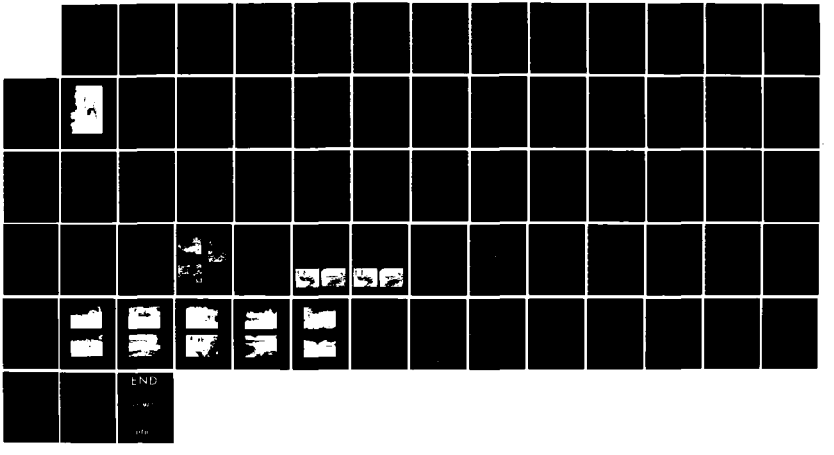
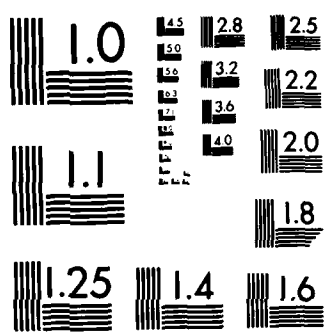
AD-A156 250 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS UPPER KIMBALL LAKE DA..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV MAR 80 1/1

UNCLASSIFIED F/G 13/13 NL





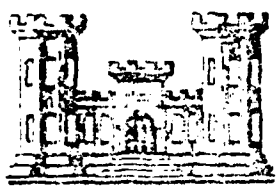
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(2)

SACO RIVER BASIN
CHATHAM, NEW HAMPSHIRE

UPPER KIMBALL LAKE DAM
NH 00149

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

MARCH 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00149	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Upper Kimball Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE March 1980 13. NUMBER OF PAGES 32
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

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

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

DAMS, INSPECTION, DAM SAFETY,

Saco River Basin
Chatham, New Hampshire
Kimball Brook tributary to Old Course Saco RIver

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

The dam consists of an earth embankment on the right with a concrete gravity spillway and earth abutments on the left. The dam is about230 ft. long and 10.2 ft. high. The dam is in fair condition. Although there were several deficiencies were noted, there was no evidence of settlement, lateral movement or signs of structural failure, or other conditions which would warrent urgent remedial attention. It is small in size with a significant hazard potential.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

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

MAY 30 1980

REPLY TO
ATTENTION OF:
NEDED

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen.

Inclosed is a copy of the Upper Kimball 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, Water Resources Board, Concord, New Hampshire 03301.

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,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SACO RIVER BASIN
CHATHAM, NEW HAMPSHIRE

UPPER KIMBALL LAKE DAM
NH 00149

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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

MARCH 1980

NATIONAL DAM INSPECTION PROGRAM
PHASE I INVESTIGATION REPORT

Identification No.:	NH 00149
Name of Dam:	Upper Kimball Lake
Town:	Chatham
County and State:	Carroll, New Hampshire
Stream:	Kimball Brook tributary to Old Course Saco River
Date of Site Visit:	31 October 1979

BRIEF ASSESSMENT

Upper Kimball Lake Dam consists of an earth embankment on the right with a concrete gravity spillway and earth abutment on the left. The spillway weir is broad crested with no means of affixing flashboards to it. The outlet works is stoplog-controlled and forms the left end of the spillway structure. The crest length of Upper Kimball Lake Dam is approximately 230 ft. and it has a height of about 10.2 ft. The dam was reconstructed in 1956 and serves primarily as a recreation dam.

Due to the extent of downstream development that would be affected in the event the dam were to fail, Upper Kimball Lake Dam is confirmed as having a "significant" hazard potential in accordance with Corps of Engineers Guidelines.

The dam is in fair condition, based on visual examination. Although several deficiencies were noted, there was no evidence of settlement, lateral movement or signs of structural failure, or other conditions which would warrant urgent remedial action.

Based on the "small" size and "significant" hazard potential classifications, in accordance with Corps of Engineers Guidelines, the adopted test flood for this dam is 1/4 of the Probable Maximum Flood (1/4 PMF). With the water level at the top of the dam and stoplogs in place, the total spillway and outlet works capacity is equal to the test flood outflow of 1,660 cfs (inflow 2,760 cfs or 450 csm). Hydraulic analyses indicate that 1,660 cfs can be passed with a freeboard of about 0.5 ft. with all stoplogs removed.

The State of New Hampshire Water Resources Board, owner of the dam, should perform remedial measures, including clearing sunken logs from the outlet works approach, cutting trees and placing earthfill on the right embankment adjacent to the spillway, restoring the upstream slope of the right embankment to design grade and repairing the failed area on the downstream side of the left abutment. This work, as outlined in Section 7.3, should be implemented within one year

after receipt of this report. The Owner should also prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan and downstream warning system that would compliment the State's existing disaster operations plan, "Link-Up".

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

This Phase I Inspection Report on Upper Kimball 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.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

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

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. In general, there are no formal operational procedures for Upper Kimball Lake Dam. A total of seven stoplogs are maintained in the outlet works year round. The Owner's instruction for emergency operations state; "Pull stoplogs if (the) dam (is) threatened."

b. Description of Any Warning System in Effect. There is no specific warning system or emergency preparedness plan in effect for this structure. However, the Owner is within the framework of the operations plan "Link-Up", an inter-agency plan in the State of New Hampshire for natural and man-made disaster operations. The plan establishes the procedure for notifying and calling upon the resources of other state agencies in times of emergency.

4.2 Maintenance Procedures

a. General. There are no established procedures or manuals for inspection and maintenance of the dam. Remedial measures such as replacement of stoplogs are reportedly performed on an as-needed basis.

b. Operating Facilities. The spillway structure appears to have received regular maintenance. There are no provisions for flashboards and the stoplogs in the outlet works are maintained at spillway crest level year round. The outlet works provide the only means of draining or lowering the level of Upper Kimball Lake. Although no attempt was made to remove the stoplogs during the site inspection, no conditions were observed which would unusually hinder their removal during times of emergency.

4.3 Evaluation

Maintenance of the facility is being performed on the basis of need. There is currently no formal operational procedures in effect for this dam. Formal operational procedures and maintenance programs should be established. A detailed emergency preparedness plan and warning system should be established for the specific dam to compliment the existing operations plan "Link-Up".

No. 9. The culvert and downstream channel appear adequate to convey the maximum spillway discharge without causing significant flooding. About midway between the dam and Lower Kimball Pond is the ruins of a breached dam which is reported to have been privately owned and previously operated for hydroelectric power generation.

3.2 Evaluation

Based on the visual examination conducted on 31 October 1979, Upper Kimball Lake Dam is considered to be in fair condition. The conditions at the upstream slope of the right embankment and at the downstream side of the left abutment have been reported by the New Hampshire Water Resources Board since 1972 and appear to be somewhat stable. The spillway structure appears to be in good condition and performing satisfactorily at the present time. However, the remedial measures outlined in Section 7.3 should be implemented to correct the noted deficiencies in the dam at the right embankment, left abutment and outlet works approach.

The masonry portion of Upper Kimball Lake Dam, the spillway, appeared to be in good condition, Photo No. 6. However, flow over the weir precluded close examination. Overall, the spillway is in good alignment as shown on Photo No. 3, with no settlement noticeable. The concrete accessible for examination appeared sound, with only one minor crack in the right training wall noted during the site inspection.

The left abutment is grass covered. The upstream slope and crest are in generally excellent condition. However, on the downstream side and immediately adjacent to the spillway training wall there is a small failed area, Photo No. 7. The failure extends as far as 2 ft. in the upstream direction and to a depth of 3 ft. below the top of the training wall. The abutment slopes steeply to meet the downstream channel at this location; this contributes to the instability. The failure appears to be a combination of erosion and sloughing. Boulders which were placed along the left downstream channel for erosion protection appear to be locally dislodged. The boulders closest to the outlet works have been displaced the most as part of the failed slope.

c. Appurtenant Structures. The outlet works appears to be in excellent condition with no major defects apparent, Photo No. 7. The access bridge (catwalk) and training walls are in good alignment. Minor erosion of the concrete was noted at the training walls on the downstream side. The condition of the stoplogs could not be determined as flow obscured their direct viewing.

There are sunken logs present at the approach to the outlet works. However, they appeared sufficiently upstream as not to create an obstruction to flow.

d. Reservoir Area. Upper Kimball Lake, Photo No. 11, is bordered by heavily forested rolling terrain to the northwest, west and east and by marsh lands to the south. The shoreline is lightly developed with summer cottages. There is no significant probability of landslides into the reservoir affecting the safety of the dam. No conditions were noted that could result in a sudden increase in sediment load into the reservoir.

e. Downstream Channel. An unnamed brook, Photo No. 10, conveys discharge from the spillway approximately 800 ft. to Lower Kimball Pond. The elevation difference between Upper Kimball Lake and Lower Kimball Pond is approximately 50 ft. according to USGS Quadrangle Sheets. About 100 ft. downstream of the dam is a roadway embankment with a 9 ft.-2 in. x 15 ft-2 in. steel pipe arch culvert, Photo

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I visual examination of Upper Kimball Lake Dam was conducted on 31 October 1979. The upstream water surface elevation was about 0.1 ft. above the spillway crest that day.

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

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

b. Dam. The earth embankment that forms the right side of the dam, Photo No. 2, is covered with moss, grass and weeds; the latter are typically less than 1 ft. in height. Minor erosion from the water line to about 1 ft. above the water surface has occurred along the upstream slope of the embankment. The exposed upstream slope is irregular in shape, due to erosion, and appears to be steeper than the 2 horizontal to 1 vertical that was designed.

Adjacent to the right spillway training wall on both the upstream and downstream sides, the crest is deficient as the embankment is significantly lower than the concrete as shown on Photo No. 3. On the upstream side this difference is 1 to 2 ft. and on the downstream side 0.5 to 1.5 ft. There is active erosion; however, it is doubtful that the difference in grade has been caused by this action alone. The embankment might have been constructed low or the difference may be caused, in part, by settlement of the earth embankment due to insufficient compaction during the placement of the fill.

There are no structural or natural items on the embankment other than two oak trees approximately 6 in. and 3 in. in diameter, respectively, located on the downstream side as shown on the right side of Photo No. 4. At several locations, particularly adjacent to the spillway, stone that formed the downstream side of the former dam is visible, Photo No. 5. The vertical alignment of the embankment appears goods. The horizontal alignment is slightly curved in agreement with the design drawings.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No design data for the former dry-laid stone masonry dam were located and none are believed to exist. Design drawings for the reconstruction of Upper Kimball Lake Dam dated 1955 and 1956 were located. The above documents and a summary of the dam's hydraulic/hydrologic features tabulated by the New Hampshire Water Resources Board comprises all the available design information known to exist.

2.2 Construction Data

No as-built data or records of the reconstruction of the dam were located and none are believed to exist.

2.3 Operational Data

No operational data, other than prior inspection reports, were located for the facility.

2.4 Evaluation of Data

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

b. Adequacy. There was a considerable amount of engineering data available to aid in the evaluation of Upper Kimball Lake Dam. A review of these data in combination with visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement, was adequate for the purposes of a Phase I assessment.

c. Validity. The information contained in the engineering data may generally be considered valid. However, details on the drawings are shown as designed and some vary from those actually built. For example, areas of riprap adjacent to the spillway are absent, the alignment of the downstream channel is not as shown on the design drawings and the slope of the upstream side of the right embankment appears steeper than 2 horizontal to 1 vertical.

9. Grout curtain	None
10. Other	Rebuilt over former composite dry-laid stone and earth fill dam in 1956

h. Diversion and Regulating Tunnel — Not applicable

i. Spillway

1. Type	2 ft. wide broad crested concrete weir
2. Length of weir	44 ft.
3. Crest elevation	95.2
4. Gates	None
5. U/S channel	Upper Kimball Lake
6. D/S channel	Unnamed brook approx. 800 ft. long at S = 0.06 to Lower Kimball Pond
7. General	D/S channel has sufficient capacity to convey test flood

j. Regulating Outlets. The reservoir outlet works consists of one 6-ft. wide stoplog bay located at the left abutment of the spillway with provisions for seven 6 ft.-6 in. x 4 in. x 8 in. wood stoplogs. The invert of the stoplog bay is 4.7 ft. below the spillway crest.

c. Elevation (Assumed Datum not NGVD)

1. Streambed at centerline of dam	89.5
2. Maximum tailwater	Unknown
3. Upstream portal invert diversion tunnel	Not applicable
4. Recreation pool	95.2
5. Full flood control pool	Not applicable
6. Spillway crest	95.2
7. Design surcharge - original design	Unknown
8. Top of dam	99.7
9. Test flood surcharge	99.7

d. Length of Reservoir

1. Maximum pool	Unknown
2. Recreation pool	Unknown
3. Flood control pool	Not applicable

e. Storage (acre-ft.)

1. Recreation pool	200
2. Flood control pool	Not applicable
3. Spillway crest	200
4. Top of dam	800
5. Test flood pool	800

f. Reservoir Surface (acres)

1. Recreation pool	136
2. Flood control pool	Not applicable
3. Spillway crest	136
4. Top of dam	Unknown
5. Test flood pool	Unknown

g. Dam

1. Type	Gravity, earth fill
2. Crest length	230 ft. approximately
3. Structural height	10.2 ft.
4. Embankment crest width	6 ft.
5. Side slopes	Approx. 2H to 1V U/S, variable D/S
6. Zoning	None
7. Impervious core	None
8. Cutoff	7.2 ft. long concrete cut-off walls from spillway training walls into earth fill at either side of spillway and below spillway to impervious soil

that the dam is periodically inspected by the Owner and that repairs are made when required.

1.3 Pertinent Data

All elevations reported herein are approximate and based on an assumed datum given on drawings prepared for the reconstruction of the dam by the New Hampshire Water Resources Board. Based on the assumed datum, the crest of the spillway weir is at El. 95.2.

The level of Upper Kimball Lake is given at El. 430 (USGS) on a New Hampshire Water Control Commission data report dated 2 November 1938. The level of the lake is also shown on the USGS North Conway, New Hampshire-Maine Quadrangle Map at El. 430. Although the data report and North Conway Quadrangle Map were both made prior to the dam's reconstruction, the lake surface is believed to be close to the level it was retained at by the former dam.

a. Drainage Area. The drainage area tributary to the dam site is 6.1 sq. mi. of moderate to steeply sloped hills which are heavily forested. There is essentially no development in the watershed, which is drained by three brooks. Upper Kimball Lake constitutes approximately 3.5 percent of the total drainage area.

b. Discharge at Dam Site

1. Outlet works	
(stoplogs removed).....	200 cfs with water surface at spillway crest
(stoplogs in place).....	550 cfs with water surface at top of dam
(stoplogs in place).....	190 cfs with water surface at top of dam
2. Maximum known flood at dam site.....	Unknown
3. Ungated spillway capacity at top of dam.....	1,470 cfs at El. 99.7
4. Ungated spillway capacity at test flood pool elevation...	1,470 cfs at El. 99.7
5. Gated spillway capacity at normal pool elevation.....	Not applicable
6. Gated spillway capacity at test flood pool elevation...	Not applicable
7. Total spillway capacity at test flood pool elevation...	1,470 cfs at El. 99.7
8. Total project discharge at test flood pool elevation...	1,660 cfs at El. 99.7
9. Total project discharge at top of dam (with stoplogs removed).....	2,020 cfs at El. 99.7

for Estimating Downstream Dam Failure Hydrographs", confirm this classification. A failure of Upper Kimball Lake Dam would jeopardize the occupants of one home immediately downstream of the dam. Potential loss of life is a few.

e. Ownership. The name, address and phone number of the current owner of Upper Kimball Lake Dam are:

Water Resources Board
State of New Hampshire
37 Pleasant Street
Concord, New Hampshire 03301
Phone: (603) 271-3406

Mr. Vernon A. Knowlton is the Chief Engineer of the Water Resources Board.

f. Operator. The Water Resources Board of the State of New Hampshire has been responsible for operation, maintenance and safety of the dam since about 1955. The board may be reached at the address and phone number listed above. The Water Resources Board does not designate a particular individual as operator of a specific dam but operates all state-owned dams by their staff of engineers and operators on a continual basis.

g. Purpose of Dam. A stone masonry and earth fill dam was built at the site shortly after the year 1800. At that time, water was stored primarily for use by three mills located downstream of the dam. The industrial uses of the dam are believed to have been abandoned sometime in the late 1800's or early 1900's. Since that time, to the present, the primary purpose of Upper Kimball Lake Dam has been to maintain a reservoir for recreational use.

h. Design and Construction History. No records of the former dam are known to exist other than the deteriorated conditions of stone masonry and embankment reported, after the dam was abandoned, by New Hampshire state agencies. Between 1954 and 1956, the dam was redesigned by the Water Resources Board. In the fall of 1956 a contractor, Gordon T. Burke, was engaged and the dam was reconstructed to its existing configuration.

i. Normal Operational Procedures. There is no formal written procedure for the operation of Upper Kimball Lake Dam. The spillway weir has a fixed crest with no provisions for flashboards. The outlet works is not operated seasonally. The wooden stoplogs, which may be removed in times of emergency, are maintained by the state. It is understood

N44°05.8' and W71°00.4', respectively. Flow from the dam is conveyed about 800 ft. by an unnamed brook to Lower Kimball Pond. The lake, pond and associated watershed system are tributary to the Old Course Saco River. The dam is also known as Upper Kimball Pond Dam and the reservoir, locally, as Webb Pond.

b. Description of Dam and Appurtenances. Upper Kimball Lake Dam consists of an earth embankment on the right with a concrete gravity spillway and earth abutment on the left. The crest length of the dam is approximately 230 ft. and it has a height, at the spillway, of about 10.2 ft.

The earth embankment on the right is about 140 ft. long with a 6-ft. crest width. The upstream slope is about 2 horizontal to 1 vertical and has no riprap or slope protection. On the downstream side, the embankment slopes down to a ground surface that is about 3 ft. lower than the crest and relatively flat.

The spillway is a broad crested concrete gravity structure. The spillway weir is 44 ft. long with no means of affixing flashboards to it. The outlet works, which is incorporated into the left side of the spillway, is 6 ft. long and stop-log controlled. The overall length of the spillway structure, weir and outlet works, is 51 ft. Concrete training walls form abutments at either end of the spillway structure. Short concrete cutoff walls extend out from the training walls into the earth embankment and earth abutment on the right and left ends, respectively.

Upper Kimball Lake Dam underwent reconstruction in 1956. In the reconstruction, an earth embankment on the left side of the prior outlet works was removed and the new spillway constructed. The remnants of the left end of the prior embankment were rebuilt and now form the left earth abutment. The abutment is in the same general configuration as the right embankment.

c. Size Classification. The storage to the top of Upper Kimball Lake Dam is reported to be 800 acre-ft., and the corresponding hydraulic height of the dam is approximately 10 ft. Storage of less than 1,000 acre-ft. and a height of less than 40 ft. classifies this dam in the "small" size category according to guidelines established by the Corps of Engineers.

d. Hazard Classification. The dam is currently classified as having a "significant" hazard potential in the Corps of Engineers National Inventory of Dams. Dam failure computations in Appendix D, which are based on "Guidance

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

UPPER KIMBALL LAKE DAM
NH 00149

SECTION 1 - PROJECT INFORMATION

1.1 General

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

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the States of New Hampshire and Maine. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 31 October 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW33-80-C-0009 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hydrologic aspects of the Investigation.

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

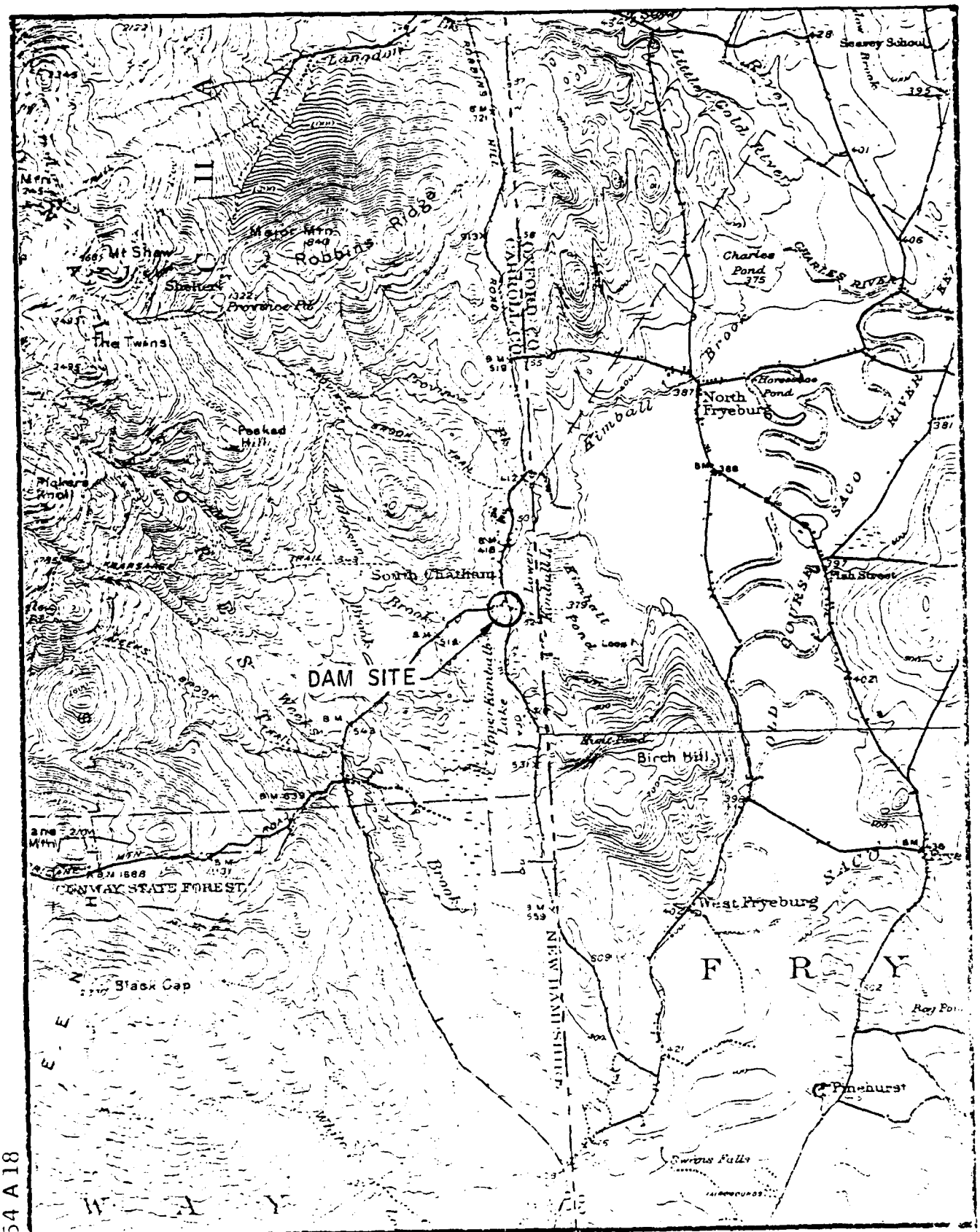
1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

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

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

1.2 Description of Project

a. Location. The dam is located at the northern end of Upper Kimball Lake as shown on the Location Map, page vii. The latitude and longitude of the dam site are



DAM: Upper Kimball Lake

IDENTIFICATION NO. NH 00149

FILE NO. 4454 A 18

LOCATION MAP

U.S.G.S. QUADRANGLE

NORTH CONWAY, NH-ME

APPROX. SCALE: 1" = 1 MILE

1. Overview of Upper Kimball Lake Dam showing downstream side

TABLE OF CONTENTS

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Upper Kimball Lake Dam is a recreational dam. It is approximately 230 ft. long including the spillway and outlet works. The 44-ft. long broad crested concrete spillway has a freeboard height of 4.5 ft. The left abutment of the spillway incorporates a 6-ft. long stoplog bay having an invert elevation 4.7 ft. below the crest of the spillway. Discharge from the spillway and outlet works is conveyed approximately 800 ft. by an unnamed brook to Lower Kimball Pond. The essentially undeveloped 6.1-sq. mi. drainage area is sloped in its upper regions, moderately sloped in the lower portion and heavily forested throughout.

5.2 Design Data

Hydraulic/hydrologic design data as reported by the Owner is as follows:

15 year storm.....	555 cfs
100 year storm capacity.....	1,400 cfs
Design flow capacity.....	1,675 cfs
Discharge (manual).....	300 cfs
(automatic).....	1,375 cfs

5.3 Experience Data

There are no records of any major hydrological occurrances at the dam site since its reconstruction in 1956. According to the Owner, the dam has not been overtopped since that time.

5.4 Test Flood Analysis

Based on the Corps of Engineers Guidelines, the recommended test flood range for the size "small" and hazard potential "significant" is the 100 year flood to 1/2 PMF (Probable Maximum Flood). The 1/4 PMF was selected for the test flood as the size of the facility places it near the low end of the classification range. The PMF was determined using the Corps of Engineers Guidelines for "Estimating Maximum Probable Discharge" in Phase I Dam Safety Investigations. The 6.1-sq. mi. drainage area

consists of rolling to moderately steep terrain with swamp and marsh lands in the southern portion of the watershed. A peak inflow rate of 1,800 csm was selected for the PMF inflow which results in a test flood inflow (1/4 PMF) of 2,760 cfs.

Surcharge storage routing of the test flood inflow was performed, assuming the top of stoplogs to be at spillway crest elevation, resulting in a routed test flood outflow of 1,660 cfs at a pond stage of El. 99.7 (top of dam). This value compares favorably with hydraulic/hydrologic data of 1,400 cfs for the 100 year storm and 1,675 cfs for the design flow furnished by the Owner. Since the maximum project discharge capacity computed during this inspection is 1,660 cfs with all stoplogs in place and the emergency operating procedures calling for the removal of stoplogs "if (the) dam (is) threatened", the project is considered hydraulically adequate to pass the test flood.

5.5 Dam Failure Analysis

Based on the Corps of Engineers Guidelines for estimating dam failure hydrographs, and assuming that a failure would occur along 40 percent of the mid-height of the dam with pond level at top of dam, the peak failure outflow is estimated to be 2,190 cfs in addition to the 1,660 cfs spillway and outlet works discharge occurring before a failure of the dam. Prior to failure, approximately 70 cfs would overtop the left downstream channel bank and flow overland a short distance before returning to the downstream channel. The roadway which crosses the downstream channel would be overtopped by about 4 ft. depth of water at its lowest point. One house located on the downstream channel left overbank, just downstream of the roadway embankment would be flooded by approximately 1,900 cfs to a depth of about 3 to 4 ft. Most of the 1,900 cfs overland flow would return to the downstream channel and be conveyed to Lower Kimball Pond with the remainder of the flow dispersing to sheet flow with no resulting hazard.

The potential loss of life resulting from a dam failure is a few and the dam is accordingly classified in the "significant" hazard category.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

There was no visual evidence of major settlement or lateral movement in the earth fill or concrete portions of Upper Kimball Lake Dam. Erosion at the upstream slope of the right embankment and a failure at the downstream side of the left abutment warrent attention. Despite these conditions, the earth fill parts of the dam appear to be structurally stable at this time.

The spillway was obscured by flowing water during the site inspection making a detailed examination of it impossible. However, based on those conditions that were observed, no reason was found to question the structural stability of the spillway structure.

6.2 Design and Construction Data

Design plans for the reconstruction of the dam were located. The plans show a typical cross section of the prior embankment and the, then proposed, addition to the embankment. The embankment was redesigned to be at a higher elevation with a 6-ft. crest width and an upstream slope of 2 horizontal to 1 vertical, the approximate slope of the former embankment. No theoretical calculations on the stability of the embankment or specifications for the type of fill used are available. However, the configuration of the embankment is generally consistent with usual design practice. Past performance of the reconstructed embankment has apparently been satisfactory and, in the absence of seepage problems, the embankment is expected to be stable.

The spillway structure was designed to be constructed over portions of the former dam with part of the structure founded directly on the streambed soils. The exact nature of the spillway's foundation is not delineated on the plans other than it is essentially the same foundation used for the former dam. A 12-in. wide concrete cutoff wall is indicated on the plans, but, the extent of the wall as constructed is not known. However, the general dimensions of the spillway cross-section are within the range of what usually would be expected for a stable structure of this size. For this reason, combined with the conditions observed during the site examination, the spillway is expected to

have an adequate factor of safety relative to overall stability.

6.3 Post Construction Changes

The dam was reconstructed, over a former stone and earth dam, in 1956. During the reconstruction, the spillway and outlet works were enlarged. Since 1956, no material changes to the dam are known to have been made.

6.4 Seismic Stability

Upper Kimball Lake Dam is located in Seismic Zone 2 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

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

Based on the results of computations included in Appendix D and described in Section 5, the facility is capable of passing the test flood, which for this structure is the 1/4 PMF, without overtopping the dam. With the water level at the top of the dam, the 44-ft. long spillway capacity is approximately 1,470 cfs or 80 percent of the routed test flood outflow and the outlet works uncontrolled capacity is 190 cfs. The routed test flood outflow of 1,660 cfs (inflow of 2,760 cfs or 450 csm) could be passed with the pond level at top of dam. If all stoplogs were removed from the outlet works during the test flood, then the routed test flood outflow of 1,660 cfs could be passed with a freeboard of about 0.5 ft.

b. Adequacy of Information. This evaluation of the dam is based primarily on visual examination, approximate hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement. The information available or obtained within the scope of this investigation was adequate for the purposes of a Phase I assessment.

c. Urgency. The recommended remedial measures outlined in Section 7.3 should be undertaken by the Owner and completed within one year after receipt of this report.

7.2 Recommendations

None

7.3 Remedial Measures

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

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

1. Clear sunken logs in upstream channel from the outlet works approach.

2. Cut the two trees on the downstream side of the right embankment.

3. Place earth fill on the upstream and downstream side of the right embankment adjacent to the spillway and establish a good growth of vegetation to retard erosion and restore the crest to its intended grade and width.

4. Regrade the exposed upstream slope of the right embankment to 2 horizontal to 1 vertical and provide riprap for slope protection within the range of wave action.

5. Reconstruct the failed area on the downstream side of the left abutment adjacent to the training wall, providing riprap protection for the steep slope, under the guidance of a registered professional engineer.

6. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for the removal of stoplogs during periods of heavy precipitation and high project discharges. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure safe, satisfactory operation and to minimize deterioration of the facility.

7. Develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam or other emergency conditions. The plan should be developed in cooperation with local officials and downstream inhabitants and should compliment the existing disaster operations plan, "Link-Up".

7.4 Alternatives

Not applicable.

APPENDIX A - INSPECTION CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Upper Kimball Lake

Date: 31 October 1979

Time: 0745-1015

Weather: Clear and cold (32°F)

Water Surface Elevation Upstream: El. 95.3 (0.1 ft. over spillway)

Stream Flow: Not known

Inspection Party:

Harl P. Aldrich, Jr. Charles R. Nickerson Haley & Aldrich, Inc.	-	Soils/Geology
Roger Wood	-	Structural/Mechanical
Joseph E. Downing Camp, Dresser & McKee, Inc.	-	Hydraulic/Hydrologic

Present During Inspection:

Kenneth T. Stern, New Hampshire Water Resources Board

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Upper Kimball Lake DATE: 31 Oct 79

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	El. 99.7 (based on an assumed datum; see Appendix B-8 for B.M. No. 1)
Current Pool Elevation	El. 95.3 (0.1 ft. over spillway crest)
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	No pavement (grass)
Movement or Settlement of Crest	None observed; however some settlement may have occurred right of spillway
Lateral Movement	None observed, except as noted elsewhere
Vertical Alignment	Good
Horizontal Alignment	Good (slightly curved)
Condition at Abutment and at Concrete Structures	Some old erosion (or settlement) right of spillway, up to 2 ft. each side of concrete seepage cutoff wall (see Photo No. 3)
Indications of Movement of Structural Items on Slopes	No structural items on slope
Trespassing on Slopes	No restrictions (area not posted)
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Moss, grass and weeds; 3 in. and 6 in. diameter trees downstream of crest toward right end
Sloughing or Erosion of Slopes or Abutments	Some erosion at waterline, upstream slope (not active). Severe erosion and movement of rock fill at left abutment, downstream of outlet works (see Photo No. 7)
Rock Slope Protection - Riprap Features	No riprap
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage	None known to exist
Toe Drains	None known to exist
Instrumentation Systems	None

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Upper Kimball Lake DATE: 31 Oct 1979

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Very good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Some minor reeds
b. Weir and Training Walls	
General Condition of Concrete	Very good - one very minor crack at right training wall U/S end
Rust or Staining	None observed
Spalling	None observed
Any Visible Reinforcing	None observed
Any Seepage or Efflo-resence	Minor efflorescence at crack U/S right side
Drain Holes	None observed
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	One tree left side-no problem Young trees right side overhanging
Floor of Channel	Good
Other Obstructions	Gravel island with weeds and grass in center of channel; minimal obstruction to flow. Channel passes under road in arch culvert in good condition

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Upper Kimball Lake DATE: 31 Oct 1979

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Good
Bottom Conditions	Not visible
Rock Slides or Falls	None observed
Log Boom	None
Debris	Two sunken logs at entrance to channel but, in present location, do not form an obstruction to flow
Condition of Concrete	Excellent
Drains or Weep Holes	None observed
b. Control Structure	
Condition of Concrete	Excellent
Stop Logs and Slots	Both in excellent condition
Vents	Not observable due to flow
Hoist	None - hand lifted stop logs
Catwalk	Concrete in excellent condition

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Upper Kimball Lake DATE: 31 Oct 1979

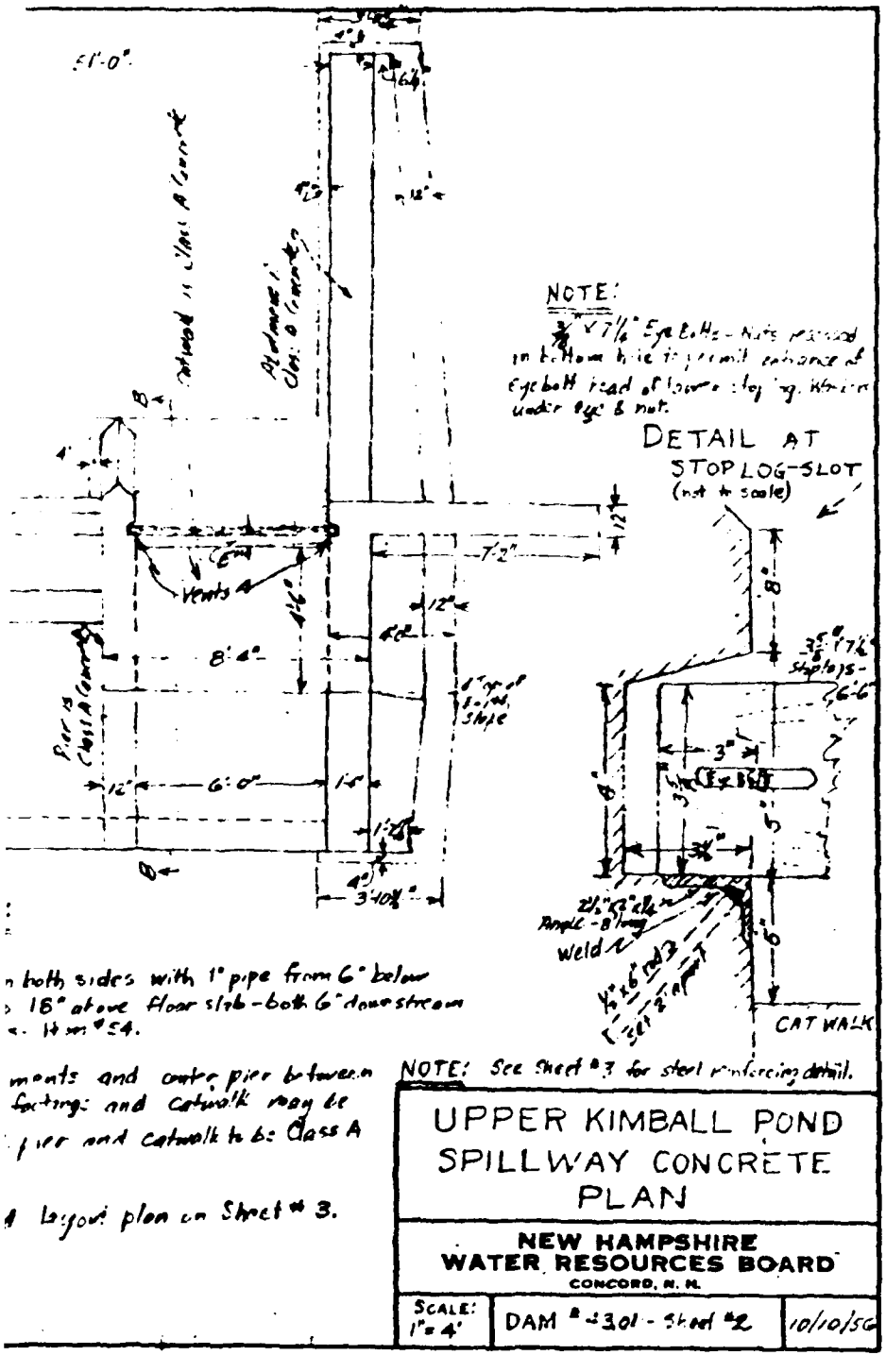
AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET CHANNEL	
General Condition of Concrete	Excellent
Rust or Staining	None observed
Spalling	None observed
Erosion or Cavitation	Very slight erosion side walls; invert not observable due to flow
Visible Reinforcing	None observed
Any Seepage or Efflo-resecnce	None observed
Condition at Joints	None observed
Drain holes	None observed
Channel	Good
Loose Rock or Trees Overhanging Channel	No trees - some loose rocks on left side
Condition of Discharge Channel	Very good

APPENDIX B - ENGINEERING DATA

UPPER KIMBALL LAKE DAM

Document	Contents	Location
Correspondence to and from State of New Hampshire Public Service Commission	Three items concerned with the Pond surface elevations dated 6 to 11 August 1934	Water Resources Board State of New Hampshire 37 Pleasant Street Concord, New Hampshire 03301
State of New Hampshire, Public Service Commission, Inspection Report and associated correspondence	Four items concerned with dam inspection report dated 16 July 1936	Water Resources Board State of New Hampshire
Raymond Seabrook letter to Public Service Commission	Correspondence on research of ownership concerning Upper Kimball Lake Dam dated 28 April 1937	Water Resources Board State of New Hampshire
New Hampshire Water Control Commission, Data on Dams in New Hampshire	Two forms with inspection information on dam dated 2 November 1938	Water Resources Board State of New Hampshire
Information for State Council Resources and Development	Four items in reference to the reconstruction of dam dated from 21 April 1953 to 31 May 1956	Water Resources Board State of New Hampshire
Upper Kimball Pond design plans	Six drawings on the reconstruction of the dam dated from 5 August 1954 to 10 October 1956	Water Resources Board State of New Hampshire

APPENDIX C - PHOTOGRAPHS

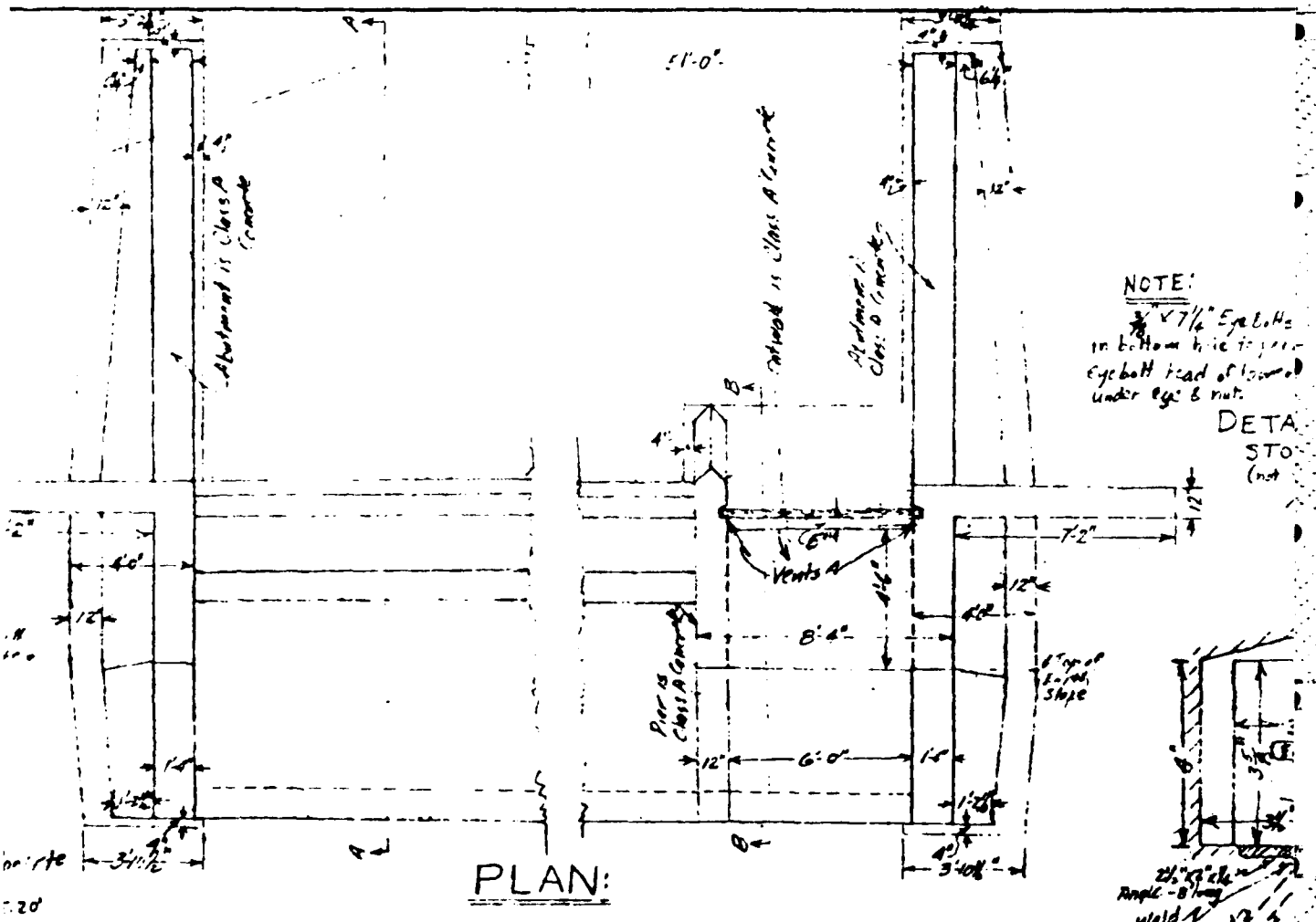


n both sides with 1" pipe from 6" below
> 18" above floor slab - both 6" downstream
<. 14 on #54.

ments and center pier between
facing: and Catwalk may be
pier and catwalk to be: Class A

4 Layout plan on Sheet # 3.

UPPER KIMBALL POND SPILLWAY CONCRETE PLAN		
NEW HAMPSHIRE WATER RESOURCES BOARD CONCORD, N. H.		
SCALE: 1" = 4'	DAM # 301 - Sheet #2	10/10/56



PLAN:

NOTE: Stop log section to be vented on both sides with 1" pipe from 6" below bottom of catwalk concrete to 18" above floor slab - both 6" downstream of stop log slot - Spillway Vents - Item #54.

All concrete except abutments and center pier between spillway & sluiceway above footings and catwalk may be Class C concrete. Abutments, pier and catwalk to be Class A Concrete.

See steel schedule and layout plan on Sheet # 3.

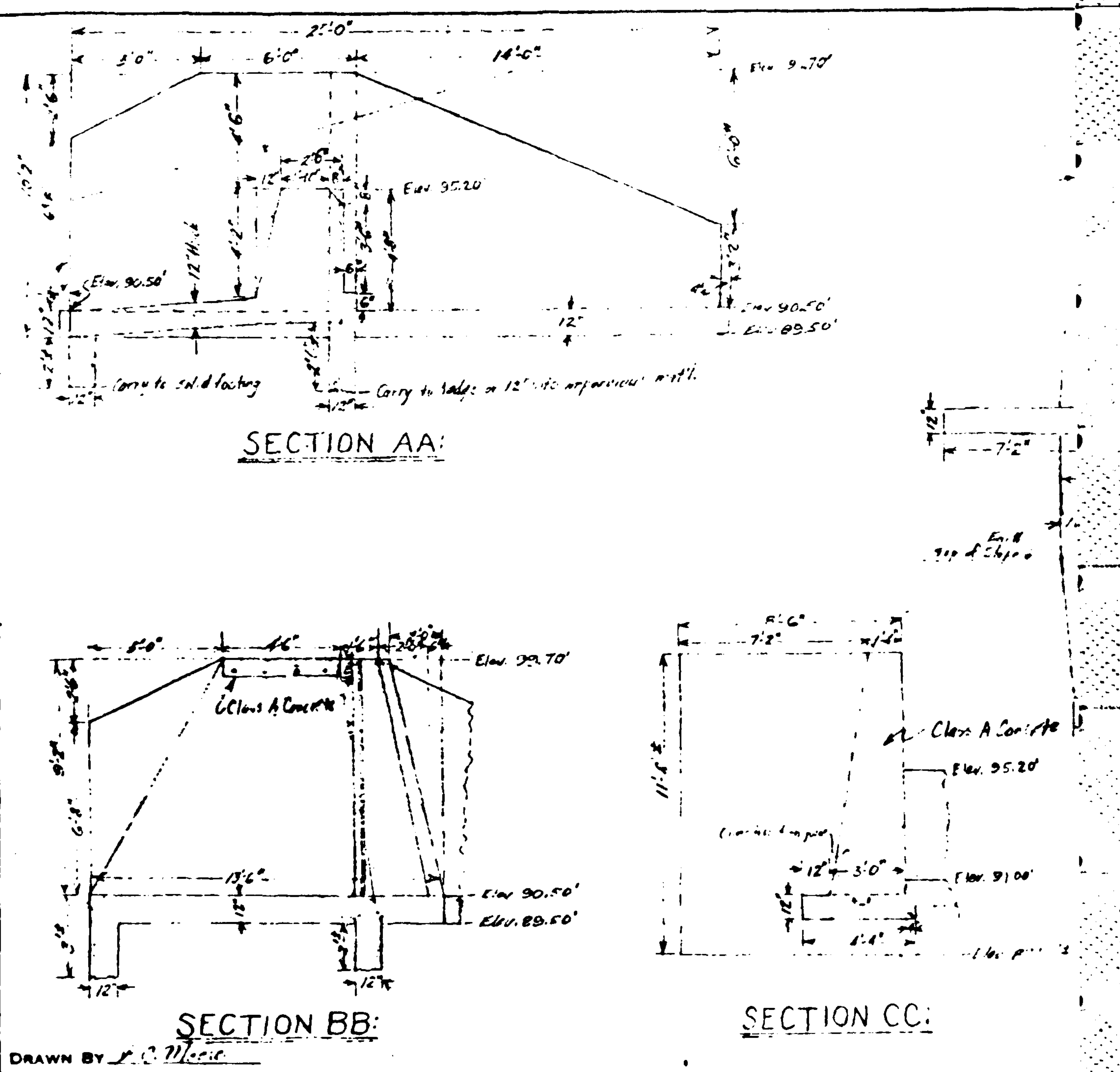
NOTE: See Sheet #3 for steel s

UPPER KIMBALL
SPILLWAY CON
PLAN

NEW HAMPSHI
WATER RESOURCES
CONCORD, N. H.

SCALE: 1" = 4'

DAM # 3.01 - Sheet

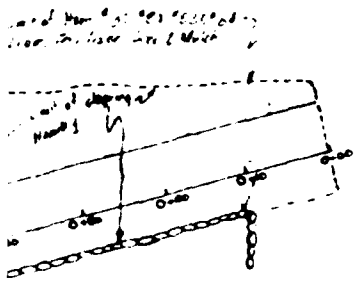


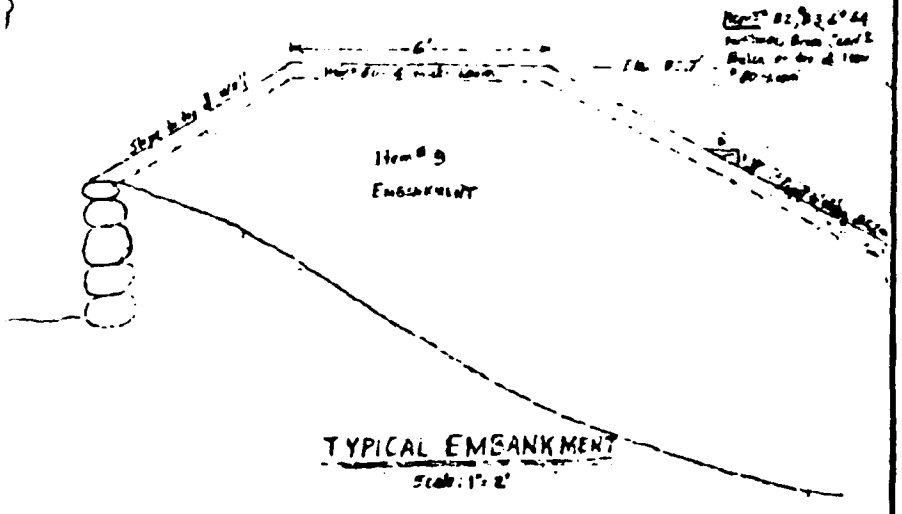
DRAWN BY ___

CHECKED BY ___

FILE NO. 4434 B30

143





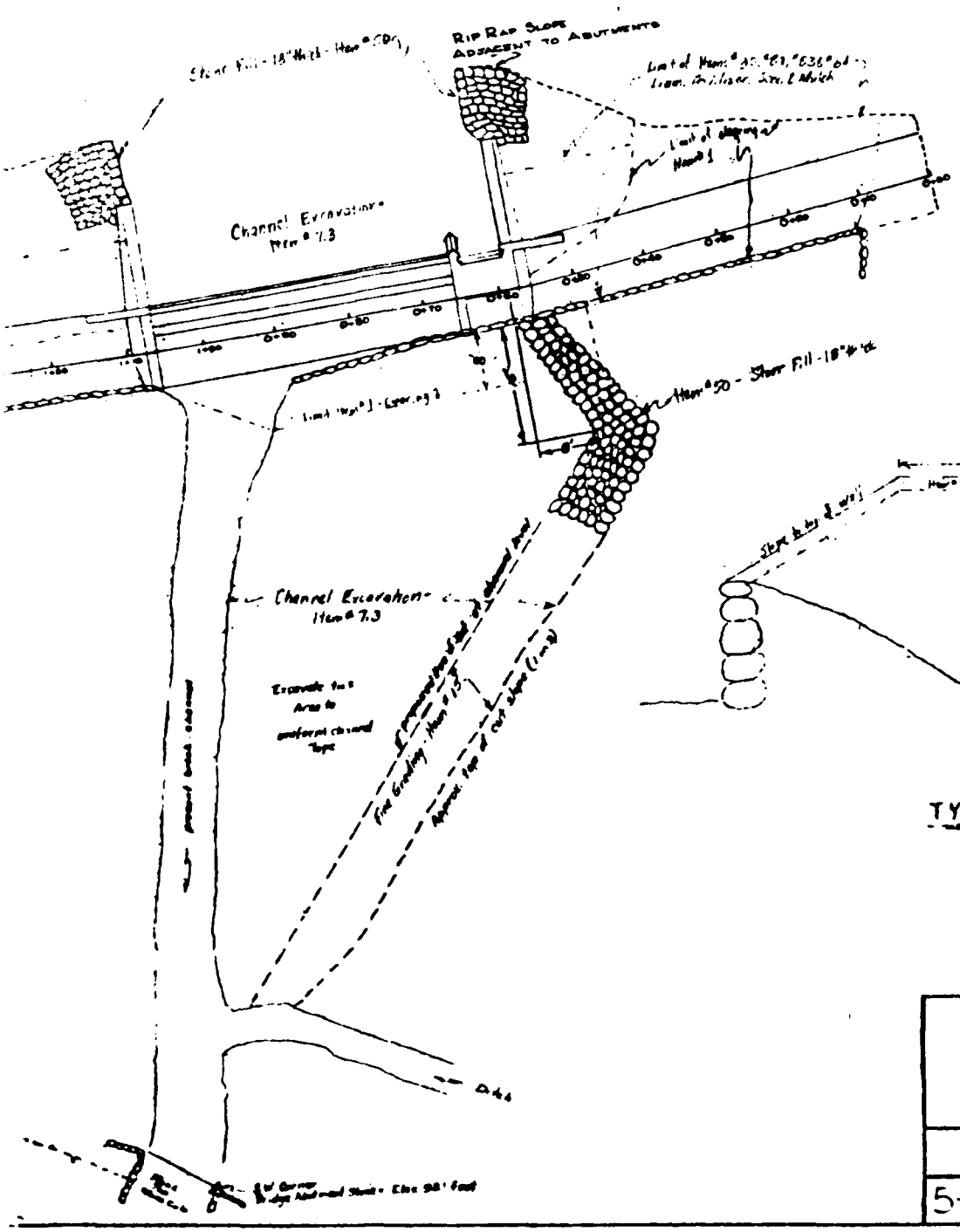
TYPICAL EMBANKMENT
Scale: 1" = 2'

UPPER KIMBALL POND
CHATHAM N.H.

NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N. H. -

5-16-55	SCALE 1"=10'	43:01

PPER KIMBALL POND



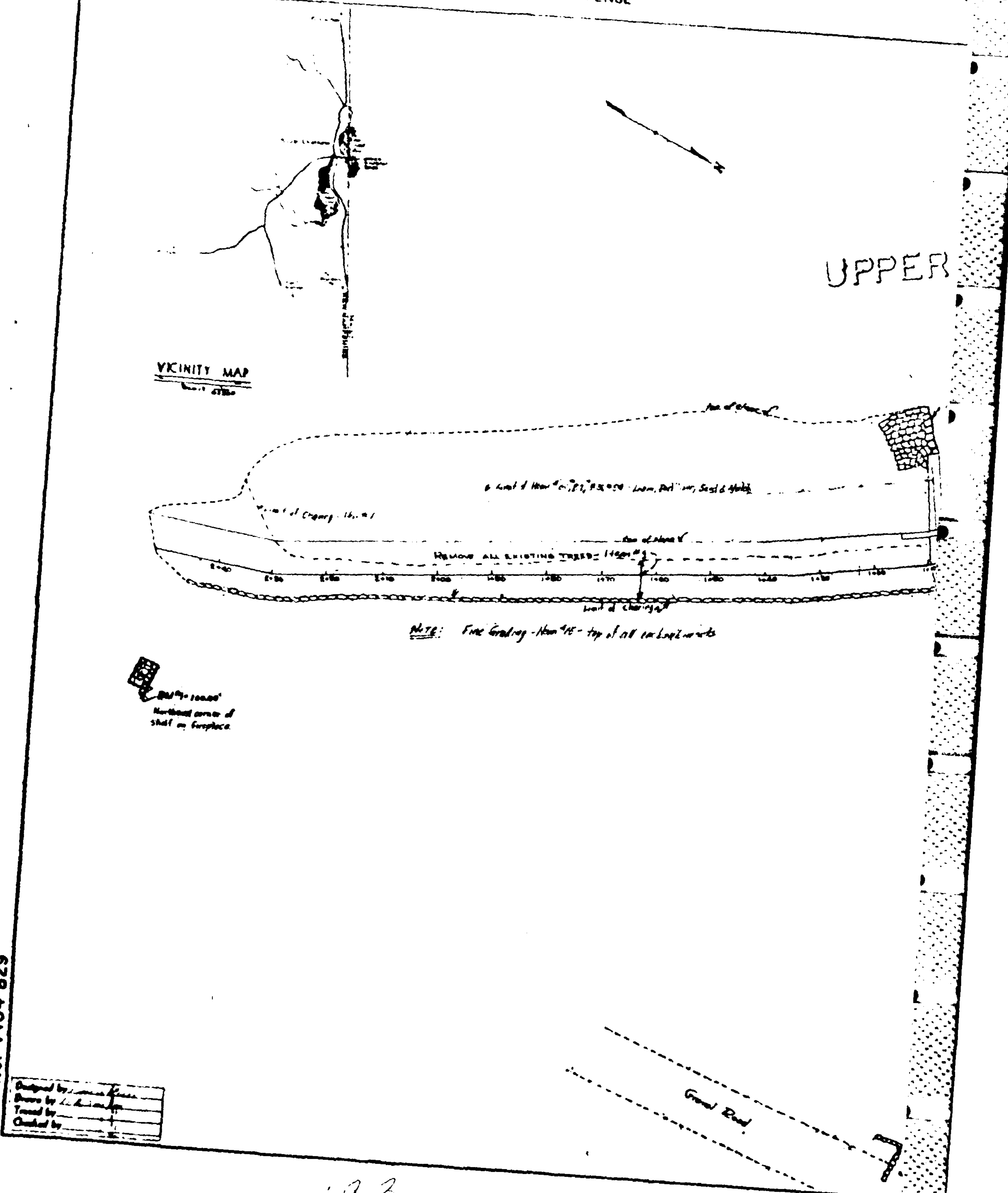
UPPER KIMBALL

CHATHAM N

NEW HAMPSHIRE WATER RESOURC
- CONCORD, N. H. -

5-16-55 | SCALE 1=10'

393



83

Upper Kimball Pond, Chatham 43.01

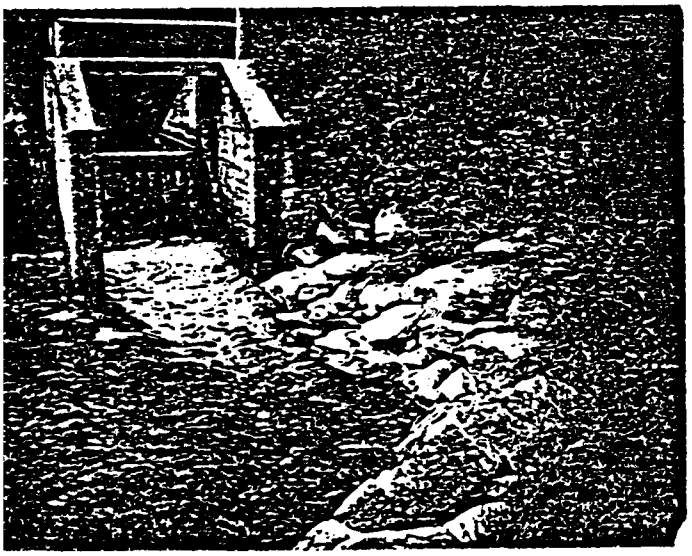
NO SEASONAL OPERATION

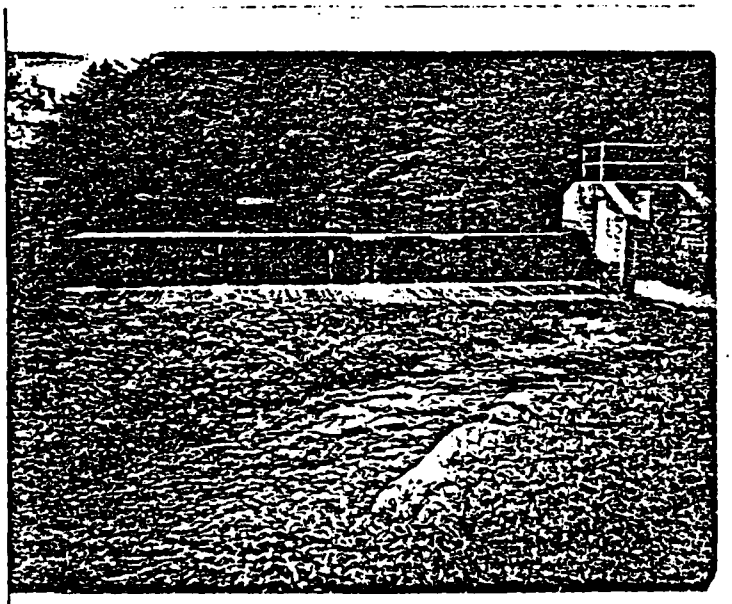
EMERGENCY OPERATION - Pull stoplogs if dam threatened

SITE VISIT CHECK LIST

Check erosion downstream of stoplogs.

BEFORE ANY EMERGENCY OPERATION
Call N. H. Water Resources Board
Office - 271-3406





Upper Kimball Pond, Chatham 43.01

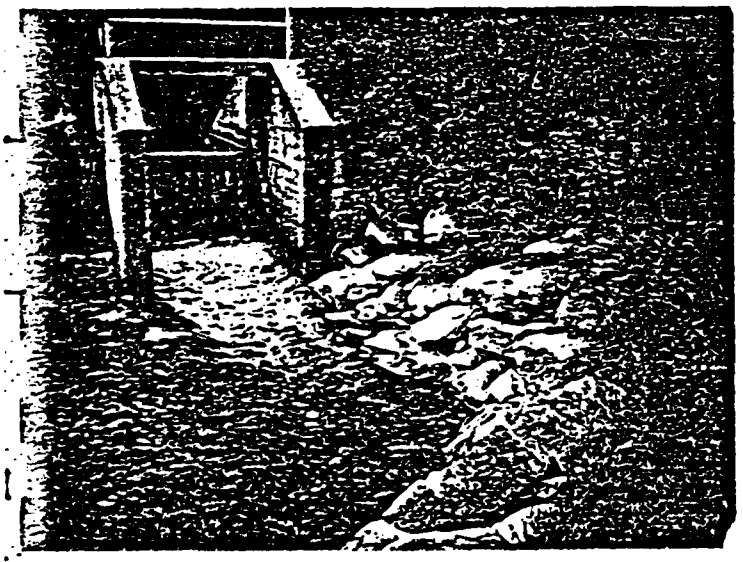
NO SEASONAL OPERATION

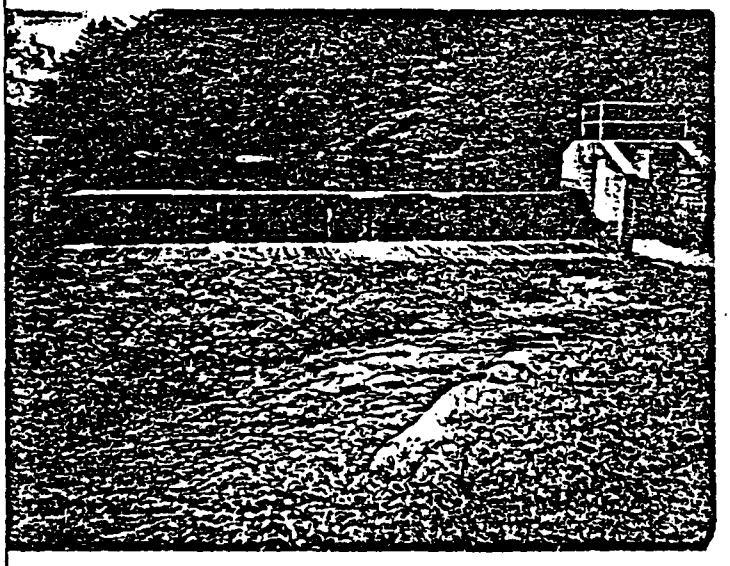
EMERGENCY OPERATION - Pull stoplogs if dam threatened

SITE VISIT CHECK LIST

Check erosion downstream of stoplogs.

BEFORE ANY EMERGENCY OPERATION
Call N. H. Water Resources Board
Office - 271-3406





Upper Kimball Pond

Chatham

43.01 #

Drainage Area (mi^2) 6.1

Pond Area (Acres) 136

Storage Perm. (Ac. Ft.) _____

Artificial (Ac. Ft.) _____

~~Gage reading @~~ Full Lake spillway crest

"O" ~~gage~~ translates to spillway crest

U.S.G.S. Elev. at full pond _____

"Fish Flow" 0.2 cfs per mi^2 2 cfs

15 year storm flow (cfs) 555

100 year storm capacity (cfs) 1400

Design flow capacity (cfs) 1675

Time to Peak (hours) _____

Discharge (manual-cfs) 300

(automatic-cfs) 1375

Spillway length (ft.) 44

Spillway crest elev. 95.2 (Local)

Flowage of fee ownership elev. _____

Top of Dam 99.7 (Local)

Flood Stage (gage-ft)

Contracts Prior to Operation of dam

How much

When

Name _____

a) # _____

Name _____

b) # _____

Name _____

c) # _____

Name _____

d) # _____

Freeboard w/o flashboards (ft.) 4.5

Flashboard height (ft) _____

Freeboard w/ flashboards (ft) _____

Spacing of pins (ft) _____

Number of pins _____

Design head over flashboards for automatic failure (ft) _____

NONE

Gate #1 on left/right (circle one) bank looking downstream _____

Number of gates _____

Size of gates _____

Gate sill elev. (gage) _____

NONE

1 Stoplog bay on right/left bank looking downstream _____

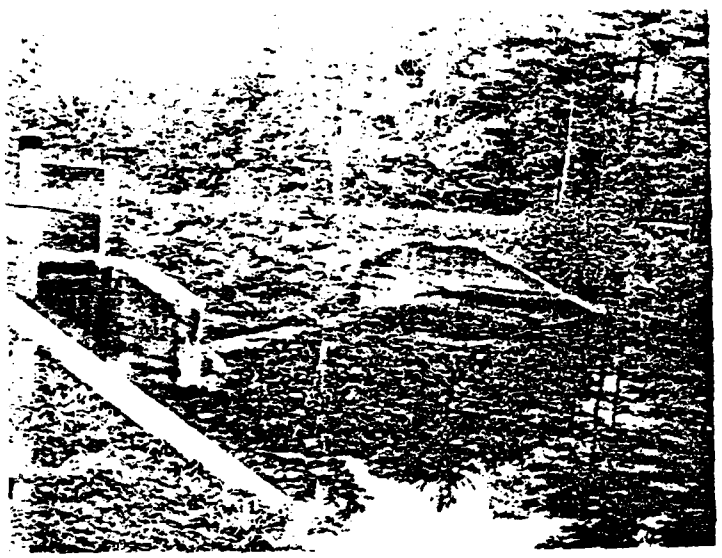
Number of stoplog bays 1

Number of S.L.'s in each bay 7

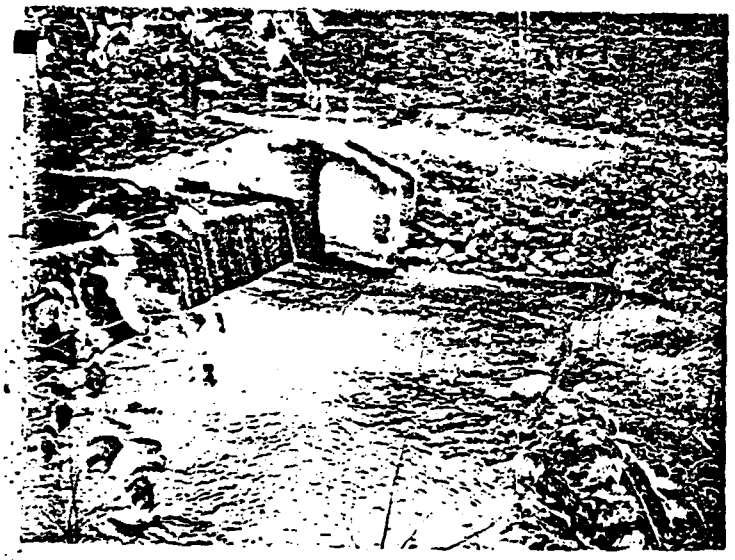
Size of each S.L. 6'6" x 4" x 8"

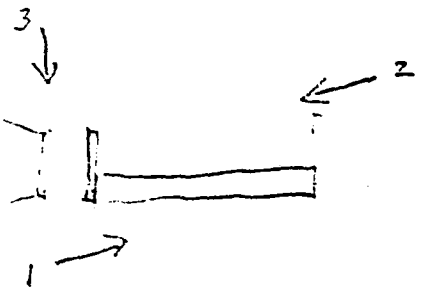
Elev. of sill of stoplog sect. 91.0 Loca

28.7" rise per inch runoff



3





N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Chatham Dam Number: 43.01

Inspected by: Robert B. Chamberlin Date: Oct. 12 1972

Local name of dam or water body: Upper Kimball Pond

Owner: N.H. Water Resources Board Address: _____

Owner was/was not interviewed during inspection.

Drainage Area: 6.13 sq. mi. Stream: Kimball Brook

Pond Area: 136 Acre, Storage 200 Normal / 8.7 Ac-Ft. Max. Head ~~4.2~~ Ft.

Foundation: Type _____, Seepage present at toe - Yes/No, _____

Spillway: Type Concrete, Freeboard over perm. crest: 4.5,

Width 44, Flashboard height _____,

Max. Capacity 1500 c.f.s.

Embankment: Type Earth - stone, Cover Vegetated Width 6,

Upstream slope 2 to 1; Downstream slope 1/2 to 1

Abutments: Type Concrete, Condition: Good, Fair, Poor

Gates or Pond Drain: Size 6' Capacity _____ Type Stop logs

Lifting apparatus _____ Operational condition Good

Changes since construction or last inspection: _____

Downstream development: _____

This dam would/would not be a menace if it failed.

Suggested reinspection date: _____

Remarks: Erosion of bank below stop log section. Brush need cutting on right embankment.

M E M O

Date: June 15, 1979

To: Vernon A. Knowlton,
Chief Engineer

From: Gary L. Kerr, GLK
Water Resources Engineer

Subject: Upper Kimball Pond, No. 43.01
Date of Inspection: June 12, 1979

I visited the subject dam and noted some general maintenance items in need of attention:

1- Several trees on the right embankment still need to be removed or cut,

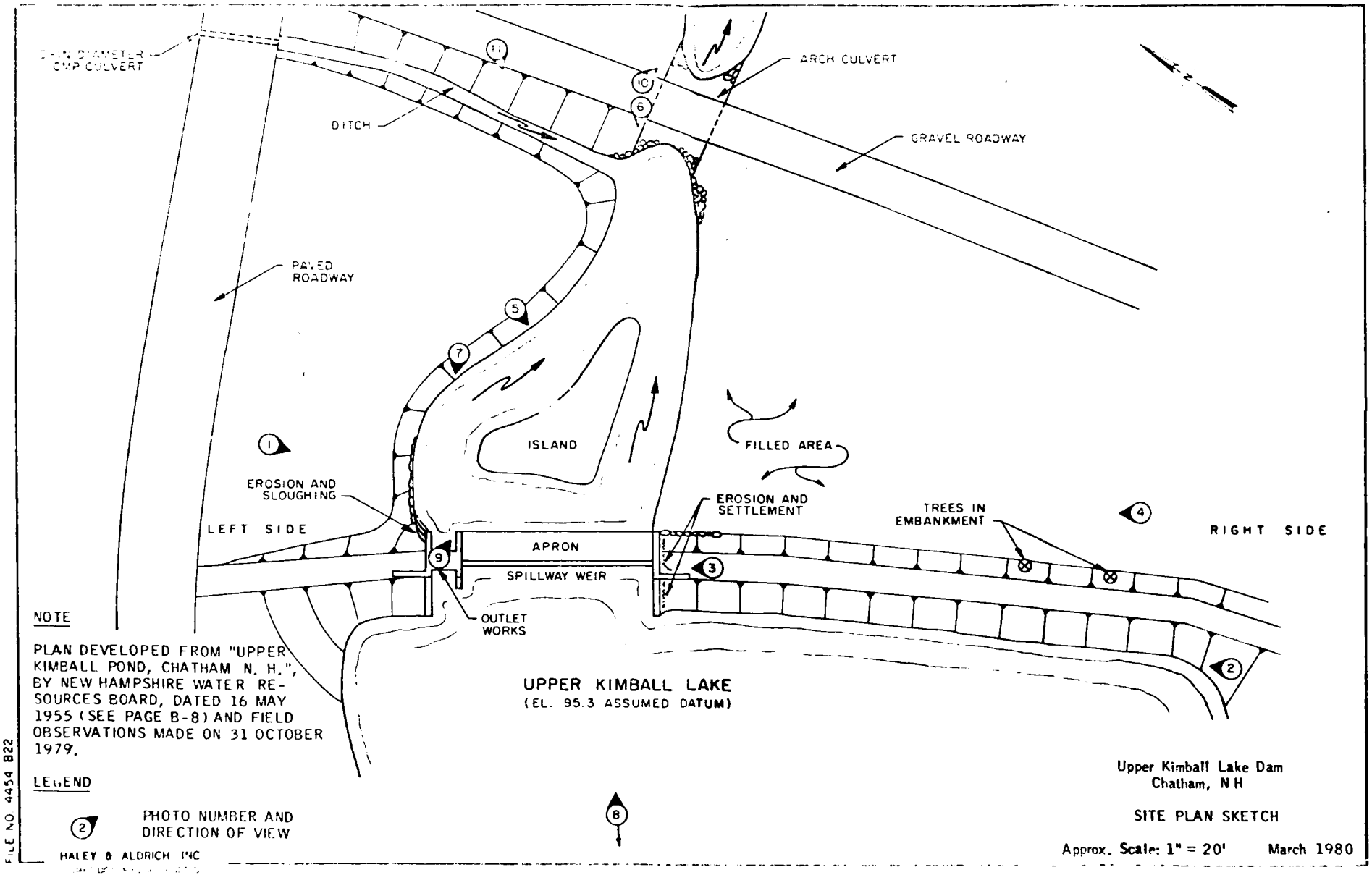
2- The grass on both embankments needs to be cut,

3- The same eroded slope exists just downstream of the stoplog section (left bank); does not appear to be any worse than last year, but warrents surveilance.

GLK:paf

LIST OF AVAILABLE DATA
UPPER KIMBALL LAKE DAM

Document	Contents	Location
New Hampshire Water Resources Board, Dams in the Town of Chatham	List and associated topographical map showing location of dams in Chatham dated 26 May 1969	Water Resources Board State of New Hampshire
New Hampshire Water Resources Board, Dam Safety Inspection Report Form	Inspection report and memorandum dated 12 October 1972	Water Resources Board State of New Hampshire (See Appendix pages B-4 and B-5)
Army Corps of Engineers Dam Inventory Program	Two sheets with three pictures of dam dated 20 March 1974	Water Resources Board State of New Hampshire
Water Resources Board letter to Board of Selectmen Town of Chatham	Notice of dam inspection dated 27 February 1976	Water Resources Board State of New Hampshire
Memo to File	Note on needed dam maintenance dated 14 April 1978	Water Resources Board State of New Hampshire
Gary L. Kerr memo to Vernon A. Knowlton, Water Resources Board	Note on needed dam maintenance dated 12 June 1979	Water Resources Board State of New Hampshire (See Appendix page B-3)
Tabulated information on Upper Kimball Pond	Hydraulic/hydrologic data on the dam	Water Resources Board State of New Hampshire (See Appendix pages B-6 and B-7)


6-IN. DIAMETER CMP CULVERT
ARCH CULVERT
DITCH
GRAVEL ROADWAY
PAVED ROADWAY
ISLAND
FILLED AREA
EROSION AND SLOUGHING
LEFT SIDE
EROSION AND SETTLEMENT
TREES IN EMBANKMENT
RIGHT SIDE
APRON
SPILLWAY WEIR
OUTLET WORKS
UPPER KIMBALL LAKE
(EL. 95.3 ASSUMED DATUM)
NOTE
PLAN DEVELOPED FROM "UPPER KIMBALL POND, CHATHAM N. H.", BY NEW HAMPSHIRE WATER RESOURCES BOARD, DATED 16 MAY 1955 (SEE PAGE B-8) AND FIELD OBSERVATIONS MADE ON 31 OCTOBER 1979.
LEGEND
PHOTO NUMBER AND DIRECTION OF VIEW
HALEY & ALDRICH INC
Upper Kimball Lake Dam
Chatham, NH
SITE PLAN SKETCH
Approx. Scale: 1" = 20'
March 1980
FILE NO 4454 B22

2. Overview of right embankment showing upstream side

3. Top of right embankment and alignment of spillway

4. Right embankment, downstream

5. Right embankment adjacent to spillway, downstream

6. Spillway and outlet works, downstream

7. Failed area adjacent to outlet works at left abutment

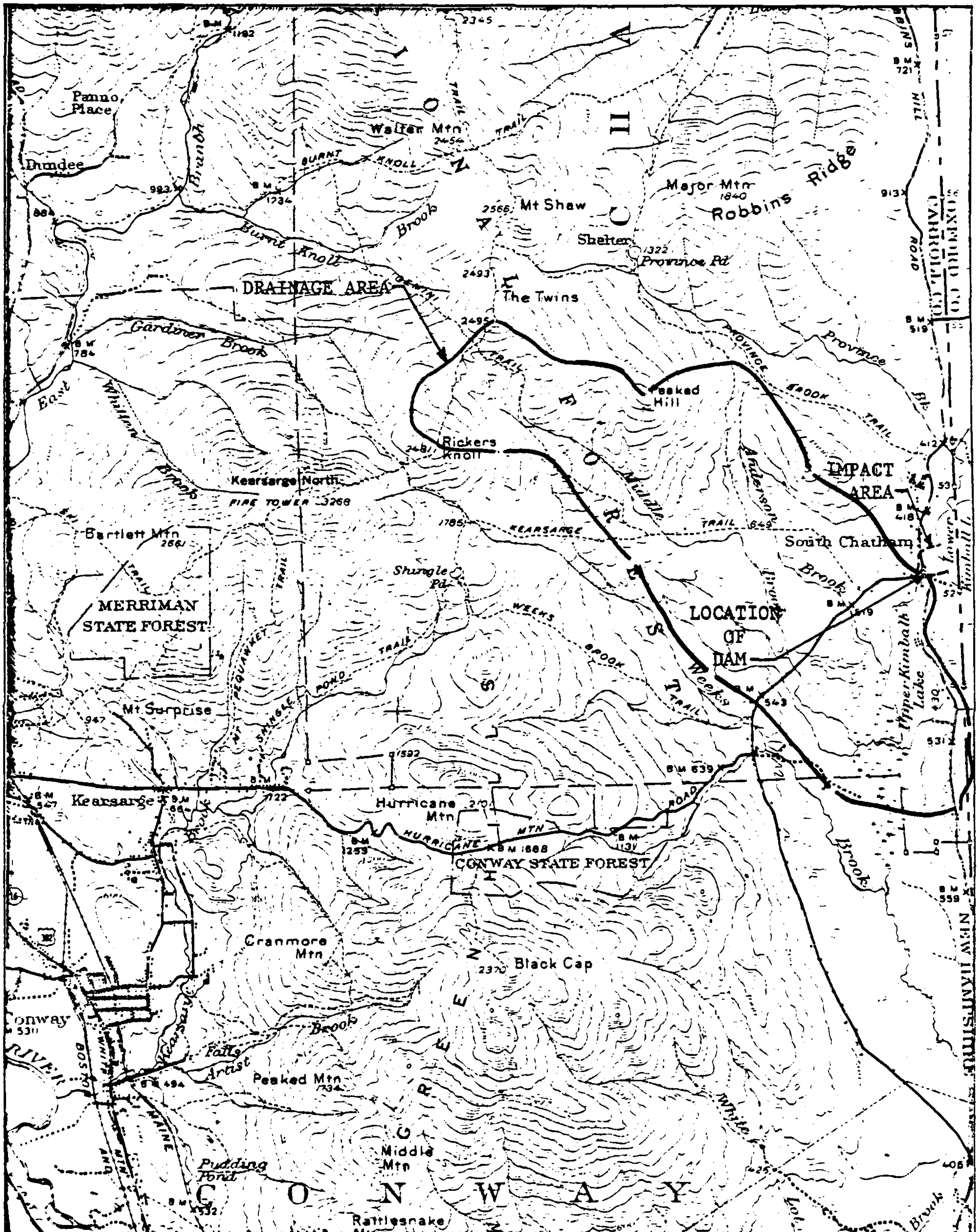
8. Overview of spillway showing upstream side

9. Downstream channel and roadway embankment with culvert

10. Unnamed brook downstream from roadway embankment

11. Overview of dam site looking upstream

APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS



UPPER KIMBALL POND DAM NH 00149		DRAINAGE AREA AND DAM FAILURE IMPACT AREA MAP APPROX. SCALE: 1"= 5200'

DRESSER & McKEE CLIENT HALEY & ALDRICH JOB NO. 561-10-RT-5 COMPUTED BY JED
PROJECT DAM INSP DATE CHECKED 1-2-80 DATE 12-28-79
DETAIL UPPER KIMBALL LAKE CHECKED BY Joe A. PAGE NO. 1

* ELEVATIONS (Local Datum)

T.o of Dam Elev. 99.7
Spillway Crest Elev. 95.2
Toe of Dam Elev. 89.5
Length of Dam: 230 ft.
Length of Spillway: 44 ft.
Outlet Works: 6 ft. wide concrete stop log bay
Inv. Elev. 90.5

* SURFACE AREAS

Drainage Area = 6.13 sq mi.

W.S. Area at spillway crest (El. 95.2) = 136 acres

Other surfaces areas can not be determined as most recent USGS Quad for North Conway is 1942 and dam was rebuilt in 1956 at a different spillway crest elevation

* STORAGE CAPACITIES

Normal Pool (Elev. 95.2) = 200 ac-ft.
Max. Pool (Elev. 99.7) = 800 ac-ft.

* Note: data reported by N.H. Water Resources Board (owner)

SIZE CLASSIFICATION

Height = 99.7 - 89.5 = 10.2 ft.

Storage at top of dam = 800 ac-ft.

∴ Size is SMALL

HAZARD CLASSIFICATION

Based on the results of the dam failure analysis, a failure would result in the potential loss of a few lives.

∴ Hazard Classification is SIGNIFICANT

TEST FLOOD DETERMINATION

For a small size and significant hazard, COE Guidelines give test flood range of 100-YR Flood (1/4 PMF) to 1/2 PMF (Probable Maximum Flood). Adopt 1/4 PMF for test flood.

The drainage area is MOUNTANOUS the upper regions and ROLLING in the lower portion. Because of the elongated shape of the watershed, use ROLLING.

Then test flood = 6.13 sq.mi x 1800 csm x 1/4 = 2760 cfs

STAGE - DISCHARGE RELATIONSHIPS

Spillway : 44 ft. long, "C" varies

Outlet Works : 6 ft. wide w/ stoplogs ; assume top of stoplogs = spillway crest during T.F., "C" = 3.3

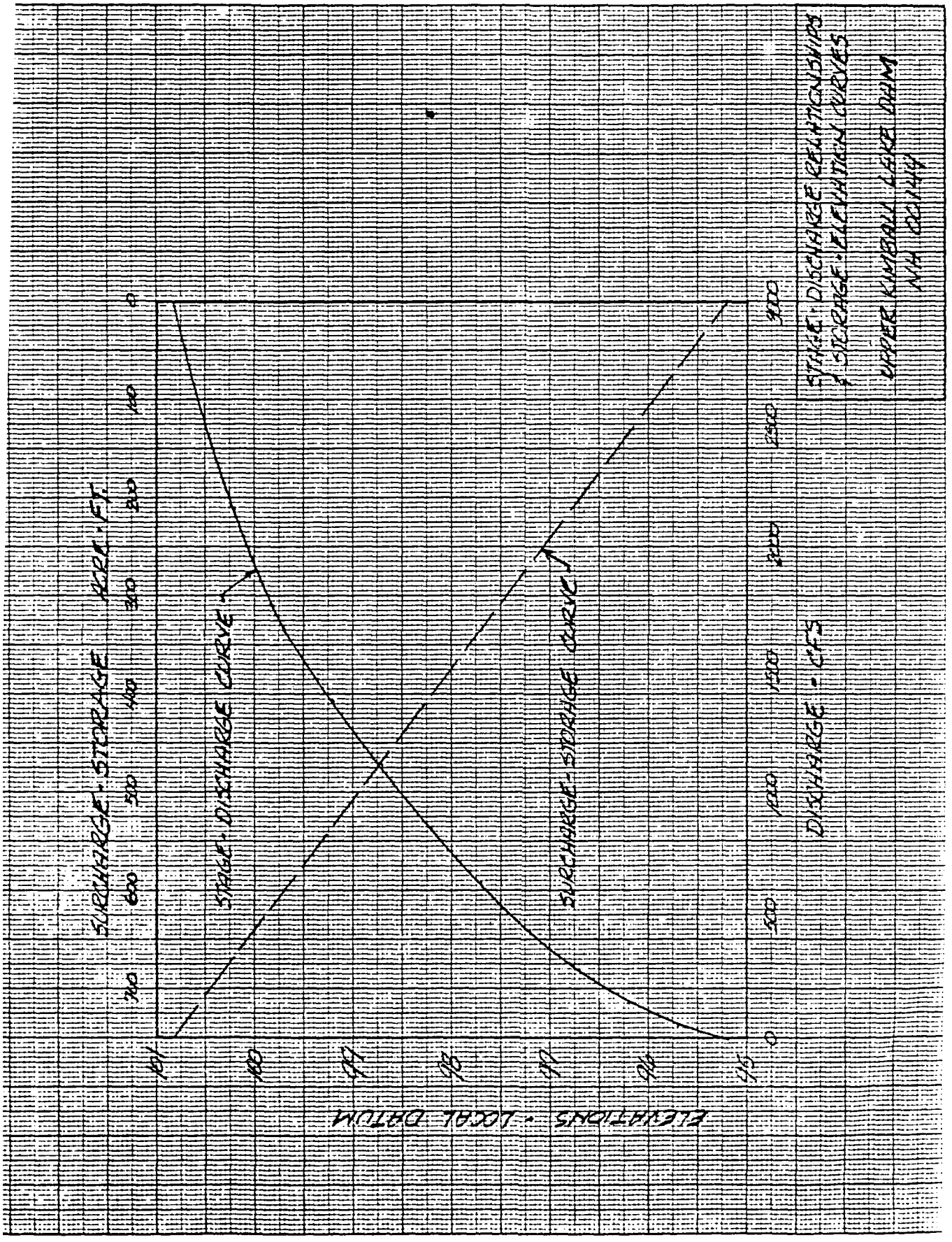
Earth Embankments : 180 ft. overflow length, "C" = 2.8

W.S. ELEV.	SPILLWAY "C"	SPILLWAY (cfs)	OUTLET WORKS (cfs)	EMBANKMENT (cfs)	TOTAL (cfs)
95.2	-	0	0	-	0
95.7	2.65	40	10	-	50
96.2	2.70	120	20	-	140
96.7	2.85	230	40	-	270
97.2	3.0	370	60	-	430
97.7	3.15	550	80	-	630
98.2	3.3	750	100	-	850
98.7	3.4	980	130	-	1110
99.2	3.45	1210	160	-	1370
99.7	3.5	1470	190	0	1660
100.2	3.55	1750	220	180	2150
100.7	3.6	2040	260	500	2800

SURCHARGE - STORAGE ROUTING

Test Flood Inflow = 2760 cfs = Q_{P_1}

Surcharge Height to pass Q_{P_1} = El. 100.67


STAGE - DISCHARGE RELATIONSHIPS
STORAGE - ELEVATION CURVES
UPPER KIMBALL LAKE DAM
MA COUNTY
DISCHARGE - CFS
ELEVATIONS - LOCAL DATUM
STAGE - DISCHARGE CURVE
DISCHARGE - STORAGE CURVE
DISCHARGE - STORAGE - ACRE - FT.

$STOR_1 = \frac{729 \text{ ac-ft} \times 12"/\text{ft}}{6.13 \text{ mi}^2 \times 640 \text{ ac/mi}^2} = 2.23"$

$Q_{P2} = Q_{P1}\left(1 - STOR/4.75"\right)$

$= 2760\left(1 - 2.23/4.75\right) = 1460 \text{ cfs}$

Surcharge = El. 99.4

$STOR_2 = \frac{560 \times 12}{6.13 \times 640} = 1.71"$

$STOR_{A_1} = \left(1.71 + 2.23\right)/2 = 1.97"$

$Q_{P3} = 2760\left(1 - 1.97/4.75\right) = 1620 \text{ cfs}$

Surcharge = El. 99.65

$STOR_3 = \frac{593 \times 12}{6.13 \times 640} = 1.81"$

$STOR_{A_2} = \left(1.81 + 1.97\right)/2 = 1.89"$

$Q_{P4} = 2760\left(1 - 1.89/4.75\right) = 1660 \text{ cfs}$

TEST FLOOD INFLOW = 2760 cfs
ROUTED TEST FLOOD OUTFLOW = 1660 cfs
TEST FLOOD ELEVATION = 99.7 (Top of Dam)

OUTLET WORKS

6 ft. concrete stop log bay, Inv. El. 90.5

1. capacity at spillway crest with all stop logs removed:
$Q = 3.3 \times 6 \times (4.7)^{1.5} = 200 \text{ cfs}$

2. capacity at top of dam with all stoplogs removed:
$Q = 3.3 \times 6 \times (9.2)^{1.5} = 550 \text{ cfs}$

3. capacity at top of dam with stoplogs at spillway crest elev.
$Q = 3.3 \times 6 \times (4.5)^{1.5} = 190 \text{ cfs}$

DAM FAILURE ANALYSIS

Top of Dam Elev. 99.7
Spillway Crest Elev. 95.2
Toe of Dam Elev. 89.5
∴ Height of dam = 99.7 - 89.5 = 10.2

Estimated mid-height length of dam = 100 ft. (including spillway)
Length @ top of dam (incl. spillway) = 230 ft.

Assume 40% of the mid-height length fails and that the failed section is to the right of the spillway abutment.

$$Q_{p_1} = 8/27\, W_b \sqrt{g}\, Y_o^{3/2}$$

$$= 8/27\,(0.4 \times 100)(32.2)^{.5}(10.2)^{1.5} = 2190 \text{ cfs}$$

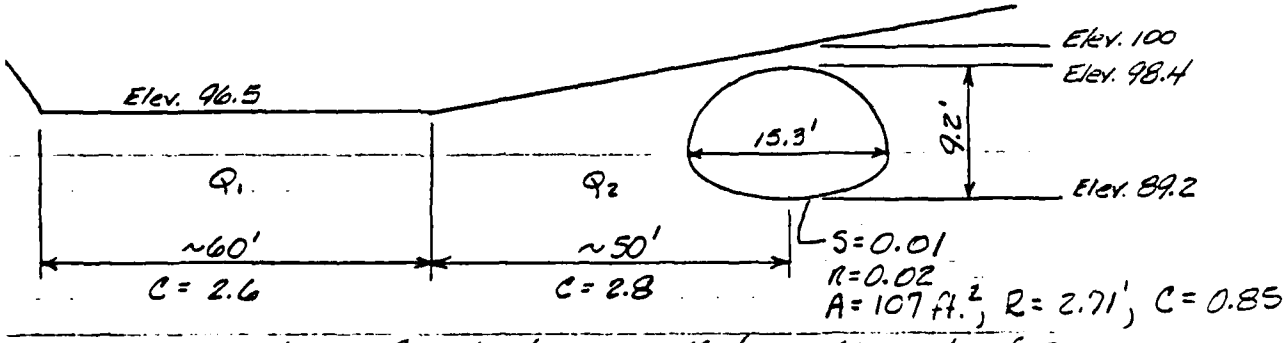
Project discharge at top of dam:

Spillway: "C" = 3.5; L = 44 ft.; H = 4.5 ft.; Outletworks: "C" = 3.3; L = 6'; H = 4.5'

$$= (3.5)(44)(4.5)^{1.5} + (3.3)(6)(4.5)^{1.5} = 1470 + 190 = 1660 \text{ cfs}$$

Combined discharge at failure = 1660 + 2190 = 3850 cfs

Approx. 75' d/s of dam is a road with a steel pipe arch 9'-2" x 15'-2"



Elevation of Culvert and Effective Weir D/S of Dam

W.S. ELEV.	CULVERT (cfs)	Q_1 (cfs)	Q_2 (cfs)	Q TOTAL
96.5	1550	0	0	1550 cfs
97.5	1660	160	10	1830 cfs
98.4	1550	410	130	2090 cfs
99.7	1770	890	280	2940 cfs
100.0	1820	1020	320	3160 cfs
102.0	2000	2010	1020	5030 cfs

Discharge prior to failure = 1660 cfs at d/s approx. backwater elev. 96.9. About 70 cfs would be overtopping the the left d/s channel bank and flowing overland and back into the channel. No apparent hazards would exist as a result of an overland flow of 70 cfs.

In the event of a dam failure, the failure outflow of 3850 cfs would the left d/s overbank by approx. 4 ft. resulting in an overland flow of about 1960 cfs.

A house located on the left bank of the channel, immeadiately d/s of the roadway, would be impacted by the est. 1960 cfs overland flow. No other existing development would appear to be in danger.

∴ Hazard Classification is "SIGNIFICANT"

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

NOT AVAILABLE AT THIS TIME

END

FILMED

8-85

DTIC