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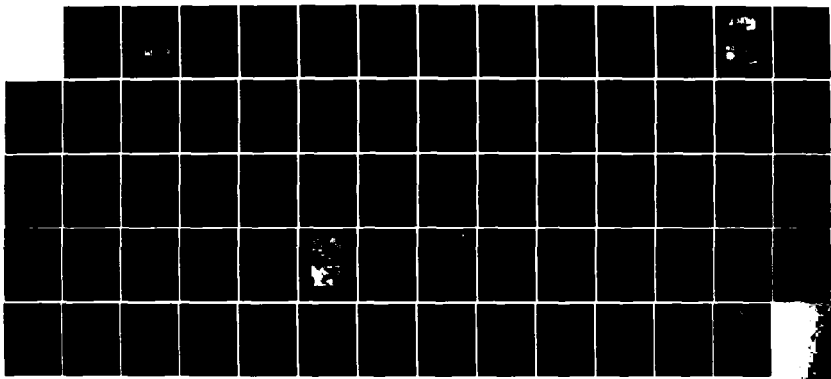
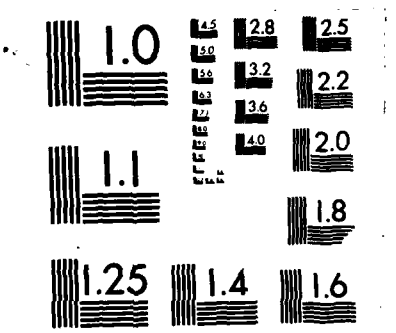




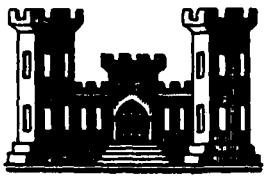
MERRIMACK RIVER BASIN
PITTSFIELD, NEW HAMPSHIRE

BERRY POND DAM

NH 00105

NHWRB 195.01

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

AUGUST 1978

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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)

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Merrimack River Basin
Pittsfield, New Hampshire
Tributary to Suncook River

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

The dam is an earthen embankment 185 ft. long and 12 ft.high, with a stop logged spillway. It is small in size with a low hazard classification. The dam's condition is rated as fair but deficiencies were found in freeboard, in emergency discharge provisions, and in draw-down capability. Intensified seepage monitoring should be done not less than once a week.

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

REPLY TO
ATTENTION OF:
NEDED

SEP 28 1978

Honorable Meldrim Thomson, Jr.
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Thomson:

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

A copy of this report has been forwarded to the 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, The Pittsfield Aqueduct Co., P. O. Box 186, Pittsfield, New Hampshire 03263.

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

Incl
As stated

BERRY POND DAM

NH 00105

MERRIMACK RIVER BASIN

PITTSFIELD, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No:	NH00105
NHWRB No:	195.01
Name of Dam:	BERRY POND
Town:	Pittsfield
County and State:	Merrimack County, New Hampshire
Stream:	Tributary to Suncook River
Date of Inspection	23 May 1978

BRIEF ASSESSMENT

Berry Pond Dam is an earth embankment 185 feet long and 12 feet high, with a stop-logged spillway, 11 feet wide and 7 feet high. The dam was superimposed in 1967 upon an earlier rock crib dam built in 1884. Three pipes penetrate the dam, two of which are abandoned. The operative pipe, a gated 8 in. line, regulates flow through a man-made channel to a downstream water supply reservoir for the Town of Pittsfield. Overflows are conducted in a natural stream to White's Pond, thence to the Suncook River below Pittsfield. A 1967 plan prepared by the N.H. Water Resources Board shows the then proposed reconstruction.

The drainage area is only 400 acres, heavily wooded, and the impoundment is 375 acre-feet. The dam's size classification is thus SMALL and its hazard potential is LOW since downstream damage would be minimal in the event of failure.

The dam's condition is rated as FAIR, but deficiencies were found in freeboard, in emergency discharge provisions, and in draw-down capability. Low volume seepage was observed both on the downstream slope, and at the toe alongside one of the abandoned pipes.

For a dam of these characteristics, a Spillway Test Flood (STF) of 140 cfs was selected which, with stop-logs in position, would overtop the dam by 0.3 feet; thus, failure could occur. However, if stop-logs were removed, the spillway capacity of over 500 cfs would be more than adequate, accenting the necessity for adequate warning and quick response time in emergencies.

It is recommended that: freeboard be improved, the most expeditious method being by removal of one or two stop-logs at the cost of some storage; the feasibility of improved draw-down facilities be investigated; increased emergency discharge capacity be provided near the right abutment; an investigation be made of installing a telemetry warning system, since power is available at the remote site; and that stand-by plans and specifications be prepared to immediately counter any future increase in turbidity or volume of seepage.

Operationally, intensified seepage monitoring should be done not less than once per week, readiness exercises to remove stop-logs should be conducted once per year, trees should be removed from the right abutment, and in the absence of telemetry a final sequenced operational and communciation plan involving downstream operations should be developed.

The above recommendations should be implemented within 1-2 years after receipt of the Phase I Inspection Report, consistent with the condition rating of FAIR. The alternatives to these recommendations would be reconstruction of the dam.

William S. Zoino, P.E.
New Hampshire Registration 3226

James H. Reynolds, P.E.
Mass. Registration 8044

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

Charles G. Tiersch

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

Fred J. Ravens Jr

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

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

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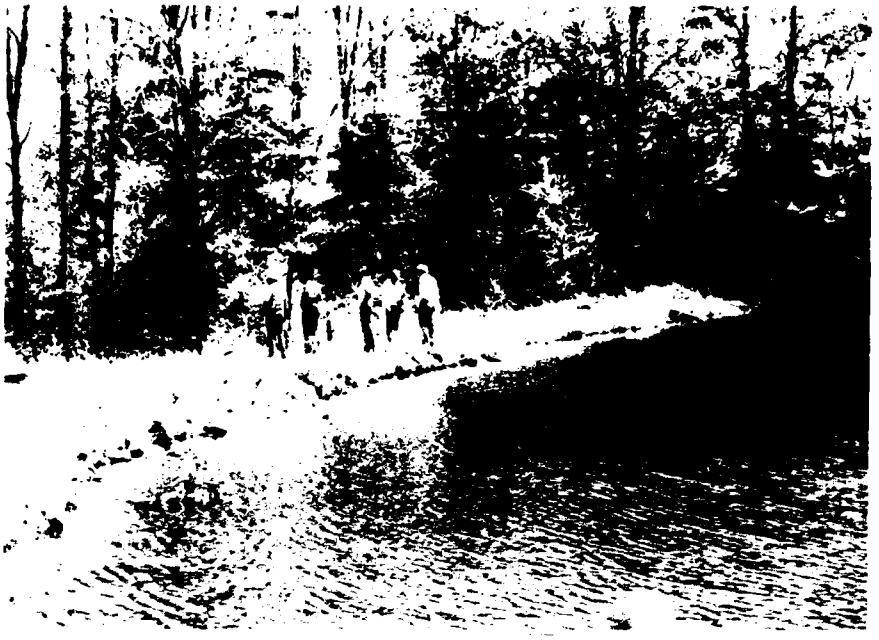


Overview from left abutment

Overview from right abutment

PHASE I INSPECTION REPORT

BERRY POND DAM, NH00105

NHWRB 195.01

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. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-73-C-0303 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) Update, verify, and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-Federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on conditions of the dams.

1.2 Description of Project

(a) Location

Berry Pond Dam is located in the Merrimack River Basin at the outlet of Berry Pond approximately 2½ miles southeast of Pittsfield. The locus is shown on the USGS Gilmanton, N.H. quadrangle, and the relation of the dam to other features in Pittsfield is shown in Figure 1 of Appendix B. Berry Brook flows from the dam to the Suncook River.

(b) Description of Dam and Appurtenances

The dam is an earth embankment 185 feet long, 12 feet high with an 11 foot wide concrete spillway with stop-logs and spanning walkway as may be seen in Figure 2, Appendix B. The dam is built upon an earlier double rock wall, earth filled dam, now serving as a core. Three pipes originally penetrated the dam two of which are now non-operative. The third, an 8 inch water line with hand-operated stem valve in the downstream slope controls the yield of the pond, an average of 200,000 gallons per day being discharged to the outlet channel. Downstream, the flow is diverted from the natural water course into a 12 inch concrete pipe and canal, then into a distribution reservoir, with overflows going to White's Pond, then into the Suncook River downstream of Pittsfield center.

(c) Size Classification

The 12 foot high dam impounds a maximum of 375 acre-feet and is thus classified as SMALL. The height and impoundment are well below the respective criteria of 25 feet and 1,000 acre-feet established by the "Guidelines" for that category.

(d) Hazard Classification

The dam is located in a rural and agricultural area, and its failure is not expected to cause serious damage or cause loss of life. Economic loss would be minimal, and the hazard potential is thus considered as LOW.

(e) Ownership

The dam is owned by the Pittsfield Aqueduct Company, which apparently was the original builder.

(f) Operator

The operator is Mr. Henry Stapleton, Secretary-Treasurer of the Pittsfield Aqueduct Company, P.O. Box 186, Pittsfield, NH, Telephone No. (603) 435-8549. Mr. Stapleton is the Post Master of Pittsfield, and the telephone of the Post Office is (603) 435-6281.

(g) Purpose of Dam

The dam is the primary water supply for the Town of Pittsfield, New Hampshire.

(h) Design and Construction History

The dam was constructed in 1884 in its original form, double rock wall, earth filled, and was reconstructed to its present configuration in 1967. The reconstruction included such improvements as raising and widening the embankment, provision of a new concrete spillway, stop-logs and extension of water line and drain lines beyond the new toe of slope.

(i) Normal Operational Procedures

Only relatively infrequent manipulation of the 8 inch valve is required to adjust flow. No need has ever arisen to draw down the dam, according to the operator. On one occasion, a downstream resident, Mrs. Norman Miner, noted rising water and notified the operator, Mr. Stapleton. The cause of the excess flow was quickly determined to be the unauthorized withdrawal of stop-logs by vandals. The normal operational condition was readily restored.

1.3 Pertinent Data

(a) Drainage Areas: 400 acres, very hilly, forested

(b) Discharge at Damsite - See Stage-Discharge Curve, Appendix D

(1) Outlet works (conduits) size: 8 inch diameter; invert elevation - Unknown

(2) Maximum known flood at damsite: Unknown

(3) Ungated spillway capacity at maximum pool elevation: (Stop-logs out) 550 cfs

(4) Gated spillway capacity at pool elevation: Not Applicable

(5) Gated spillway capacity at maximum pool elevation: Not Applicable

(6) Total spillway capacity at maximum pool elevation: Unknown

(c) Elevation (feet above MSL)

(1) Top Dam: 887.0 feet (Estimated average)

(2) Maximum pool design surcharge: Top of dam 887.0

(3) Full flood control pool: Not Applicable

(4) Normal Summer pool: 886.0 feet assumed normal pond level from USGS map

(5) Spillway crest (normal): 885.8 feet (Top of stop-logs)

(6) Upstream portal invert diversion tunnel: Not Applicable

(7) Streambed at centerline of dam: 875 feet (estimated)

(8) Maximum tailwater: Unknown

(d) Reservoir

(1) Length of maximum pool: About same as normal pool, length of 3500 feet

(2) Length of recreation pool: Not Applicable

(3) Length of flood control pool: Not Applicable

(e) Storage (acre feet) - See Storage Elevation Curve, Appendix D

(1) Normal pool: 301 acre feet

(2) Flood control pool: Not Applicable

(3) Design surcharge: Unknown

(4) Top of dam: 336 acre feet (Estimated as 301 + 35 x 1.0)

(f) Reservoir Surface (acres)

(1) Top Dam: 35 acres (approx.)

(2) Maximum Pool: (Top of dam) 35 acres(approx.)

(3) Flood Control Pool: Not Applicable

(4) Recreation Pool: Not Applicable

(5) Spillway Crest: 34 acres (approx.)

(g) Dam

(1) Type: Earth fill

(2) Length: 180 feet

(3) Height: 12 feet (estimate)

(4) Top Width: 12 feet average

(5) Side Slopes: Upstream - Varies, Downstream - 3:1

(6) Zoning: Gravel shell, reconstruction, see Appendix B

(7) Impervious Core: Type unknown

(8) Cutoff: Unknown

(9) Grout Curtain: Not Applicable

(10) Other: None

(i) Spillway

(1) Type: Peinforced concrete outlet structure

(2) Length of Weir: 10 feet 10 inches

(3) Crest Elevation: 880.0 feet (Permanent structure - not including stop-logs)

(4) Gates: See item 1.3(j) (5) below

(5) Upstream Channel: Approach from pond

(6) Downstream Channel: Narrow, irregular earth bottom channel for about 100 feet downstream of outlet, then well defined stream channel

(7) General: Also has remnants of old 10 feet wide emergency spillway which is no longer of much value

(j) Regulating Outlets

(1) Invert: 880.0 feet

(2) Size: 10 feet 10 inches long

(3) Description: Removable stop-log weir normally set at about elevation 886 feet

(4) Control Mechanism: Manual removal of stop-logs

(5) Other: 8 inch water line with control gage on downstream face is used to release water for use as municipal supply (See Appendix B)

SECTION 2 - ENGINEERING DATA

2.1 Design

Of the original 1884 dam upon which the present dam was superimposed, no design data exists beyond a primitive sketch from 1939, shown in Appendix B.

The reconstruction plans of 1967, also shown in Appendix B, reveal little about zoning or core materials, except for a gravel downstream shell. The drawings show a rather steep upstream slope, with no riprap, and only minimum free board.

2.2 Construction

No data exists on the original dam forming the core of the present structure, but to the best of the New Hampshire Water Resource Board's knowledge, the present dam was constructed under some supervision. However, little if any trace can be detected of what was to have been an emergency spillway on the right or southeast abutment.

2.3 Operation

Adequate information is available on the operation of the dam. It is controlled by the Pittsfield Aqueduct Company whose operator is Mr. Henry Stapleton. He is aware of the necessity of coordinating operations with the operator of the downstream dam, his brother John Stapleton. Operational objectives now focus on insuring a water supply of 200,000 gpd to 250,000 gpd.

2.4 Evaluation of Data

Prime data source is the 1967 reconstruction drawings of the Water Resources Board shown in Appendix B, which as noted, reveal little of the dam's composition or foundation. This information herein is necessarily drawn from earlier state inspection documents, sketches and correspondence, supplemented by the recent observations of the inspection team.

Thus, for the combined information from all sources affecting dam evaluation, the availability, adequacy, and the validity of the relatively sparse data can only be considered as fair; however, the visual inspection and the dam characteristics are considered as a satisfactory basis upon which to form an evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The general appearance of the dam was good, with a stable shoreline upstream of the dam. Some minor erosion less than 6 inches laterally was evident on the upstream face which is not riprapped. Two seepage points were noted on the downstream slope.

(b) Dam

The dam was reasonably tended with evidence of a continuing program of growth cutting, altnough several trees were standing at the right abutment area.

Two seepage areas were noted on the downstream slope of the earth dam. One seepage point is located 89 feet to the left of the concrete outlet box along the centerline of the earth embankment and approximately 25 feet downstream of and roughly 9 feet lower in elevation than the crest of the earth dam. Seepage was estimated at less than 0.05 gpm. A second seepage point was noted on the right abutment where the 10-inch outlet pipe exits on the slope. The seepage on the outside of the pipe is rust-colored and is estimated as less than 0.1 gallons per minute. It is understood that this outlet pipe has been plugged with concrete at its upstream end

With the exception of the two small seeps noted, the earth dike appears to be stable with no evidence of settlement or lateral movement.

(c) Appurtenant Structures

(1) Outlet Structure

As shown in the drawings of Appendix B, the outlet structure consists of a sluiceway type structure 10 ft-10 in. width with two 4 foot cut-off walls and a structural steel center support for accommodating two sections of timber stop-logs. The entire structure is constructed of reinforced concrete. The side walls have a top width of 8 inches and a back batter ratio of 4 in 12. The

bottom slab is 12 inches in thickness. The sluiceway is spanned by a 3-foot wide by 12-inch thick walkway, and stop-logs are in place.

Visual observations do not reveal any signs of cracks, spalls or efflourescence of concrete, which can thus be readily classified as being in excellent condition. The intermediate steel column support and stop-log slot angles are in good condition. Stop-logs, although submerged, appeared to be in good condition. Spare stop-logs were not in evidence on the dam site.

It should be noted that there is minor scour in evidence between the southwest approach wall and the northwest cutoff wall of the structure.

(2) Pipe Outlets

At the present time there are three pipes under the earth embankment consisting of 6-inch, 10-inch and 8-inch steel drains. The outlets of the 6-inch and 10-inch drains are visible in the channel bed. The outlet of the 8-inch drain is submerged. The inlets of all three drains are submerged. The 6-inch drain, the most easterly, has been completely sealed. The 10-inch drain, the center drain and illustrated as a 12-inch drain on the drawings, which is equipped with a non-operable gate valve, no longer functions. The 8-inch drain (the most westerly drain), is equipped with a non-rising stem gate valve and in-situ gate wrench. The purpose of this valve is to afford additional flow in the outlet brook without the removal of stop-logs. The opening and closing of this gate was successful without any major effort or inclination of any malfunction.

(d) Reservoir Area

As noted, the reservoir shore is stable and forested.

(e) Downstream Channel

Pooling backwater and marsh all exist at the toe of the embankment. The downstream channel, while reasonably free of vegetation and overhanging trees is constricted by the remnants of a former low concrete dam. The town's water supply intake, a 12 in. concrete

pipe, is placed directly in the stream bed at the ruined dam, but then immediately deflects to the north away from the stream proper.

3.2 Evaluation

The visual inspection is considered as having adequately revealed key characteristics of the dam as they may relate to its stability and integrity.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

Operations are essentially limited to adjusting the water supply gate to maintain average daily flow of up to o.25 mgd. On one known occasion stop-logs were mischievously removed, but rising water downstream prompted quick response and reinsertion.

4.2 Maintenance of Dam

Maintenance is fair, but the brush cutting operations could be expanded to include trees at the right abutment. Debris from a debilitated watering shelter was at the toe of slope.

4.3 Maintenance of Operating Facilities

While the drain valve is non-operative, the water supply valve appears to be satisfactorily maintained as are the stop-logs.

4.4 Warning System

The dam operator, Mr. Henry Stapleton, maintains close liaison with his brother, John Stapleton, the operator of the downstream White's Pond Dam. A resident near the crossing of Rt. 107 by Berry Pond Brook, alerts Henry Stapleton when the brook level becomes excessive.

4.5 Evaluation

In view of the characteristics of the dam and drainage area, the operational procedures are now adequate, but should be systematized and documented.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

(a) Design Data

The primary data sources available for the Berry Pond Dam are an "Inventory of Dams and Water Power Developments" by the New Hampshire Water Resources Board dated September 1934 and "Data on Dams and Reservoirs in New Hampshire" by the New Hampshire Water Resources Board dated April 1939. These sources contain basic data on the original dam and pond. The details of the current spillway stop-log weir are recorded on a design drawing from the New Hampshire Water Resources Board dated October 5, 1967.

An inspection of the dam in November 1977 by the New Hampshire Water Resources Board recommended several maintenance actions be taken on the part of the Pittsfield Aqueduct Company and a letter in the files indicates that the corrective actions were taken in February, 1978.

The dam serves as a water supply reservoir for the Town of Pittsfield which draws up to 250,000 gpd (0.39 cfs) through an 8-inch diameter pipe serving Pittsfield. There is no known operating policy to lower the pond elevation at the time of a flood.

(b) Experience Data

No recorded data on experienced peak floods is known to be available for Berry Pond Dam.

(c) Visual Observations

As noted earlier the dam is an earthen dike 185 feet in length with a concrete sluice containing stop-logs. To the east of the sluice is a depressed area that was intended to serve as an emergency spillway. It is about 6 inches below the average crest elevation and approximately 20 feet wide.

The stop-logs are normally maintained at a height of 5.5 feet above the bottom of the sluice. The normal pond elevation is 1 or 2 inches above the top of the stop-logs. The dam operates with only about 0.75 feet of freeboard between the normal pond elevation and the

emergency spillway, and the spillway only allows for 0.5 to 1.0 feet of flow before most of the embankment is overtopped.

The drainage area feeding the pond is approximately 400 acres (0.625 sq.mi.), and the normal pond surface area is approximately 35 acres. The pertinent hydraulic and hydrologic data for the dam are summarized in Appendix D.

(d) Overtopping Potential

The hydrologic conditions of interest in this Phase I investigation are those that are required to assess the adequacy of dam in terms of its overtopping potential and its ability to safely allow an appropriately large flood to pass. This involves investigations to determine how the recommended Spillway Test Flood (STF) compares with the dam discharge and storage capacities. None of the original hydraulic and hydrologic design records were available for use in this study.

Spillway Test Flood guidelines based on the size and hazard potential classifications of the dam are specified in the "Recommended Guidelines". For a dam classified as SMALL in size with a LOW hazard potential, an appropriate STF would be between the 50-year and 100-year peak flows. The magnitude of the 100-year peak flow has been evaluated by three methods as discussed in Appendix D. The peak flow recommended for use as the Spillway Test Flood is based on an assumed 4 inches of runoff in 12 hours with a triangular-shaped hydrograph. The recommended flow is 260 cfs into the pond.

The 100-year peak flow was utilized as the STF since the hazard condition is considered to be on the upper end of the LOW range.

When the 260 cfs peak was adjusted to account for surcharge storage the resulting STD equals 140 cfs. This reduction was done in accordance with the procedure suggested by the Corps of Engineers (NED) for "Estimating the Effect of Surcharge Storage on Maximum Probable Discharges.: The Storage-Stage curve included in Appendix D was developed assuming linear storage vs. elevation relation increasing as the product of the pond area of 35 acres, and the head above the stop-log crest.

The discharge capacity of Berry Pond Dam is dependent on the level of the lake and the condition of the emergency spillway. Presently the emergency spillway is in a state of disrepair and is in need of maintenance and clearing. For this analysis the stop-logs were assumed to be left in place at an elevation 1.5 feet below the average crest. The emergency spillway was considered as a gap 20 feet wide and 0.5 feet lower than the average dam crest. The space between the top of the stop-logs and the concrete beam across the sluice structure was set at 0.5 feet. Initially the sluice acts as a sharp crested weir but once the concrete beam is surcharged this gap behaves as an underflow sluice gate. The Discharge-Stage curve contained in Appendix D illustrates the various stages of flow that occurs as the pond level rises. When depth above stop-logs crest (H) is less than 0.5 feet, the sluice provides a weir 10.8 feet wide. For a depth above stop-logs between 0.5 and 1.0 feet, the sluice acts as a underflow gate 10.8 feet wide and 0.5 feet deep. When H is between 1.0 and 1.5 feet, the emergency spillway provides a very rapid increase in flow with minimal change in head. When H is greater than 1.5 feet the entire crest of the dam starts spilling like a weir.

The resulting stage for a discharge of 140 cfs would be 1.78 feet, or almost 0.3 feet above the overtopping elevation of 1.50 feet. The condition of the dam crest is rough and irregular although it is assumed level at H=1.5 feet in the analysis. Similarly the emergency spillway is an irregular swale that was approximated by a 20 feet wide, 0.5 feet deep gap. The analysis indicates that the dam would be overtopped, the severity being highly dependent on the amount of growth or rubble on the emergency spillway.

5.2 Hydraulic/Hydrologic Evaluation

The results of the hydraulic and hydrologic assessment of Berry Pond Dam indicate that overtopping would be likely to occur with a storm of less than a 100-year magnitude. Thus there is better than a 1 percent chance of overtopping in any given year. Given that the dam serves as the water supply source for the community of Pittsfield, additional precautions should be taken to prevent failure. The recommended solution would be to upgrade the emergency spillway to a level elevation approximately 0.5 feet above the normal pond elevation and wide enough to pass the STF in the event the sluice opening becomes blocked with trash. In addition any other low spots in the dam crest should be filled to insure that all flow is directed to the emergency spillway which should be constructed with a permanent bottom to prevent failure at that point.

5.3 Downstream Dam Failure Hazard Estimates

The flood hazards in downstream areas that would result from a failure of the dam were estimated through the use of the procedure set forth in "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs," Corps of Engineers, New England Division, April, 1978. This procedure allows the attenuation of dam failure hydrographs to be accounted for in computing flows and flooding depths in downstream areas. These calculations take into account the hydraulic and storage characteristics of the stream reaches downstream of the dam.

For the purposes of these calculations, it was assumed that failure of the dam would occur as soon as the crest of the dam at an average elevation of 887 feet is overtopped. This corresponds to a height of about 12 feet above the stream bed.

Berry Pond Brook downstream of the dam was divided into two reaches for the flood hazard determinations. The first reach extends about 4000 feet from the dam to the Route 107 crossing. The second reach extends about 4500 feet from Route 107 to the White's Pond Inlet. Both reaches are steeply sloping mountain streams.

The results of the calculations indicate little attenuation of the peak flows in the stream and an average depth of flow of about 5.7 feet in the first reach. Damage potential in reach one would be limited to a possible threat to one building and to failure of the roadway crossings at the road to Berry Pond and at Route 107.

In reach two there would be a slight increase in flooding depth to about 6.3 feet because of more moderate stream slopes. This reach flows through completely undeveloped terrain with no buildings or roads to be damaged.

At White's Pond, it is anticipated that the calculated reach two peak inflow depth of 6.3 feet would be significantly attenuated in passing through storage in White's Pond. The increase in pond stage due to the sudden inflow would result in a corresponding increase in outflow over the dam and dike. Although this inflow could contribute to the overtopping of these dams, the magnitude of the increase would be considerably less than the 6.3 feet depth of the inflow.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

There are no design calculations available for review of the structural stability of the dam and appurtenant structures. However, the extensive investigations and finding do not indicate any displacement and/or distress which would warrant the preparation of structural stability calculations based on assumed physical properties and technical values. The dam is now stable, but deficiencies described under Section 7 should be corrected.

(b) Design and Construction Data

According to the "Inventory of Dams in the U.S.A." dated March 12, 1974, the original dam was completed in 1884. In 1967 the dam crest elevation was increased by 2 (two) feet and a new outlet structure constructed. Design calculations for this new outlet structure are not available. A copy of the design drawing is enclosed in Appendix B.

(c) Operating Records

Not available

(d) Post Construction Changes

Unknown

(e) Seismic Stability

Seismic Zone 2 - Not Applicable

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The condition of Berry Pond Dam is FAIR, but it is deficient in freeboard criteria as recommended by the American Society of Civil Engineers (ASCE), and as adopted by the Bureau of Reclamation. The persistent but low volume seepage represents no immediate danger but must be diligently monitored.

The dam is now stable, with no serious indication of threat.

(b) Adequacy of Information

The known characteristics of the dam, its drainage area and areas downstream are such as to indicate that the information now available is an adequate base upon which to form evaluations.

(c) Urgency

Improvements described herein should be initiated in the near term, within 1 to 2 years after the receipt by the owner of the Phase I Inspection Report.

(d) Need for Additional Information

At this time, there is no evident need for additional information.

7.2 Recommendations

The dam's freeboard of less than 2 feet is deficient by the ASCE criteria, and protection should be improved. At the cost of some loss of storage, this could most expeditiously be done by removing a few stop-logs. In the long term, if the crest is to be raised, then any restored slope must be suitably rip-rapped.

Increased emergency discharge capacity should be provided, desirably through formal construction of a well defined protected channel at the right abutment.

Investigation should be made of improved drawdown facilities to supplement the 8 inch water supply line which is inadequate for this purpose.

In view of the remoteness of the dam, and of the availability of power at the site, investigation should be made of the feasibility of installing telemetry at the site, to serve as an automatic warning system with a terminal at a permanently manned station.

Stand-by plans and specifications should be prepared for expeditious implementation if current seepage seriously increases in turbidity or volume.

7.3 Remedial Measures

(a) Alternatives

Unless improved emergency discharge capacity can be provided and the impoundment drawn-down to provide flood storage and adequate freeboard, the dam should be reconstructed.

(b) O & M Procedures

(1) Monitoring of seepage sources should be intensified to not less than one visit per week, with particular attention being given to any changes in turbidity or volume.

(2) Readiness exercises in emergency removal of stop-logs should be conducted at least once per year.

(3) No remedial measures are required at the outlet structure at the present time, other than clearing of debris.

(4) Trees should be removed from the right abutment in the area of the ill-defined emergency spillway.

(5) A definite schedule of preventive maintenance items should be developed by the owners and submitted to the New Hampshire Water Resources Board for review and comment.

(6) A formal sequenced operational plan for emergencies involving downstream dam operators should be developed and submitted to the New Hampshire Water Resources Board for review and comment. In the absence of remote sensing through telemetry, the procedure should include a communications plan, permitting prompt warning and response.

APPENDIX A

CHECK LISTS FOR VISUAL INSPECTION

INSPECTION TEAM ORGANIZATION

Date: 23 May 1978 - 1:30 P.M.
NH00105
BERRY POND
Pittsfield, New Hampshire
Suncook River
NHWRB 195.11

Weather: Sunny, warm

Inspection Team

James H. Reynolds	Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZDA)	Team Captain
William S. Zoino	GZDA	Soils
Nicholas A. Campagna	GZDA	Soils
Andrew Christo	Andrew Christo Engineers, Inc.	Structural & Concrete
Paul Razgha	Andrew Christo Engineers, Inc.	Structural & Mech.
Richard L. Laramie	Resource Analysis, Inc.	Hydrology

State Official

Gary Kerr, New Hampshire Water Resources Board

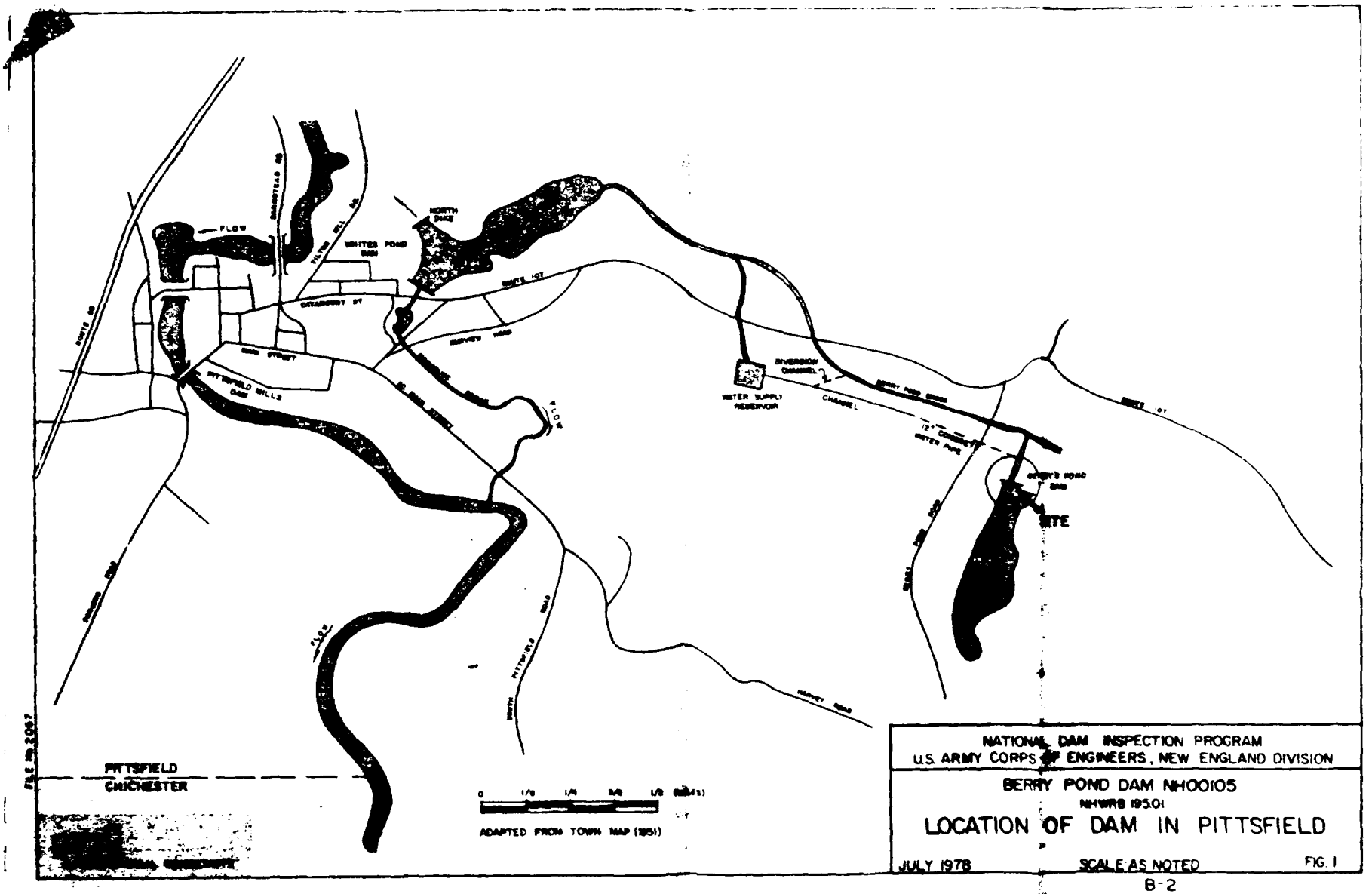
Owners Representative

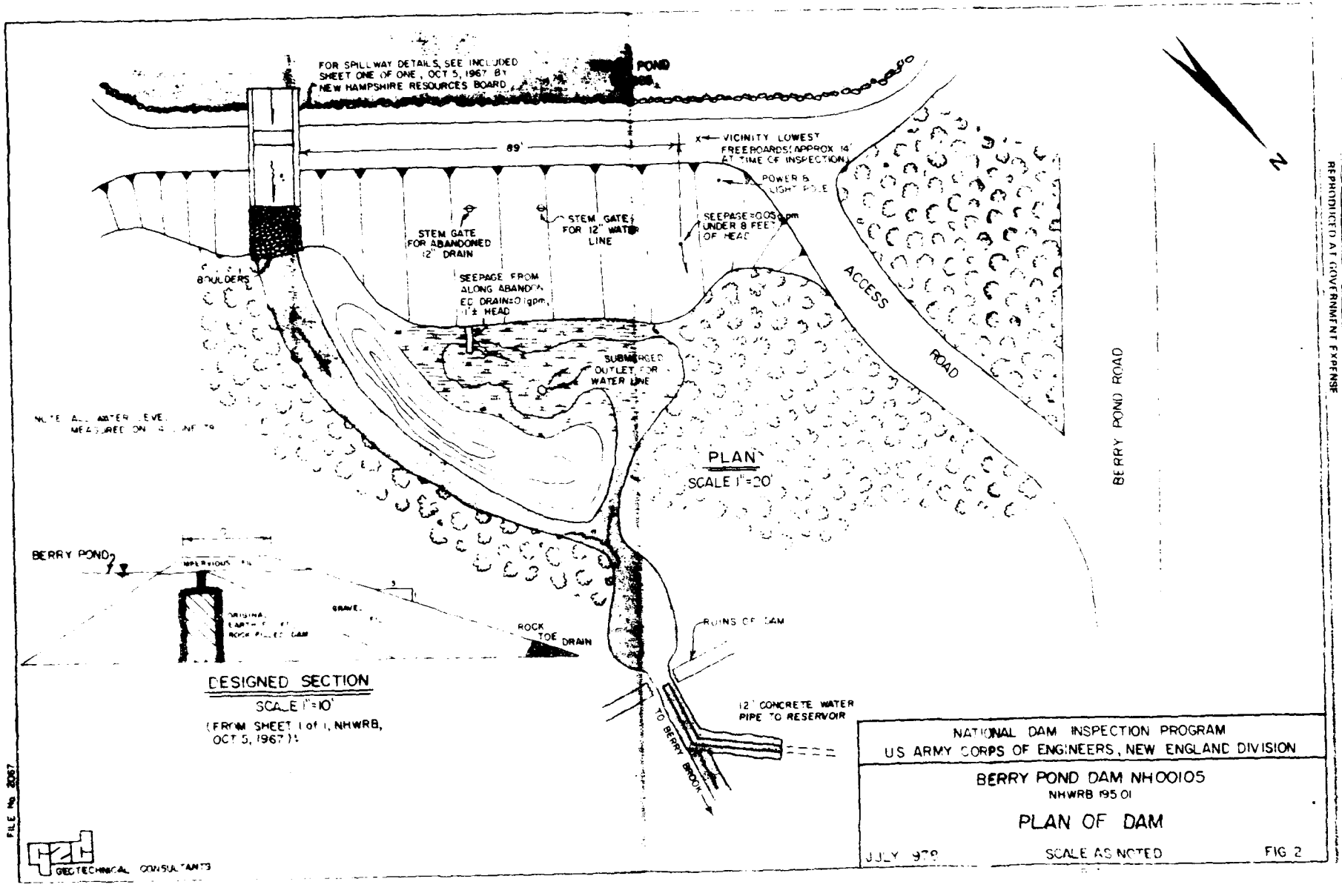
Henry F. Stapleton, Pittsfield Aqueduct Company

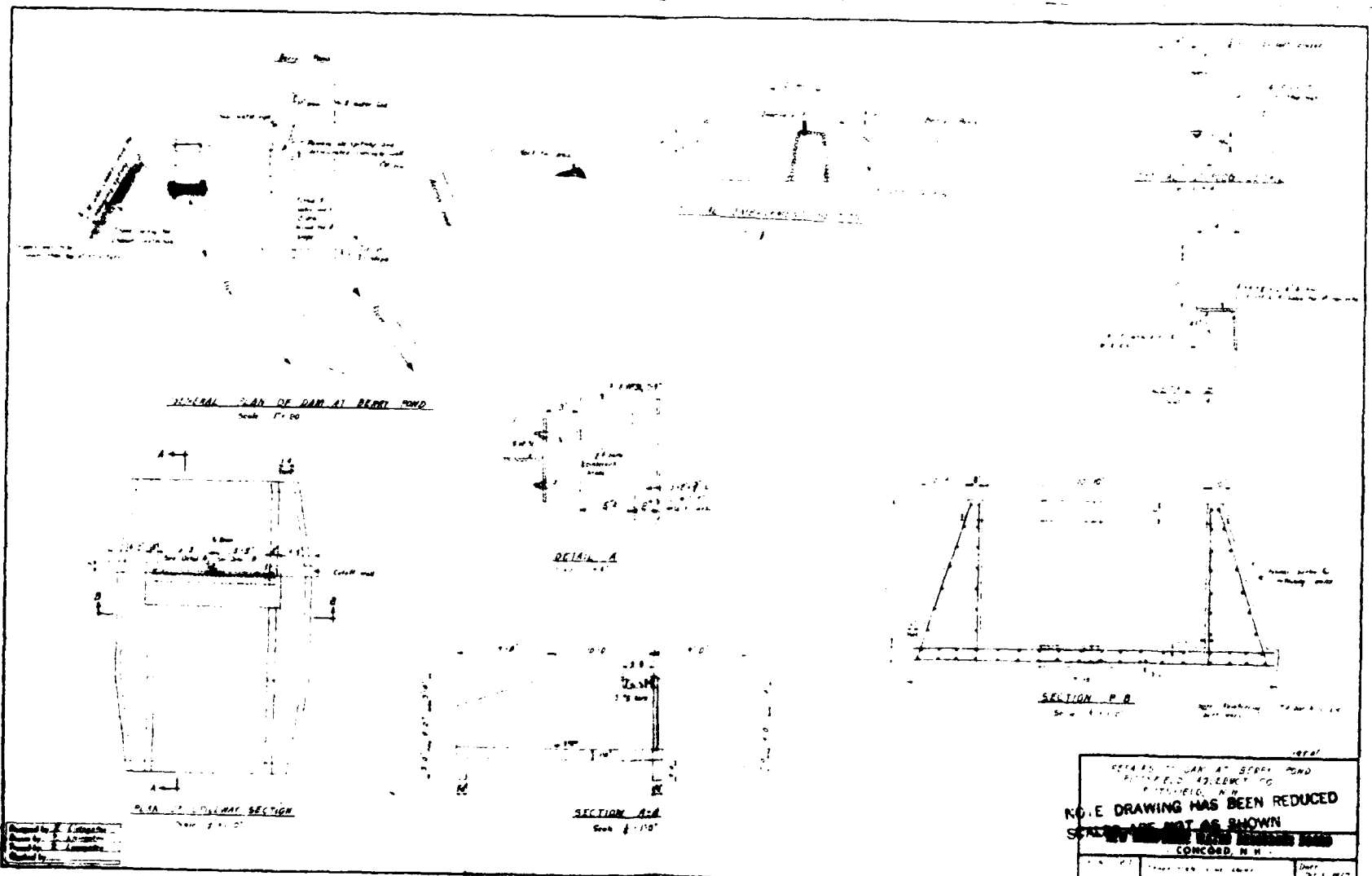
TEAM MEMBERS CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION
DAM EMBANKMENT		
Surface Cracks	MAC	None
Movement or Settlement of Crest		None
Lateral Movement		None
Vertical Alignment		Good
Condition at Abutment and at Concrete Structures		Good - slight erosion at spillway walls
Indications of Movement of Structural Items on Slopes		None
Trespassing on Slopes	AKR	Moderate
Sloughing or Erosion of Slopes or Abutments		Moderate erosion, 6" at upstream run-up zone
Rock Slope Protection - Riprap Failures		No riprap
Unusual Movement or Cracking at or near Toes		None
Unusual Embankment or Downstream Seepage		(a) Seepage, 89' left of spillway wall 25' downstream of crest, less than .05 gpm. (b) Seepage, rusty, along abandoned area drain pipe- approx. .1 gpm
Piping or Boils		None
Toe Drains		Submerged in back water

TEAM MEMBERS CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION
OUTLET STRUCTURE		
General Condition of Concrete		Excellent
Rust or Staining		None
Spalling		None
Visible Reinforcing		None
Seepage or Efflorescence		None
Cracks		None
Weep Holes		Non existent
Obstructions		None
Stop-Logs Including Supports		Good
Spare Stop-Logs		Not in evidence on the dam site
8-INCH DRAIN OUTLET		
Operating Condition of Valve		Good, without any major effort
Pipe Inlet		Submerged, not visible
Pipe Outlet		Submerged, not visible
OUTLET CHANNEL		
Obstructions		Channel partially obstructed by ruins of concrete dam 300 ft. downstream

Appendix B


FLOW
WHITES POND DAM
NORTH DIKE
ROUTE 20
ROUTE 107
PITTSFIELD MILLS DAM
MAIN STREET
RIVERSIDE CHANNEL
WATER SUPPLY RESERVOIR
CHANNEL
BERRY POND DAM
SITE
SOUTH PITTSFIELD ROAD
PITTSFIELD
CHICHESTER
0 1/8 1/4 3/8 1/2 (Miles)
ADAPTED FROM TOWN MAP (1951)
NATIONAL DAM INSPECTION PROGRAM
U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION
BERRY POND DAM NH00105
NHWRB 195.01
LOCATION OF DAM IN PITTSFIELD
JULY 1978
SCALE AS NOTED
FIG. 1


FOR SPILLWAY DETAILS, SEE INCLUDED SHEET ONE OF ONE, OCT 5, 1967 BY NEW HAMPSHIRE RESOURCES BOARD
POND
89'
VICINITY LOWEST FREEBOARDS (APPROX 14' AT TIME OF INSPECTION)
POWER & LIGHT POLE
STEM GATE FOR ABANDONED 12" DRAIN
STEM GATE FOR 12" WATER LINE
SEEPAGE=.005 gpm UNDER 8 FEET OF HEAD
BOULDERS
SEEPAGE FROM ALONG ABANDONED DRAIN=0 (gpm) ± HEAD
SUBMERGED OUTLET FOR WATER LINE
ACCESS ROAD
BERRY POND ROAD
N
PLAN
SCALE 1"=20'
BERRY POND
IMPERVIOUS FILL
ORIGINAL EARTH DAM
GRAVEL
ROCK TOE DRAIN
RUINS OF DAM
12" CONCRETE WATER PIPE TO RESERVOIR
TO BERRY BROOK
DESIGNED SECTION
SCALE 1"=10'
(FROM SHEET 1 of 1, NHWRB, OCT 5, 1967)
GEOTECHNICAL CONSULTANTS
FILE No. 2067
NATIONAL DAM INSPECTION PROGRAM
US ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION
BERRY POND DAM NH00105
NHWRB 195.01
PLAN OF DAM
JULY 978
SCALE AS NOTED
FIG. 2
REPRODUCED AT GOVERNMENT EXPENSE



HAMPSHIRE
R RESOURCES
JARD
RD, N. H.

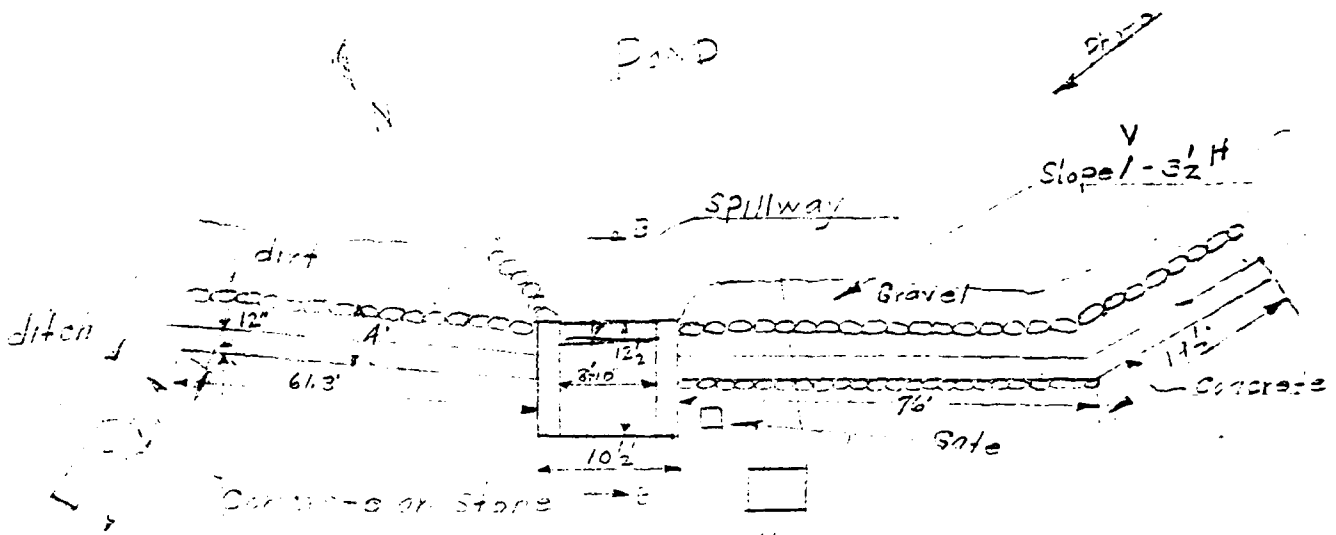
PROJECT

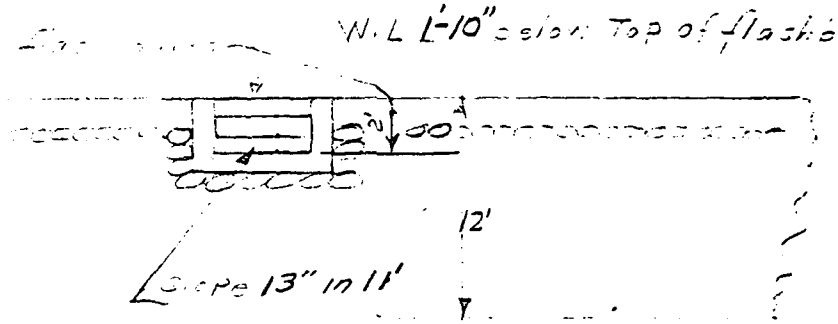
FILE 195.01

SUBJECT

ACC

COMPUTER CHECKER CONT. FROM ACC. CONT. ON ACC. SUMMARY ON ACC. DATE 7/11/30





The following is a list of records which are on file at the New Hampshire Water Resources Board in Concord, New Hampshire and are not included in this report:

(a) New Hampshire Water Resources Board Inspection Report, November 28, 1977

(b) New Hampshire Water Control Commission Report on Dam Inspection, August 14, 1950

(c) New Hampshire Water Control Commission Data on Reservoirs and Ponds in New Hampshire, August 11, 1939

(d) New Hampshire Water Control Commission Data on Dams in New Hampshire, April 28, 1939

(e) New Hampshire Water Control Commission Data on Reservoirs and Ponds in New Hampshire, August 11, 1939

(f) Memorandum-Report, S.J. Lord to New Hampshire Public Service Commission, June 10, 1932

PITTSFIELD AQUEDUCT COMPANY

P.O. BOX 186, PITTSFIELD, NEW HAMPSHIRE 03263

Phone (603) 435-8549
Postoffice 435-6281

CEDRIC H. DUSTIN, JR., President

HENRY F. STAPLETON Secretary-Treasurer

February 25, 1978

Mr. George M. McGee, Sr.
N. H. Water Resources Board
37 Pleasant Street
Concord, New Hampshire 03301

Dear Mr. McGee:

With reference to your letter in regard to the inspection of dam #195.01 at Berry Pond and maintained by this company, please be advised that action has been taken on both noted items. The debris noted on the stoplog has been removed from the top of the spillway outlet and the remainder will be removed after the ice is out of the pond.

Some of the debris that had collected on the concrete sluicway had been removed prior to cold weather and the remainder will be completely removed as soon as the snow is gone and we can get down to it.

Hope that this will meet with your approval.

Sincerely,

Henry F. Stapleton

Henry F. Stapleton
Secretary - Treasurer

State of New Hampshire

WATER RESOURCES BOARD

CONCORD

January 9, 1978

Pittsfield Aquaduct Co.
c/o Robert S. Charron, Chairman
Board of Selectmen
Town Hall
Pittsfield, NH 03263

Dear Mr. Charron:

Your Board's dam under the provisions of RSA Chapter 482, Sections 8 through 15, copy enclosed, was inspected on the 28th of November 1977 by an engineer of the New Hampshire Water Resources Board. This dam (#195.01) Berry Pond) is classifiedin the files of this office as a menace structure because of its location upstream of populated areas. As such, it must be maintained in a manner not to endanger public safety nor become a dam in disrepair.

As a result of this inspection it is noted that a couple of items of maintenance or repair are in need of attention and so listed here:

1) Debris on the stoplog (spillway outlet) section should be removed as it restricts flow from the pond. This structure has less than a foot of freeboard which therefore requires careful monitoring of the pond level. This dam structure is not the type which coulc withstand an appreciable flow over the earthern dike, and therefore must be operated to prevent that occurring.

2) There is also debris collected on the concrete sluiceway and should be removed to restore the flow characteristics.

Because this dam is classified as a menace structure, we require a schedule of your proposed repairs within a month's time. If you have any questions, please contact us at your convenience.

Very truly yours,

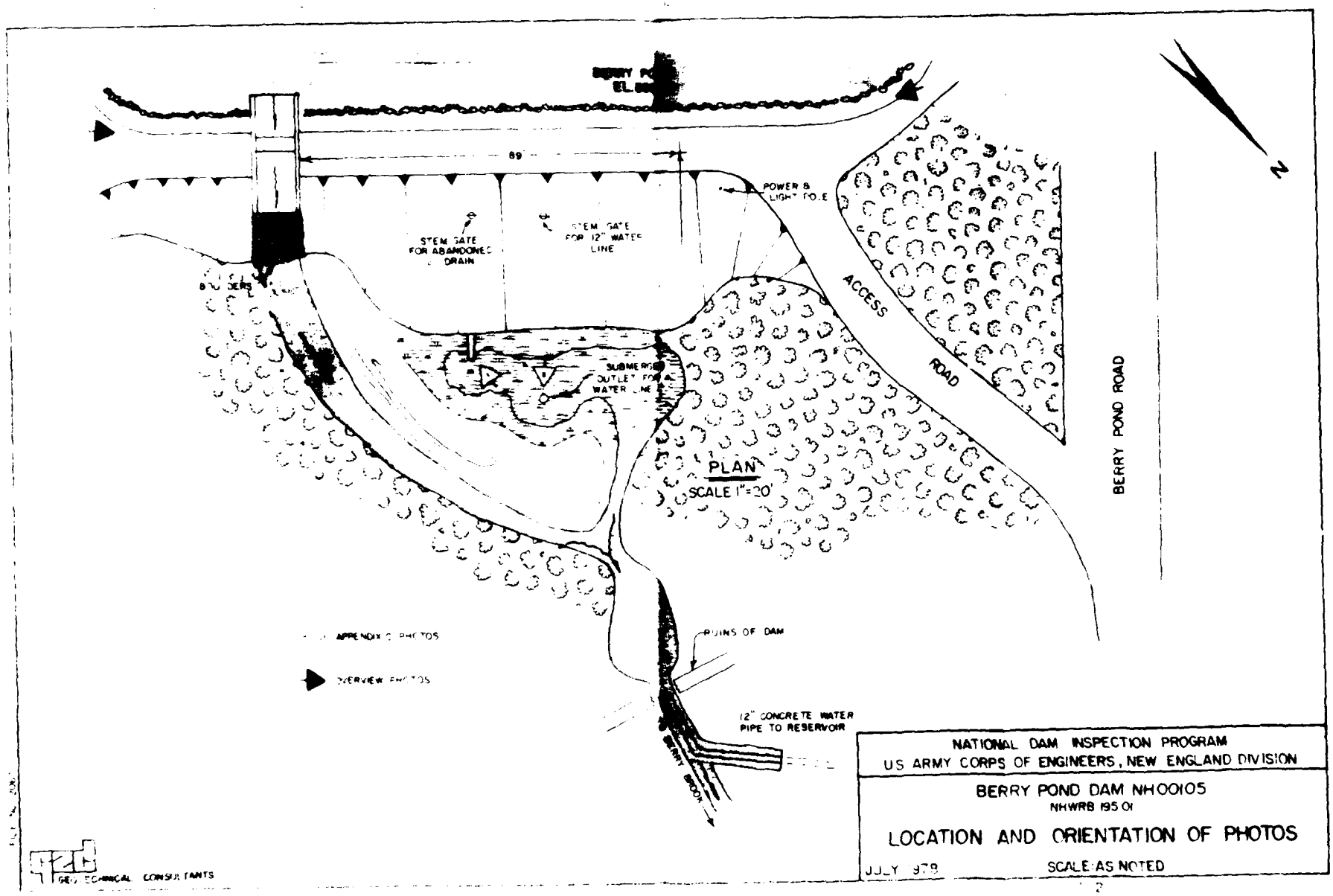
George M. McGee, Sr.
Chairman

GMMG:GK:njk

Enc.

APPENDIX C

SELECTED PHOTOGRAPHS



NATIONAL DAM INSPECTION PROGRAM
US ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION

BERRY POND DAM NH00105
NHWRB 195.01

LOCATION AND ORIENTATION OF PHOTOS

JULY 979 SCALE: AS NOTED

TECHNICAL CONSULTANTS

1. Seepage alongside abandoned outlet pipe looking downstream

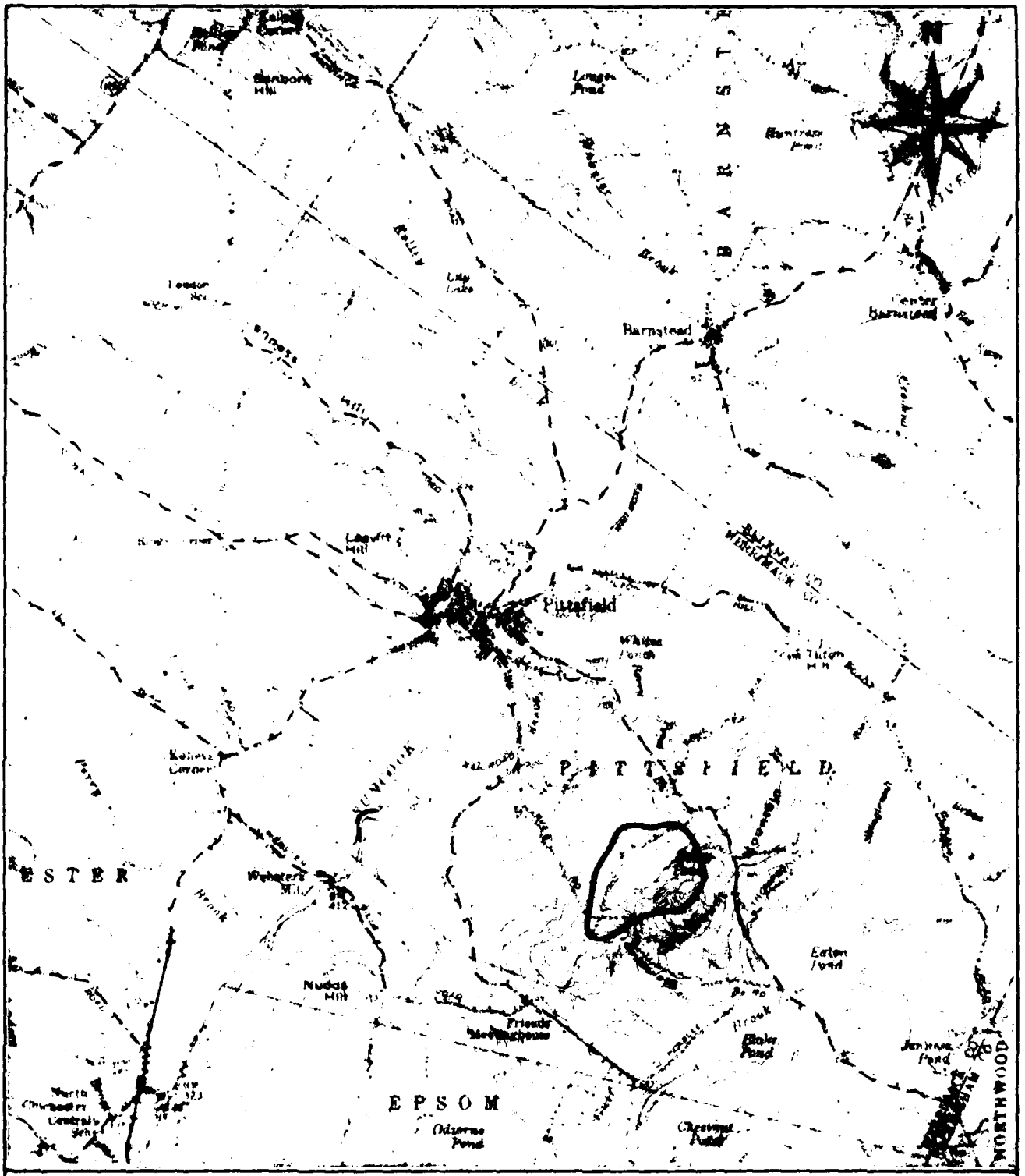
2. Outlet channel showing discharge of silt-laden water upon opening of outlet gate

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

FOR

BERRY POND DAM



- SCALE -

0 1/2 1 1-1/2 2 miles

FROM: USGS GILMANTON, N.H. QUADRANGLE MAP

GEOTECHNICAL CONSULTANTS

NATIONAL DAM INSPECTION PROGRAM
U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION

BERRY POND DAM NH00105
NHWRB 195.01
DRAINAGE AREA

JULY 1978

FILE No. 2067

DAMS 148 BERRY POND # 6 6-27-78 DWood 1 of 15

SIZE CLASSIFICATION = SMALL

HAZARD CLASSIFICATION = LOW

- NO SIGNIFICANT DEVELOPMENT IN AREA IMMEDIATELY DOWN STREAM OF BERRY'S POND WHERE POND LIES BETWEEN BERRY'S AND HAZARD AREA.

SPILLWAY DESIGN FLOOD: 50 YR TO 100 YR FREQ.

TO DETERMINE 50 AND 100 YR FLOWS WE'LL USE LEBLANC'S REGRESSION EQN'S, USGS SPECIAL REP. INVEST 76-77

AREA = 400 ACRES = .625 SQMI

SLOPE = 1" TRIAL LENGTH
EL. AT .1" = 850
EL. AT .85" = 1010 $\frac{1010-850}{.85-.1}$ 165 ft/mi

RAINFALL INDEX: I = 2.8" USED FOR SYNOPSIS CASE 08955 IN REGRESSION

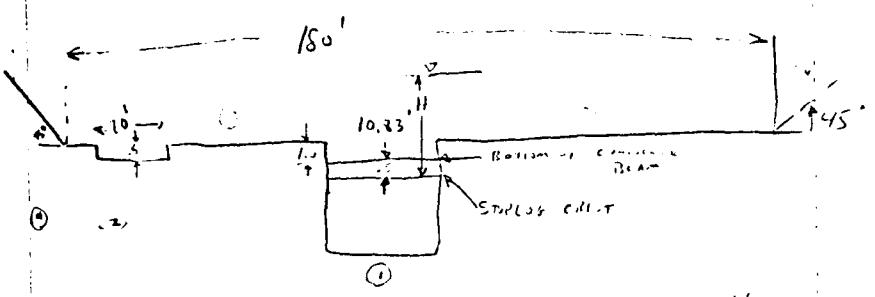
$$P_{50} = .62 A^{1.05} S^{.54} I^{2.50} = .62(.625)^{1.05}(165)^{.54}(2.8)^{2.5}$$

$P_{50} = 78$ cfs

$$P_{100} = .55 A^{1.05} S^{.56} I^{2.72} = 0.55(.625)^{1.05}\ 165^{.56}\ 2.8^{2.72}$$

$\therefore P_{100} = 96$ cfs

The accuracy of the LeBlanc formulation for DA < 1 sqmi is debatable as a check the Rational Formula should be used:



USE [illegible] FOR BOTTOM FOR [illegible]

$H < .5'$ $\quad Q = C_1(10.83)H_1^{3/2}$

$.5 < H < 1.0$ $\quad Q_1 = L\left[\frac{C_2}{\sqrt{1+C_2\omega/\gamma_1}}\right]\omega\sqrt{2\gamma_1} = 10.83\left[\frac{.61}{\sqrt{1+.61(.5)/H}}\right].5\sqrt{2(32)(H)}$

$1.0 < H < 1.5$ $\quad Q = Q_1 + C_3 L_3 H_3^{3/2} = 10.83\left[\frac{.61}{\sqrt{1+.61(.5)/H}}\right].5\sqrt{2gH} + 2.6(1)(H-.60)^{3/2}$

$H > 1.5$ $\quad Q = Q_1 + C_2 L_2 H_2^{3/2} + C_3 L_3 H_3^{3/2} + C_4 L_4 H_4^{3/2}$

$$Q = 10.83\left[\frac{.61}{\sqrt{1+.61(.5)/H}}\right].5\sqrt{2gH} + 2.6(1)(H-.60)^{3/2} + 2.8(1)(H-.60)^{3/2}$$
$$+2.8\left[2(H-1.5)\right].5(H-1.5)^{3/2}$$

Time of concentration ≈ 1 hour

1 hour - 100 year rainfall = 2.4"

$C \approx 0.3$

$Q_{100} = CIA = 0.3(2.4)(400 \text{ acres})$

$Q = 288$ cfs

Another method is to estimate the runoff from 100 year event at ≈ 4.0"

$4"/12 \times .62 \text{ sq mi} \times 640 \text{ acres/sq mi} = 132 \text{ ac-ft}$

$= 1597.2 \text{ cfs-hrs}$

Assume a triangular hydrograph with a base of 12 hours.

Area of triangle = $\frac{1}{2} BH$

$1597.2 \text{ cfs-hrs} = \frac{1}{2}(12)(H)$

$H = 266.2$ cfs

For the STF we will use 260 cfs from 4" of runoff.

```
LIST
100 REM STAGE DISCHARGE CALC FOR BERRYS POND DAM JOB 148LIST
110 PAGE
120 C1=3
130 C2=2.8
140 E=1.5
150 PRINT "TOTAL DISCHARGE FROM BERRYS POND DAM AS FUNC OF HEAD"
160 PRINT USING 170:
170 IMAGE // 2T"HEAD"30T"DISCHARGE"
180 PRINT USING 190:
190 IMAGE 10T"TOTAL    Q1       Q2       Q3      Q4    "
200 FOR H=0.3 TO 1.7 STEP 0.05
210 Q1=C1*10.83*H↑E
220 Q2=0
230 Q3=0
240 Q4=0
250 IF H<=0.5 THEN 320
260 Q1=10.83*(0.61/(1+0.61*0.5/H)↑0.5)*0.5*(2*32*H)↑0.5
270 IF H<=1 THEN 320
280 Q2=C2*20*(H-1)↑E
290 IF H<=1.5 THEN 320
300 Q3=C2*160*(H-1.5)↑E
310 Q4=C2*(2*(H-1.5))*(0.5*(H-1.5))↑E
320 Q7=Q1+Q2+Q3+Q4
330 PRINT USING 340:H,Q7,Q1,Q2,Q3,Q4
340 IMAGE 2T,2D.2D,8D,8D,8D,8D,8D
350 NEXT H
360 END
```

TOTAL DISCHARGE FROM BERRYS POND DAM AS FUNC OF HEAD

HEAD	DISCHARGE				
	TOTAL	Q1	Q2	Q3	Q4
0.30	5	5	0	0	0
0.35	7	7	0	0	0
0.40	8	8	0	0	0
0.45	10	10	0	0	0
0.50	11	11	0	0	0
0.55	16	16	0	0	0
0.60	17	17	0	0	0
0.65	18	18	0	0	0
0.70	18	18	0	0	0
0.75	19	19	0	0	0
0.80	20	20	0	0	0
0.85	21	21	0	0	0
0.90	22	22	0	0	0
0.95	22	22	0	0	0
1.00	23	23	0	0	0
1.05	24	24	1	0	0
1.10	26	25	2	0	0
1.15	28	25	3	0	0
1.20	31	26	5	0	0
1.25	33	26	7	0	0
1.30	36	27	9	0	0
1.35	39	28	12	0	0
1.40	42	28	14	0	0
1.45	46	29	17	0	0
1.50	49	30	20	0	0
1.55	58	30	23	5	0
1.60	71	31	26	14	0
1.65	87	31	29	26	0
1.70	105	32	33	40	0

TOTAL DISCHARGE FROM BERRYS POND DAM AS FUNC OF HEAD

HEAD	DISCHARGE				
	TOTAL	Q1	Q2	Q3	Q4
1.75	125	32	36	56	0
1.80	147	33	40	74	0
1.85	170	33	44	93	0
1.90	195	34	48	113	0
1.95	222	34	52	135	0
2.00	250	35	56	158	0
2.05	279	35	60	183	0
2.10	309	36	65	208	1
2.15	341	36	69	235	1
2.20	374	37	74	262	1
2.25	407	37	78	291	1
2.30	442	38	83	321	1
2.35	478	38	88	351	1
2.40	515	39	93	383	2
2.45	553	39	98	415	2
2.50	592	39	103	448	2

DAMS 148 | BERRY POND #6 | 6-27-78 DW Wood | 5/15

STORAGE - STAGE RELATIONSHIP

SURFACE AREA OF POND AT NORMAL POOL = 35 ACRES

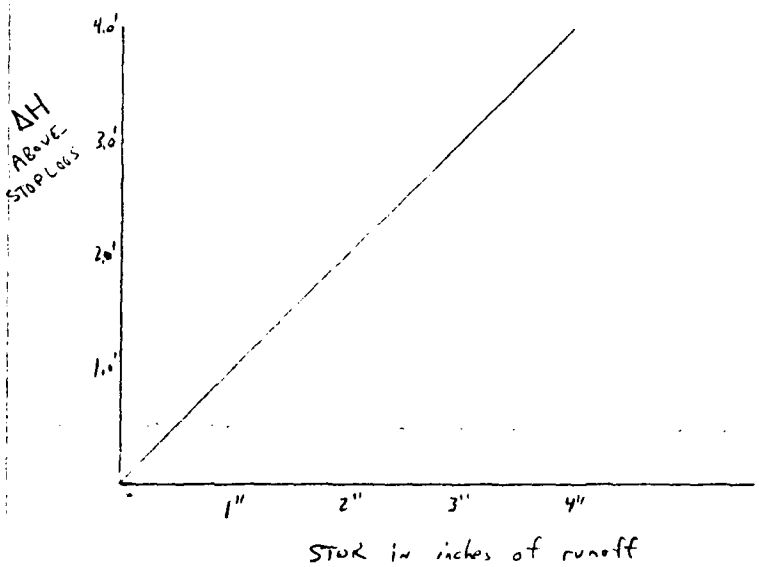
35 ACRES = .054688 sq mi

1 inch of runoff would cause:

$\frac{400}{35}$ = 11.43" rise in water surface

1 foot of rise is equivalent to 1.05" of runoff

use 1' x 1" of runoff



DAMS 148 | BERRY POND #6 | 6-29-78 DWW 6 of 15

REDUCTION IN FLOW DUE TO STORAGE

FOR 260 cfs, $H \approx 7.02$

FT OF HEAD EQUATES TO $2.02 \times 1'' = 2.02''$ OF RUNOFF

$$Q_{P_2} = Q_{P_1} \times \left(1 - \frac{STOR_1}{4}\right)$$

$$Q_{P_2} = 260\left(1 - \frac{2.02}{4}\right) = 128.7 \text{ cfs}$$

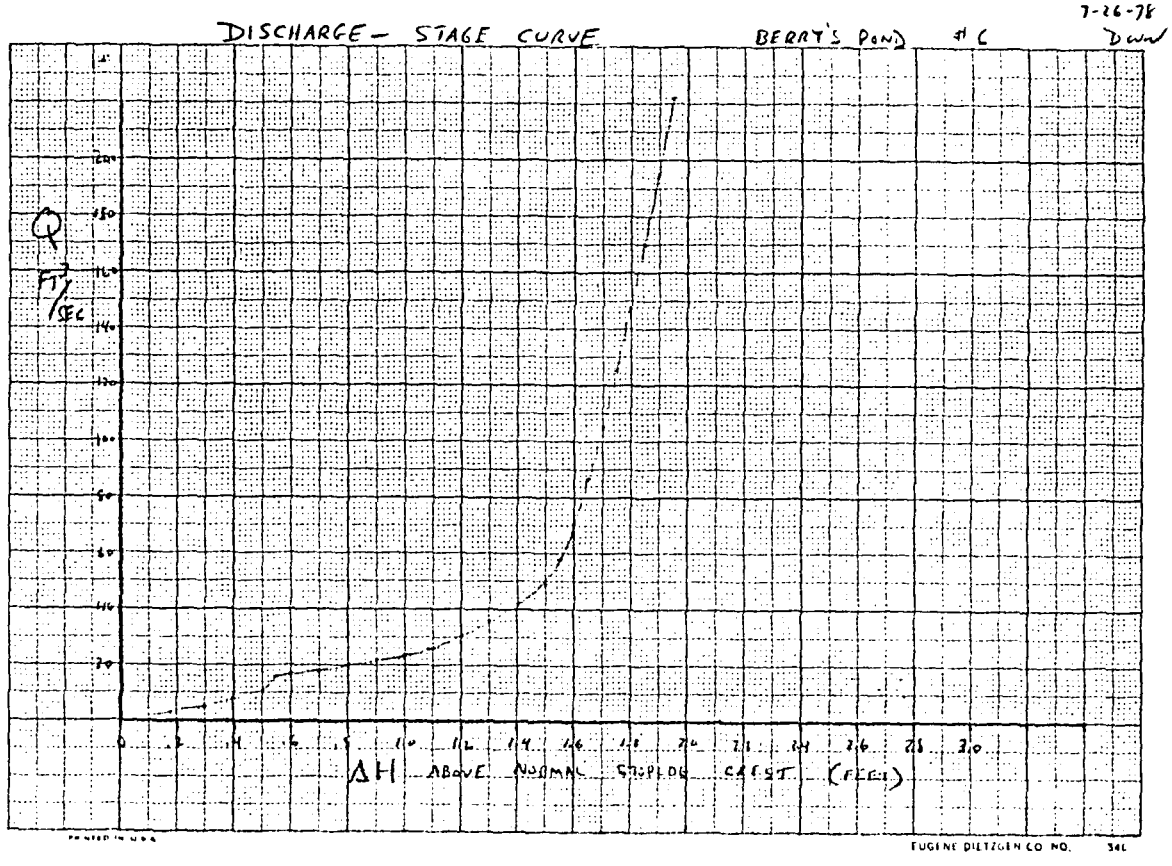
128.7 cfs requires $H \approx 1.76$

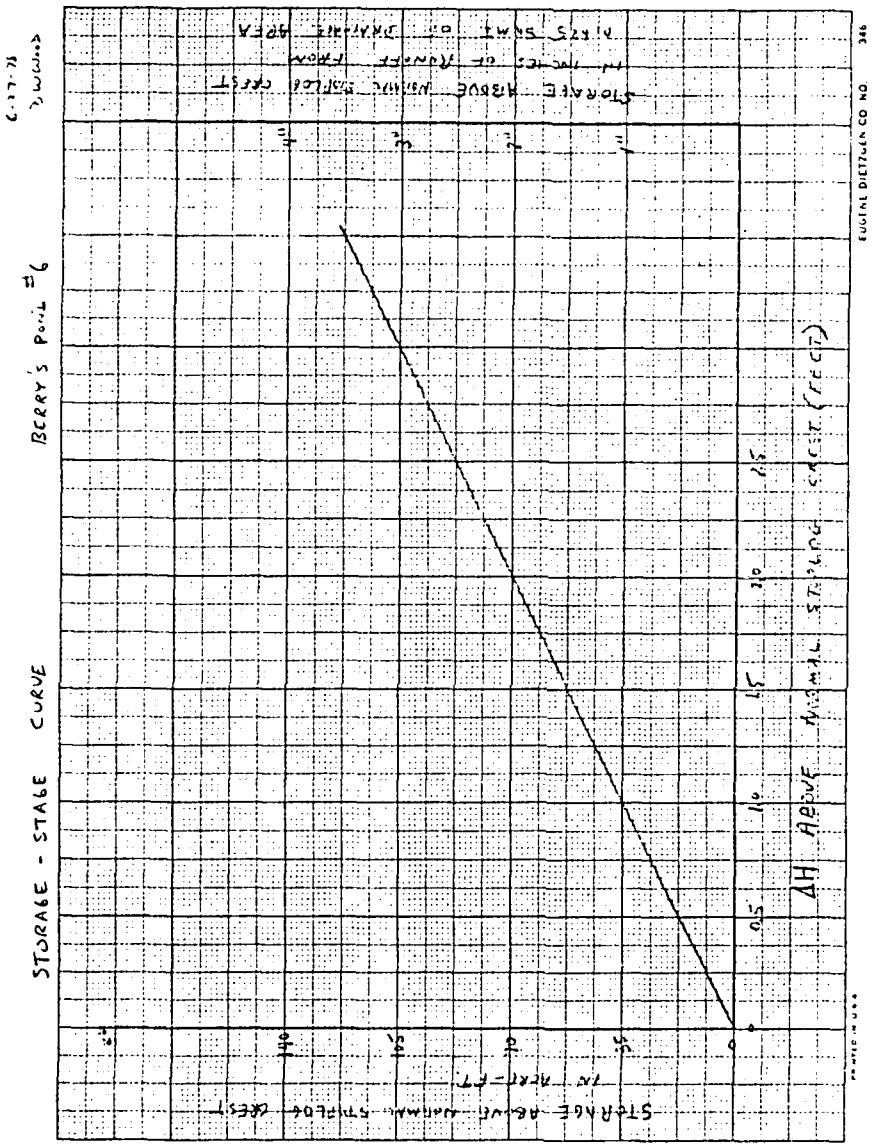
$STOR_2 = 1.76 \times 1'' = 1.76''$

AVG STOR = $\frac{2.02 + 1.76}{2} = 1.89$

$$Q_{P_3} = 260\left(1 - \frac{1.89}{4}\right) = 137.2 \approx 140 \text{ cfs}$$

Thus the STF results in a $H \approx 1.78$ FT
This is ≈ 0.3 above the overtopping stage


DISCHARGE – STAGE CURVE
BERRY'S POND #C
7-26-78
DWW
Q
FT³/SEC
ΔH ABOVE NORMAL STAGE OF CREST (FEET)
EUGENE DIETZGEN CO NO. 340


STORAGE - STAGE CURVE
BERRY'S POND
STORAGE ABOVE MINIMUM SPILLWAY CREST
IN ACRE-FT
ΔH ABOVE MINIMAL STAGING CREST (FEET)
EUGENE DIETZGEN CO NO 346

BERRY POND DAM

RLL
29 JUNE 78 Page 10 of 15

CALCULATION OF ESTIMATED DOWNSTREAM DAM FAILURE FLOOD STAGES
— BASED ON COE "RULE OF THUMB" GUIDANCE APRIL 77?

STEP 1 RESERVOIR STORAGE (S) AT TIME OF FAILURE

ASSUME: FAILURE WHEN DAM CREST AT ELEV 887' IS OVERTOPPED SINCE DAM IS OF EARTHFILL CONSTRUCTION.

$S = 336$ AF @ 887'.

STEP 2. PEAK FAILURE OUTFLOW (QP1)

$QP1 = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$

WHERE W_b = BREACH WIDTH = 40% OF LENGTH

$= 0.4(180') = 72'$

$g = 32.2$

Y_o = POND HEIGHT ABOVE STREAMBED AT FAILURE

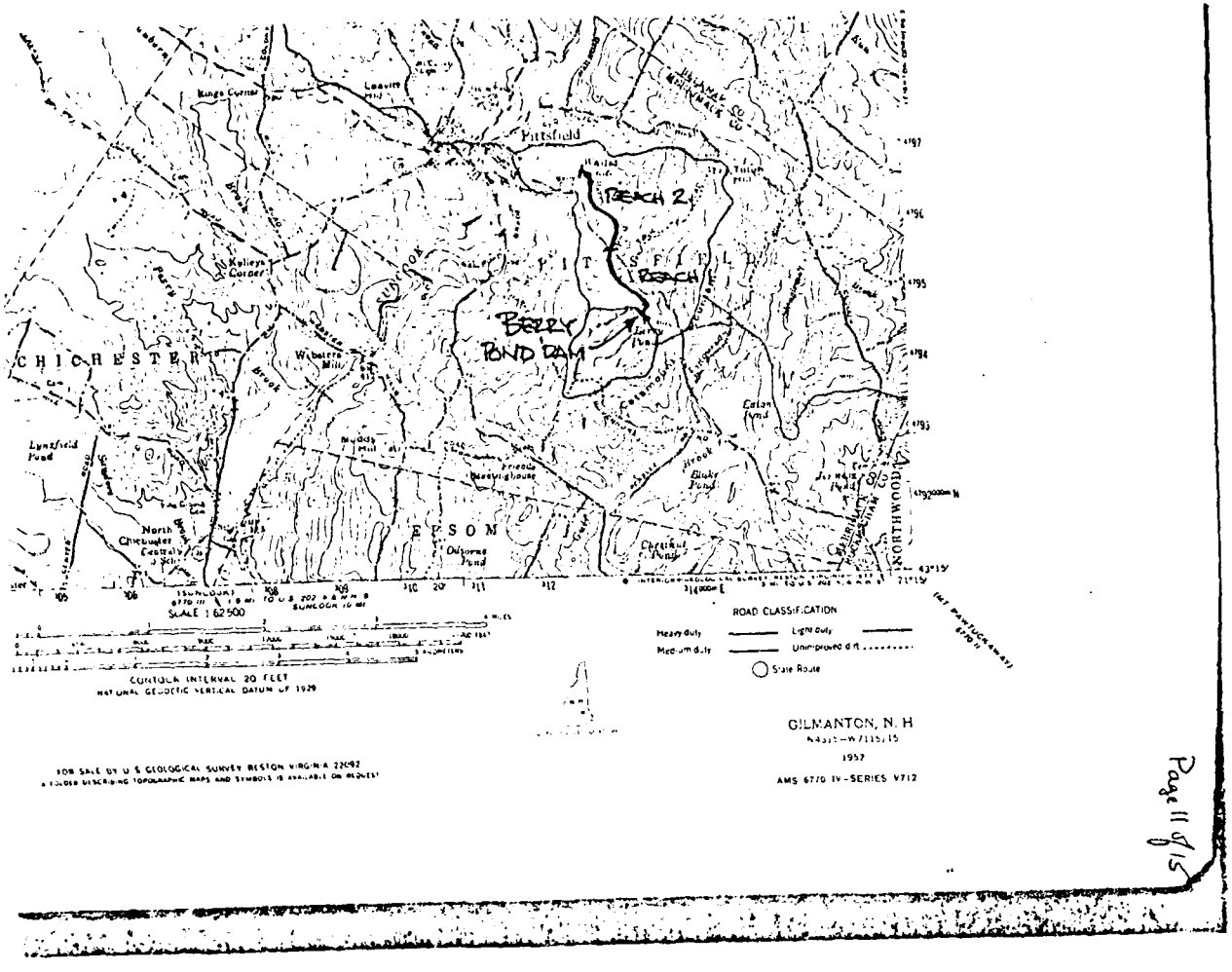
$= 887. - 875' = 12'$

$\therefore QP1 = \frac{8}{27}(72)\sqrt{32.2}(12)^{3/2} = 5030$ cfs

STEP 3 STAGE DISCHARGE RATINGS FOR DOWNSTREAM REACHES

ASSUMED CROSS SECTIONS FOR DS REACHES SHOWN ON USGS TOPO MAP ARE PLOTTED ON THE ATTACHED SHEET.

COMPUTER OUTPUT TABLE OF STAGE-DISCHARGE RELATIONSHIPS ARE ATTACHED



D-14

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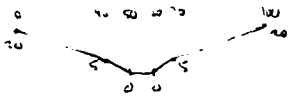
BERRY POND DAM

REACH 1 – DAM TO RTE 67 CROSSING

L = 4000'

S = $\frac{870-666}{4000}$ = .053

n = .020



REACH 2

L = 4500'

S = $\frac{660-510}{4500}$ = .033

n = .020

X-SECTION SAME AS ①

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	12.0	14.5	0.8	10.6	181.6
2.0	2.0	28.0	18.9	1.5	36.3	623.2
3.0	3.0	48.0	23.4	2.0	77.5	1328.8
4.0	4.0	72.0	27.9	2.6	135.5	2324.7
5.0	5.0	100.0	32.4	3.1	212.2	3640.1
6.0	6.0	132.3	37.4	3.5	307.2	5268.2
7.0	7.0	169.3	42.5	4.0	425.6	7299.2
8.0	8.0	211.0	47.6	4.4	569.6	9768.6
9.0	9.0	257.3	52.7	4.9	741.1	12710.4
10.0	10.0	308.3	57.8	5.3	942.1	16157.7
11.0	11.0	364.0	62.9	5.8	1174.4	20142.4
12.0	12.0	424.3	67.9	6.2	1439.9	24695.4
13.0	13.0	489.3	73.0	6.7	1740.2	29846.8
14.0	14.0	559.0	78.1	7.2	2077.2	35626.0
15.0	15.0	633.3	83.2	7.6	2452.4	42061.8
16.0	16.0	712.3	88.3	8.1	2867.6	49182.3
17.0	17.0	796.0	93.4	8.5	3324.3	57015.0
18.0	18.0	884.3	98.5	9.0	3824.0	65587.0
19.0	19.0	977.3	103.5	9.4	4368.5	74924.7
20.0	20.0	1075.0	108.6	9.9	4959.1	85054.2

BERRY POND DAM - REACH 1

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	12.0	14.5	0.8	10.6	143.3
2.0	2.0	28.0	18.9	1.5	36.3	491.8
3.0	3.0	48.0	23.4	2.0	77.5	1048.5
4.0	4.0	72.0	27.9	2.6	135.5	1834.4
5.0	5.0	100.0	32.4	3.1	212.2	2872.3
6.0	6.0	132.3	37.4	3.5	307.2	4157.0
7.0	7.0	169.3	42.5	4.0	425.6	5759.6
8.0	8.0	211.0	47.6	4.4	569.6	7708.1
9.0	9.0	257.3	52.7	4.9	741.1	10029.5
10.0	10.0	308.3	57.8	5.3	942.1	12749.7
11.0	11.0	364.0	62.9	5.8	1174.4	15893.9
12.0	12.0	424.3	67.9	6.2	1439.9	19486.5
13.0	13.0	489.3	73.0	6.7	1740.2	23551.4
14.0	14.0	559.0	78.1	7.2	2077.2	28111.6
15.0	15.0	633.3	83.2	7.6	2452.4	33190.0
16.0	16.0	712.3	88.3	8.1	2867.6	38808.6
17.0	17.0	796.0	93.4	8.5	3324.3	44989.2
18.0	18.0	884.3	98.5	9.0	3824.0	51753.1
19.0	19.0	977.3	103.5	9.4	4368.5	59121.3
20.0	20.0	1075.0	108.6	9.9	4959.1	67114.2

Berry Pond Dam - Reach 2

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STEP 4 CALCULATIONS

REACH 1 $Q_{PI} = 5030$ cfs

$H = f(Q_{PI}) = 5.8'$

AREA @ 5.8' = 127 sq ft.

$V_1 = L \times \text{AREA} = 4000 \times 127 / 43560 = 11.7$ AF ($\leq \frac{1}{2}S$)

$Q_{P2T} = Q_{PI}\left(1 - \frac{11.7}{336}\right) = 4850$ cfs

$H = f(Q_{P2T}) = 5.7'$

AREA @ 5.7' = 124 SF

$V_2 = 4000 \times 124 / 43560 = 11.4$ AF

$V_{AVG} = \frac{11.7 + 11.4}{2} = 11.55$

$Q_{P2} = 5030\left(1 - \frac{11.55}{336}\right) = 4860$ cfs

REACH 2 $Q_{PI} = 4860$ cfs

$H = f(Q_{PI}) = 6.4'$

AREA @ 6.4 = 148 SF

$V_1 = L \times \text{AREA} = 4500 \times 148 / 43560 = 15.3$ AF ($\leq \frac{1}{2}S$)

$Q_{P2T} = Q_{PI}\left(1 - \frac{15.3}{336}\right) = 4640$ cfs

$H = f(Q_{P2T}) = 6.3'$

AREA @ 6.3 = 143 SF

$V_2 = 4500 \times 143 / 43560 = 14.8$ AF

$V_{AVG} = \frac{14.8 + 15.3}{2} = 15.1$

$Q_{P2} = 4860\left(1 - \frac{15.1}{336}\right) = 4640$ cfs

WHITES POND

$\Delta H = \frac{\text{VOLUME FROM BERRY}}{\text{AREA OF WHITES}} = \frac{336\ \text{AF}}{36\ \text{AC}} =$

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE CONGR DIST.	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NH	105	NED	NH 01	013	01	BERRY POND DAM	4317.0	7117.8	15	AUG	78

POPULAR NAME	NAME OF IMPOUNDMENT
	BERRY POND

REGION BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 05	BERRY POND BROOK	PITTSFIELD	3	2510

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1884	5	13	12	375	300	NED	N	N	N	N	02AUG78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
3	196	C	11	80	2400		0									

OWNER	ENGINEERING BY	CONSTRUCTION BY
PITTSFIELD AQUEDUCT CO		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
GOLDBERG ZOINO DUNNICLIFF + ASSOC	23	MAY	78	PL92-367

REMARKS

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