CONNECTICUT RIVER BASIN
GRANTHAM, NEW HAMPSHIRE

EASTMAN LAKE DAM
NH 00039
NHWRB 97.04

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

MAY 1979

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**Eastman Lake Dam**

**Title and Subtitle:**

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS

**Authors:**

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NEW ENGLAND DIVISION

**Performing Organization Name and Address:**

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Connecticut River Basin
Grantham, New Hampshire
Eastman Brook

**Abstract (Continue on reverse side if necessary and identify by block number):**

The dam has a maximum height of 45 ft. and is about 415 ft. long. The dam is judged to be in good condition. Two wet patches were observed on the downstream side above the elevation of the permanent pool. The dam is classified as intermediate in size with a hazard potential of high. There is work which must be done on the remaining spillway to assure the continued performance of the dam.
DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.
Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Eastman Lake 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 Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, ATTN: Mr. Jonathan Burnham, Manager.

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 Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer
EASTMAN LAKE DAM
NH 00039
NHWRB 97.04

CONNECTICUT RIVER BASIN
GRANTHAM, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Distribution/
Availability Codes
Avail and/or
Dist. special
NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: NH 00039
Name of Dam: Eastman Lake Dam
Town: Grantham
County and State: Sullivan, New Hampshire
Stream: Eastman Brook
Date of Inspection: June 7, 1978

BRIEF ASSESSMENT

Eastman Lake Dam is an earth dam across the outlet of Eastman Brook in the central western part of New Hampshire about fifteen miles southeast of the city of Lebanon. The dam has a maximum height of 45 feet and is approximately 415 feet long with a 40-foot wide roadway at the top. The principal spillway is a 42-inch diameter concrete pipe which is located at the base of and near the center of the dam. The intake structure is a reinforced concrete riser with a single stage crest. Provision was made in the design for an emergency spillway with a crest length of 50 feet. The emergency spillway has been rough graded but not finished.

The dam is judged to be in good condition. Two wet patches were observed on the downstream side above the elevation of the permanent pool. On the upstream seeded slope four minor areas of erosion were observed. Continuance of this classification depends on proper operations and maintenance of the dam.

This dam falls under the category of high hazard potential, and it is intermediate in size. The test flood peak inflow is equal to the probable maximum flood, 15,560 cfs, and the test flood peak outflow is 3,548 cfs. Hydraulic analysis indicates that the surcharge height above the crest of the principal spillway is about 14.9 feet and above the crest of the emergency spillway is about 8.2 feet. The project will pass the test flood peak outflow without overtopping the dam, and therefore the spillway capacity is adequate.

The remaining work on the emergency spillway should be started within one year of receipt of Phase I report by the owner and the following recommended operation and maintenance measures, as stated in Section 7.3, should be implemented within 2 years.

1. The erosion areas on the upstream side should be corrected.
2. The soft patches on the downstream face should be monitored to determine the cause and then corrective measures taken.

3. An operating and maintenance manual for the project be prepared.

4. A program of technical bi-annual periodic inspections of the project features should be prepared and initiated.

5. Surveillance and a warning system be developed for periods of unusually heavy rains and runoff.

FAY, SPOFFORD & THORNDIKE, INC.

By:

Jurgis Gimbutas, P.E.
Project Engineer

Richard W. Albrecht, P.E.
Vice President
This Phase I Inspection Report on Eastram Lake 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. Tiernach
CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Raven, Jr.
FRED J. RAVEN, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper
SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

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

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable 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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EASTMAN LAKE DRAINAGE AREA

SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOREGICAL SURVEY

SUNAPEE, N.H. 1955
AMS 6570-1-SERIES V172
MASCOWA, N.H. 1927
EASTMAN LAKE DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Fay, Spofford & Thorndike, Inc., Engineers, have 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 was issued to Fay, Spofford & Thorndike, Inc., under a letter of May 3, 1978, from Mr. Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0308 has been assigned by the Corps of Engineers for this work.

b. Purpose

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

2) Encourage and 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 Description of Project

a. Location

Eastman Pond is located in the central western part of New Hampshire and about 15 miles southeast of the city of Lebanon. Eastman Lake Dam is built on the south end of the lake, which is the outlet of Eastman Brook. This brook flows, via several other brooks, into Sugar River, which is tributary to the Connecticut River. About 2 1/2 miles downstream from the lake and situated on the banks of Stocker Brook, is the village of East Grantham. Another 1/2 mile
downstream, the village of Grantham is located at the confluence of the Stocker and North Branch Brooks. These villages are about 125 feet lower than the crest elevation of the spillway of this dam.

b. Description of Dam

The dam, built in 1972, is a compacted earth embankment dam with a length of 415 feet and a maximum height of 45 feet above the stream bed. The top of the dam is 40 feet wide and accommodates a two-lane paved roadway. It has a 15-foot wide berm on the upstream side which can be used as a mini-transit lane. The slopes are 1 vertical to 2.5 horizontal with riprap slope protection below a 15-foot wide berm on the upstream side (Photographs No. 1, 2, and 4, Appendix C).

The principal spillway is a 42-inch diameter concrete pipe placed at the base of the embankment near the middle length. This pipe is cantilevered at the outlet into a riprap stilling basin (Photograph No. 7, Appendix C).

The intake structure is a reinforced concrete covered riser with a single stage crest (Photographs No. 5 and 6, Appendix C). The reservoir (lake) drain is a 30-inch diameter concrete pipe from the upstream toe to the riser. Flow through this pipe is controlled by a sluice gate mounted inside of the riser.

The emergency spillway is a 50-foot wide earth channel, rough graded, and located east of the dam. This emergency channel joins Eastman Brook about 1,100 feet downstream of the dam (Photographs No. 9, 10, 11, 12, and 13, Appendix C).

c. Size Classification

The storage capacity at the spillway crest is 3,350 acre-feet which falls in the range $\geq 1,000$ and $< 50,000$ acre-feet. Therefore, on the basis of Table 1, Size Classification, in the guidelines furnished by the Corps of Engineers, the dam is classified as intermediate in size.

d. Hazard Classification

In the event of failure of this dam, East Grantham, which is at a distance of approximately 2 1/2 miles downstream of the dam, will be in danger of being flooded. Because the flood wave normally does not exceed more than two-thirds the height of the dam and on the basis of engineering judgment, it is estimated that in the event of failure of this dam loss of more than a few lives and excessive property damage would probably occur. Therefore, on the basis of Table 2, Hazard
Potential Classification, in the guidelines furnished by the Corps of Engineers, this dam falls in the category of high hazard potential. The approximate damage impact area is included in Appendix D.

e. Ownership

The owner of the Eastman Lake Dam is the Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, telephone (603) 863-4444. They have initiated and executed the construction of this dam and developed a planned residential community around the lake.

f. Operator

Mr. Jonathan Burnham, Manager, Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, telephone (603) 863-4444.

g. Purpose of Dam

The prime purpose of this dam is for recreation for the residential community located near the lake area. The secondary purpose is flood control of the inhabited valley of Eastman Brook.

h. Design and Construction History

Prior to construction of this dam by the present owner, there was a smaller dam and a bridge over Eastman Brook located north of the present dam. The water elevation of the smaller dam was approximately 1096 with a storage area of about 142 acres. With the new dam in place, the water level of the pond is at crest elevation, 1109.0, of the intake structure, which results in a storage area of approximately 335 acres.

Preliminary topography for the lake shores with a proposed dam at the south end was prepared in September 1971, by Hayes Engineering, Inc., Melrose, Massachusetts. This work was based on topographical plans prepared by the U.S. Department of Agriculture, Soil Conservation Service, with contour intervals of 4 feet.

Haley & Aldrich, Inc., Consulting Soil Engineers of Cambridge, Massachusetts, were engaged to provide engineering services for a new dam, approximately 350 feet south of the existing dam. Subsurface explorations were made from September 3, to October 15, 1971, with soil borings drilled by C. L. Guild Company, Inc., Braintree, Massachusetts. The design drawings, specifications, soils analysis, and other supporting data were submitted for review to the New Hampshire Water Resources Board on January 17, 1972. The design was done.
in accordance with the design criteria of the Soil Conservation Service. The Board requested some changes, which were incorporated in the final construction drawings.

Haley & Aldrich, Inc., provided engineering services in the field during construction from May to September, 1972. As of September 22, 1972, the dam was substantially complete. The emergency spillway remained unfinished as it was rough graded only.

The dam has been functioning satisfactorily since its completion.

i. Normal Operational Procedure

This dam is checked regularly by Mr. Jonathan Burnham, Manager of Controlled Environment Corporation. The only control available to lower the level of the lake is a 30-inch concrete pipe drain regulated by a sluice gate. The sluice gate is manually operated from the top of the riser.

1.3 Pertinent Data

a. Drainage Area

Eastman Pond as shown on the U.S.G.S. Quadrangle Sheet is located on the headwaters of Eastman Brook. It has a total drainage area of 7.5 square miles. The watershed is highly wooded, undulated, and rolling.

b. Discharge at Dam Site

(1) Outlets Works (conduits) -

Size - 30-inch diameter and invert Elevation 1094.0

(2) Maximum known flood at dam site - Flood of September 21-24, 1938. The magnitude is unknown.

(3) Ungated spillway capacity at maximum pool elevation

(a) Principal spillway (42-inch diameter concrete pipe).

257 cfs at 1123.9 Elevation
261 cfs at 1125.0 Elevation (at top of dam)
(b) Emergency Spillway.

3346 cfs at 1123.9 Elevation
4041 cfs at 1125.0 Elevation (at top of dam)

(4) Total Spillway Capacity (Principal and Emergency Spillways) at maximum pool elevation.

3603 cfs at 1123.9 Elevation
4302 cfs at 1125.0 Elevation (at top of dam)

c. Elevation (Feet above MSL)

(1) Top of dam - 1125.0.

(2) Maximum pool elevation caused by the test flood - 1123.9.

(3) Recreation pool - 1109. It is assumed that the recreation pool elevation is the same as the normal conservation level and the spillway crest elevation.

(4) Spillway crest - 1109.

(5) Upstream portal invert diversion tunnel - 1094.0.

(6) Stream bed at centerline of dam - 1090.

(7) Maximum tail water - 1089.0 (estimated).

d. Reservoir

(1) Length of maximum pool - 2 miles (estimated).

(2) Length of recreation pool - 1.6 miles (estimated).

(3) Length of flood control pool - 1.8 miles (estimated).

e. Storage (Acre-Feet)

(1) Recreation pool - 3,350 acre-feet.

(2) Flood control pool - 5,170 acre-feet (estimated).

(3) Design surcharge - 5,675 acre-feet (estimated) at a surcharge elevation of 1115.4 during passage of the Soil Conservation Service emergency spillway hydrograph.
(4) Top of dam - 9,225 acre-feet (estimated).

f. Reservoir Surface (Acres)
(1) Top of dam - 435 acres (estimated).
(2) Maximum pool - 513 acres (estimated).
(3) Flood control pool - 369 acres.
(4) Recreation pool - 335 acres. It is assumed that the recreation pool elevation is the same as the spillway crest elevation.
(5) Spillway crest - 335 acres.

(5) Spillway crest - 335 acres.

g. Dam
(1) Type Earth embankment.
(2) Length 415 feet.
(3) Height 45 feet.
(4) Top width 40 feet.
(5) Side slopes 1 vertical to 2.5 horizontal.
(6) Zoning Essentially, it is a homogeneous type of dam consisting of impervious glacial till. Drawings allowed material having less than 30 per cent finer than No. 200 mesh sieve to be placed in the downstream portion of the dam.
(7) Impervious core None.
(8) Cutoff Compacted earth, cut-off trench with a minimum width of 12 feet.
h. Intake Structure

(1) Type
Reinforced concrete riser.

(2) Length of weir
10.5 feet.

(3) Crest elevation
1109.

(4) Gates
None.

(5) U/S channel
Pond.

i. Emergency Spillway

According to visual observations made on June 6, 1978, this spillway has been rough-graded but not finished. Plans prepared for the construction of this dam indicate the following:

(1) Type
Vegetated earth channel.

(2) Dimensions
50 feet wide and approximately 1,100 feet long.

(3) Crest elevation
1115.7.

(4) Gate
None.

(5) U/S channel
Pond.

j. Reservoir Drain

(1) Invert
1094.0.

(2) Size
30-inch diameter.

(3) Description
Concrete pipe.

(4) Control mechanism
Gate control, manually operated.
SECTION 2 - ENGINEERING DATA

2.1 Design

Drawings indicating plans, elevations, and sections of the dam and appurtenant structures, including the details of the discharge facilities, such as outlet works, and emergency spillways, were obtained from Haley & Aldrich, Inc. Selected drawings are included in Appendix B. The design report which includes the logs of the borings and the design summary sheet was also obtained from Haley & Aldrich, Inc. See Appendix B for detailed listing.

2.2 Construction

a. Concrete Properties

Source, type of aggregate, cement used, mix design data, and result of testing are not available from project records. Available records indicate that Haley & Aldrich, Inc., had full-time representation at the site between May, and September, 1972. Therefore, data pertaining to the concrete properties may be filed in the office of Haley & Aldrich, Inc., Cambridge, Massachusetts.

b. Construction History

(1) Initially during construction, Eastman Brook was diverted into a 10-foot wide riprap channel along the east abutment. After the completion of the reservoir drain, the riser, and the 42-inch conduit, this brook was redverted into the principal spillway.

(2) Available design drawings have been revised to indicate the modifications made during construction due to field conditions.

(3) Construction sequence, pertinent construction problems, and maintenance repair are not available from project records.

c. Testing

Construction control test are not available from project records. Since there was a representative of Haley & Aldrich, Inc., on the site, these tests were probably performed.
2.3 **Operation**

Records of operation of this dam and of performance observations are not available.

2.4 **Evaluation**

a. **Availability**

Pertinent structural, geotechnical, hydrologic, and hydraulic data, which formed the basis of the design of the dam, are available at the office of Haley & Aldrich, Inc., who designed this dam.

b. **Adequacy**

Sufficient engineering data are available for a Phase I inspection.

c. **Validity**

The available engineering data is considered valid on the basis of the results of the visual inspection.
3.1 Findings

The Phase I inspection of the Eastman Lake Dam was performed on June 6, 1978. A copy of the inspection check list is included in Appendix A.

a. General

In general, the soil and rock features are in good condition. The concrete structure of this dam was observed to be in good condition, see subparagraph c.

b. Dam

The 40-foot wide paved roadway on the crest is in excellent condition with no visible signs of horizontal or transverse cracks. The wood guardrail is also in good condition with no apparent vertical or horizontal misalignments. The upstream and downstream seeded slopes on each side of the dam are in good condition. The riprap slope protection below the 15-foot wide berm on the upstream side is also in good condition, and there is no indication of sloughing, bulging, or movement of the slopes. No evidence of piping was observed.

Two wet patches were observed on the downstream side approximately 150 feet east of the existing catch basin above the elevation of the permanent pool. These patches were also observed in 1976, by the New Hampshire Water Resources Board.

On the upstream seeded slopes, four areas of erosion, minor in nature, were observed.

c. Appurtenant Structures

At the time of our inspection, the water level was at Elevation 1109 msl. The concrete of the riser above the reservoir water surface was observed to be in excellent condition. The sluice gate in the riser controlling flow through the 30-inch reservoir (lake) drain is in operable condition. The 42-inch diameter outlet pipe is in excellent condition. The joint alignment is generally good. No erosion was noted. The wooden footbridge over the outlet channel, approximately 20 feet from the outlet structure, is in good condition. The wooden railings on either side of the bridge are also in good condition. It appears that this bridge was built for scenic reasons and will not impede the flow in the channel.
The inspection indicated that the emergency spillway has not been completed; and the existing alignment is offset, approximately 25 feet, at the roadway crossing. Along the east side of the spillway there is a sewer line which terminates at a treatment plant that contains lagoons. The channel of this spillway is being used as a construction roadway and, therefore, the channel and its side slopes have not been seeded. This situation was also observed in 1976, by the New Hampshire Water Resources Board. In this report, the inspecting engineer stated the following: "If spillway used, there would be a tremendous amount of silt going downstream, needless to say what would happen to the sewer line."

Field observation indicates that the lake level is controlled by the intake structure, concrete riser. The only control available to lower the level of the lake is the 30-inch drain.

d. Reservoir Area

Eastman Pond is at the head of Eastman Brook and south of North Grantham, which is located near the west shore of the pond.

Eastman Pond has an area of 335 acres at Elevation 1109. There is a planned residential area and some cottages around the pond. The shoreline is heavily wooded.

e. Downstream Channel

The downstream channel and side slopes are in good condition.

Debris was observed in this channel. The quantity of debris is small and will not impede the flow in the channel.

3.2 Evaluation

The observed condition of the dam is good. The potential problems observed during the visual inspection are:

a. Unfinished emergency spillway.

b. Two soft spots on the downstream face.

c. Erosion areas on the upstream slope.
SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Controlled Environment Corporation has operated the Eastman Lake Dam since it was constructed in 1972. The lake level is controlled by the intake structure which is a reinforced concrete riser with a single stage crest. The only control available to lower the level of the lake is a 30 inch concrete pipe drain which connects to a concrete riser. The flow through the drain is regulated by a sluice gate manually operated from the top of the riser.

4.2 Maintenance of Dam

The maintenance of Eastman Lake Dam is the responsibility of the Controlled Environment Corporation.

4.3 Maintenance of Operating Facilities

No written maintenance procedures were disclosed for Eastman Lake Dam.

The maintenance of the manually operated gate controlling flow in the 30-inch diameter reservoir drain is good.

4.4 Description of any Warning System in Effect

A flood warning system is non-existent.

4.5 Evaluation

The current operation and maintenance procedures for Eastman Lake Dam are on ad hoc basis.
SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

(1) This dam falls under the category of high hazard potential, and it is intermediate in size. Using the "Recommended Guidelines for Safety Inspection of Dams," the recommended spillway test flood peak inflow is equal to the probable maximum flood. The spillway test flood inflow hydrograph, estimated, is furnished in Appendix D. The spillway test inflow flood peak is 15,560 cfs.

(2) The computed peak outflow is 3,548 cfs, corresponding to the routed spillway test flood peak inflow. Refer to Appendix D for details.

(3) The lake storage capacity versus the elevation, an estimated capacity curve, is included in Appendix D.

(4) The estimated composite discharge rating curve for the principal spillway and emergency spillway is furnished in Appendix D.

(5) The hydrologic map of the watershed above the dam site, including reservoir area, watercourse, is furnished in Appendix D.

b. Experience Data

This dam has not been exposed to any unusual floods.

c. Visual Observations

The crest of the earth dam is 9.1 feet above the crest of the emergency spillway or 16 feet above the crest of the principal spillway. The hydraulic design of the principal spillway is good. The outlet of the principal spillway cantilevers into a stilling basin at the toe of the dam. The emergency spillway has been rough-graded but not finished at the time of the inspection. It must be noted here that the New Hampshire Water Resources Board has taken a serious view of the lapse on the part of the owner for not carrying out all the requirements of the construction permit.
d. Overtopping Potential

The spillway test flood peak inflow is 15,560 cfs. When this test flood is routed by an approximate method through the lake, it is found that the maximum surcharge water surface elevation in the lake would be 1123.9. Therefore, the earth dam will not be overtopped. Surcharge height above the crest of the principal spillway would be about 14.9 feet, and the surcharge height above the crest of the emergency spillway would be 8.2 feet.
SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The upstream slope could not be seen due to the fact that it was underwater. The slopes of the embankment do not show any weak areas. The visual inspection revealed no evidence of stability problems.

b. Design and Construction Data

Design drawings and the design report for this project were obtained from project records. These drawings have been revised by the design engineer to indicate modifications made due to field conditions. The design report indicates that stability analysis for sudden drawdown and long-term condition was performed by the Design Engineer. The design report contained no computations but listed the minimum factor of safety of 2.5.

c. Operating Records

Except for memorandums and correspondence listed in Appendix B, other records are not available.

d. Post-Construction Changes

Available records indicate that this dam has not been modified since its construction.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the recommended Phase I guidelines, does not warrant seismic analyses.
SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Examination of available documents and visual inspection of Eastman Lake Dam and its appurtenant structures did not reveal any defects which would render the project inadequate from the standpoint of structural stability and the dam is judged to be in good condition.

b. Adequacy of Information

An adequate assessment of the dam consistent with the scope of a Phase I investigation has been made based upon the visual inspection and available information.

c. Urgency

The remaining work on the emergency spillway should be started within one year of receipt of Phase I report by the owner and the operational and maintenance measures, enumerated in Section 7.3 below, should be implemented within 2 years.

d. Need for Additional Investigation

At this time, there are no problems which would require additional investigation.

7.2 Recommendations

No major modification or engineering investigation is recommended at this time.

7.3 Remedial Measures

Although the dam is generally maintained in good condition, it is considered important that the following operating and maintenance procedures be attended to as early as practical:

a. The emergency spillway should be completed as per approved plans and specifications.

b. Erosion areas on the upstream slope should be corrected as continued erosion could develop into a serious problem.
c. The two soft patches on the downstream face should be monitored and the cause should be explored for correction.

d. An operating and maintenance manual for the project should be prepared.

e. A program of technical bi-annual periodic inspection of the project feature should be prepared and initiated.

f. As the dam is upstream of a populated area, round-the-clock surveillance should be provided during periods of high precipitation.

g. The owner should develop a formal warning system. An operational procedure to follow in the event of an emergency should also be adopted.

7.4 **Alternatives**

None recommended.
APPENDIX A

VISUAL INSPECTION CHECK LISTS
APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: Eastman Lake Dam
DATE: June 7, 1978
TIME: 830 - 1200
WEATHER: Sunny
W.S. ELEV.: 1109 U.S. DN.S.

PARTY:
1. Jurgis Gimbutas, P.E. Team Captain - Structural and Concrete
2. Harvey H. Stoller, P.E. Soil, Geology, & Foundations
3. V. Rao Maddineni, P.E. Hydraulics & Hydrology

PROJECT FEATURE INSPECTED BY REMARKS

1. Dam Embankment H. H. Stoller Good
2. Intake Channel H. H. Stoller Good
3. Intake Structure - Riser J. Gimbutas Excellent
4. Outlet Works - Conduit J. Gimbutas Excellent
5. Outlet Channel H. H. Stoller Good
6. Pond and Downstream Channel V. R. Maddineni Good
PERIODIC INSPECTION CHECK LIST

PROJECT: Eastman Lake Dam  DATE: June 7, 1978

PROJECT FEATURE: Dam Embankment
DISCIPLINE: Soils & Foundations
NAME:

PROJECT FEATURE: 
DISCIPLINE: 
NAME: 

DISCIPLINE: 
NAME: 

AREA EVALUATED | CONDITION
--- | ---
DAM EMBANKMENT |
Crest Elevation | 1125.0 msl
Current Pool Elevation | 1109 msl
Maximum Impoundment to Date | 1110.8 msl
Surface Cracks | None observed
Pavement Condition | Excellent
Movement or Settlement of Crest | None observed
Lateral Movement | None observed
Vertical Alignment | No visual vertical misalignment observed
Horizontal Alignment | No visual horizontal misalignment observed
Condition at Abutment and at Concrete Structures | Good

A-2
PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam DATE June 7, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations NAME

PROJECT FEATURE

DISCIPLINE

DISCIPLINE

NAME

NAME

<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
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</thead>
<tbody>
<tr>
<td>Indications of Movement of Structural Items on Slopes</td>
<td>None observed</td>
</tr>
<tr>
<td>Trespassing on Slopes</td>
<td>None observed</td>
</tr>
<tr>
<td>Sloughing or Erosion of Slopes or Abutments</td>
<td>Minor erosion (see narrative)</td>
</tr>
<tr>
<td>Rock Slope Protection - Riprap Failures</td>
<td>Good condition</td>
</tr>
<tr>
<td>Unusual Movement or Cracking at or Near Toes</td>
<td>None</td>
</tr>
<tr>
<td>Unusual Embankment or Downstream Seepage</td>
<td>None (see narrative)</td>
</tr>
<tr>
<td>Piping or Boils</td>
<td>None observed</td>
</tr>
<tr>
<td>Foundation Drainage Features</td>
<td>Could not be observed</td>
</tr>
<tr>
<td>Toe Drains</td>
<td>None</td>
</tr>
<tr>
<td>Instrumentation System</td>
<td>None</td>
</tr>
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PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam

DATE June 7, 1978

PROJECT FEATURE Intake Channel

DISCIPLINE Structures

NAME

DISCIPLINE Soils & Foundations

NAME

DISCIPLINE Hydraulics & Hydrology

NAME

AREA EVALUATED

OUTLET WORKS - INTAKE CHANNEL

AND INTAKE STRUCTURE (RISER)

<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Intake Channel</td>
<td></td>
</tr>
<tr>
<td>Slope Conditions</td>
<td>Slopes above water level in good condition</td>
</tr>
<tr>
<td>Bottom Conditions</td>
<td>Could not be observed</td>
</tr>
<tr>
<td>Rock Slides or Falls</td>
<td>None observed above water line</td>
</tr>
<tr>
<td>Log Boom</td>
<td>None</td>
</tr>
<tr>
<td>Debris</td>
<td>None observed</td>
</tr>
<tr>
<td>b. Intake Structure (Riser)</td>
<td></td>
</tr>
<tr>
<td>Condition of Concrete</td>
<td>Excellent</td>
</tr>
<tr>
<td>Stop Logs and Slots</td>
<td>None</td>
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A-4
# PERIODIC INSPECTION CHECK LIST

**PROJECT**  Eastman Lake Dam  
**DATE**  June 7, 1978  

<table>
<thead>
<tr>
<th>PROJECT FEATURE</th>
<th>DISCIPLINE</th>
<th>NAME</th>
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<tr>
<td>Outlet Channel</td>
<td>Soils &amp; Foundations</td>
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</tr>
<tr>
<td>Outlet Channel</td>
<td>Hydraulics &amp; Hydrology</td>
<td></td>
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</tbody>
</table>

## AREA EVALUATED

### OUTLET WORKS - CONDUIT

- **Size**: 42-inch concrete pipe
  - **General Condition of Concrete**: Excellent
  - **Erosion or Cavitation**: None observed
  - **Outlet Channel**
    - **Loose Rock or Trees**: None observed
    - **Overhanging Channel**: None observed
  - **Condition of Discharge Channel**: Good
APPENDIX B

EXISTING AVAILABLE INFORMATION
APPENDIX B

1. Listing of Design, Construction, and Maintenance Records:

Haley & Aldrich, Inc., 238 Main Street, Cambridge, Massachusetts, have the tracings of their design drawings dated January 14, 1972 to March 9, 1972. There are twelve sheets, including Sheet 6A.

The general title of the drawings, design report, and specifications listed above is: Controlled Environment Corporation, Grantham, New Hampshire, Eastman Lake Dam.

These drawings show the dam site plan, principal spillway, dam section with cutoff trench and drainage blanket, emergency spillway, riser and gate house details, conduit details, cradle and bent details. Reservoir Drain Sheets 1 to 6, 7, 10, and 11 have revisions (construction notes) dated September 22, 1972. The revision for Sheet 6A is dated March 9, 1972. Haley & Aldrich, Inc., file number is 2786.

Three sets of blueprints of the above drawings are filed at the New Hampshire Water Resources Board in Concord, New Hampshire.

Haley & Aldrich, Inc., and the New Hampshire Water Resources Board also have the design report, dated January 17, 1972, which contains the design data, foundation and soils data, and project specifications; all of which are found in two books.

Other records filed at the New Hampshire Water Resources Board are:

(1) Eastman Pond topographical plan, dated September 22, 1971, showing the old existing dam, and the proposed dam, made by Hayes Engineering, Inc., 828 Lynn Fells Parkway, Melrose, Massachusetts.

Note: A copy of this plan is also included with the Haley & Aldrich, Inc., design report of 1972.

(2) February 18, to December 12, 1972. Exchange of letters between Mr. Donald M. Rapoza, Water Resources Engineer, New Hampshire Water Resources Board, and Mr. Peter L. LeCount, P.E., of Haley & Aldrich, Inc., containing various design changes and additions, and finishing up the construction.

Note: These changes are added to the design drawings and revisions.

B-1
(3) July 8, 1976. Memorandum from Mr. Vernon A. Knowlton, Water Resources Engineer, to the Board of Directors, New Hampshire Water Resources Board. This memorandum explains the potentially dangerous situation since the owner of the dam had not completed the construction of the emergency spillway. It recommends that the spillway be completed during the summer of 1976.

2. Copies of Past Inspection Reports Included Are:
   July 2, 1976, by Mr. Donald M. Rapoza, New Hampshire Water Resources Board (four pages).

3. Drawings included with this appendix are the following sheets selected from the design plans made by Haley & Aldrich, Inc., in 1972:
   Sheet No. 1. Dam Site Plan, including General Notes.
   Sheet No. 2. Principal Spillway and Dam Section.
   Sheet No. 3. Cutoff Trench and Drainage Blanket.
   Sheet No. 4. Emergency Spillway Alignment and Details.
NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: __________________________ Dam Number: 2704

Name of Dam, Stream and/or Water Body: Epseoma Lake

Owner: __________________________ Telephone Number: ________________

Mailing Address: ________________

Max. Height of Dam: 40 ft. Pond Area: 335 acres Length of Dam: 275 ft.

FOUNDATION: DAM FOUND ON SHELP (SEE PLAN)

OUTLET WORKS:

Pipe (Principal) Specification Dimension
10" CIPRAINED STEEL PIPE
Outlet works: Excellent condition

ABUTMENTS:

STRUCTURE BUILT FROM NATURAL EARTH ON BOTH ENDS

EMBANKMENT: EARTH EMBANKMENT ON BOTH ENDS TRANSIT LANDS ON UPSTREAM SIDE VERY SANDY OF EMBANKMENT ON ELECTRIC SIDE FOUND IN TWO DRAINAGE SIDES OF THE EMBANKMENT AT THE RIVER EMBANKMENT

Note: Give Size, Condition and detailed description for each item, if applicable.
Spillway: Length: [SEE PLANS] Freeboard: 

Seepage: Location, estimated quantity, etc.

[SEE COMMENT ON]

Changes Since Construction or Last Inspection:

[DATE]

Tail Water Conditions:

[Normal STREAM FLOW RECOMMENDED]

Overall Condition of Dam: DAM EXCELLENT, Spillway POOR

Contact with Owner: [NAME]

Date of Inspection: JUNE 25, 1976

Suggested Reinspection Date AFTER ES

Class of Dam: [RISK CLASS C]

Signature: [SIGNATURE]

Date: JULY 24, 1976

Emergency Spillway: SEE #2 IN COMMENT SHEET
CONCERNS:

1. THIS PROD. APPEARS TO BE TELLING THE

PERMANENT FLOODS MAY BE CARTING FROM A VENDRED ROLLING

FLOODGATE, SAW TWO CEMENTERS AT THE

REPLACEMENT DISAPPEARED INTO ROCK RILLIPNTH, SHOULD

BE REMOVED BEFORE THEY CAUSE ANY DAMAGE TO THE

FLOODGATE.

2. THE EMERGENCY SPILLWAY IS NOT COMPLETED

AND THE EXISTING ALIGNMENT IS NOT

APPROXIMATELY 25 FEET AT THE CAVES CROSSING

THESE ARE PLACES WHERE SPILLING IN THE G0.S.

THIS IS RECOMMEND AS A SECOND BANK.

WHERE THE END OF THE FLOW

CAUSE MORE FLOWING THE LENGTH OF SPILLWAY

IF SPILLWAY WOULD NOT BE A THREAT.

AMOUNT OF SALT GONNA DECREASE BAD TO

SPY WERE WOULD happen TO THE ORIGINAL LINES.

REFERENCE:

1. HAVE THE ES. EVALUATE THE DISCHARGE CAPACITY OF

SPILLWAY WITH EXISTING ALIGNMENT

2. REQUIRE CEMENT TO BE CONCRETE

ES. ACCORDING TO PROJECT PLAN IF DISCHARGE

CAPACITY WILL BE REDUCED BY ES. OR.

ALIGNMENT.
SKETCH OF DAM
(Show Plan, Elevation & Cross Sections)

SEE PLANS IN FILE
GENERAL NOTES

1. All pipe elevations noted between -1 and +15 feet below water level are in feet.

2. Reinforced concrete pipes, 24-inches in diameter, will be used for the diversion channel and for the control of water levels. The reinforced concrete pipe will be of the standard 10,000 psi concrete pipe designed for 1,000 psi static head. The pipe will be placed at least 15 feet below the water level in the channel.

3. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

4. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

5. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

6. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

7. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

8. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

9. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

10. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

11. All concrete and material will be placed in accordance with the manufacturer's specification and the workmanship will be in accordance with the manufacturer's guidelines.

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<tr>
<th>SHEET NO</th>
<th>TITLE</th>
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<tbody>
<tr>
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<td>DAM SITE PLAN</td>
</tr>
<tr>
<td>2</td>
<td>PRINCIPAL SPILLWAY AND DAM SECTION</td>
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<tr>
<td>3</td>
<td>CUTOFF TRENCH AND DRAINAGE BLANKET</td>
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<tr>
<td>4</td>
<td>EMERGENCY SPILLWAY ALIGNMENT AND DETAILS</td>
</tr>
<tr>
<td>5-7</td>
<td>RISER DETAILS</td>
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<td>8</td>
<td>RISER ACCESSORIES</td>
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<td>9</td>
<td>CONDUIT DETAILS</td>
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<tr>
<td>10</td>
<td>CRADLE AND BENT DETAILS</td>
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<tr>
<td>11</td>
<td>RESERVOIR DRAIN DETAILS</td>
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EASTMAN LAKE DAM
DAM SITE PLAN

Haley & Aldrich, Inc.
Consulting Engineers
Cambridge, Massachusetts

DRAWN BY
CHECKED BY
APPROVED BY

DATE | SCALE | SHEET NO
---|---|---
11/11/72 | 1" = 10' | 1
NOTES

- Typical section
- Cutoff trench
- Scale 1:5

- Riprap and drainage blanket material gradation requirements

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<tr>
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<td>30-50</td>
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<td>10-20</td>
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- Drain fill

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<td>80-100</td>
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<tr>
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<td>75-100</td>
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<tr>
<td>2 1/2&quot;</td>
<td>15-60</td>
</tr>
<tr>
<td>1&quot;</td>
<td>0-5</td>
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</table>

- Filter material

<table>
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<th>Percent Fractions (%)</th>
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<tr>
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<td>20-35</td>
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<td>0-10</td>
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<tr>
<td>1/2&quot;</td>
<td>0-5</td>
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</table>

- Typical section for riprap filter and drainage blanket
- Not to scale

- Riprap and drainage blanket material gradation requirements

- Typical section cutoff trench and drainage blanket

- All construction to be planned, detailed, and stated by Engineer to determine

- Scale 1:5

- Riprap and drainage blanket material gradation requirements

- Typical section cutoff trench and drainage blanket

- Not to scale

- Riprap and drainage blanket material gradation requirements

- Typical section cutoff trench and drainage blanket

- Not to scale
PROPOSED EMERGENCY SPILLWAY
BOTTOM PROFILE

Scales 1"=40' Horiz
1"=4' Vert.

DUMPED ROCK
EROSION PROTECTION IN DITCH AT
PIPE OUTLET
AND INLET
18" ACCMP WITH
METAL ENDWALL
AND DROP INLET

TOPSOIL SEED AND
MULCH SLOPES

TOPSOIL SEED BOTTOM

TYPICAL EMERGENCY SPILLWAY
CROSS SECTION

ROAD TO BE
CUT INTO SPILL
WAY BANKS TO
AVOID OB
STRUCTION OF
WATERWAY

ROAD CROSSING DETAIL
Scale 1"=40

HALEY & ALDRICH 1971
PROPOSED EMERGENCY SPILLWAY BOTTOM PROFILE

Scales

1"=40' Note

1"=4' Note

NOTE

Road grade to be such that entire roadway section lies above 51-3225 in order to
be in bottom of emergency spillway cut. Roadway
decayed to have spillway cross-sections.

Road to be cut into spillway banks to avoid ob-
struction of spillway cut

Road Crossing Detail

NOTES

1. Spillway baseline alignment and crown surface.
   Slope existing which provided by survey Eng. 1

2. Emergency spillway constructed and road alignment
   established in field by survey Eng. 1 (or similar).

3. Road crossing not to obstruct emergency spillway
   details and grade requirements this sheet.

4. Elevation datum in U.S.G.S. Mean Sea Level.

5. Appendix E-45 to Engineer's report to be in
   the direction of the Engineer in areas of special
   terrain.

6. Spillway front to slope to be driven
   10 m. from embankment at lower end
   Blurred to around drop slope and 5 ft., and over

EMERGENCY SPILLWAY STATIONING

EMERGENCY SPILLWAY STATIONING
NOTES

1. Proposed spillway alignment and grade were submitted for review and approval by Messrs. Eastman M. West, Miss. John J. Kelley, and Mr. Robert E. Eldred. In order to place the spillway on the drawing it is necessary to make certain revisions to the proposed spillway alignment.

2. Elevation and grade were given by Messrs. Eastman M. West, Miss. John J. Kelley, and Mr. Robert E. Eldred. These elevations and grades appear to be consistent with the design.

3. Elevation and grade were adjusted in order to place the spillway on the drawing. The spillway alignment shown on the drawing is consistent with the design.

4. Elevation data is U.S.G.S. Mean Sea Level.

5. Waterways and/or drainage system are to be provided at the discretion of the Engineer in areas of water contacts and erosion hazards.

6. Elevations and grades were adjusted to meet the design.

7. Elevations and grades were adjusted to meet the design.

8. Elevations and grades were adjusted to meet the design.

9. Elevations and grades were adjusted to meet the design.

EMERGENCY SPILLWAY ALIGNMENT AND DETAILS

Haley & Aldrich, Inc.
Consulting Engineers
Cambridge, Massachusetts

Drawing by:
Checked by:
Approved by:

Date: 1/3/72
Sheet: 4
APPENDIX C

PHOTOGRAPHS
# APPENDIX C

## REPRESENTATIVE PHOTOGRAPHS OF PROJECT

### LOCATION PLAN

Plan 1 - Location of Photographs Taken June 7, 1978

### PHOTOGRAPHS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Negative No.</th>
<th>Page</th>
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<tbody>
<tr>
<td>1.</td>
<td>Roadway along top of Eastman Lake Dam, looking northeast.</td>
<td>5-32</td>
<td>C-4</td>
</tr>
<tr>
<td>2.</td>
<td>Erosion of seeded slope between the upstream berm and top of dam.</td>
<td>5-28</td>
<td>C-4</td>
</tr>
<tr>
<td>3.</td>
<td>Erosion of surface drain on the upstream slope, above the berm.</td>
<td>5-30</td>
<td>C-5</td>
</tr>
<tr>
<td>4.</td>
<td>Riprap protection of upstream slope and intake structure.</td>
<td>5-27</td>
<td>C-5</td>
</tr>
<tr>
<td>5.</td>
<td>Intake structure riser with two crests, looking northwest.</td>
<td>5-29</td>
<td>C-6</td>
</tr>
<tr>
<td>6.</td>
<td>Crest is inside of intake riser.</td>
<td>6-13A</td>
<td>C-6</td>
</tr>
<tr>
<td>7.</td>
<td>Spillway pipe outlet and riprap protection of stilling basin.</td>
<td>6-4A</td>
<td>C-7</td>
</tr>
<tr>
<td>8.</td>
<td>Outlet channel and footbridge, looking downstream from top of dam.</td>
<td>5-33</td>
<td>C-7</td>
</tr>
<tr>
<td>9.</td>
<td>Emergency spillway, unfinished, looking north towards the lake.</td>
<td>6-7A &amp; 8A</td>
<td>C-8</td>
</tr>
<tr>
<td>10.</td>
<td>Lake outlet to the emergency spillway.</td>
<td>5-35</td>
<td>C-9</td>
</tr>
<tr>
<td>11.</td>
<td>Service road crossing the emergency spillway, looking west.</td>
<td>6-10A</td>
<td>C-9</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Negative No.</td>
<td>Page</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>12</td>
<td>Emergency spillway, unfinished, looking downstream, south</td>
<td>6-9A</td>
<td>C-10</td>
</tr>
<tr>
<td>13</td>
<td>End of emergency spillway near Eastman Brook.</td>
<td>6-6A</td>
<td>6-10</td>
</tr>
</tbody>
</table>

C-2
Section of water intake in the upstream part of the dam.
5. Intake Structure: Riser with Two Treats, Looking Northeast.

6. Test is index of intake view.
1. Property Collector, Unfinished, Looking Downstream.

2. Property Collector, Unfinished, Looking Downstream.

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS
Total Estimated Area of Elevated Pond (

= 15,625 ft²

The Immediate area of Elevated Pond (12.5 ft
Elevated) by measurement and
through use of a pool depth
Charts of Engineering, is found to be

PEAK MAXIMUM FLOOD PEAK INFLOW

= 7.5 x 26.25

= 196.875 cfs

= 15,625.5 cfs (est)

As determined from Table 1 and recommended guidelines for safety
protection of dam, Elevated Pond will
also serve as an intermediate
reservoir. The length to date + potential + additions in
and Table 2, as follows: the category of
high rainfall from

D-1
Appendix D

Spillway test flood peak inflow

= 15,560 cfs
maximum height = 25,400 ft

immediate action = 250 ft

\[ T = \left( \frac{-5400}{7700 \times 360} \right)^{0.5} = \left( \frac{116,294}{7700 \times 3.625} \right) \]

\[ T = 1.728 \text{ hrs} \]

\[ T = 2.0 \text{ hrs (2hrs)} \]

SPILLWAY TEST FLOOD PEAK INFLOW

\[ = 15,560 \text{ cfs} \]
SPILLING TEST FLUID PEAK INFLOW ($Q_p$) = 15,560 cfs

<table>
<thead>
<tr>
<th>$T$ (hrs)</th>
<th>$T/7$</th>
<th>$Q / Q_p$</th>
<th>$Q$ (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.25</td>
<td>0.15</td>
<td>726</td>
</tr>
<tr>
<td>1.00</td>
<td>0.50</td>
<td>0.38</td>
<td>2800</td>
</tr>
<tr>
<td>1.50</td>
<td>0.75</td>
<td>0.73</td>
<td>11,358</td>
</tr>
<tr>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>15,560</td>
</tr>
<tr>
<td>2.50</td>
<td>1.25</td>
<td>0.80</td>
<td>12,448</td>
</tr>
<tr>
<td>3.00</td>
<td>1.50</td>
<td>0.50</td>
<td>4,247</td>
</tr>
<tr>
<td>3.50</td>
<td>1.75</td>
<td>0.25</td>
<td>3,890</td>
</tr>
<tr>
<td>4.00</td>
<td>2.00</td>
<td>0.17</td>
<td>2,624</td>
</tr>
<tr>
<td>5.00</td>
<td>2.75</td>
<td>0.06</td>
<td>1,340</td>
</tr>
<tr>
<td>6.00</td>
<td>3.50</td>
<td>0.02</td>
<td>611</td>
</tr>
<tr>
<td>8.00</td>
<td>4.00</td>
<td>0.01</td>
<td>156</td>
</tr>
</tbody>
</table>
Length of emergency spillway = 42 ft

Depth of emergency spillway = 11 ft

Area of emergency spillway = 115.7

Discharge at emergency spillway rate = 2.85 ft³/s

\[ Q = 2.85 \times 10^{1.5} \]

<table>
<thead>
<tr>
<th>H</th>
<th>EL.</th>
<th>Q (ft³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>111.7</td>
<td>143.0</td>
</tr>
<tr>
<td>20</td>
<td>117.7</td>
<td>413.0</td>
</tr>
<tr>
<td>30</td>
<td>118.7</td>
<td>740.0</td>
</tr>
<tr>
<td>40</td>
<td>119.7</td>
<td>1140.0</td>
</tr>
<tr>
<td>50</td>
<td>120.7</td>
<td>1530.0</td>
</tr>
<tr>
<td>60</td>
<td>121.7</td>
<td>2694.0</td>
</tr>
<tr>
<td>70</td>
<td>122.7</td>
<td>2639.0</td>
</tr>
<tr>
<td>80</td>
<td>123.7</td>
<td>3224.0</td>
</tr>
<tr>
<td>100</td>
<td>125.7</td>
<td>4806.0</td>
</tr>
<tr>
<td>150</td>
<td>130.7</td>
<td>8272.0</td>
</tr>
<tr>
<td>200</td>
<td>135.7</td>
<td>12341.0</td>
</tr>
<tr>
<td>250</td>
<td>140.7</td>
<td>17120.0</td>
</tr>
</tbody>
</table>
\[ C \times \frac{\pi}{4} \times \left( \frac{2.5}{2} \right)^2 \times 8 \times \sqrt{h} = 22.5 \]

\[ h = 1115.7 - 2.5 \times 0.5 = 26.77 \text{ ft} \]

\[ C = \frac{22.5}{377.678} = 0.0596 \]

\[ Q_{ps} = 0.0596 \times \frac{\pi}{4} \times \left( \frac{2.5}{2} \right)^2 \times 8 \times \sqrt{h} = 4.8564 \sqrt{h} \]

**Discharge Through Drain:**

\[ Q = 0.4 \times \frac{\pi}{4} \times \left( \frac{2.5}{2} \right)^2 \times 8 \times \sqrt{h} = 23.56 \sqrt{h} \]

At elevation EL 110.9:

\[ Q = 23.56 \times \sqrt{110.9} = 91.5 \text{ cfs} \]

At elevation EL 1115.7:

\[ Q = 23.56 \times \sqrt{1115.7} = 109.0 \text{ cfs} \]
<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>h (ft)</th>
<th>$Q_{RS}$ (cfs)</th>
<th>$Q_{ES}$ (cfs)</th>
<th>$Q_{PMAX}$ (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110.5</td>
<td>16</td>
<td>174.0</td>
<td></td>
<td>174.0</td>
</tr>
<tr>
<td>110.7</td>
<td>18</td>
<td>165.0</td>
<td></td>
<td>165.0</td>
</tr>
<tr>
<td>110.9</td>
<td>20</td>
<td>195.0</td>
<td></td>
<td>195.0</td>
</tr>
<tr>
<td>111.0</td>
<td>21</td>
<td>200.0</td>
<td></td>
<td>200.0</td>
</tr>
<tr>
<td>111.2</td>
<td>23</td>
<td>264.0</td>
<td></td>
<td>264.0</td>
</tr>
<tr>
<td>111.4</td>
<td>25</td>
<td>218.0</td>
<td></td>
<td>218.0</td>
</tr>
<tr>
<td>111.57</td>
<td>26.7</td>
<td>225.0</td>
<td></td>
<td>225.0</td>
</tr>
<tr>
<td>111.67</td>
<td>27.7</td>
<td>229.0</td>
<td>146.0</td>
<td>372.0</td>
</tr>
<tr>
<td>111.77</td>
<td>28.7</td>
<td>233.0</td>
<td>456.0</td>
<td>656.0</td>
</tr>
<tr>
<td>111.87</td>
<td>29.7</td>
<td>237.0</td>
<td>730.0</td>
<td>977.0</td>
</tr>
<tr>
<td>111.97</td>
<td>30.7</td>
<td>241.0</td>
<td>1143.0</td>
<td>1639.0</td>
</tr>
<tr>
<td>112.07</td>
<td>31.7</td>
<td>246.0</td>
<td>1575.0</td>
<td>2255.0</td>
</tr>
<tr>
<td>112.17</td>
<td>32.7</td>
<td>249.0</td>
<td>2064.0</td>
<td>2840.0</td>
</tr>
<tr>
<td>112.27</td>
<td>33.7</td>
<td>253.0</td>
<td>2413.0</td>
<td>3220.0</td>
</tr>
<tr>
<td>112.37</td>
<td>34.7</td>
<td>257.0</td>
<td>2794.0</td>
<td>3740.0</td>
</tr>
<tr>
<td>112.57</td>
<td>36.7</td>
<td>264.0</td>
<td>4564.0</td>
<td>4770.0</td>
</tr>
<tr>
<td>113.07</td>
<td>41.7</td>
<td>281.0</td>
<td>6187.0</td>
<td>6734.0</td>
</tr>
<tr>
<td>113.57</td>
<td>46.7</td>
<td>298.0</td>
<td>7746.0</td>
<td>8544.0</td>
</tr>
<tr>
<td>114.07</td>
<td>51.7</td>
<td>313.0</td>
<td>17812.0</td>
<td>18125.0</td>
</tr>
<tr>
<td>ELE.</td>
<td>VOLUME (MILL.-F)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1111.0</td>
<td>22.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1112.5</td>
<td>3500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1120.3</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1122.6</td>
<td>48700</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STILLWATER TEST FLOOD PEAK INFLOW \( Q_R = 15.5 \text{ cfs} \)

**TRIAL #1**

Actual end of volume = 17" of runoff volume

Available Surchage storage into the top of dam

\[
\frac{3.55 \times 16 \times 12}{7.5 \times 640} = 15.4 \text{ inches of runoff from dam}
\]

Surchage storage Vol. = \( \frac{15.4}{17} = 0.81 \)

Referring to Figure 17-11 in Sec. NEH, Section 4,

Conclusion

\[
\frac{\text{OUTFLO\text{ IN\text{ FLOW PEAK RATE}}} = 0.27}{\text{INFLOW PEAK RATE}}
\]

\[
\text{OUTFLOW PEAK RATE} = 0.27 \times 15.5 \text{ cfs} = 4.26 \text{ cfs}
\]

**TRIAL #2:**
FROM THE Composite discharge rating curve, the
altered outflow peak rate corresponds to
ELE: 112.2 Ft.

i.e. Surchage height above normal spillway level
= 13.7 Ft.


Vit. of discharge (cubic) \( = \frac{3.85 \times 12.7 \times 12}{7.5 \times 640} \)

\[ = 18.19 \text{ cubic yards} \]

Now, apply the above expression:

\[ Q_p = 15,510 \left(1 - \frac{13.19}{19}\right) \]

\[ = 15,510 \left(1 - 0.694\right) \]

\[ = 15,510 \times 0.306 \]

\[ = 4.761 \text{ cft} \]

**Trial #4**:

From the composite discharge making curve, the static cutoff was taken to correspond to E.C. 8-2-5.8

d.e. discharge height = 16.8 ft

Vit. of discharge (cubic) \( = \frac{3.85 \times 16.8 \times 12}{7.5 \times 640} \)

\[ = 16.17 \text{ cubic yards} \]

Average of 8.718 and 8.712 = \( \frac{18.19 + 16.17}{2} = 17.18'' \)

\[ Q_p = 15,560 \left(1 - \frac{14.26}{19}\right) \]

D-11
To determine peak cutflow:

1. Peak cutflow \( Q_3 \) = \( 0.66 \times (1 - 0.77) \)
   \[ Q_3 = 0.66 \times 0.23 \]
   \[ Q_3 = 0.15 \text{ cfs} \]

The cut used in the ELE is 123.4 ft from the

concrete slab end of the

principal building

Surchage at above end of

emergency spillway

is \( 14.8 \) ft.

ELEC. 11916-001: 125.6 ft above the

slab is not surcharged due to spillway

The inflow flood.

2. Peak cutflow = 0.1548 cfs.
SPILLWAY TEST FLOOD INFLOW HYDROGRAF
EASTMAN POND DAM

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

EASTMAN POND, NEW HAMPSHIRE

SCALE AS SHOWN

DATE AUGUST 1974
EASTMAN POND DAM

EASTMAN BROOK

NEW HAMPSHIRE

SCALE AS SHOWN

DATE AUGUST 1978
COMPOSITE RATING CURVE FOR SPILLWAY AND EMERGENCY S...
EASTMAN POND DAM

EASTMAN BROOK, NEW HAMPSHIRE

SCALE AS SHOWN
DATE AUGUST, 1978
DRAINAGE AREA
EASTMAN LAKE

DOWNSTREAM DRAINAGE
IMPACT AREA

SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

SUNAPEE, N.H. 1955
AMS 6570-I-SERIES V712
MASCOMA, N.H. 1927
APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS