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#### NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT

Identification No.:NH00073Name of Dam:Smith Pond DamTown:EnfieldCounty and State:Grafton County, New HampshireStream:Unnamed tributary to Mascoma LakeDate of Inspection:May 9, 1979

#### BRIEF ASSESSMENT

Smith Pond Dam has a hydraulic height of 11 feet, is about 18 feet wide, and is about 150 feet long. It is an earthen embankment contained between dry masonry walls; the upstream wall has been crudely faced with concrete. The dam has a concrete spillway and a low-level gate which is inoperable. The dam forms the headwaters of an unnamed tributary to Mascoma Lake, and is located in west central New Hampshire. The dam, along with four dikes, contain runoff from a 0.9 square mile drainage area. Maximum storage capacity is about 775 acre-feet. Smith Pond Dam is used as an upstream storage reservoir for water supply. The pond is slightly less than a half mile in length with a surface area of about 62 acres.

The dam is in poor condition. Major concerns are: the inadequate spillway capacity, the lack of an operable gate for the low-level conduit, the 15-foot long depression in the dam crest over the conduit, seepage at two of the four dikes, and the large trees growing on the dikes.

Based on small size and significant hazard classification in accordance with Corps guidelines, the test flood is ½ Probable Maximum Flood (PMF). A test flood outflow of 1080 cfs (1200 csm) would overtop the dam by about 1.4 feet. The spillway capacity is 40 cfs which is only 4 percent of the test flood discharge; therefore the spillway is considered inadequate. A major breach at top of dam could result in the loss of 4-6 lives and appreciable property damage.

The owner, LaSalette Seminary, should implement the results of the recommendations and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I inspection report.

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#### 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 a ailable data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

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

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

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

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March 1979 Figure 1 - Overview of Smith Pond Dam.



#### NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT SMITH POND DAM

#### SECTION 1 PROJECT INFORMATION

#### 1.1 General

a. <u>Authority</u>. 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. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0009 has been assigned by the Corps of Engineers for this work.

#### b. Purpose

(1) To 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) To encourage and prepare the State to initiate quickly effective dam safety programs for non-Federal dams.

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

#### 1.2 Description of Project

a. Location. Smith Pond Dam is located in the Town of Enfield, New Hampshire and forms the headwaters of an unnamed tributary to Mascoma Lake. After discharging at the damsite the unnamed tributary flows northerly for a distance of about 1.4 miles before emptying into Mascoma Lake. Smith Pond Dam is shown on U.S.G.S. Quadrangle, Mascoma, New Hampshire with coordinates approximately at N 43° 35' 24", W 72° 06' 18", Grafton County, New Hampshire. (See Location Map page vii.)

b. <u>Description of Dam and Appurtenances</u>. Smith Pond Dam is an earthen embankment dam with a nearly vertical dry masonry upstream face which has a crudely constructed concrete facing and a nearly vertical dry masonry wall on the downstream side. The dam totals 150 feet in length, has a structural height of 13 feet, and averages 18 feet wide at the crest. The dam was built with a dog leg at

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about 60 feet from the right (east) abutment with an angle of about 30° from the axis through the portion containing the spill-The concrete spillway consists of a 4.7-foot wide by 1.1way. foot high stoplog facility which has been constructed through the top of the dam. A low-level conduit passes through the dam estimated to be about 3 square feet in cross-section. An inoperable gate covers the upstream opening and has been wedged open partially to allow a small amount of discharge (estimated to be 1 cfs). Four low dikes, two east and two west of the dam, are required to retain the pond. The near west dike is about 150 feet west of the west dam abutment and is about 50 feet long. The far west dike is about 800 feet west of the dam. It is 80 feet long and about 6 feet in height. The near east dike is about 500 feet east of the dam; it is 160 feet long and 6 feet in height. The far east dike is about 900 feet east of the dam; it is about 25 feet long and about 2.5 feet high.

c. Size Classification. Small (hydraulic height - 11 feet; storage - 775 acre-feet based on height and storage ( < 40 feet in height and  $\geq$  50 to < 1,000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. <u>Hazard Classification</u>. Significant Hazard. A major breach could result in a loss of 4-6 lives and appreciable property damage. (See Section 5.1 f.)

e. <u>Ownership</u>. Smith Pond Dam was originally constructed and owned by the Shakers. Ownership was passed to LaSalette Seminary at some unknown date around 1927.

f. Operator. The current owner and operator of Smith Pond Dam is LaSalette Seminary, Enfield, New Hampshire 03748. Phone: (603) 632-5533.

g. <u>Purpose</u>. The original purpose for the construction of the dam by the Shakers is not known. It is believed they may have used it for water storage. The Shakers constructed a diversion channel six feet wide at varying depths from the main channel about one mile across the base of the mountain to their village. The current owner, LaSalette Seminary, utilizes the upstream storage for water supply including drinking, kitchen, toilets, fire hydrants and irrigation of gardens.

h. Design and Construction History. Little is known about the design or construction of the dam. According to information contained in the files of the NHWRB, the dam was built illegally by the Shakers in the late 1800's. Under ownership by the LaSalette Seminary, some reconstruction took place in 1947. No plans or design data were revealed for this reconstruction.

i. Normal Operating Procedures. No written operating procedures exist for Smith Pond Dam. During the summer months, the dam is visited usually every two weeks by the owner. Any major deficiencies are reported. During periods of little rainfall, water is diverted from the main channel into the diversion channel to supply water for the Seminary. This diversion is

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accomplished by obstructing flow in the main channel and forcing water into the diversion channel.

#### 1.3 Pertinent Data

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a. Drainage Area. The drainage area consists of 0.9 square mile (576 acres) that is predominantly wooded terrain. The normal surface area of Smith Pond is 62 acres which constitutes 11 percent of the watershed.

#### b. Discharge at Damsite

(1) Outlet works (conduit) - one low-level outlet of unknown size. The gate is presently inoperable.

- (2) The maximum discharge at the dam is unknown.
- (3) Ungated spillway capacity at top of dam 40 cfs @ 1651.3' MSL
- (4) Ungated spillway capacity at test flood elevation -120 cfs @ 1652.7' MSL
- (5) Gated spillway capacity at top of dam not applicable
- (6) Gated spillway capacity at test flood elevation not applicable
- (7) Total spillway capacity at test flood elevation -120 cfs @ 1652.7' MSL
- (8) Total project discharge at test flood elevation -1080 cfs @ 1652.7' MSL
- c. Elevation (ft. above MSL; see (6) below)
  - (1) Streambed at centerline of dam 1640.3 (downstream toe)
  - (2) Maximum tailwater unknown
  - (3) Upstream invert low-level outlet unknown
  - (4) Recreation pool not applicable
  - (5) Full flood control pool not applicable

(6) Spillway crest - 1650 (shown on U.S.G.S. Quadrangle Sheet and assumed to be spillway crest elevation)

- (7) Design Surcharge unknown
- (8) Top of dam 1651.3 (Main dam embankment)

(9) Test flood pool - 1652.7 (10)Dike crest near easterly - 1651.3
far easterly - 1651.9 near westerly - 1651.3 far westerly - 1652.4 d. Reservoir (miles) (1)Length of maximum pool - 0.45 Length of pool at spillway crest - 0.45 (2)Length of flood control pool - not applicable (3) Storage (acre-feet) e. (1)Recreation pool - not applicable Flood control pool - not applicable (2)(3)Spillway crest pool - 680 (4) Top of dam - 775 (5) Test flood pool - 920 f. Reservoir Surface (acres) (1)Recreation pool - not applicable Flood control pool - not applicable (2) (3) Spillway crest - 62 Test flood pool - 91 (4) (5) Top of dam - 78 g. Dam Type - earth fill between dry masonry faces; (1)upstream masonry has a concrete facing. (2) Length - 150' Height - 13' (structural height) (3) (4) Top width - averages 18' Side Slopes - vertical upstream and downstream (5) 1 - 4

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- (6) Zoning unknown
- (7) Impervious core unknown
- (8) Cutoff unknown
- (9) Grout curtain unknown

h. <u>Diversion and Regulating Tunnel</u> - not applicable (See j. below.)

i. Spillway

- (1) Type concrete
- (2) Length of weir -4.7'
- (3) Crest elevation 1650' MSL
- (4) Gates none

(5) U/S Channel - Smith Pond. The approach channel bottom has large boulders and exposed bedrock; the banks are lined with trees.

(6) D/S Channel - Discharge over the dam and from the low-level outlet flows northerly for a distance of about 350 feet through a marshy area averaging 50 feet in width. The tributary then drops sharply into a narrow confined channel and flows for about 1.3 miles to its confluence with Mascoma Lake. The channel bottom consists of coarse gravel and boulders and is heavily obstructed with fallen trees and underbrush. State Route 4A crosses the tributary 0.1 mile upstream of the confluence with Mascoma Lake. Four inhabited structures are located near this crossing.

A diversion channel was constructed by the Shakers to provide water for their village. This diversion channel branches off from the main channel about 1 mile downstream of the dam and totals approximately 2 miles in length. The channel is six feet wide and its banks vary from three to eight feet high. This channel flows along the base of a mountain and crosses two other unnamed tributaries to Mascoma Lake. It also provides additional inflow into two small storage reservoirs.

j. <u>Regulating Outlets</u>. One inoperative low-level gate, of unknown size, passes discharge through a conduit under the dam into the downstream channel. The gate is presently partially open allowing flow; no operating mechanism exists.

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#### SECTION 2 ENGINEERING DATA

#### 2.1 Design

No original design data were obtained for Smith Pond Dam. However, in a letter sent to the New Hampshire Water Resources Board (NHWRB) from LaSalette Seminary, there is a sketch of the dam with approximate measurements and two photographs of the dam were obtained. (See sketch in Appendix B.)

#### 2.2 Construction

No construction data were disclosed for Smith Pond Dam.

#### 2.3 Operation

No engineering operational data were disclosed.

## 2.4 Evaluation

a. <u>Availability</u>. Little engineering data were found for Smith Pond Dam. A search of the files of the NHWRB and direct contact with the owner, revealed only a limited amount of recorded information.

b. Adequacy. The final assessments and recommendations of this investigation are based primarily on the visual inspection and the hydrologic and hydraulic calculations.

c. Validity. Visual inspection of the dam and spillway reflect that the sketched plan generally conforms to the existing structure.

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#### SECTION 3 VISUAL INSPECTION

#### 3.1 Findings

a. <u>General</u>. Smith Pond Dam is a low dam which impounds a reservoir of small size. The watershed above the reservoir is steep and heavily wooded. The downstream area is steep and heavily wooded.

Smith Pond Dam is an earthen embankment dam with Dam. b. a hydraulic height of 11 feet, 150 feet long, and averages 18 feet wide at the crest. The upstream face of the dam is a nearly vertical dry masonry wall which has a crudely constructed concrete facing on the upstream side. (See Appendix C - Figures 2 and 3.) The downstream face of the dam is a nearly vertical dry masonry wall. (See Appendix C - Figure 4.) Soil covers most of the crest of the dam except in one area about 15 feet long. Here a depression has developed about one foot deep in which a rubble-type of fill is exposed. The depression is next to the upstream edge of the crest and is located directly above the low-level outlet. (See Appendix C - Figure 5.) Brush, coarse weeds, and saplings are growing on the crest of the dam. (See Appendix C - Figure 6.) Several large trees and some brush are growing immediately downstream of the dam. No evidence of seepage was observed on the downstream face of the dam or from the natural ground immediately downstream of the dam.

Two low earth dikes east of the dam and two dikes west of the dam were built to contain the pond. Large trees are growing on the crest, upstream slope, and downstream slope of all four dikes. (See Appendix C - Figures 7 and 8.) A footpath traverses the crest of each of the four dikes. Minor seepage was occurring at the downstream toe of the far east dike. Major seepage, estimated to be 2-3 cfs, was occurring at the downstream toe of the near east dike. (See Appendix C - Figure 9.) No seepage was observed at the downstream toe of the west dikes.

c. Appurtenant Structures. The concrete wall on the upstream face of the dam is in fair condition. Numerous hairline cracks and small spalled areas were observed in the concrete wall. No indication of differential movement was observed. Near the eastern end of the main dam a 4.7-foot wide by 1.1-foot high stoplog facility and discharge channel has been constructed through the top of the dam to serve as the principal spillway. (See Appendix C - Figure 10.) No stoplogs were in place at the time of the inspection; one stoplog slot has been cemented in hindering future use. The concrete was observed to be in deteriorated condition with several cracks and spalled areas. (See Appendix C - Figure 10.) A considerable amount of debris has collected in the spillway. (See Appendix C - Figures 10 and 11.) The spillway discharge channel is in ledge. (See Appendix C - Figure 12.) Flow was discharging from a rectangular opening in the downstream face of the dam. (See Appendix C - Figure 13.) Available records indicate this acts as a low-level outlet. No evidence of a low-level outlet control mechanism or valve was observed during the visual inspection.

d. <u>Reservoir Area</u>. The watershed above the reservoir is rolling and heavily wooded. (See Appendix C - Figure 14.) No camps or other structures were observed on the shore of the reservoir. Sedimentation in the reservoir appears to be insignificant.

e. <u>Downstream Channel</u>. The bottom of the channel immediately downstream of the dam is in bedrock and is partially covered with boulders. Many trees overhang the channel. Two large logs lie across the main channel immediately downstream of the dam, and some debris was noted in the small channel that leads from the spillway to the main channel. (See Appendix C - Figure 15.) After discharging at the dam, the unnamed tributary flows 1.4 miles before emptying into Mascoma Lake. The State Route 4A crossing is located about 500 feet upstream of this confluence. Three inhabited structures are located in this reach, and one other is located just upstream of the crossing. (See Appendix C - Figure 16.)

#### 3.2 Evaluation

Based on the visual inspection, Smith Pond Dam is in poor condition. Brush is growing on the crest of the dam. If it is allowed to continue growing, the crest will become covered with trees. If a tree then blows over and its roots are pulled out, or if a tree dies or is cut and its roots rot, serious seepage and erosion problems may result.

The one-foot-deep depression on the crest of the dam above the low-level outlet pipe is evidence of some past problem, which may have been overtopping, piping, or collapse of or leakage and piping into the low-level outlet pipe. The same problem may develop again and could lead to failure of the dam if remedial action is not taken. The concrete facing on the upstream face is in poor condition (poorly constructed).

Trees overhanging the downstream channel and logs and debris lying in the downstream channel could result in temporary damming of the channel during periods of floodflow.

If any of the trees growing immediately downstream of the dam blow over and pull out their roots, or if a tree dies or is cut down and its roots rot, seepage and erosion problems could result.

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The footpath on the crest of all four dikes is devoid of vegetation and is consequently susceptible to erosion. Trees are growing on the crest, upstream face, and downstream face of all four dikes. If any of the trees blow over and pull out their roots, or if a tree dies or is cut down and its roots rot, seepage and erosion problems could result. Seepage noted at the downstream toe of two of the four dikes, if uncorrected, could lead to a stability problem in the future.

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#### SECTION 4 OPERATIONAL PROCEDURES

## 4.1 Procedures

No written operational procedures exist for Smith Pond Dam. The flow through the spillway is not regulated and therefore discharge is controlled by the hydrologic characteristics of the drainage basin and through the partially open inoperable low-level gate. During periods of little rainfall, flow in the main channel is obstructed forcing water into the diversion channel to provide a water supply for the LaSalette Seminary.

#### 4.2 Maintenance of Dam

LaSalette Seminary owns and is responsible for the maintenance of Smith Pond Dam.

#### 4.3 Maintenance of Operating Facilities

Operating facilities are maintained by LaSalette Seminary. The gate is not operable and has not been so for many years.

#### 4.4 Description of Any Warning System in Effect

No warning system or procedures were found for Smith Pond Dam.

#### 4.5 Evaluation

Such operational and maintenance procedures that exist would not ensure that all problems could be remedied within a reasonable amount of time.

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#### SECTION 5 HYDROLOGIC/HYDRAULIC

#### 5.1 Evaluation of Features

a. <u>General</u>. Smith Pond Dam is a earth embankment dam placed between dry masenry walls. The upstream face has a crudely constructed concrete facing. The low-level outlet is inoperable. Four dikes, two east of the dam and two west of the dam, are required to contain he pond.

b. Design Data. No hydrologic or hydraulic design data were oftained.

c. Experience Data. No hydrologic or hydraulic experience data were disclosed.

d. Visual inspection. At the time of inspection, no visual evidence was noted of damage to the damaged by excessive discharge. The low-level date, partially open, is inoperable.

e. Test Flood Analy so omith form has is classified as being small in size having thy fractic height of 11 feet and a maximum storage capacity of the treatest the dom was determined to have a Significant Hazard to gift ation. Using the Recommended Guidelines for Safety Inspection. Themas, the test flood was determined to be 5 the Probable Max mum Flood (PMF).

Using 5 the PMF, the test flood fillow or Smith Pond Dam having a drainage area of 0.9 square mile, was actermined to be 1150 cfs. The test flood discharge after routing was inculated to be 1080 cfs, reflecting negligible surcharge storage offects on reducing peak inflows. The overtopping analysis indicates that the dam would be overtopped by approximately 1.4 feet during test flood conditions. The water depth discharging through the spillway, over the main dam, near easterly dike, far easterly dike, westerly dike, and far westerly dike would be 2.7 feet, 1.4 feet, 1.4 feet, 0.8 feet, 1.4 feet and 0.3 feet respectively. The spillway will pass 40 cfs or 4 percent of the test flood discharge. Therefore, the spillway is considered inadequate.

f. Dam Failure Analysis. The impact of failure of the dam at top of dam was assessed using Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to Mascoma Lake, a distance of 1.4 miles. A major breach at top of dam would result in an increase in stage of 8.0 feet, above the antecedent stage of 3 feet, along the reach. A breach of the dam would increase the stage such that the depth of water flowing over State Route 4A would be about 3.2 feet. The total stage increase of 11 feet could cause appreciable property damage to State Route 4A and four inhabited structures resulting in the potential loss of 4-6 lives.

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Additional property damage could result if the diversion tunnel capacity were to be exceeded and out-of-channel flow occurred. As a result of the analysis described above, the Smith Pond Dam was classified as Significant Hazard.



#### SECTION 6 STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

a. <u>Visual Observations</u>. The visual examination indicates the following evidence of potential problems:

(1) Seepage at the downstream toe of the two dikes that are east of the dam.

(2) Depression on the crest of the dam above the lowlevel outlet pipe.

(3) Lack of an operable low-level gate for the low-level conduit.

(4) Brush growing on the crest of the dam.

(5) Trees growing immediately downstream of the dam.

(6) Trees growing on the crest, upstream face, and downstream face of all four dikes.

(7) Lack of vegetation in the footpath on the crests of the four dikes.

b. <u>Design and Construction Data</u>. No design or construction data are available.

c. Operating Records. No operating records pertinent to the structural stability of the dam are available.

d. Post-Construction Changes. A letter dated December 6, 1972 indicates that "the dam was reconstructed in 1947". The reconstruction may have included the construction of the concrete facing on the upstream side of the dam.

e. <u>Seismic Stability</u>. This dam is located in Seismic Zone 2 and in accordance with the Phase I guidelines does not warrant seismic analysis.

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SECTION 7 ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment

a. <u>Condition</u>. The visual examination indicates that Smith Pond Dam is in poor condition. The major concerns with respect to the integrity of the dam if left uncorrected are:

(1) The inadequately sized spillway.

(2) The lack of an operable low-level gate for the low-level conduit.

(3) Depression on the crest of the dam above the lowlevel outlet pipe.

(4) Seepage at the downstream toe of the two dikes that are east of the dam.

(5) Brush growing on the crest of the dam.

(6) Trees growing immediately downstream of the dam.

(7) Trees growing on the crest, upstream face, and downstream face of all four dikes.

(8) Lack of vegetation in the footpath on the crests of the four dikes.

b. Adequacy of Information. The information available is such that the assessment of this dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2 and 7.3 should be implemented by the owner within one year after receipt of this Phase I report.

d. <u>Need for Additional Information</u>. There is no need for additional information to complete this Phase I investigation.

7.2 Recommendations

The owner should engage a Registered Professional Engineer to:

a. Design and construct additional spillway capacity.

b. Investigate the depression on the crest of the dam above the low-level outlet pipe, and design and implement necessary remedial repairs.

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c. Design and supervise procedures for clearing trees and brush and root systems from the crest of the dam, and from the crest, upstream and downstream slope of the four dikes.

d. Investigate the seepage which is occurring at the downstream toe of the two dikes east of the dam, and design and implement necessary remedial measures.

e. Design and supervise procedures for restoring control of the low-level outlet.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Maintain clearance of all trees and brush from the area within 25 feet downstream from the toes of the dam and dikes.

(2) Remove the debris from the overflow spillway channel.

(3) Remove trees and brush from the channel downstream of the dam for a distance of 25 feet on either side of the channel within 100 feet of the toe of the dam.

(4) Prevent trespassing on the crest of the four dikes and reestablish grassy vegetation in the existing footpath on the dikes.

(5) Monitor the seepage regularly each month and continue to watch for new seepages that may occur.

(6) Visually inspect the dam and appurtenant structures once each month.

(7) Engage a Registered Professional Engineer to make a comprehensive technical inspection of the dam once each year.

(8) Establish a surveillance program for use during and immediately after heavy rainfall and also a warning program to follow in case of emergency conditions.

7.4 Alternatives

None recommended.

7-2

APPENDIX A

VISUAL INSPECTION CHECKLIST

PROJECT Smith Pond Dam, N. H.	DATE <u>May 9, 1</u> 979
	TIME 0930
	WEATHER Sunny, warm
	W.S. ELEV. U.S. DN.S. <u>1650</u> 1640.
PARTY:	
1. Warren Gurhan	6. Rohald Hirschreid
2. Stephen Gilman	7. Pattu Kesavan
3. Gerry Blanchette	8. Brother Claude Rheaume
4. Robert Ojendyk	9
5. Leslie Williams 10	0
PROJECT FEATURE	INSPECTED BY REMARKS
1. Hydrology/Hydraulics	W. Guinan/L. Williams
2. Structural Stability	S. Gilman/G. Blanchette
3. Soils and Geology	R. Hirschfeld
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PERIODIC INSPECTION CHECKLI	ST
PROJECT Smith Pond Dam, N. H.	DATE <u>May 9, 1979</u>
PROJECT FEATURE <u>Dam Embankment</u>	NAME
DISCIPLINE	NAME

Т

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1651.3' MSL (low point)
Current Pool Elevation	1650' MSL
Maximum Impoundment to Date	
Surface Cracks	Sinkhole in crest immediately downstream of masonry upstream
Pavement Condition	face and above low-level outlet.
Movement or Settlement of Crest	See "Surface Cracks" above.
Lateral Movement	None apparent
Vertical Alignment	See "Surface Cracks" above.
Horizontal Alignment	Fair
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None apparent
Trespassing on Slopes	None apparent
Sloughing or Erosion of Slopes or Abutments	None apparent
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or Near Toe	None apparent
Unusual Embankment or Down- stream Seepage	None apparent
Piping or Boils	None apparent
Foundation Drainage Features	None apparent
Toe Drains	None apparent
Instrumentation System	None apparent
Vegetation	Trees and brush on crest

PROJECT Smith Pond Dam. N H		DATE Ma	<b>v 9.</b> 1	979
NOUBCI Pitter Fyild Delle It			<u></u>	<u> </u>
PROJECT FEATURE <u>East Dikes</u>		NAME		
DISCIPLINE		NAME	<u> </u>	
	Nach			
AREA EVALUATED	East Dike	CONDITION	I Eas	rar t Dike
DIKE EMBANKMENT				
Crest Elevation	1651.3		1651.9	
Current Pool Elevation	1650		1650	
Maximum Impoundment to Date	Unknown	Į	Unknow	n
Surface Cracks	None appare	ent 1	None a	pparent
Pavement Condition	Not paved	1	Not par	ved
Movement or Settlement of Crest	None appare	ent 1	None aj	pparent
Lateral Movement	None appare	ent 1	None ap	pparent
Vertical Alignment	Good	(	Good	
Horizontal Alignment	Good	C	Good	
Condition at Abutment and at Concrete Structures	Good	C	Good	
Indications of Movement of Structural Items on Slopes	None appare	nt N	lone ap	oparent
Trespassing on Slopes	Footpath on	crest I	Pootpat	h on
Sloughing or Erosion of Slopes or Abutments	None appare	nt N	crest None ap	: pparent
Rock Slope Protection - Riprap Failures	None appare	nt N	lone ap	parent
Unusual Movement or Cracking at or Near Toes	None appare	nt N	ione ap	parent
Unusual Embankment or Down- stream Seepage	Major seepa downstream	ge at N toe - d	linor s lownstr	eepage eam of
Piping or Boils	estimated 2 None appare	-3 cfs t nt N	oe Ione ar	parent
Foundation Drainage Features	None appare	nt N	lone ap	parent
Toe Drains	None appare	nt N	ione ap	parent
Instrumentation System	None appare	nt N	ione ap	parent
Vegetation	Large tr <b>ees</b>	M	lany tr	ees

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PERIODIC INSPE	CTION CHECKLIST	
PROJECT Smith Pond Dam, N. H.	DATE	ay 9, 1979
PROJECT FEATURE West Dikes	NAME	
DISCIPLINE NAME		
AREA EVALUATED	Near West Dike CONDITI	ON West Dike
DIKE EMBANKMENT		
Crest Elevation	1651.3	1652.4
Current Pool Elevation	1650	1650
Maximum Impoundment to Date	Unknown	Unknown
Surface Cracks	None apparent	None apparent
Pavement Condition	Not paved	Not paved
Movement or Settlement of Crest	None apparent	None apparent
Lateral Movement	None apparent	None apparent
Vertical Alignment	Good	Good
Horizontal Alignment	Good	Good
Condition at Abutment and at Concrete Structures	Good	Good
Indications of Movement of Structural Items on Slopes	None apparent	None apparent
Trespassing on Slopes	Footpath on crest	Footpath on
Sloughing or Erosion of Slopes or Abutments	None apparent	crest None apparent
Rock Slope Protection - Riprap Failures	None apparent	None apparent
Unusual Movement or Cracking at or Near Toes	None apparent	None apparent
Unusual Embankment or Down- stream Seepage	None apparent	None apparent
Piping or Boils	None apparent	None apparent
Foundation Drainage Features	None apparent	None apparent
Toe Drains	None apparent	None apparent
Instrumentation System	None apparent	None apparent
Vegetation	Trees & brush	Trees & brush

PERIODIC INSPECTION CHECKLIST		
PROJECT Smith Pond Dam, N. H.	DATE <u>May 9, 1979</u>	
PROJECT FEATURE Spillway	NAME	
DISCIPLINE	NAME	
AREA EVALUATED	CONDITION	
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS		
a. Approach Channel		
General Condition	Good	
Loose Rock Overhanging Channel	None	
Trees Overhanging Channel	None	
Floor of Approach Channel	Bedrock and boulders	
b. Weir and Training Walls		
General Condition of Concrete		
Rust or Staining		
Spalling		
Any Visible Reinforcing		
Any Seepage or Effloresœnœ		
Drain Holes	None	
c. Discharge Channel		
General Condition	Poor	
Loose Rock Overhanging Channel	None	
Trees Overhanging Channel	Many overhanging	
Floor of Channel	Bedrock	
Other Obstructions	Logs across channel	

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PROJECT Smith Pond Dam, N. PROJECT FEATURE Reservoir	H. <u>DATE May 9, 1979</u> NAME L. Williams
AREA EVALUATED	REMARKS
Stability of Shoreline Sedimentation Changes in Watershed Runoff Potential Upstream Hazards	Good None observed None
Downstream Hazards	State Route 4A and 4 houses 1.4 miles downstream.
Alert Facilities	None observed
Hydrometeorological Gages	None
Operational & Maintenance Regulations	None posted

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## APPENDIX B

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ENGINEERING DATA



## State of New Hampshire

WATER RESOURCES BOARD 37 Pleasant Street Concord, N.H. 03301

TELEPHONE 271-3406

June 27, 1978

Lasallette Seminary Route 4A Enfield, New Hampshire 03748

Re: Smith Pond Channel, Enfield, No. 77.12

Gentlemen:

At the request of the New Hampshire Public Works and Highway Department and property owners to investigate and suggest a solution to the problem which occurs during high water every year along the Channel flowing from the Smith Pond, an engineer made an inspection of the area on June 14, 1978.

Brother Claude Rheaume of the Seminary, Dick Heath, Wilmot Estey of the Highway Department and Allen Nickerson (property owner) were present during the inspection.

Walking along the Channel the engineer found that the Channel flowing from the Smith Pond was very shallow due to the sand, gravel and silt rolling in and filling it. Also, at every ten or fifteen feet intervals, the trees' trunks have narrowed the channels to such a degree that every fall and winter the leaves and snow blocked these bottlenecks and caused the water to flow over the banks, run along the field and occasionally flooded the highway (Route 4A).

The culverts under Route 4A in this area are not designed to take this discharge and hence the water has flowed over the roads causing a menace situation to the motorists. The same situation upstream has caused problems at the trailor park and Mr. Bassey who lives in this area has complained to us in the past.

The engineer suggests the following:

- 1- The Highway Department could increase the culvert sizes to flow the occasional discharges from the Channel. This still would not solve the problem at the trailor park. Moreover, the Highway Department is not obligated to increase the sizes of the culvert more than the design required. Cost of the replacement will also be high. Therefore, this suggestion should be taken into account only as a last solution.
- 2- It is recommended that the Seminary should excavate the Channel about two niles where it brauches off from the main Channel and cut all the trees which are obstructing the flow. This would definitely solve the problem and if the Channel is properly maintained there should not be any flooding occurring in the future also.

NEW HAMPSHIRE WATER RESOURCES BOARD

Page two

June 27, 1978

Lasallette Seminary

As a conclusion we suggest that the second solution should be carried out by the Seminary who is the responsible owner of the Smith Pond and the Channel.

If you have any questions please write or call us.

Sincerely,

George McGee, Sr., Chairma

GMM:PK:paf cc: Dick Heath Harvey Bassey Allen Nickerson

#### NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

TOWN: End Field Dam Number: 77.12 Name of Dam, Stream and/or Water Body: Smith Pond Owner: La Salette Seminary Telephone Number: Mailing Address: Max. Height of Dam: 8 Pond Area: 96 A Length of Dam: 100' FOUNDATION: ladge OUTLET WORKS: Gate inoperative 5120 unknown Cononate overflow 28" mide 1' deep ABUTMENTS: EMBANKOVENT: Concrete upstream Free Dry Stone downstream Note: Give Sizing, Condition and detailed description for each item, if applicable. B-3
-3-Dam No. - There should cut Trash should be remarked COMMENTS: berre march from spilling . **#**} · • B-4

SPILLWAY:	Length: 23	Freeboard:
SEEPAGE: L	ocation, estimated quantity, etc	<b>c.</b>
		· · · · · · · · · · · · · · · · · · ·
•		
Changes Sinc	e Construction or Last Inspection	on:
Tail Water C	onditions:	
		······································
Overall Cond	ition of Dam: Fair	
Contact With	Owner: No	
Date of Insp	ection: 1 June 77	Suggested Reinspection Date
Class of Dam	: <u>menace</u>	
	•	Signature Steph Burnt
		Date

Note: Give Sizing, Condition and detailed description for each item, if applicable.

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Dam No.\_\_\_\_

SKETCH OF DAM

(Show Plan, Elevation & Cross Sections)

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### NEW HAMPSHIRE WATER RESOURCES BOARD

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SITE EVALUATION DATA
OWNER: La Salette Semmary TELEPHONE NO.
ELEMAND ADDRESS: EndField NH
SITE LOCATION (TOWN OR CITY) Endfield
NAME OF STREAM OR WATERBODY: Smith Pond
QUADRANGLE:LOCATION
HEIGHT OF (PROPOSED, EXISTING) DAM 8 LENGTH 105'
TYPE OF (PROPOSED, EXISTING) STRUCTURE <u>Concrete</u> or stone clubble stone well
DRAINAGE AREA 1.05 SM POND AREA 90
AVAILABLE ARTIFICIAL STORAGE: PERMANENT:TEMPORARY:TOTAL 100 AF
EXISTING DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE
POTENTIAL DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE
POTENTIAL DAMAGE HOWNSTREAM OF STRUCTURE (EXPLAIN IN DETAIL AND INCLUDE ANY POTEN- TLAL LOSS OF LIFE ESTIMATE) Wash cut of Rte 44 possable damage to Blds
OTHER COMMENTS:
CLASS OF STRUCTURE Non and MENACE N B D DAM # 17, 12 DATE OF INSPECTION: 1 J CODE 2]
B-7 SIGNED DB WWW
SIGNATURE
DATE :

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#### MEMORANDUM

DATE: May 25, 1973

FROM: Pattu D. Kesavan, Water Resources Engineer

SUBJECT: Smith Pond, Enfield - #77.12

TO: Vernon A. Knowlton, Chief Engineer, Water Resources Board

On May 2, 1973, I inspected the Smith Pond dam in Enfield. Brother Richard Dionue of LaSalette Seminary accompanied we during my inspection.

This 96-acre Smith Pour has 5 55-ft. long, 8-ft. deep, 15 1/2 ft. wide dam at us outlet. The Seminary uses this water for Frinking purposes. About 1 1/4 mile downstream of this dam is Rte. 4-A, and the drop in elevation between these two points is about 650 feet.

This will be classified as a menace dam. Plans and completed "Statement of Intent" forms are filed in Enfield dam file #77.12.

PDK: js

THE STATE OF NEW HAMPSHIRE <u>May 7</u> 1973 County of <u>Araftern</u> ss. STATEMENT OF INTENT TO CONSTRUCT OR RECONSTRUCT A DAM AT Smith's Cond RECEIVED TO THE WATER RESOURCES BOARD: In compliance with the provisions of RSA 482:3. 127 5 1415 We, La Salette Seminary Concontion, Willen Correction ECART I, La Salette Seminary Concontion (Here state name of person or persons, partnership, association, corporation, etc.) hereby state our intent to the Water Resources Board to construct, to reconstruct, to make repairs to, a dam along, or (cross out portion not applicable) across: To continue using (Here state name of stream or body of water) At a point <u>Cast end if Smith's Cond</u> april. (Here give location, by distance from mouth of stream, sounty or <u>nunicipal boundary</u> in the town (s) of Empield in accordance with PRELIMINARY PLANS, and SPECIFICATIONS FILED WITH THIS STATEMENT AND MADE A PART HEREOF. We, understand that more detailed plan and specifications may be requested Ι, by the Board in conformance with RSA 482:4 and that, if such plans are requested. construction will not commence until such plans have been filed with and approved by the Board.

B-9

The purpose of the proposed construction is for channel which Ritchen, toilets, fine hydrants, irrigation for gardens The construction will consist of <u>65 feet long</u> (Here give brief description of work Spiet deep IZ 15/2 fret wide is not owned by applicant. All land to be flowed 😕

Brother Richard Dionne La Salette Seminary Address Rta 4A Crifield, n. H. 03748

Note: This statement together with plans, specifications and information and data filed in connection herewith will remain on file in the office of the Water Resources Board. This statement is to be filed in duplicate.

All other information is already in your file. B-10

. . . . .

DATE:	December 11, 1972
FROM:	Pattu D. Kesavan, Water Resources Engineer
SUBJECT:	Smith Pond, Enfield, N.H.
то:	Vernon A. Knowlton, Chief Water Resources Engineer

Based on the Special Forestry Program's letter of February 29, 1972, I went to Enfield on November 27, 1972, to inspect the illegal dam at the outlet of Smith Pond.

Due to the weather conditions, I was unable to get to the site, but I gathered some information from the Town Clerk. LaSalette Seminary, Enfield, bought this dam from Shakers who might have built the dam in the late 1800's. Referring to our old town blueprints, this present Smith Pond is shown as three small ponds called lily ponds, and are approximately six to seven acres each in area.

In my opinion, these three ponds were impounded together when the dam was built in the late 1800's and became one large pond, known as Smith Pond. The latest data available on the Smith Pond indicates that this is a natural pond raised by damming with an area of 96 acres. Maximum depth sounded 36 feet and average depth 11 feet.

PDK/js

B-11

La Salette Seminary Enfield, N. H. .03748 December 6, 1972

RECEIVED

DEC 8 1972 NEW BAMPSHILLE WATER RECOURCES EDADA

Dear Sir,

Here are a few photoes and a basic diagram of the dam we have on Smith's Pond. The winter conditions being what they are, we could not get very accurate measurements of the dam. When the dam was reconstructed in 1947 there were no plans made so we cannot tell you the exact measurements now. We do have written information concerning the history of the pond since 1835, but at no time have the original owners, or the Shakers, or ourselves taken the pains of assuring ourselves that the dam is architecturally safe. Your concern is appreciated and we hope that you let us know if we can be of more assistance. Thank you.

Sincerely yours,

Brother Richard Rionne



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NATIONAL	PROGR	AM OF INS	SPECTIC	ON OF NO	N-FED. DAMS
	SM	ITH P	OND	DAM	
SMITH	POND			NEW	AMPSHIRE
I			SCALE NO	TO SCALE	
Ī			DATE JUL	Y, 1979	

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APPENDIX C

PHOTOGRAPHS





# IN PROPERTY AT GOVERNMENT EXPENSE



Figure 2 - Looking at upstream face of the dam from the west bank of the pond.



May 9, 1979

Figure 3 - Looking eastward along crest of main dam from the west abutment. Note irregularity of concrete facing.

#### ARE CONCEPTATION FROM INTEMPENSE



May 9, 1979 Figure 4 - Looking westward along the downstream face of the dam.



May 9, 1979

Figure 5 - Looking at the depression in which a rubble-type of fill is exposed. This depression is located directly above the low-level outlet.

#### CHARGE HERD AT GOVERNMENT EXPENSE



May 9, 1979

Figure 6 - Looking west along crest of main dam. Note the brush and saplings growing on the crest of the dam.



Figure 7 - Looking at downstream face of the farther westerly dike.



Figure 8 - Looking eastward along crest of the first easterly dike.



Figure 9 - Seepage downstream from the dike shown in Figure 8.

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# REPRODUCED AT GOVERNMENT EXPENSE



Figure 10 - View of entrance to spillway channel. Note debris.



May 9, 1979

Figure 11 - Looking downstream along spillway channel across crest.

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May 9, 1979

Figure 12 - Looking at spillway discharge channel. Note the exposed bedrock.



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Figure 13 - View of the low-level outlet.

#### HE PRODUCED AT GOVERNMENT EXPENSE



May 9, 1979

Figure 14 - Looking upstream into the reservoir from the main dam.



May 9, 1979

Figure 15 - Looking at downstream channel of spillway and low-level outlet.

# REPRODUCED AT GOVERNMENT EXPENSE



Figure 16 - Overview of downstream hazard area. Structure upstream of road crossing is located just off photo at right side.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

- 300



D-1

# HYUKOLOSY / + TURADLICS

Una name Area = 0.9 mil Size Classification = Small Harard Clarritication = Significant Test Flood = 1/2 PMF

Step#1 Calculate MMF using Preliminary avidance tor Estamating Maximum Fictuable Discharge in Phase I Dam Satety Investigations, March 1978."

Slope of waterchied is about 290 ft/mi. Therefore the mountainable curve will be used. Using Recommended Guidelines for UA's less than 2 mi2, a can value of 2550 will be applied to smith fond Dam: 2550 can x 0.9 m.2 - 2300 cts ( 9p.) 2550 can x 0.9 m.2 - 2300 cts ( 9p.)

Step " : a. between working Heyn to are Do of 2300 cts. To do the interview of the over work to whether for Emith the bar. Duttlow would be our at five sporeate areas: (1) the procept shillowy, (2) the main dams embandment, including the working like; (3) the easterly dike; (1) the faither easterly dike; ( (and (5) the faither westerly dike. The following is an analysis of the above.

Since the house theory channel is steep - 1650-200 - 214 fflit is 1990 - How investrean will probably -665-824 be separatively. Since flow in Smith road a list clake (sub-critical, the hydraulic control over the critical lists for low dricharges, occuring at the spillway. It is the maryes even the investigation are best computed prime the open for low General are best computed prime the open

D-2

(1) for application on section across this outlet is theme on says 4. Determine a discharge curve to find

Irid No.	(H.)	Elevation	<u>a.</u> (cfs)
l	0	1650.0	0
2	<i>ن</i> . ک	1650.3	5
a. V	0.1	1. 50.4	٦
4	0.5	1650.5	9
5	0 <b>(</b>	1650.6	12
ما	0.7	1650.7	٤ ۲
7	J . 8	1650.8	ιŶ
8	0.9	16509	23
٩	10	1651.0	27
(0)	(.(	1651.1	اد
ιl	1.3	1651.3	40
12	1.9	1651.4	70
13	2.4	1652.4	୧୧
14	<b>~</b> 5. <b>0</b>	1653.0	139
15	4.0 D-3	1654.0	215

Ref. : See Engineering Handbock for Hydraulics; Sol Conservation Savice, 0.5. Dept. of Agriculture; STU. DWG. ES-24.

There illows will be combined and we'r section flows to determine the total discharge from Smith Pond.

Trial #1 2, =0	<u>Ge</u> = 0 Ge = 0 b
Trial #2 d. =.3	$G_{L} = .95$ $G_{L} = .95$ $G_{L} = -7.5$ b $-7.7$
Trid # 3 dc=1	$\frac{Q_{L}}{6} = 1.45$ $\frac{Q_{L}}{4.7} = 1.45$ $Q_{L} = 6.815$
Trial $# 4$ $d_{c}=.5$	$\frac{Q_{L}}{D} = 2$ $\frac{Q_{L}}{Q_{L}} = 2$ $Q_{L} = q_{L} - q_{L}$
Trid # 5 016	$\frac{a_c}{b} = 2.65$ $\frac{a_c}{4.7} = 2.65$ $a_c = 12.75$
Trial $\#6$ $a_{1} = .7$	$\frac{G_{L}}{6} = 3.35$ $\frac{G_{L}}{7.7} = 3.35$ $G_{L} = 15.745$
Trial # 7 de = 18	$\frac{G_{c}}{b} = -1.08$ $\frac{G_{c}}{7.7} = -1.08$ $G_{c} = -1.09,176$
Trick # 8 dr = . 9	$\frac{Q_{1}}{10} = 4.85$ $\frac{Q_{1}}{1.7} = 4.85$ $Q_{1} = 22.8$
Trick #9 de ~ 1.0	$\frac{Q_{1}}{6} = -1.85$ $\frac{Q_{1}}{4.7} = 5.68$ $Q_{1} = 26.7$

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$$\frac{Trial + 10}{d_{c} = 11} \qquad \frac{\omega_{c}}{b} \qquad 6.55 \qquad \frac{\omega_{c}}{1/7} = 6.55 \qquad q_{c} = 30.785$$

$$\frac{Trial + 11}{d_{c} = 13} \qquad \frac{\omega_{c}}{b} = 8.472 \qquad \frac{G_{c}}{1/7} = 8.472 \qquad q_{c} = 39.574$$

$$\frac{Trial + 12}{d_{c} = 1.9} \qquad \frac{Q_{c}}{b} = 14.89 \qquad \frac{Q_{c}}{1/7} = 14.89 \qquad Q_{c} = 67.983$$

$$\frac{Trial + 12}{d_{c} = 2.47} \qquad \frac{Q_{c}}{b} = 21.1 \qquad \frac{Q_{c}}{4.7} = 24.1 \qquad Q_{c} = 99.17$$

$$\frac{Trial + 14}{d_{c} = 3.0} \qquad \frac{Q_{c}}{b} = 29.5 \qquad \frac{Q_{c}}{4.7} = 29.5 \qquad Q_{c} = 138.65$$

$$\frac{Tricl + 15}{d_{c} = 4.0} \qquad \frac{Q_{c}}{b} = -45.25 \qquad Q_{c} = 45.25 \qquad Q_{c} = 212.675$$

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D-5

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action only the man date which and ment  
and the minimum tike. A which section  
action the other is shown on page 8. Determine a  
discharge - isting curve using the were equation  
$$G = CLH^{22}$$
, where  $C' = 2.6$ .

Arral #1 Assume derotion & 16500 (spillway elevation) u = Octs

Trid #1 Argune elevation & 1651.3 (crest elevation) Q=0

Trial #4 Assume elevation @ 1651.9 (crost elevation  
(a faither earterly dike) 
$$\dot{a} = [2.6(\pm)(12)(.6)^{3k}] + [2.6(\pm)(12)(.6$$

Truch #5 Assume -levation & 1652.4 ( crest elevation & for the wester, dike)  $G = [2.6(15)(2)^{3/2}] + [2.6(2)(2)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] + [2.6(2)(2)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] + [2.6(2)(15)(2)^{3/2}] = 4 + 0.2 + 20 + 27 + 15 + 82 + 9 + 20 + 35 + 5 + 4 = 2.51 cfs$ 

$$\begin{aligned} & \left[ \frac{1}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{3}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{3}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{3}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (5) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] + \left[ \frac{2}{2} \cdot \left( \frac{1}{2} \right) (1) \cdot \left( \frac{1}{2} \right)^{3/2} \right] = 5 + 28 + 42 + 96 + 9 + 3 + 115 + 177 + 28 \\ + \frac{12}{2} + 16 + 89 + 10 = 6711 \quad (1) \quad ($$

Tricl # 1/ Accure elevation & 16540  

$$0 = \left[ 2.6(\frac{1}{2})(12)(1.8)^{3/2}\right] + \left[ 2.6(15)(1.8)^{3/2}\right] + \left[ 2.6(15)(2.55)^{3/2}\right] + \left[ 2.6(30)(2)^{3/2}\right] + \left[ 2.6(15)(1.5)^{3/2}\right] + \left[ 2.6(13)(10)(1.8)^{3/2}\right] + \left[ 2.6(21)(2)^{3/2}\right] + \left[ 2.6(37)(2.5)^{3/2}\right] + \left[ 2.6(13)(17)^{3/2}\right] + \left[ 2.6(21)(2)^{3/2}\right] + \left[ 2.6(7)(19)^{3/2}\right] + \left[ 2.6(23)(2.3)^{3/2}\right] + \left[ 2.6(5)(19)^{3/2}\right] = 32 + 944 + 114 + 221 + 52 + 31 + 277 + 380 + 75 + 154 + 48 + 209 + 30 = 1715 \cdot cfs$$

D-8

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Thick #1 Assume Elevation @ 1651.3  
Q = 0 cfs  
11.1 + 2 Acture Elevation & 1651.9 (100 point & farther  
Easterly dike)  
C = 
$$[2.6(\frac{1}{2})(50(.4))^{\frac{3}{2}}] + [2.6(\frac{1}{2})(25(.4))^{\frac{3}{2}}] + [2.6(\frac{1}{2})(25)^{\frac{3}{2}}]$$
  
 $f = 6 + 5 + 12 + 18 = 84$  cfs  
Thick #3 Acture Elevation @ 1652.7 (100 point & former  
workerly dike)  
Q =  $[2.6(50)(.7)^{\frac{3}{2}}] + [2.6(\frac{1}{2})(90)(9)^{\frac{3}{2}}] + [2.6(\frac{1}{2})(20)(1.3)^{\frac{3}{2}}]$   
 $+ [2.6((40)(1.1)^{\frac{3}{2}}]$   
Q =  $76 + 55 + 39 + 120 = 290$  cfs  
Thick = 4 Acture Elevation & 1653.0  
Q =  $[2.6(50)(1.3)^{\frac{3}{2}}] + [2.6(50)(1.5)^{\frac{3}{2}}] + [2.6(20)(1.35)^{\frac{3}{2}}] + [2.6(70)(1.7)^{\frac{3}{2}}]$   
 $A = 143 + 160 + 82 + 231 = 666$  cfs

$$Trial #5 Assume Elevation @ 1654.0
G = [2.6 (50)(2.3)32] + [2.6(50) 2.15)32] + [2.6(20)(2.35)32] +
[2.6(40)(2.7)32]
G = 153, + 110 + 187 + 161 = 1511.$$

- (1) matrix is the like . A weir section errors the collectic resource on page II. Determine a discovery eictic coire complete weir equation  $G = CLH^{2n}$ , where C = 2.6. Lead #1 A we clurch E = 16514 (vect elerchoir) G = 1Lind H = A showe elevation E = 1652.4 (low point Efor there we try tike)  $G = [2.6(25)(5)^{2n}] = 23$  cfs Tricl #2 Arguine elevation E = 1652.0  $G = [2.6(25)(1)^{3n}] = 275$  cfs Tricl #4 Arguine elevation E = 1654.0 $G = [2.6(25)(1)^{3n}] = 198$  cfs
- (5) certher westerly dike . . Aweir section across this outlet is chown on juge 15. Determine a discharge rating curve using the mair equation &= CLH 32 where is is 2.6.

Trial HI Arrene elevation 6 1652.4 (low your 6 dike) Q=0

Trid = 2 Accounce elevation @ 16530  $G = [2.6(\frac{1}{2})(50)(\frac{1}{2}) + [2.(\frac{1}{2})(\frac{1}{2})^{\frac{3}{2}}]$  G = 20 + 9 = 39cts G = 20 + 9 = 39cts  $G = [2.6(-1)(\frac{1}{2})^{\frac{3}{2}}] + [2.6(30)(\frac{1}{2})^{\frac{3}{2}}]$   $G = [2.6(-1)(\frac{1}{2})^{\frac{3}{2}}] + [2.6(30)(\frac{1}{2})^{\frac{3}{2}}]$   $G = [2.6(-1)(\frac{1}{2})^{\frac{3}{2}}] + [2.6(30)(\frac{1}{2})^{\frac{3}{2}}]$ G = 237 cts



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Make a composite die beige - when a rectuding the discharges through the spillway for Smith Pond

Elevation	and:	Griefs)	Q3612	Q. ( (4)	Qa (cfs)	Qtotal
1650.0 1650.7 1650.4 1650.6 1650.6 1650.7 1650.7 1650.7 1650.7 1650.7 1651.7 1651.7 1651.7 1651.7 1651.7 1651.7 1651.7 1651.7	0571269377100993213	0 50 255 681 1743	0 87 290 666 15/1	0 23 75 198	C 29 33.7	057926927107100716005745

D-13



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Step# 2a. Test Flood Inflow = 1150 cts Elevation @ 1150 cts = 1652.7' msc Step #26. Determine volume of Sur charge in Inchas of Runoff. From past reteriore (see page 15) average depth was found to be "Infect of collections" the surface area of the pond i: 62 sites This fore the storage of 200 Ac-Ft, which yeilds an overage depth of Steet, i unreasonable, and there fore was not used. Normal Storage (spillway crest - 1650.0) = 680 Ac-Ft Surtage Area = 62 Acres Using Frustium of Piramid Equation' and planimetered surface areas, revelop points for a storage - elevation corre.  $v = 1/3h (b_1 + b_2 + 1/b_1 + b_2)$ - enlarged surface area (Ac) Bibso Storage & spillway art. 630 Ac-Fr Surface Area = 115 Acres 6 1660 4. 310[(62+115)+~62×115] = 871 AL-Ft Total Storage @ 1660 = 1550 Ac-Ft @ 1680 Suitare Area = 140 Acies Y= + 20 [[115+140] + 115+140] = 2546 AL-Ft Tital Storage @ 1680 = 4097 AC-Ft

DATE: December 11, 1972

FROM: Pattu D. Kesavan, Water Resources Engineer

SUBJECT: Smith Pond, Enfield, N.H.

TO:

Vernon A. Knowlton, Chief Water Resources Engineer

Based on the Special Forestry Program's letter of February 29, 1972, I went to Enfield on November 27, 1972, to inspect the illegal dam at the outlet of Smith Pond.

Due to the weather conditions, I was unable to get to the site, but I gathered some information from the Town Clerk. LaSalette Seminary, Enfield, bought this dam from Shakers who might have built the dam in the late 1800's. Referring to our old town blueprints, this present Smith Pond is shown as three small ponds called lily ponds, and are approximately six to seven acres each in area.

In my opinion, these three ponds were impounded together when the dam was built in the late 1800's and became one large pond, known as Smith Pond. The latest data available on the Smith Pond indicates that this is a natural pond raised by damming with an area of 96 acres. Maximum depth sounded 36 feet and average depth / 11 feet.

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$$\begin{aligned} & (1 - \frac{1}{19}) \\ & (1 - \frac{$$

Step #1d Determine surcharge height to provide  

$$cf 904 cfs.$$
  
 $G_{V_1} = 904 cfs = 7.1652.6 \implies 5tor 860 AC-FT$   
180 Ac-At × doiline × Gridae × 12.7/4 = 3.75 run off  
(Dick 2)

c .

Test Flood = "ZPMF Test Flood Inthons = 1150 cts Test Flood Discharge (atter rations) = 1080 cfs, reflecting nound ble sucharge storage effects Test Flood Elevation = 1652.7

Depth of Overtexpine over structures: Spilling elev. 1650 - depth \$ 2.7' Main daw combank. 1651.3 - depth = 1.41 Easterly dike 1651.3 - depth \$1.41 For costory alke 1651.9 \$ 0.8' Near westerly dike 1651.3 \$ 1.4' For westerly dike 1652.7 = 0.3'

Top of dam -1651.3 - dam would be overtopped by 1.4 during test flood.

Storage @ top dom = 775 ACFT

Spillword copacity @ 1651.3 = 40 cfs which is 4 percent of test flood discharge.

D-19

Breach Analysis

Vetermine effects of kiesde at top of dam to raisity downstream hazard condition

$$W_{b} = 149 \times 0.4 = 60'$$
  
 $\gamma = 1651.3 - 1640.7 = 11$   
From above equation  $Q_{p} = \frac{8}{27} 60 \sqrt{32.2} 11'' = 3680 cfs$   
Greach  $Q = 3680.4s$ 

Reach #1

Use a typical closs section along the downstream reach which extends from down 350 feet downstream. This area would provide some storage effects. Develop a rating curve for this section by use of Monnings Equation: Q = 142 · A · A<sup>23</sup>. 5<sup>12</sup> n= composite - n' value A = area of section (H<sup>2</sup>) R = Bp(wetted perimeter) S = slope of reach

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Anna - 200 4th x 200 + x 13500 = 2.8 Ac Ft

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April (1) (1) (1) 3080 (1-28) 3010 (x = 3670 - to Stage = 55' Antecedent discharge = 40 cfs = 0.4' Lines in Feach 1 by breach would be 4.1 ft.

D-22

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Trial 12 Assume tage (a 10' http:/// 2 (c) (10 + 20) - 2 (f) (b) L(0) + 20 - 2 (f) (b) L(0) + 20 - 2 (f) (b)  $L = \frac{100}{122} - 1.87$   $Q = \frac{100}{29} + 20 + 1.87$  Z = 2099 ctsTrial #4 Assume tage (a 15' Area = 2(10)(10 + 100) + 2(40)(10)L(0) + 20 = 680 fit

$$R = \frac{1.47}{.09} - 680 \cdot 3.06^{33} \cdot 0.13^{1/2}$$
  
= 8555 cfs

This reach would provide no storage Q= 3670 cfs Stage - 11.5'

Anteredent discharge = 40 cfs Stage = 3'

Total Thoreace in stage \$ 8.5 dang the said





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STATE ROUTE WA READ  
L = 48 feet  
SV" 
$$\pounds$$
 colvert  
HW Available = 4'  
Area = 16 ft<sup>2</sup>  
Q = CAUZGIN (ORIFICE & QUATION)  
Kt =  $\frac{29.1 \text{ (n)}^2 \text{ L}}{R^{4/3}}$   
R = Area/weited reconctor = 1.13  
N = 0.024  
L = 46'  
Kt = 0.68  
Assume entrance and exit losses = 1.1  
. Total = 1.1 + 0.68 = 1.78

Assume WSEL @ top of road G = 0.75 (16) ~2 (32.2 × 6.25 Oculvert = 240.75 cts

Lively a structure for the the the link with a dge  
attend to the sector is a page 1, to letermine  
here is the contraction is an page 1, to letermine  
here is the contraction is a page 1, to letermine  
the link with the contraction is to 1.15  

$$f = \zeta_{1} H^{21}$$
 (Weit Equation)  $\zeta_{2} = 2.6$   
Total No. 1. Assume stage elevation is of (sepatroad)  
 $f = 2.41$  is  
Total No. 2. Assume stage elevation is of (sepatroad)  
 $f = 2.41$  is  
 $f = 0.5 (leptic)(2.22x725)$   
 $= 2.54$  is  
 $f = 1.6 (f = 0.16)(2.13) + (2.6(100)(11))$   
 $= 1.0 (f = 0.12)(2.13) + (2.6(100)(12)))$   
 $= 1.0 (f = 0.12)(2.13) + (2.6(100)(12))) + (2.6(100)(1.5)))$   
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 $= 1.0 (f = 0.12)(1.2(3)(2.13)(2.13)) + (2.6(100)(1.5))) + (2.6(100)(1.5)))$   
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S.E. - 111 Jan & Anto March All - Site The show a trace would cause appreciation property domate to State Route 4A and 4 what ted Structures One house located on Structures the house iscored out the princoun elde on the hood would be a potential for the bu of 4-6 hurs and appreciable becker. Therefore, Smith Pond Dan mus shartfied Simificant HOZOVO.

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## APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS