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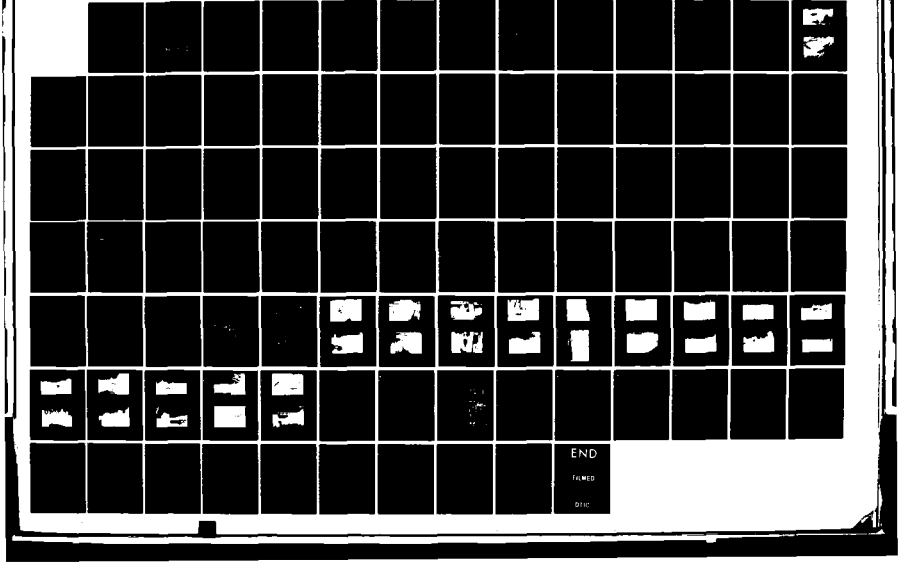
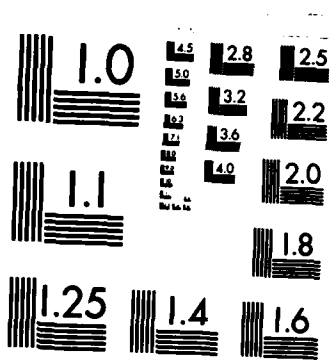
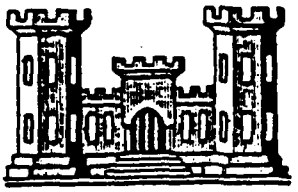




SUDBURY RIVER BASIN
FRAMINGHAM, MASSACHUSETTS

CENTRAL STREET DAM
MA 00340

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

FEBRUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

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18. SUPPLEMENTARY NOTES

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

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

DAMS, INSPECTION, DAM SAFETY,

Sudbury River Basin
Framingham, Massachusetts
Sudbury River

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

Central Street Dam is a 24 foot high composite masonry and earth dam consisting of a 182 foot wide masonry spillway forming the right half of the dam, a 40 foot long by 15 foot wode masonry/earth retaining wall section located just to the left of the spillway. The dam is classified as small in size with a high hazard potential. The dam is in fair condition.

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

REPLY TO
ATTENTION OF:

AUG 0 6 1981

NEDED

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

Dear Governor King:

Inclosed is a copy of the Central Street Dam (MA-00340) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve 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 vitally important.

Copies of this report have been forwarded to the Department of Environmental Quality Engineering, and to the owner, Saxonville Realty Trust Company, 2 Central Street, Framingham, MA 01701. Copies will be available to the public in thirty days.

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

Sincerely,

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

Incl
As stated

CENTRAL STREET DAM

MA 00340

SUDBURY RIVER BASIN

FRAMINGHAM, MASSACHUSETTS

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No:	MA 00340
Name of Dam:	Central Street Dam
Town:	Framingham
County and State:	Middlesex County, Massachusetts
Stream:	Sudbury River
Date of Inspection:	November 12, 1979

BRIEF ASSESSMENT

Central Street Dam is a 24-foot high composite masonry and earth dam consisting of a 182-foot wide masonry spillway forming the right half of the dam, a 40-foot long by 15-foot wide masonry/earth retaining wall section located just to the left of the spillway, and an earth embankment extending from the retaining wall to the left abutment. It is believed that the dam was constructed around 1900 to impound water for use at the Roxbury Carpet Company (now known as the Saxonville Industrial Park). Currently, there are two 14-inch diameter pipes used to provide process water to the Industrial Park.

Saxonville Pond extends for a distance of approximately 1.5 river miles upstream of the dam and covers a surface area of approximately 64 acres at normal pool elevation. The 86 square mile drainage basin for Central Street Dam includes several reservoirs and many developed urban areas. At the top of dam Elevation 150.0, the storage capacity is 840 acre-feet.

The dam is classified as a "Small" size, "High" hazard structure based on its height, storage capacity, and potential for property damage and loss of life in the event of a dam failure. The principal damage center is located approximately 0.5 miles downstream of the dam in the vicinity of Concord Street and includes several commercial and residential buildings. Because the height of the dam is on the low side of the height range for a "Small" size structure, a test flood equivalent to one-half of the PMF has been chosen.

Under the assumed conditions, the peak inflow and outflow rates are 10,000 cfs. The peak outflow corresponds to a reservoir stage of 1.3 feet above the top of the dam. The spillway capacity, assuming a pool elevation at the top of the dam, is equal to approximately 55 percent of the routed test flood outflow.

Based upon visual examination of the site, it appears that Central Street Dam is in fair condition. The stability of the right side stone masonry abutment wall and the stone masonry portion of the dam located just to the left of the spillway is questionable due to the extent of the cracking, undermining, tree growth, and wall displacement. Furthermore, the condition of the spillway could not be adequately assessed because of the large quantity of water flowing over the weir at the time of the inspection. The earth embankment portion of the dam appears to be in satisfactory condition.

Within one year after receipt of this Phase I inspection report, the Owner should retain the services of a qualified registered professional engineer and implement the results of his evaluation of the following: 1) a detailed hydraulic study to determine the discharge capacity of the dam when Saxonville Pond floodwaters start to overflow Central Street in the area of Centennial Place or the low area near the easterly side of Hallett Road. This study would determine what flood damages could occur in these overflow areas during major floods and then recommendations could be made for specific actions to be taken to minimize or eliminate these possible damages. These recommendations might include, but not be limited to, the lowering of the spillway crest, removal of the flashboards, the establishment of an emergency plan in which sandbags would be placed across these two overflow areas; 2) a detailed inspection during reservoir drawdown of all masonry construction including the spillway and especially the spillway abutment walls and the abandoned gate structure to the left of the spillway; 3) an investigation of the seismic stability of the dam.

In addition, the Owner should implement the following operation and maintenance measures: 1) remove trees and brush present on the crest of the dam and growing through cracks in the stone masonry construction; 2) repair all the stone masonry construction as required; 3) develop and implement an ongoing operation and maintenance program to insure the future integrity of the dam; 4) institute a program of annual technical inspection; 5) develop a formal surveillance and flood warning plan, including round-the-clock monitoring of the dam during periods of heavy precipitation and/or runoff; and 6) remove the flashboards during the summer to increase the project discharge capacity.

O'BRIEN & GERE ENGINEERS, INC.

John J. Williams, P.E.
Vice President
New York Registration No. 050794

Date: 7/15/81

This Phase I Inspection Report on Central Street Dam (MA-00340) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

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

ARAMAST MAHTESIAN, MEMBER
Geotechmical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in 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 aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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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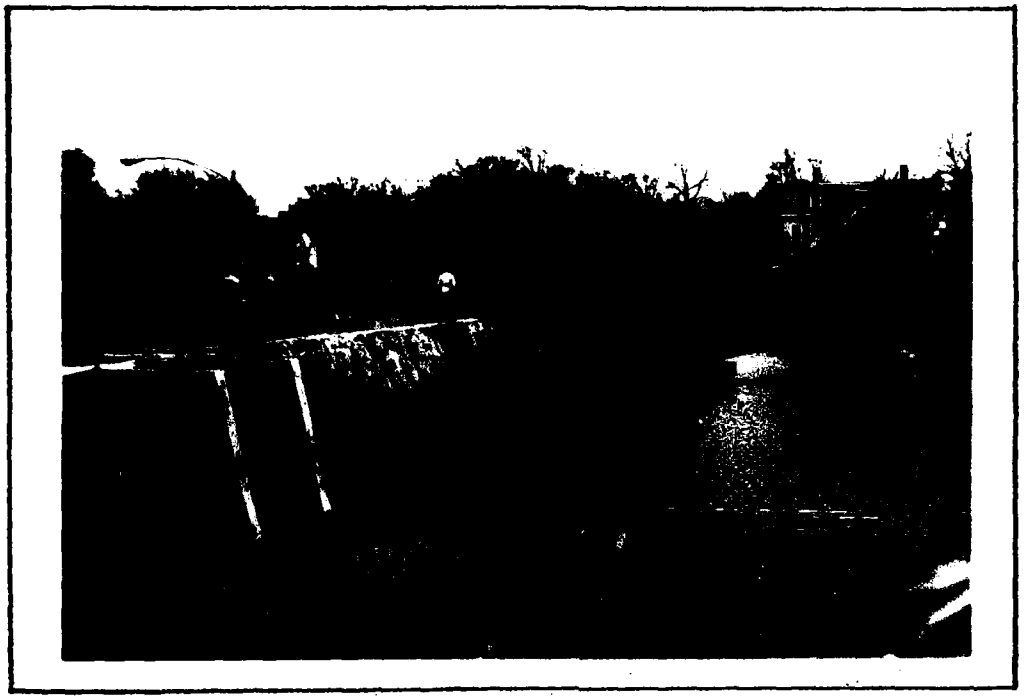
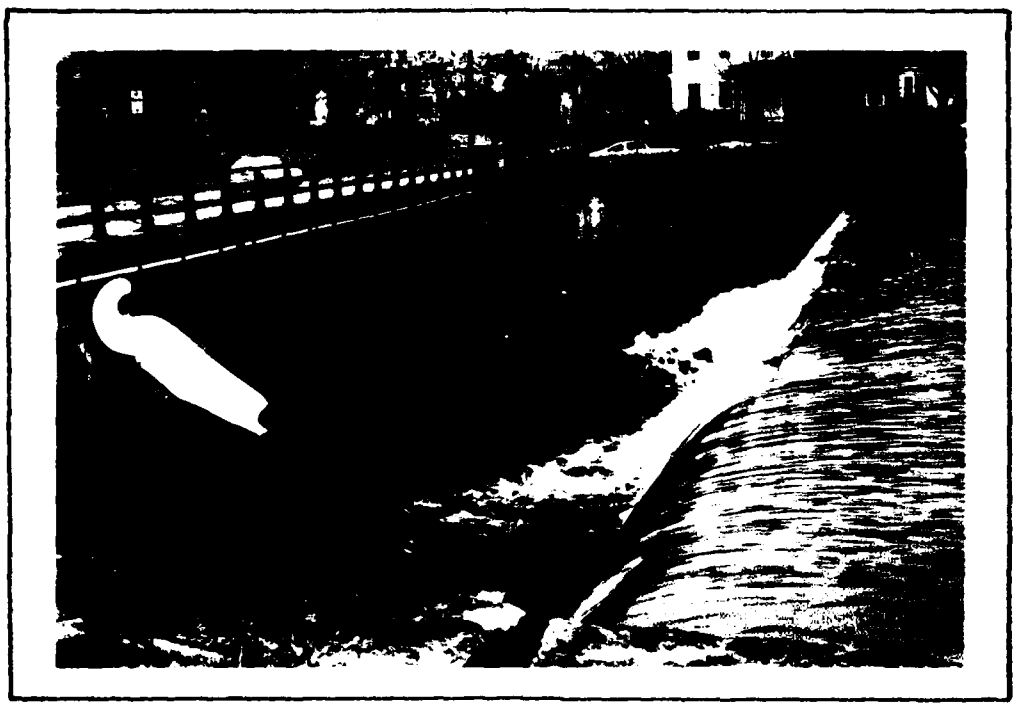


UPSTREAM OVERVIEW OF THE DAM FROM THE LEFT SIDE OF THE IMPOUNDMENT (11/12/79)



DOWNSTREAM OVERVIEW OF THE DAM FROM THE LEFT SIDE SPILLWAY ABUTMENT. (11/12/79)

The peak outflow for the test flood would also be about 10,000 cfs, which would correspond to a reservoir stage of 1.3 feet above the spillway crest (1.3 feet above the top of the dam). The spillway capacity at the crest of dam Elev. 150.0 is 5470 cfs, which is approximately 55 percent of the routed test flood outflow.

5.5 Dam Failure Analysis

A failure of the Central Street Dam was simulated through the use of the HEC-1-DB computer program, assuming a 75-foot wide by 20-foot deep breach with vertical side slopes would develop within one hour from the start of the failure. Failure was assumed to occur with the pool level at spillway crest in the first case and at the top of the dam for the second case. The resulting outflow in each case was routed to the main damage center, located approximately 0.5 miles downstream of the dam along Concord Street. The damage center is located on the right overbank of the Sudbury River and consists of a gas station, lumber yard, other commercial establishments and residences (Pg. C-9). The channel cross-section at this point is shown on sheet D-6. A breach of the dam for either case could cause excessive property damage and the possible loss of more than a few lives. The peak flows at the damage center for each case were 6,140 cfs and 9,760 cfs, respectively.

The breach analysis computed a stream depth of 9.3 feet (4.3 feet above the right channel bank) at the flood impact area for the first case. The depth of the flow in the channel at the flood impact area immediately prior to failure, was judged to be negligible for the first case. For the second case, the breach analysis computed a stream depth of 11.2 feet (6.2 feet above the right channel bank) at the flood impact area. The depth of flow at the flood impact area immediately prior to failure for the second case was computed to be 8.3 feet (3.3 feet above the right channel bank).

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Central Street Dam drainage basin comprises approximately 86.0 square miles of mostly forested land with about 10 percent of the area inundated by reservoirs and 25 percent of the area developed for residential, commercial and industrial purposes. Major bodies of water include Sudbury Reservoir, Whitehall Reservoir, Hopkinton Reservoir, Ashland Reservoir, Framingham Reservoir No. 1, Framingham Reservoir No. 2, and Framingham Reservoir No. 3.

Developed areas within the drainage basin include portions of the Towns of Framingham, Marlborough, Westborough, Ashland, and Southborough. All of these towns lie on major water courses or tributaries of the Sudbury River which ultimately carries runoff to Saxonville Pond. Elevations within the drainage basin range from Elevation 707 at the Fay Mountain Lookout Tower in Westborough to Elevation 144.8 at the spillway crest.

5.2 Design Data

Hydraulic and hydrologic data used for the design of Central Street Dam is not available, according to the Owner's representative.

5.3 Experience Data

The flood of record in Framingham occured in August, 1955, as a result 12.5 inches of rain which fell over a three-day period during Hurricane Diane. The maximum water level recorded at the dam during that period was Elev. 149.2. A corresponding peak outflow of 4,400 cfs was recorded. Further experience data may be obtained from the Saxonville Local Protection, Design Memorandum No. 1, entitled "Hydrologic Analysis", prepared by the Corps of Engineers, New England Division.

5.4 Test Flood Analysis

The recommended test flood range for a "Small" size, "High" hazard dam is from one-half of the Probable Maximum Flood (PMF) to the full PMF. Because the height of the dam is on the low side of the height range for a "Small" size structure, a test flood equivalent to one-half of the PMF has been chosen.

The Corps of Engineers has calculated a Standard Project Flood (SPF) of 10,000 cfs for Central Street Dam (Ref. Saxonville Local Protection, Design Memorandum No. 1, Hydrologic Analysis). Since the SPF generally ranges between 40 percent and 60 percent of the PMF, a one-half PMF value of 10,000 cfs is considered to be a reasonable estimate.

SECTION 4

OPERATION AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. Responsibility for the regulation of the pool level by inserting or removing stop logs and the operation of the 4-foot wide by 6-foot high sluice gate which regulates the discharge to the 54-inch diameter bypass pipe, is under the jurisdiction of the Town of Framingham Engineering Department. According to the Town Engineer, Mr. Fred Sargent, the sluice gate is normally open at all times. Personnel from the Saxonville Industrial Park have obtained permission from the Owner to operate the gate valves on the two 14-inch diameter process water lines to the Industrial Park. The Saxonville Realty Trust Company is responsible for the installation, removal and maintenance of the boards on the crest of the spillway.

Further information with regard to operations, relative to the Saxonville Local Protection Project, is contained in the Operation and Maintenance Manual prepared by the Corps of Engineers.

b. Description of Any Warning System in Effect. Currently, no formal warning system is in effect. According to the Framingham Director of Public Works, Mr. James E. Hanscom, the dam would be monitored during periods of high runoff, so that downstream residents could be alerted in the event of a possible dam failure.

4.2 Maintenance Procedures

a. General. Suggested maintenance procedures have been included in an Operation and Maintenance Manual prepared by the Corps of Engineers for facilities constructed under the Saxonville Local Protection Project. No maintenance procedures exist for the portions of the dam not associated with the Saxonville Local Protection Project.

b. Operating Facilities. Other than occasional removal of debris from the trask rack located at the inlet structure to the 54-inch diameter bypass pipe, no maintenance procedures are performed on a routine basis, according to the Owner's representative.

4.3 Evaluation

The current operation and maintenance procedures recommended for the Saxonville Local Protection Project in the Operation and Maintenance Manual prepared by the Corps of Engineers should be followed. Maintenance of the dam, however, has not been satisfactory and should be improved as recommended in Section 7 of this report.

Other pertinent items observed during the field inspection of the dam included two large sluice gate operators on the portion of the dam just to the left of the spillway, a flood control wall on the left dam embankment constructed by the Corps of Engineers from 1977-79, and an exposed rock ledge at the downstream toe of the spillway. The gate operators apparently have not been used since the bypass pipe was installed. These features are illustrated on photos included in Appendix C.

c. Appurtenant Structures. The outlets from the dam have recently been modified as part of the Saxonville Local Protection Project. These modifications included the installation of two new 14-inch diameter valves on the process water lines to the Saxonville Industrial Park and the installation of a new inlet structure equipped with an upstream trash rack, stop log slots, a 4-foot wide by 6-foot high sluice gate and a 54-inch diameter pipe. Detailed plans and photos of the inlet structure have been included in Appendix B and Appendix C, repsectively.

d. Reservoir Area. The reservoir shoreline has slopes varying from about 2 to 20 percent. The area draining to Central Street Dam is primarily forested with an estimated 10 percent of the basin inundated by reservoirs and 25 percent developed for residential, commercial and industrial purposes. No slope instability along the reservoir shoreline is not evident. Siltation is evident in the reservoir.

e. Downstream Channel. The channel has recently been re-aligned and cleared of all major obstructions under the Saxonville Local Protection Project for a distance of 0.8 miles downstream of the dam. This work was designed and the construction supervised by the Corps of Engineers. The bridge at Concord Street, 0.5 miles downstream of the dam, could obstruct high flows. The remainder of the Sudbury River Channel to the Concord River meanders through generally swampy land and, for the most part, is located away from populated areas.

3.2 Evaluation

The dam appears to be in fair condition. The visible stone masonry construction on either side of the overflow section is deteriorated as evidenced by cracking and loss of mortar, displacement of individual stone blocks, the growth of trees and brush between the blocks, vertical and horizontal misalignment and spurting seepage (10 gpm) discharging through the outlet conduit gate structure. All of the masonry construction, including the spillway and especially the spillway abutment wall and the abandoned gate structure left of the spillway, should be inspected during a period of reservoir drawdown to more accurately assess their condition.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. Central Street Dam was inspected on November 12, 1979. At the time of inspection, water was flowing over the weir crest at a depth of aproximately 1.3 feet and over the flashboards at a depth of 0.1 feet. Because of the large quantity of water flowing over the spillway, it was very difficult to observe the condition of the downstream face of the spillway wall. Underwater areas were not inspected. A check list of observations and comments made during the field inspection is included as Appendix A of this report.

b. Dam. The dam is approximately 400 feet long, the maximum height near the left side of the spillway is 24 feet and it has the following major characteristics:

1. The right abutment of the dam consists of a vertical stone masonry wall which extends from a point approximately 30 feet downstream of the spillway to a point several hundred feet upstream of the dam. This wall shows signs of slight settlement, cracking of mortar between the cut granite stones forming its face, and some undermining at its base downstream of the spillway. These features are illustrated on photo 3 of Appendix C.

2. The spillway is approximately 182 feet long and extends for approximately half the length of the dam. The masonry spillway appears vertical on its downstream face. The upstream face of the spillway was completely submerged and, at the time of the inspection, appeared to be covered either by an upstream embankment or an accumulation of sediment. Wooden flashboards have been installed along the top of the spillway. The flashboards are approximately 1.2 feet high and, except for a 45 foot section at the left side of the spillway and a few places where the flashboards have been broken, extended for the entire width of the spillway. The flashboards were apparently installed to concentrate the discharge along the left side of the spillway where the outlet channel is located, thereby keeping freezing spray off Central Street during the winter.

3. The stone masonry spillway abutment wall, the assumed inoperable outlet conduit gate structure and the embankment retaining walls extending to the left (east) of the spillway are in poor condition. Significant cracking and loss of mortar between individual stone blocks is evident. Trees and brush are growing from voids between the blocks in some locations (refer to pgs. C-2, 4 and 5). The spillway abutment wall to the left of the spillway has blocks which are displaced up to 6 inches from their original positions (refer to pgs. C-2, 4, and 5). Spurting seepage estimated at 10 gpm was discharging from the abandoned stone masonry gate structure near its intersection with the Central Street bridge abutment (refer to Pg C-5). It was noted that remedial grouting of the masonry has been performed in the vicinity of the leakage. The embankment section of the dam east of the bridge abutment appears to be in satisfactory condition.

4. A copy of the Operation and Maintenance Manual prepared by the Corps of Engineers for the Saxonville Local Protection Project, was obtained from the Town of Framingham, Department of Public Works.

No information with respect to the original design and construction of the dam is available, according to the Owner's representative.

b. Adequacy of Information. Sufficient information has been obtained through field observations, from data supplied by the Corps of Engineers, and through subsequent conversations with the Owner's representative and personnel from the town of Framingham to conduct a Phase I dam evaluation.

c. Validity. It appears that the information obtained with respect to the recent dam modifications and the construction of the adjacent Saxonville Local Protection Project are valid.

SECTION 2

ENGINEERING DATA

2.1 Design

According to Mr. John Finley of the Saxonville Realty Trust Company, no design information is available with respect to the original dam construction. Design data for construction of the concrete flood wall, the water chamber structure and the L.P.P., which extends from the dam downstream to Danforth Street, is available at the Corps office in Waltham, MA.

2.2 Construction

Construction information is available from the Corps of Engineers, New England Division, for the Saxonville Local Protention Project. Selected portions of these construction drawings are included in Appendix B. Information relative to the original construction of Central Street Dam is not available according to the Owner's representative.

2.3 Operation

Construction of the Saxonville Local Protection Project between 1977 and 1979 included modifications to existing outlet controls. Two new 14-inch diameter gate valves operated, as required, by personnel from the Saxonville Industrial Park, were installed on the previously existing process water lines to the Saxonville Industrial Park. Construction also included an inlet structure with stop log slots for regulating pool elevations and a manually-operated 4-foot wide by 6-foot high sluice gate used to control the bypass discharge through a 54-inch diameter pipe. The elevation of the stop logs and opening of the sluice gate, however, are currently controlled by personnel from the Town of Framingham, Engineering Department.

2.4 Evaluation

a. Availability. The following information was obtained for the purpose of preparing this report:

1. The inspection report and associated sketches included in Appendix B were obtained from the Commonwealth of Massachusetts, DEQE.

2. Pages B-1 through B-6 included in Appendix B, were obtained from recent Corps of Engineers Contract Drawings for the Saxonville Local Protection Project.

3. The remaining drawings and charts included in Appendix B were obtained from Design Memorandum No. 1 entitled "Hydrologic Analysis" which was prepared by the Corps of Engineers, New England Division, for the Saxonville Local Protection Project.

h. Diversion and Regulating Tunnel. — Not applicable

i. Spillway.

1. Type	Overflow drop
2. Length of weir (total with and w/o flashboards)	182 feet
3. Crest Elevation (w/o flashboards, length 45 feet)	144.8
4. Crest Elevation (w/o flashboards, length 137 feet)	146.0
5. Gates	None
6. Upstream channel	None
7. Downstream channel	Sudbury River

j. Regulatory Outlets.

1. Invert Elevation	132.2
2. Size	54-inch diameter
3. Description	Bypass Pipe
4. Control Mechanism	Manually-operated sluice gate.

9. Total Project Discharge at Test Flood Elevation. The total project discharge, including flow through the 54-inch diameter pipe, is approximately 10,300 cfs at test flood Elev. 151.3.

c. Elevation. (NGVD)

1. Streambed at Toe of Dam	126.0±
2. Bottom of Cutoff	Unknown
3. Maximum Tailwater	Unknown
4. Normal Pool	144.8
5. Full Clood Control Pool	NA
6. Spillway Crest (Ungated)	144.8
7. Design Surcharge	Unknown
8. Top of Dam	150.0
9. Corps of Engineers Wall (Part of Saxonville Local Protection Project)	155.2
10. Test Flood Surcharge	151.3

d. Reservoir Length. (Feet)

1. Normal Pool	9,200
2. Flood Control Pool	NA
3. Spillway Crest Pool	9,200
4. Top of Dam	9,500
5. Test Flood Pool	9,600

e. Storage. (Acre-Feet)

1. Normal Pool	400
2. Flood Control Pool	NA
3. Spillway Crest Pool	401
4. Top of Dam	840
5. Test Flood Pool	990

f. Reservoir Surface. (Acres)

1. Normal Pool	64
2. Flood Control Pool	NA
3. Spillway Crest	64
4. Top of Dam	106
5. Test Flood Pool	125±

g. Dam Data.

1. Type	Masonry/Earth Embankment
2. Length	400 feet
3. Height	24 feet
4. Top Width	Varies
5. Side Slopes (Upstream)	Unknown, Submerged
(Downstream)	Vertical
6. Zoning	Unknown
7. Impervious Core	Unknown
8. Cutoff	Unknown
9. Grout Curtain	Unknown

Street in the winter, flashboards were installed, thus diverting discharge to the left end of the spillway.

1.3 Pertinent Data

a. Drainage Area. The area draining to the Sudbury River upstream of the Central Street Dam includes several bodies of water which are Sudbury Reservoir, Whitehall Reservoir, Hopkinton Reservoir, Ashland Reservoir, Framingham Reservoir No. 1, Framingham Reservoir No. 2, Framingham Reservoir No.3, and several other small lakes and ponds. It is estimated that these bodies of water comprise approximately 10 percent of the drainage basin area. The remaining area is 70 percent forested and 30 percent developed for residential, commercial and industrial purposes. Portions of Framingham, Marlborough, Westborough, Ashland and Southborough are included in the developed areas.

The total drainage area is approximately 86.0 square miles and ranges in elevation from 144.8 at the spillway crest to 707 at the Fay Mountain Lookout Tower in Westborough.

b. Discharge at Damsite

1. Outlet Works. There are three operable outlets which discharge from the water chamber structure: two 14-inch diameter process water lines for the Saxonville Industrial Park and a 54-inch diameter bypass pipe recently installed under the flood control wall, which was constructed by the Corps of Engineers from 1977-1979. The capacity of the process water lines is not known, but the discharge from the 54-inch diameter bypass pipe is estimated to be 260 cfs at normal pool elevation.

2. Maximum Known Flood. The flood of record for the Sudbury River at Central Street Dam occurred over a three day period, from August 17 to 19, 1955. The peak discharge for this event was 4400 cfs with the corresponding stage in the impoundment at Elev. 149.2.

3. Ungated Spillway Capacity at Top of Dam. The spillway capacity at top of dam Elevation 150.0, is 5470 cfs.

4. Ungated Spillway Capacity at Test Flood Elevation. At test flood elevation 151.3, the ungated spillway capacity is approximately 10,000 cfs.

5. Gated Spillway Capacity at Normal Pool Elevation. Not Applicable.

6. Gated Spillway Capacity at Test Flood Elevation. Not Applicable.

7. Total Spillway Capacity at Test Flood Elevation. (See 4 above)

8. Total Project Discharge at Top of Dam. The total project discharge, including flow through the 54-inch diameter bypass pipe, is estimated to be 5790 cfs at top of dam Elevation 150.0.

The breach analysis computed a stream depth of 11.2 feet (6.2 feet above the right channel bank) at the flood impact area for the situation with the reservoir surface at the top of the dam. The depth of flow at the flood impact area immediately prior to failure was computed to be 8.3 feet (3.3 feet above the right channel bank) with the reservoir surface at the top of the dam. For a dam breach with the reservoir surface at the spillway crest, the stream depth at the flood impact area would be 9.3 feet (4.3 feet above the right channel bank). The depth of flow in the channel at the flood impact area immediately prior to failure would be negligible with the reservoir surface at the spillway crest.

Because of these conditions, the hazard classification for Central Street Dam is "High".

e. Ownership. The dam is owned by the Saxonville Realty Trust Company, 2 Central Street, Framingham, MA 01701,Telephone: (617) 877-8001.

f. Operator. Mr. Fred Sargent, Engineer for the Town of Framingham (Telephone: (617) 875-8646), is currently responsible for the operation and maintenance of the 54-inch diameter bypass pipe and sluice gate plus the associated stoplogs and trash rack. This system is located in the left portion of the dam under the flood control wall built by the Corps of Engineers.

According to Mr. Sargent, it is expected that the Department of Public Works will soon assume this responsibility. In that event, the Director of Public Works, Town of Framingham, Mr. James E. Hanscom (Telephone: (617) 872-4391), would be the responsible person.

Control of the flow of water to the Saxonville Industrial Park, through two 14-inch diameter gate valves on the process water lines, has been assigned to Mr. Thomas Maroneski (Telephone: (617) 877-8001) by the Saxonville Realty Trust Company. The Saxonville Realty Trust is responsible for the installation, removal and maintenance of the flashboards on the crest of the spillway.

g. Purpose of Dam. Central Street Dam was most likely constructed for industrial water supply purposes. Currently, the dam impounds water for industrial purposes.

h. Design and Construction History. The dam was originally constructed about 1900 to impound water for the Roxbury Carpet Company (now known as the Saxonville Industrial Park). Further design and construction information is not available according to the Owner's representative, Mr. John Finley. Information on the 175 feet long concrete flood wall and the water chamber (inlet) structure built in 1977-1979 is available at the Corps office in Waltham, MA; the town engineer has the construction drawings for these modifications.

i. Normal Operating Procedures. According to the Owner's representative, there are no operating procedures followed on a routine basis. Personnel from the Industrial Park operate the 14-inch diameter gate valves which control the amount of water supplied to the factory. The gate for the 54-inch diameter bypass pipe is usually in the open position. The flashboards and the spillway appear to have not been maintained for several years. To reduce spray, which would turn to ice on Central

Street. Approximately 8 river miles further downstream in the Town of Wayland, the Sudbury River is joined by Wash Brook. From that point, the Sudbury River winds approximately 12 river miles in a northerly direction to the Town of Concord, where it joins the Assabet River to form the Concord River, a principal tributary of the Merrimack River.

b. Description of Dam and Appurtenances. Central Street Dam is a composite masonry and earth dam which impounds water from the Sudbury River to form Saxonville Pond. The dam is approximately 400 feet long and has a maximum height of 24 feet. A vertical stone masonry wall adjacent to Centennial Place forms the right abutment of the dam. From this wall the masonry spillway extends 182 feet to another masonry wall (photo 4, appendix D) which continues for about 40 feet and then ties into a new concrete wall. This 175 foot long wall along the left embankment was constructed by the Corps of Engineers in 1977-79 to prevent floodwaters from the pond from overflowing onto Central Street and into the Village of Saxonville.

The outlet works at the dam have also been modified by the Corps as part of the Saxonville Local Protection Project (L.P.P.) contract. This modification included installation of a new water chamber structure (inlet) with an upstream trash rack, stop log slots, a 4-foot by 6-foot sluice gate, 54-inch diameter discharge pipe to the downstream channel and 14-inch diameter valves on the process water lines to the Saxonville Industrial Park. Detailed plans and photos of the inlet structure are included in appendix B & C, respectively.

The improvements to the outlet works and the construction of the 175-foot concrete wall were necessary as part of the Saxonville Local Protection Project (L.P.P.). The L.P.P. is located along the left bank of the Sudbury River and extends from the Central Street Dam to the Danforth Street Bridge, a distance of about 3,800 feet. Project features consist of 2,500 feet of earth dikes, 1,340 feet of concrete floodwalls, channel realignment, a pumping station, a vehicular flood gate and other appurtenant works. The L.P.P. was designed for a Standard Project Flood of 10,000 cfs with a minimum freeboard of two feet. The project was constructed over a period of three years from 1977 to 1979 to provide flood protection to the Village of Saxonville.

c. Size Classification. Central Street Dam has a maximum height of 24 feet and a maximum storage capacity of 840 acre-feet with the water surface at the top of the dam. Because the maximum height is less then 40 feet and the maximum storage is less then 1,000 acre-feet, Central Street Dam is classified as a "Small" size structure.

d. Hazard Classification. Because of the construction of the Saxonville Local Protection Project in 1979, the downstream flood impact area is now located in an area approximately 0.5 miles downstream of the dam along Concord Street on the right side of the river. Several commercial and residential buildings in this area could experience excessive damage and the possible loss of more than a few lives could occur with a breaching of Central Street Dam. In addition, excessive property damage and possible loss of life could be experienced in the area to the left of the Concord Street Bridge if the flood gates are not closed during a flood event.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CENTRAL STREET DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. The National Dam Inspection Act (Public Law 92-367) was passed by Congress on August 8, 1972. This Act authorized the Secretary of the Army to initiate, through the Corps of Engineers, the National Program for Inspection of Dams throughout the United States. Responsibility for supervising inspection of dams in the New England Region has been assigned to the New England Division of the Corps of Engineers.

O'Brien & Gere Engineers, Inc. has been retained by the New England Division to inspect and report on selected non-federal dams in the Commonwealth of Massachusetts. Authorization and Notice to Proceed were issued to O'Brien & Gere by a letter dated November 6, 1979 and signed by Colonel William E. Hodgson, Jr. Contract No. DACW 33-80-C-0014 has been assigned by the Corps for this work.

b. Purpose of Inspection. The purpose of inspecting and evaluating non-federal dams is to:

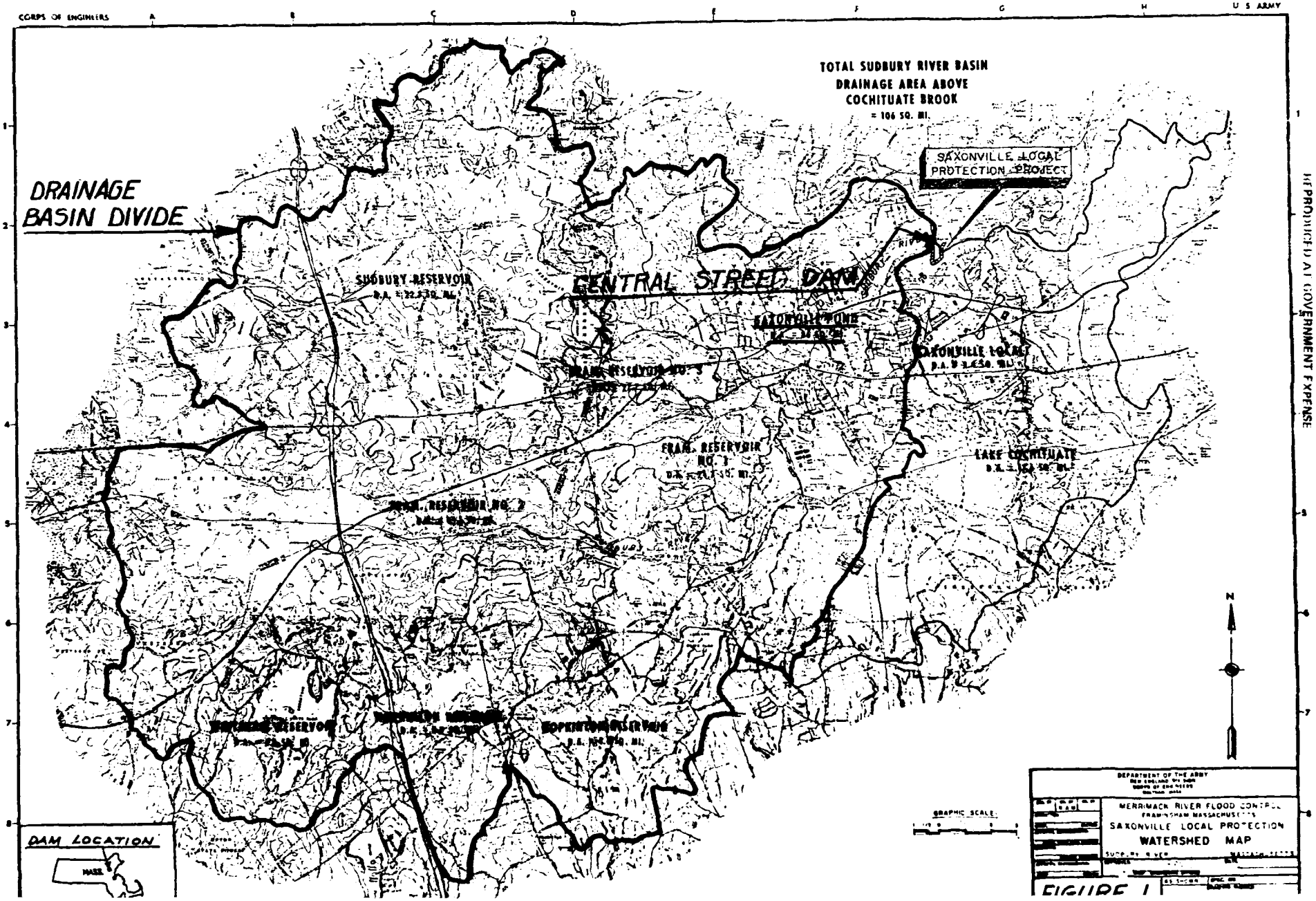
1. Identify conditions which would threaten public safety and make the Owner aware of any deficiencies to permit him to correct them in a timely manner;

2. Encourage and prepare the states to initiate effective dam safety programs for non-federal dams as soon as possible.

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

1.2 Description of Project (Information with regard to this dam was obtained from the Corps of Engineers, the Town of Framingham and the Massachusetts Department of Environmental Quality & Engineering (DEQE).)

a. Location. Central Street Dam, often referred to as the Saxonville Dam, is located in the Town of Framingham, Massachusetts. The Watershed Map from the Saxonville Local Protection, Design Memorandum No. 1, entitled "Hydrologic Analysis", prepared by the Corps of Engineers, New England Division, has been included as Figure 1 on page vi of this report to illustrate the location. USGS reference coordinates for this site are N 42°19.5' and W 71° 24.1'. The major drainage center, that area most likely to be adversely affected by a failure of Central Street Dam, is located approximately 0.5 miles downstream of the dam in the vicinity of Concord


CORPS OF ENGINEERS
U S ARMY
TOTAL SUDBURY RIVER BASIN
DRAINAGE AREA ABOVE
COCHITUATE BROOK
= 106 SQ. MI.
SAXONVILLE LOCAL
PROTECTION PROJECT
DRAINAGE
BASIN DIVIDE
CENTRAL STREET DAM
SUDBURY RESERVOIR
SAXONVILLE DAM
FRAM. RESERVOIR NO. 3
SAXONVILLE LOCAL
FRAM. RESERVOIR
NO. 1
LAKE COCHITUATE
FRAM. RESERVOIR NO. 2
DAM LOCATION
MASS.
GRAPHIC SCALE
DEPARTMENT OF THE ARMY
NEW ENGLAND DIV. CORPS
OF ENGINEERS
WALTHAM, MASS.
MERRIMACK RIVER FLOOD CONTROL
FRAMINGHAM MASSACHUSETTS
SAXONVILLE LOCAL PROTECTION
WATERSHED MAP
FIGURE 1
REPRODUCED AT GOVERNMENT EXPENSE

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The dam appears to be in fair condition. The visible stone masonry construction on either side of the overflow section is deteriorated as evidenced by cracking and loss of mortar, displacement of individual stone blocks, the growth of trees and brush between the blocks, vertical and horizontal misalignment and spurting seepage (10 gpm) discharging through the outlet conduit gate structure. Several photos of these conditions are included in Appendix C.

6.2 Design and Construction Data

The only design and construction data obtained for this site are related to construction of the Saxonville Local Protection Project between 1977 and 1979. According to the Owner's representative, drawings of the original dam construction are not available.

6.3 Post Construction Changes

The U.S. Army Corps of Engineers designed and supervised construction of certain facilities at the dam site between 1977 and 1979. Modifications to existing dam facilities included installation of new gate valves on two existing 14-inch diameter process water lines serving the Saxonville Industrial Park, construction of a 54-inch diameter outlet used to bypass flows around the spillway and construction of a concrete wall about 175 feet long on the crest of the dam beginning from the left abutment. Drawings of these modifications are included in Appendix B.

6.4 Seismic Stability

The dam is located in Seismic Zone 3 on the "Seismic Zone Map of Contiguous States." Therefore, according to the recommended guidelines for Phase I Safety Inspection of Dams, a seismic stability analysis should be performed as recommended in Section 7.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Conditions. Based upon a visual examination of the site, it appears that Central Street Dam is in fair condition. The visible stone masonry construction on either side of the spillway is deteriorated as evidenced by cracking and loss of mortar, displacement of individual stone blocks, vegetative growth between the blocks, vertical and horizontal misalignment and spurting seepage (10 gpm) discharging through the outlet conduit gate structure. Furthermore, the condition of the spillway could not be adequately assessed because of the large quantity of water flowing over the weir.

b. Adequacy of Information. Sufficient information has been obtained through field observations, from data supplied by the Corps of Engineers, and through subsequent conversations with the Owner's representative and personnel from the Town of Framingham to conduct a Phase I dam evaluation.

c. Urgency. The recommendations and remedial measures described in this section should be implemented within one year from the date of receipt of this report. However, because of the large quantity of water flowing over the spillway, it is recommended that further inspection be performed during a period when the reservoir can be drawn down below the spillway crest.

7.2 Recommendations.

It is recommended that the Owner retain the services and implement the recommendations of a qualified registered professional engineer, experienced in the design and construction of dams, for the following purposes:

1. Perform a detailed hydraulic study to determine the discharge capacity of the dam when Saxonville Pond floodwaters start to overflow Central Street in the area of Centennial Place of the low area near the easterly side of Hallett Road. Determine what flood damages could occur in these overflow areas during major floods and then recommend specific actions to be taken to minimize or eliminate these possible damages. These recommendations might include, but not be limited to, the lowering of the spillway crest, removal of the flashboards, the establishment of an emergency plan in which sandbags would be placed across these two overflow areas.

2. All of the masonry construction, including the spillway and especially the spillway abutment wall and abandoned gate structure east of the spillway, should be inspected during a period of reservoir drawdown to more accurately assess the condition of these structures.

3. An investigation of the seismic stability of the dam (utilizing conventional equivalent static load methods) should be performed.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The Owner should also implement the following operation and maintenance procedures:

1. Trees and brush present on the crest of the dam and growing through the cracks in the mortar of the stone masonry construction should be removed.

2. All stone masonry construction should be repaired as required.

3. Develop and implement an ongoing operation and maintenance program to insure the future integrity of the dam.

4. Institute a program of annual periodic technical inspection.

5. A formal surveilance and flood warning plan should be developed, including round-the-clock monitoring during periods of heavy precipitation.

6. The flashboards should be removed during the summer to increase project discharge capacity.

7.4 Alternatives

No valid alternatives to the recommendations described above are considered feasible for this site.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

INSPECTION TEAM ORGANIZATION

Project: Central Street Dam

National I.D. #: MA 00340

Location: Framingham, Massachusetts

Type of Dam: Earth Embankment

Inspection Date(s): November 12, 1979

Weather: Overcast, lt. rain, mid 40's

Pool Elevation: 146.3 ± MSL

Inspection Team

Leonard Beck	O'Brien & Gere	Structures
Steven Snider	O'Brien & Gere	Foundations & Materials
Alan Hanscom	O'Brien & Gere	Structures
Rodney Georges	Bryant & Associates	Hydrology/Hydraulics

*Mr. John J. Williams, Vice-President, O'Brien & Gere has visited the site but not necessarily in conjunction with the inspection team.

Owner's Representative

Mr. John Finley; Saxonville Realty Trust Company; 2 Central St.; Framingham, MA; 01701; Telephone: (617) 877-8001.

VISUAL INSPECTION CHECK LIST

Project: Central Street Dam

National I.D. #: MA 00340

Date(s): November 12, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	150±
Current Pool Elevation	146.3
Maximum Impoundment to Date	700± Acre-feet
Surface Cracks	None Observed
Pavement Condition	NA
Movement or Settlement of Crest	Negligible
Lateral Movement	at northeast masonry wall
Vertical Alignment	masonry stones have shifted
Horizontal Alignment	Fair condition
Condition at Abutment and at Concrete Structures	Very poor condition - NE abut.
Indications of Movements of Structural Items on Slopes	No significant movement
Trespassing on Slopes	Very little
Vegetation on Slopes	Several trees growing from masonry retaining wall
Sloughing or Erosion of Slopes or Abutments	Significant sloughing at retaining wall
Rock Slope Protection - Riprap Failures	No Riprap, but retaining wall is failing

VISUAL INSPECTION CHECK LIST

Project: Central Street

National I.D. #: MA 00340

Date(s): November 12, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Con't)	
Unusual Movement or Cracking at or near Toes	NA
Unusual Embankment or Downstream Seepage	Much seepage through retaining wall
Piping or Boils	None observed
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	NA

VISUAL INSPECTION CHECK LIST

Project: Central Street Dam

National I.D. #: MA 00340

Date(s): November 12, 1979

AREA EVALUATED	CONDITIONS
CONCRETE/MASONRY DAM	
Crest Elevation	144.8
Current Pool Elevation	146.3±
Maximum Impoundment to Date	700± Acre-Feet
Any Noticeable Seepage	At masonry retaining wall
Conditions of Abutment	Poor at NE abutment
Drains	Unknown
Water Passages	Unknown
Foundation	Unknown
Masonry/Concrete Surface Cracks	Much cracking in ret. wall
Structural Cracking	Impossible to see because of high discharge rate
Vertical and Horizontal Alignment	Appears to be good
Monolith Joints	Poor @ ret. wall - see photos
Construction Joints	Cannot observe
Upstream Embankment	Grass-covered w/ brush
Instrumentation System	None
Inspection Galleries	None

VISUAL INSPECTION CHECK LIST

Project: Central Street Dam

National I.D. #: MA 00340

Date(s): November 12, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	None
General Condition	NA
Loose Rock Overhanging Channel	NA
Trees Overhanging Channel	NA
Floor of Approach Channel	NA
b. Weir and Training Walls	
General Condition of Concrete	Appears to be fair
Rust or Staining	None Observed
Spalling	Slight
Any Visible Reinforcing	None Observed
Any Seepage or Efflorescence	None Observed
Drain Holes	Unknown
c. Discharge Channel	
General Condition	Irregular ledge formation

VISUAL INSPECTION CHECK LIST

Project: Central Street Dam

National I.D. #: MA 00340

Date(s): November 12, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Con't)	
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Irregular - see photos
Other Obstructions	Bridge Piers

APPENDIX B

ENGINEERING DATA

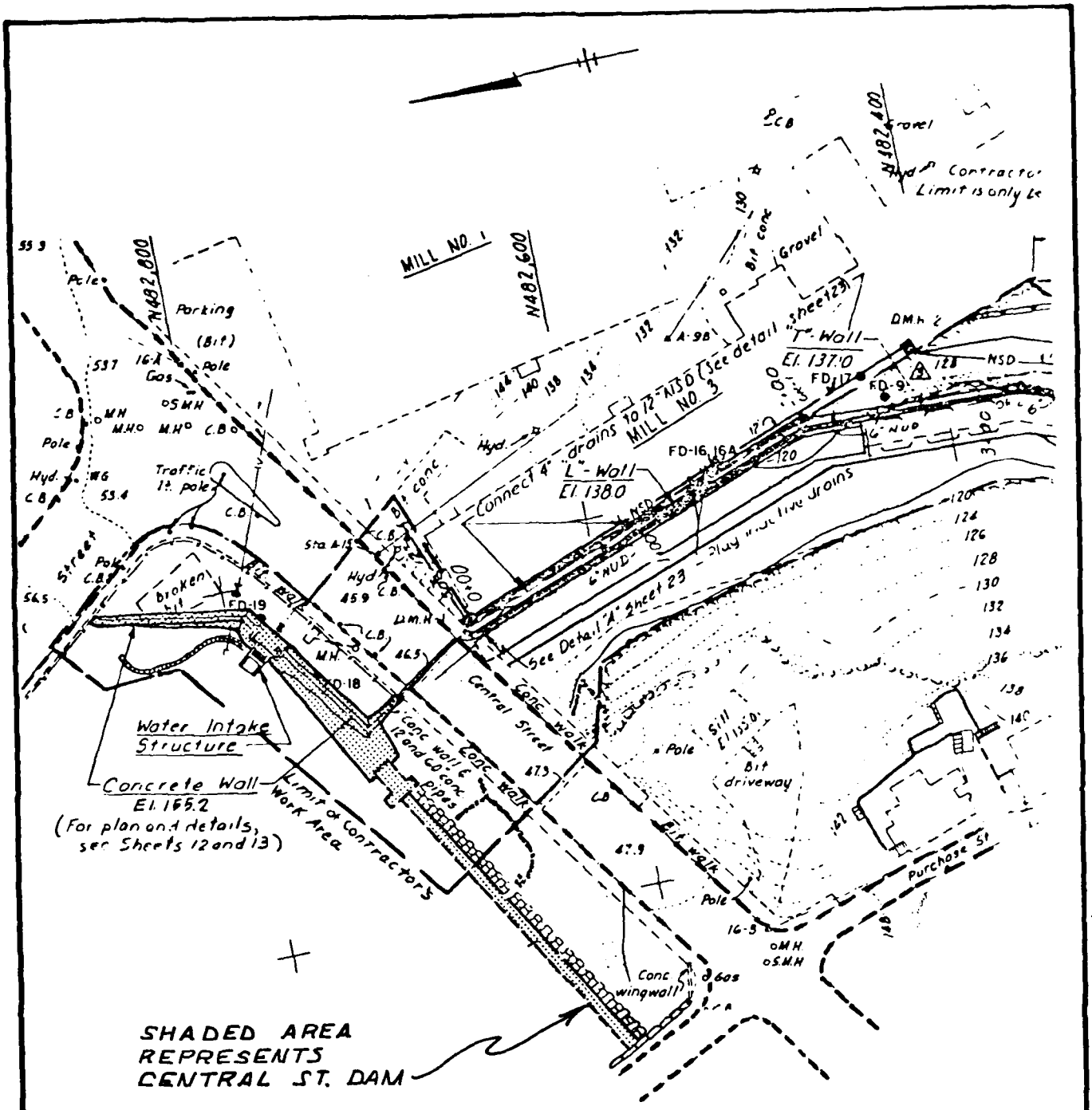
O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
CENTRAL STREET DAM				

APPENDIX B

ENGINEERING DATA

TABLE OF CONTENTS

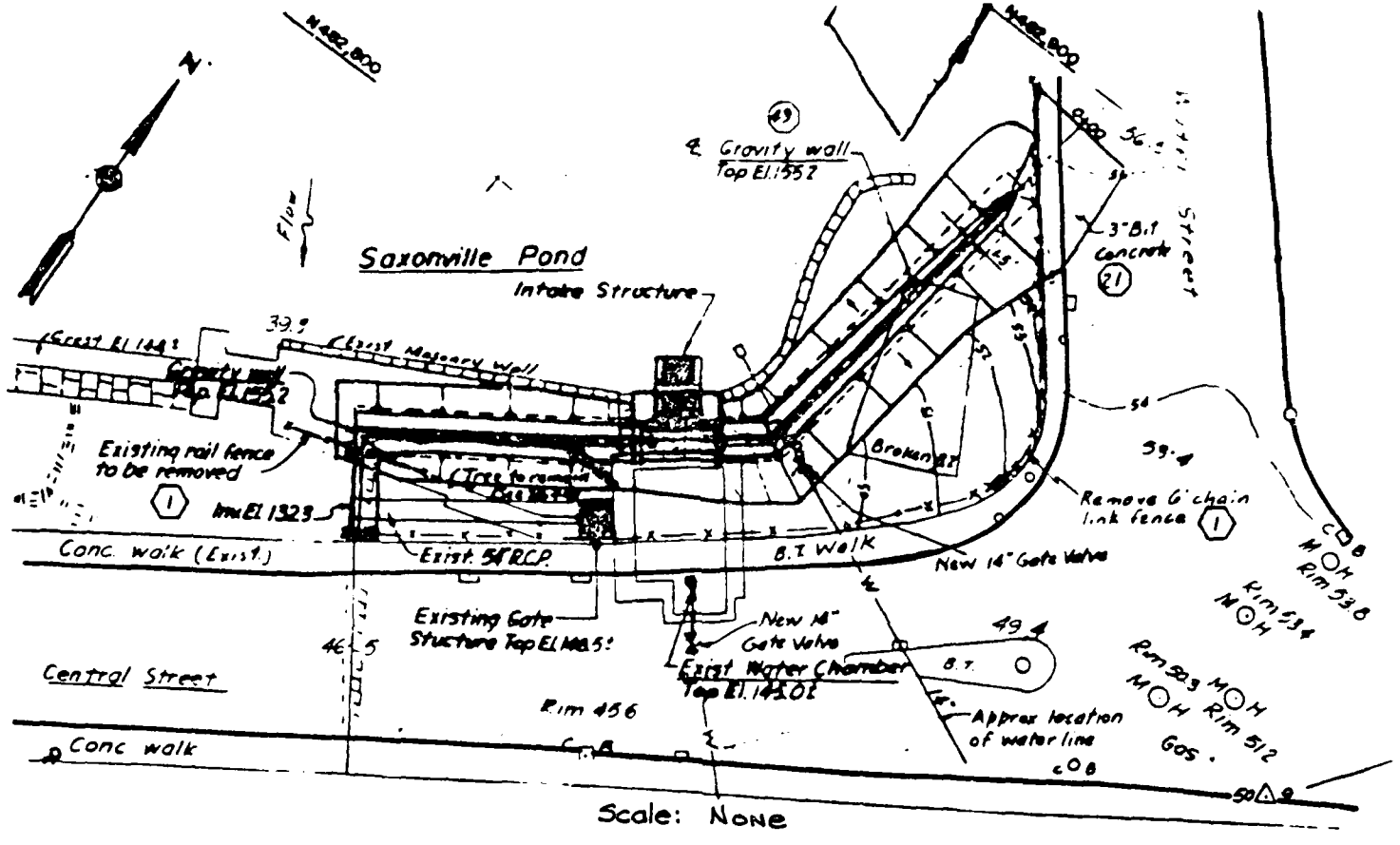


SITE PLAN

Scale: None

NOTE: THIS PLAN HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.

B-1



PLAN OF CENTRAL ST. DAM
FLOOD CONTROL WALL

NOTE:
This plan has been reproduced from U.S. Army Corps of Engineers Design Drawings.

B-2

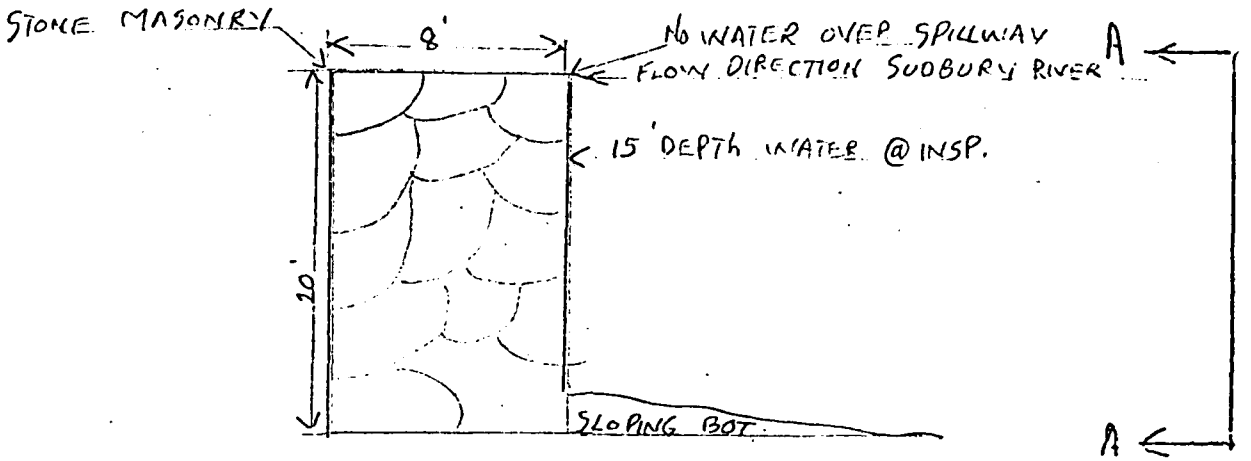
TABLE 1-I

PERTINENT DATA ON RESERVOIRS AND DAMS IN THE SUDBURY RIVER WATERSHED

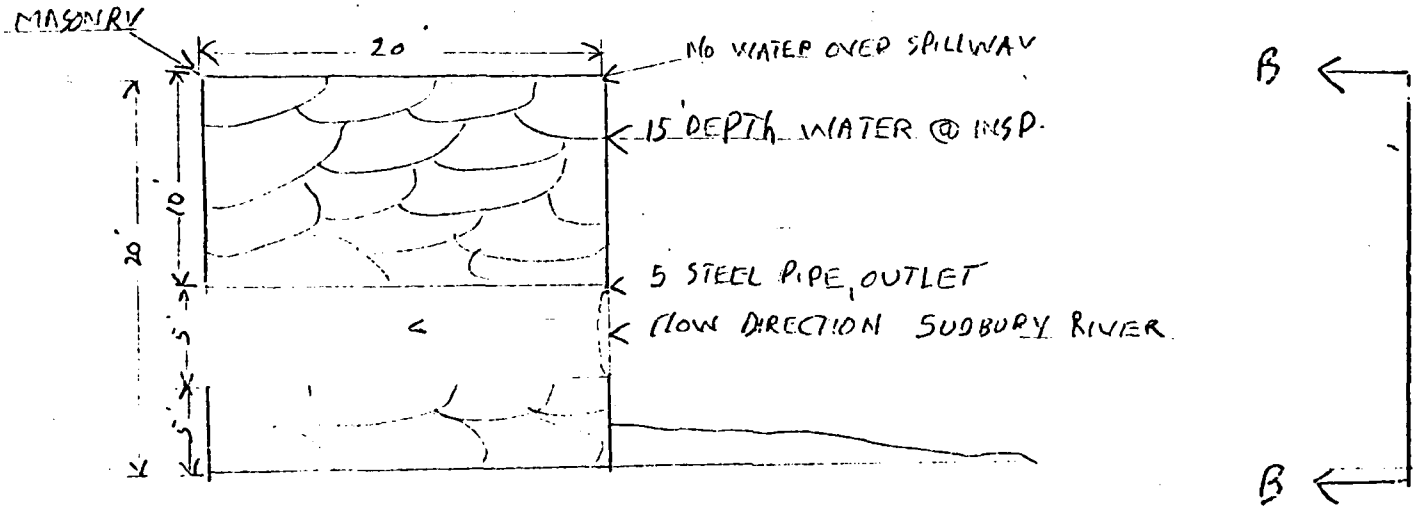
Name	Drainage Area (sq. mi.)	Surface Area (acres)	Capacity (ac-ft)	Spillway Length (feet)	Spillway Crest Elevation (ft msl)	Top of Flashboards (ft msl)	Top of Dam Elevation (ft msl)
Ashland	6.43	169	4,345	30	218.58	219.56	225.35
Hopkinton	5.86	193	4,665	30	298.35	299.35	305.35
Whitehall	4.35	601	3,855	--	--	--	334.25*
Sudbury	22.28	1,292	22,249	300	253.35	254.51	260.35
Framingham #1	74.66	154	954	168.25	161.95	163.62	171.15
" #2	45.14	134	1,726	184.38	170.22	171.47	178.18
" #3	27.68	250	3,680	100.25	179.64	180.85	185.67
Saxonville	86	30±	--	181.7	144.8	146.0±	148 left abut. 150 right abut.
L. Cochituate	17.58	730	6,433	63	138.71	138.75	142.71

* Overflow elevation of roadway on top of dam.

4-9-100-6



X SECTION AA



X SECTION BB

SKETCH NOT TO SCALE

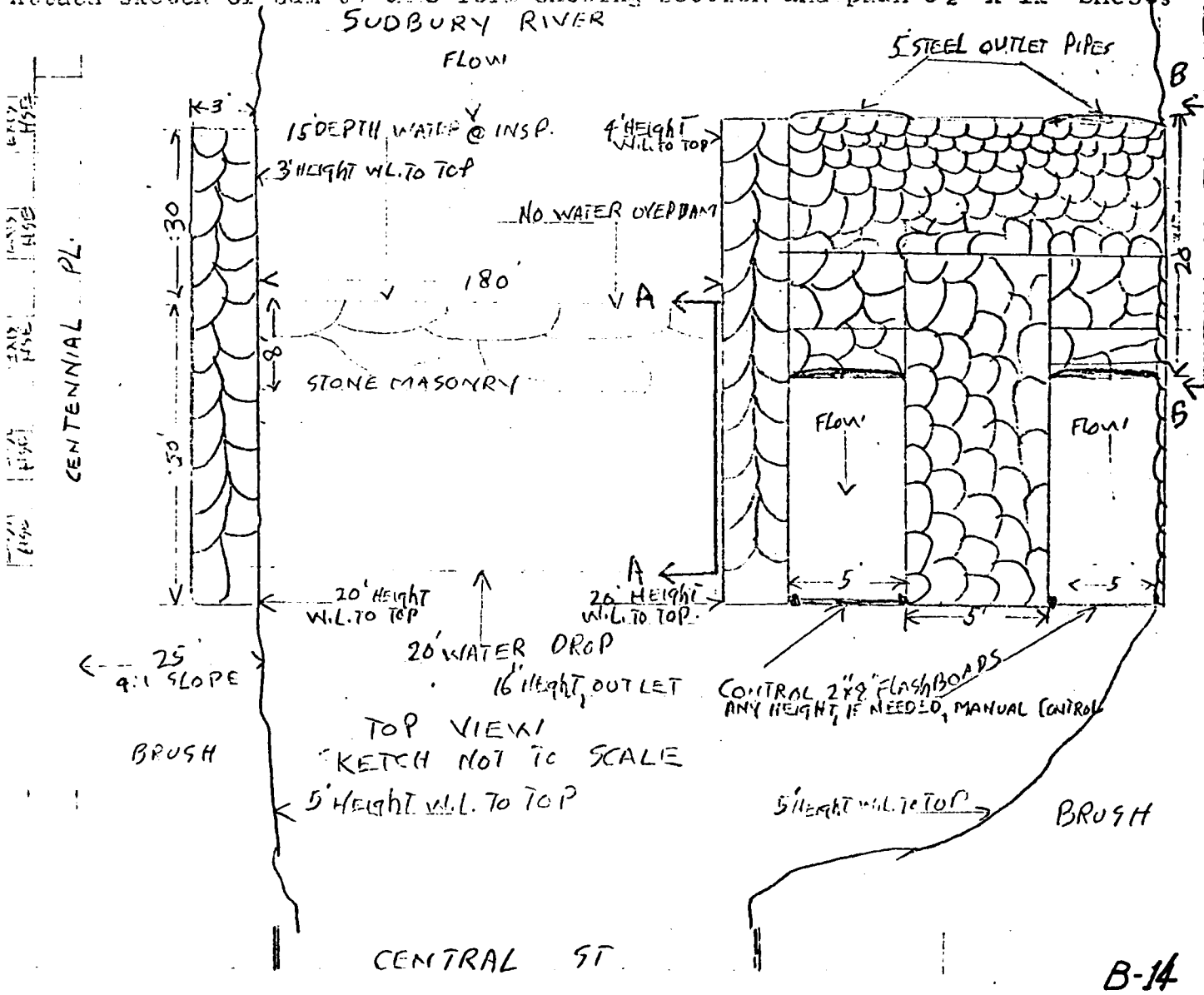
DAM NO. 14-9-100-6

Risk to life and property in event of complete failure.

No. of people EST. 50
No. of homes
No. of businesses 1
No. of industries
No. of utilities
Railroads
Other dams
Other

Type
Type

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



B-14

DESCRIPTION OF DAM
DISTRICT #4

mitted by FRANCIS H. PARÉ & ADAM Z. PIZAN Dam No. 4-9-100-6
7/25/73 City/Town FRAMINGHAM, 01701
Name of Dam CENTRAL ST DAM

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

Year built: 1900 Year/s of subsequent repairs REPAIRED DAM, 6/10/73
5/73

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

Drainage Area: 2 SQ. Mi. 1280 ACRES.

Normal Ponding Area: 60 acres; Ave. Depth 6'
Impoundment: 120 MIL. gals; 360 acre ft.

No. and type of dwellings located adjacent to pond or reservoir i.e. summer homes etc. 1 BUSINESS AT DAM OUTLET

Dimensions of Dam: Length 180' Max. Height 20'
Slopes: Upstream Face VER.
Downstream Face "
Width across top 10'

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

A. Description of present land usage downstream of dam: 25 % rural; 75 % urban

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

B-13

DAM NO. 4-9-100-7 (6)

2.) Remarks & Recommendations: (Fully Explain)

DAM IS IN GOOD CONDITION.

(3.) 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 _____

DAM NO. 4-9-100-7 6

) Downstream Face of Dam: Condition: 1. Good ✓ 2 Minor Repairs ____

3. Major Repairs ____ Urgent Repairs ____

Comments: ____

) Emergency Spillway: Condition: 1. Good ✓ 2. Minor Repairs ____

3. Major Repairs ____ 4. Urgent Repairs ____

Comments: ____

5) Water level @ time of inspection ____ ft. above 0.5' below ____

top of dam ✓ Principal spillway ____

other ____

1) Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ____

Animal Burrows and Washouts ____

Damage to slopes or top of dam ____

Cracked or Damaged Masonry ____

Evidence of Seepage ____

Evidence of Piping ____

Erosion ____

Leaks ____

Trash and/or debris impeding flow ____

Clogged or blocked spillway ____

Other NO DEFICIENCIES NOTED

6

OK File

INSPECTION REPORT - DAMS AND RESERVOIRS

(1.) Location: ~~City~~/Town FRAMINGHAM Dam No. 4-9-100-5

Name of Dam CENTRAL ST. DAM Inspected by A.Z. PIZAN + F.H. PARE

Date of Inspection 7-25-'73

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

Reg. of Deeds _____ Pers. Contact _____

	Name	St. & No.	~~City~~/Town	State	Tel. No.
1.	SAXONVILLE REALTY TRUST	2 CENTRAL ST.	FRAMINGHAM	MASS. 01701	877-8001
2.					
3.					

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

	Name	St. & No.	City/Town	State	Tel. No.
	SAME				

(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.

Remarks: _____

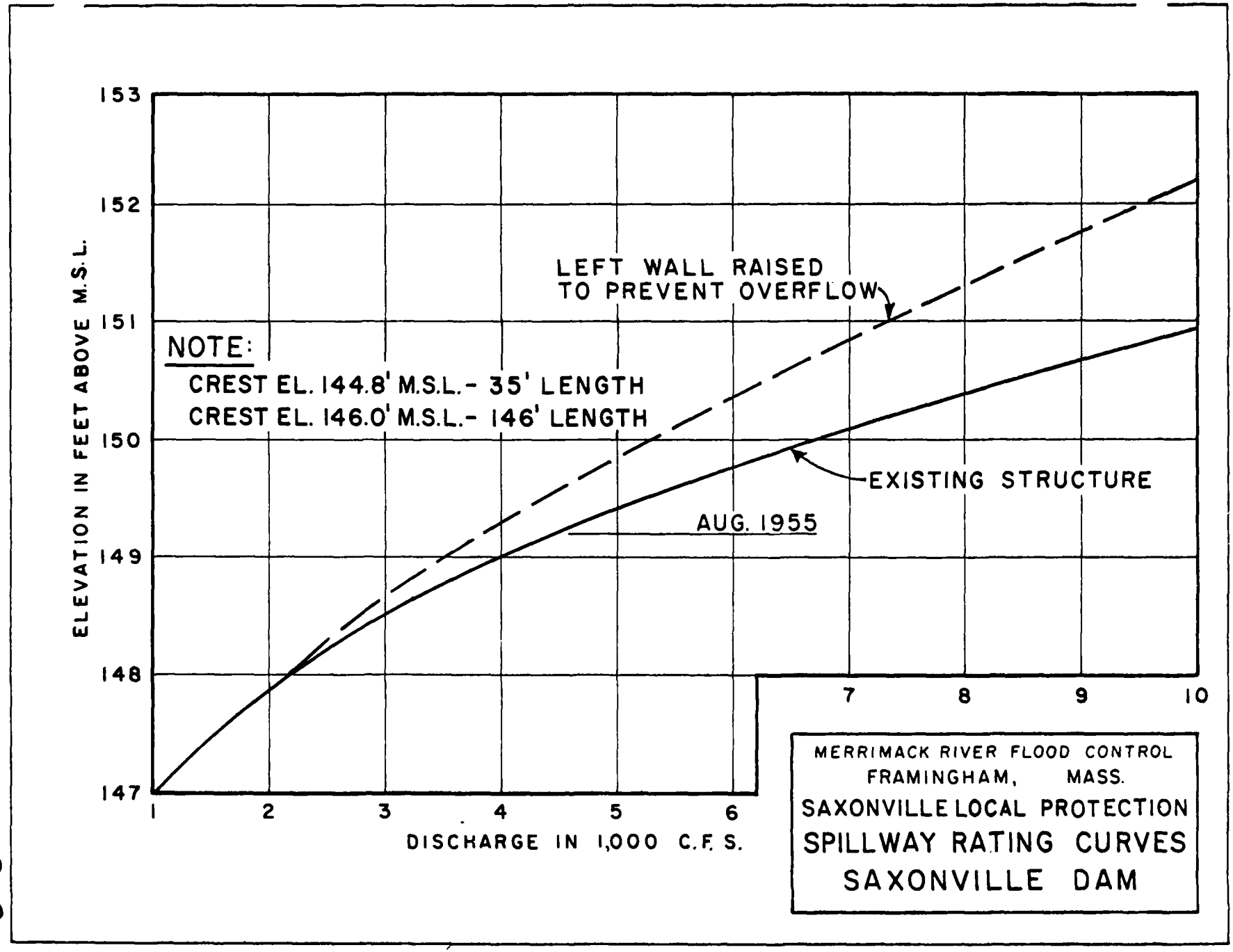
(7) Upstream Face of Dam: Condition:

1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

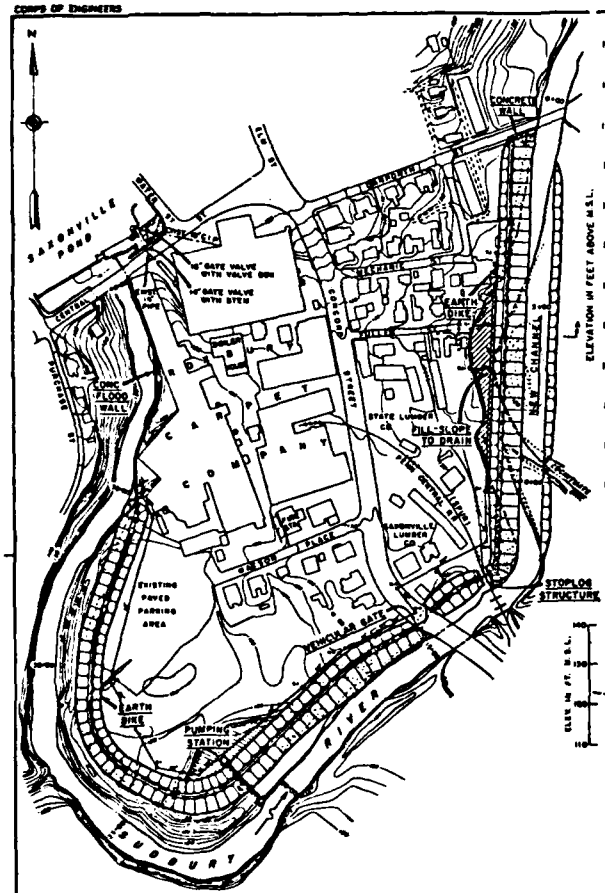
Remarks: _____

B-10


153
152
151
150
149
148
147
ELEVATION IN FEET ABOVE M.S.L.
1
2
3
4
5
6
7
8
9
10
DISCHARGE IN 1,000 C.F.S.
LEFT WALL RAISED
TO PREVENT OVERFLOW
NOTE:
CREST EL. 144.8' M.S.L.- 35' LENGTH
CREST EL. 146.0' M.S.L.- 146' LENGTH
EXISTING STRUCTURE
AUG. 1955
MERRIMACK RIVER FLOOD CONTROL
FRAMINGHAM, MASS.
SAXONVILLE LOCAL PROTECTION
SPILLWAY RATING CURVES
SAXONVILLE DAM

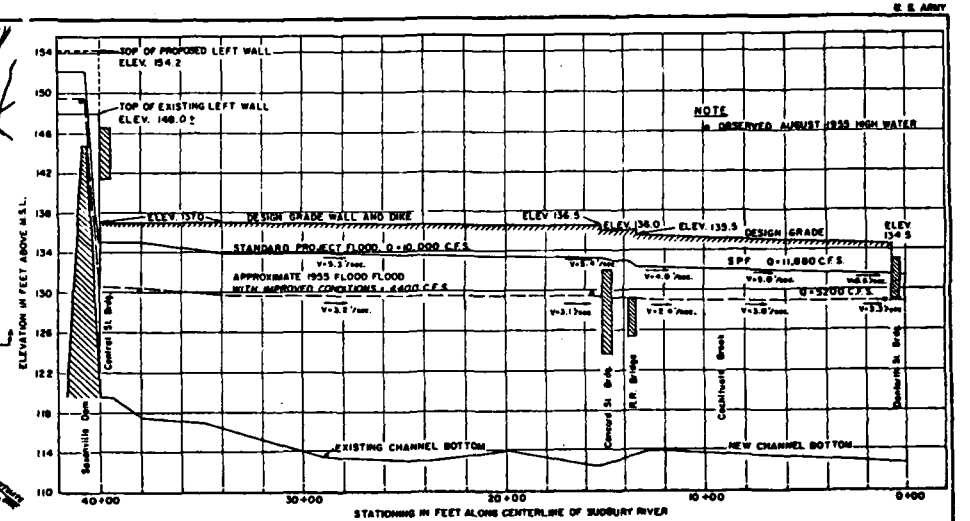
CORPS OF ENGINEERS

U. S. ARMY

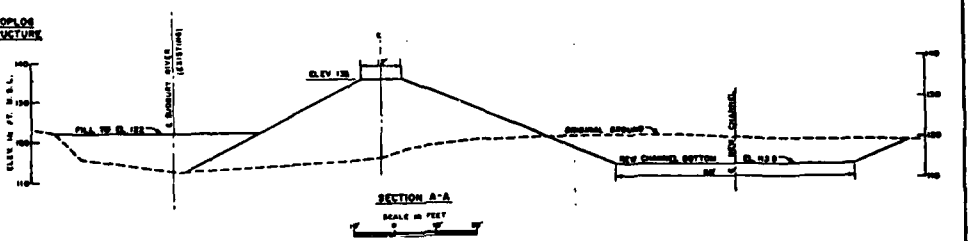


GENERAL PLAN

SCALE IN FEET

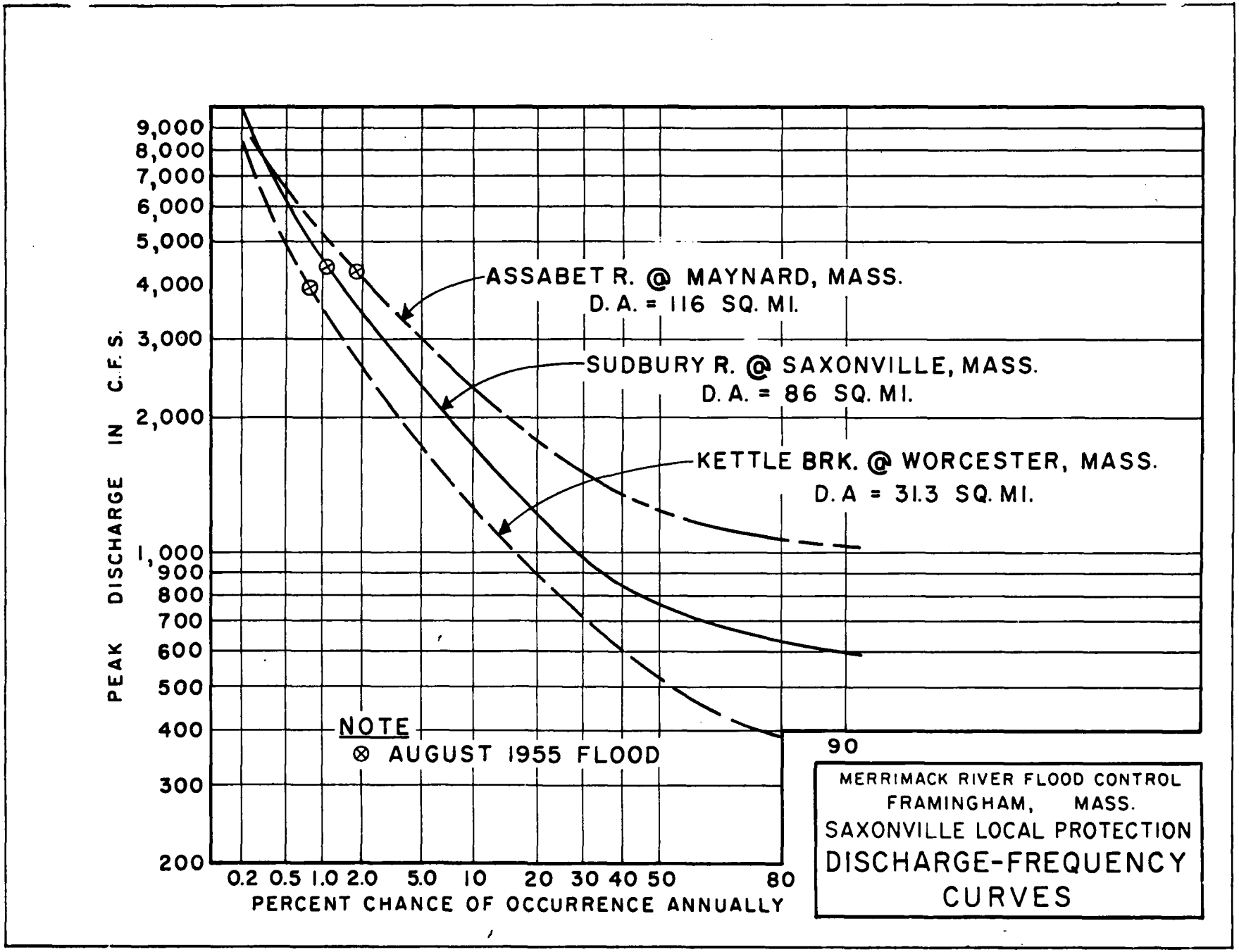


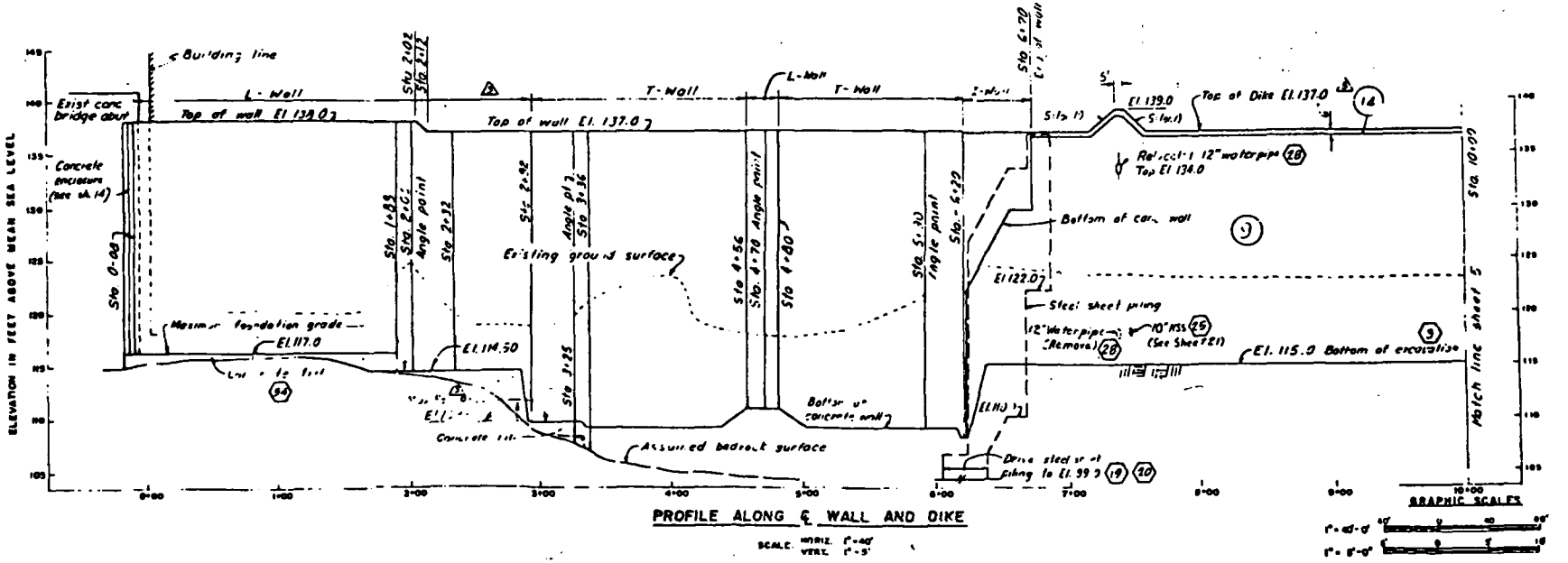
PROFILE OF SUDBURY RIVER AT SAXONVILLE MASSACHUSETTS



MERRIMACK RIVER FLOOD CONTROL
SAXONVILLE LOCAL PROTECTION
PLAN, PROFILE AND SECTION
SUDBURY RIVER MASSACHUSETTS

B-8


9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
PEAK DISCHARGE IN C.F.S.
ASSABET R. @ MAYNARD, MASS.
D. A. = 116 SQ. MI.
SUDBURY R. @ SAXONVILLE, MASS.
D. A. = 86 SQ. MI.
KETTLE BRK. @ WORCESTER, MASS.
D. A = 31.3 SQ. MI.
NOTE
⊗ AUGUST 1955 FLOOD
0.2 0.5 1.0 2.0 5.0 10 20 30 40 50 80 90
PERCENT CHANCE OF OCCURRENCE ANNUALLY
MERRIMACK RIVER FLOOD CONTROL
FRAMINGHAM, MASS.
SAXONVILLE LOCAL PROTECTION
DISCHARGE-FREQUENCY
CURVES



PROFILE ALONG ℄ WALL AND DIKE

SCALE: HORIZ. 1"=40'
VERT. 1"=5'

GRAPHIC SCALES

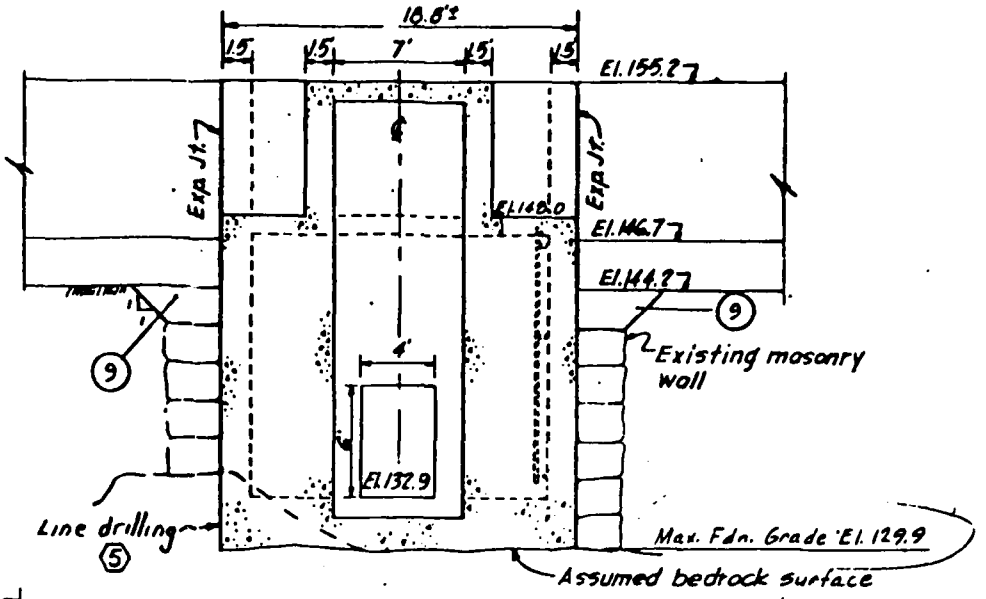
1"=40'-0"

1"=5'-0"

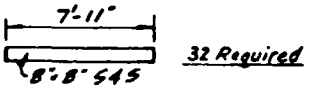
PROFILE - CENTRAL ST. DAM
DOWNSTREAM WALL and DIKE

NOTE:

INFORMATION PRESENTED ON THI SHEET HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.

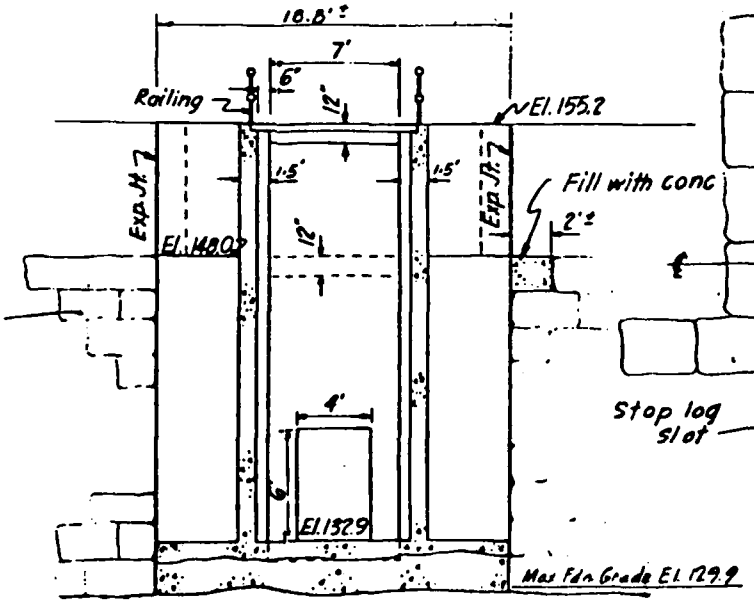


SECTION E-E
SCALE 1"=5'

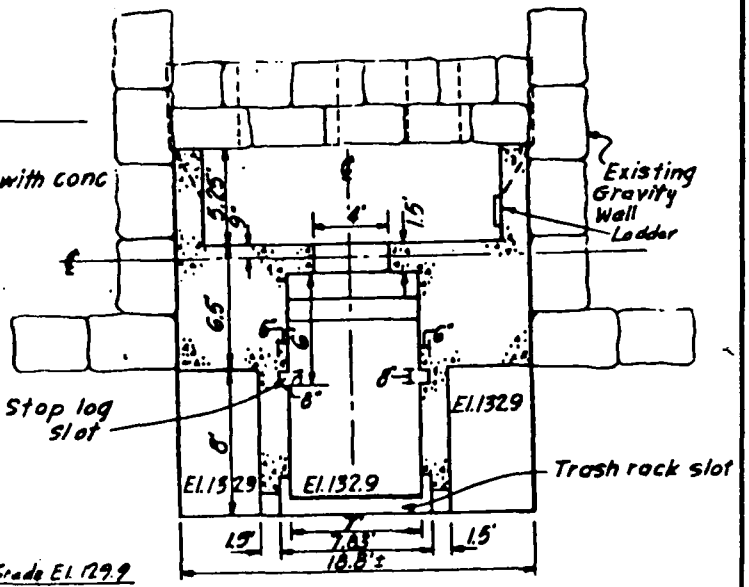


32 Required

WOOD STOP LOG (59)
NOT TO SCALE



SECTION D-D
SCALE 1"=5'

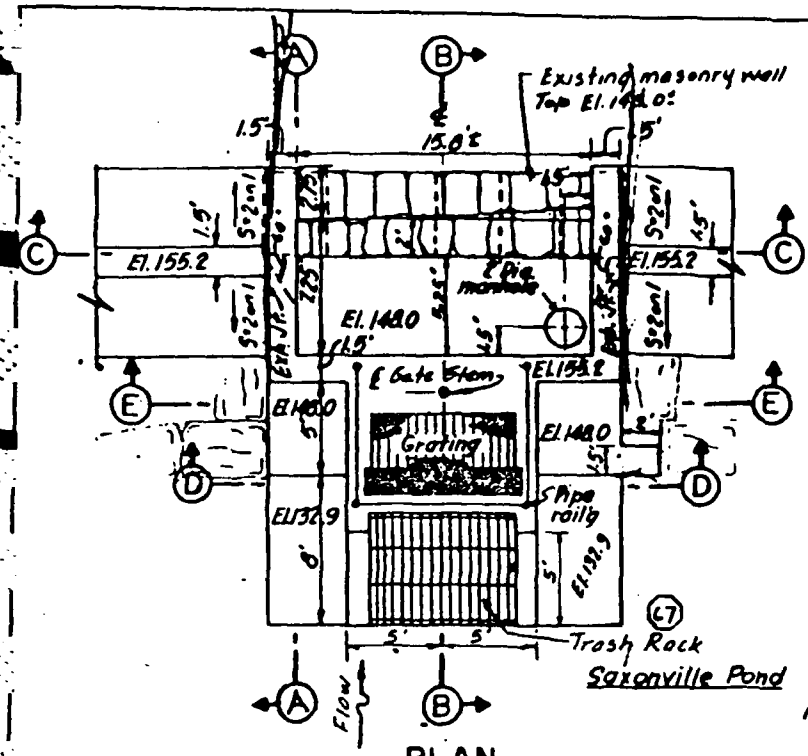


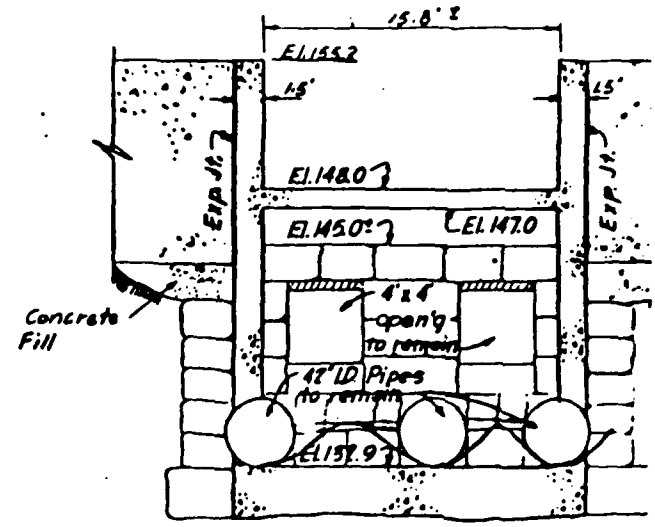
SECTION F-F
SCALE 1"=5'

MISC. SECTIONS
CENTRAL ST. DAM INLET STRUCTURE

NOTES:

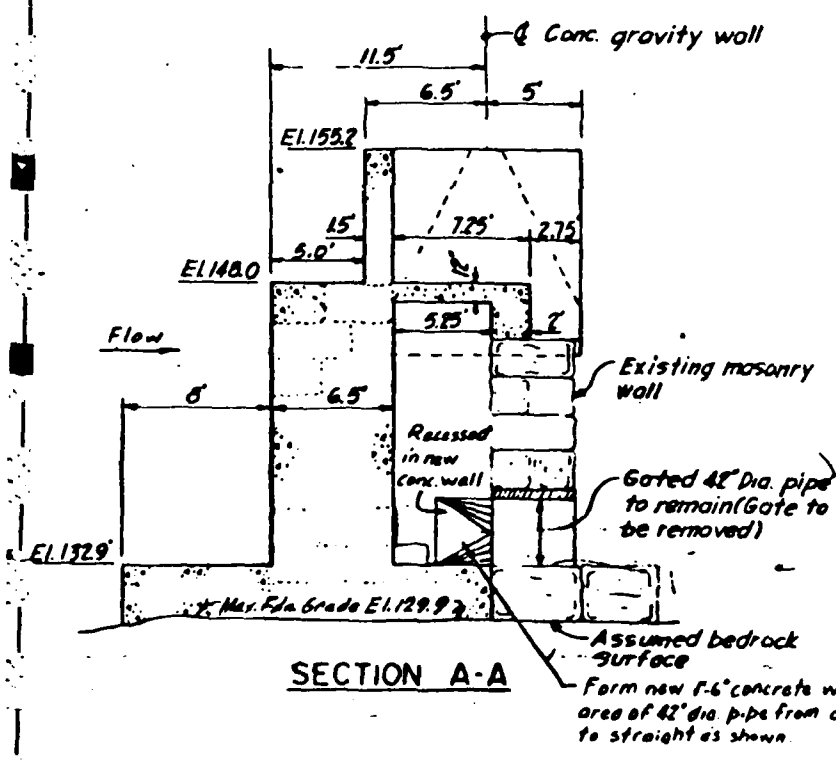
1. REFER TO PAGE B-4 FOR SECTION ORIENTATIONS.
2. INFORMATION PRESENTED ON THIS SHEET HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.



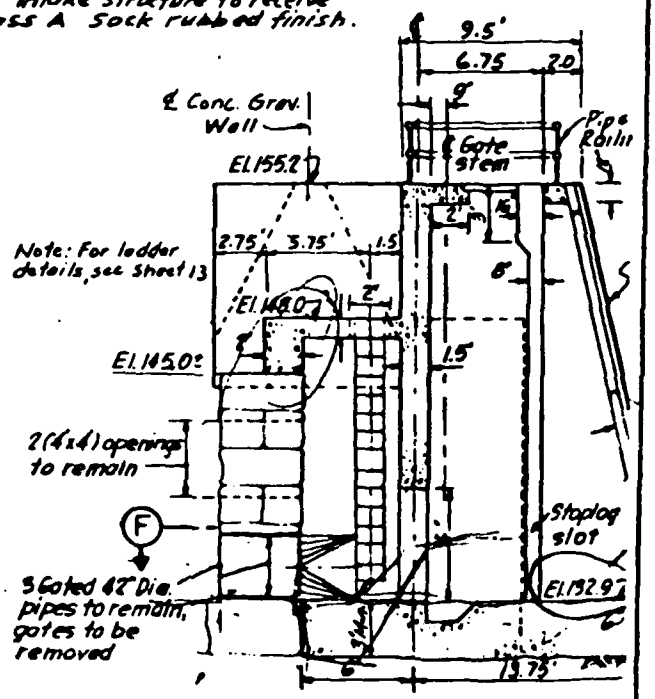


SECTION C-C

NOTE:
The exposed landside vertical concrete surfaces of the intake structure to receive class A sack rubbed finish.



SECTION A-A

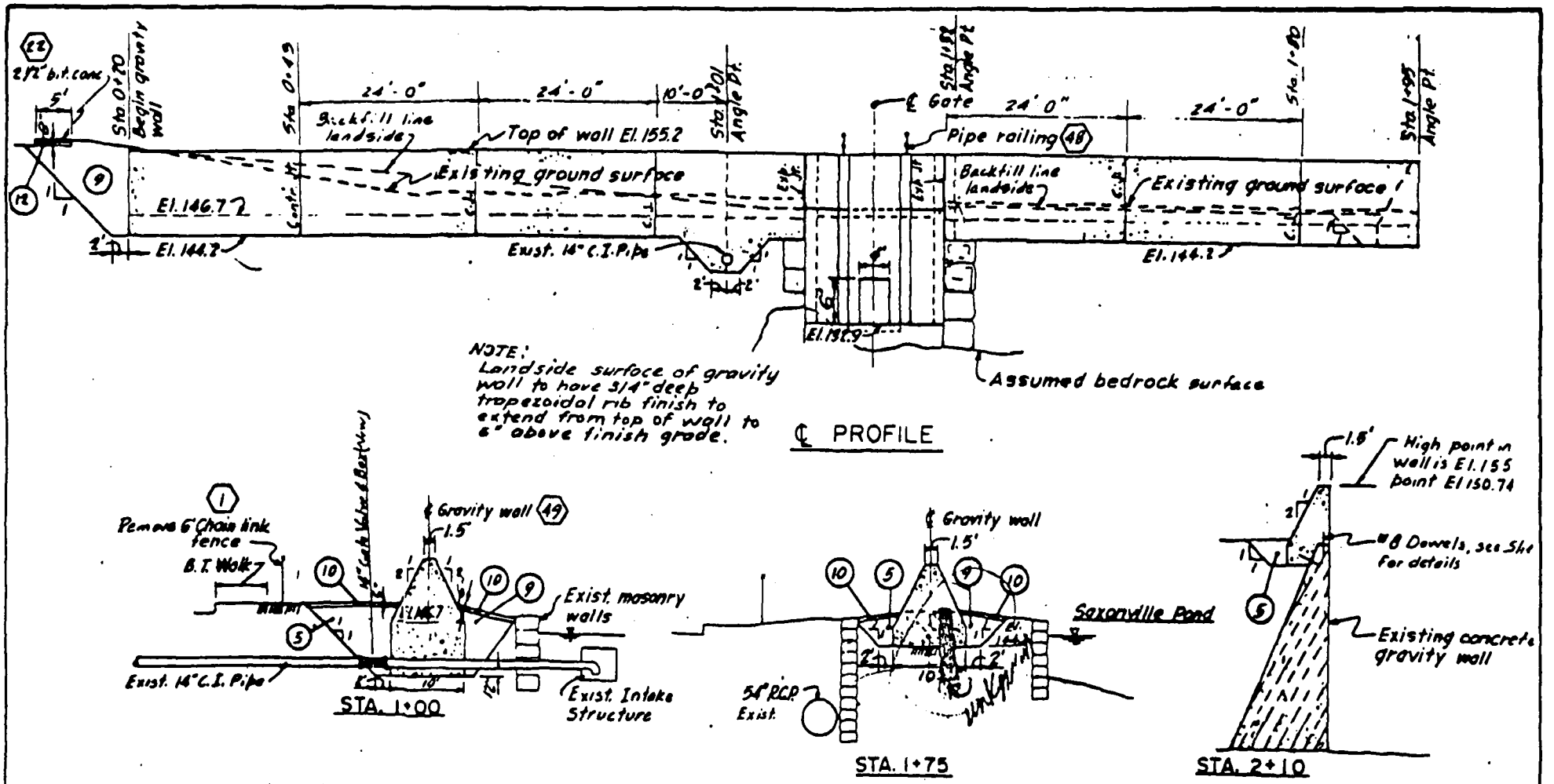


SECTION B-B

PLAN and SECTIONS
CENTRAL ST. DAM INLET STRUCTURE

NOTE:

INFORMATION PRESENTED ON THIS SHEET HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.



B-3

PROFILE and SECTIONS
CENTRAL ST. DAM FLOOD CONTROL WALL

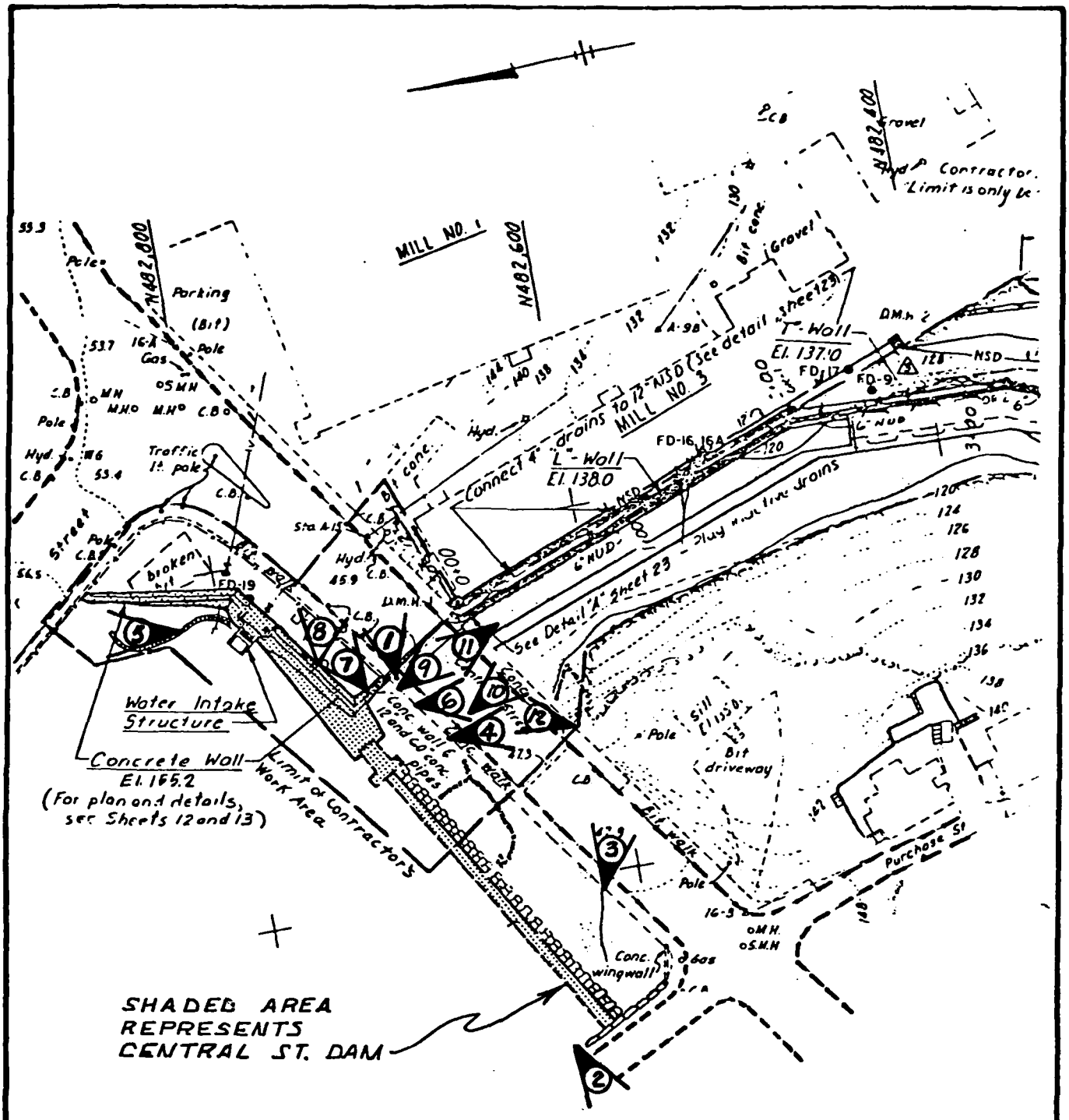
NOTE:

INFORMATION PRESENTED ON THIS SHEET HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.

APPENDIX C

PHOTOGRAPHS

APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT



LEGEND ① THE LOCATION AND DIRECTION IN WHICH EACH PHOTO WAS TAKEN AND THE NUMBER OF THE PHOTO

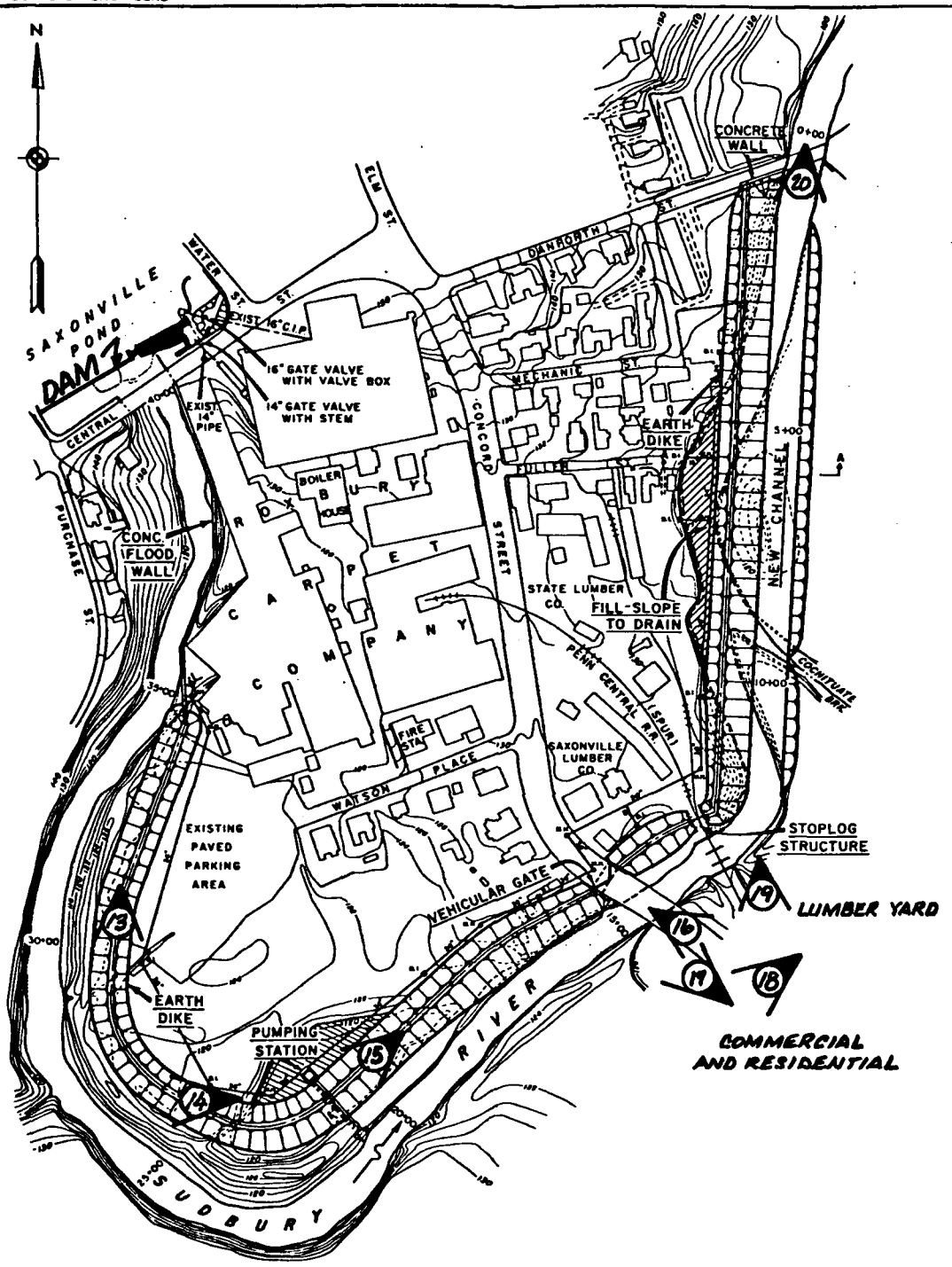
SITE PLAN

Scale: None

PG. A

NOTE:
THIS PLAN HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS.

CORPS OF ENGINEERS



LEGEND (1) THE LOCATION AND DIRECTION IN WHICH EACH PHOTO WAS TAKEN AND THE NUMBER OF THE PHOTO

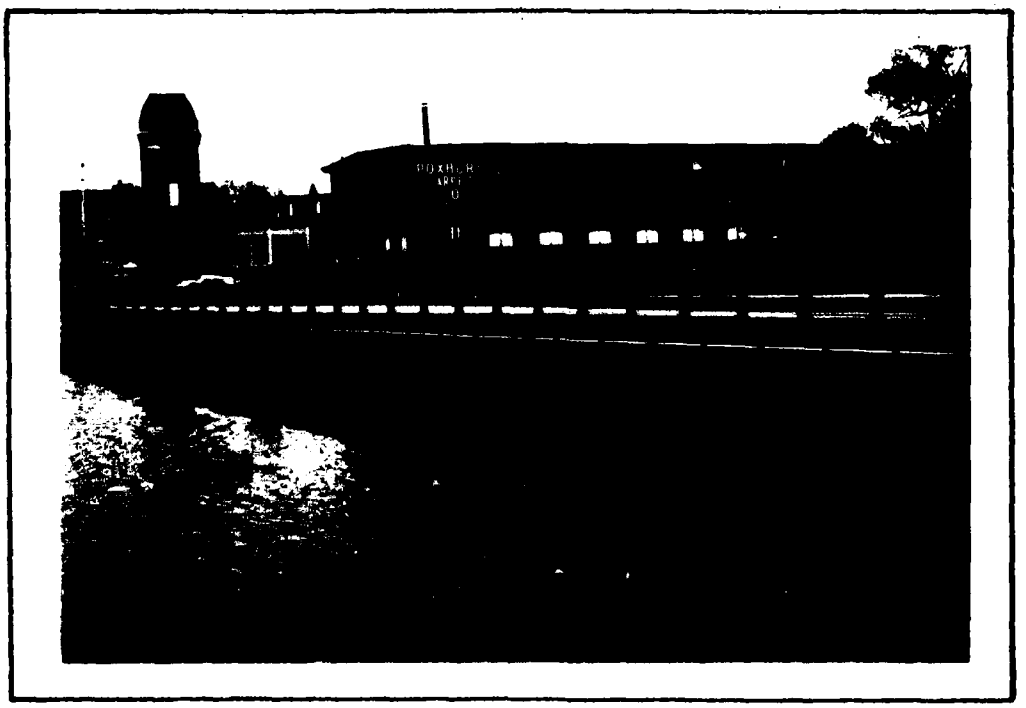
REGIONAL PLAN

SCALE IN FEET

PG. B

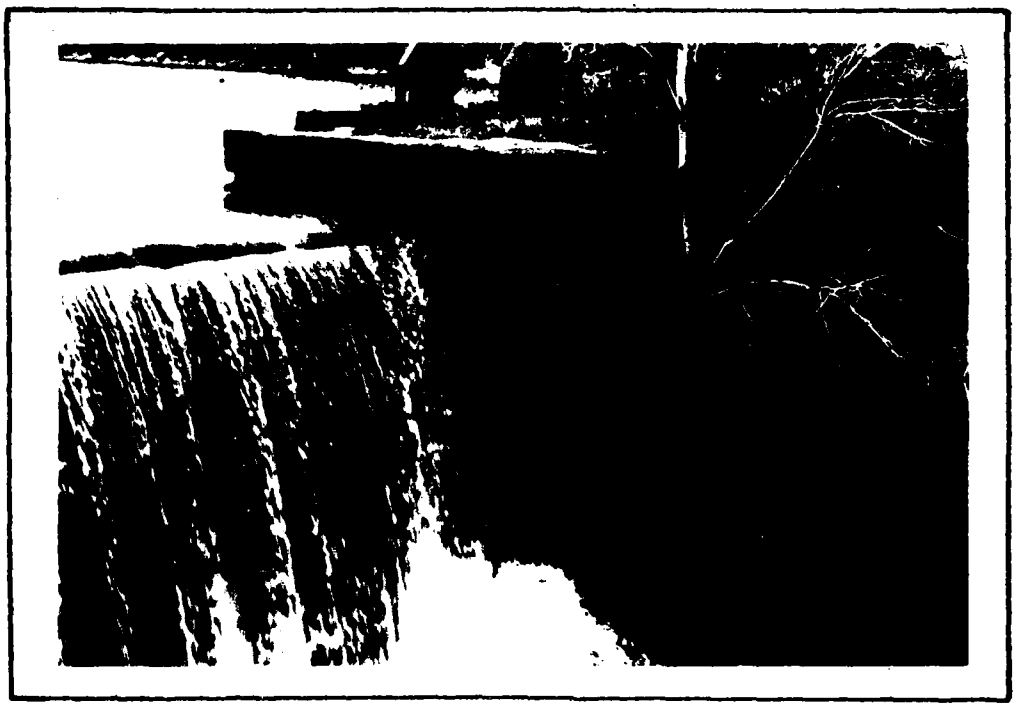
NOTE: THIS PLAN HAS BEEN REPRODUCED FROM U.S. ARMY CORPS OF ENGINEERS DESIGN DRAWINGS

1. LOOKING ACROSS THE SPILLWAY FROM THE LEFT SIDE SPILLWAY ABUTMENT SHOWING CONDITIONS IMMEDIATELY DOWNSTREAM OF THE DAM. (11/12/79)

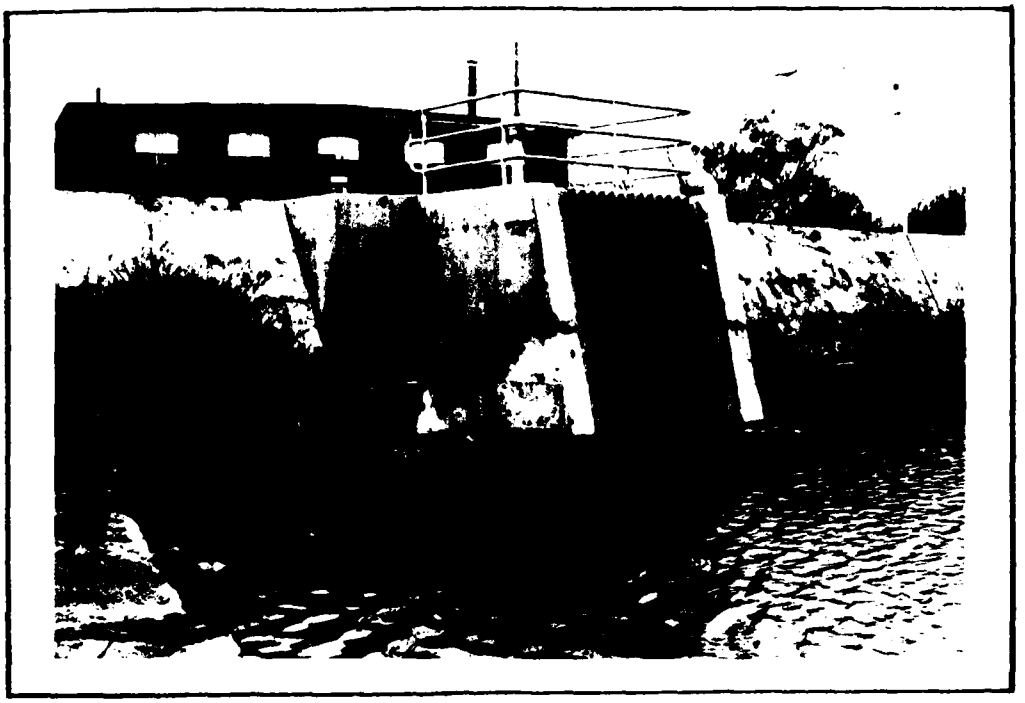


2. LOOKING ACROSS THE SPILLWAY FROM THE RIGHT SIDE SPILLWAY ABUTMENT SHOWING CONDITIONS IMMEDIATELY DOWNSTREAM OF THE DAM. (11/12/79)

3. DETAILS OF RIGHT SPILLWAY ABUTMENT. (11/12/79)



4. CONDITIONS AT THE LEFT SPILLWAY ABUTMENT. (11/12/79)

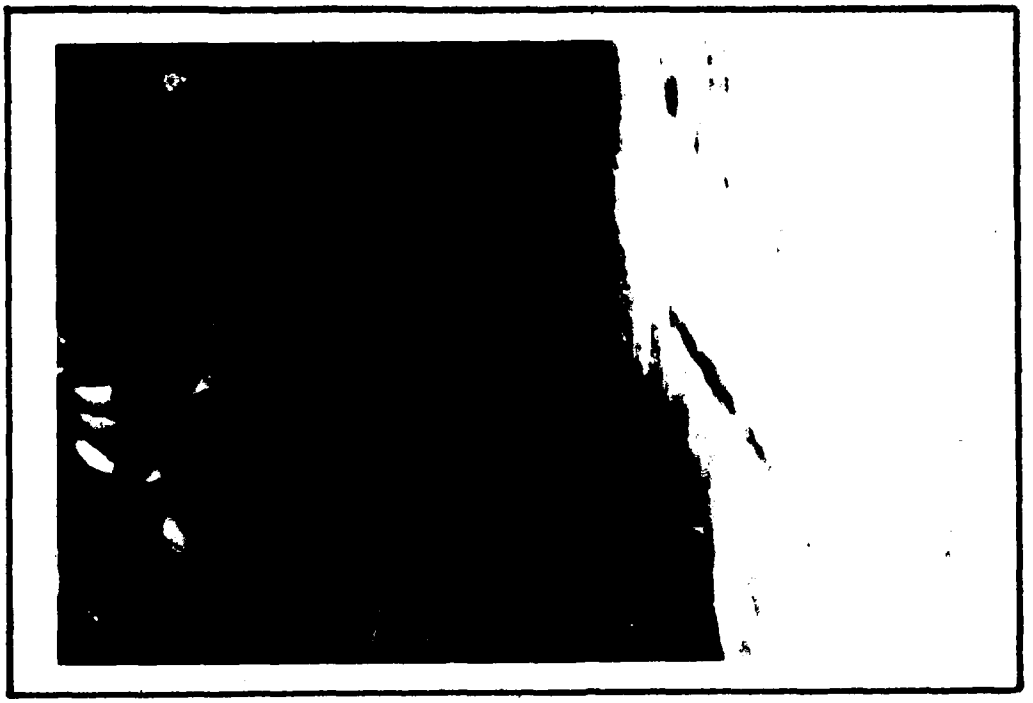


5. INLET DETAILS FOR THE 4-FOOT WIDE BY 6-FOOT HIGH IMPOUNDMENT REGULATING GATE APPROXIMATELY 110 FEET LEFT OF THE LEFT SIDE SPILLWAY ABUTMENT. (11/12/79)

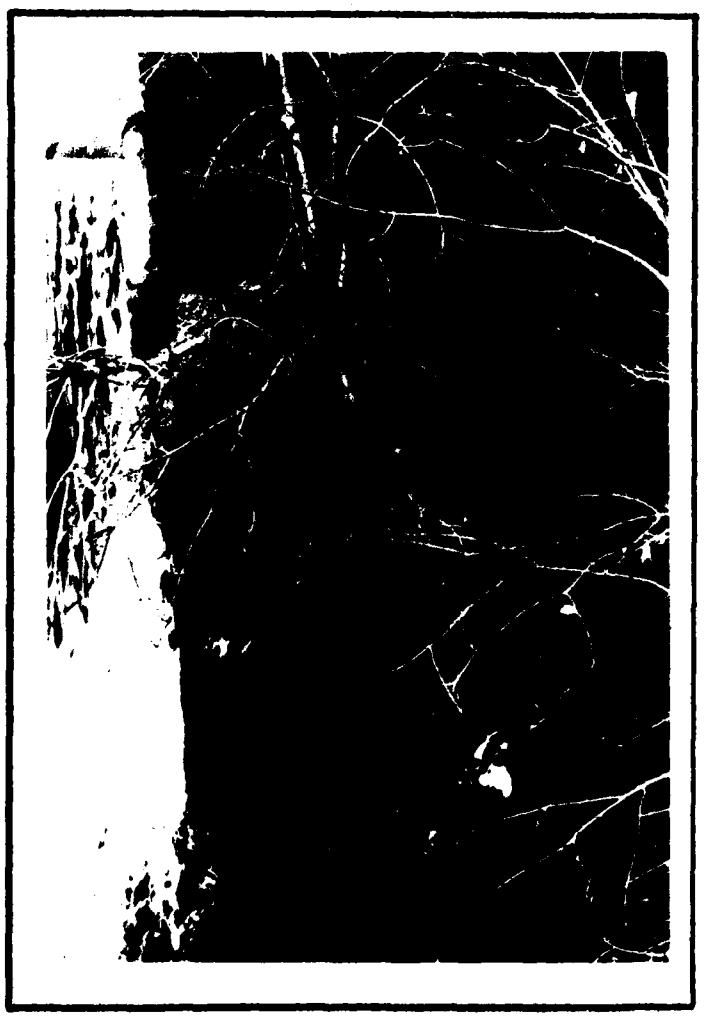
6. DISCHARGE FROM THE 54 INCH DIAMETER IMPOUNDMENT REGULATING SYSTEM ABOUT 25 FEET DOWNSTREAM FROM THE LEFT ABUTMENT OF THE SPILLWAY. (11/12/79)

7. DISPLACEMENT OF MASONRY BLOCKS ON LEFT ABUTMENT WALL OF SPILLWAY (11/12/79)

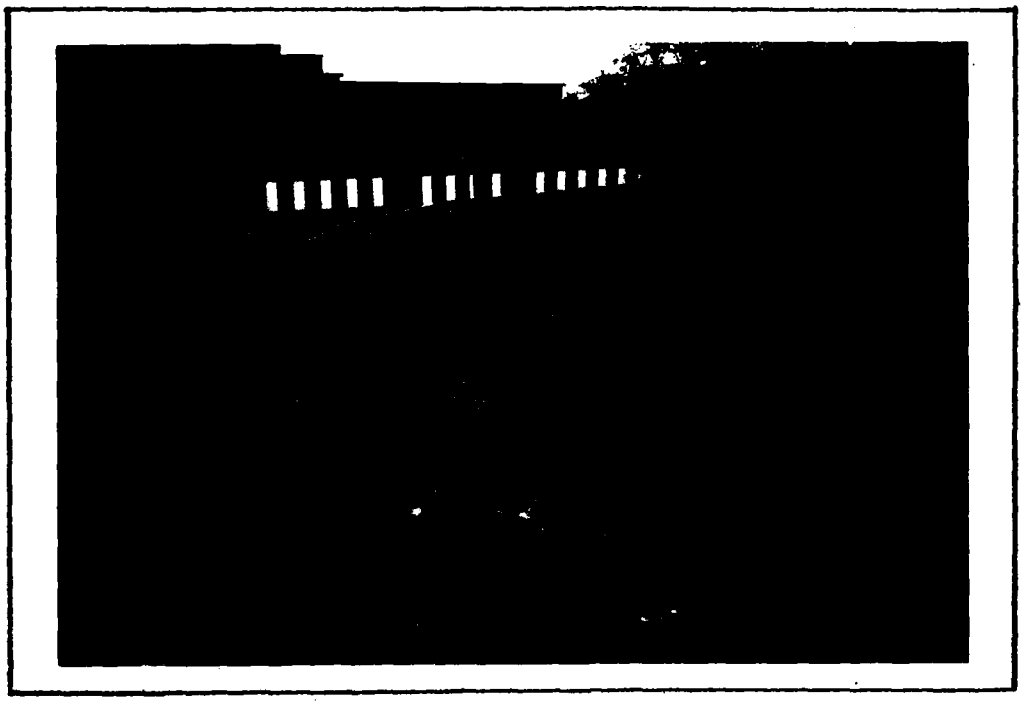
8. 80 YEAR OLD GATE HOISTS TO THE LEFT OF THE LEFT SIDE SPILLWAY ABUTMENT. (11/12/79)



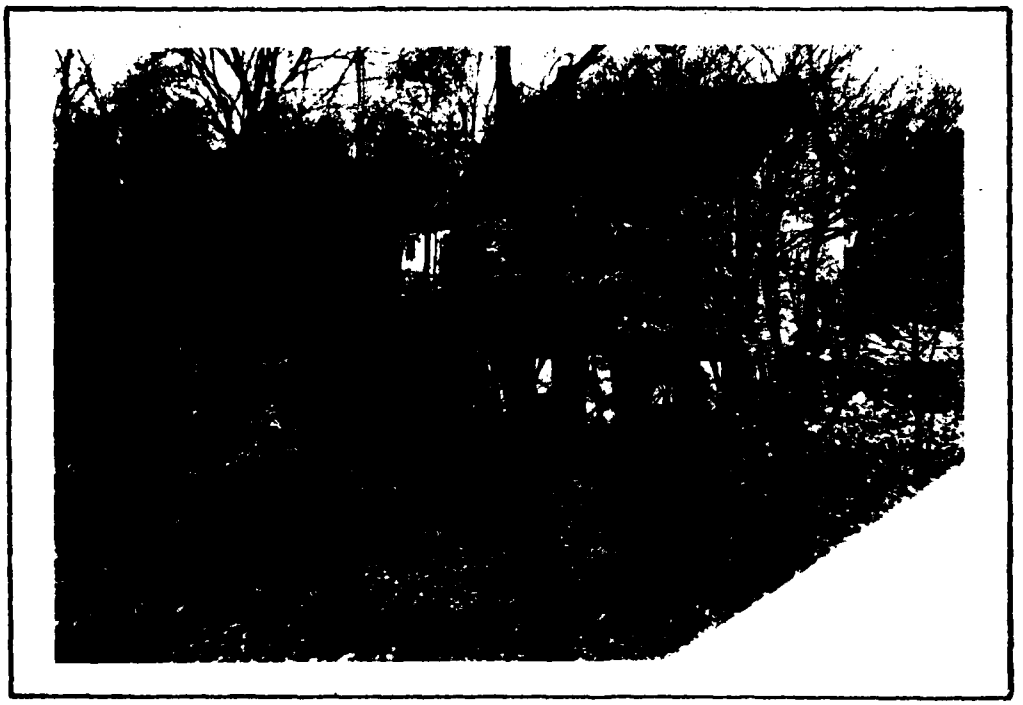
9. CLEAR SEEPAGE THROUGH THE ABUTMENT WALL LEFT OF THE SPILLWAY. (11/12/79)



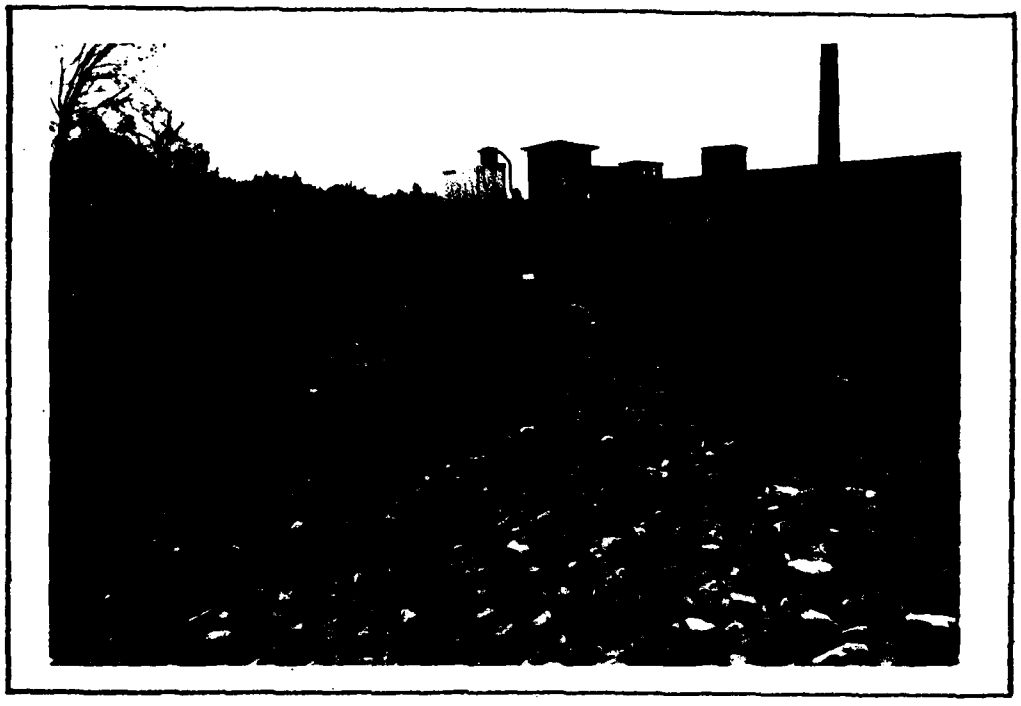
10. DETAILS OF THE LEFT SIDE SPILLWAY ABUTMENT SHOWING A TREE GROWING IN THE WALL, DISPLACED BLOCKS AND THE POOR CONDITION OF THE MORTAR. (11/12/79)



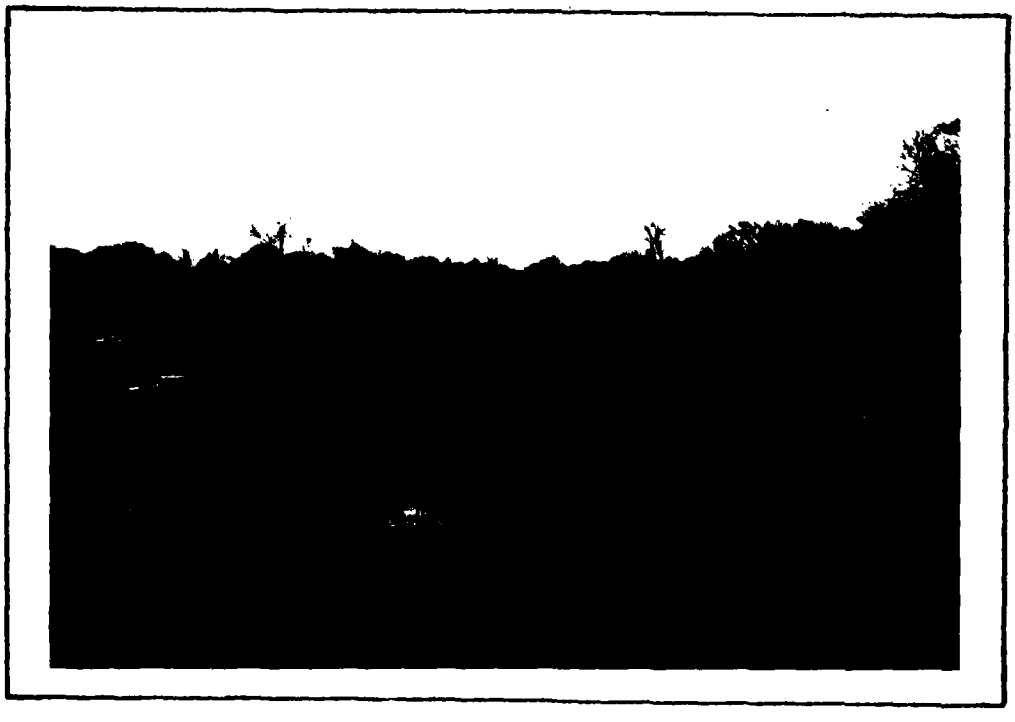
11. DOWNSTREAM CHANNEL SHOWING RECENTLY COMPLETED CORPS FLOOD WALL FROM APPROXIMATELY 80 TO 550 FEET DOWNSTREAM OF THE DAM. (11/12/79)



12. HOUSE ON THE RIGHT BANK OF THE CHANNEL APPROXIMATELY 150 FEET DOWNSTREAM OF THE DAM. (11/12/79)



13. LOOKING UPSTREAM ALONG THE SUDBURY RIVER FROM ABOUT 800 FEET DOWNSTREAM OF THE DAM SHOWING THE DIKE AND FLOOD WALL WORK RECENTLY COMPLETED. (11/12/79)



14. LOOKING DOWNSTREAM FROM ABOUT 1700 FEET DOWNSTREAM OF THE DAM SHOWING THE DIKE, PUMPING STATION, PONDING AREA, AND SLUICE GATE STRUCTURE RECENTLY COMPLETED. (11/12/79)

15. LOOKING DOWNSTREAM FROM ABOUT 2200 FEET DOWNSTREAM OF THE DAM SHOWING THE DIKE, FLOOD WALL AND STREET GATE RECENTLY COMPLETED. (11/12/79)

16. LOOKING NORTH ALONG CONCORD STREET ABOUT 2300 FEET DOWNSTREAM FROM THE DAM SHOWING A PORTION OF THE AREA PROTECTED BY THE FLOOD WALLS AND DIKES. (11/12/79)

17. LOOKING SOUTH ALONG CONCORD STREET SHOWING A PORTION OF THE AREA NOT PROTECTED BY THE FLOOD WALLS AND DIKES. (11/12/79)

18. LUMBER YARD ABOUT ½ MILE DOWNSTREAM OF THE DAM ON THE RIGHT SIDE OF SUDBURY RIVER NOT PROTECTED BY THE FLOOD WALLS AND DIKES. (11/12/79)

FLOOD HYDROGRAPH PACKAGE (HEC-1) CENTRAL STREET (SAXONVILLE POND) DAM BREACH (WITH RESERVOIR SURFACE
DAM SAFETY VERSION JULY 1978 OUTFLOW ROUTED TO DAMAGE CENTER AT TOP OF DAM)
LAST MODIFICATION 26 FEB 79

INPUT

```
     1          A1       HYDROLOGIC ANALYSIS OF CENTRAL STREET (SAXONVILLE POND) DAM
     2          A2                  NATIONAL DAM INSPECTION PROGRAM
     3          A3          NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4          B    300       0       5       0       0       0       0       0      -4       0
     5          B1     5
     6          J      2       1       1
     7          J1     0
     8          K      1   OUT-8                                           1
     9          K1                    SAXONVILLE POND OUTFLOW
    10          Y                                   1       1
    11          Y1     1                                                -150      -1
    12          Y4 144.8     146     147     148     149     150     151     153     155     160
    13          Y5     0     170     880    2020    3580    5470    8560   18780   34430  109620
    14          $A     0      64     106     227
    15          $E   126   144.8     150     160
    16          $S 144.8
    17          $D   150
    18          $B    75     .01     130       1     150     150
    19          $B    75     .01     130       1     150     160
    20          K      1   DNST-6                                          1
    21          K1                ROUTE SAXONVILLE OUTFLOW TOWARD DAMAGE CENTER
    22          Y                                   1       1
    23          Y1     1                                                  -1
    24          Y6   .05     .05     .08     115     140    2000    .002
    25          Y7     0     137      25     127      50     117      55     115     115     115
    26          Y7   120     117     160     130     190     140
    27          K      1   DNST-7                                          1
    28          K1            ROUTE FLOW TO UNPROTECTED SECTION (DAMAGE CENTER)
    29          Y                                   1       1
    30          Y1     1                                                  -1
    31          Y6   .02     .05     .08     115     140      50    .002
    32          Y7     0   136.5      0.1     122      12     122      30     115      90     115
    33          Y7   150     120     550     130     650     140
    34          K     99
```

UNITED COMPUTING SYSTEMS, INC.

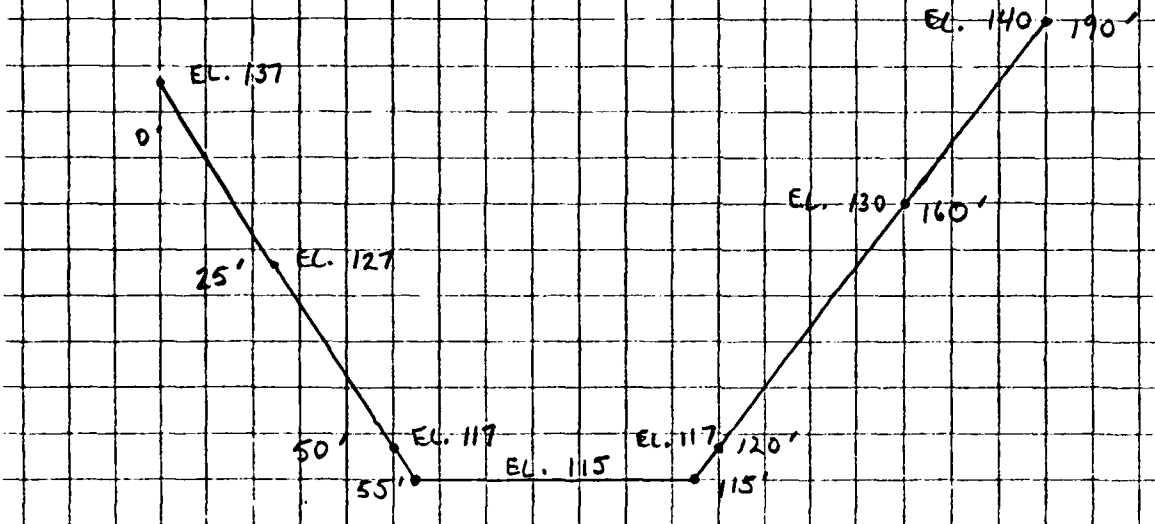
D-1

RIEN & GERE

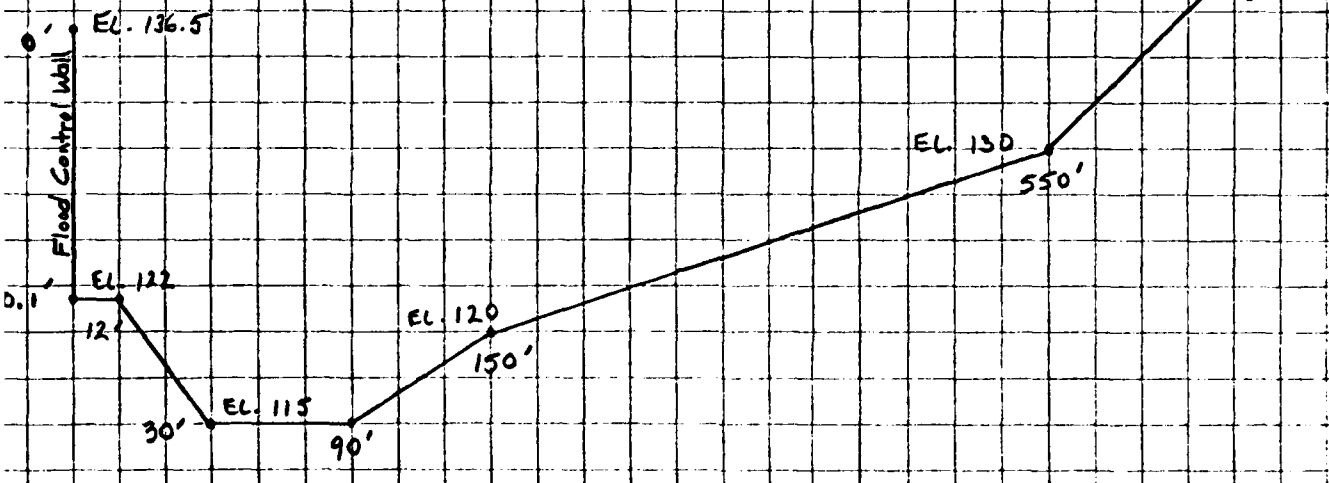
CENTRAL STREET (SAXONVILLE) DAM	SHEET 0-6	BY RRB	DATE 1/15/80	JOB NO. 2060-001

NSTREAM CHANNEL CHARACTERISTICS FOR ROUTING BREACH FLOOD

SUDBURY RIVER DOWNSTREAM OF SAXONVILLE POND

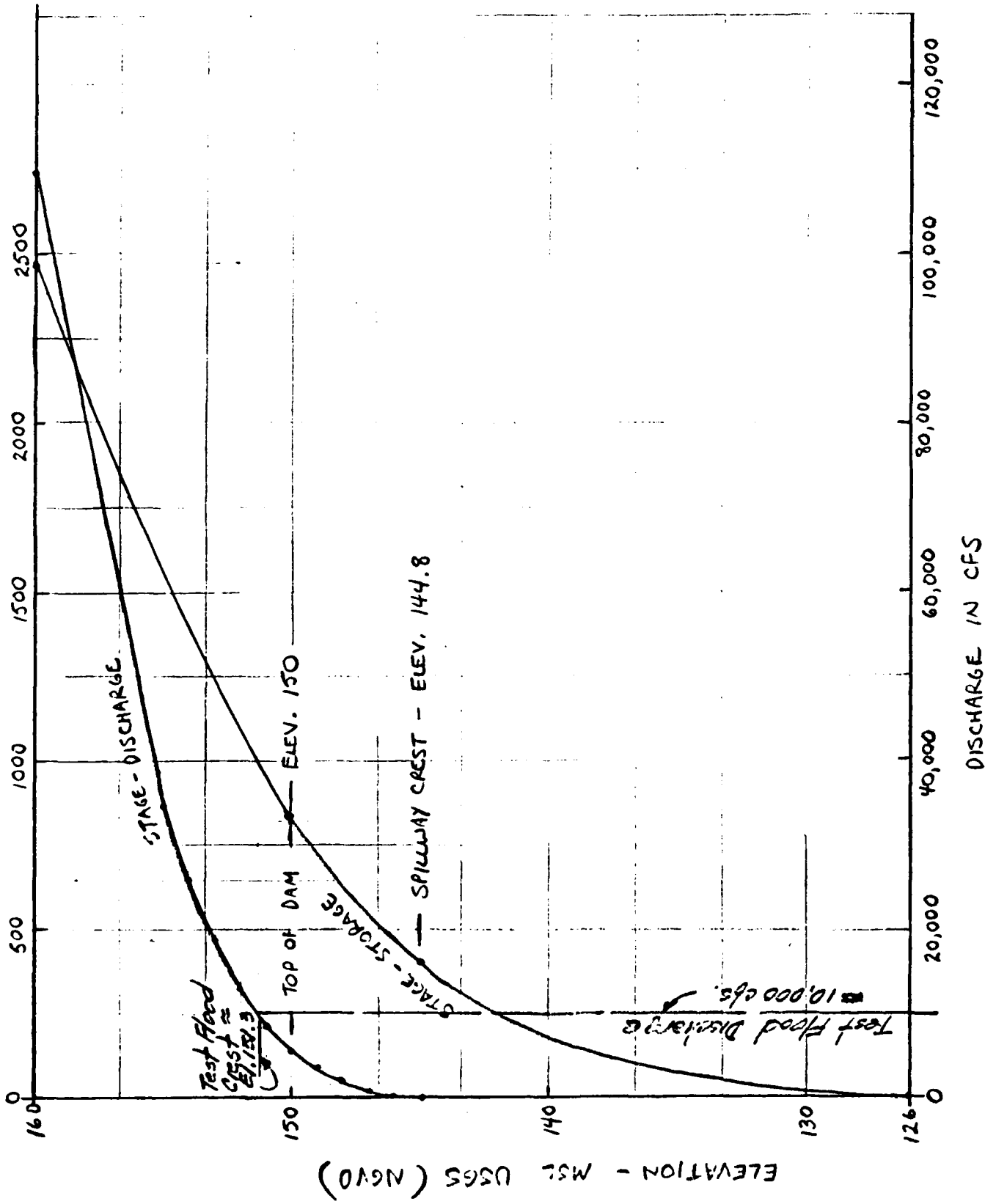


SUDBURY RIVER AT DAMAGE CENTER



'BRIEN & GERE
NGINEERS, INC.

E - STORAGE & STAGE - DISCHARGE CURVES	SHEET D-5	BY RRB	DATE 2/14/80	JOB NO 2060-001



O'BRIEN & GERE
ENGINEERS, INC.

ENTRAL STREET (SAYONVILLE) DAM	SHEET D-4	BY RRB	DATE 4/4/80	JOB NO 2060-001

TEST FLOOD ANALYSIS

BASED ON A TEST FLOOD PEAK INFLOW OF 10,000 CFS, THE SPILLWAY (DISCHARGE CAPACITY = 5,470 CFS) IS CAPABLE OF DISCHARGING APPROXIMATELY 55 % OF THE ROUTED TEST FLOOD OUTFLOW. THE TEST FLOOD ELEVATION IS APPROXIMATELY 15|.3 WHICH IS 1.3 FEET ABOVE THE TOP OF THE DAM.

Test Flood ≈ 0.5 PMF

CENTRAL STREET LAKE DAM - H & H (CONT.)

STAGE-DISCHARGE

(H=0 @ SPILLWAY CREST) ELEV. = 144.8 (W/O FLASHBOARDS)

1) SPILLWAY (NO FLASHBOARDS - LEFT SIDE) : $C = 2.9$, $L = 45'$, $Q_1 = CLH^{1.5}$
2) SPILLWAY (WITH FLASHBOARDS - RIGHT SIDE) : $C = 3.3$, $L = 136.7'$, $Q_2 = CL(H-1.2)^{1.5}$
3) LEFT WALL : $C = 2.8$, $L = 40'$, $Q_3 = CL(H-3.2)^{1.5}$
4) TOP OF DAM (RIGHT SIDE) : $C = 2.7$, L VARIES, $Q_4 = CL(H-5.2)^{1.5}$
5) CENTRAL ST. (WEST) : $C = 2.8$, L VARIES, $Q_5 = CL(H-5.2)^{1.5}$
6) CENTRAL ST. (EAST) : $C = 3.1$, L VARIES, $Q_6 = CL(H-10.4)^{1.5}$

ELEV. MSL-NGVD	H FT.	Q_1 CFS	Q_2 CFS	Q_3 CFS	Q_4 CFS	Q_5 CFS	Q_6 CFS	ΣQ CFS
144.8	0	0	0	0	0	0	0	0
145	0.2	12	0	0	0	0	0	12
146	1.2	172	0	0	0	0	0	170
147	2.2	426	451	0	0	0	0	880
148	3.2	747	1276	0	0	0	0	2,020
149	4.2	1123	2344	112	0	0	0	3,580
150	5.2	1547	3609	317	0	0	0	5,470
151	6.2	2015	5042	582	108	819	0	8,560
152	7.2	2521	6628	896	321	2653	0	13,020
153	8.2	3064	8353	1252	617	5492	0	18,780
154	9.2	3642	10205	1646	994	9408	0	25,900
155	10.2	4251	12177	2074	1449	14478	0	34,430
160	15.2	7733	23625	4656	4952	62527	6129	109,620

STAGE - AREA - STORAGE

ELEV. (MSL-NGVD)	AREA (ACRES)	STORAGE (ACRE-FT. → COMPUTED BY HEC-1 PROGRAM)
126	0	0
144.8	64	400
150	106	840
160	227	2,470

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO D-2 OF
CALCULATED BY R DATE 1/16/80
CHECKED BY L.B. DATE 2/14/80
SCALE

CENTRAL ST. LAKE DAM - H&H

DRAINAGE AREA

= 86.0 SQ.M. ±5
TOTAL DRAINAGE AREA
11.3 SQ. MILES
SUB-DRAINAGE AREA FOR CENTRAL STREET DAM

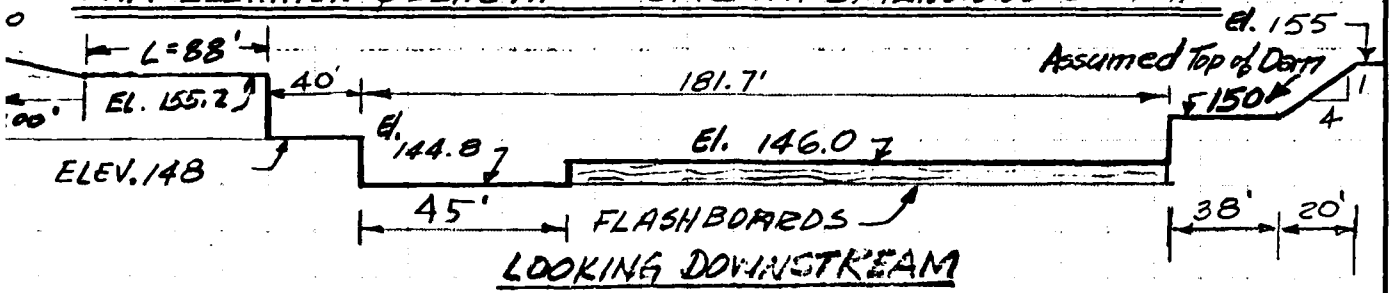
TEST FLOOD DETERMINATION

THE CORPS OF ENGINEERS HAS CALCULATED A STANDARD PROJECT FLOOD (SPF) OF 10,000 CFS FOR CENTRAL STREET DAM (REFERENCE: SAXONVILLE LOCAL PROTECTION, DESIGN MEMORANDUM NO. 1, HYOROLOGIC ANALYSIS). THE SPF GENERALLY RANGES BETWEEN 40% AND 60% OF THE PMF, THEREFORE A ½ PMF VALUE OF 11,000 CFS MAY BE ASSUMED. DOUBLING THE ½ PMF TO OBTAIN THE TEST FLOOD WHICH IS THE PMF, THE ASSUMED TEST FLOOD PEAK INFLOW IS 22,000 CFS.

HYDRAULICS

DISCHARGE CALCULATIONS

DAM ELEVATION & LENGTH and SPILLWAY DIMENSIONS SKETCH



LOOKING DOWNSTREAM

Ap = 15.9 □

Kp = 0.00561
54"ϕ, n=0.015
CS-42, SCS

lp = 60'

Kn = 1.2
SCS, Design Note B

BYPASS PIPE
DISCHARGE THRU 54"ϕ CONDUIT

$Q = Cp\, Hp^{1/2}$ Q OUTLET EL. 134.55

$Q = 80\, Hp^{1/2}$

W.S. El. 144.8 Q = 256 ≈ 260 cfs.

Dam El. 150.0 Q = 314 ≈ 320 cfs.

$Cp = Ap \sqrt{\frac{2g}{1 + K_n + K_p L_p}}$

$Cp = 15.9 \sqrt{\frac{64.4}{1 + 1.2 + 0.00561 \times 60}}$

$Cp \approx 60$


DAM LOCATION
MASS.
CENTRAL STREET DAM

O'BRIEN & GERE
ENGINEERS, INC.

ECT CENTRAL STREET DAM	SHEET	BY	DATE	JOB NO

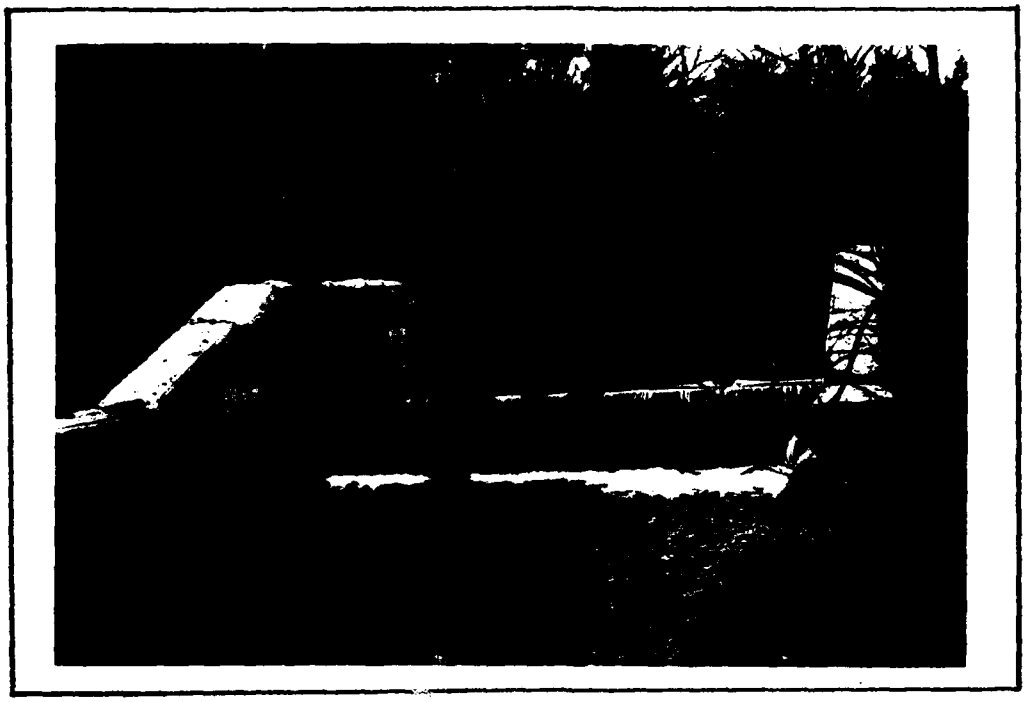
APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

TABLE OF CONTENTS

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

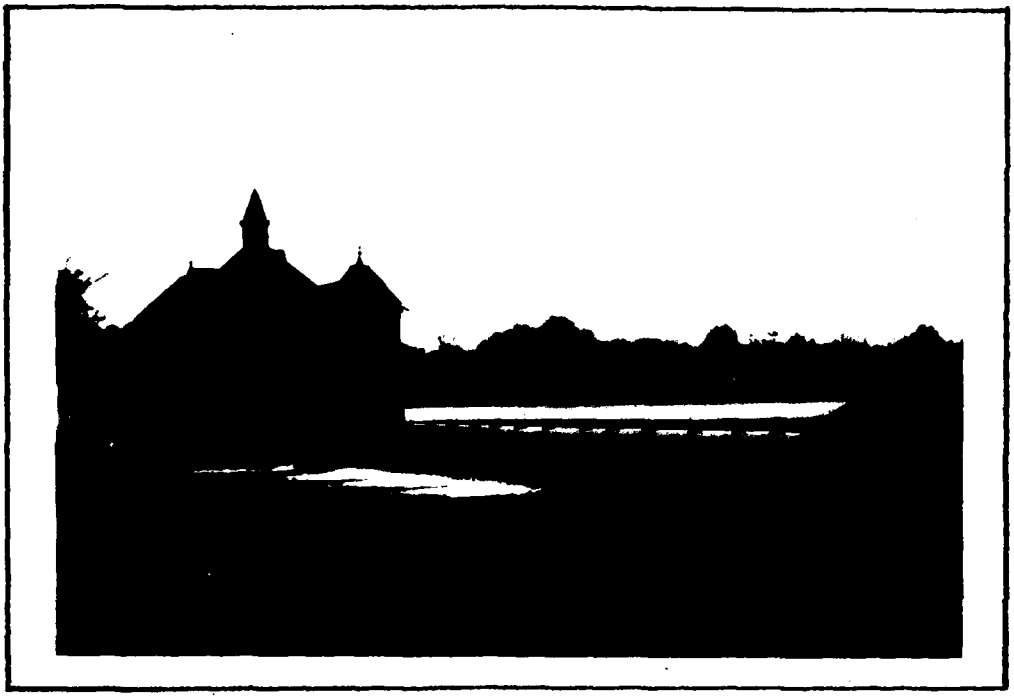


27. ASHLAND RESERVOIR SPILLWAY APPROXIMATELY 8 MILES UPSTREAM OF CENTRAL STREET DAM ON SPRING BROOK. (11/12/79)

28. HOPKINTON RESERVOIR SPILLWAY APPROXIMATELY 10 MILES UPSTREAM OF CENTRAL STREET DAM ON INDIAN BROOK. (11/12/79)

25. RESERVOIR NO. 3 DAM AND SPILLWAY APPROXIMATELY 5 MILES UPSTREAM OF CENTRAL STREET DAM ON STONY BROOK. (11/12/79)

26. SUDBURY RESERVOIR DAM AND SPILLWAY APPROXIMATELY 7 MILES UPSTREAM OF CENTRAL STREET DAM ON STONY BROOK. (11/12/79)

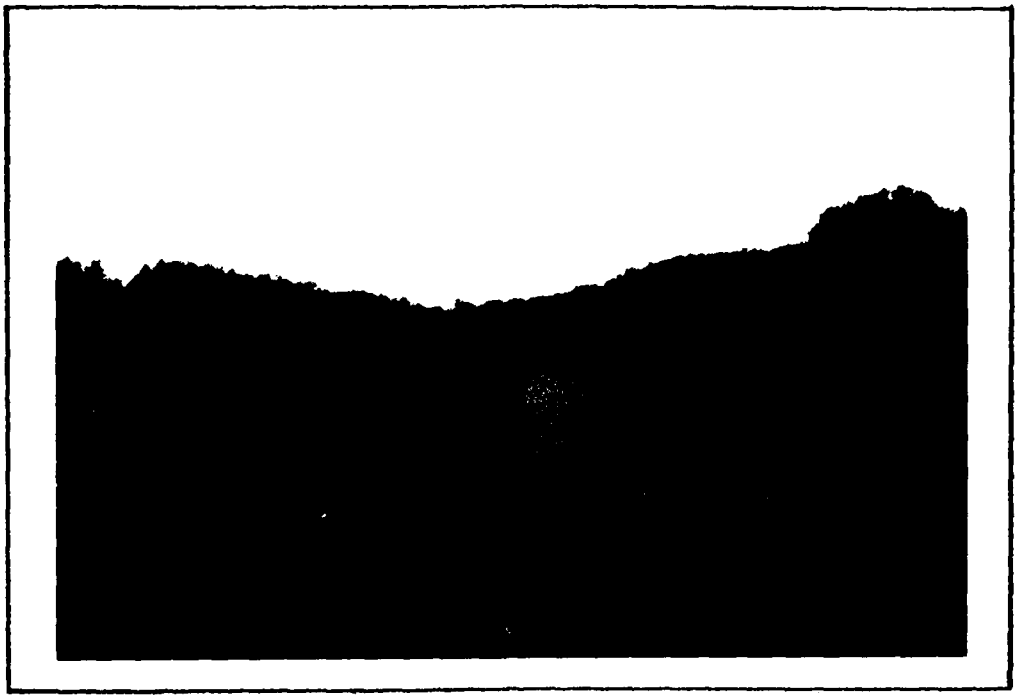


23. RESERVOIR NO. 1 DAM AND SPILLWAY APPROXIMATELY 4 MILES UPSTREAM OF CENTRAL STREET DAM ON SUDBURY RIVER. (11/12/79)

24. RESERVOIR NO. 2 DAM AND SPILLWAY APPROXIMATELY 5 MILES UPSTREAM OF CENTRAL STREET DAM ON SUDBURY RIVER. (11/12/79)

21. AQUEDUCT CROSSING THE SUDBURY RIVER APPROXIMATELY 3 MILES DOWNSTREAM OF THE DAM. (11/12/79)

22. CHANNEL OBSTRUCTION ABOUT 3¼ MILES DOWNSTREAM FROM THE DAM. (11/12/79)



19. SUDBURY RIVER ABOUT ½ MILE DOWNSTREAM OF THE DAM SHOWING THE FLOOD PROTECTION DIKE ON THE LEFT AND NO FLOOD PROTECTION ALONG THE RIGHT BANK. (11/12/79)

20. SUDBURY RIVER ABOUT 3/4MILE DOWNSTREAM OF THE DAM. (11/12/79)

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**********
   HYDROGRAPH PACKAGE (HEC-1)
FLOOD SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN DATED 04/02/80.
     TIME 14.43.36.

                HYDROLOGIC ANALYSIS OF CENTRAL STREET (SAXONVILLE POND) DAM
                        NATIONAL DAM INSPECTION PROGRAM
                    NEW ENGLAND DIVISION - CORPS OF ENGINEERS

                                JOB SPECIFICATION
      NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
     300      0      5      0      0      0      0      0     -4      0
                         JOPER    NWT  LROPT  TRACE
                             5      0      0      0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 2 NRTIO= 1 LRTIO= 1
NO INFLOW ---->     RTIOS=  0.00

**********  **********  **********  **********  **********

                            HYDROGRAPH ROUTING

                        SAXONVILLE POND OUTFLOW

            ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAME  ISTAGE  IAUTO
            OUT-8      1      0      0     0     0      1       0      0

                    ALL PLANS HAVE SAME
                        ROUTING DATA
          QLOSS  CLOSS   AVG  IRES  ISAME  IOPT  IPMP        LSTR
            0.0  0.000  0.00     1      1     0     0           0

                NSTPS  NSTDL   LAG  AMSKK      X    TSK  STORA  ISPRAT
                    1      0     0  0.000  0.000  0.000   -150.      -1

STAGE     144.80  146.00  147.00  148.00  149.00  150.00  151.00  153.00  155.00  160.00
FLOW        0.00  170.00  880.00 2020.00 3580.00 5470.00 8560.00 18780.00 34430.00 109620.00

SURFACE AREA=    0.     64.    106.    227.
CAPACITY=        0.    401.    838.   2466.
ELEVATION=     126.    145.    150.    160.

                CREL   SPWID   COQW   EXPW   ELEVL   COOL   CAREA   EXPL
SPILLWAY CREST ELEVATION -> 144.8    0.0    0.0    0.0    0.0    0.0    0.0    0.0

                                DAM DATA
                          TOPEL   COQD   EXPD  DAMWID
TOP OF DAM ELEVATION ->   150.0    0.0    0.0     0.0

                            DAM BREACH DATA
                    BRWID      Z   ELBM  TFAIL   WSEL  FAILEL
                      75.    .01 130.00   1.00 150.00  150.00

BEGIN DAM FAILURE AT  0.00 HOURS

PEAK OUTFLOW IS   10163. AT TIME   1.00 HOURS
                  -> PEAK BREACH DISCHARGE

                            DAM BREACH DATA
                    BRWID      Z   ELBM  TFAIL   WSEL  FAILEL
                      75.    .01 130.00   1.00 150.00  160.00

PEAK OUTFLOW IS    5470. AT TIME   0.00 HOURS -> PEAK SPILLWAY DISCHARGE PRIOR TO BREACH
```

STAGE-DISCHARGE DATA

STAGE-STORAGE DATA

BREACH DATA - FAILURE BEGINS IMMEDIATELY WITH RESERVOIR SURFACE AT TOP OF DAM

BREACH DATA - NO FAILURE OCCURS

UNITED COMPUTING SYSTEMS, INC.

D.8

FLOWS ROUTED TO END OF RIPRAP-LINED CHANNEL NEAR THE DAMAGE CENTER

HYDROGRAPH ROUTING

ROUTE SAXONVILLE OUTFLOW TOWARD DAMAGE CENTER

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	DNST-6	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0500	.0500	.0800	115.0	140.0	2000.	.00200

} DOWNSTREAM CHANNEL CHARACTERISTICS

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 137.00 25.00 127.00 50.00 117.00 55.00 115.00 115.00 115.00
120.00 117.00 160.00 130.00 190.00 140.00

} CHANNEL CROSS-SECTION AT END OF CHANNEL

STORAGE	0.00	3.82	8.05	12.71	17.82	23.37	29.36	35.80	42.68	50.00
	57.77	65.98	74.63	83.72	93.25	103.21	113.61	124.44	135.56	146.92
OUTFLOW	0.00	128.19	423.80	869.19	1450.39	2165.24	3013.71	3996.93	5116.73	6375.35
	7775.36	9319.48	11011.21	12853.09	14847.59	16997.73	19306.56	21813.25	24574.07	27500.83
STAGE	115.00	116.32	117.63	118.95	120.26	121.58	122.89	124.21	125.53	126.84
	128.16	129.47	130.79	132.11	133.42	134.74	136.05	137.37	138.68	140.00
FLOW	0.00	128.19	423.80	869.19	1450.39	2165.24	3013.71	3996.93	5116.73	6375.35
	7775.36	9319.48	11011.21	12853.09	14847.59	16997.73	19306.56	21813.25	24574.07	27500.83

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL

MAXIMUM STAGE IS 129.8 → MAXIMUM STREAM ELEVATION IN CHANNEL DUE TO DAM BREACH

MAXIMUM STAGE IS 125.2 → MAXIMUM STREAM ELEVATION IN CHANNEL DUE TO SPILLWAY DISCHARGE

HYDROGRAPH ROUTING

FLOWS ROUTED TO DAMAGE CENTER

ROUTE FLOW TO UNPROTECTED SECTION (DAMAGE CENTER)

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	DNST-7	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0200	.0500	.0800	115.0	140.0	50.	.00200

} CHANNEL CHARACTERISTICS AT DAMAGE AREA

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 136.50 .10 122.00 12.00 122.00 30.00 115.00 90.00 115.00
150.00 120.00 550.00 130.00 650.00 140.00

} CHANNEL CROSS-SECTION AT DAMAGE AREA

STORAGE	0.00	.11	.24	.40	.60	.86	1.21	1.65	2.17	2.77
	3.45	4.21	5.04	5.89	6.76	7.66	8.57	9.50	10.45	11.42
OUTFLOW	0.00	134.10	456.15	962.30	1690.14	2752.92	4186.79	6060.64	8361.45	11109.15
	14327.75	18042.60	22466.41	27520.59	33059.03	39069.24	45542.00	52518.03	59981.33	67906.15
STAGE	115.00	116.32	117.63	118.95	120.26	121.58	122.89	124.21	125.53	126.84
	128.16	129.47	130.79	132.11	133.42	134.74	136.05	137.37	138.68	140.00
FLOW	0.00	134.10	456.15	962.30	1690.14	2752.92	4186.79	6060.64	8361.45	11109.15
	14327.75	18042.60	22466.41	27520.59	33059.03	39069.24	45542.00	52518.03	59981.33	67906.15

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE CHANNEL AT THE DAMAGE AREA

MAXIMUM STAGE IS 126.2 → MAXIMUM STREAM ELEVATION AT DAMAGE CENTER DUE TO DAM BREACH

MAXIMUM STAGE IS 123.3 → MAXIMUM STREAM ELEVATION AT DAMAGE CENTER DUE TO SPILLWAY DISCHARGE

****

CENTRAL STREET DAM BREACH RESULTS

SUMMARY OF DAM SAFETY ANALYSIS

WITH RESERVOIR SURFACE AT TOP OF DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	150.00	144.80	150.00
STORAGE	838.	401.	838.
OUTFLOW	5470.	0.	5470.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	149.91	0.00	838.	10163.	0.00	1.00	0.00

→ PEAK BREACH DISCHARGE

SPILLWAY DISCHARGE RESULTS

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	150.00	144.80	150.00
STORAGE	838.	401.	838.
OUTFLOW	5470.	0.	5470.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	149.66	0.00	838.	5470.	0.00	0.00	0.00

→ PEAK SPILLWAY DISCHARGE

FLOW CONDITIONS IN DOWNSTREAM CHANNEL DUE TO DAM BREACH → PLAN 1 STATION DNST-6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	9780.	129.8	1.00

FLOW CONDITIONS IN DOWNSTREAM CHANNEL DUE TO SPILLWAY DISCHARGE → PLAN 2 STATION DNST-6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	4828.	125.2	.08

FLOW CONDITIONS AT DAMAGE AREA DUE TO DAM BREACH → PLAN 1 STATION DNST-7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	9762.	126.2	1.00

→ DAM BREACH FLOW AT DAMAGE AREA

FLOW CONDITIONS AT DAMAGE AREA DUE TO SPILLWAY DISCHARGE → PLAN 2 STATION DNST-7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	4828.	123.3	.08

→ SPILLWAY DISCHARGE FLOW AT DAMAGE AREA

FLOOD HYDROGRAPH PACKAGE (HEC-1) CENTRAL STREET (SAXONVILLE POND) DAM BREACH (BREACH OCCURS WITH RESERVOIR
DAM SAFETY VERSION JULY 1978 OUTFLOW ROUTED TO DAMAGE CENTER SURFACE AT SPILLWAY CREST)
LAST MODIFICATION 26 FEB 79

INPUT

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     1          A1        HYDROLOGIC ANALYSIS OF CENTRAL STREET (SAXONVILLE POND) DAM
     2          A2                  NATIONAL DAM INSPECTION PROGRAM
     3          A3              NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4          B    300       0       30       0        0        0        0        0        -4       0
     5          B1     5
     6          J      1       1        1
     7          J1     0
     8          K      1    OUT=8                                          1
     9          K1                          SAXONVILLE POND OUTFLOW
    10          Y                                    1        1
    11          Y1     1                                                 -150      -1
    12          Y4  144.8     146      147      148      149      150      151      153      155      160
    13          Y5     0      170      880     2020     3580     5470     8560    18780    34430   109620
    14          SA     0       64      106      227
    15          SE   126    144.8      150      160
    16          SS 144.8
    17          SD   150
    18          S8    75      .01      130        1    144.8    144.8
    19          K      1    DNST-6                                         1
    20          K1                  ROUTE SAXONVILLE OUTFLOW TOWARD DAMAGE CENTER
    21          Y                                    1        1
    22          Y1     1                                                   -1
    23          Y6   .05      .05      .08      115      140     2000     .002
    24          Y7     0      137       25      127       50      117       55      115      115      115
    25          Y7   120      117      160      130      190      140
    26          K      1    DNST-7                                         1
    27          K1                  ROUTE FLOW TO UNPROTECTED SECTION (DAMAGE CENTER)
    28          Y                                    1        1
    29          Y1     1                                                   -1
    30          Y6   .02      .05      .08      115      140       50     .002
    31          Y7     0    136.5      0.1      122       12      122       30      115       90      115
    32          Y7   150      120      550      130      650      140
    33          K     99
```

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE= 02/19/80.
TIME= 12.51.18.

HYDROLOGIC ANALYSIS OF CENTRAL STREET (SAXONVILLE POND) DAM
NATIONAL DAM INSPECTION PROGRAM
NEW ENGLAND DIVISION - CORPS OF ENGINEERS

JOB SPECIFICATION

NU	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	30	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	ITRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 0.00

HYDROGRAPH ROUTING

SAXONVILLE POND OUTFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUT-8	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-150.	-1

STAGE	144.80	146.00	147.00	148.00	149.00	150.00	151.00	153.00	155.00	160.00
FLOW	0.00	170.00	880.00	2020.00	3580.00	5470.00	8560.00	18780.00	34430.00	109620.00

STAGE-DISCHARGE DATA

SURFACE AREA=	0.	64.	106.	227.
CAPACITY=	0.	401.	838.	2466.
ELEVATION=	126.	145.	150.	160.

STAGE-STORAGE DATA

SPILLWAY CREST ELEVATION →

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
144.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
150.0	0.0	0.0	0.

TOP OF DAM ELEVATION →

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
75.	.01	130.00	1.00	144.80	144.80

BREACH DATA - FAILURE BEGINS IMMEDIATELY WITH RESERVOIR SURFACE AT SPILLWAY CREST

BEGIN DAM FAILURE AT 0.00 HOURS

PEAK OUTFLOW IS 7405. AT TIME 1.00 HOURS

→ PEAK BREACH DISCHARGE

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HYDROGRAPH ROUTING

ROUTE SAXONVILLE OUTFLOW TOWARD DAMAGE CENTER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ONST=6	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

BREACH OUTFLOW ROUTED TO END OF RIPRAP-LINED CHANNEL

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0500	.0500	.0800	115.0	140.0	2000.	.00200

} DOWNSTREAM CHANNEL CHARACTERISTICS

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 137.00 25.00 127.00 50.00 117.00 55.00 115.00 115.00 115.00
120.00 117.00 160.00 130.00 190.00 140.00

} CHANNEL CROSS-SECTION AT END OF CHANNEL

STORAGE	0.00	3.82	8.05	12.71	17.82	23.37	29.36	35.80	42.68	50.00
	57.77	65.98	74.63	83.72	93.25	103.21	113.61	124.44	135.56	146.92
OUTFLOW	0.00	128.19	423.80	869.19	1450.39	2165.24	3013.71	3996.93	5116.73	6375.35
	7775.36	9319.48	11011.21	12853.09	14847.59	16997.73	19306.56	21813.25	24576.01	27500.83
STAGE	115.00	116.32	117.63	118.95	120.26	121.58	122.89	124.21	125.53	126.84
	128.16	129.47	130.79	132.11	133.42	134.74	136.05	137.37	138.68	140.00
FLOW	0.00	128.19	423.80	869.19	1450.39	2165.24	3013.71	3996.93	5116.73	6375.35
	7775.36	9319.48	11011.21	12853.09	14847.59	16997.73	19306.56	21813.25	24576.01	27500.83

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL

MAXIMUM STAGE IS 126.6

→ PEAK WATER ELEVATION AT END OF CHANNEL

HYDROGRAPH ROUTING

ROUTE FLOW TO UNPROTECTED SECTION (DAMAGE CENTER)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ONST-7	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

ROUTED BREACH OUTFLOW ROUTED TO THE DAMAGE CENTER (WHERE THE PROTECTION ENDS ON THE RIGHT SIDE)

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	FLWTH	SEL
.0200	.0500	.0800	115.0	140.0	50.	.00200

} CHANNEL CHARACTERISTICS TO DAMAGE CENTER

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 136.50 .10 122.00 12.00 122.00 30.00 115.00 90.00 115.00
150.00 120.00 550.00 130.00 650.00 140.00

} CHANNEL CROSS-SECTION AT DAMAGE AREA

STORAGE	0.00	.11	.24	.40	.60	.86	1.21	1.65	2.17	2.77
	3.45	4.21	5.04	5.89	6.76	7.66	8.57	9.50	10.45	11.42
OUTFLOW	0.00	134.10	456.15	962.30	1690.14	2752.92	4186.79	6060.64	8361.45	11109.15
	14327.75	18042.60	22466.41	27520.59	33059.03	39069.24	45542.00	52518.03	59981.33	67906.15
STAGE	115.00	116.32	117.63	118.95	120.26	121.58	122.89	124.21	125.53	126.84
	128.16	129.47	130.79	132.11	133.42	134.74	136.05	137.37	138.68	140.00
FLOW	0.00	134.10	456.15	962.30	1690.14	2752.92	4186.79	6060.64	8361.45	11109.15
	14327.75	18042.60	22466.41	27520.59	33059.03	39069.24	45542.00	52518.03	59981.33	67906.15

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE CHANNEL AT THE DAMAGE CENTER

MAXIMUM STAGE IS 124.3

→ MAXIMUM WATER ELEVATION AT THE DAMAGE AREA

********** ********** ********** ********** **********

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RESULTS OF CENTRAL STREET (SAXONVILLE POND) DAM BREACH (@ SPILLWAY CREST)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	144.80	144.80	150.00
STORAGE	401.	401.	838 → STORAGE CAPACITY
OUTFLOW	0.	0.	5470. → SPILLWAY DISCHARGE CAPACITY

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	144.80	0.00	401.	7405. → PEAK BREACH DISCHARGE	0.00	1.00	0.00

PROTECTIVE CHANNEL → PLAN 1 STATION DNST-6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	6186.	126.6 → PEAK WATER ELEVATION AT END OF PROTECTIVE CHANNEL	1.00

DAMAGE CENTER → PLAN 1 STATION DNST-7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	6140.	124.3 → PEAK WATER ELEVATION AT DAMAGE CENTER	1.00

END

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