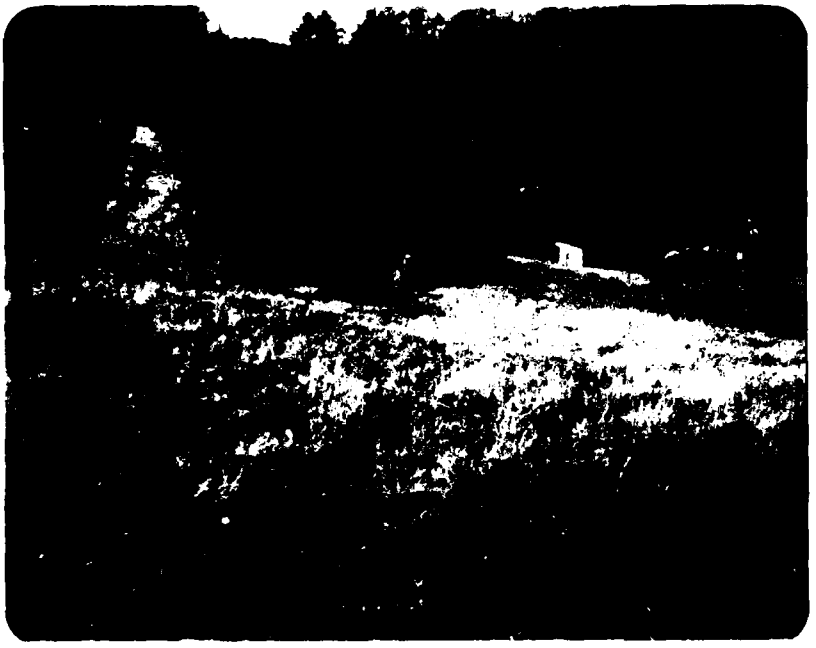


NO. 2 VIEW OF SPILLWAY CREST



NO. 3 VIEW OF SPILLWAY AND DISCHARGE CHANNEL

NO. 4 VIEW OF DOWNSTREAM SLOPE OF DAM



NO. 5 VIEW OF DOWNSTREAM SLOPE OF DAM

NO. 6 VIEW OF OUTLET CONDUIT

NO. 7 VIEW OF OUTLET DISCHARGE CHANNEL

NO. 8 VIEW OF UPSTREAM SLOPE OF DIKE

APPENDIX D

HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

		Page
Figure D-1	Drainage Area Map - Cohasse Brook Reservoir	D-1
Hydrologic and Hydraulic Computations		D-2

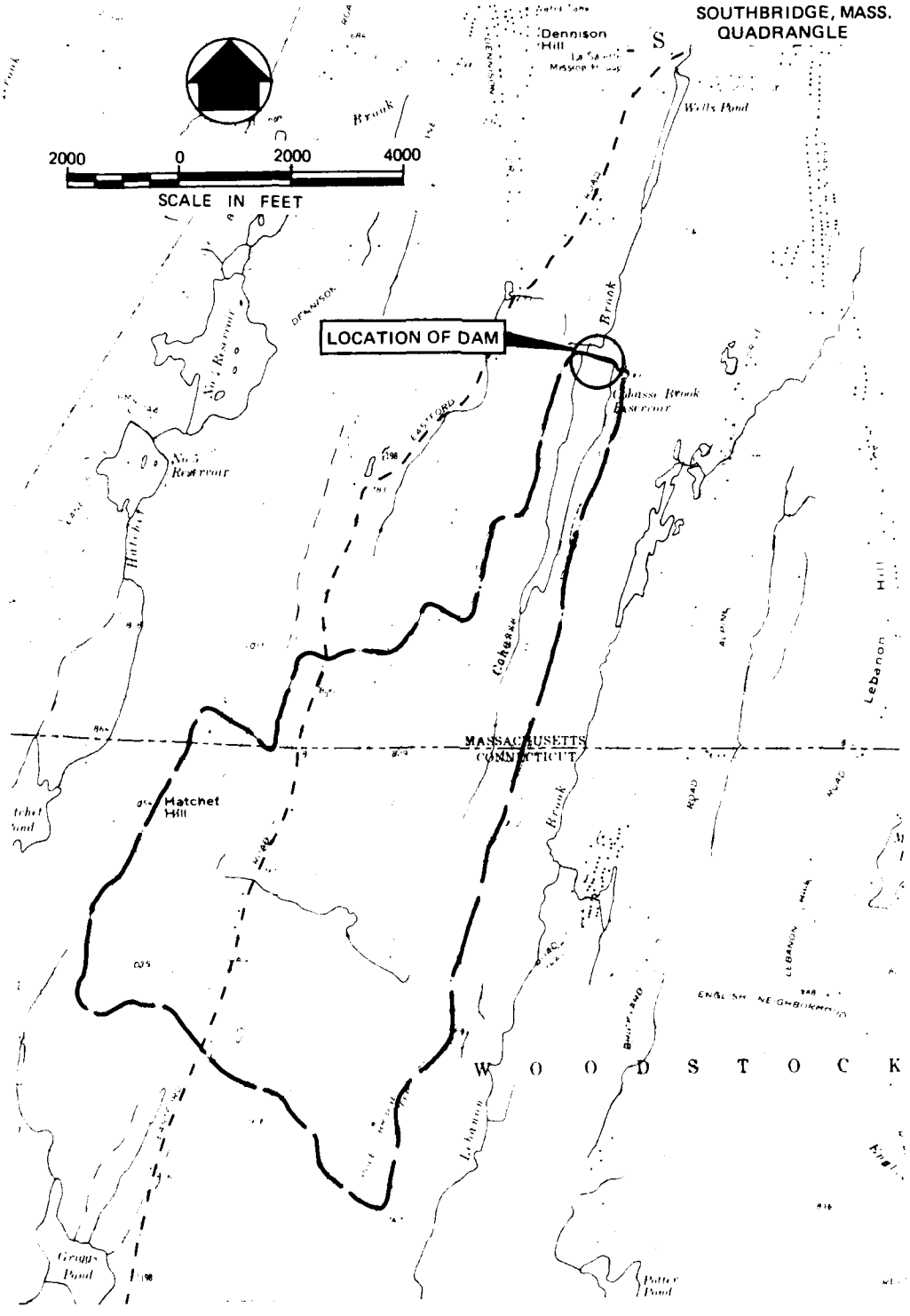


FIG. D-1 DRAINAGE AREA MAP – COHASSE BROOK RESERVOIR

Project Nat. Review of Non Fed. Dams Acct. No. 6191 Page 1 of 4
Subject Worcester County, Mass. Compt'd By LEB Date 12/8/78
Detail COHASSE BROOK RES. Ck'd By MBD Date 12/29/78

(I) Test Flood Storage & Storage Functions - Without Flashboards

1 - Total Drainage Area - 1.96 mi^2

2 - Pond(s) Area: 0.08 mi^2
Swamp(s) Area: .02 + .02 + .03 + .10 = 0.17
Total Area Pond(s) & Swamp(s): 0.25

$\%$ Ponds & Swamps $= \frac{0.25}{1.96} \cong 12\%$

3 - $\frac{1035 - 632}{13900} = 2.89$ } Say Ave Slope = 3%

4 - Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be between "Rolling" and Flat & Coastal" and taken at 1550 c.f.s./mi²
Size Class: Interm.; Hazard Pot.: High; Spill. Des. Flood: P.M.F.
Use: Test Flood = P.M.F.

5 - Test Flood Inflow = $(1550)1.96 \cong 3100$ c.f.s.

6 - Pond Storage
The pond area is 0.08 sq. mi. at elev. 632
Based on a const. area, storage increases at 54 ac. feet per foot of depth increase.

7 - Storage Functions are based on $Q_{out} = Q_{in}\left[1 - \frac{S_{out}}{R}\right]$
S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area

S (in Inches) $= 12\,D\left(\frac{0.08}{1.96}\right) = 0.49\,D$; R = 6 hr rain of storm

D = Storage Depth (above spillway) on reservoir in feet

8 - Storage Functions: (F_{TF}); D = 0 @ Pond El. 632

$$F_{TF} = 3100 - 163\,S = 3100 - 80\,D$$

Project Nat. Review of Non Fed. Dams Acct No. 6191 Page 2 of 4
Subject Worcester Mass. Area Compld By LEB Date 12/19/78
Detail COHASSE BROOK DAM Ck'd By MBA Date 12/29/78

(II) Discharge Ratings

A - Ogee Spillway

Width = 40', $Q = CLH^{1.5} = 4 \times 40 \times H^{1.5} = 160H^{1.5}$

Res. El.	633	634	635	636	637	638	639	640
Discharge	160	450	830	1280	1790	2350	2960	3620

B - Low Level Outlet

30 in. ϕ pipe - Say Losses = 3 × Vel. Hd. (Ent, Ex + Valve Fixed)

Head = 632 - 583 = 49 ft = $3.0 \frac{V^2}{2g}$

$V = 32$ fps, $Q_L = 150$ cfs

Time to Lower Res. 1 ft = $\frac{54(43560)}{150(3600)}$ = 4 hours

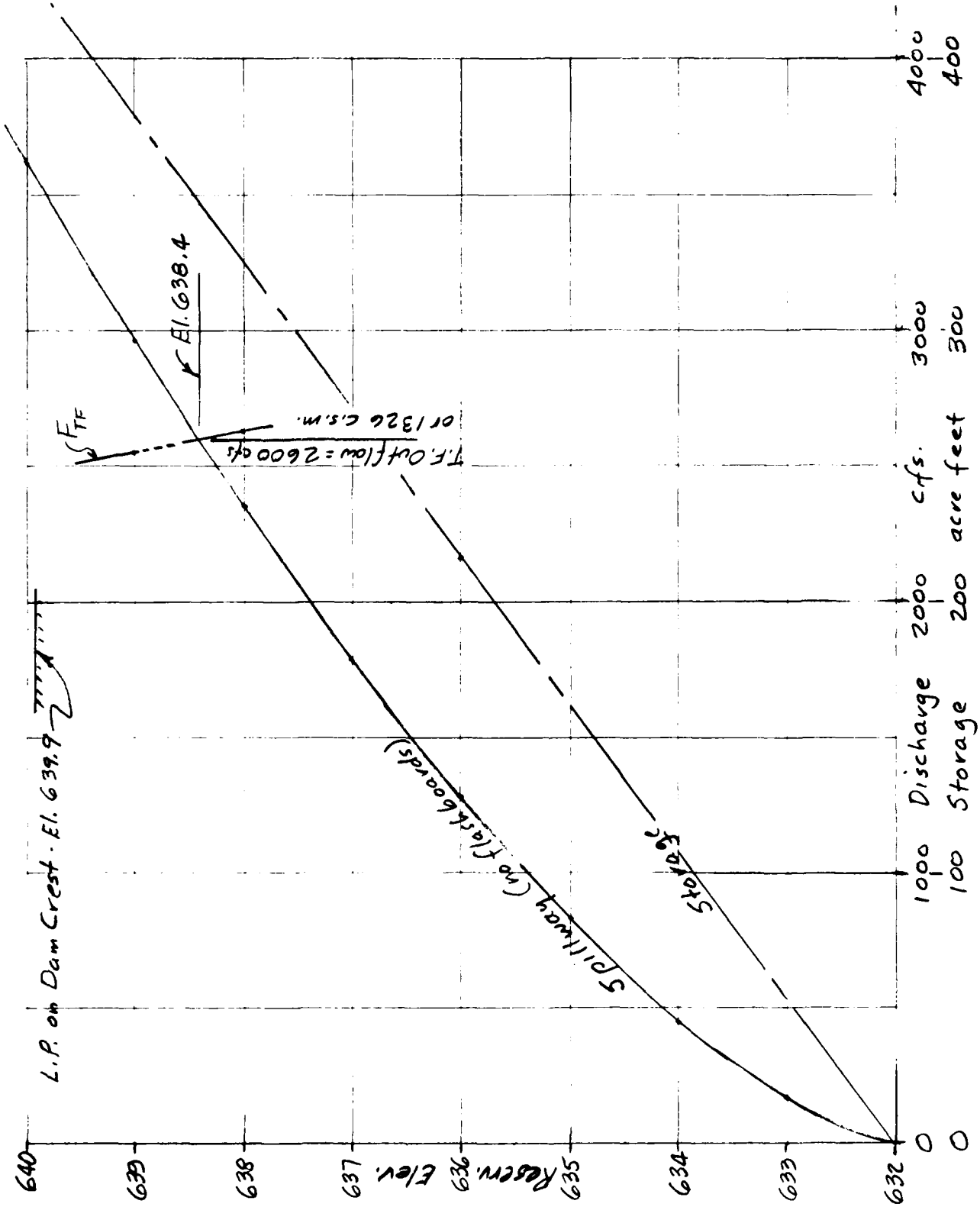
METCALF & EDDY, ENGINEERS

Project Nat. Review of Non Fed Dams Acct. No. 6191 Page 3 of 4

Subject Worcester Mass. Area Comptd By LEB Date 12/19/73

Detail COHASSE BROOK DAM Ck'd By MBF Date 12/25/78

(III) Discharge, Storage & Storage Function vs Res. Level



METCALF & EDDY, ENGINEERS

Project Nat Review of Non Fed Dams Acct No 6191 Page 4 of 4
Subject Worcester Mass. Area Compld. By LEB Date 12/19/78
Detail COHASSE BROOK RES. Ck'd. By MBF Date 12/29/78

(IV) Failure of Dam

Peak Failure Flow:

Pond Elevation – 638.4 (Max. Pond w/ T.F. Qout)
Toe Elevation — 584.0 (Bot. of Dam – not channel)
Y_o = 54.4 ft.

Dam Length Subject to Breaching = 220 ft
$W_o = 40\%(220) = 88$ ft.

T.F. Qout = 2600 cfs

$$Q_{P_1} = 1.68\, W_o (Y_o)^{1.5} = 1.68(88)(54.4)^{1.5} = 59300 \text{ c.f.s.}$$

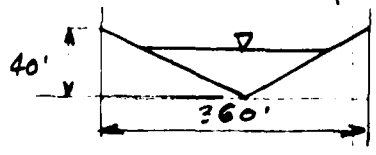
Total 61,900 cfs.

Storage Volume Released:

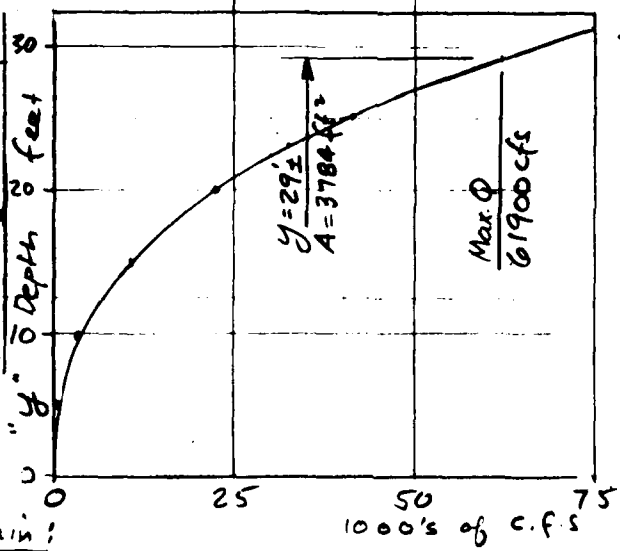
Storage Above Spillway = 346 ac. ft.
Storage Below Spillway $48 \times \frac{1}{3} \times 52$ = 832
S = Total Storage = 1178 ac. ft.

1st Channel Hydraulics: $S = \frac{20}{1700} = .0118$, $n = .06$, $V = 2.7 R^{2/3}$

$R \cong \frac{1}{2} y$ ∴ $V = 1.7 y^{2/3}$; $A = 4.5 y^2$



y	A	V	Q
5	112.5	5.0	560
10	450	7.9	3550
15	1012	10.3	10460
20	1800	12.5	22500
25	2812	14.5	40900
30	4050	16.4	66500
35	5512	18.2	100300
37	6160	18.9	116300



At outskirts of Southbridge
Dist. = 6500 ft
Vol. = 6500(3784) = 565 ac ft.

Trial $Q_{P_2} = 61900\left(1 - \frac{565}{1178}\right)$
" " = 32200

$y_2 = 23$; Ave y = 27'

∴ Q_{P_2} = 50000 cfs at entrance to Southbridge

Time to Drain:

$$\frac{43560\ (1178)}{3600\,(\frac{1}{2})(59300)} = 0.48 \text{ Hours. or } 29 \text{ min.}$$

METCALF & EDDY, ENGINEERS

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

COHASSE BROOK RESERVOIR

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
[illegible]	[illegible]	[illegible]	[illegible]	27	2				[illegible] RESERVOIR DAM	[illegible]	7235.2	09FEB79

POPULAR NAME	NAME OF IMPOUNDMENT

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	DIST FROM DAM (MI)	POPULATION
[illegible]	[illegible]	[illegible]	[illegible]	0	16900

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
[illegible]	[illegible]	S	60	60	1500	850	FED	N	N	N	N	21FEB79

REMARKS

D/S HAS	SPILLWAY LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT)	MAXIMUM DISCHARGE (FT)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (W)	POWER CAPACITY PROPOSED (MW)	NO	NAVIGATION LOCKS LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)
[illegible]	760	[illegible]	[illegible]	450	200000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
[illegible]	METCALF AND EDDY INC	[illegible] INC

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
[illegible]	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
METCALF AND EDDY INC	[illegible] 78	PUBLIC LAW 92-367

REMARKS

END

FILMED

7-85

DTIC