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HOUSATONIC RIVER BASIN
WEST STOCKBRIDGE, MASSACHUSETTS

AD-A155 617

SHAKER MILL POND DAM
MA 00732

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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HSMC
Sept. 24, '81*

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

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HOUSATONIC RIVER BASIN
WEST STOCKBRIDGE, MASSACHUSETTS

SHAKER MILL POND DAM
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

JULY 1979

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00732
Name of Dam: Shaker Mill Pond
Town: West Stockbridge
County: Berkshire
State: Massachusetts
Stream: Williams River
Date of Site Visit: 30 May 1979

BRIEF ASSESSMENT

Shaker Mill Pond Dam consists of a gunite covered concrete and masonry spillway structure between approach channel walls and abutting earth roadway embankments. The overall length of the dam is about 50 ft. and its maximum height is 20.4 ft. There are two regulating outlets at the dam site. The dam was originally built in 1910 to provide a pond for power generation. Shaker Mill Pond is now used for recreation and as a fire protection supply.

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

The dam is in fair condition, based on a visual examination of the structure. Several deficiencies, mainly due to deterioration, were noted. However, there was no evidence of settlement, lateral movement or other signs of structural failure of the dam, or other conditions which would warrant urgent remedial action.

Based on the "intermediate" size and "high" hazard potential classifications in accordance with Corps of Engineers guidelines, the test flood for this dam is the Probable Maximum Flood (PMF). Hydraulic analyses indicate that the test flood outflow of 27,200 cfs (inflow 40,500 cfs or 1,250 csm) would overtop the dam by about 18 ft. With the water level at the top of dam (level of Route 102 bridge deck), the ungated spillway capacity is approximately 1,600 cfs, which is 6 percent of the test flood outflow.

The Town of West Stockbridge, owner of the dam, should engage a registered professional engineer to 1) perform a detailed examination of the spillway under no flow conditions, 2) observe the owner demonstrate the operation of the outlet works, 3) investigate the seepage occurring at the abutments and 4) perform a more detailed hydrologic analysis and then investigate spillway discharge adequacy, as outlined in Section 7.2.

Any necessary modifications resulting from the investigations, and remedial measures, including repairing eroded and cracked portions of the dam, repairing the collapsed right discharge channel wall, rebuilding and restoring power to the gate house, removing debris in the downstream channel and sealing leaks through the outlet works, as outlined in Section 7.3, should be implemented by the Owner within one year after receipt of this report. The Owner should also prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan.

HALEY & ALDRICH, INC.
by:



Harl Aldrich
President



PREFACE

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

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

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

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

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

TABLE OF CONTENTS

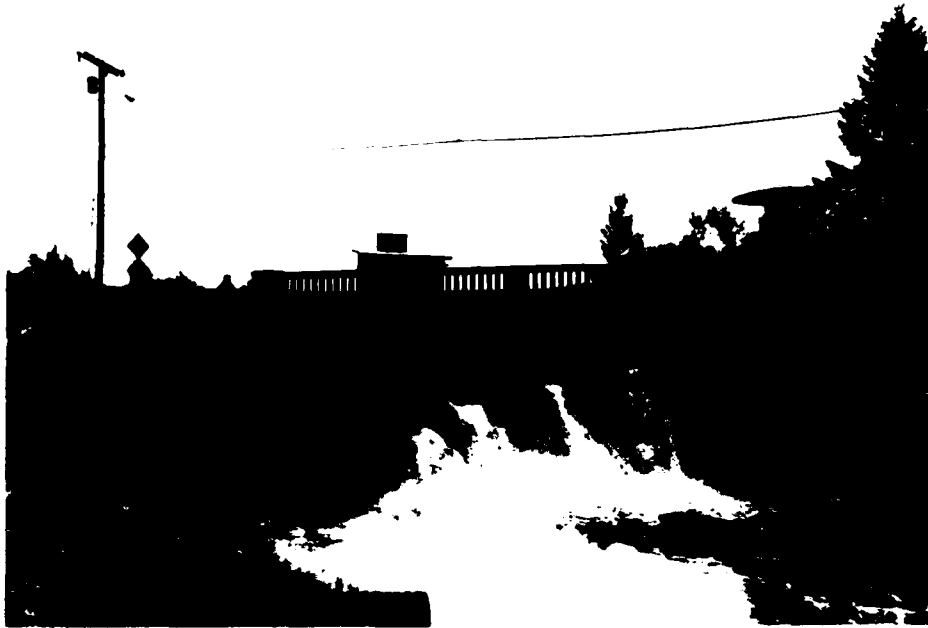
<u>Section</u>	<u>Page</u>
LETTER OF TRANSMITTAL	
BRIEF ASSESSMENT	
REVIEW BOARD PAGE	
PREFACE	i
TABLE OF CONTENTS	iii
OVERVIEW PHOTO	vi
LOCATION MAP	vii
1. PROJECT INFORMATION	
1.1 General	1
a. Authority	1
b. Purpose of Inspection	1
1.2 Description of Project	2
a. Location	2
b. Description of Dam and Appurtenances	2
c. Size Classification	3
d. Hazard Classification	3
e. Ownership	3
f. Operator	3
g. Purpose of Dam	4
h. Design and Construction History	4
i. Normal Operational Procedures	4
1.3 Pertinent Data	4
2. ENGINEERING DATA	
2.1 Design Data	9
2.2 Construction Data	9
2.3 Operation Data	9
2.4 Evaluation of Data	9

TABLE OF CONTENTS (Continued)

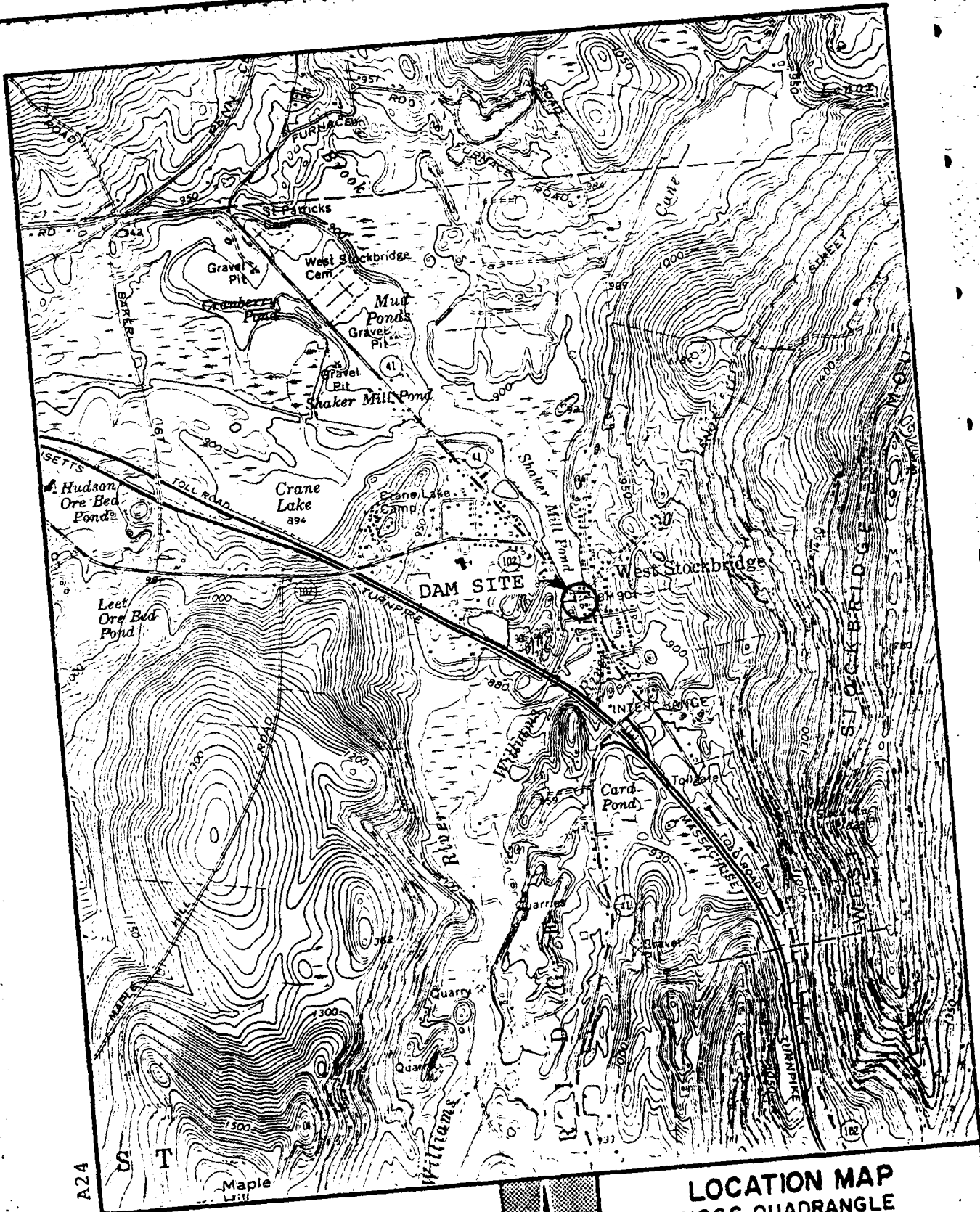
<u>Section</u>	<u>Page</u>
3. VISUAL EXAMINATION	
3.1 Findings	10
a. General	10
b. Dam	10
c. Appurtenant Structures	11
d. Reservoir Area	12
e. Downstream Channel	13
3.2 Evaluation	13
4. OPERATIONAL PROCEDURES	
4.1 Procedures	15
4.2 Maintenance of Dam	15
4.3 Maintenance of Operating Facilities	15
4.4 Description of any Warning System in Effect	15
4.5 Evaluation	15
5. HYDRAULIC/HYDROLOGIC	
5.1 Evaluation of Features	17
a. General	17
b. Design Data	17
c. Experience Data	17
d. Visual Observations	17
e. Test Flood Analysis	18
f. Dam Failure Analysis	18
6. STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	20
a. Visual Observations	20
b. Design and Construction Data	20
c. Operating Records	20
d. Post-Construction Changes	20
e. Seismic Stability	20

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
7. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES	
7.1 Dam Assessment	21
a. Condition	21
b. Adequacy of Information	21
c. Urgency	21
d. Need for Additional Investigation	21
7.2 Recommendations	21
7.3 Remedial Measures	22
a. Operation and Maintenance Procedures	22
7.4 Alternatives	23
APPENDIX A - INSPECTION CHECKLIST	A-1
APPENDIX B - ENGINEERING DATA	B-1
APPENDIX C - PHOTOGRAPHS	C-1
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	D-1
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	E-1

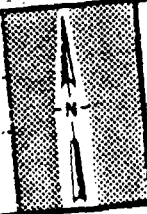


1. Overview of Shaker Mill Pond Dam



FILE NO. 4270 A24

DAM: SHAKER MILL POND
 IDENTIFICATION NO. MA 00732



LOCATION MAP
USGS QUADRANGLE
 STOCKBRIDGE, MA
 APPROX. SCALE: 1" = 2000'

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM
SHAKER MILL POND DAM
MA 00732

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

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

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

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

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

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

1.2 Description of Project

a. Location. Shaker Mill Pond Dam is located immediately downstream of the Route 102 bridge on Williams River near the center of West Stockbridge, Massachusetts, as shown on the Location Map, page vii. The latitude and longitude of the dam site are $N42^{\circ}20.1'$ and $W73^{\circ}22.1'$. Williams River joins Housatonic River at a point about 8 miles south of the dam.

b. Description of Dam and Appurtenances. Shaker Mill Pond Dam is approximately 50 ft. long and a maximum of 20.4 ft. in height. The dam itself consists of a concrete and masonry spillway weir immediately downstream of the concrete walls and earth embankments abutting the Route 102 bridge which form the approach channel to the spillway. Appurtenant to the dam are three outlets (two of which can be operated), a small wooden gate house, an abandoned generator structure and various concrete and stone masonry walls. The general configuration of the dam is shown on the "Site Plan Sketch", page C-1.

The main spillway is 20 ft. long, 1 ft. deep and ogee-shaped in cross-section, Photos No. 2 and 3. There are eight steel dowels on the main spillway crest (which is at El. 893.8 National Geodetic Vertical Datum (NGVD)) that could be used to install flashboards. The spillway length increases to about 50 ft. by stepped up sections on both sides of the main spillway, as shown on the overview photo and schematically on page D-7. The downstream face of the spillway and the adjacent training walls have been covered with gunite. The top of dam is considered to be the Route 102 bridge deck at El. 900.1.

The regulating outlets consist of two gated 36-in. diameter conduits. The outlet nearest the right (west) abutment has a manually-operated gate, Photo No. 4, and upstream invert at El. 887.5. The center outlet passing through the spillway is controlled by a motor-driven gate mechanism in the gate house above the spillway, Photo No. 3. Its upstream invert is at El. 889.0. There is also a gated conduit at the left (east) abutment of the spillway which was designed as a penstock to the turbine housed in a concrete generator structure at the spillway toe, Photo No. 9. However, this third

outlet is no longer operative.

The roadway embankments at the left and right abutments are approximately 30 ft. wide at the top of the dam and retained by concrete walls. There is also a 25 ft. long concrete wing wall through the right abutment parallel to the spillway axis. A 6-in. diameter pipe apparently drains the area behind the wall.

c. Size Classification. Shaker Mill Pond Dam has an estimated maximum storage capacity of 1,200 acre-ft. at the top of dam. The corresponding maximum hydraulic height of the dam is 20.4 ft. Storage of from 1,000 to 50,000 acre-ft. classifies this dam in the "intermediate" size category, according to the guidelines established by the Corps of Engineers.

d. Hazard Classification. Based on the Phase I investigations and dam failure analysis (Section 5.1f) in accordance with Corps of Engineers guidelines, Shaker Mill Pond Dam was found to have a "high" hazard potential. If the dam were to fail, a business and residential district along the river, particularly the right bank downstream of Depot Street, would be subject to serious flooding. Therefore, the potential for loss of lives and extensive economic loss to commercial and residential properties is high.

e. Ownership. The name and address of the current owner is:

Board of Selectmen
Town of West Stockbridge
West Stockbridge, MA 01266

The Town of West Stockbridge reportedly acquired the dam from the Massachusetts Electric Company, Route 7, Great Barrington, MA in 1964. It was also reported that the South Berkshire Electric Power Company once owned the dam about twenty years ago (circa 1959), and that the original owner was Brossidy Mill (grist mill, circa 1895).

f. Operator. Mr. John Viola, Highway Superintendent,

Town of West Stockbridge, is responsible for operation, maintenance and safety of the dam. His office phone number is (413) 232-7794 and home phone number is (413) 232-7724.

g. Purpose of Dam. The original purpose of the dam was to provide water power for a grist mill. A turbine and generator were installed at the dam site by a power company, but the equipment was never used to any extent. Currently the dam maintains the level of Shaker Mill Pond, which is used for recreation and as a fire protection supply.

h. Design and Construction History. The dam was originally constructed in 1910. A drawing of the proposed dam by Barnes & Spaulding, Engineers, dated October 1909 is included in Appendix B. No further information regarding the original design and construction was disclosed.

In 1948 the bridge immediately upstream of the dam was overtopped in a flood, causing extensive damage to the dam and property in the center of town. Consequently the right abutment adjacent to the spillway was reconstructed, and a 20 ft. long section of the spillway was lowered by about 1 ft. to increase the discharge capacity.

It is not known when the generator structure was constructed at the toe of the spillway. In 1972 the Town of West Stockbridge completed extensive repairs to the dam to correct the unsafe conditions at the dam as directed by the Massachusetts Department of Public Works in a letter dated 16 June 1971 (see page B-4). The 1972 modifications may have included the gunite covering on the dam, constructing a buried cutoff wall upstream of the wing wall at the right abutment and a weep pipe to drain the area behind the wing wall.

i. Normal Operational Procedures. There is no formal established routine for the operation of the dam. The two regulating outlets are operated as required during periods of high water levels and heavy precipitation. Flashboards have not been installed at the dam for many years.

1.3 Pertinent Data

All elevations reported herein are approximate and

based on rough measurements made on 30 May 1979 at the dam site. The USGS benchmark on the left abutment of the Route 102 bridge, which is given as El. 901 NGVD, was used as the reference elevation.

a. Drainage Area. The total drainage area of Williams Brook above Shaker Mill Pond Dam shown on page D-1 is estimated to be 32.4 square miles. Ground elevations in the watershed vary from a low of about El. 900 near the dam to a high of about El. 2,070 on Pelly Peak in the Town of Richmond. The majority of the area consists of rolling woodland with some flat residential, swamp and pond areas.

b. Discharge at Dam Site

1. Outlet works.....
 - a) 36-in. dia. waste outlet near right bank, Inv. El. 887.5
 - b) 36-in. dia. waste outlet through spillway, Inv. El. 889.0
 - c) Penstock to turbine (not operative)
2. Maximum known flood at dam site..... Not available
3. Ungated spillway capacity at top of dam (without flashboards)... 1,600 cfs at El. 900.1
4. Ungated spillway capacity at test flood pool elevation (without flashboards)..... 2,160 cfs at El. 918.0 (Portion of test flood flowing over spillway; the remaining 25,040 cfs would flow over the dam and banks)
5. Gated spillway capacity at normal pool elevation..... Not applicable
6. Gated spillway capacity at test flood pool elevation..... Not applicable
7. Total spillway capacity at test flood pool elevation..... 2,160 cfs at El. 918.0 (see note for item 4)

8. Total project discharge
at test flood pool
elevation..... 27,200 cfs at El. 918.0

c. Elevation (ft. above NGVD)

1. Streambed at centerline
of dam..... 879.7
2. Maximum tailwater..... Unknown
3. Upstream portal invert
diversion tunnel..... Not applicable
4. Recreation pool..... 893.8
5. Full flood control pool. Not applicable
6. Spillway crest (without
flashboards)..... 893.8
7. Design surcharge -
original design..... Unknown
8. Top of dam..... 900.1
9. Test flood design sur-
charge..... 918.0

d. Reservoir .

1. Length of maximum pool.. 1.5 mi. (Est.)
2. Length of recreation
pool..... 1.0 mi. (Est.)
3. Length of flood control
pool..... Not applicable

e. Storage (acre-feet)

1. Recreation pool..... 130
2. Flood control pool..... Not applicable
3. Spillway crest..... 130
4. Top of dam..... 1,200
5. Test flood pool..... 11,000

f. Reservoir Surface (acres)

1. Recreation pool..... 32
2. Flood control pool..... Not applicable
3. Spillway crest..... 32
4. Top of dam..... 320
5. Test flood pool..... 850

g. Dam

1. Type..... Concrete and masonry gravity structure
2. Length..... 49.2 ft.
3. Height..... 20.4 ft. max.
4. Top width..... Varies
5. Side slopes..... Varies
6. Zoning..... Unknown
7. Impervious core..... Concrete and masonry walls
8. Cutoff..... Concrete and masonry walls
9. Grout curtain..... Unknown
10. Other..... Roadway embankment at each abutment has minimum 30 ft. width at top of dam

h. Diversion and Regulating Tunnel. Not applicable

i. Spillway

1. Type..... Concrete and masonry gravity, overflow, ogee-shaped weir with no flashboards in place
2. Length of weir..... 20 ft.
3. Crest elevation..... 893.8
4. Gates..... None
5. U/S Channel..... Restricted by 44 ft. wide by 9.5 ft. high opening under Route 102 bridge
6. D/S channel..... About 35 ft. wide with stone sidewalls; flow was slightly turbulent
7. General..... Several dwellings were built right on edge of the river bank

j. Regulating Outlets. There are two (2) regulating outlets for this dam. One 36-in. diameter pipe in the outlet works on the right has an invert of about El. 887.5 and is controlled through a hand-operated 42-in. square steel slide gate on the downstream side of the dam. The

second outlet is a 36-in. diameter pipe which passes through the spillway to the left of the outlet structure and has an invert of about El. 889.0. The 4-ft. square wooden gate for this pipe is operated through gearwheels activated by a motor driven belt wheel located in a small wooden gatehouse above the spillway. There was no belt on the wheel at the time of the site visit (30 May 1979). Furthermore, there is no electrical power source to the gatehouse, so electrical power for the motor must be taken from the adjacent Shaker Mill Museum. In the event power is not available, a handle on the belt wheel can be used to manually operate the gate.

The penstock to the turbine in the generator structure at the toe of the spillway on the left side is controlled by a wooden gate on the upstream side which is inoperative.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

One drawing of the proposed dam dated 1909 is available.

2.2 Construction Data

No engineering data documenting the original construction of the dam are available. The post-construction changes described in Section 1.2h are based on information contained in prior inspection reports or reported by the operator of the dam, Mr. John Viola.

2.3 Operation Data

Prior county and state inspection reports since 1968 are the only operation records available for this dam.

2.4 Evaluation of Data

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

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

c. Validity. The information contained in the engineering data may generally be considered valid. However, the dimensions of the dam given in the 18 January 1973 state inspection report, page B-11, differ somewhat but not significantly from those measured on 30 May 1979 during the Phase I site visit.

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I visual examination of Shaker Mill Pond Dam was conducted on 30 May 1979. The upstream water surface elevation was about 0.7 ft. above the 20 ft. long spillway crest or El. 894.5 NGVD on that day.

In general, the project was found to be in fair condition. Several deficiencies which require correction were noted.

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

b. Dam. The dam is basically an ogee-shaped spillway between concrete or stone masonry side walls, Photos No. 1, 2 and 3. Gunite had been applied to the downstream face of the spillway and is now cracked and separated from the spillway in several locations. Although the downstream face is partially obscured by flowing water, the location of the principal crack or cracks is evident where water impinges on the displacement at the crack, Photo No. 3. Large pieces of gunite have broken off above and below the center outlet pipe and surface erosion is evident in many areas of the irregular downstream face of the spillway.

Large portions of gunite covering have broken off the left downstream training wall of the right outlet works structure, revealing a concrete wall with several cracks and heavy surface erosion, Photo No. 5. The downstream face of the outlet structure under the wooden operating platform is constructed of grouted stone masonry in fair condition. The remaining concrete portions of the outlet structure and exposed portion of the concrete wing wall are in good condition, Photo No. 4. Note that a 6-in. diameter pipe is flowing about one-third to one-half full,

Photo No. 4, apparently draining an area immediately behind the wing wall.

Seepage is occurring through some broken rock fill at the right (west) abutment, Photos No. 4 and 10, emerging about 1 ft. above the tailwater elevation or 8.5 ft. below the upstream pond level. The water is clear with no evidence of turbidity. Seepage is also occurring at the toe of broken rock fill at the left (east) abutment, Photo No. 8, at an elevation approximately 3 ft. below the upstream pond level. The estimated flow from this spring is about 2 to 3 gallons per minute. The water appeared to be clear.

c. Appurtenant Structures. The approach channel is formed by two walls (downstream of the concrete abutments of the Route 102 bridge shown on Photo No. 12). The right (west) concrete wall was reportedly built in 1948. It appears to be in good condition, except for a large horizontal crack or deteriorated joint near the water line, Photo No. 2, through which seepage occurring at the downstream end of the right abutment may be entering. The short left (east) wall appears to be stone masonry construction covered with gunite, Photo No. 6. It was wet at the contact between the gunite covering and the left abutment, Photo No. 8, where seepage was observed.

An outlet works structure is present between the spillway weir and the right discharge channel wall, Photo No. 4. The operating platform for the slide gate control is constructed of wood and is in good condition. The support for the platform is adequate. The wooden walkway ramp to the platform is on a steep grade and could be slippery during bad weather. There are no handrails on the platform or the walkway ramp. The outlet conduit is controlled by a manually operated steel slide gate, partially shown on Photo No. 5, which was reported to be operational, but was not opened during the site visit. The closed gate is leaking.

The wooden gate structure to the left of the outlet works, Photos No. 1, 2, 3, 6 and 11, is used to house control mechanism for the 36-in. diameter

pipe which discharges on the downstream face of the spillway. The structure is in very poor condition. The windows are broken, and the floor is badly deteriorated. There is no easy access to the gatehouse from the adjacent concrete platform nor are handrails provided for safety. The control mechanisms are gearwheels activated by a motor driven belt wheel, Photo No. 7. However, no belt was observed and there was no electrical power source to the gatehouse. It was reported that the only power near the dam which could be used was in Shaker Mill Museum. The gate control mechanism could also be operated manually. The gate was fully open during the site visit, Photo No. 3.

On the left (east) side of the spillway at the toe of the dam is an abandoned concrete structure which houses a turbine and generator, Photos No. 1, 6, 9 and 11. The walls of the structure are stained and show several cracks with efflorescence. The flow to the generator structure was controlled by a wooden gate operated through a wooden stem rack and pinion gear device, Photos No. 2 and 6. The gate is not operative. A hole was broken out on the downstream wall of the generator structure to allow the water seeping through the gate to return to the downstream channel, Photo No. 9.

The left (east) discharge channel wall is of grouted stone masonry construction and appears to be in relatively good condition, Photo No. 9. The right (west) wall is of similar construction and for the most part is also in relatively good condition. However, the first 20 ft. of the wall beyond the dam appear to have experienced a structural failure, and some of the remains are seen in the channel, Photo No. 10. Water was observed seeping through the left abutment at this location.

d. Reservoir Area. Shaker Mill Pond is a relatively long, shallow reservoir, Photo No. 13. There are flat residential areas on either side of the pond immediately upstream of the dam. The shoreline to the north consists generally of wooded slopes and swampy areas. There is no significant probability of landslides into the reservoir affecting the safety of the dam.

Sedimentation has raised the pond bottom to about El. 887 upstream of the dam, which is 5 to 7 ft. higher than the downstream channel bottom just below the dam.

e. Downstream Channel. Williams River joins the Housatonic River at a point about 8 miles south of West Stockbridge. About 1,600 ft. downstream from the dam the river passes under the Massachusetts Turnpike. A 1,000 ft. long channel portion immediately downstream of the dam and within the downtown area of West Stockbridge was studied for flood impacts. Within this area there are commercial and residential type buildings on both banks of the channel.

The channel, in general, has a rectangular shape with bottom widths varying from 35 to 50 ft. and depths varying from 10 to 15 ft. at the banks. Erosion protection of both banks is provided by stone masonry walls. The left bank, where Route 102 is located, is relatively higher than the right bank.

The first bridge over the channel is on Depot Street, about 300 ft. downstream from the dam. It is a concrete bridge with a rectangular opening 38.5 ft. wide and 13.3 ft. high. Edges of foundation walls under several buildings are flush with the channel sidewalls. The land level on the right bank drops by about 5 ft. at a distance of about 50 ft. below the bridge. Another bridge is located about 200 ft. downstream from Depot Street. The rectangular clear opening under this bridge is 40 ft. wide and 7.8 ft. high. The channel bottom slope is controlled with an existing shallow overflow weir about 250 ft. below the second bridge.

3.2 Evaluation

Based on the visual examination conducted on 30 May 1979, Shaker Mill Pond Dam is considered to be in fair condition. Although the dam showed no signs of instability during the site visit, the fair condition assessment is due to the general deterioration of the gunite and concrete, the deteriorated conditions of the wooden gate structure, the lack of power at the gate structure, and the condition of the right channel wall downstream of the dam. Seepage is also occurring at both abutments of the

of the dam, which was noted by the Massachusetts Department of Public Works in 1971 in a list of several unsafe conditions at the dam requiring prompt action. Evidently, the remedial measures taken in 1972 by the owner did not eliminate the seepage entirely.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

In general, there are no formal procedures to provide routine maintenance and satisfactory operation of the dam. The two regulating outlets are operated as required during periods of high water and heavy precipitation. Flashboards are generally not installed at the spillway.

4.2 Maintenance of Dam

There are no established procedures or manuals for inspection and maintenance of the dam. No maintenance work on the dam has reportedly been performed since the extensive 1972 repairs requested by the Massachusetts Department of Public Works in 1971.

4.3 Maintenance of Operating Facilities

It was reported that the operating facilities are maintained on a demand basis. Although the gate mechanisms appear to be well maintained, the condition of the wooden gatehouse indicates that this facility, in general, has received little or no maintenance for sometime. The left (east) outlet gate was replaced and a new platform constructed over the right (west) outlet gate in 1960, according to the 1968 state inspection report.

4.4 Description of any Warning System in Effect

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

4.5 Evaluation

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

walls and channels. Incorporated in this procedure should be a procedure to operate the reservoir outlet gates periodically.

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

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. The dam consists of a concrete and masonry spillway between approach channel walls and earth abutments. The bridge on Route 102 is immediately upstream of the dam, and this structure would control major discharges from the reservoir. The original purpose of the dam was to provide water storage and flow regulation for power generation at the dam site. Now the pond is mainly used for recreational purposes.

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

c. Experience Data. No historical records of the maximum flows are available. However, reportedly, Route 102 was overtopped and several dwellings downstream from the dam were flooded during the 1948 flood. The spillway crest was lowered by one foot and the right abutment was reconstructed with concrete after the flooding event.

d. Visual Observations. Shaker Mill Pond at normal levels has an average width of about 300 ft. and a length of about 1 mile. It is surrounded by rolling woodlands. On the day of the site visit, 30 May 1979, about 0.7 ft. of water was flowing over the spillway, which had no flashboards. The depth of the pond, just upstream of the spillway, was measured at about 8.0 ft. The center outlet underneath a small gate house was fully open. A gate on the right (west) outlet was closed. The left (east) outlet which was used to convey flows into the generator structure was permanently blocked.

Medium size trees and bushes were observed on the sides of the channel, particularly within the section between the dam and Depot Street. Several dwellings were either at the flood plain or extended right on top of the channel side wall. Two bridge crossings exist over the channel within a distance of about 500 ft. from the dam. Vertical side walls of the channels are made of stone masonry.

The main spillway crest is 20 ft. long and 1 ft. deep. The length increases to about 50 ft. by stepped up sections on both sides of the main spillway (page D-7). A bench mark with elevation 901.0 is located on top of the Route 102 bridge left abutment wall.

e. Test Flood Analysis. Based upon the Corps of Engineers guidelines, the recommended test flood for "intermediate" size dams having a "high" hazard potential is the PMF (Probable Maximum Flood). The PMF was determined using Corps of Engineers Guidelines for Estimating Maximum Probable Discharge in the Phase I Safety Investigation. The watershed terrain was determined to be 95 percent rolling and 5 percent flat (swamp and water surface). From this, an inflow rate of 1,250 cfs per square mile (csm) was interpolated for the drainage area of 32.4 square miles. The resulting PMF inflow is 40,500 cfs.

Surcharge-storage routing was performed through Shaker Mill Pond using the stage-discharge and area-volume curves shown in Appendix D. Flow through the low-level outlet conduits were ignored for this evaluation. The test flood outflow, estimated to be 27,200 cfs, would occur when the water surface elevation in the pond is at El. 918.0. This is about 18 ft. above the top of the dam. At this time the tail water elevation would be about 12 ft. above the river banks. As a result, a large area extending from upstream to downstream of the dam would be seriously flooded.

With the water level at the top of dam, the capacity of the existing spillway at this dam site is about 1,600 cfs or 6 percent of the test flood outflow. There is therefore a high probability of the dam (Route 102 roadway) being overtopped.

f. Dam Failure Analysis. Based on Corps of Engineers Guidelines for Estimating Dam Failure Hydrographs, and assuming that a failure would occur along 85 percent of the spillway structure, the peak failure outflow is estimated to be 6,470 cfs. The flow just before failure would be approximately 1,600 cfs. As shown in Appendix D, the hydraulic profile for a discharge of 1,600 cfs would be below the top of the lower bank. Because of this prior condition, the

failure could occur with people in the flood hazard area unprepared.

The storage capacity of the downstream channel within the study area is negligible in comparison to the volume of the pond prior to the failure. An approximate failure flood hydraulic profile is shown on page D-9, Appendix D. The area extending about 200 ft. downstream from Depot Street, particularly on the right bank, would be subject to a serious flooding. Here a hardware store, three two-story commercial and residential buildings on Depot Street, another residential building, one exhibit hall, and one restaurant - resident complex on the lower area downstream of Depot Street are estimated to be subject to flooding to a depth varying from 4 ft. to 7 ft.

In conclusion, in the event of a dam failure, potential for loss of lives exists and excessive residential and commercial property damages are expected to occur. Therefore, the hazard potential classification for this dam is considered high, in accordance with Corps of Engineers guidelines.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. There was no visual evidence of dam instability during the site visit on 30 May 1979. There was no evidence of movement of structural items, except for the collapsed section of the downstream channel wall to the right of the dam.

b. Design and Construction Data. Design data in the form of a drawing of the original proposed dam construction (dated 1909) is available. Review of the drawing indicates that the dimensions and configuration of the spillway is consistent with typical spillways of this magnitude.

c. Operating Records. There were no known operating records available for this facility to aid in the evaluation of the structural stability.

d. Post-Construction Changes. Review of the drawing of the original proposed dam construction, the different methods of construction and different shades and consistencies of concrete indicate that this dam has been repaired and altered several times. During the site visit, it was reported that the right outlet structure has been reconstructed, the main spillway crest lowered and a cut off wall added to the right of the outlet.

e. Seismic Stability. Shaker Mill Pond Dam is located in a Seismic Zone 1 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS
AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination of Shaker Mill Pond Dam revealed that the structure was in fair condition. Although there were no signs of impending structural failure or other conditions which would warrant urgent remedial action, several deficiencies were noted.

Based on the results of computations included in Appendix D and described in Section 5, the spillway is not capable of passing the test flood, which for this structure is the PMF. The test flood outflow of 27,200 cfs (inflow 40,500 cfs or 1,250 csm) would overtop the dam by about 18 ft. With the water level at the top of dam, the spillway capacity is about 1,600 cfs, which is 6 percent of the test flood outflow.

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

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

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

7.2 Recommendations

It is recommended that the Town of West Stockbridge,

owner of the dam, engage a registered professional engineer to undertake the following investigations:

1. Perform a detailed inspection of the spillway during no or low flow conditions.
2. Observe the owner demonstrate the operation of the outlet works slide gate to the right of the spillway and the gate control mechanism for the outlet through the spillway.
3. Perform an investigation to evaluate the seeping that is occurring through the right and left channel walls downstream of the dam. The investigation should include a comparison of the location, character and amount of seepage flow at times of high and low pond levels in an effort to determine the paths of seepage.
4. Perform a more detailed hydrologic analysis. Based on the findings, investigate spillway discharge adequacy.

The Owner should then implement corrective measures on the basis of these engineering investigations.

7.3 Remedial Measures

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

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

1. Repair erosion damage to the dam in general. The repairs should include the removal of all the gunite and provide erosion protection which would be more resistant to the type of conditions which this dam experiences.
2. Repair the large horizontal crack or deteriorated joint in the right (west) approach channel wall.
3. Reconstruct the stone masonry wall where it has collapsed on the right side downstream of the dam.

4. Remove the debris in the channel downstream of the outlet structure.
5. Reconstruct the wooden gatehouse and supply electrical power for the operation of the gate.
6. Seal off the inlet to the abandoned generator structure and repair the leaking steel gate for the right outlet works.
7. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for surveillance of the dam during periods of heavy precipitation and high reservoir water levels. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure satisfactory operation and to minimize deterioration of the facility. The regulating outlet gates should be operated periodically.
8. Develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam or other emergency conditions. The plan should be developed in cooperation with local officials and downstream inhabitants.

7.4 Alternatives

In addition to sealing off the inlet to the generator structure, the structure should be demolished and removed, thus eliminating a large obstruction to flow over the spillway during high water flow.

APPENDIX A - INSPECTION CHECK LIST

	<u>Page</u>
<u>VISUAL INSPECTION PARTY ORGANIZATION</u>	A-1
<u>VISUAL INSPECTION CHECK LIST</u>	
Dam Abutments and Roadway Embankment	A-2
Outlet Works - Spillway Weir, Approach and Discharge Channels	A-3
Right Outlet Works	A-4
Outlet Works - Gate House	A-5
Generator Structure	A-5

VISUAL INSPECTION PARTY ORGANIZATION
NATIONAL DAM INSPECTION PROGRAM

Dam: Shaker Mill Pond

Date: 30 May 1979

Time: 1030-1300

Weather: Overcast with light rain, temperature 60's F.

Water Surface Elevation Upstream: El. 894.5 NGVD (0.7 ft.
above top of concrete
weir)

Stream Flow: Estimated 50 cfs

Inspection Party:

Harl P. Aldrich, Jr.	- Soils/Geology
Richard A. Brown	
Haley & Aldrich, Inc.	
A. Ulvi Gulbey	- Hydraulic/Hydrologic
Robert H. Sheldon	
Robert P. Howard	- Structural/Mechanical
Camp, Dresser & McKee, Inc.	

Present During Inspection:

John Viola, Highway Superintendent, Town of West Stock-
bridge

**VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM**

DAM: Shaker Mill Pond DATE: 30 May 79

AREA EVALUATED	CONDITION
<u>DAM ABUTMENTS AND ROADWAY EMBANKMENT</u>	
Crest Elevation	Top of dam considered to be level of Route 102 bridge deck, El. 900.1 NGVD
Current Pool Elevation	El. 894.5, 0.7 ft. above the main spillway crest
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Good on Route 102 roadway
Movement or Settlement of Crest	None evident
Lateral Movement	None evident
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Concrete left bridge abutment cracked; large horizontal crack in right approach channel wall near upstream water level
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Unrestricted
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Minor vegetation in rock fill on downstream side of abutments
Sloughing or Erosion of Slopes or Abutments	Erosion on downstream side of right abutment due to collapse of downstream channel wall
Rock Slope Protection - Riprap Failures	Concrete wall on upstream side of roadway. Broken rock fill on downstream side of abutments
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Clear water seeping through broken rock fill on downstream side at both abutments (Emerging 1 ft. above tailwater on right side; 2-3 gpm about 3 ft. below pond level on left side)

A-2

FILE NO. 4160

**VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM**

DAM: Shaker Mill Pond DATE: 30 May 79

AREA EVALUATED	CONDITION
Piping or Boils Foundation Drainage Features Toe Drains Instrumentation Systems	None observed, seepage clear None known to exist 6-in. pipe flowing one-half to one-third full draining area behind wing wall at right abutment None
<p><u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u></p>	
<p>a. <u>Approach Channel</u></p>	
General Condition	Right concrete wall is in good condition, except for a large horizontal crack or deteriorated joint near the water surface level. Left wall appears to be stone masonry with gunite coating in good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Submerged - not observed
<p>b. <u>Weir and Training Walls</u></p>	
General Condition of Concrete	General condition is fair
Rusting or Staining Spalling	Some rusting and staining observed Gunite covering over major portion of the dam cracked and separated from dam surface. Large pieces of gunite broken off in several locations
Any Visible Reinforcing	None observed

**VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM**

DAM: Shaker Mill Pond DATE: 30 May 79

AREA EVALUATED	CONDITION
<p>Any Seepage or Efflorescence Drain Holes</p>	<p>Minor efflorescence observed None observed</p>
<p><u>c. Discharge Channel</u></p> <p>General Condition Loose Rock Overhanging Channel Trees Overhanging Channel Floor of Channel Walls</p>	<p>General condition is good None observed None observed Submerged - not observed Left wall is grouted stone masonry in good condition. Right wall is grouted stone masonry, and for the most part in good condition. 15 to 20 ft. of wall downstream of dam has failed and some remains in channel</p>
<p><u>RIGHT OUTLET WORKS</u></p> <p>General Condition Training Wall</p> <p>Outlet Walls</p> <p>Platform</p>	<p>General condition is good to fair Concrete wall covered with gunite. Large areas of gunite spalled off. Cracks in wall with heavy surface erosion Downstream face of outlet of grouted stone masonry in fair condition. Remaining portions of concrete construction in good condition. Concrete wing wall in good condition Wood construction in good condition. Support of platform only adequate. Remains of old platform observed. Walkway of wood plank on steep grade. No handrails on platform or walkway</p>

FILE NO. 4160

**VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM**

DAM: Shaker Mill Pond DATE: 30 May 79

AREA EVALUATED	CONDITION
Gate	Manually operated slide gate in good condition. Gate leaking. Not operated during the investigation
<u>OUTLET WORKS - GATE HOUSE</u>	
a. <u>General Condition</u>	Wooden gate house in very poor condition. The windows are broken. Floor is in a very deteriorated condition
b. <u>Mechanical and Electrical</u>	
Float Wells Service Gate	None 36-in. diameter gate operated by gearwheels activated by a motor driven beltwheel in good condition. Provisions for manual operations provided. Belt not present
Lightning Protection System Emergency Power System	None observed
Wiring and Lighting System in Gate House	Electric box and wiring observed, but no power line to gate house. Power must be brought in from Shaker Mill Museum
	None observed
<u>GENERATOR STRUCTURE</u>	
General Condition of Concrete	General condition of concrete is good
Rust or Staining	Some rust and staining observed
Spalling	None observed
Visible Reinforcing	Reinforcing exposed in discharge hole
Cracks	Several surface cracks observed
Efflorescence	Efflorescence observed at surface cracks

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Shaker Mill Pond DATE: 30 May 79

AREA EVALUATED	CONDITION
Drain Holes	Drain hole broken out on downstream wall. Gate seepage runs out hole to channel
Gate	Reported wooden gate with wooden stem, rack and pinion gear device. Gate was leaking
Other	Water wheel extremely rusted and abandoned

FILE NO. 4160

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

A-6

APPENDIX B - ENGINEERING DATA

			<u>Page</u>
<u>LIST OF AVAILABLE DATA</u>			B-1
<u>PRIOR INSPECTION REPORTS</u>			
<u>Date</u>	<u>By Whom</u>		
12 August 1968	County of Berkshire		B-2
17 May 1971	Mass. Dept. of Public Works		B-3
16 June 1971 (letter)	Mass. Dept. of Public Works		B-4
18 January 1973	Mass. Dept. of Public Works		B-6
13 November 1974	Mass. Dept. of Public Works		B-12
4 November 1976	Mass. Dept. of Public Works		B-15
<u>DRAWINGS</u>			
"Proposed Dam at Shaker Mill," Barnes & Spaulding, Engineers, October 1909			B-19

LIST OF AVAILABLE DATA
SHAKER MILL POND DAM

<u>Document</u>	<u>Content</u>	<u>Location</u>
County inspection reports, Shaker Mill Pond Dam	Report dated 12 August 1968	Mass. Department of Environmental Quality Engineering, Division of Waterways, 100 Nashua Street, Boston, MA 02114 and page B-2
State inspection reports, Dam No. 1-2-326-3	Four reports from 1971 through 1976, including cover letters and description of dam, if any	Mass. Department of Environmental Quality Engineering and pages B-3 through B-18
Drawing entitled "Proposed Dam at Shaker Mill" by Barnes & Spaulding, Engineers, October 1909	Plans, sections, elevation and details of proposed dam, Scale: 1 in. = 4 ft.	Berkshire County Engineering Department, Court House, Pittsfield, MA 01201 and pages B-19 and B-20

COUNTY OF BERKSHIRE, MASS.
INSPECTION OF DAMS

City or Town of West Stockbridge Date August 12, 1968

Name of Dam Shaker Mill Inspector William A. Hearn

Owner Mass. to town of West Stockbridge Address Town Hall Tel. _____
1964

Carotaker Selectman Address " " Tel. _____

Location Center of village

Type and Dimensions Concrete, Gravity type, Roadway forms earth embankment
100' long, 14' high

Spillway, type and size Concrete, 35' long, 4' freshboard

Outlet, type and size West gate 42" square steel, Center gate 4' square wood
East gate to generator house 4' x 5' wood

Flashboards, type and height None

Date Built 1910 Condition Poor

When last repaired 1960 By whose orders Owners

Nature of Repairs East gate replanked, new platform over West Gate

Purpose of Dam Formerly power

Approximate storage of water 65 acres

Approximate area of water shed 3 square miles

Possible damage due to failure of dam Serious to adjacent properties below dam

Remarks Spillway leaking badly at west end, Westery gate also leaking. Water
level 1" over spillway, downstream well needs pointing up

Recommendations Repairs be initiated at once and steps taken to lower level

INSPECTION OF DAMS

Dam #29-3
BERKSHIRE
1-2-22-73

City or Town of West Stockbridge Date May 17, 1971

Name of Dam Shaker Mill Inspector R. Northrup & P. Fozzie

Owner Town of West Stockbridge Address Town Hall

Caretaker Town of West Stockbridge Address Town Hall

Location At center of village on Route 41 at bridge.

Type of Dimensions Conc. gravity type roadway forms earth embank. 100' long, 14' high.

Spillway, type and size Conc. 35' long, 4' freeboard.

Outlets, type and size Westgate 42" square steel Center gate 4' square wood
Eastgate to generator house 4 X 5 wood.

Flashboards, type and height None - provisions made

Date Built 1910 Condition Poor

When last repaired 1960 By whose orders Owners

Nature of Repairs East gate replanked, new platform over west gate.

Purpose of Dam Formerly power.

Approximate storage of water 65 acres

Approximate area of water shed 3 square miles

Possible damage due to failure of dam Disastrous to Town.

Remarks Water 10" over spillway. West gate leaking. West end at spillway leaking
badly. Seepage at east end. Center gate open.

Recommendations Immediate repairs. 2 pictures taken.

for immediate repairs
Notes: Berkshire County Edge Report: Aug. 18, 1968
Letter to Rod at School: June 14, 1971

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1-2-326-3

June 19, 1971

BOARD OF SUPERVISORS
West Stockbridge
Massachusetts 01250

Gentlemen:

Re: Shaker Mill - Dam

This office has been made aware of the unsafe conditions of Shaker Mill Dam. Inspection reports by Berkshire County Engineer dated August 12, 1963 and the Department of Public Works dated May 17, 1971 point out the need for immediate repairs.

In accordance with Chapter 253 of the Massachusetts General Laws, as most recently amended by Chap. 595 of the Acts of 1970, the Commissioner of the Massachusetts Department of Public Works is responsible for inspection of the safety of mill dams and reservoirs and their potential hazards to life and property downstream.

Section 46 of Chapter 595 provides that the Commissioner shall determine and direct what alterations and repairs are required to make the structure permanent and secure, and shall in writing order the owner thereof to make such alterations or repairs within a reasonable time.

Based on the report of inspection, I find it necessary to inform you that the following deficiencies were found and that corrective measures should be initiated within (30) thirty days from receipt of this letter.

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permit fully legible reproduction

Board of Selectmen, Stockbridge

June 16, 1971

You are hereby directed to:

1. Control water over spillway.

2. Repair leaking West Gate.

3. Repair leaking spillway at West End.

4. Correct seepage at east end.

5. Make center gate operative.

I sincerely hope that you will recognize your responsibility in this matter and make the necessary repairs to render the dam safe.

Your prompt action in this matter would be appreciated.

Very truly yours,

ROBERT S. FOSTER
Acting Commissioner

c.c. Dist. #1

LRA:arm
LRA
EC

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INSPECTION REPORT - DAMS AND RESERVOIRS

OK
file

1. Location: City/Town West Stockbridge Dam No. 1-2-326-3
Name of Dam Shaker Mill Inspected by: RD Jordan
Date of Inspection 1-18-73

2. Owner/s: per: Assessors Prev. Inspection X
Reg. of Deeds Pers. Contact _____

1. Town of West Stockbridge - West Stockbridge, MA
Name _____ St. & No. _____ City/Town _____ State Tel. No. _____
2. Name _____ St. & No. _____ City/Town _____ State Tel. No. _____
3. Name _____ St. & No. _____ City/Town _____ State Tel. No. _____

3. Caretaker [if any] e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.
Name _____ St. & No. _____ City/Town _____ State Tel. No. _____

4. No. of Pictures taken 2

5. Degree of Hazard: [if dam should fail completely]*
1. Minor _____ 2. Moderate _____
3. Severe X 4. Disastrous _____

*This rating may change as land use changes [future development]

6. Outlet Control: Automatic _____ Manual X
Operative X yes: _____ no: _____
Comments: _____

7. Upstream Face of Dam: Condition:
1. Good X 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____
Comments: _____

L-168 A

- 2 -

DAM NO. 1-2-326-3

8. Downstream Face of Dam: Condition: 1. Good X . 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

- Emergency Spillway: Condition: 1. Good _____ . 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

10. Water level @ time of inspection: 1 . ft. above _____ . below X .
top of dam _____ .
principal spillway X _____ .
other _____ .

11. Summary of Deficiencies Noted:

Growth [Trees and Brush] on Embankment	<u>None</u>
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	_____

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12. Remarks & Recommendations: [Fully Explain]

In 1972 the Town of West Stockbridge completed extensive repairs on this dam.
At the time of this inspection, no deficiencies were noted.

13. Overall Condition:

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

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DESCRIPTION OF DAM

DISTRICT ONE

Submitted by RDJordan

Dam No. 1-2-326-3

Date 1-18-73

City/Town West Stockbridge

Name of Dam Shaker Mill

1. Location: Topo Sheet No. 2-D

Provide 8-1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1910 Year/s of subsequent repairs 1972

3. Purpose of Dam: Water Supply _____, Recreational _____, Irrigation _____, Other formerly power

4. Drainage Area: 3 sq. mi. _____ acres.

5. Normal Ponding Area: 65 Acres; Avg. Depth _____, Impoundment: _____ gals; _____ acre ft.

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

7. Dimensions of Dam: Length 85', Max. Height 14', Slopes: Upstream Face conc., Downstream Face conc., Width across top 5'

8. Classification of Dam by Material: Earth _____, Conc. Masonry X, Stone Masonry _____, Timber _____, Rockfill _____, Other _____

9. A. Description of present land usage downstream of dam: _____
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
Yes X No _____

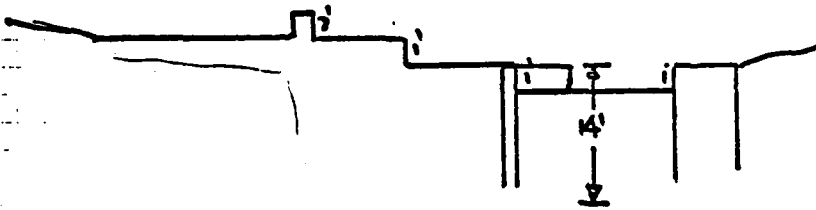
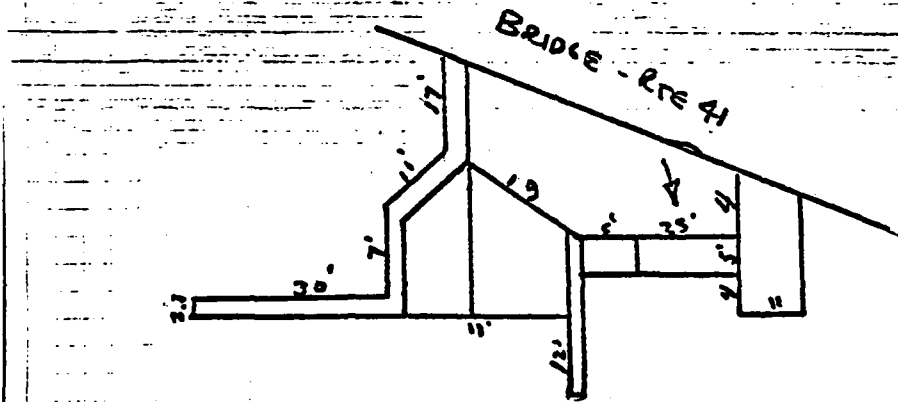
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10. Risk to life and property in event of complete failure.

No. of people _____	Could cause severe damage to south West
No. of homes _____	section of Town.
No. of Businesses _____	
No. of Industries _____	Type _____
No. of Utilities _____	Type _____
Railroads _____	
Other dams _____	
Other _____	

11. Attach Sketch of dam to this form showing section and plan on 8-1/2" x 11" sheet.

SHAKER MILL
1-2-326-3



L-168

OK
File 14

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town West Stockbridge Dam No. 1-2-326-3
Name of Dam Shaker Mill Inspected by: RD Jordan-FVancari
Date of Inspection 11/13/74

2. Owner/s: per: Assessors _____
Reg. of Deeds _____ Pers. Contact _____
Prev. Inspection X

1.	<u>Town of Stockbridge</u>	<u>West Stockbridge, MA</u>
	Name	St. & No. City/Town State Tel. No.
2.	Name	St. & No. City/Town State Tel. No.
3.	Name	St. & No. City/Town State Tel. No.

3. Caretaker [if any] e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.
Name _____ St. & No. _____ City/Town _____ State Tel. No. _____

4. No. of Pictures taken 4

5. Degree of Hazard: [if dam should fail completely]*
1. Minor _____ 2. Moderate _____
3. Severe X 4. Disastrous _____

*This rating may change as land use changes [future development]

6. Outlet Control: Automatic _____ Manual X
Operative X yes: _____ no. _____

Comments: _____

upstream face of Dam: Condition:
1. Good X 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

8. Downstream Face of Dam: Condition: 1. Good X 2. Minor Repairs _____
 3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

9. Emergency Spillway: Condition: 1. Good _____ 2. Minor Repairs _____
 3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

10. Water level @ time of inspection: 0.3 ft. above X below _____
 top of dam _____
 principal spillway X _____
 other _____

11. Summary of Deficiencies Noted:

- Growth [Trees and Brush] on Embankment NONE
- 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 "

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The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

March 7, 1977

Board of Selectmen
Town of West Stockbridge
Town Hall
West Stockbridge, Mass. 01262

RE: Insp. Dam #1-2-326-3
Shaker Mill Dam
West Stockbridge

Gentlemen:

On 11-4-76, an Engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate the owner to be Town of West Stockbridge. If this information is incorrect will you please notify this office.

The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dams Safety Act). Chapter 705 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

The results of the inspection indicate that this dam is safe; however, the following conditions were noted that require attention:

- 1) Minor spalling of the gunite on spillway face.

We call these conditions to your attention before they become serious and more expensive to correct. With any correspondence please include the number of the Dam as indicated above.

Very truly yours,

John J. Hannon, P.E.
Chief Engineer

A/c:

CC: Dean Amidon
Robert Jordan
Al McCallum
File

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B-15

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: Co. / Town WEST STOCKBRIDGE Dam No: 1-2-326-3
Name of Dam Shaker Mill Inspected by RD Jordan-RS Spaniol
Date of Inspection 11-4-76

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

Reg. of Deeds Pers. Contact

1. Town of West Stockbridge West Stockbridge, MA 01262
Name St. & No. City/Town State Tel

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

3. Name St. & No. City/Town State Tel. no.

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

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

4. No. of Pictures taken 1

5. Degree of Hazard: [if dam should fail completely]*

- 1. Minor _____
- 2. Moderate _____
- 3. Severe X _____
- 4. Disastrous _____

*This rating may change as land use changes [future development]

6. Outlet Control: Automatic _____ Manual X _____
Operative X yes; _____ no.

Comments: _____

upstream face of Dam: Condition:

- 1. Good X _____
- 2. Minor Repairs _____
- 3. Major Repairs _____
- 4. Urgent Repairs _____

Comments: _____

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8.

Downstream Face of Dam: Condition: 1. Good x 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

9.

Emergency Spillway: Condition: 1. Good x 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

10.

Water level @ time of inspection: 0.2 ft. above x below _____
top of dam _____
principal spillway x _____
other _____

11.

Summary of Deficiencies Noted:

- Growth [Trees and Brush] on Embankment NONE
- 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 "

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12. Remarks & Recommendations: [Fully Explain] PREVIOUS INSPECTION DATE: November 13, 1974

The only deficiency noted at this inspection was some minor spalling of the gunite on the spillway face. The abutments and the top of the dam are in good condition.

All drawdown equipment is functioning properly.

For location see Topo Sheet 2-D.

13. Overall Condition:

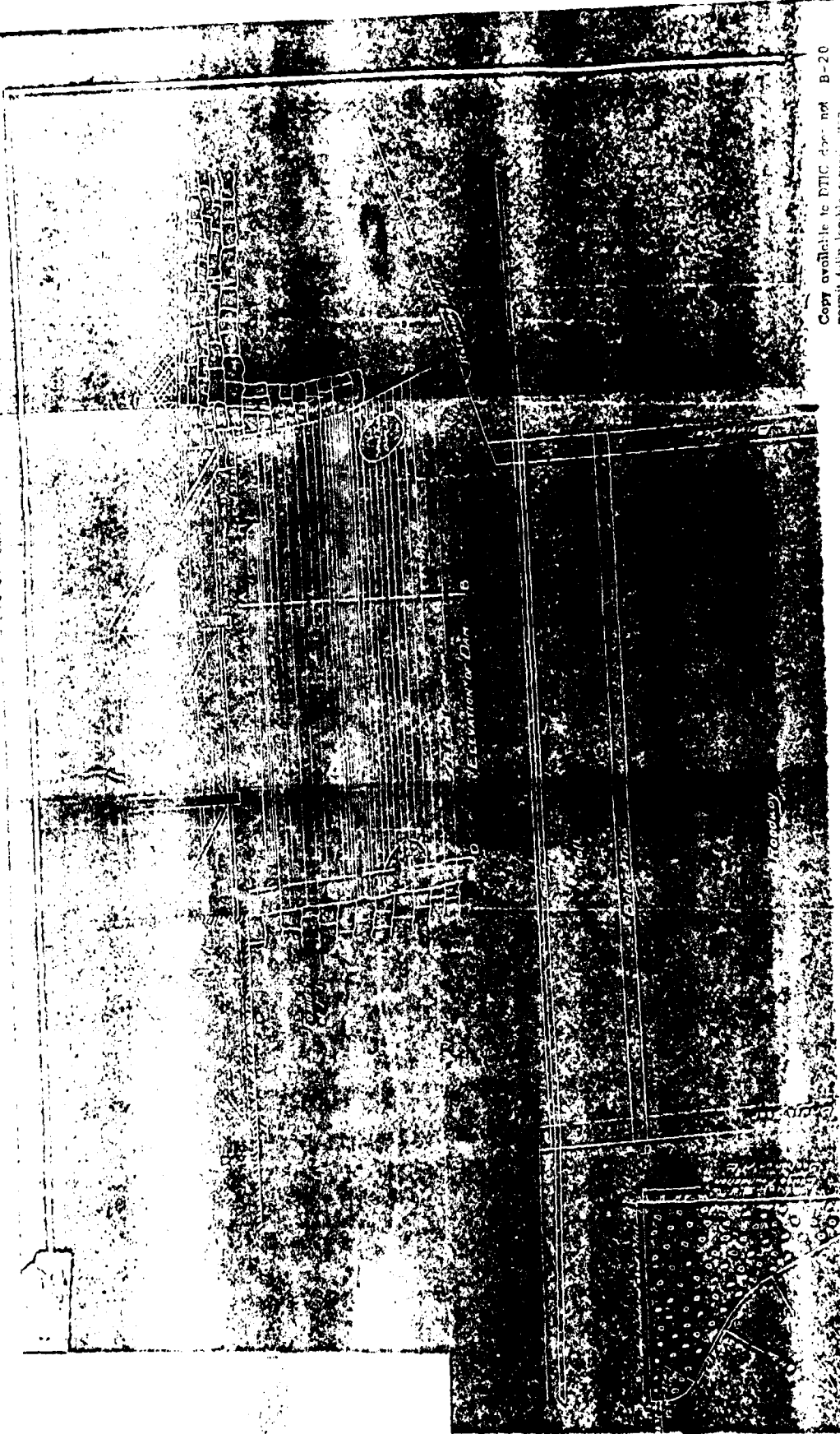
- 1. Safe _____
- 2. Minor repairs needed _____
- 3. Conditionally safe - major repairs needed _____
- 4. Unsafe _____
- 5. Reservoir impoundment no longer exists [explain]
Recommend removal from inspection list _____

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Proposed Dam of
 Summit of Mt. West, Sevier County, Miss.
 James L. Cassin, Owner
 Sevier Dam Co., October 1909
 Bureau of Consulting Engineers
 Portland, Me.

Copy available for reproduction B-19
 Patent July 1, 1910, Exp. 1920



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Electrician's Dan

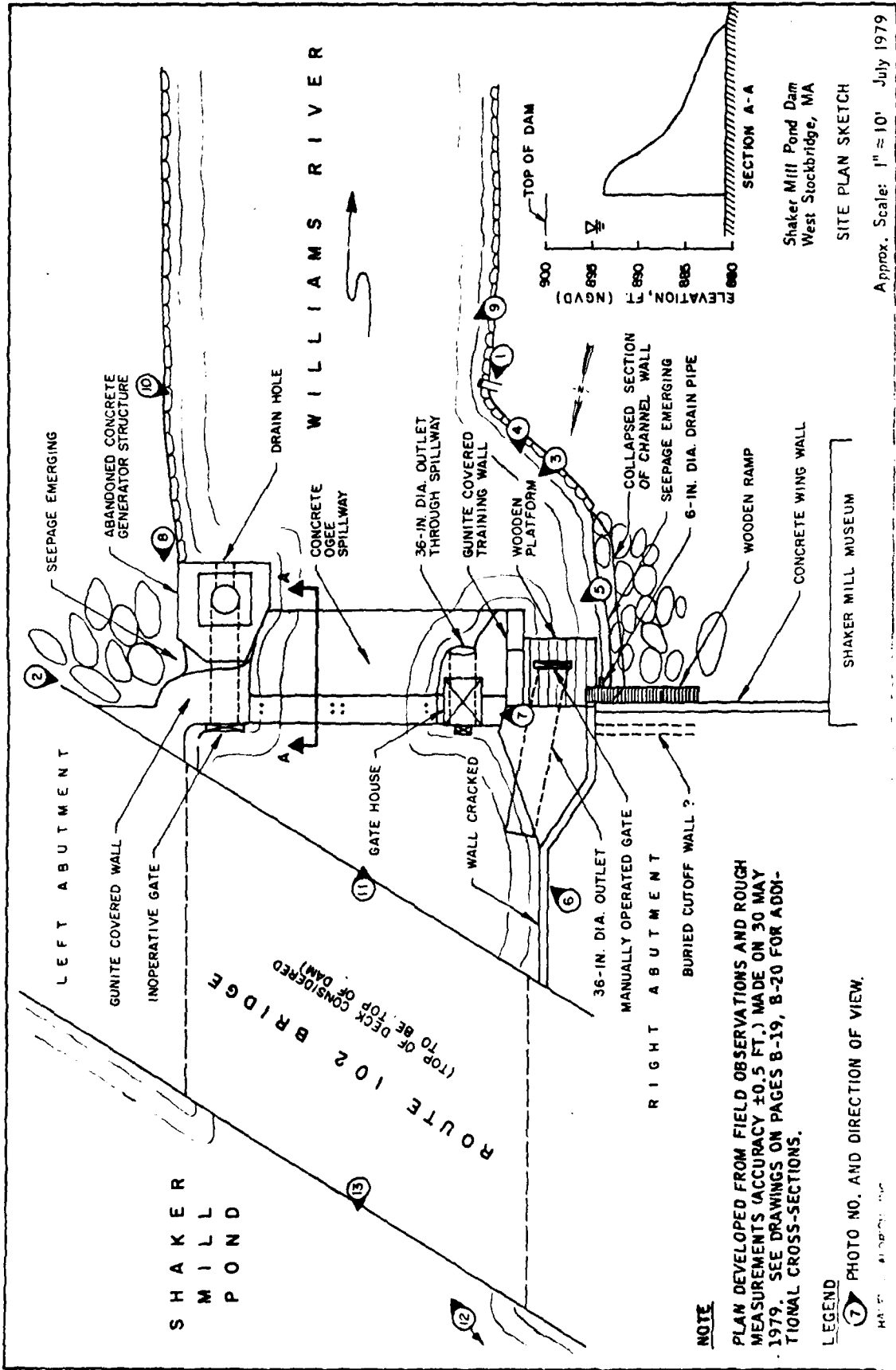
Electrician's Dan

APPENDIX C - PHOTOGRAPHS

	<u>Page</u>
<u>LOCATION PLAN</u>	
Site Plan Sketch	C-1

PHOTOGRAPHS

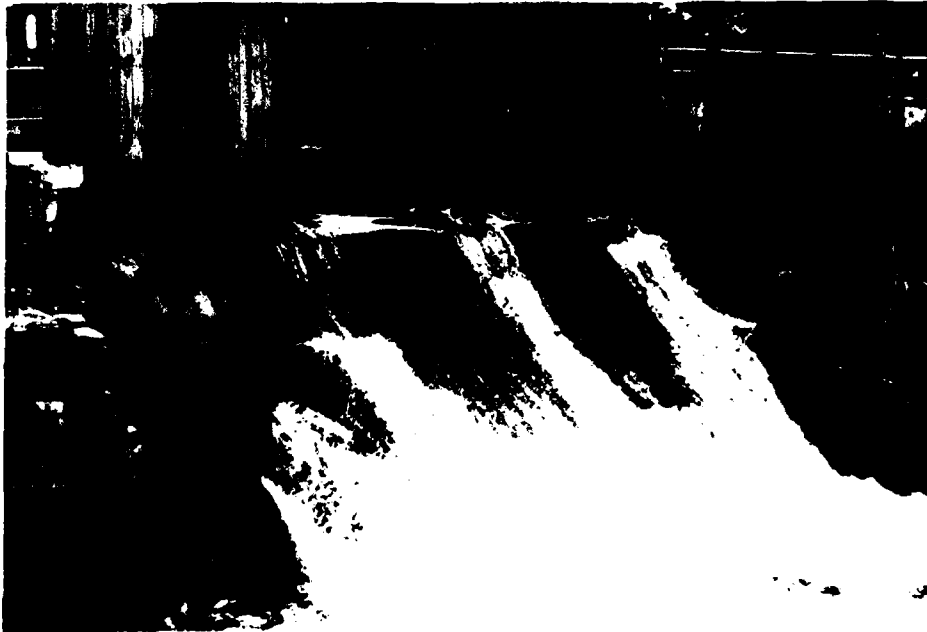
<u>No.</u>	<u>Title</u>	<u>Roll</u>	<u>Frame</u>	<u>Page</u>
1.	Overview of Shaker Mill Pond Dam	C39	1	vi
2.	Spillway and right approach channel wall	17	11	C-2
3.	Spillway, center outlet through spillway and left approach channel walls	17	7	C-2
4.	Right outlet works and wing wall at right abutment	17	5	C-3
5.	Deteriorated right spillway training wall	17	23	C-3
6.	Upstream side of dam	C39	12	C-4
7.	Center outlet gate control mechanism inside gate house	C39	18	C-4
8.	Gunite covered wall and rock fill at left abutment where seepage is emerging	17	17	C-5
9.	Abandoned concrete generator structure and left discharge channel wall	17	4	C-5
10.	Collapsed first 20 ft. of right discharge channel wall	17	13	C-6
11.	Downstream channel below dam (April 1979)	A1	16A	C-6
12.	Upstream side of Route 102 bridge structure	17	8	C-7
13.	Shaker Mill Pond upstream from Route 102 bridge	17	25	C-7



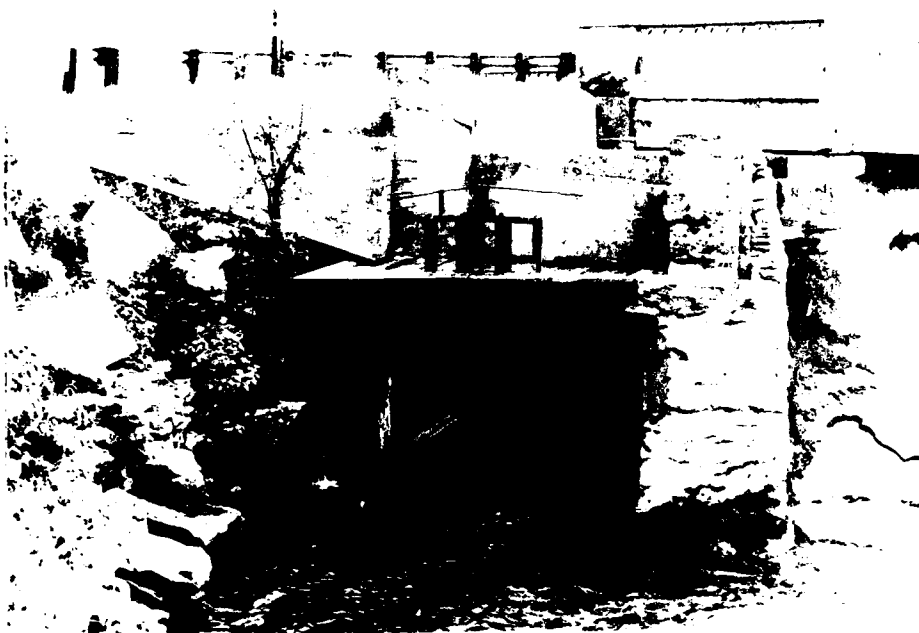
4270 840



2. Spillway and right approach channel wall



3. Spillway, center outlet through spillway
and left approach channel walls



4. Right outlet works and wing wall at right abutment



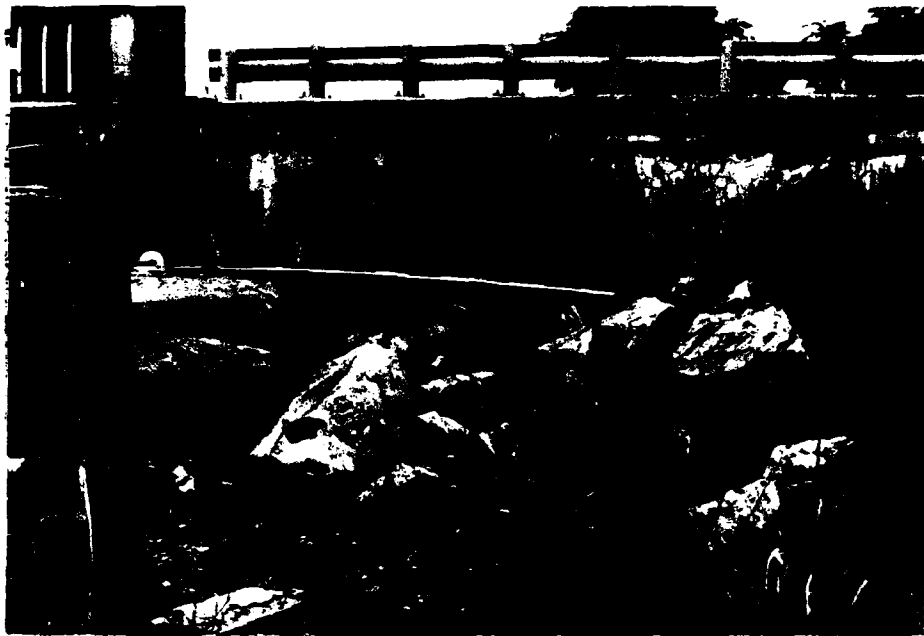
5. Deteriorated right spillway training wall



6. Upstream side of dam



7. Center outlet gate control mechanism inside gate house



8. Gunite covered wall and rock fill at left abutment where seepage is emerging



9. Abandoned concrete generator structure and left discharge channel wall



10. Collapsed first 20 ft. of right discharge channel wall



11. Downstream channel below dam (April 1979)



12. Upstream side of Route 102 bridge structure



13. Shaker Mill Pond upstream from Route 102 bridge

APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

<u>Subject</u>	<u>Page</u>
Drainage Area and Failure Flood Impact Area Map	D-1
Size Classification, Hazard Potential and Test Flood Development	D-2
Surcharge-Storage Routing, Tail Water	D-3
Stage-Discharge Curve, Dam and Spillway	D-4
Pond Area-Volume Curve	D-5
Stage-Discharge Curve, Tailwater	D-6
Capacity of Existing Spillway	D-7
Dam Failure Analysis	D-8
Hydraulic Profiles (Before and After Failure)	D-9
Downstream Channel Cross-Sections and Stage-Dis- charge Relations	D-11



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



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

Size classification

Dam Height = Els. : $900.1 - 879.7 = 20.4\text{-Ft}$ < 40-Ft.

Storage Volume : $1,200\text{ ac-ft}$ @ El. 900.1 > 1,000 ac-ft

Size : Intermediate

Hazard Potential Classification

In case of a dam failure the right bank would be subject to flooding particularly in the area downstream of Depot street. The hazard potential is considered "high" because of potential for loss of lives and excessive residential and commercial property damages.

Test Flood Development

Size : Intermediate Hazard Potential : High

Test Flood Flow : PMF

Watershed Area : $32.4\text{ sqmi} = 20,736\text{ acres}$

Terrain : rolling with 5 percent flat (water, swamps, etc.)

Peak Flow Rate : 1250 cfs/sqmi

$PMF = 32.4 \times 1250 = 40,500\text{ cfs} = \text{Spillway Test Flood Inflow}$

Surcharge - Storage Routing

$Q_{p1} = 40,500 \text{ cfs}$ (FME \rightarrow Max Runoff - 19")

WSE in Pond = 926.0 (see stage discharge curve in Page D-4)

Pond Storage Volume = 19,200 ac-ft (see Area-Volume curve, page D-5)

Normal Pond Volume = 130 ac-ft @ EL. 893.8

$STDR_1 = \frac{(19,200 - 130) \cdot 12}{20,736} = 11.04 \text{ -in}$

$Q_{p2} = 40,500 \left(1 - \frac{11.04}{19}\right) = 16,970 \text{ cfs}$ WSE (Pond) = 911.1 AV = 6,100 - 130 = 5,970 ac-ft

$STDR_2 = \frac{5,970 \cdot 12}{20,736} = 3.45 \text{ -in}$ $STDR_{av} = 7.25"$ $Q_{p3} = 25,030 \text{ cfs}$

WSE in Pond = 916.6 AV = 9,700 $STDR_3 = 5.61"$

$STDR_{av} = 6.43"$ $Q_{p4} = 40,500 \left(1 - \frac{6.43}{19.0}\right) = 21,800 \text{ cfs}$

Pond WSE = 917.7 AV = 10,500 ac-ft $STDR_4 = 6.08"$ $STDR_{av} = 6.25"$

$Q_{p5} = 40,500 \left(1 - \frac{6.25}{19.0}\right) = 27,200 \text{ cfs}$ WSE (Pond) = 918.0 AV = 10,850 ac-ft

$STDR_5 = 6.28" \approx 6.25"$

TEST FLOOD OUTFLOW = 27,200 cfs @ Pond EL. 918.0

Tail Water : The tailwater stage-discharge curve on page D-6 shows that the spillway crest would be submerged by about 18.8 feet (912.6 - 893.8) at the test flood discharge.

CAMP CRENSHAW & MARSH INC.

CLIENT H & A

JOB NO 561-9-R1-14

PAGE 3

PROJECT COE Dam Inspection

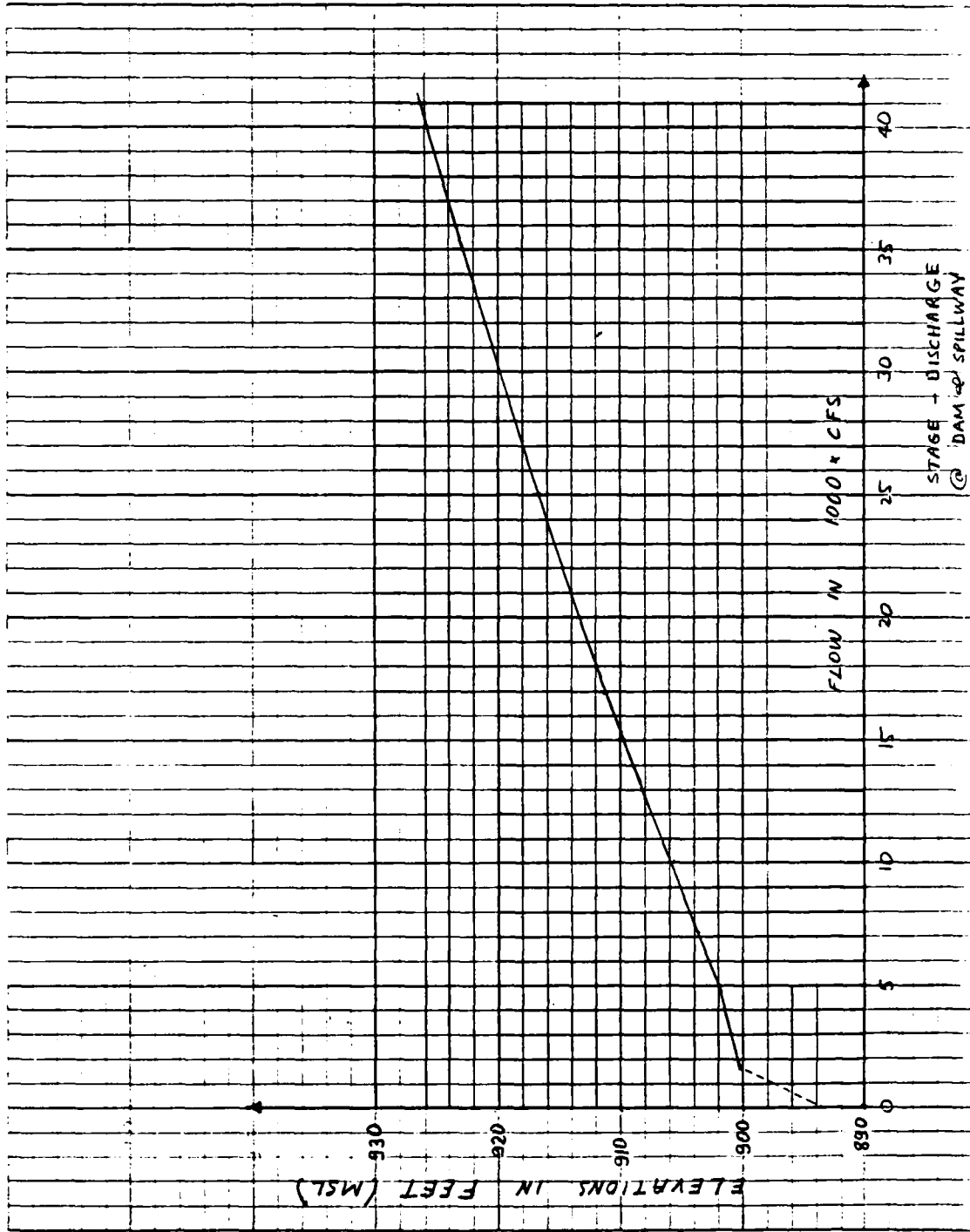
DATE CHECKED 7/2/79

DATE 6/18/79

DETAIL SHAKER MILL AND DAM

CHECKED BY RHS

COMPUTED BY AVG



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JOB NO 561-9-21-14

PAGE 4

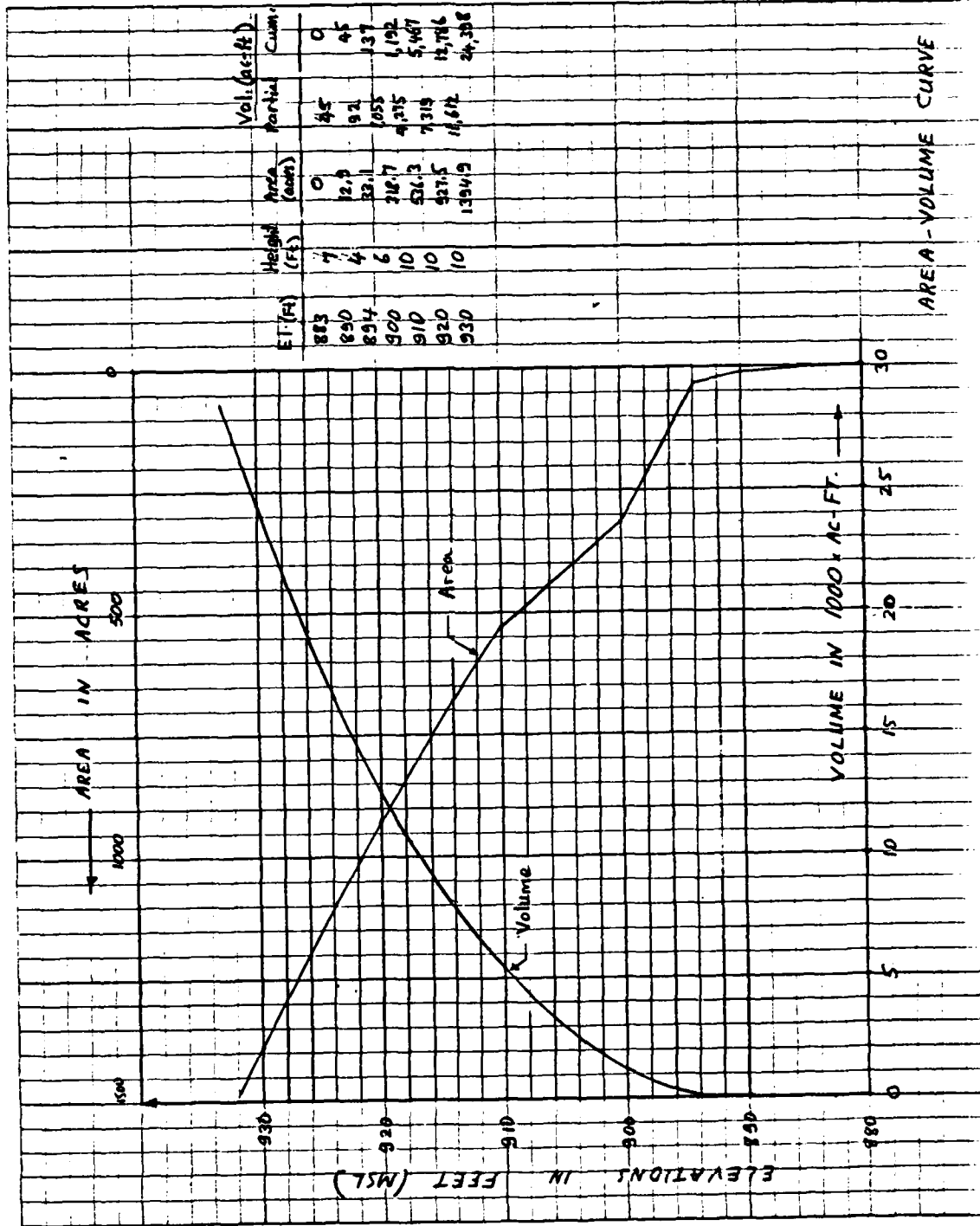
PROJECT COE Dam Inspection DATE CHECKED 7/2/79

DATE 6/14/79

DETAIL SHAWER MILL POND DAM

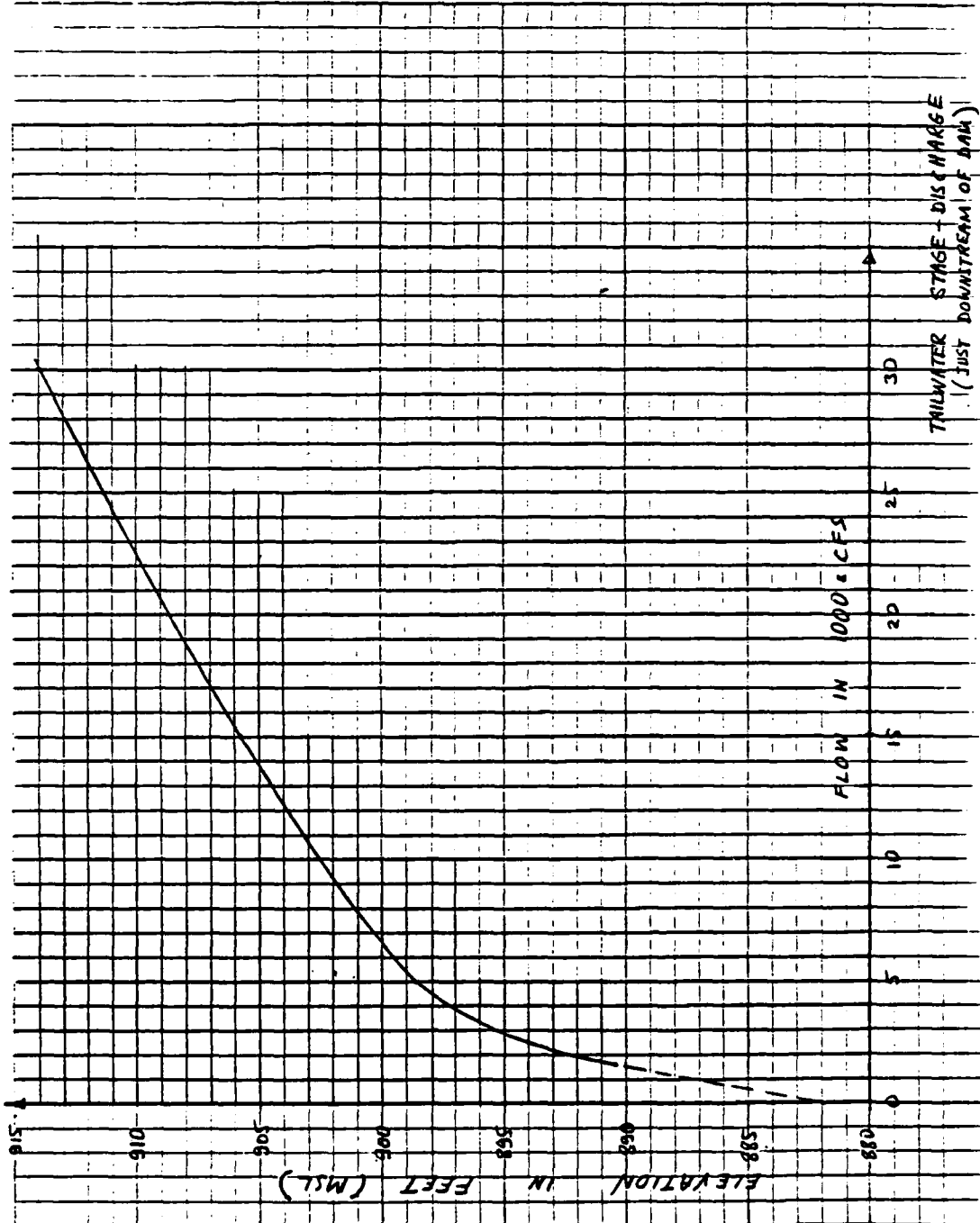
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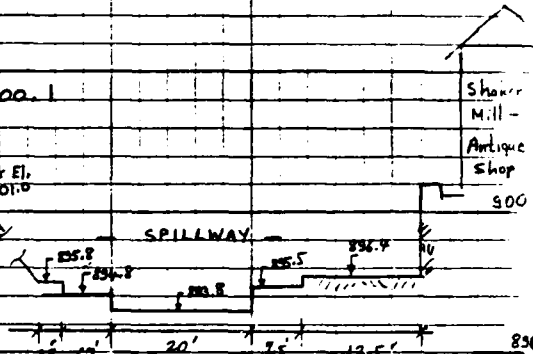
CLIENT H&A JOB NO. 561-9-RF-14 PAGE 5
PROJECT COE Dam Inspection DATE CHECKED 7/2/79 DATE 6/15/79
DETAIL SHAKER MILL POND DAM CHECKED BY RHS COMPUTED BY AVG



Capacity of Existing Spillway

Top of Dam = Route 102 surface El = 900.1

Bench Mark El. 901.0
 Route 102



$$Q_1 = 3.0 \cdot 20 (900.1 - 893.8)^{3/2} = 94.9 \text{ cfs}$$

$$Q_2 = 2.5 \cdot 25 (900.1 - 895.8)^{3/2} = 56 \text{ cfs}$$

$$Q_3 = 2.5 \cdot 67 (900.1 - 894.8)^{3/2} = 204 \text{ cfs}$$

$$Q_4 = 2.5 \cdot 75 (900.1 - 895.5)^{3/2} = 185 \text{ cfs}$$

$$Q_5 = 2.5 \cdot 12.5 (900.1 - 896.4)^{3/2} = 222 \text{ cfs}$$

$$\Sigma Q = 1,616 \text{ cfs}$$

Say 1,600 cfs

SECTIONAL VIEW - LOOKING DOWNSTREAM

Flow Over Spillway during Test Flood Pool El. 918.0

(this is a theoretical separation of flow during the test flood discharge)

$$Q = 3.5 \cdot 49.2 (918.0 - 912.6)^{3/2} = 2,160 \text{ cfs}$$

↑
tailwater elv.

(the remaining $(27,200 - 2,160) = 25,040$ cfs would flow over the dam and the banks)

Conclusion: Capacity of the existing spillway at the Shaker Mill Pond Dam is about 6 percent of the test flood outflow and the dam has a high probability of being overtopped.

Dam Failure Analysis

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

$Y_o = 20.4$ $W_b = 0.85 \times 49.2 = 41.8$

$Q_p = \frac{8}{27} \cdot 41.8 \cdot 5.67 = 92.1 \approx 6,470$ cfs

Storage Volume @ E. 901.1 = 1,200' ac-ft = S

Flow in the channel prior to a failure: 1,600 cfs (Page D-7)

Approximate hydraulic profiles prior and after to a failure are shown in Page D-9.

Flood Flow Routing:

Reach 1: between Dam and Depot St.

$Q_p @ \text{Depot St} = Q_p (1 - \frac{V_1}{S})$

$V_1 = \frac{357 + 1175}{2} \cdot 300 = \frac{1}{43,560} = 5.3$ ac-ft (negligible amount)

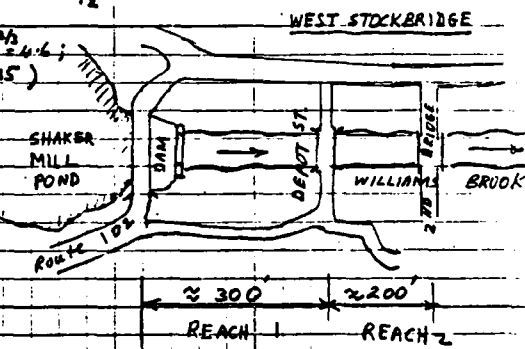
$Q_p = 6,470 (1 - \frac{5.3}{1,200}) = 6,440$ cfs = Q_p

S = 0.0022 (From Manning; $A = 705$ ft²; $R = 4.6$; $n = 0.035$)
 Ah = 0.6-ft.
 WSE @ Depot St. = 999.5

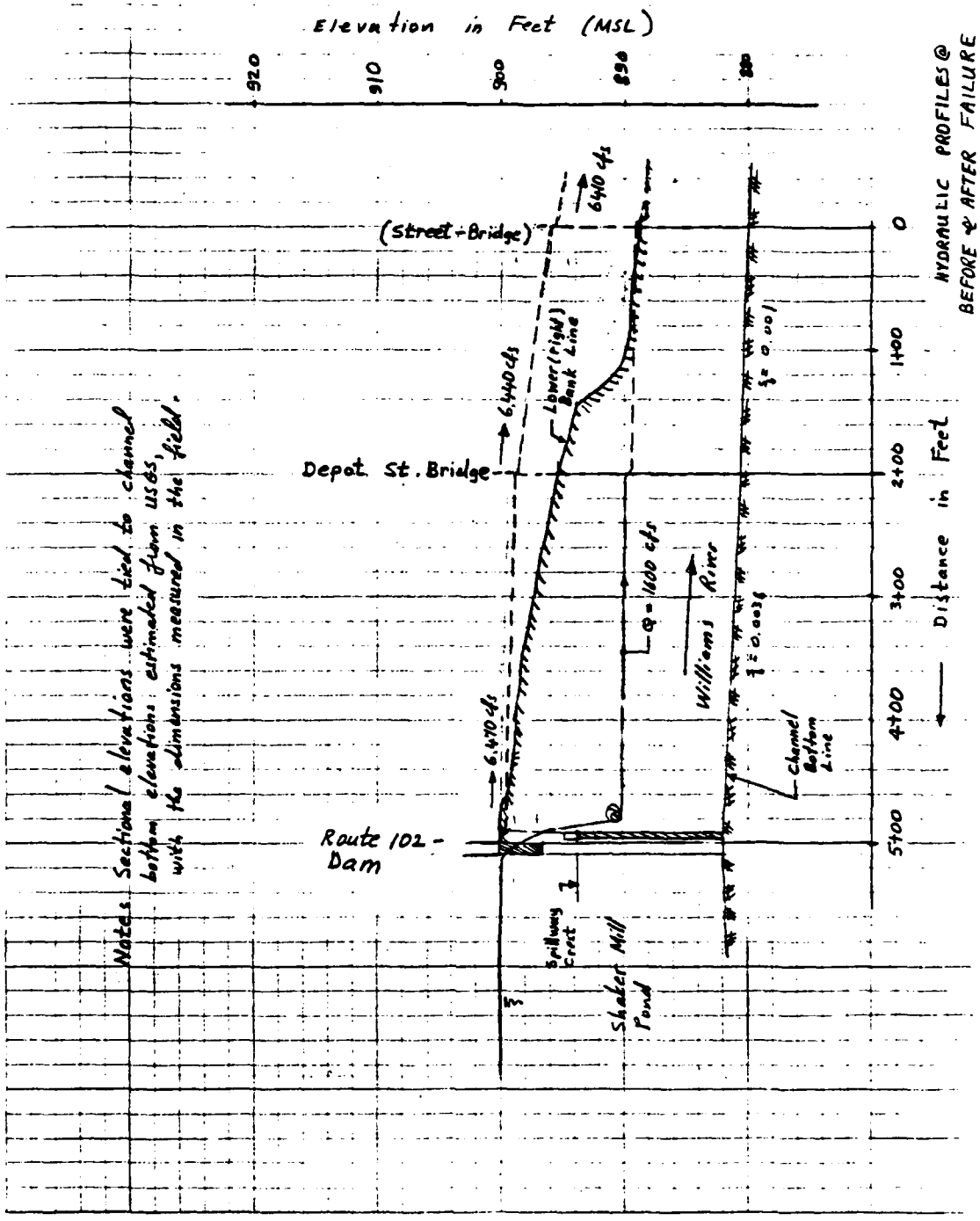
Reach 2

$V_2 = \frac{1,160 + 1,240}{2} \cdot 200 = \frac{1}{43,560} = 5.5$ ac-ft

$Q_p = 6,440 (1 - \frac{5.5}{1,195}) = 6,410$ cfs = Q_p



The lower reach (Reach 2) would be flooded to depths 4-ft (downstream of Depot St.) to 7-ft (upstream of the second bridge).



Notes: Sectional elevations were tied to channel bottom elevations; estimated from USGS, with the dimensions measured in the field.

HYDRAULIC PROFILES @
BEFORE & AFTER FAILURE

D-9

D-9

Based on the results of the hydraulic analysis and the hydraulic profile on Page D-9 the following areas are expected to be flooded along the portion of the downstream channel which was studied:

Location	Right Bank		Left Bank	
	Upstream	Downstream	Upstream	Downstream
Dam ~ Rt. 102 Bridge	- A parking lot for school buses - A restaurant - A garage & car. sta. - A house - A bank bldg.	- An antique shop - Baldwin Hardware - 2 Vacant bldgs. - Post office - A clothing store	- Several dwellings on shown on USGS.	- A house - A baker shop - 3 - two story bldg. - Town Hall
Depot St.	(included above)	3 - two story bldgs. (Store + dwelling) 1 dwelling on lower land.	(included above)	- A package store - A Nordky shop - Weavers - An antique shop - Westbridge Inn
Lower Street	(included above)	1 Exhibit Hall 1 Resident + Take-out restaurant.	(included above)	- Several homes right on the banks - A variety shop

Conclusion In the event of a dam failure potential for loss of lives exists and excessive damages to residential and commercial properties are expected to occur; therefore the hazard classification for this dam is considered "high".

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass.

CLIENT H-A
PROJECT COE Dam Inspection
DETAIL Shaker Mill Pond Dam

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DOWNSTREAM CHANNEL

CROSS SECTIONS

AND

STAGE - DISCHARGE RELATIONS

D-11

D-11

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Boston, Mass.

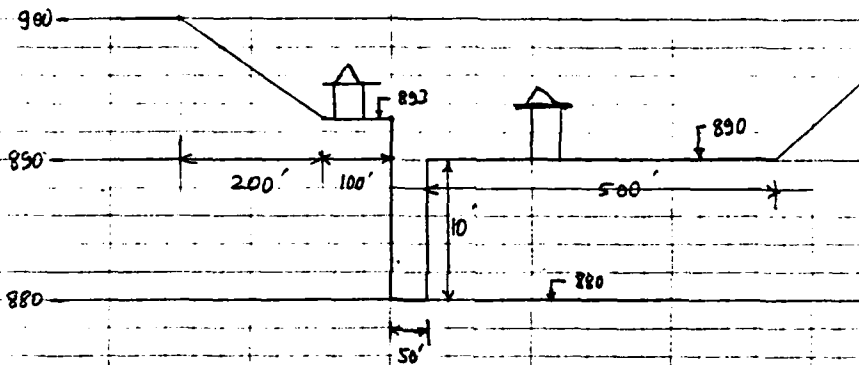
CLIENT H & A
PROJECT COE Dam Inspection
DETAIL SHAKER MILL POND DAM

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DATE 6/11/79
PAGE NO. 216

Downstream Channel - Hydraulic Computations

1. A section about 600-ft downst of the Dam =



Channel bottom gradient = $\frac{10}{9000} = 0.0011$ say 0.001

$n = 0.035$ (estimated)

$S = 0.0316$

$Q = \frac{1.49}{0.035} A R^{2/3} 0.0316 = 1.35 A R^{2/3}$

Elv.	d (ft)	A (sq ft)	R	$R^{2/3}$	Q
885	5	250	4.17	2.53	874
890	10	500	7.14	3.71	2,505
892	13	$A_1 = 650$	$R_1 = 8.55$	4.19	3,692
		$A_2 = 1350$	$R_2 = 2.67$	1.93	2,454
					6,126
900	20	$A_1 = 1,000$	$R_1 = 13.16$	5.58	7,559
		$A_2 = 6,000$	$R_2 = 10.0$	4.65	25,080
		$A_3 = 1,400$	$R_3 = 4.66$	2.80	3,520
					36,130

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass.

CLIENT HWA
PROJECT COE Dam Inspection
DETAIL SHAKER MILL POND DAM

JOB NO 561-9-R4-14

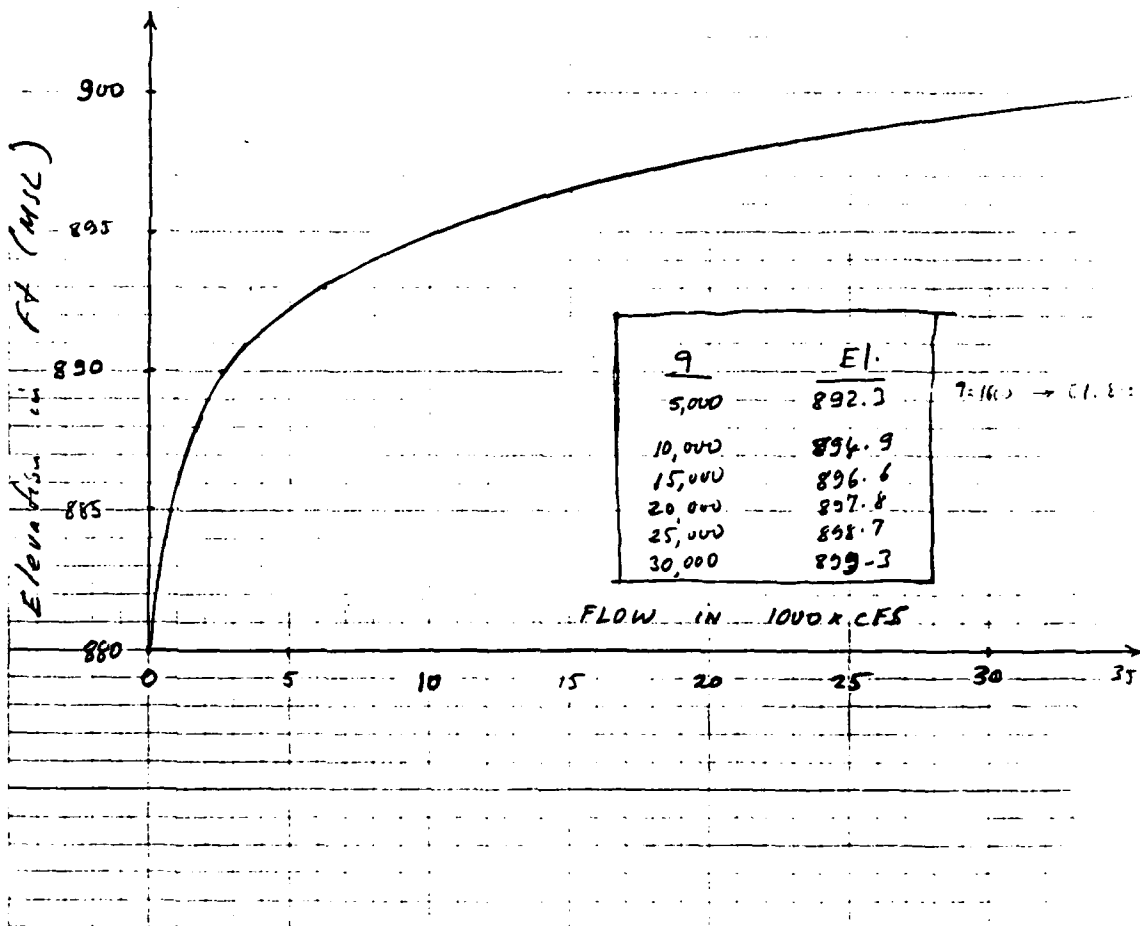
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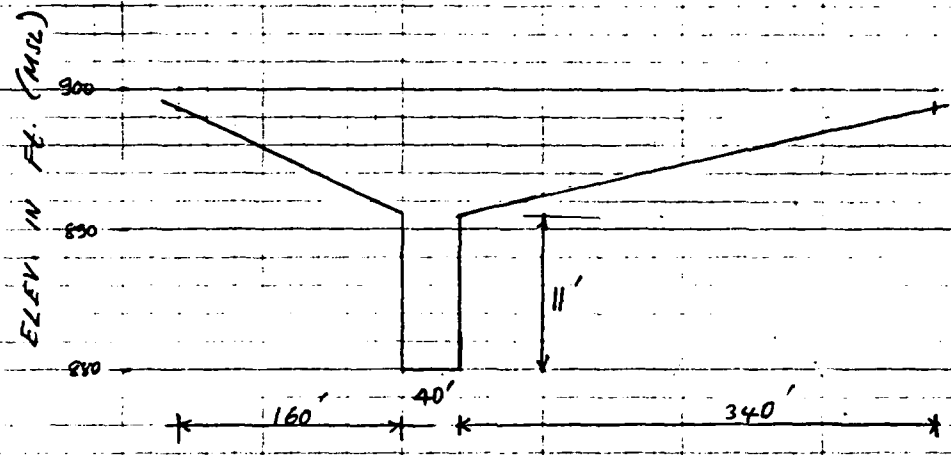
PAGE 2
DATE 6/11/77
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STAGE - DISCHARGE CURVE

at a channel section 500-ft. downstream of the dam.



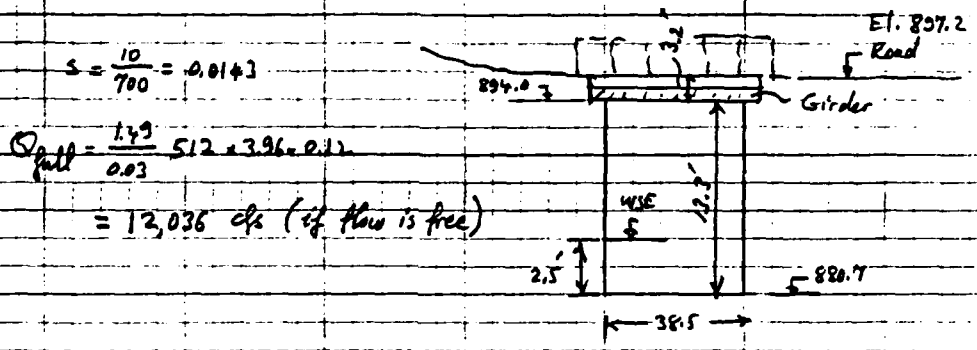
Channel Section 100 - Ft downstream of Depot street Bridge



Stage - Discharge Relation @ Downstream of Depot street

<u>Q (cfs)</u>	<u>WSE (Ft)</u>
1600	889.3
5,000	894.7
10,000	899.0
15,000	900.9
25,000	904.6

BRIDGE ON DEPOT STREET



$Q_1 = 5000 \text{ cfs}$ downst. WSE = 894.7 (see pp. 3)

$Q = Q_1 + Q_2$
 $Q_1 = 0.6 \cdot 512 = 8.02 \sqrt{h_1} = 2,464 \sqrt{h_1}$
 $Q_2 = 2.5 \cdot L \cdot h_2^{3/2}$

Stage - Discharge Relation - Summary

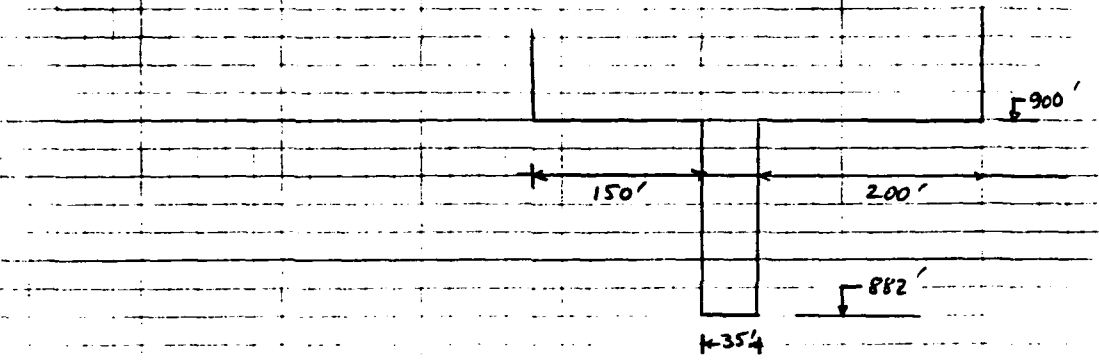
<u>Q</u> <u>(cfs)</u>	<u>WSE</u> <u>(ft)</u>	<u>L</u> <u>(ft)</u>
5,000	897.9	400
10,000	901.5	600
15,000	904.4	650
25,000	909.4	750

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Environmental Engineers
Boston, Mass.

CLIENT HVA
PROJECT COF Dams
DETAIL Shaker Mill Pond Dam

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CHECKED BY _____ PAGE NO. 5

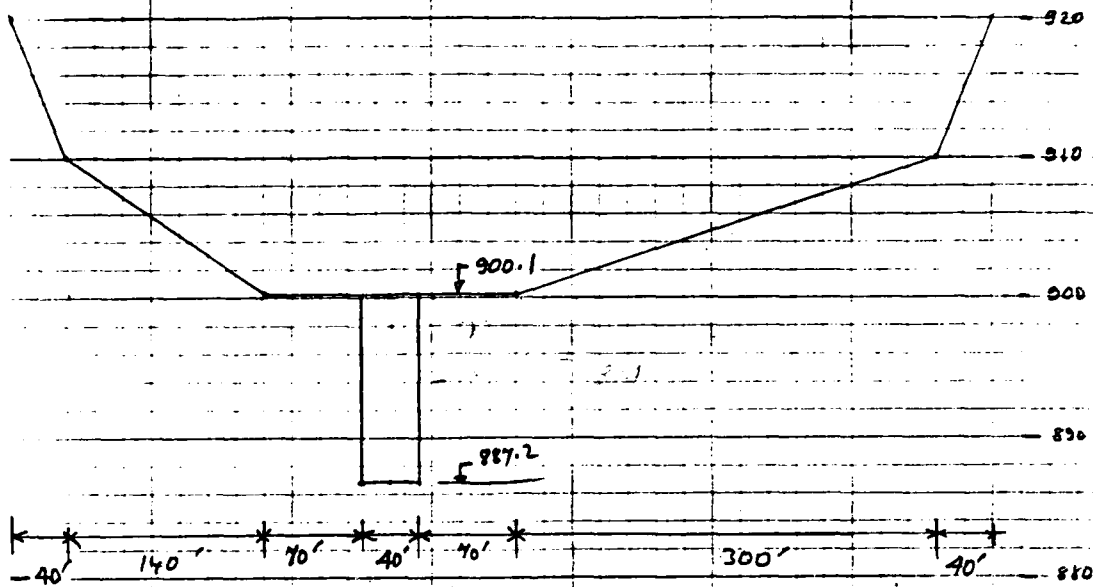
TAILWATER STAGE-DISCHARGE RELATION



<u>Q</u>	<u>W.S.</u> <u>EL.</u>
<u>1,600</u>	<u>890.4</u>
<u>5,000</u>	<u>898.7</u>
<u>10,000</u>	<u>902.7</u>
<u>15,000</u>	<u>905.8</u>
<u>25,000</u>	<u>911.4</u>

CAMP DRESSER & MCKEE CLIENT HWA JOB NO. 561-9-Rt-14 COMPUTED BY AUG
 Environmental Engineers PROJECT CDF Dams DATE CHECKED _____ DATE 6/18/75
 Boston, Mass. DETAIL SHAKER HILL POND CHECKED BY _____ PAGE NO 6

Cross-section at the bridge (Route 102) = Top of Dam



Stage - Discharge Relation - Summary

<u>Q (cfs)</u>	<u>Pond WSE (ft)</u>	<u>L (ft)</u>
1,600	900.1	—
5,000	902.0	200
10,000	905.9	430
15,000	909.8	550
25,000	916.6	700

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

END

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8-85

DTIC