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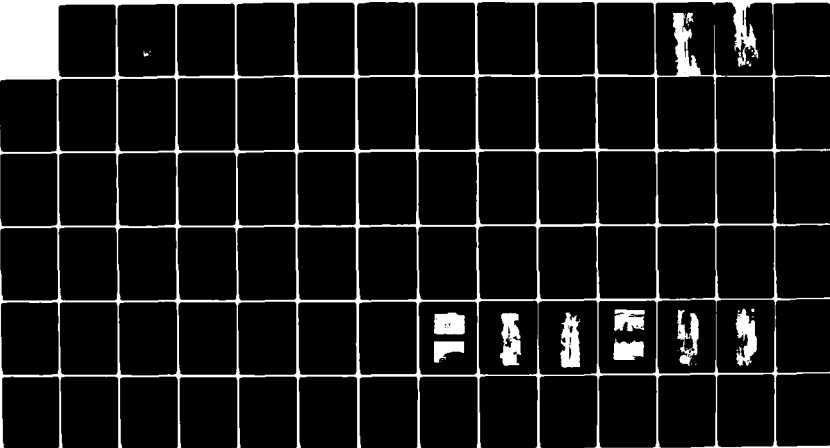
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
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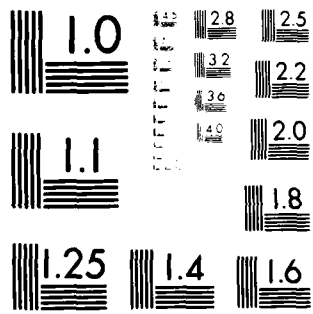
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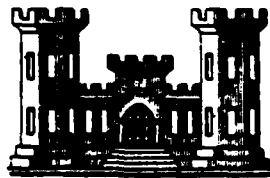
CONNECTICUT RIVER BASIN  
WARE, MASSACHUSETTS

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SNOW POND DAM  
MA 00079

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

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AUGUST 1978

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE August 1978
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Ware, Massachusetts		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Snow Pond dam is approximately 200 ft. long overall, and consists of a small earth embankment approximately 6 ft. high, an ungated concrete ogee spillway, a section of earth fill retained by concrete and stone masonry walls and a 6 ft. diameter outlet pipe. The dam is in fair condition. Based on the size and hazard classification, the spillway design flood falls between the 100-year flood and 1/2 the PMF.		



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

REPLY TO  
ATTENTION OF:

NEDED

Honorable Michael S. Dukakis  
Governor of the Commonwealth of  
Massachusetts  
State House  
Boston, Massachusetts 02133

NOV 28 1978

Dear Governor Dukakis:

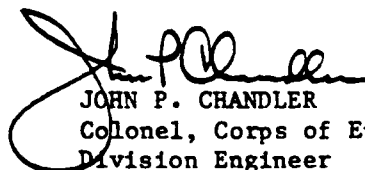
I am forwarding to you a copy of the Snow Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study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

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Ware Water Department, Church Street, Ware, Massachusetts 01802, ATTN: Mr. John Harszy, Superintendent.

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

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

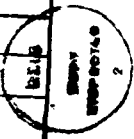
Sincerely yours,

  
JOHN P. CHANDLER  
Colonel, Corps of Engineers  
Division Engineer

Incl  
As stated

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SNOW POND DAM  
MA 00079



"Original contains color plates: All DTIC reproductions will be in black and white"

CONNECTICUT RIVER BASIN  
WARE, MASSACHUSETTS

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT

PHASE I INVESTIGATION REPORT  
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00079  
Name of Dam: Snow Pond  
Town: Ware  
County: Hampshire  
State: Massachusetts  
Stream: Muddy Brook  
Date of Site Visit: 12 May 1978

Snow Pond dam is approximately 200 ft. long overall, and consists of a small earth embankment approximately 6 ft. high, an ungated concrete ogee spillway, a section of earth fill retained by concrete and stone masonry walls and a 6-ft. diameter outlet pipe. The original dam, constructed prior to 1920, has been overtopped, partially destroyed and rebuilt on several occasions.

The dam is in fair condition. There are no obvious signs of failure or conditions which would warrant urgent remedial treatment.

Based on the size and hazard classification in accordance with the Corps of Engineers guidelines, the spillway design flood falls between the 100-year flood and one-half the probable maximum flood. Hydraulic analyses indicate that the spillway cannot pass either one-half the probable maximum flood or the 100-year flood and the spillway is considered inadequate.

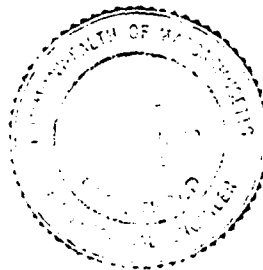
Recommendations for remedial work include earthwork to restore embankment grades, structural repair of the control gate to the outlet conduit and reconstruction of certain retaining walls. Work should be designed and constructed as soon as practical under the supervision of a registered professional engineer

HALEY & ALDRICH, INC.

by:



Harl Aldrich  
President



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

*Charles G. Tiersch*

CHARLES G. TIERSCH, Chairman  
Chief, Foundation and Materials Branch  
Engineering Division

*Fred J. Ravens, Jr.*

FRED J. RAVENS, Jr., Member  
Chief, Design Branch  
Engineering Division

*Saul Cooper*

SAUL COOPER, Member  
Chief, Water Control Branch  
Engineering Division

APPROVAL RECOMMENDED:

*Joe B. Fryar*

JOE B. FRYAR  
Chief, Engineering Division

SEP 1 1975

## 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.

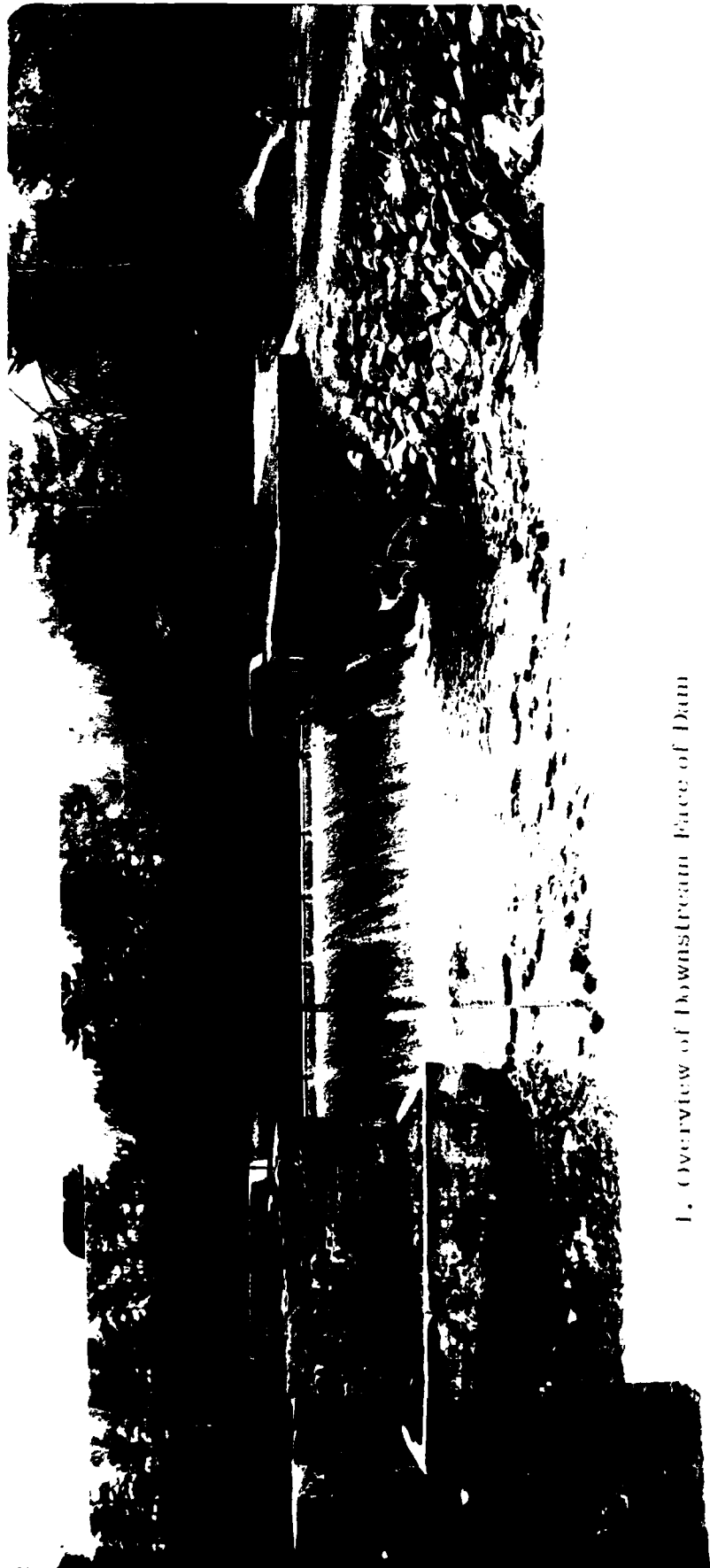
Phase I investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood, referred to in this report as the spillway design flood, is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), 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 aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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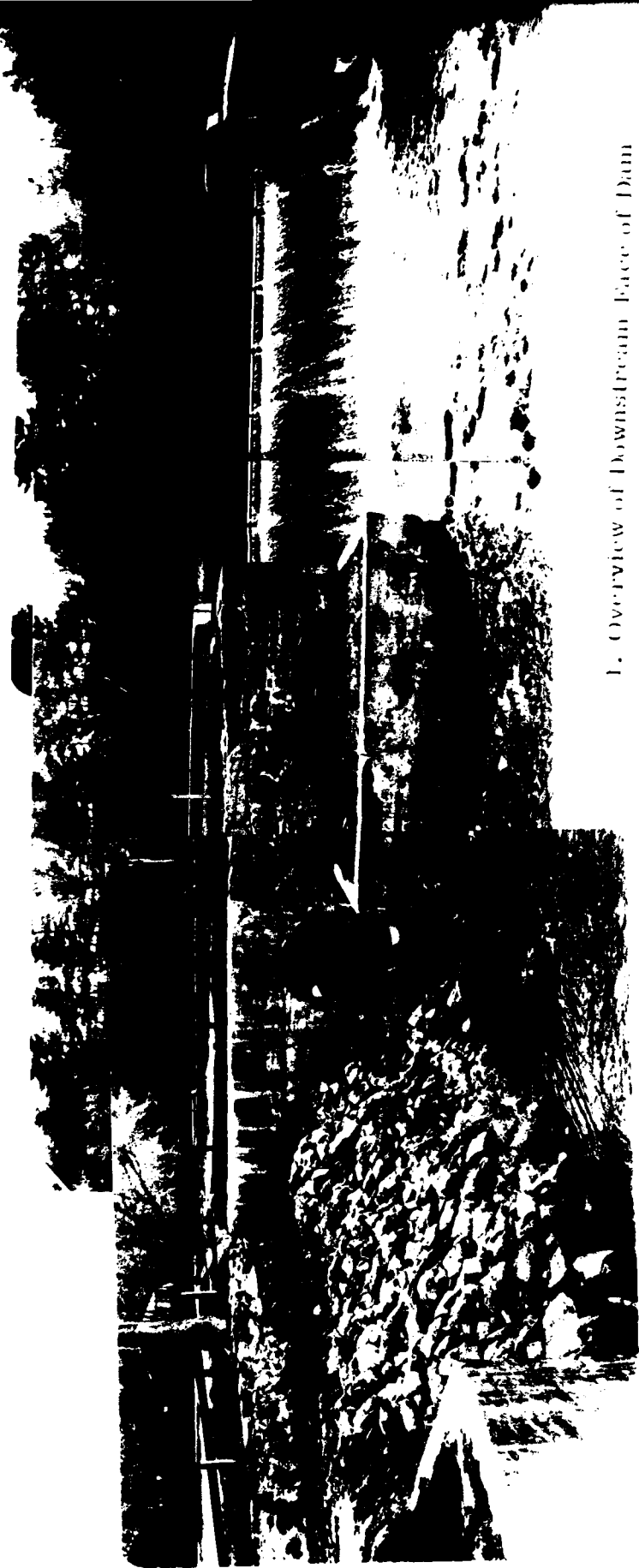
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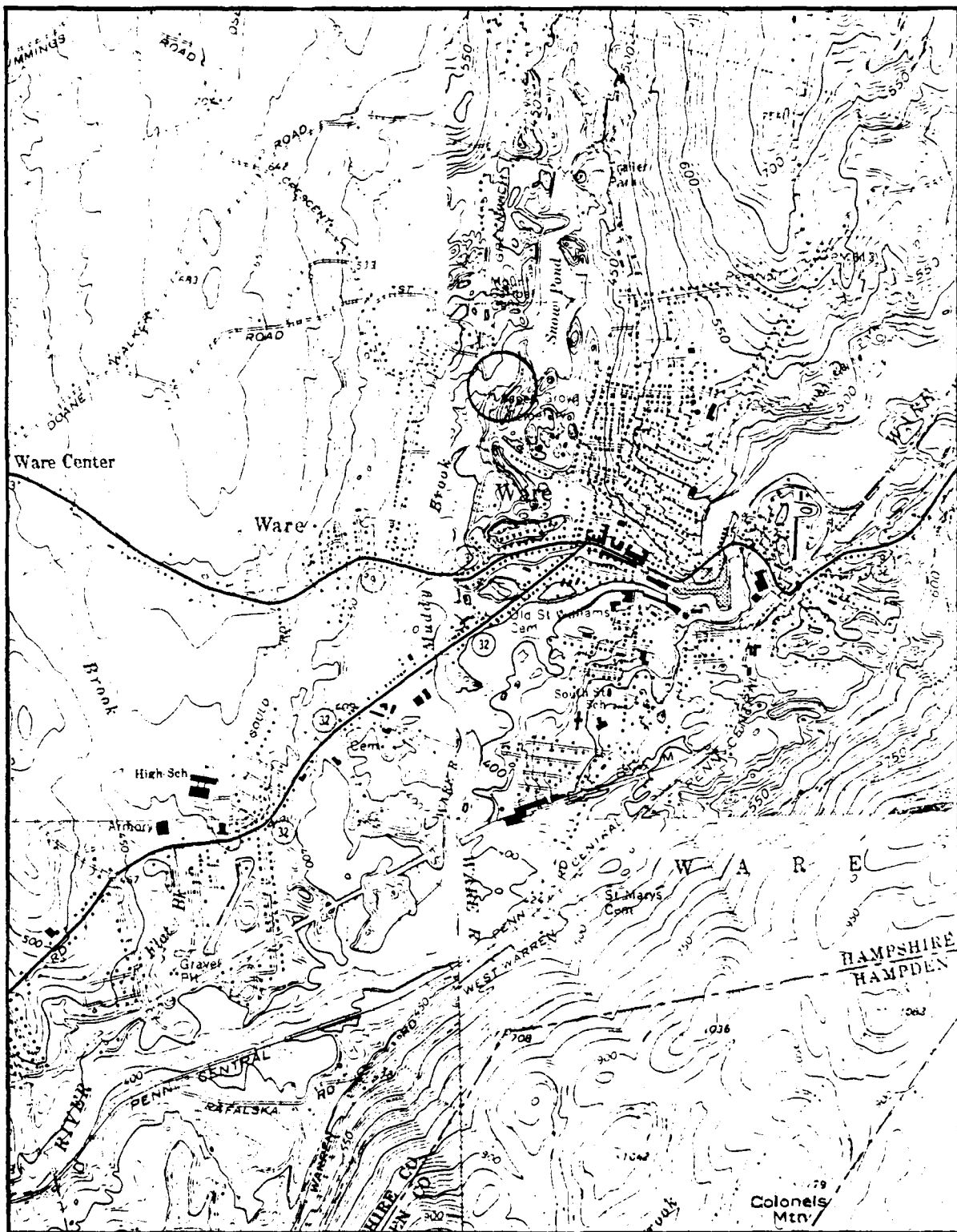


1. Overview of Downstream Face of Dam



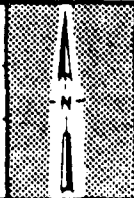
1. Overview of Downstream Face of Dam

(1)



FILE NO. 4160

DAM: Snow Pond  
 IDENTIFICATION NO. MA 00079



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

PHASE I INVESTIGATION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
SNOW POND DAM  
MA 00079

I. PROJECT INFORMATION

1.1 GENERAL

A. Authority. Public Law 92-367, August 3, 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 26 April 1978 from Colonel Ralph T. Garver, Corps of Engineers. Contract No. DACW33-78-C-0301 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. The primary purposes of the National Dam Inspection Program are to:

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.
3. To update, verify and complete the National Inventory of Dams.

## 1.2 PROJECT DESCRIPTION

A. Location. Snow Pond is located on Muddy Brook, approximately one-half mile northwest of the Town of Ware, Massachusetts, as shown on the Location Map, page vi. Muddy Brook discharges into the Ware River about 1 mile below the dam.

B. Dam and Appurtenances. The Snow Pond dam consists of a low earth embankment, earth embankments retained by concrete and stone masonry walls, an ungated concrete spillway, and an outlet structure, as shown on the Site Plan Sketch included in Appendix C-1, and by the Overview Photo, page v.

A low earth embankment is located left of the spillway, extending approximately 90 ft. to the left abutment. The embankment is approximately 6 ft. higher than ground surface beyond the downstream toe. The top is typically 7 ft. wide but varies from a few feet at the spillway to approximately 8 ft. Side slopes also vary from about 2 horizontal to 1 vertical to 3:1 or flatter. The upstream slope is earth, some of which is grass covered, as shown by Photos 2 and 3.

Immediately adjacent to the left end of the spillway, the embankment is retained by concrete (upstream) and stone masonry (downstream) walls, as shown on Photos 2 and 6, Appendix C. To the right of the spillway, the embankment is also formed by vertical retaining walls, the type and configuration of which are shown on the sketch and Photos 4, 5 and 7 in Appendix C.

The spillway is an ungated ogee type, 44 ft. wide and approximately 9 ft. high with 11 in. flashboards. The top of the concrete walls at each end of the spillway and the top of the dam are about 5 ft. 6 in. above the spillway crest.

A 6 ft. diameter steel outlet pipe is located through the retained embankment right of the spillway. The conduit has a slide gate at the upstream end.

Rough cross-sections of the dam are shown in the 1975 Massachusetts Department of Environmental Quality Engineering Inspection Report included in Appendix B.

C. Size Classification. The storage to the top of dam is estimated to be 243.4 acre-feet, and the height of the dam is approximately 6 ft. Storage of 1000 acre-feet and height of less than 40 ft.

classifies Snow Pond Dam in the "small" category according to guidelines established by the Corps of Engineers.

D. Hazard Classification. Snow Pond is currently classified as having a "high" hazard potential in the Corps of Engineers National Inventory of Dams.

As discussed in detail in Section 5, 1E, failure of the dam may damage two isolated homes, Greenwich Street and some local public utilities; however, the event would be unlikely to cause loss of life or excessive damage. Based on the results of the Phase I Investigation, a reclassification to "significant" hazard potential is recommended.

E. Ownership. The pond and dam are owned by the Ware Water Department. The owner's address is: Ware Water Department, Church Street, Ware, MA 01082 (Phone: 413/967-4931). The Superintendent of the Water Department, Mr. John Harszy, acted as owner representative during this investigation.

F. Operator. Operation and maintenance of the dam are the responsibility of the Ware Water Department.

G. Purpose of the Dam. The dam was originally constructed as part of a water supply system for the Town of Ware. Snow Pond is presently used for recreational purposes.

H. Design and Construction History. The original dam was constructed prior to 1920. No records of the original design and construction were located.

It is understood from Mr. John Harszy that the dam failed in September 1938. No information concerning the specific damage resulting from the 1938 failure was located. Subsequent repairs, in 1939, included the concrete work which now covers portions of the original masonry construction.

Information from the owner and from a 1975 inspection report by the Massachusetts Department of Environmental Quality Engineering indicates that repair work, including placement of downstream riprap, was done by the Corps of Engineers in 1955. However, no records of this work were located by the New England Division.

In 1964, the owner completed some repairs which, according to

the 1972 Massachusetts DPW Report (Appendix B), included replacement of the gate for the outlet pipe.

I. Normal Operation Procedure. There is no established routine for operation of the dam. Mr. John Harszy stated that the gate has not been operated since about 1970.

### 1.3 PERTINENT DATA

Elevations as used in this report are referenced to Mean Sea Level datum (MSL).

A. Drainage Area. The drainage area is estimated to be 12,400 acres (19.4 square miles).

B. Discharge at Dam Site. Maximum flood at dam site is unknown. The maximum spillway capacity is approximately 2230 cfs with the flashboards removed and approximately 1730 cfs with the flashboards in place at a water surface of approximately El. 420.

#### C. Elevation (ft. above MSL)

1. Top dam embankment (left side).....	420 (Est.)
2. Maximum pool-design surcharge (1/2 PMF).....	Unknown
3. Full flood control pool.....	Unknown
4. Recreation pool.....	415 (Est.)
5. Spillway crest (with flashboards)....	415 (Est.)
6. Upstream portal invert diversion tunnel.....	Unknown
7. Streambed at centerline of dam.....	405.5 (Est.)
8. Maximum tailwater.....	Unknown

#### D. Reservoir

1. Length of maximum pool.....	0.9 miles (Est.)
2. Length of recreation pool.....	0.9 miles (Est.)
3. Length of flood control pool.....	Unknown

#### E. Storage (acre-feet)

1. Recreation pool.....	80.1 (Est.)
2. Flood control pool.....	Unknown

- 3. Design surcharge (1/2 PMF)..... Unknown
- 4. Top of dam..... 243.4 (Est.)

F. Reservoir Surface (acres)

- 1. Top of dam..... 40
- 2. Maximum pool..... 40
- 3. Flood control pool..... Unknown
- 4. Recreation pool..... 25.3
- 5. Spillway crest..... 25.3

G. Dam

- 1. Type..... 1. Earth embankment and 2. Earth retained by concrete and stone masonry walls
- 2. Length overall (including spillway).. Approx. 200 feet
- 3. Height of earth embankment..... Approx. 6 feet above ground surface beyond downstream toe
- 4. Top width of earth embankment..... Approx. 7 feet
- 5. Side slopes of earth embankment... Variable, 2:1 to 3:1 or flatter
- 6. Zoning..... Unknown
- 7. Impervious core..... Unknown
- 8. Cutoff..... Unknown
- 9. Grout curtain..... Unknown

H. Spillway

- 1. Type..... Concrete ogee weir
- 2. Length of weir..... 44 feet
- 3. Crest elevation..... 414 (Est.)
- 4. Flashboards..... 11 inches
- 5. U/S Channel..... N/A
- 6. D/S Channel..... 3% slope

I. Regulating Outlet. The outlet is controlled by a 6-foot by 6-foot timber sluice gate exiting into a 6-foot diameter steel pipe. It is a hand-operated gate with double timber stems. The rack and pinion lifting device is only present at one of the stems. The condition

of the assembly and the timber supports indicate the gate is inoperable at present. The invert of the 6-foot diameter pipe is estimated to be El. 410.

## II. ENGINEERING DATA

### 2.1 DESIGN, CONSTRUCTION AND OPERATION RECORDS

No records concerning design, construction or operation of the dam were located.

### 2.2 EVALUATION

Since no engineering data are available, the evaluation of the dam must be based primarily on the results of the visual evaluation described in the following section.

### III. VISUAL EXAMINATION

#### 3.1 FINDINGS

A. General. The Phase I visual examination of the Snow Pond dam was conducted on 12 May 1978.

In general, the earth embankment, and concrete spillway were found to be in fair condition. Some deficiencies which require correction were noted. The outlet gate was inoperable.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C.

B. Dam. The earth dam embankment located left of the spillway is in fair to good condition. There was no evidence of settlement, lateral movement or other serious defects.

There has been considerable erosion and loss of ground near the spillway, caused primarily by human foot traffic and rainfall. The embankment at this location has no topsoil or grass cover, as shown on Photos 2 and 3.

Although the upstream slope of the embankment is bare near the spillway and covered only by grass toward the left abutment, there was no evidence of serious erosion due to wave action.

Seepage was noted right of the spillway, at the base of the upper and lower retaining walls, as described in the following section.

Ground level between retaining walls located right of the spillway and in a large flat area beyond the right abutment is estimated to be 1.5 ft. lower than the top of the adjacent concrete walls. This condition is shown on Photos 4 and 5. If the dam were overtopped, water would flow first over the right side in a broad "emergency spillway" before the embankment on the left side would be overtopped.

C. Appurtenant Structures. Although the spillway weir was partially obscured by water flowing over the weir, the weir concrete appeared to be in good condition. The weir has some slight surface erosion and a few minor voids which appear to have occurred at horizontal joints in the weir. The downstream apron concrete also appeared to be in good condition. There is indication of minor scour ad-

jaacent to the downstream edge of the apron. Flashboards at the top of the weir are in good to excellent condition. Both walls contain cracks, efflorescence, and eroded areas where the water flowing over the weir was in contact with the concrete. The eroded areas extend to six inches in depth and reinforcing bars can be observed in the deeper depressions. The downstream ends of these walls are in the poorest condition with cracking and undercutting taking place. The wall on the right side has a major crack present at the end of the apron.

The outlet structure is in good condition except at the invert of the 6-ft. conduit which has deteriorated concrete. The timber control gate appears in good condition. The timber support for the rack and pinion lifting device at the left stem is almost completely deteriorated and the device is missing. Stop logs are present in front of the gate starting about one foot below the water surface. The growth on the timber and the appearance of the stop logs indicate they have been in place for some time. Water is bypassing the gate and flowing along the bottom few inches of the penstock at a rate estimated to be 75 to 100 gpm. The downstream end of the penstock is shown in Photo No. 8. The water apparently is coming from the upper two sides of the gate. The leakage could not be located by observations at the front face of the gate.

Vehicle and pedestrian access to the outlet structure is along the top of the right embankment of the dam. The elevation of this region is lower than other portions of the dam. It is expected that this region would be among the first to flood during high water. It is extremely doubtful that in its present condition the outlet structure could be reached, the stop logs removed and the gate lifted in sufficient time to aid in an emergency. If this area was brought to the same grade as the left embankment and the gate was repaired, it would still require the removal of the underwater stop logs to get the full relief benefit of the pipe.

The walls at the upstream face of the dam appear to contain concrete in good condition. The upper stone masonry wall located on the downstream side between the spillway and conduit indicates the presence of moisture at the bottom of the wall at mid-length. The lower wall in the same area is a stone masonry wall faced with concrete. The concrete is in poor condition with major cracks, undermined areas and loose concrete as shown by Photos No. 1 and 8. Water is percolating out from beneath this wall in at least two locations near the south end of the wall, at tailwater elevation.

D. Reservoir Area. The area around Snow Pond is generally wooded with side slopes which are highly variable. There is no significant potential for landslides into the pond which could create waves that might overtop the dam. No conditions which could result in a sudden increase in sediment load into the pond were noted.

E. Downstream Channel. Approximately 100 ft. downstream of the dam, Greenwich Road crosses Muddy Brook over a bridge constructed in 1935, Photo No. 9. The brook channel and side slopes have been paved with cobbles and boulders. The slope protection is generally in fair to good condition. There are no obstructions to the channel before it passes beneath the bridge, save for one large tree on the left slope immediately upstream of the bridge, Photo No. 9.

The elevation of the top of the road at the bridge location is approximately 415 ft. (MSL). The culvert is 19 ft. 6 in. wide, 10 ft. 0 in. in height, and 30 ft. long. The upstream invert elevation of the culvert is approximately 405 ft. (MSL). In the event of a dam failure, Greenwich Road would act as a second dam with an estimated surge flow depth of 2.8 ft. over the road. However, there is the possibility of the road then being breached.

### 3.2 EVALUATION

The Snow Pond Dam has been overtopped on several occasions, has been reconstructed in part and has experienced moderate deterioration through the years. The gate for the outlet conduit should not be considered operational in its present condition. In an emergency, the outlet would have to be opened by utilizing mobile equipment.

Remedial work is required to correct deficiencies which will become more serious with time.

#### IV. OPERATIONAL PROCEDURES

There are no established operational procedures, maintenance programs or warning systems in effect for this dam. Grass is mowed periodically and brush is cleared when it develops.

For a structure of this type, which is classified in the "significant" hazard category, a periodic observation and maintenance program should be established to examine the dam and maintain slopes and walls.

## V. HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

A. Design Data. No plans or hydraulic design were found for Snow Pond Dam. Only sketches which accompanied previous inspection reports were available.

The recommended spillway design flood (SDF) for the size (small) and hazard potential (significant) classification of this dam is between the 100-year flood and one half the probable maximum flood (1/2 PMF).

B. Experience Data. Because of the need to generate the 100-year flood flow for this dam, a method known as the Carl Johnson Method described in an open-file report of the U. S. Geological Survey and based on regression analyses of certain Massachusetts stream flow records, was used. This method resulted in a peak flow of 1495 cfs for the 100-year flood. The PMF was determined using the chart prepared by the Corps of Engineers, New England Division in the Guidelines. Assuming rolling terrain results in a PMF of 29,200 cfs, considering the effect of surcharge storage (which reduces the PMF by 500 cfs). Because the water surface area of the pond is only 25 acres, flood routing techniques were not deemed worthwhile. The foregoing results in a value of 14,600 cfs for the 1/2 PMF).

C. Visual Observations. The inspection revealed that 11 inches of flashboards were installed atop the concrete ogee spillway crest. Previous inspection reports indicate that up to 12 in. of flashboards are installed and maintained by the Ware Water Department. Although the conditions of the concrete spillway wingwalls and apron has deteriorated somewhat as described in Section 3, there were no conditions observed that would indicate a reduction in capacity of the spillway during a flood occurrence. The channel immediately downstream of the spillway is earth with cobbles and boulders. Between the spillway and the Greenwich Road bridge some 200 ft. downstream, both banks are cobble-lined to the concrete wing-walls that convey the flow of water to the 20-ft. wide by 10-ft. high bridge opening. Downstream of the bridge the channel has a slope of about 1 percent for about 1000 ft., below which the channel slope flattens somewhat as the flood plain widens through a swampy area about 1000 ft. long. Downstream another 1000 ft., the flows of Muddy Brook are

conveyed beneath the Route 9 bridge, and 2000 ft. further the stream meets the Ware River after passing beneath the Route 32 bridge. In the event of overtopping of the northerly wing of the dam, it is likely that the two houses immediately upstream of the bridge on the westerly side of Greenwich Road would suffer minor to moderate flooding. From Greenwich Road downstream to Route 9, development is somewhat sparse and at considerably higher (25-30 ft.) elevations than the brook channel.

However, at Route 9 houses immediately adjacent to the Muddy Brook bridge would be affected as the area was during the September 1938 flood, when the water was 5.5 ft. deep on Route 9. Downstream of the Route 32 bridge a shopping center would be affected by even the 100-year flood flow on Muddy Brook, as would some housing in the immediate area.

D. Overtopping Potential. As stated previously, based on the size and hazard classifications published in the Guidelines, the SDF falls in the range of 100-yr. flood to 1/2 PMF. Assuming that the stop logs are removed and allowing for 1 foot of freeboard, the spillway can safely pass 1430 cfs. This value is slightly less than the 100-year flow. However, the spillway could pass the 100-year flow if only 10 inches of freeboard was assumed, (or if the top of the dam was at the same elevation as the concrete walls of the spillway and no allowance for uncertainty had to be made).

Analysis of the culvert under Greenwich Road which is immediately downstream of the dam indicates that it is capable of passing the 100-year flood with only a minimal flow depth of less than 6 in. over the road. If a SDF of 1/4 PMF (7,400 cfs) was selected for this dam, the effects on Greenwich Road would be an overtopping by approximately 2.8 feet, assuming that the dam did not fail.

E. Evaluation. The spillway is not capable of passing the 1/2 PMF and it is questionable whether it could handle the 100-year flood. If failure of the dam were to occur, a hazard would exist for inhabitants and structures on the west side of Greenwich Road, at Route 9 and adjacent to Route 32 as previously described. Although the hazard would be unlikely to cause loss of life or substantial damage in these areas, it is deemed to be of a significant nature.

If the dam were breached, Greenwich Road would act as a second dam. Assuming that 40 percent of the dam's length was breached, the resulting flow of 7425 cfs would cause a maximum surge flow depth of 2.8 ft. over Greenwich Road. As stated previously, it is likely that the two houses immediately upstream of the bridge on the westerly side of Greenwich Road would suffer minor to moderate flooding. However, downstream of Greenwich Road, a flood plain exists which would provide an adequate storage capacity for the peak failure outflow.

In the event of an occurrence of a peak discharge equivalent to 1/2 PMF (14,600 cfs), it would be necessary to extend the spillway wingwalls vertically a distance of at least 16 ft. to contain the flood within the confines of the existing spillway. Should a peak discharge equivalent to 1/2 PMF (14,600 cfs) occur with the dam in its existing state, and the dam not fail or breach, the water level would crest 4.8 ft. above the top of the spillway wingwall. However, it is unlikely that such a buildup would occur without first a portion of the dam being breached.

In conclusion, the present spillway is inadequate to pass any flood in excess of the 100-yr. flood. An SFD on 1/4 PMF would likely cause a failure of the dam after it was overtopped with resultant downstream flooding as previously discussed in Section 5.1D.

## VI. STRUCTURAL STABILITY

### 6.1 EVALUATION OF EMBANKMENT STRUCTURAL STABILITY

A. Visual Observations. No visual evidence of instability in the small earth embankment left of the spillway was noted during the site examination on 12 May 1978.

B. Design and Construction Data. A theoretical analysis of the structural stability of the dam embankment was not possible due to lack of pertinent design and construction data. However, the embankment cross-section in relation to pond level compares favorably with other low embankments which have proven to be safe.

C. Operating Records. Not applicable.

D. Post-Construction Changes. There have been no known structural changes to the embankment.

E. Seismic Stability. Since the Snow Pond Dam is located in Seismic Zone 2, the scope of work has not included a study of stability during earthquake events. However, it is very unlikely that the embankment would fail in the event of an earthquake.

### 6.2 EVALUATION OF SPILLWAY STRUCTURAL STABILITY

A. Visual Observations. There was no visual evidence of movement or distress in the spillway concrete. The spillway training walls, particularly the right side wall downstream of the weir, has experienced cracking due to local movement and undercutting. The local stability of this low wall is suspect.

B. Design and Construction Data. No original design or construction data are known to exist for the present spillway. A theoretical structural analysis of the spillway was not possible due to the lack of pertinent data. The present condition of the spillway weir after a reported 40 years of operation plus the visual observations of its condition indicate the weir is currently stable.

C. Operating Records. No operating records are known to exist for the spillway and for the outlet conduit.

D. Post Construction Changes. The spillway was reported to be rebuilt in 1938, the gate renewed in 1964 and the flashboards replaced in 1977.

E. Seismic Stability. A theoretical analysis for seismic stability of the weir is not possible due to the lack of pertinent design data. The low height of the weir, approximately 9 feet, the present condition of the weir, and the location of the structure in Seismic Zone 2 indicate that seismic stability of the weir should not be a problem.

## VII. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

A. Condition. The visual examination of the earth embankment, spillway weir and concrete and stone masonry walls reveal that the Snow Pond Dam is generally in fair condition. There are no obvious conditions which would warrant urgent remedial treatment. Nevertheless, certain earthwork and structural features require corrective work to prevent further deterioration of the dam.

The spillway is not capable of passing the 1/2 PMF, and it is questionable whether it could handle the 100-year flood. Before the dam was overtopped, however, water would flow across the broad flat area beyond the right abutment before where ground level is believed to be about 1.5 ft. lower than the top of the earth embankment on the left side.

If failure of the dam were to occur, a hazard would exist for inhabitants and structures downstream. However, a wide flood plain exists directly downstream of the dam which could provide in part the necessary storage capacity to slow down the flood waters.

B. Adequacy of Information. Although very little data are available concerning the design and construction of the dam, the data are considered adequate for a Phase I Investigation when supplemented by field observations.

C. Urgency. It is recommended that the additional investigation and remedial work outlined in Sections 7.2 and 7.3, respectively, be undertaken as soon as practical, unless otherwise noted.

D. Need for Additional Investigation. The additional investigations outlined in Section 7.2 should be performed by the Town of Ware.

### 7.2 RECOMMENDATIONS FOR ADDITIONAL INVESTIGATIONS

It is recommended that the Town of Ware engage a registered professional engineer to undertake the following investigations:

1. An investigation of the area between the spillway and outlet conduit to determine the source and path of seepage, as well as the full extent of required repairs as identified in Section 7.3B.
2. Hydrologic studies to determine what alternative measures are necessary to significantly increase the discharge capabilities of the dam. These alternatives could include the use of the 6-ft. diameter pipe with a properly maintained sluice gate and a predetermined emergency operation procedure.

### 7.3 REMEDIAL MEASURES

A. Alternatives. Not applicable.

B. Operation and Maintenance, and Procedures. It is recommended that the following general recommendations for remedial work be undertaken by the Town of Ware to correct deficiencies noted during the visual examination:

1. Place earth fill left of the spillway to restore the earth embankment to its "design" cross-section. As a minimum, place loam and seed or sod the slopes and top of dam. Since erosion in this area by swimmers has been a continued problem, consideration should be given to surfacing this area with asphalt concrete to prevent future wear.
2. Place earth fill right of the spillway to raise the grade to an elevation equal to the top of the wall on the upstream side. Since the retaining wall on the downstream side is lower, the earth fill may be sloped down to meet the grade at the top of wall. The required earth fill should be carried to a point approximately 10 ft. beyond the end of the upstream wall, after which the fill may be sloped down to meet existing ground.
3. Renew and repair lifting devices for the control gate on the outlet conduit. Remove and store stop logs. Check structural conditions of gate and repair if necessary. This work should be accomplished immediately to make the gate fully operable.

4. Reconstruct low concrete-faced masonry wall located downstream of the spillway weir, on the right side.

Although the dam is generally in fair condition, it is important that the following items also be accomplished:

1. Until remedial work is accomplished, the rate of leakage through the outlet conduit and seepage at the base of walls right of the spillway should be periodically monitored.
2. Round-the-clock surveillance and provisions for removing flashboards should be provided by the owner during and following periods of unusually heavy precipitation. The owner should also develop a formal emergency preparedness plan and warning system.
3. It is recommended that the Town of Ware establish a program to periodically inspect the dam and provide for routine maintenance.

APPENDIX A  
INSPECTION TEAM ORGANIZATION AND CHECK LIST

	<u>Page No.</u>
<u>VISUAL INSPECTION PARTY ORGANIZATION</u>	1
<u>VISUAL INSPECTION CHECK LIST</u>	
Dam Embankment	2
Outlet Works - Structure	3
Outlet Works - Spillway Weir, Approach and Discharge Channels	3

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Snow Pond

Date: 12 May 1978

Time: 0745-1030

Weather: High Thin Clouds and Cool

Water Surface Elevation Upstream: Approximately 3 in. water flowing over flashboards. Approximately El. 415 (MSL Datum)

Stream Flow: Not known

Inspection Party:

Harl P. Aldrich, Jr. Haley & Aldrich, Inc.	- Soils
Allen W. Hatheway Haley & Aldrich, Inc.	- Geology
Roger H. Wood Camp, Dresser & McKee, Inc.	- Structural/ Mechanical

Present During Inspection:

John W. Critchfield, Haley & Aldrich, Inc.  
John Harszy, Supt. Ware Water Dept.

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

DAM : Snow Pond DATE : 12 May 78

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u> (Left Abutment)	
Crest Elevation	Approximately El. 420
Current Pool Elvation	Approximately El. 415
Maximum Impoundment to Date	Not known
Surface Cracks	None observed
Pavement Condition	No pavement
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Fair to good (embankment irregular)
Horizontal Alignment	Not applicable (embankment irregular)
Condition at Abutment and at Concrete Structures	Some erosion by human traffic and rainfall at spillway abutment and granite wall
Indications of Movement of Structural Items on Slopes	There are no structural items on the embankment
Trespassing on Slopes	Unrestricted to human traffic
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Mostly grass but some portions near abutment are bare
Sloughing or Erosion of Slopes or Abutments	Some erosion by human traffic and rainfall near spillway
Rock Slope Protection - Riprap Failures	No rock or riprap on upstream slope
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed on embankment left of spillway; some seepage noted at base of walls right of spillway (see text)
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation Systems	None

FILE NO. 4160

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

DAM: Snow Pond DATE: 12 May 78

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - STRUCTURE</u>	
<p>a. <u>Concrete and Structural</u></p> <p>General Condition</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Rusting or Corrosion of Steel Conduit</p> <p>b. <u>Mechanical and Electrical</u></p> <p>Lifting Device</p> <p>Service Gate</p> <p>Stop Logs</p>	<p>Good - deterioration of concrete, lower portion downstream end</p> <p>Leaks each side top of gate</p> <p>Outlet pipe appeared in good condition; 6-ft. diameter</p> <p>(No electrical)</p> <p>Lifting device missing at one stem of gate. Support for device deteriorated.</p> <p>6 ft. x 6 ft. timber gate</p> <p>In-place to 12 in. below water surface; growth on logs; logs wedged in position</p>
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
<p>a. <u>Approach Channel</u></p> <p>General Condition</p> <p>Floor of Approach</p> <p>b. <u>Weir, Training Walls &amp; Apron</u></p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Erosion</p> <p>Spalling</p> <p>Any Visible Reinforcing</p>	<p>No channel present - spillway is at edge of reservoir</p> <p>Not observable</p> <p>Weir - good, some surface erosion, some voids at possible horizontal joints</p> <p>Sidewalls - fair to poor (downstream)</p> <p>Apron - good</p> <p>None observed</p> <p>At walls adjacent to weir</p> <p>Some spalling at walls - concrete loose</p> <p>At bottom of left training wall</p>

FILE NO. 4160

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

DAM : Snow Pond DATE : 12 May 78

AREA EVALUATED	CONDITION
Any Seepage or Efflorescence Drain Holes	Both training walls, downstream portion  Left side - 2 drains - no water
c. <u>Discharge Channel</u>	
General Condition	Good
Loose Rock Overhanging Channel	None observed; sides of channel covered by irregular cobbles and boulders
Trees Overhanging Channel	Not significant (one tree present)
Floor of Channel	Cobbles and boulders (stream bed); some branches
Other Obstructions	None observed. Highway bridge immediately downstream provides opening for flow

FILE NO. 4160

APPENDIX B  
LIST OF AVAILABLE DOCUMENTS AND  
PRIOR INSPECTION REPORTS

		<u>Page No.</u>
<u>LIST OF AVAILABLE DOCUMENTS</u>		(None)
<u>PRIOR INSPECTION REPORTS</u>		
<u>Date</u>	<u>By</u>	
1968	An engineering consultant to Board of County Commission- ers of Hampshire County	1
22 November 1972	Mass. Department of Public Works	3
26 February 1975	Mass. Department of Public Works	10
29 March 1977	Mass. Department of Environ- mental Quality Engineering	17



# Hampshire County

OFFICE COUNTY COMMISSIONERS  
NORTHAMPTON, MASS. 01060

County Commissioners  
CHAIRMAN  
JOHN H. BREGUER  
WILLIAMSBURG  
EDWIN M. PODOLAK  
HADLEY  
HIRAM H. BROWNELL  
NORTHAMPTON

August 30, 1968

Board of Water Commissioners  
Wire Water Department  
4 Church Street  
Ware, Massachusetts 01082

Gentlemen:

The engineering consultant to the Board of County Commissioners of Hampshire County has recently completed an inspection of Snow Pond Dam situated in Ware and has submitted a report relative to his findings. According to our records, the dam and pond are owned by the Town of Ware and are under the jurisdiction of the Water Department. If ownership of the dam has changed, will you kindly notify our Board.

The contents of the report of the engineering consultant are as follows:

"The embankment portion of this dam located to the left of the spillway is in need of attention again. Both sloping faces and the top of the embankment immediately to the left of the spillway abutment are eroded and repairs are necessary to the embankment in this area. All tree growth along the entire length of the earth embankment beyond the eroded point should be cut down. The area of the embankment now eroded is in the same area where trouble of this nature has occurred in the past. The use of this area by swimmers causes erosion of the soil and prevents the development of a good sod. Either the embankment should be repaired, from time to time as needed, or a good paving should be placed on the embankment in this area which would resist the wear resulting from the use of the embankment by swimmers. A Type-I pavement placed on this portion of the embankment might be the permanent solution to the erosion problem. In any event, the earth now eroded away should be replaced, the embankment properly shaped and surfaced.

"The masonry of the left abutment of the spillway section is in fair condition. Some erosion has taken place on the face of the abutment wall at the spillway overflow water line. This condition is not too bad as yet but will need attention in the future.

"The downstream stone masonry wall of the left abutment structure is in need of maintenance. Joints at the stone masonry face should be pointed and filled as needed with a good cement grout.

Board of Water Commissioners

August 30, 1968

"The spillway itself was o.k. Minor erosion was noted on the surface of the masonry. Normal flashboards were on the crest and water level in storage was down about 4 inches from the top of the flashboards.

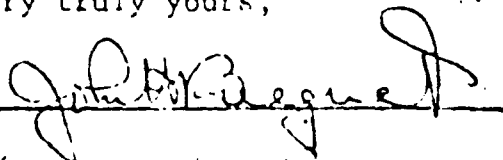
"The right abutment of the spillway is in the same general condition reported in recent years. The concrete seems to be eroding more and, though the condition is not as yet dangerous, the owner should be giving consideration to repairs in the not too distant future. The retaining wall at the toe of the right abutment is eroded on exposed surfaces.

"The drawdown gate still leaks and the face of the masonry wall at the discharge end of the drawdown tube is eroding at the bottom and the side of the tube. The gate operating mechanism is broken and should be repaired. The gate should be checked within the next year and, following a thorough inspection of its condition and operation, maintenance and repairs as then found necessary, should be accomplished. The drawdown tube through the dam is large in diameter. Any failure of the gate could cause a sizeable discharge of water. Should this discharge be a result of sudden gate failure, persons and property downstream might suffer some damage. Consequently, the gate should be maintained in workable and good structural condition. It is recommended that the owner of the dam be advised of the necessary maintenance needed."

The repairs and maintenance work as outlined in the report of the engineering consultant should be accomplished at an early date. The tree growth on the embankment to the left of the spillway is becoming quite large and these trees should be cut down. The embankment would be in much better condition, would be safer and would require less maintenance in the future if the tree growth was eliminated entirely or the trees cut down and replaced with smaller trees as they become larger.

Repairs to the embankment adjacent to the left abutment of the spillway are necessary before the erosion becomes worse. Other work recommended by the engineering consultant including servicing and maintenance of the drawdown gate is advisable for the safety of the dam.

Very truly yours,



36  
FILE

INSPECTION REPORT - DAMS AND RESERVOIRS

①

LOCATION:

Stock/Town Ware County Hampshire Dam No. 2-3-309-7  
Name of Dam Snow Pond Dam  
Topo Sheet No. 17C Mass. Sect. Coordinates: N 462,400 E 397,600  
Inspected by: R. C. Salls, P.E. On Nov. 22, 1972 Date Last Inspection June 1970

②

OWNER/S: As of Nov. 22, 1972

per: Assessors X, Reg. of Deeds \_\_\_\_\_, Prev. Insp. \_\_\_\_\_, Per. Contact X  
Board of Water Commissioners  
1. Ware Water Dept. 4 Church St. Ware, Mass. 01081  
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  
agent owner, appointed by multi owners.  
Mr. John Harlow  
Supt. Ware Water Dept. 4 Church St. Ware, Mass. 01082 Bus. 967-4931  
Res. 967-4618  
Name St. & No. City/Town State Tel. No.

④

DATA:  
No. of Pictures Taken - Sketches See Description of Dam  
Plans, Where None located.

⑤

DEGREE OF HAZARD: (if dam should fail completely)\*

- 1. Minor \_\_\_\_\_
- 2. Moderate \_\_\_\_\_
- 3. Severe \_\_\_\_\_
- 4. Disastrous X

Comments: Bridges on Routes 9 & 32 below Shopping Center near Junction Muddy Brook & Ware River.  
\*This rating may change as land use changes (future development).



9. EMERGENCY SPILLWAY: Available x. Needed \_\_\_\_\_.

Height Above Normal Water 2 1/2 Ft.

Width 30 Ft. Height 2 Ft. Material Earth

Condition: 1. Good x. 3. Major Repairs \_\_\_\_\_.

2. Minor Repairs \_\_\_\_\_. 4. Urgent Repairs \_\_\_\_\_.

Comments: Earth embankment on easterly end dam.

10. WATER LEVEL AT TIME OF INSPECTION: 4 1/3 Ft. Above \_\_\_\_\_ Below x.

Top Dam x P.L. Principal Spillway

Other Top dam is considered to be top of upstream face wall.

Normal Freeboard 4 1/3 Ft.

11. SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment None

Animal Burrows and Washouts None seen

Damage to Slopes or Top of Dam None seen

Cracked or Damaged Masonry None seen

Evidence of Seepage No evidence found

Evidence of Piping No evidence found

Leaks None found

Erosion None seen

Trash and/or Debris Impeding Flow None

Clogged or Blocked Spillway No

Other \_\_\_\_\_

12. 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 \_\_\_\_\_.

13. REMARKS AND RECOMMENDATIONS: (Fully Explain)

This dam was inspected with Mr. John Harfzy, Superintendent of Ware Water Department on November 22, 1972. It appeared to be in good order at the time of inspection.

It is an earth embankment dam with an Ogee spillway of concrete construction near the center and concrete or stone masonry face walls on much of both faces. It was repaired by the Army Engineers after the 1955 flood and in 1964 the town replaced the drawdown gate and did other repairs.

The dam serves a dual purpose - it is a part of the Ware water supply system, has a flood control function and is used for recreation.

RCS/sd/gm

DESCRIPTION OF DAM

DISTRICT 2

Submitted by R. C. Salls, P. E. Dam No. 2-8-309-7  
 Date December 4, 1972 City/Town Ware  
 Name of Dam Snow Pond Dam

1. Location: Topo Sheet No. 17C Mass. Rect. Coordinates N 462,400 E 397,600  
 Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.  
On Muddy Brook about 100 ft. east of Pleasant St. and about 1/2 mile north of Route 9, W. Main St. via Barnes Road and Pleasant Street.

2. Year built Unknown Year/s of subsequent repairs 1964  
New Gate

3. Purpose of Dam: Water Supply x Recreational \_\_\_\_\_  
 Irrigation \_\_\_\_\_ Other \_\_\_\_\_

4. Drainage Area: 19 sq. mi. \_\_\_\_\_ acres.  
 Type: City, Bus. & Ind. \_\_\_\_\_ Dense Res. \_\_\_\_\_ Suburban 10% Rural, Farm 20%  
 Wood & Scrub Land 70% Slope: Steep 20% Med. 50% Slight 30%

5. Normal Ponding Area: 24 Acres; Ave. Depth 6'-7'  
 Impoundment: 55 Million gals.; 168 acre ft.  
 Silted in: Yes \_\_\_\_\_ No x Approx. Amount Storage Area \_\_\_\_\_

6. No. and type of dwellings located adjacent to pond or reservoir \_\_\_\_\_  
 i.e. summer homes etc. None

7. Dimensions of Dam: Length 205 1/2 ft. Max. Height 13 1/2 ft.  
 Freeboard 4'-4"  
 Slopes: Upstream Face Vertical  
 Downstream Face Vertical westerly end - 3:1 Eastern End  
 Width across top 25 1/2 Ft.

DAM NO. 2-8-209-7

8. Classification of Dam by Material:  
Spillway Structure Face walls  
Earth x Conc. Masonry x Stone Masonry x  
Timber \_\_\_\_\_ Rockfill \_\_\_\_\_ Other \_\_\_\_\_

8A. Dam Type Gravity x Straight x Curved, Arched \_\_\_\_\_ Other \_\_\_\_\_

9. A. Description of present land usage downstream of dam:  
50 % rural; 50 % 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. yes x no \_\_\_\_\_  
C. Character Downstream Valley: Narrow \_\_\_\_\_ Wide x Developed 50%  
Rural 50% Urban 50%

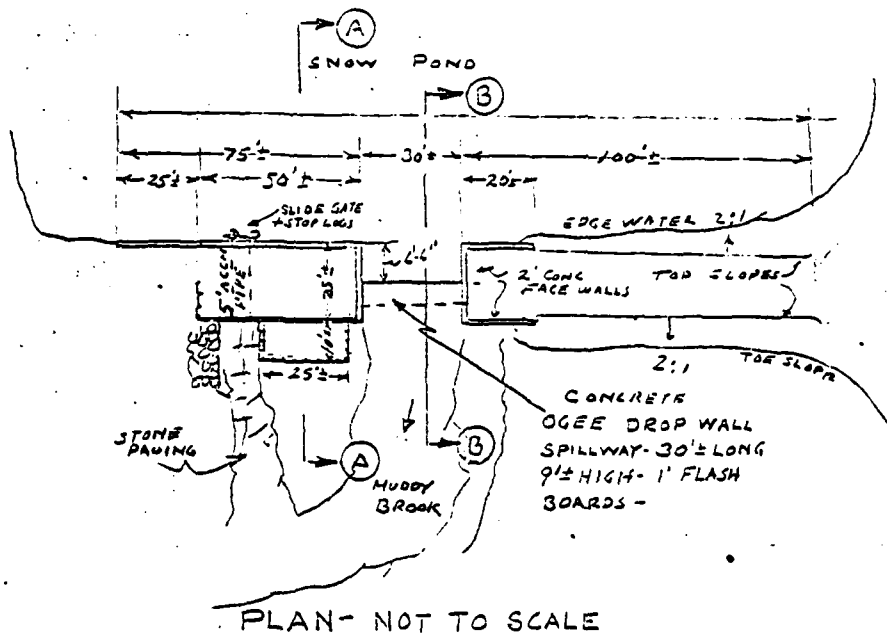
10. Risk to life and property in event of complete failure.  
No. of people 4 - 5  
No. of homes 6 - 7  
No. of businesses 3 Retail  
No. of industries None Type \_\_\_\_\_  
No. of utilities 4 Type Electric & Telephone Lines and Warr Water Dept.  
Railroads None  
Other dams Yes - Hardwick Pond Dam #2-8-309-17 upstream and Muddy Brook Dam  
Other Bridges on State Highways Routes 9 & 32  
Town Swimming Pool

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

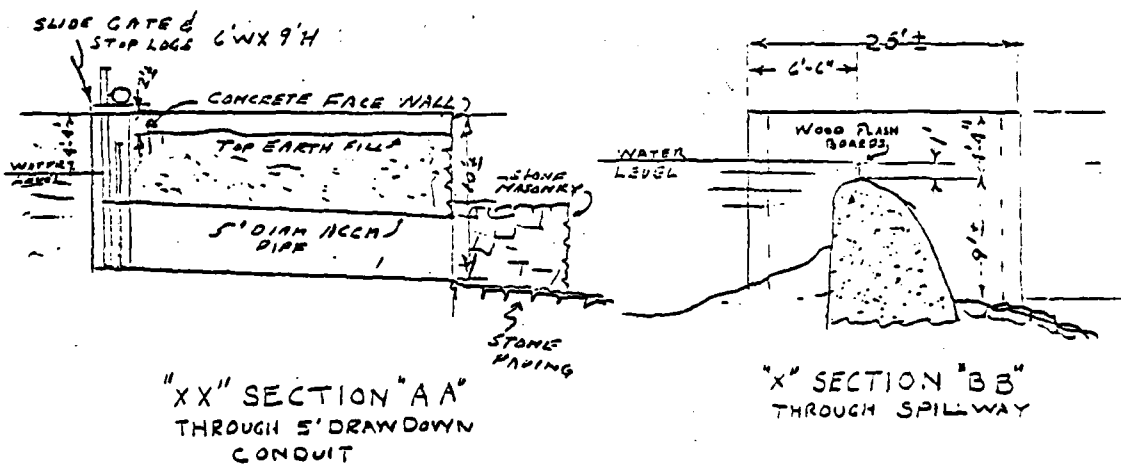
RCS/vk/gm  
Attachments  
Locis Plan  
Sketches

SKETCHES-Not To Scale

DAM No 2-B-303-7  
SNOW POND DAM.



PLAN - NOT TO SCALE



"X" SECTION "AA"  
THROUGH 5' DRAW DOWN  
CONDUIT

"X" SECTION "BB"  
THROUGH SPILLWAY

Nov 15/72  
RCS

March 13, 1975

Board of Water Commissioners  
Ware Water Department  
4 Church Street  
Ware, Massachusetts 01082

RE: Inspection-Dam #2-8-309-7  
Ware  
Snow Pond Dam

Gentlemen:

On February 26, 1975, an engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate that the Ware Water Commission is the owner. Will you please notify this office if this information is not current.

The inspection was made in accordance with Chapter 253 of the Massachusetts General Laws as amended by Chapter 595 of the Acts of 1970 (Dams-Safety Act).

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

1. There is a crack in the northwesterly side wall of the spillway which is about one inch wide and runs from top to bottom of wall.
2. Just downstream of the above crack there is minor undercutting of the base wall.
3. There is minor seepage at the junction of the main wall and top of the pad wall. There are several leaks between the slide gate and side channels holding the gate in place of which, one is a pressure leak.

Mr. John Harszy was present during the inspection and indicated that these matters would be checked as soon as working conditions permitted. With any correspondence, please include the number of the dam as indicated above.

Very truly yours,

*NLD*

NORMAN L. DIDOLI, P.E.  
Acting Deputy Chief Engineer

*JLH*  
LRA:jap  
cc: John Harszy, Capt.  
F. J. Hoey  
R. Sells

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:  
 City/Town Ware County Hampshire Dam No. 2-8-309-7  
 Name of Dam Snow Pond Dam  
 Topo Sheet No. 17C Coordinates: N 462,400 , E 5397,600  
 Inspected by: Harold T. Shumway , On 2-26-75 Date  
 Last Inspection 11-22-72

2. OWNER/S: As of 2-26-75  
 per: Assessors \_\_\_\_\_, Reg. of Deeds \_\_\_\_\_, Prev. Insp. X, Per. Contact X  
 Board of Water Commissioners  
 1. Ware Water Dept., 4 Church St., Ware, Mass. 01082 413-967-4931  
 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.  
Mr. John Harszy Bus. 413-967-4931  
Supt. Ware Water Dept., 4 Church St., Ware, Mass. Res. 413-367-4619  
 Name St. & No. City/Town State Tel. No.

4. DATA:  
 No. of Pictures Taken None Sketches See description of Dam.  
 Plans, Where None located

5. DEGREE OF HAZARD: (if dam should fail completely)\*  
 1. Minor \_\_\_\_\_ 3. Severe \_\_\_\_\_  
 2. Moderate \_\_\_\_\_ 4. Disastrous X  
 Comments: Approx. 55 million gallons impoundment. - Shopping Center near junction  
Muddy brook and Ware River. Bridges on Rtes. 9 & 32 downstream. Also  
 \*This rating may change as land use changes (future development).  
Muddy Brook Dam No. 2-8-309-6 (presently breached) is just a short  
distance downstream.

⑥ OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: Approx. center dam - 30' W. X 4'-4" H. conc. crest overflow spillway with ogee drop wall 9' high.

Controls Yes, TYPE: 1' high flashboards - 6" in place at time of inspection

Automatic     . Manual X. Operative Yes X, No     .

Comments: Northwesterly side wall or abut. of spillway is being undercut by water action at lower end of ogee drop wall.

No. 2 Location and Type: Northwesterly of spillway - 5' dia. A.C.C.M. pipe sluice.

Controls Yes, Type: Rack & pinion slide gate plus stop logs

Automatic     . Manual X. Operative Yes X, No     .

Comments: Repaired in 1964 part of controls in office of Water Dept. to prevent vandalism. Wood support frame for part of rack & pinion gears arched is splintered by vandals.

No. 3 Location and Type: Southeasterly end of dam - earth embankment which is 30'+ W. X 2' H. and 2 1/2'+, above normal water level.

Controls None, Type:     

Automatic     . Manual     . Operative Yes     , No     .

Comments: This embankment is an emergency overflow outlet

Drawdown present Yes X, No     . Operative Yes X, No     .

Comments: See No. 2 above

⑦ DAM UPSTREAM FACE: Slope Vertical, Depth Water at Dam 10'

Material: Turf X. Brush & Trees     . Rock fill     . Masonry X. Wood     

Other 3:1 Turfed slopes beyond masonry face walls

Condition: 1. Good     . 3. Major Repairs     .

2. Minor Repairs X. 4. Urgent Repairs     .

Comments: Minor erosion in some areas of slope due to pedestrian traffic

⑧ DAM DOWNSTREAM FACE: Slope Vertical northerly of spillway  
4:1 slope southerly of spillway

Material: Turf X. Brush & Trees     . Rock Fill     . Masonry X. Wood     

Other     

Condition: 1. Good     . 3. Major Repairs     .

2. Minor Repairs X. 4. Urgent Repairs     .

Comments: There is a stone masonry wall about 5' high around pad at base of northerly part of dam between spillway and drawdown conduit. See

9. EMERGENCY SPILLWAY: Available X, Needed \_\_\_\_\_.

Height Above Normal Water: 2 1/2 Ft.

Width 80+ Ft. Height 2 Ft. Material Earth

Condition: 1. Good \_\_\_\_\_, 2. Minor Repairs X, 3. Major Repairs \_\_\_\_\_, 4. Urgent Repairs \_\_\_\_\_.

Comments: Earth embankment on southeasterly end of dam. Some erosion from pedestrian traffic.

10. WATER LEVEL AT TIME OF INSPECTION: 3 Ft. Above \_\_\_\_\_, Below X \_\_\_\_\_.

Top Dam X F.L. Principal Spillway \_\_\_\_\_.

Other Top of dam is considered to be top of upstream face wall

Normal Freeboard 4 1/3 Ft.

11. SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment None found

Animal Burrows and Washouts None found

Damage to Slopes or Top of Dam Minor erosion of earth embankment on southeasterly end of dam.

Cracked or Damaged Masonry Yes - see sketch - cracks and spalling of concrete

Evidence of Seepage Yes - minor seepage at union of base of dam wall and top of 5' pad. See sketch.

Evidence of Piping None found

Leaks Yes - some leaks were noted around edges of slide gate at upstream end of 5' diameter pipe.

Erosion Minor along top of earth embankment - see line 3 above

Trash and/or Debris Impeding Flow None found

Clogged or Blocked Spillway None found

Other \_\_\_\_\_

(12.)

## OVERALL CONDITION:

1. Safe \_\_\_\_\_.
2. Minor repairs needed     X    \_\_\_\_\_.
3. Conditionally safe - major repairs needed \_\_\_\_\_.
4. Unsafe \_\_\_\_\_.
5. Reservoir impoundment no longer exists (explain)  
Recommend removal from inspection list \_\_\_\_\_.

(13.)

## REMARKS AND RECOMMENDATIONS: (Fully Explain)

The grade and alignment of dam structure and embankment are good. There was some minor erosion of southeasterly embankment on the top and upstream slope from pedestrian traffic noted. A crack in the masonry of the northwesterly side wall of spillway (see sketch) was noted. This crack is about one inch wide and runs from top to bottom of wall.

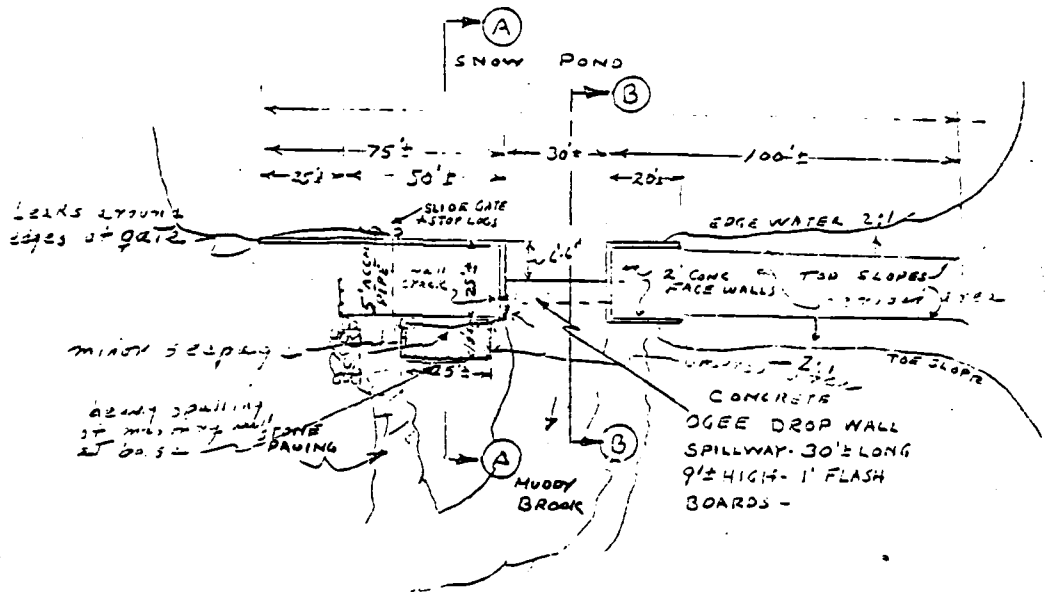
Just downstream of this crack a slight undercutting of side wall at union of base of wall with ogee spillway face was observed. Further along, the base of masonry wall of pad area, see sketch, is undercut from six inches to a foot in depth and approximately three feet in length. Along the downstream face of this same pad, the stone and concrete wall is heavily spalled from water line to toe of wall. Some minor seepage was noted at junction of toe of main dam wall and top of pad wall. This seepage is of small quantity and appears to be of minor concern at this time. A flow of water through the five foot diameter pipe of 5 to 6 inches in depth was noted. Investigation inside of the pipe showed several leaks between the slide gate and the side channels holding gate in place. One of these leaks was a pressure leak spurting water two feet +, into space and a stream of 2 inches in diameter +. This condition was brought to the attention of the Ware Water Department Superintendent, Mr. John Harszy, who was present at inspection. He stated these leaks would be checked as soon as working conditions permitted.

The water level of basin at toe of spillway and the heavy flow of water over the crest, one foot, +, prevented a close inspection of these above mentioned conditions. However, from what could be observed at this time the District recommends that the Ware Water Department be directed to closely check and repair the existing problems noted in the Inspection Report.

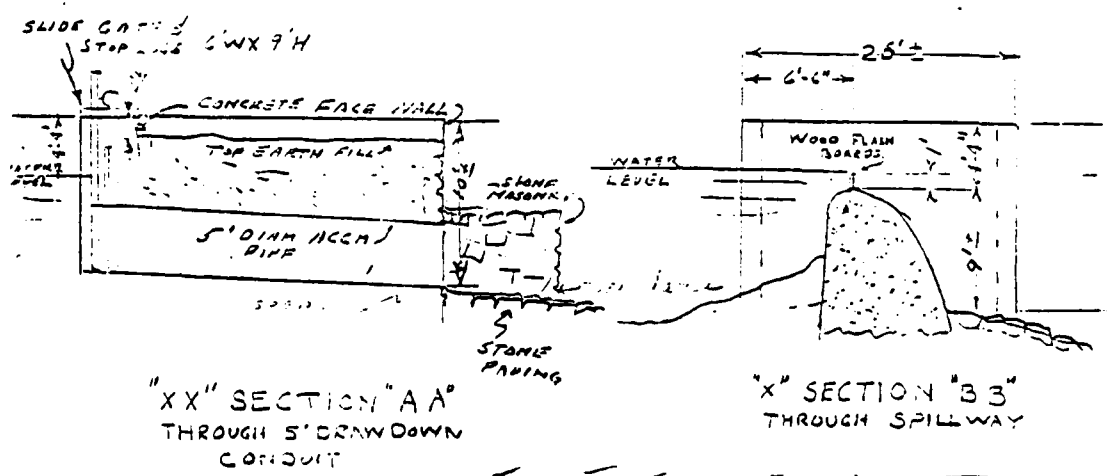
HTS/jr

SKETCHES - NOT TO SCALE

DAM NO 2-8-309-7  
SNOW POND DAM.



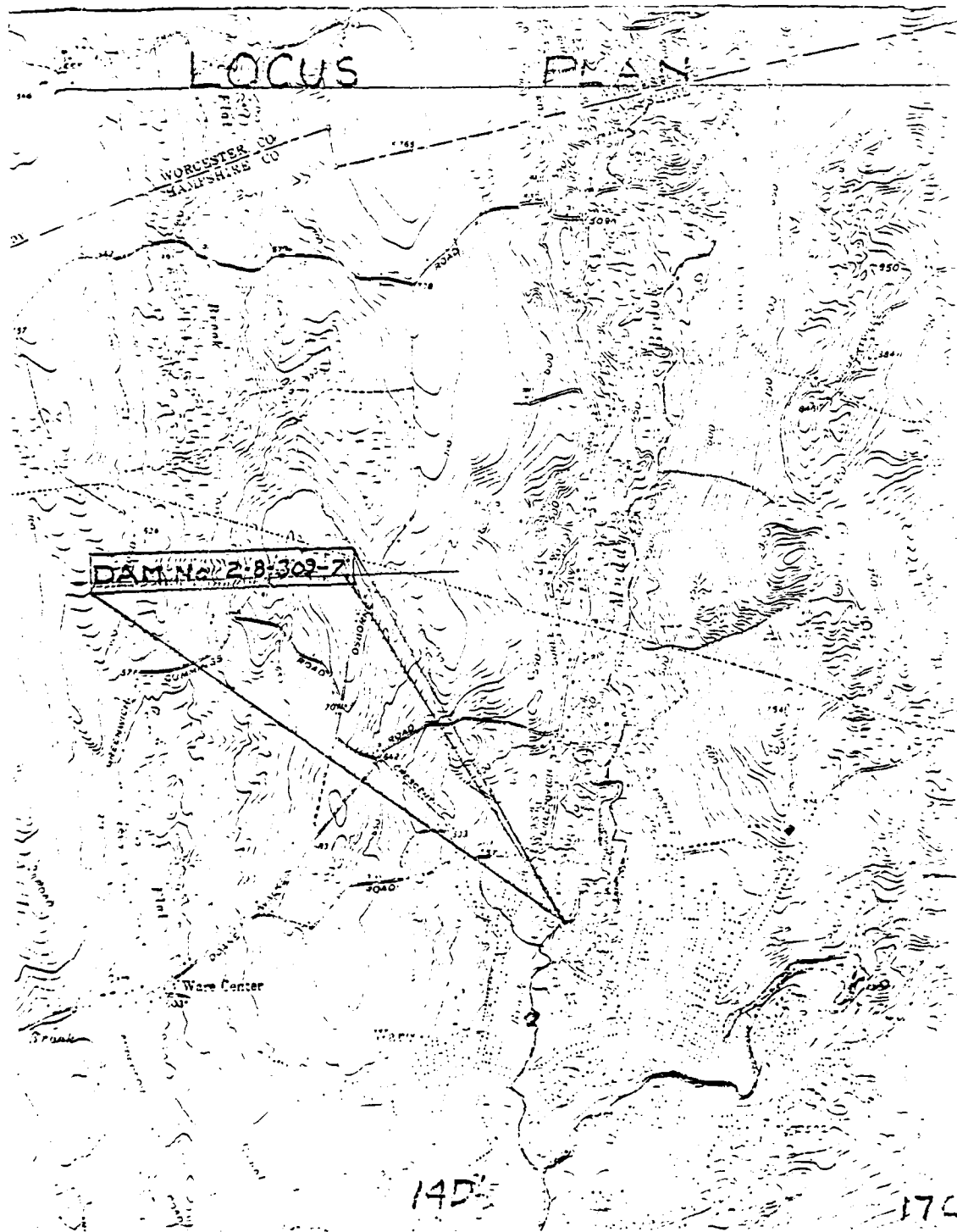
PLAN - NOT TO SCALE



"XX" SECTION "A"  
THROUGH 5" DRAIN DOWN  
CONDUIT

"X" SECTION "B"  
THROUGH SPILLWAY

Nov 20/72





*The Commonwealth of Massachusetts*

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

100 Nashua Street, Boston 02114

May 12, 1977

Board of Water Commissioners  
Ware Water Department  
Att: Mr. John Harszy (Supt.)  
4 Church Street  
Ware, Massachusetts

Re: Insp. Dam #2-8-309-7  
Snow Pond Dam  
Ware

Dear Sir:

On 3-29-77, 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 Ware. 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 706 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 conditionally safe. The following conditions were noted that require attention:

Better turf cover needed on top and upstream slope. Cracked and spalled concrete, undercutting action. Minor seepage in several areas. Leaks around gate seals of drawdown gate. Erosion at end of and around side of south easterly training walls.

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 V. Hannon, P.E.  
Chief Engineer

cc: F.W. Hoey  
At: H. T. Shumway

INSPECTION REPORT - DAMS AND RESERVOIRS

1.

LOCATION:

City/Town Ware County Hampshire Dam No. 2-3-109-7  
 Name of Dam Snow Pond Dam  
 Mass. Rect.  
 Topo Sheet No. 17 C Coordinates: N 462,400, E 397,600  
 Inspected by: Harold T. Shumway, On March 29, 1977 Date  
 Last Inspection 2-26-76

2.

OWNER/S: As of March 29, 1977

per: Assessors \_\_\_\_\_, Reg. of Deeds \_\_\_\_\_, Prev. Insp. x, Per. Contact X

Board of Water Commissioners

Name	St. & No.	City/Town	State	Tel. No.
1. <u>Ware Water Dept., 4 Church Street, Ware, Massachusetts.</u>				
2. _____				
3. _____				

3.

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

Mr. John Marszy  
Supt. Ware Water Dept., 4 Church Street, Ware, Massachusetts.  
 Name St. & No. City/Town State Tel. No.

4.

DATA:

No. of Pictures Taken None Sketches See description of Dam.  
 Plans, Where None located

5.

DEGREE OF HAZARD: (if dam should fail completely)\*

1. Minor \_\_\_\_\_ 3. Severe \_\_\_\_\_  
 2. Moderate \_\_\_\_\_ 4. Disastrous x

Approx. 55 million gallons impoundment - Shopping Center near junction  
 Comments: Muddy Brook and Ware River. Bridges on Rte. #9 and #12 downstream  
plus Water Dept. installations.

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

5. OUTLETS: OUTLET CONTROLS AND DRAWDOWN

Approx. center of dam - 30'W. X 4'-4" H. concrete crest

No. 1 Location and Type: overflow spillway with ogee abutment 9'-6" high.

Controls yes, Type: 11' high flashboards

Automatic     . Manual X. Operative Yes X, No     .

Comments: Stanchion pins bent over-11' high flashboards at a 45° angle.  
Northwesterly of spillway-5' diameter A.S.C.M. pipe sluice.

No. 2 Location and Type:     

Controls Yes, Type: Sluiceway with rack and pinion controls, plus stop logs

Automatic     . Manual X. Operative Yes X, No     .

Comments: Easterly pinion gear removed-timber supports rotten and broken-  
gate stem deteriorating-gate can be operated with difficulty.

Southerly end of dam-earth embankment 50'-wide X 2'-high

No. 3 Location and Type: and 2'-6" above normal water level.

Controls None, Type:     

Automatic     . Manual     . Operative Yes     , No     .

Comments: This embankment is an emergency over flow outlet.

Drawdown present Yes X, No     . Operative Yes X, No     .

Comments: See No. 2 above.

7. DAM UPSTREAM FACE: Slope Vertical, Depth Water at Dam 10'

Concrete & stone

Material: Turf X. Brush & Trees     . Rock Fill     . Masonry X. Wood     

Other 3:1 turfed slopes beyond masonry face walls.

Condition: 1. Good     . 3. Major Repairs     .

2. Minor Repairs X. 4. Urgent Repairs     .

Comments: Fresh filled area of earthen embankment has no turf cover developed  
as yet.

8. DAM DOWNSTREAM FACE: Slope 4:1 slope southerly of spillway.

Stone & concrete

Material: Turf X. Brush & Trees     . Rock Fill     . Masonry X. Wood     

Northerly and

Other     

Condition: 1. Good     . 3. Major Repairs X.

2. Minor Repairs     . 4. Urgent Repairs     .

Comment: 2 minor seepage areas in down stream face of masonry wall-nice areas  
cutting of south easterly abutment wall, leakage of several 1/2" dia.  
around gate seals-see remarks for further details.

9. EMERGENCY SPILLWAY: Available yes. Needed     .  
 Height Above Normal Water:      Ft.  
 Width      Ft. Height      Ft. Material       
 Condition: 1. Good     . 3. Major Repairs     .  
 2. Minor Repairs x. 4. Urgent Repairs     .  
 Comments: Better turf cover needed on newly filled area.

10. WATER LEVEL AT TIME OF INSPECTION: 4 1/2 Ft. Above     . Below x.  
 Top Dam      F.L. Principal Spillway     .  
 Other Top of concrete walls.  
 Normal Freeboard 4 1/3 Ft.

11. SUMMARY OF DEFICIENCIES NOTED:  
 Growth (Trees and Brush) on Embankment None found.  
 Animal Burrows and Washouts None found.  
 Damage to Slopes or Top of Dam Better turf cover needed on top and upstream side.  
 Cracked or Damaged Masonry Cracked and spalled concrete, undercutting action, cavities.  
 Evidence of Seepage Minor seepage in several areas.  
 Evidence of Piping None found.  
 Leaks Leak around gate seals of drawdown gate.  
 Erosion Scour at end of and slope side of south westerly training walls.  
 Trash and/or Debris Impeding Flow None found.  
 Clogged or Blocked Spillway None found.  
 Other     .

⑫

## OVERALL CONDITION:

1. Safe \_\_\_\_\_.
2. Minor repairs needed \_\_\_\_\_.
3. Conditionally safe - major repairs needed \_\_\_\_\_ X
4. Unsafe \_\_\_\_\_.
5. Reservoir impoundment no longer exists (explain)  
Recommend removal from inspection list \_\_\_\_\_

⑬

## REMARKS AND RECOMMENDATIONS: (Fully Explain)

The eroded area in the south easterly embankment noted on last inspection of 2-26-75 has been regraded but needs a better turf cover. The leaks around the gate seals are still evident but of a much smaller volume than previously noted. The gate controls are in need of repairs-see item #6-sub 2. The 10'- $\frac{1}{2}$  by 25'- $\frac{1}{2}$  toe pad has deteriorated further and has a cavity 4" to 8" deep, 1' to 3' high, and 12' to 20' in length on the base of the down stream wall. The side wall of pad next to spillway channel has cracked and is shifting in alignment. Minor under cutting action is occurring along the union of spillway drop wall with abutment side walls.

Minor seepage is occurring in some areas on down stream face walls and along toe of dam.

Due to the deteriorating condition of the toe pad and other conditions noted in this report the District rates this dam as conditionally safe - major repairs needed, and notes that if same rate of deterioration continues this dam could become unsafe within a period of time.

HTS/at

APPENDIX C  
SELECTED PHOTOGRAPHS OF PROJECT

LOCATION PLAN

Page No.

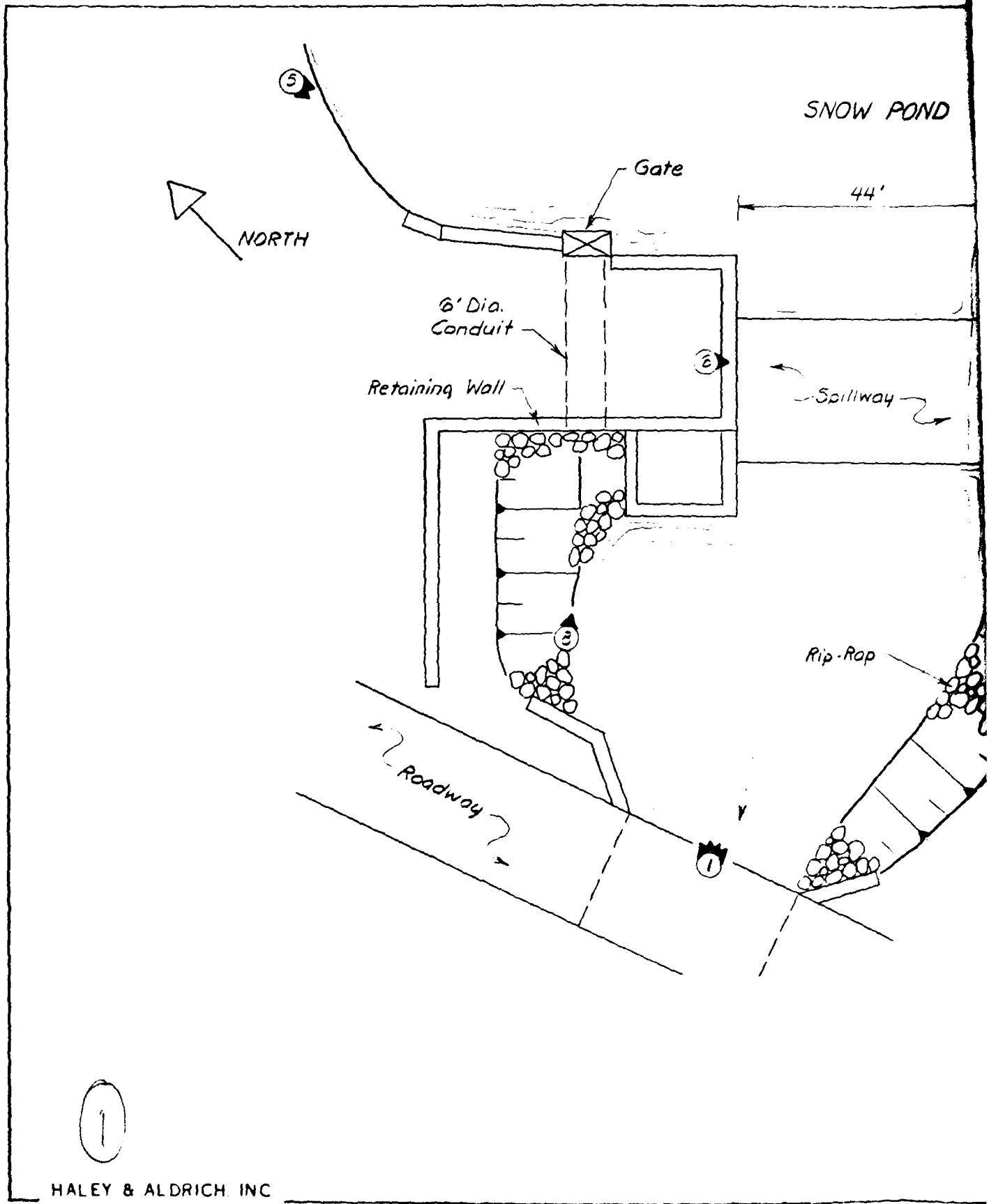
Site Plan Sketch

1

PHOTOGRAPHS

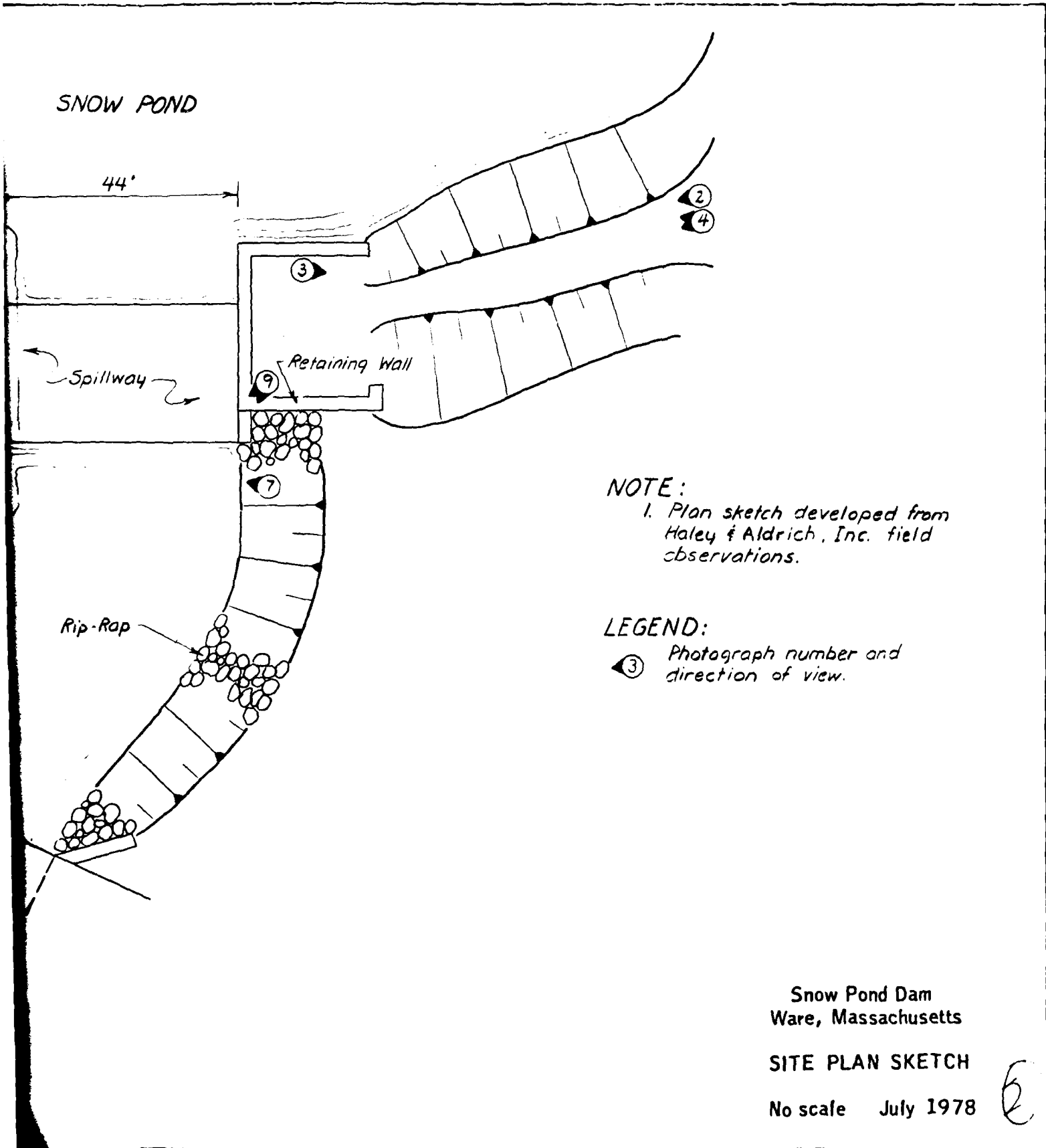
<u>No.</u>	<u>Title</u>	<u>Roll</u>	<u>Frame</u>	<u>Page No.</u>
1.	Overview of Downstream Face of Dam	7	8, 9A, 10, 11	v
2.	Embankment, Viewed from Left Abutment	7	3	2
3.	Embankment, Viewed from Left of Spillway	7	4	2
4.	Right Side of Dam, Viewed from Left of Spillway	7	5, 6	3
5.	Upstream Face of Dam, Viewed from Beyond Right Abutment	7	15, 16	4
6.	Left Training Wall	7	20	5
7.	Right Training Wall	7	23	5
8.	Lower Retaining Wall and Outlet Pipe, Downstream, Right of Spillway	7	18, 19	6
9.	Downstream Channel, Viewed from Left of Spillway	7	1, 2	7

FILE 4160 88



(1)

HALEY & ALDRICH, INC  
CAMBRIDGE MASSACHUSETTS





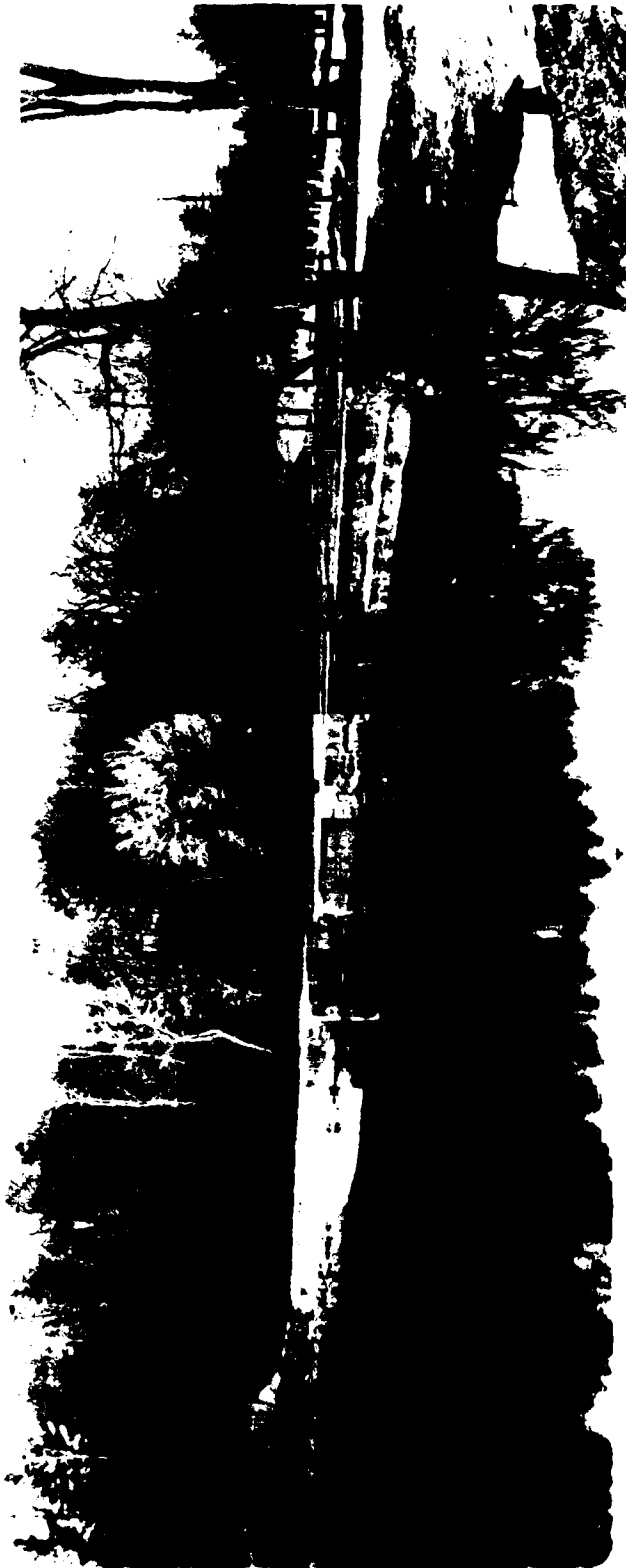
2. Embankment, Viewed from Left Abutment



3. Embankment, Viewed from Left of Spillway



4. Right Side of Dam, Viewed from Left of Spillway



5. Upstream Face of Dam, Viewed from Beyond Right Abutment



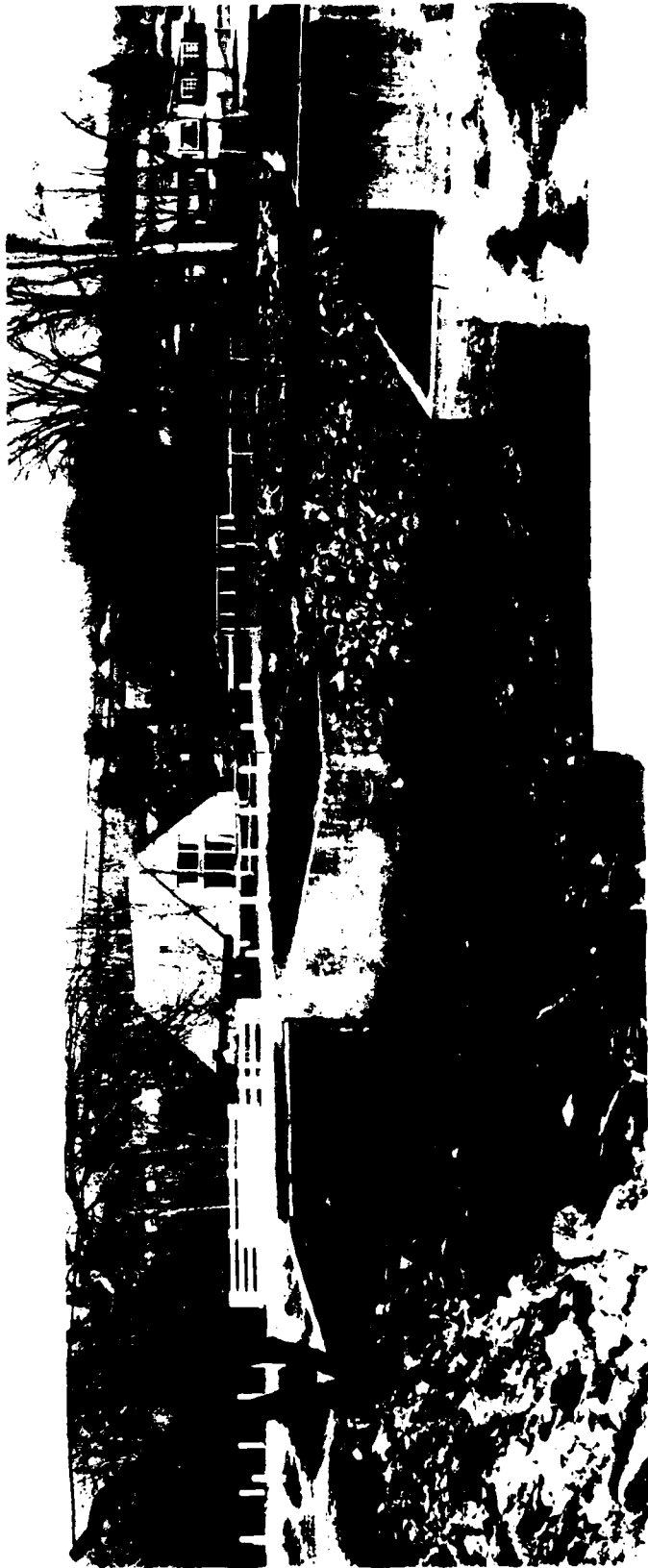
6. Left Training Wall



7. Right Training Wall



8. Lower Retaining Wall and Outlet Pipe, Downstream, Right of Spillway



9. Downstream Channel, Viewed from Left of Spillway

APPENDIX D  
OUTLINE OF DRAINAGE AREA AND  
HYDRAULIC COMPUTATIONS

<u>COMPUTATIONS</u>	<u>Page No.</u>
Drainage Area	1
Time of Concentration and Maximum Probable Flood	2
SCS 100-Year Flood	3
Carl Johnson 100-Year Flood	6
Sketch of Spillway	7
Flood Routing	8
Greenwich Road (Pleasant Street) Culvert Capacity	9
 <u>OUTLINE OF DRAINAGE AREA</u>	
Drainage Area Map	12

CAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT Walden Station, D.I. JOB NO. 5412-27  
PROJECT San Pond DATE CHECKED \_\_\_\_\_  
DETAIL Hydrology CHECKED BY \_\_\_\_\_

PAGE \_\_\_\_\_  
DATE 1-29-72  
COMPUTED BY 2-20

Drainage Area

- Area 1 = 1244.3 A
- Area 2 = 1209.4 A
- Area 3 = 1571.2 A
- Area 4 = 2332.3 A
- Area 5 = 3350.8 A
- Area 6 = 1531.7 A
- Area 7 = 1179.5 A

12915.2 A

Length of Watershed = 69,400' 153200' above  
Hardwick Pond

Slope (avg. for watershed)

15%	10410'	2120' 2439'
25%	58990'	~970'

Slope = .01093 (≅ 1.093%)

Curve Number Determination

- Swamps : 770 A
- Lakes : 100 A
- Roads : 114 A
- Forest : 10915 A
- Open spaces : 830 A
- Homes : 180 A

Assume Hydrologic Soil Group B/C

<u>Land Use</u>	<u>Area</u>	<u>CN</u>	<u>CN x Area</u>
Swamps	770	98	76226
Lakes	100	100	10000
Roads	114	99	11272
Forest	10915	63	689655
Open spaces	830	68	56440
Homes	180	75	13500
	<u>12915</u>		<u>823325</u>

CAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT US Army Corps of Engineers  
PROJECT Washburn Dam  
DETAIL Hydrology

JOB NO. 51-2-12  
DATE CHECKED \_\_\_\_\_  
CHECKED BY \_\_\_\_\_

PAGE 2  
DATE 2-27-78  
COMPUTED BY ---

$$KTD \cdot L = \frac{2233.25}{12415} = 0.18 \text{ sec} \cdot \text{ft} \cdot \text{ft}^2$$

$$S = 2.00 \cdot 10 = 5.1515'$$

$$L = \frac{2.3 \cdot (5.1515)^{1.7}}{1900 \cdot 1.4} = \frac{23,200 \cdot (5.1515)^{1.7}}{1900 \cdot 1.4}$$

+ not applicable for > 2000' cfs but try anyway

$$L = 13.4 \text{ hrs}$$

$$AD = 0.4 \cdot L = 0.4 \cdot 13.4 = 5.36 \text{ hrs}$$

# Do 100 yr, 12 hr, rainfall = 5.6 inches

Time (hrs)	R <sub>1</sub> /P <sub>2</sub>	Mass P (inches)	Mass Q (inches)
10.0	0.181	1.01	0
10.5	.209	1.13	.01
11.0	.235	1.32	.02
11.5	.293	1.58	.05
11.75	.387	2.17	.21
12.2	.463	3.21	.92
12.5	.735	6.12	1.10
13.2	.772	6.32	1.23

Use Quickflow for PMF from 100 yr. storm

Drainage Area = 19,459 mi<sup>2</sup>  
From crest,

$$PMF = 1590 \text{ cfs} / \text{sq. mile}$$

$$= 27,430 \text{ cfs} / 10 \cdot 12 \text{ PMF} = 16281 \text{ cfs}$$

Estimating effect of Archorage Storage on Maximum Flood Discharges

$$Q_0 = 27,430 \text{ cfs}$$

Lag time = 45'

$$L = 3.16$$

$$Q = Q_0 \cdot L^{-0.2}$$

CAMP DRESSER & MCKEE CLIENT WELLS, D. T. & COMPANY JOB NO. 57-1-2-PT PAGE 3  
 Environmental Engineers PROJECT Flood Hazard DATE CHECKED \_\_\_\_\_ DATE 1-22-72  
 Boston, Mass. DETAIL Spillway CHECKED BY \_\_\_\_\_ COMPUTED BY J. J.

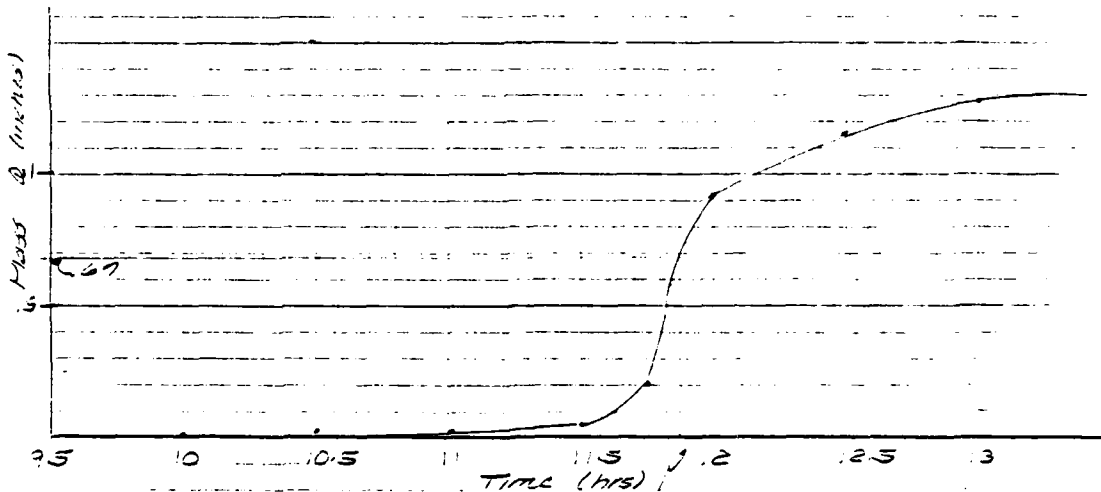
Length and profile of top of dam is unknown. So  
 total rise over dam and spillway at R.H.F. cannot  
 be calculated at this time.

Spillway capacity  
 = to basic design, assuming 10 ft rise above

$$Q = CLH^{3/2}$$

$$Q = 9.0 \times 44 \times 3.33^{3/2} = 950 \text{ cfs}$$

Final determination of 100 yr. Flood



$$11.88 - 9.5 \text{ A.D.} = 11.88 - 9.5(5.36) = -12.20$$

CAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT 46A C.D.T. 4-9-01  
PROJECT 46A-1-1000  
DETAIL 46A-1-1000

JOB NO. 901-3-8  
DATE CHECKED \_\_\_\_\_  
CHECKED BY \_\_\_\_\_

PAGE 2  
DATE 12-22-02  
COMPUTED BY ML

Computations for Instantaneous Peak  
Discharge

Increment	Time (hrs)	Mass Runoff (inches)	$\Delta D$ (inches)	$\Delta Q$	$\Delta Q$	$\Delta Q$
$\Delta D_1$	-12.24	0	0	0	0.2	0
	-6.98	0	0	0	0.2	0
$\Delta D_2$	-1.52	0	0	0	0.4	0
$\Delta D_3$	3.84	0	0	0	0.8	0
$\Delta D_4$	9.2	0	0	0	0.8	0
$\Delta D_5$	14.56	1.3	1.3	3.6	1.5	3.6
$\Delta D_6$	19.92	1.3	0	0	0.67	0
$\Delta D_7$	25.28	1.3	0	0	0.33	0

$$\Delta Q = 484 \text{ A } \Delta D = 484 \times 2.35 \Delta D_5 = 3.6$$

$$\frac{484 \times L}{2} = 5.36 + 13.4$$

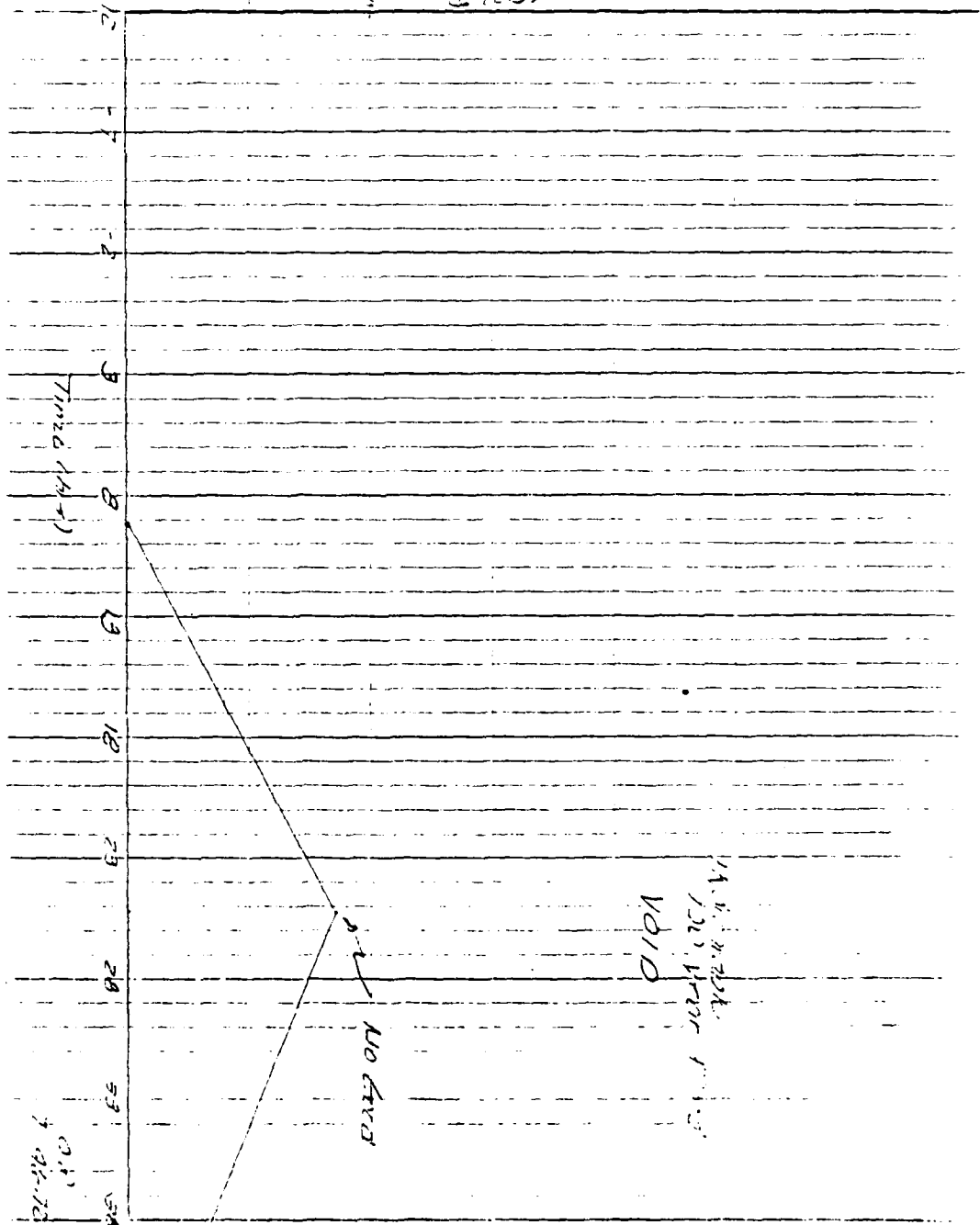
From this analysis, it looks like 8.9 cfs @ 12.24 hrs; check another method.

Try SCS Torsion Method see Page 6

Note: lag time using improvised channel for channel time and appropriate SCS Graphs for Overland Flow would be greater than 13.4 hrs probably.

CAMP-DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT HEA U.D. Group 1 JOB NO. 761-2-27 PAGE 5  
PROJECT PAVING DATE CHECKED \_\_\_\_\_ DATE 1/22/72  
DETAIL SECTION 3 (15) CHECKED BY \_\_\_\_\_ COMPUTED BY JCS



CAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT HEA WOT Group I JOB NO. 5121-2-PT  
PROJECT Fox Pond DATE CHECKED \_\_\_\_\_  
DETAIL Hydrology CHECKED BY \_\_\_\_\_

PAGE 10  
DATE 10/23/77  
COMPUTED BY ADD

Try Carl Johnson's Method For Determining  
Flows

$$P_{100} = .240 \cdot A^{.79} \cdot S^{.87} \cdot P^{4.08}$$

P = Rainfall in feet/year. Mass. is 3.5'/year

S = slope of watershed course using 15%  
and 25% method

A = Drainage Area in square miles

For Snow Pond Watershed:

$$P = 3.5'/year$$

$$S = 1.093\% = 57.7'/mile$$

$$A = 12415^A = 17.459 \text{ miles}$$

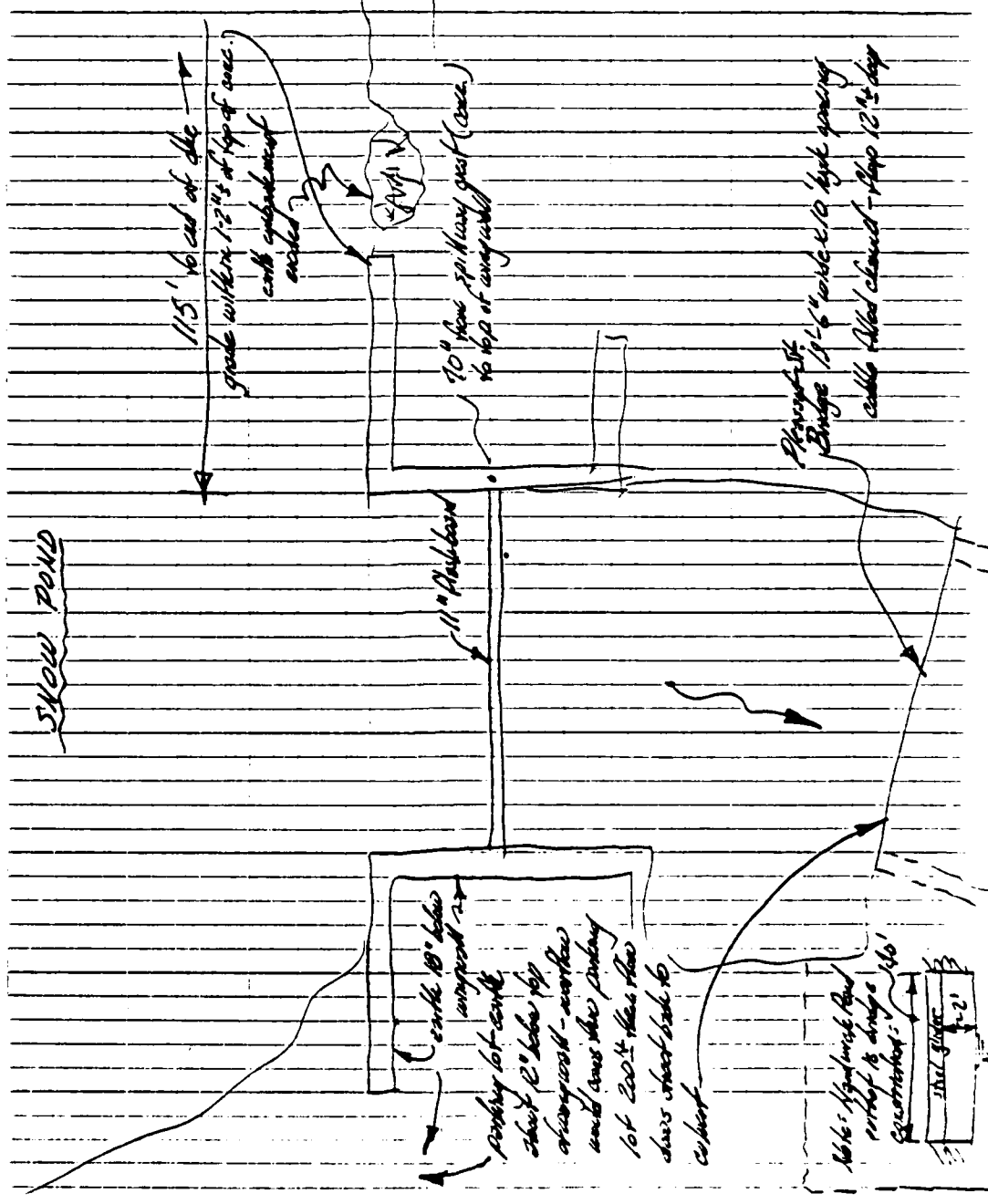
$$P_{100} = .240 \times 19.4^{.79} \times 57.7^{.87} \times 3.5^{4.08}$$

$$P_{100} = \underline{1275 \text{ cfs}}$$

CAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass.

CLIENT Richard Attie - City of Lynn JOB NO \_\_\_\_\_  
PROJECT Deep Investigation Report DATE CHECKED \_\_\_\_\_  
DETAIL Storm Pond - 12 Ave CHECKED BY \_\_\_\_\_

PAGE 1 of 1  
DATE June 29, 1978  
COMPUTED BY W. J. ...



Volume of storage (STOR.) in inches of runoff

& Assume Surface Area constant as depth increases (although it isn't)

S.A. Snow Pond  $\approx 25^A$

$$STOR_1 = \frac{25^A \times 12.7'}{19.4 \text{ sq. mi.} \times 53.3} = .307$$

Maximum Possible Flood Runoff  $\approx 19''$

$$\text{So } Q_{o2} = Q_{o1} \times \left(1 - \frac{STOR_1}{19}\right)$$

$$Q_{o2} = 29680 \times \left(1 - \frac{.307}{19}\right) = 29,200 \text{ cfs}$$

Surcharge Height to Pass 29,200 cfs

From Graph on Page 8,  $H = 12.53'$

$$STOR_2 = \frac{25^A \times 12.53'}{19.4 \text{ sq. mi.} \times 53.3} = .304$$

$$\frac{STOR_1 - STOR_2}{2} = \frac{.307 - .304}{2} = .0015$$

$$Q_{o3} = 29680 \times \left(1 - \frac{.0015}{19}\right) = 29,203 \text{ cfs}$$

So Reduced Peak Flow = 29,203 cfs

$$\text{So } 1/2 \text{ PMF} = 14,602 \text{ cfs}$$

However, Spillway still can't pass PMF of the  
 $1/2 \text{ PMF}$

DAMP DRESSER & MCKEE  
Environmental Engineers  
Boston, Mass

CLIENT: Wiley E. Alarich, L.D.E.  
PROJECT: Truss Pond  
DETAILS: Revisions

JOB NO: 541-2-27  
DATE CHECKED: 3/13/72  
CHECKED BY: EF

PAGE: \_\_\_\_\_  
DATE: 7-22-72  
COMPUTED BY: \_\_\_\_\_

Estimate downstream Dam Failure Hydrographs

STEP 1: S at time of failure (i.e. when W.S. is at top of dam)

420 Res. Surface - Top of dam: 40 acres  
415 Spillway Crest (w/ Fr. Roads): 25.3 acres (9.5 acres less)

Elevation: 100 ft

415 80.1'

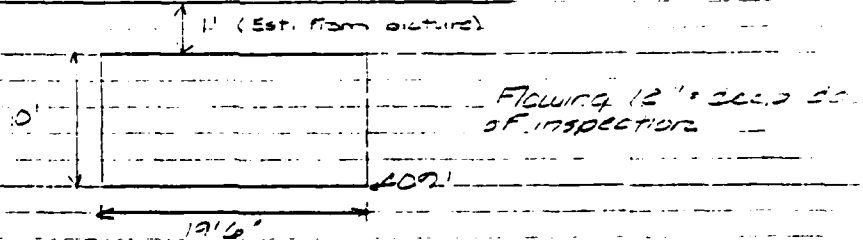
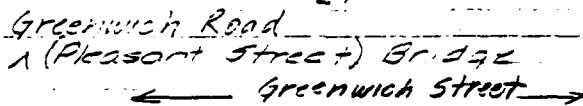
420 243.4'

S = 243.4' Area - A

STEP 2:  $Q_{p1} = \frac{2}{27} W_0 \sqrt{S} \cdot 10^{3/2}$

$W_0 = 190 \times 200 = 80' \cdot A$

$Q_{p1} = \frac{2}{27} \times 80' \times 132.2' \times 14.5^{3/2} = 7427' \cdot C.F.$



From State Inspector Report, Dis. Point of Spillway = 410'

$\frac{1}{200} = .0050$  slope 304' x 308' center line through crest

LOCALITY OF CULVERT: FIGURE 9 Full NO SPILLWAY

$A = 175.59 \text{ F}^2$        $n = .040$  (cobble on ground)

$WD = 59 \text{ F}$

$R = 175.59 / 59 = 2.977$

$S = .005$

$L = 30 \text{ F}$        $L = 0.80 \text{ Long Brake}$        $R_1 = 0.38$

$Q = 1.486 (175.59)^{2/3} (.005)^{1/2} \times 175$  (Assume normal depth)

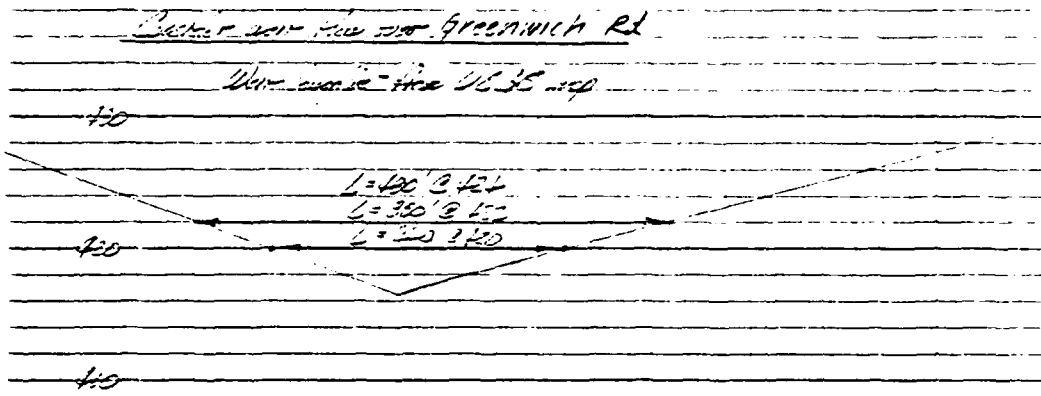
$Q = 1137 \text{ cfs}$

WATER LEVEL AT TOP OF ROAD IS EQUAL AT TOP OF BOX CULVERT

$Q = 0.80 \times 175 \sqrt{64.4 \times 1} = 1252 \text{ cfs}$

- I didn't see the sense in going through a backwater analysis of the culvert because, since the top of road is the same elevation as top of spillway when dam overflows, all the static energy in the water behind dam turns into kinetic energy. Energy will be lost and unless the breach occurs before peak of storm, the road will probably act like a secondary dam, with some flow across the roadway.

- There is the possibility of the road embankment being secured if it is composed of grass and gravel (highly permeable material). The road itself could be breached and the water would escape. However, the same structure in the section of Muddy Brook between Greenwich Rd and Route 9, are approximately 25' in elevation higher than the creek. Also, the section of the brook is very narrow and this would not would cause the effect of the road appearing to be a makeshift because of the more or less natural storage capacity.



House 200 2.0 ft deep over Greenwich Rd. (Elev. 101)  $L_{water} = 250$

$$Q = (2.5 \times 250) \left( \frac{1}{2} \right)^{\frac{2}{3}} + 0.8 (1.5) \sqrt{2.5} = 7.5 + 170 = 225.5 \text{ cfs}$$

225.5 cfs

House 200 3.0 ft deep over Greenwich Rd. (Elev. 102)  $L_{water} = 350$

$$Q = (2.5 \times 350) \left( \frac{1}{2} \right)^{\frac{2}{3}} + 0.8 (1.5) \sqrt{3.5} = 2475 + 2.13 = 2477.13 \text{ cfs}$$

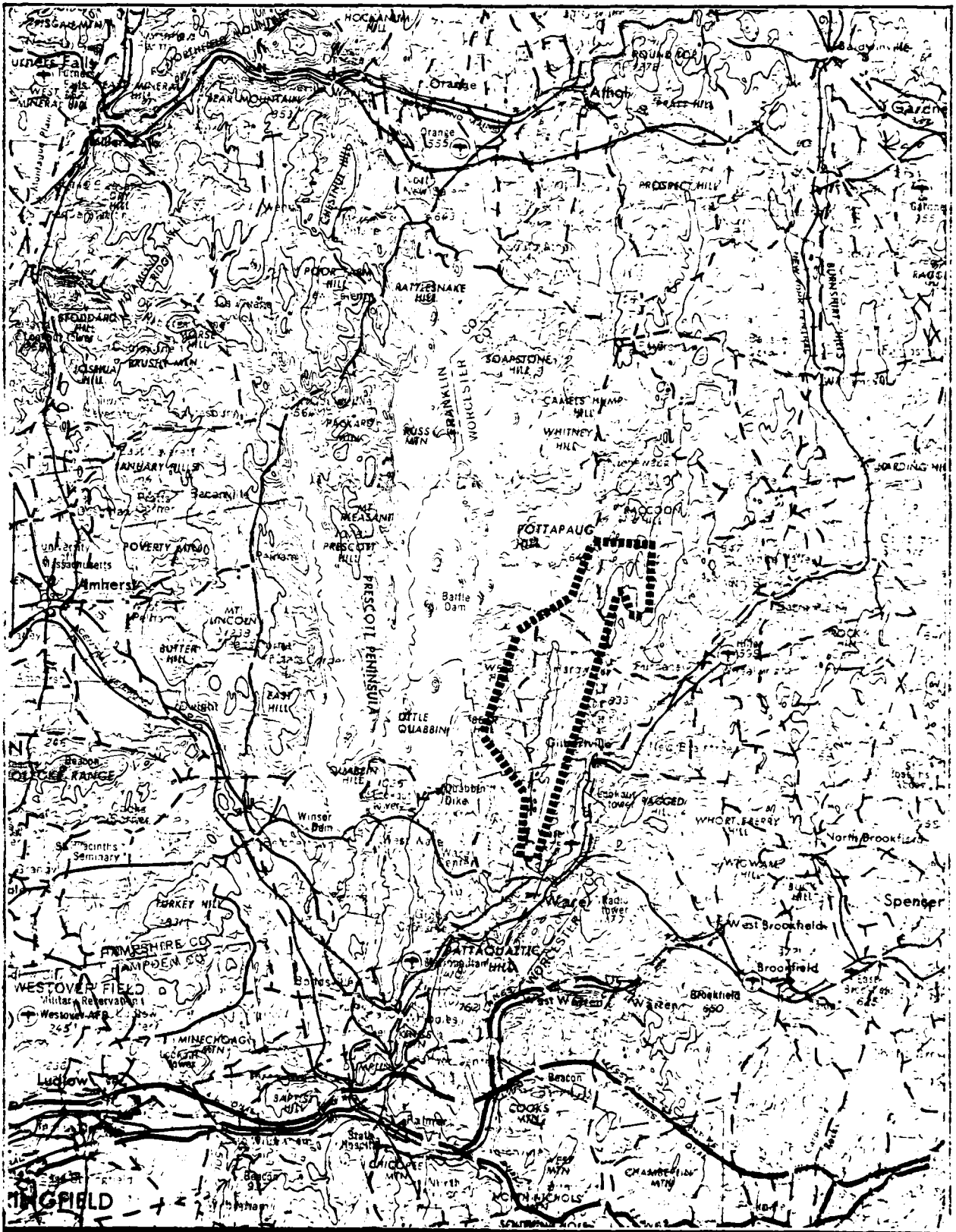
2477.13 cfs

House 200 3.0 ft deep over Greenwich Rd. (Elev. 103)  $L_{water} = 450$

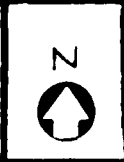
$$Q = (2.5 \times 450) \left( \frac{1}{2} \right)^{\frac{2}{3}} + 0.8 (1.5) \sqrt{4.5} = 5752 - 5502 = 250 \text{ cfs}$$

250 cfs

To bracket the Sewer Pipe there will have minimum depth of 2.0 ft over Greenwich Rd. if the structure is at elevation



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



**SNOW POND DAM**  
**DRAINAGE AREA**  
 SCALE 1:500 000

APPENDIX E  
INFORMATION AS CONTAINED IN  
THE NATIONAL INVENTORY OF DAMS



# INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	DIVISION	STATE	COUNTY	DIST.	CITY	COUNTY	CONGR.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE (DAY, MO, YR)
791 NEJ	MA	015						SNOW POND DAM	4216.0	7214.8	08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT			
	SNOW POND			
RECONBASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	DIST FROM DAM (MI.)	POPULATION
0108	MUDDY BROOK	WARE	1	8679

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES (ACRES-FT.)	DIST OWN	FED. R	PRV/PED	SCS A	VER/DATE
RECTGRPG	1920	R	15	9	243	80	N	N	N	28AUG78

REMARKS
21-RETAINING WALLS 22-PRIOR TO 24-25-27-ESTIMATED

D/S HAS RESERVOIR	SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	INSTALLED PROPOSED	NO. LENGTH (FT.)	NAVIGATION LOCKS
2	200 C	44	1430			

OWNER	ENGINEERING BY	CONSTRUCTION BY
WARE WATER DEPARTMENT		

REGULATORY AGENCY	OPERATION	MAINTENANCE
NONE	NONE	MA DPM

INSPECTION BY	INSPECTION DATE (DAY, MO, YR)	AUTHORITY FOR INSPECTION
MALEY & ALDRICH, INC.	12MAY78	PL 92-367

REMARKS