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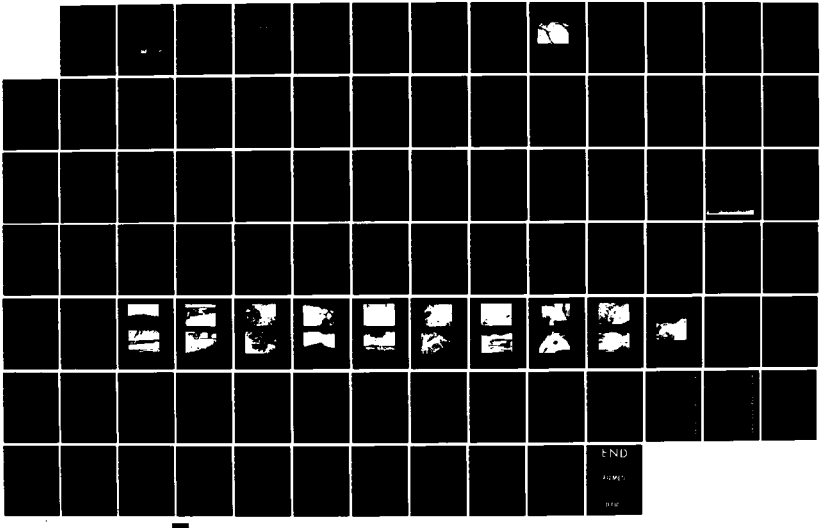

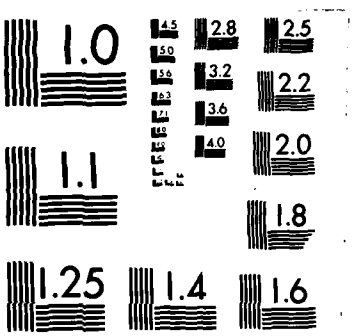

CONNECTICUT RIVER BASIN

DIXVILLE, NEW HAMPSHIRE

LAKE GLORIETTE DAM AND DIKE
NH00171 & 00168

STATE NO 65.02 & 65.01

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

AUGUST 1979

UNCLASSIFIED

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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)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Dixville, New Hampshire
Lake Gloriette

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

The dam has a hydraulic height of 33 ft. and is 100 ft. long. It is an earthen embankment with a riadway running along the crest. The dam and dike are in fair condition. There are various concerns which should be corrected. It is small in size with a significant hazard potential for the dam and low hazard for the dike. A major breach at top of dam could result in appreciable damage to farmland as well as the possible loss of sections of Rt. 26, which would be subjected to erosive velocities.

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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00171 and NH00168
Name of Dam:	Lake Gloriette Dam and Dike
Town:	Dixville
County and State:	Coos County, New Hampshire
Lake:	Lake Gloriette
Date of Inspection:	June 7, 1979

BRIEF ASSESSMENT

Lake Gloriette Dam has a hydraulic height of 33 feet, is 32 feet wide at the crest, and is 100 feet long. It is an earthen embankment with a roadway running along the crest. The spillway discharges into a corrugated metal arch pipe which measures 7' 7" H x 11' 10" W. This conduit runs downstream for a length of about 75 feet with a slope of approximately 24%.

Located approximately 1000 feet north of Lake Gloriette Dam is Lake Gloriette Dike. The dike has a hydraulic height of 34', is 43' wide at the crest, and is 240 feet long. It is an earth embankment with a paved roadway along its crest. A 3' x 3' square masonry conduit extends under the road through the dike embankment and has been plugged at its downstream end.

The dam and dike are located in northern New Hampshire and combine to impound Lake Gloriette. Lake Gloriette is used for recreational purposes by the Balsams Hotel. It has a maximum storage capacity of about 640 acre-feet. Normal pool is approximately 1600 feet in length with a surface area of about 26 acres.

The dam and dike are in fair condition. Major concerns are: the absence of a dewatering facility, the existence of an open conduit under the crest of the dike which has its downstream end buried under fill, the presence of a trench for a TV cable on the downstream slope of the dike, the growth of brush and trees in several spots on the upstream and downstream slopes of the dam and dike, the erosion of the upstream slope of the dam on both sides of the concrete spillway entrance structure, the evidence of minor settlement and cracking of the roadway pavement on the crest of the dam, and an animal burrow on the downstream slope of the dike.

Based on small size for the dam and dike and a significant hazard classification for the dam (low hazard for the dike) in accordance with Corps guidelines, the test flood is ½ the Probable Maximum Flood (PMF). A test flood outflow of 2350 cfs (1300 csm) would overtop the dam by 1.7 feet and the dike by 1.2 feet. The spillway will pass 820 cfs or about 35 percent of the test flood.

A major breach at top of dam could result in appreciable damage to farmland as well as the possible loss of sections of Route 26 which would be subjected to erosive velocities.

The Balsams, Inc. should implement the results of recommendations and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I Inspection Report.

Warren A. Guinan
Project Manager
N.H. P.E. 2339

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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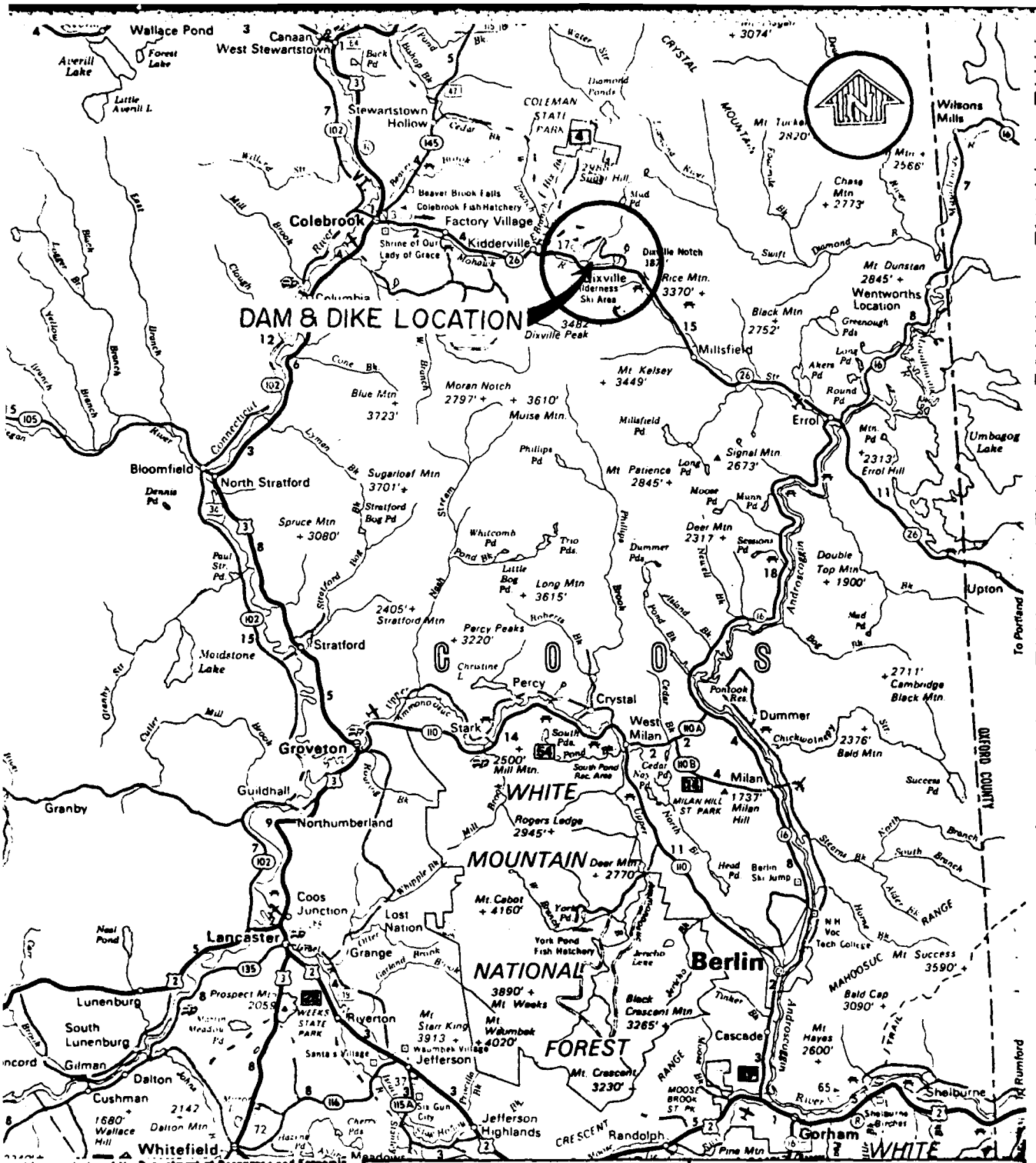
Figure 1 - Overview of Lake Gloriette Dam.



SCALE IN MILES

0 5 10

...IP BASED ON STATE OF NEW HAMPSHIRE ...FICIAL HIGHWAY MAP.

Anderson-Nichols & Co., Inc.	U.S. ARMY ENGINEER DIV. NEW ENGLAND
CONCORD NEW HAMPSHIRE	CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LAKE GLORIETTE DAM AND DIKE LOCATION MAP

MOHAWK RIVER NEW HAMPSHIRE

			SCALE: SEE BAR SCALE
			DATE: AUGUST 1979

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
LAKE GLORIETTE DAM AND DIKE

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. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of March 22, 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0050 has been assigned by the Corps of Engineers for this work.

b. Purpose.

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

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

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

1.2 Description of Project

a. Location. The Lake Gloriette Dam and Dike are located in Dixville, New Hampshire in the Dixville Notch area. The project consists of an earthen dam and an earthen dike. It spans the headwaters of the Mohawk River to form Lake Gloriette, which is utilized for recreational purposes. The dam and dike are shown on the U.S.G.S. Quadrangle, Dixville, New Hampshire with coordinates approximately at N 44° 52' 05", W 71° 18' 23". (See Location Map page viii.)

In the New Hampshire Water Resources Board (NHWRB) files the dam is referred to as the south outlet to Lake Gloriette and the dike is referred to as the north outlet to Lake Gloriette.

b. Description of the Dam and Appurtenances. Lake loriette impoundment structures consist of an earthen dam and n earthen dike. The dam is the more southerly of the embankents and is the closer to Route 26. The dam is about 100 feet ong. A paved section of roadway leading from Route 26 to the alsams Hotel runs along the crest of both the dam and dike. he dam has a 19' concrete spillway with a 4.5' high and 4' ide stoplog section located at its center. The spillway discharges into a 7.7' H x 11' 10" W corrugated metal pipe arch hich runs downstream for a length of about 75 feet at an approxmate slope of 24%. The pipe arch discharges into a stream hich becomes the Mohawk River further downstream.

he Lake Gloriette Dike is located approximately 1000 feet north f the dam. It is about 240 feet long. a 3' x 3' square stone asonry conduit runs under the paved road through the dike emankment, but has been plugged at its downstream end. The upstream end is filled almost to the crown. A television cable nd 1" plastic pipe pass through the conduit. The Balsams Hotel olf course is located on the downstream side of the dike mbankment.

c. Size Classification. Small (hydraulic height - 33 feet (dam) and 34 feet (dike) storage - 640 acre-feet) based on criteria (small size corresponds to an impoundment structure with eight $\geq$ 25 and $<$ 40 feet storage $\geq$ 50 and $<$ 1000 acre-feet) n Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant Hazard (dam). A ajor breach in the dam would result in appreciable damage to farms and farmland in the downstream Mohawk River floodplain; as well as loss of major sections of Route 26 that runs adjacent to the river. Low Hazard (dike). A major breach of the dike ould result in flooding of the golf course below it which offers sufficient storage to preclude downstream damage.

e. Ownership. Lake Gloriette Dam and Dike are owned by he Balsams, Inc. and have been since their construction.

f. Operator. The current owner and operator of the dam nd dike at Lake Gloriette is the Balsams, Inc., Dixville, New ampshire 03528. Phone: (603) 255-3400. (Mr. Rouland Joulin is the resident maintenance manager).

g. Purpose of the Dam. This dam and dike impound Lake loriette, which is used for recreational purposes by the Balsams otel.

h. Design and Construction History. The Lake Gloriette am was reconstructed in 1968. The New Hampshire Department of ublic Works and Highways (NHDPWH) designed and supervised the onstruction of the dam as part of the New Hampshire Route 26

econstruction project. The construction was performed by aledonia Sand and Gravel of St. Johnsbury, Vermont. Little nformation was disclosed relating to the design and construction f the original dam which was completed prior to 1913.

onstruction of the dike occurred concurrently with the original am construction and was completed prior to 1913. Little nformation was disclosed relating to its design and construc- ion.

i. Normal Operating Procedures. No written operating rocedures were disclosed for Lake Gloriette Dam and Dike.

.3 Pertinent Data

a. Drainage Area. The drainage area consists of 1.82 square iles (1165 acres) of rolling to mountainous terrain.

b. Discharge at Damsite.

(1) Outlet works (conduits) - Concrete spillway dis- charges in 7'7" H x 11'10" W corrugated metal pipe arch at invert elevation 1845.0' MSL.

(2) The maximum discharge at damsite is unknown.

(3) Ungated spillway capacity @ maximum pool elevation - 320 cfs @ 1855.5' MSL.

(4) Ungated spillway capacity @ test flood elevation - 930 cfs @ 1857.2' MSL.

(5) Gated spillway capacity @ top of dam elevation - not applicable.

(6) Gated spillway capacity @ test flood elevation - not applicable.

(7) Total spillway capacity @ test flood elevation - 930 cfs @ 1857.2' MSL.

(8) Total project discharge @ test flood elevation - 2350 cfs @ 1857.2.

c. Elevation. (ft. above MSL)

(1) Top of dam - 1855.5

(2) Top of dike - 1856.0

(3) Test flood pool - 1857.2

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination indicates that Lake Gloriette Dam and Dike are in fair condition. The major concerns with respect to the integrity of the dam and dike, if left uncorrected, are:

(1) Existence of an open culvert under the crest of the dike with its downstream end buried under fill.

(2) Erosion of the upstream slope of the dam on both sides of the concrete spillway-entrance structure.

(3) Brush growing on the upstream slope near the north abutment of the dam.

(4) Trees growing on the north bank of the downstream channel of the dam immediately adjacent to the contact between the downstream slope and the dam abutment.

(5) Minor settlement and cracking of the roadway pavement on the crest of the dam.

(6) Trees growing on the downstream slope near the abutments of the dike.

(7) Brush growing on the upstream slope of the dike.

(8) Animal burrow on the downstream slope of the dike.

(9) Trench, backfilled with unknown material, for a TV cable laid under the downstream slope of the dike.

b. Adequacy of Information. The information available is such that the assessment of this dam and dike must be based primarily on the NHDPWH plans and sketches for the dam and on the results of the visual inspection.

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

d. Need for Additional Investigation. There is no need for additional investigation for the purposes of the Phase I inspection.

c. Operating Records. No operating records pertinent to the structural stability were disclosed.

d. Post-Construction Changes. According to a representative of Balsams, Inc. additional fill was placed on the downstream slope of the dike when the roadway was widened in 1968.

e. Seismic Stability. The dam and dike are located in Seismic Zone 2 and in accordance with Phase I guidelines do not warrant seismic stability analyses.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual examination indicates the following evidence of potential problems:

(1) Existence of an open culvert under the crest of the dike with its downstream end buried under fill.

(2) Erosion of the upstream slope of the dam on both sides of the concrete spillway-entrance structure.

(3) Brush growing on the upstream slope near the north abutment of the dam.

(4) Trees growing on the north bank of the downstream channel of the dam immediately adjacent to the contact betweeen the downstream slope and the abutment.

(5) Minor settlement and cracking of the roadway pavement on the crest of the dam.

(6) Trees growing on the downstream slope near the abutments of the dike.

(7) Brush growing on the upstream slope of the dike.

(8) Animal burrow on the downstream slope of the dike.

(9) Trench, backfilled with unknown material, for a TV cable laid under the downstream slope of the dike.

b. Design and Construction Data. NHDPWH plans and sketches dated 5/67 show the design of the spillway discharge pipe which was built at the time of the reconstruction of State Highway 26. The logs of two borings made under the downstream section of the spillway pipe show that it is founded on silty till and boulders; the logs of two other borings show that the concrete inlet structure is founded on "silty sand, small stone, and muck" which, in turn, is underlain by "silty till and boulders." The drawings also show that the design called for a sheet pile cutoff wall driven to a depth of 24 feet below the base of the concrete inlet structure to a distance of 15 feet on either side of the centerline. It also shows a 4-foot wide cutoff of "impervious material" extending the entire width (which is not specified) of the excavation. It is not possible to verify these subsurface details on the basis of the visual inspection alone.

would result in a reservoir pool elevation of 1857.2 MSL. This would result in the overtopping of the dam by 1.7 feet and would overtop the dike by 1.2 feet. The total project capacity is 820 cfs which is about 35 percent of the test flood discharge.

f. Dam Failure Analysis. The analysis of the impact of the failure of the dam covered the entire reach of the Mohawk River located downstream of the dam. Within this reach a low lying area extending from the dam to a point just upstream of Kidderville, a section covering approximately 3.1 miles, was analyzed for high hazard potential. A breach occurring with the reservoir level at the top of dam would result in the discharge of 16,815 cfs. At a point just upstream of Kidderville and approximately 3.1 miles downstream of the dam, the breach discharge would increase the stage depth 9.7 feet above the antecedent stage depth of 5.5 feet resulting from the antecedent flow rate of 800 cfs. The total stage depth of 15.2 feet would probably result in appreciable property damage to farmland and the probable loss of sections of Route 26 which would be susceptible to high erosive velocities.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. General. Lake Gloriette impoundment features consist of a low earthen dam and low earthen dike which impounds a reservoir of small size. The length of the dam embankment is about 100 feet and the top of the dam is about 6.5 feet above the concrete spillway crest. The dike, located approximately 1000 feet north of the dam, is about 240 feet long and the top of the dike is about 7.0 feet above concrete spillway crest.

b. Design Data. Limited hydrologic and hydraulic date for the Lake Gloriette Dam and Dike were disclosed. NHDPWH design data indicated that a design flow, based on a 10-year event, of 300 cfs was used to guide outlet selection. A drainage area of 1.60 square miles was also given.(See Appendix B.) The drainage area shown herein, as measured by planimeter, was found to be 1.82 square miles.

c. Experience Data. In April, 1960, Lake Abeniki Dam failed releasing flow into Lake Gloriette which resulted in the overtopping of the original Lake Gloriette dam (south outlet), and dike (north outlet). It also resulted in the erosion of a section of Route 26 adjacent to the dam. Presently Lake Abeniki contains approximately one third the volume of water that was impounded at the time of the 1960 dam failure. Therefore it is probable that the effects of a failure of the present Lake Abeniki Dam would be less severe than the effects which resulted from the 1960 dam failure.

d. Visual Observations. At the time of inspection, no visual evidence was noted of damage to any portions of the embankments or of the concrete structure caused by excessive discharges.

e. Test Flood Analysis. Both dam and dike are classified as being small in size, having a hydraulic height of 33 feet and 34 feet respectively, and a maximum (top of dam) storage of approximately 640 acre-feet. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood was determined to be 1/2 the Probable Maximum Flood (PMF). The watershed above the dam, determined to have an average slope of 413 feet mile, is classified as mountainous. From the PMF Peak Flow Rates graph the discharge for a mountainous watershed of 1.82 square miles is 2600 cubic feet per second per square mile (csm). Thus, the PMF flow rate is 4732 cubic feet per second (cfs) and the test flood (1/2 PMF) inflow is 2366 cfs. The test flood outflow discharge is 2350 cfs. Analysis of the elevation versus discharge curve indicates that a flood of this magnitude (2350 cfs)

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures were disclosed for Lake Gloriette Dam and Dike.

4.2 Maintenance of Dam

The Balsams, Inc. is responsible for the maintenance of Lake Gloriette Dam and Dike.

4.3 Maintenance of Operating Facilities

No formal maintenance program was disclosed.

4.4 Description of Any Warning System in Effect

No written warning system was disclosed for Lake Gloriette Dam and Dike.

4.5 Evaluation

The present operational and maintenance procedures are not adequate to insure that all problems encountered be remedied within a reasonable amount of time.

has a boulder-covered bottom. The south bank of the channel is the fill for State Highway 26 and is riprapped to a height of about 3 feet above the channel bottom. Many saplings are growing up through the riprap. The north bank of the channel is covered with large trees, many of which overhang the channel. Two small logs and a barrel were noted in the discharge channel. (See Appendix C - Figure 20.)

3.2 Evaluation

a. General. The absence of a means of dewatering the reservoir (no low-flow outlet) causes an overall evaluation of fair for the general condition of Lake Gloriette Dam (South Outlet) and Dike (North Outlet).

b. Dam. The minor settlement and cracking of the roadway pavement on the crest of the dam indicates that some settlement of the embankment fill has occurred.

Erosion of the upstream slope of the dam on both sides of the concrete spillway-entrance structure, if not repaired, could become a significant stability problem.

Brush on the upstream face near the north abutment may grow into trees if not cleared. If the trees should blow over and pull out their roots, or if a tree dies and its roots rot, serious erosion and seepage problems could result.

Trees overhanging the north side of the discharge channel and a barrel and two logs in the channel could result in temporary damming of the discharge channel during periods of floodflow. Saplings on the south bank of the discharge channel, if allowed to grow into trees, could result in a similar problem.

c. Dike. There are trees growing on the downstream slope near the abutments. If any trees blow over and pull out their roots, or if a tree dies and its roots rot, serious seepage and erosion problems may result. Brush growing on the upstream slope will become trees, if not cleared, and could cause problems similar to those associated with the trees on the downstream slope.

The old culvert beneath the crest of the dam, the outlet of which has been covered with fill, could result in major erosion and piping problems if the lake level rises high enough so that water enters the culvert on the upstream end.

The animal burrow on the downstream face could be a focus for a concentration of seepage and piping if the animal(s) is not removed and the burrow is not backfilled.

The trench in which the TV cable was laid on the downstream face of the dam could be a focus for concentration of seepage and piping if it was not backfilled with a suitable, properly compacted soil.

(See Appendix C - Figure 12.) Near the south abutment there is a low dry masonry wall at the downstream edge of the crest. This wall apparently extended along the entire length of the downstream side of crest at one time (according to a sketch dated 10/9/39, which was found in the NHWRB files), and may have been buried under additional fill that is reported to have been placed for widening the roadway on the crest. At one time there was a culvert (3' x 3' box) with its invert 6 feet below the crest. This culvert apparently served as a spillway (sketch dated 10/9/39). On the present downstream slope, no visual evidence could be found of this culvert at the time of the inspection. The inlet to the culvert was visible on the upstream face and was partially filled with sand and gravel. (See Appendix C - Figures 13 & 14.) A TV cable comes out of the culvert entrance and continues underground to the Balsams Hotel nearby. About 4 feet of the same TV cable is visible on the surface of the downstream slope near the toe, and it is reported that the rest of the cable is buried beneath the downstream slope. The area downstream of the north outlet has been filled and regraded for use as a golf course, and, as a result, there is no defined channel for a distance of several hundred feet. (See Appendix C - Figure 15.) Several soft, wet areas and a small pond are downstream of the dike embankment, but they appear to be the result of a generally high water table in the broad, flat valley and not the result of seepage through the dike and its foundation. The old culvert beneath the crest of the dike, the outlet of which has been covered with fill, could result in major erosion and piping problems if the lake level rises high enough so that water enters the culvert on the upstream end.

d. Appurtenant Structures. The overflow spillway is located in the center of the dam (south embankment). The concrete spillway is 6.5 feet high and 19 feet long with a 4.0 foot wide wood stoplog section at the center. (See Appendix C - Figure 16.) Overflow discharges into a 7'7" high by 11'10" wide corrugated metal arch pipe which passes through the dam embankment and discharges to the tailwater approximately 22 feet below the crest of the spillway. (Appendix C - Figures 17 & 18.) The overflow structure and outlet pipe were observed to be in excellent condition with no evidence of deterioration or distress. The wooden stops and steel stoplog slots were also observed to be in good condition. However, some surface rust was noted on the steel stoplog slots.

e. Reservoir Area. The watershed above the reservoir is steeply sloping and heavily wooded. A large stately residence and the Balsams Hotel are located on the shore of the reservoir. State Highway 26 is located along much of the south bank of the reservoir. No evidence of significant sedimentation in the reservoir was observed. (See Appendix C - Figure 19.)

f. Downstream Channel. The channel downstream of the dam

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Lake Gloriette impoundment features consist of an earthen dam and dike each of small height. The dike is located approximately 1000 feet north of the dam. The dam and dike impound a reservoir of small size. The watershed above the reservoir is steeply sloping and heavily wooded. The area immediately downstream of the dam is gently to steeply sloping and partially wooded; below the dike is an open plain (golf course).

b. Dam. Lake Gloriette Dam is an earthen embankment about 33 feet high (hydraulic and structural), 100 feet long, and 32 feet wide at the crest. (Appendix C - Figures 2 & 3.) There is a paved roadway on the crest of the dam. Some minor settlement of the roadway has occurred and two minor longitudinal cracks near the downstream edge of the pavement were observed. The upstream slope of the dam is covered with riprap from an elevation about 2 feet above the reservoir level at the time of the inspection to an unknown elevation below the reservoir level. (See Appendix C - Figure 4.) Between the top of the riprap and the crest of the dam there is a poorly established cover of grass and weeds, except close to the north abutment where there is brush. There is extensive erosion of the upstream slope on either side of the concrete spillway-entrance structure. The downstream slope of the dam is covered with riprap. (See Appendix C - Figure 5.) A few small saplings are growing up through the riprap. Many large trees are growing on the north abutment immediately downstream of its contact with the downstream face. (See Appendix C - Figure 6.)

A ridge of natural terrain, about 2,800 feet long, separates the dam and dike. The north abutment of the dam and the south abutment of the dike are contained in this ridge.

c. Dike. The dike, approximately 1000' north of the Lake Gloriette Dam, is an earth embankment about 34 feet high, 240 feet long, and 43 feet wide at the crest. (See Appendix C - Figures 7 & 8.) The crest has a paved roadway. (See Appendix C - Figure 9.) The upstream slope is riprapped from about one foot above the reservoir level (at the time of the inspection) to an unknown elevation below the water level. From the top of the riprap to the crest the upstream slope is covered with brush and in limited areas, grass. Minor erosion of the upstream slope has occurred where water has run off from the roadway. (See Appendix C - Figure 10.) The downstream slope is covered with grass and weeds over its central portion and there are trees on the downstream slope near the abutments. (See Appendix C - Figure 11.) At least one large animal burrow was noted on the downstream slope.

tion with visual inspections and hydrologic and hydraulic calculations.

c. Validity. The visual inspection disclosed that the present visible portions of the dam are consistent with the NHDPWH design plans and sketches.

SECTION 2
ENGINEERING DATA

2.1 Design

The Lake Gloriette Dam was designed by the New Hampshire Department of Public Works and Highways (NHDPWH), Bridge Design Division, in 1967. Design data were found at the NHDPWH office in Concord, New Hampshire. These data consisted of:

1) General plan and section
2) Layout and log of borings; stoplog design
3) Dam masonry and dam reinforcing
4) Roadway plan and profile
5) Preliminary hydrology and hydraulics for dam outlet

These data may be seen in Appendix B.

Plan and sectional sketches of the dam and dike prepared by Frank Doudera, Inc. dated October 9, 1939, were located in the files of the New Hampshire Water Resources Board (NHWRB) and may be seen in Appendix B.

2.2 Construction

Caledonia Sand and Gravel of St. Johnsbury, Vermont completed construction of the dam in 1968. No revisions to the design plans which reflect as-built conditions were disclosed.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. NHDPWH engineering plans and sketches, limited geologic data, and limited detailed hydrologic and hydraulic calculations for the Lake Gloriette Dam, reconstructed in 1968, are on file at the NHDPWH Concord, New Hampshire office.

A search of the NHWRB files and direct contact with the owner revealed only a limited amount of available information on the Lake Gloriette Dike.

b. Adequacy. Field inspection of the Lake Gloriette Dam indicated that NHDPWH plans and sketches were adequate. Because of the limited amount of detailed available data for the dike and the limited amount of detailed hydrologic and hydraulic calculations, the final assessments and recommendations were based on the NHDPWH plans and sketches for the dam in conjunc-

(3) Crest elevation - 1849 MSL

(4) Gates - none

(5) Stoplogs - A 4' wide stoplog section is located at the center of the dam. Invert elevation - 1845.5 MSL.

(6) U/S Channel - Lake Gloriette - recreational lake with clean and forested banks.

(7) D/S Channel - the downstream channel is relatively wide and unobstructed. It is clear of debris but contains many large boulders. There are many trees overhanging the banks. The downstream channel of the dike is a wide flat plain used as a golf course.

k. Regulating Outlets. A 7' 7" W x 11' 10" H corrugated metal pipe arch is the only outlet from the dam; the outlet through the dike is plugged at the downstream end,but is slightly open at the upstream end.

(2) Length - 100'

(3) Height - 33' (structural height)

(4) Top width - 32' (paved with guard rails)

(5) Side slopes - downstream face of dam is inclined at 1½H:1V; both upstream and downstream slopes are riprapped.

(6) Zoning - Unknown

(7) Impervious core - a 4' width impervious core is shown on the NHDPWH plans.

(8) Cutoff - (NHDPWH) design plans indicate a 4' wide cutoff core of impervious material and a sheet piling cutoff wall.

(9) Grout curtain - unknown

h. Dike.

(1) Type - earthen embankment with paved roadway on the crest.

(2) Length - 240'

(3) Height - 34'

(4) Top width - 43'

(5) Side slopes - upstream 1H:1V
downstream 2H:1V

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

i. Diversion and Regulating Tunnel. Not applicable.

(see j. below)

j. Spillway.

(1) Type - concrete

(2) Length of weir - 19'

(4) Maximum pool - design surcharge - unknown

(5) Full flood control pool - not applicable

(6) Recreation pool - 1845.5

(7) Stoplog invert - 1845.5

(8) Spillway crest - 1849.0

(9) Upstream portal invert - 1845.0
Downstream portal invert - 1827.0

(10) Streambed at centerline of main dam - 1822.2 (at downstream toe)

d. Reservoir. (feet)

(1) Length of maximum pool - 1800

(2) Length of spillway crest pool - 1600

(3) Length of flood control pool - not applicable

e. Storage. (acre-feet)

(1) Spillway crest pool - 300 (approximate)

(2) Test flood pool - 705 (approximate)

(3) Design surcharge - unknown

(4) Top of dam - 640 (approximate)

f. Reservoir Surface. (acres)

(1) Top of dam - 36.7 (approximate)

(2) Test flood pool - 38.2 (approximate)

(3) Flood control pool - not applicable

(4) Recreation pool - 25.6

(5) Spillway crest - 25.6 (approximate)

g. Dam.

(1) Type - earthen embankment with paved roadway on the crest.

7.2 Recommendations

The owner should engage a registered professional engineer to:

(1) Properly seal the culvert which extends under the road through the dike embankment.

(2) Design and install an adequate dewatering facility.

(3) Design repairs for the erosion of the upstream slope next to the concrete spillway-entrance structure of the dam.

(4) Design and oversee procedures for clearing trees and root systems on north abutment immediately adjacent to the contact between the downstream slope and the abutment of the dam.

(5) Investigate the minor settlement and cracking of the roadway pavement on the crest of the dam.

(6) Design and oversee procedures for clearing trees, brush, and root systems from the upstream and downstream slopes of the dike.

(7) Design and oversee procedures for removing and relocating the TV cable that has been laid underground on the downstream slope of the dike and through the culvert which extends under the road through the dike embankment.

(8) Spillway adequacy should be reviewed in light of the New Hampshire Department of Public Works and Highways standards, because the arch culvert outlet was designed as a highway design item for the 1968 reconstruction.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Remove the animal and its burrow on the downstream face of the dike.

(2) Visually inspect the dam and dike once a month.

(3) Engage a registered professional engineer to make a comprehensive technical inspection of the dam and dike once a year.

(4) Establish a round the clock surveillance program for use during and immediately after heavy rainfall and also a warning program to follow in case of floodflow conditions or imminent dam failure.

7.4 Alternatives. None.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

TIME 8 AM

WEATHER Sunny, cool, 55°

W.S. ELEV. U.S. 1846.0 DN.S. 1822

PARTY:

1. Warren Guinan
2. Stephen Gilman
3. Kathryn Hively
4. Ronald Hirschfeld
5. Pattu Kesavan (NHWRB)
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrology/Hydraulics	W. Guinan	
2.	Structural Stability	S. Gilman	
3.	Soils & Geology	R. Hirschfeld	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

PROJECT FEATURE Dam Embankment NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1855.5
Current Pool Elevation	1846.0
Maximum Impoundment to Date	Unknown
Surface Cracks	See "Pavement Condition"
Pavement Condition	Minor settlement of pavement, two minor longitudinal cracks near downstream edge
Movement or Settlement of Crest	See "Pavement Condition"
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	Significant erosion adjacent to upstream edge of pavement to spillway box structure
Rock Slope Protection - Riprap Failures	Riprap on upstream and downstream slopes-no failures observed
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed
Vegetation	Paved roadway on crest. A few small saplings growing through riprap on downstream slope, minor amount of brush growing above riprap level on upstream slope

PERIODIC INSPECTION CHECKLIST

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

PROJECT FEATURE Dike Embankment NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	1856.0
Current Pool Elevation	1846.0
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Good
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	Small channel eroded on upstream face next to roadway
Rock Slope Protection - Riprap Failures	No riprap failures observed
Unusual Movement or Cracking at or Near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed
Vegetation	Brush and small trees on upstream slope; grass on downstream slope appears to have been mowed last year.

Note: 3'x3' stone masonry culvert has been plugged on D/S end. Inside of U/S end not visible. Visible portion of U/S end shows concrete head wall in deteriorated condition.

PERIODIC INSPECTION CHECKLIST

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

PROJECT FEATURE Outlet Works NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	A few trees overhanging right bank
Floor of Approach Channel	Not visible beneath water surface
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	Very little - only surface rust on steel stoplog slots
Spalling	None
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Many trees overhanging right bank
Floor of Channel	Boulders
Other Obstructions	One log
d. Stoplogs and Slots	Good condition-little surface rust on slots
	Stoplogs weathered on exterior but sound.

PERIODIC INSPECTION CHECKLIST

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

PROJECT FEATURE Outlet Conduit NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	OUTLET CONDUIT
General Condition of Concrete	Good
Rust or Staining	None visible
Spalling	None visible
Erosion or Cavitation	None visible
Visible Reinforcing	None
Any Seepage or Efflorescence	None visible
Condition at Joints	Good-No indications of movement
Drain holes	None visible
Channel	
Loose Rock or Trees Overhanging Channel	Riprap lined along the channel
Condition of Discharge Channel	Good
Corrugated Steel Culvert	Good condition - little erosion of asphalt on invert.

PROJECT Lake Gloriette Dam & Dike DATE June 7, 1979

PROJECT FEATURE Reservoir NAME

AREA EVALUATED	REMARKS
Stability of Shoreline	Good
Sedimentation	None observed.
Changes in Watershed Runoff Potential	None
Upstream Hazards	None
Downstream Hazards	N.H. Route 26, farmland.
Alert Facilities	None posted.
Hydrometeorological Gages	None apparent.
Operational & Maintenance Regulations	None posted.

APPENDIX B

ENGINEERING DATA

To be by Bridge Rec. 2-15-67 per HER.

OUTLET STRUCTURE AT LAKE GLORIETTE

Watershed Area

The watershed encompasses the total areas tributary to Lakes Glorietta and Abeniki and receives limited flow from Mud Pond. Flood flows from Mud Pond will overflow to Moose Brook or Sugar Hill Brook and will not reach Lake Abeniki.

Lake Abeniki is basically a water supply and therefore should not be considered as having effective flood storage.

Areas (Lake Glorietta & Abeniki)

10.45 — 12.20
8.75 — 8.75 — Use 1.7
1.70 — 3.45

$$\frac{(1.7)(62,500)^2}{(144)(43,560)} = 1,060 \text{ ac.} \quad (1.6 \text{ sq mi.})$$

Mud Pond

3.52 — 5.20
1.86 — 1.86 — Use 1.7
1.66 — 2)3.34 = 1.67

Same as above 1,060 (1.6 sq. mi.)

Assume 10% of Mud Pond area is effective in flood design for Lake Glorietta outlet

Total Watershed area =
1,060 + 106 = 1,166 acres
= (1.82 sq. mi.)

Available storage · Lake Gloriette only

14.73
14.50
5 ⌊.23 = 0.046 [illegible]

$\frac{(0.046)(62,500)^2}{(144)(43,560)} = \underline{29\ ac.}$

% storage $\frac{29}{1160} = \underline{2.5\%}$

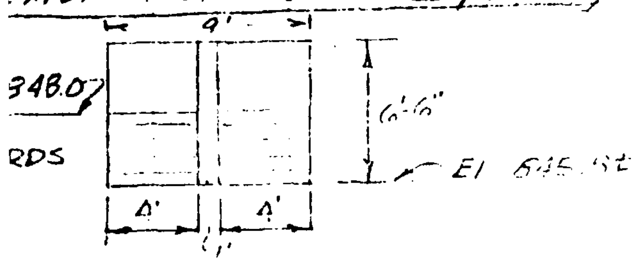
Design Flow (Use 10 year storm)

(from BPR Chart No 2 Peak Rates of Runoff For Adirondack White Mountains and Maine Woods)

Rainfall index = 1.7 Q_{10} = 300 cfs
Storage Factor = 2.5 Q_{50} = 400 cfs

Use 300 cfs for design

Exist. Box Culv Capacity



Assume no stor. [illegible] and Headwater at 853± (max. before overflow). Assume inlet control

Waterway opening

from chart 10CB (Headwater depths for Box Culverts with Entrance Control Inlet type ?)

$\frac{HDW}{D} = \frac{853 - 845.8}{6.5} = \frac{7.2}{6.5} = 1.1$

Q/FT = 48 cfs
8 × 48 = 384 cfs

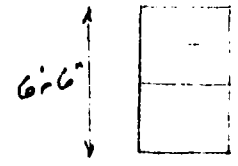
Exist Box Culv. Capacity (cont'd)

Assume step boards in to El 850.0

Treat as an orifice

formula

$$Q = CA\sqrt{2gh}$$



$$h = 852 - \left[\frac{852.3 - 848}{2} + 848\right]$$

$$h = 852 - 850.2$$

$$= 2.8$$

$C = 0.62$ (Conc. Hydr. Handbook, fig. 23 Series)

$A = 5.2 \times 4 = 20.8$ □

$$Q = (0.62)(20.8)\sqrt{2g(2.8)}$$

$$= (12.9)(13.4)$$

$$= \underline{174 \text{ cfs}}$$

Division Eng. Bran indicated this culvert overflowed once in last 5 years. It was assumed that the step boards were in place.

OUTLET	833.00	20.00	1.50
INLET	833.00	20.00	1.50

MAT.	SHAPE	RISE	OFF.	OUTLET ELEV.	ELEV. INLET	OFF.	T.
2	1	4.50	40.8	833.56	833.04	38.0	4
2	1	3.00	31.4	838.73	838.68	31.2	2
2	1	3.50	26.7	842.34	842.31	26.5	2
2	1	3.00	24.1	843.37	844.36	22.5	3
2	1	3.50	19.0	844.11	844.12	21.4	3
2	1	7.00	21.0	844.16	845.85	19.2	3

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

ION STATE NO. 85.01

t Dixville : County Coos

m Lake Iloriette

-Primary Connecticut River : Secondary Connecticut River

Name

linates—Lat. 44° 50' + 12.300 : Long. 71° 20' -7000

AL DATA

iage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 1.92 Sq. Mi.

all length of dam 75 ft.: Date of Construction -

ht: Stream bed to highest elev. 13 ft.: Max. Structure 13.25' ft.

—Dam : Reservoir

IPTION

e Gates

pe None

mber 2 : Size ft. high x ft. wide

evation Invert : Total Area sq. ft.

ıist

te Gates Conduit

mber None : Materials

ze ft.: Length ft.: Area sq. ft.

ankment

'pe Earth with roadway on top

eight—Max. 18 ft.: Min. - ft.

op—Width 30 : Elev. - ft.

opes—Upstream - on - : Downstream - on -

ngth—Right of Spillway - : Left of Spillway -

way

aterials of Construction Stone and concrete culvert under roadway

ngth—Total 10 ft.: Net 9'4" ft.

eight of permanent section—Max. - ft.: Min. - ft.

ashboards—Type Removable stop planks : Height 3'3" ft.

evation—Permanent Crest - : Top of Flashboard

ood Capacity 390 cfs.: cfs/sq. mi.

ments

aterials: Stone masonry

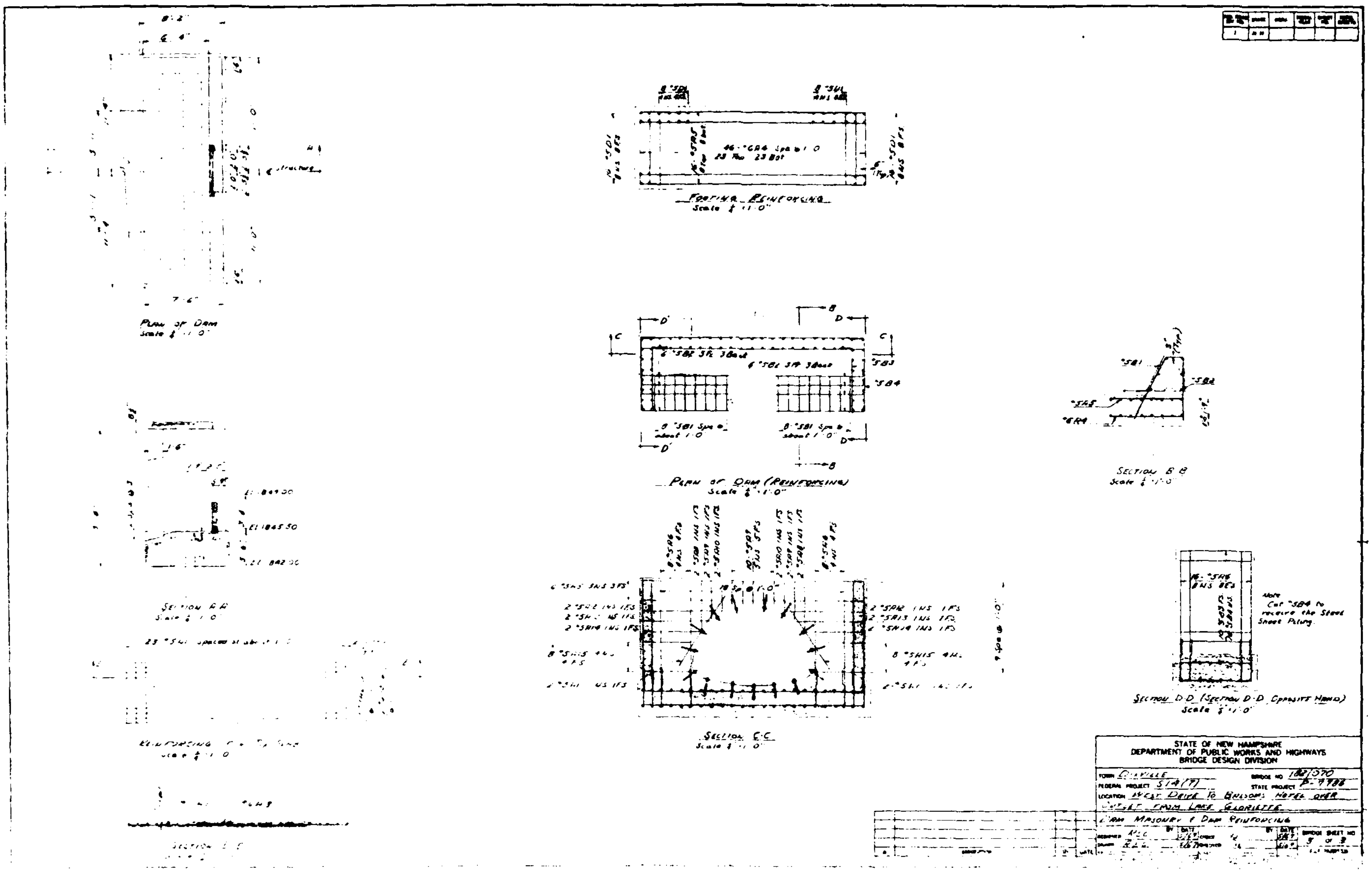
eeboard: Max. 3'6" ft.: Min. 3'6" ft.

lworks to Power Devel.—(See "Data on Power Development")

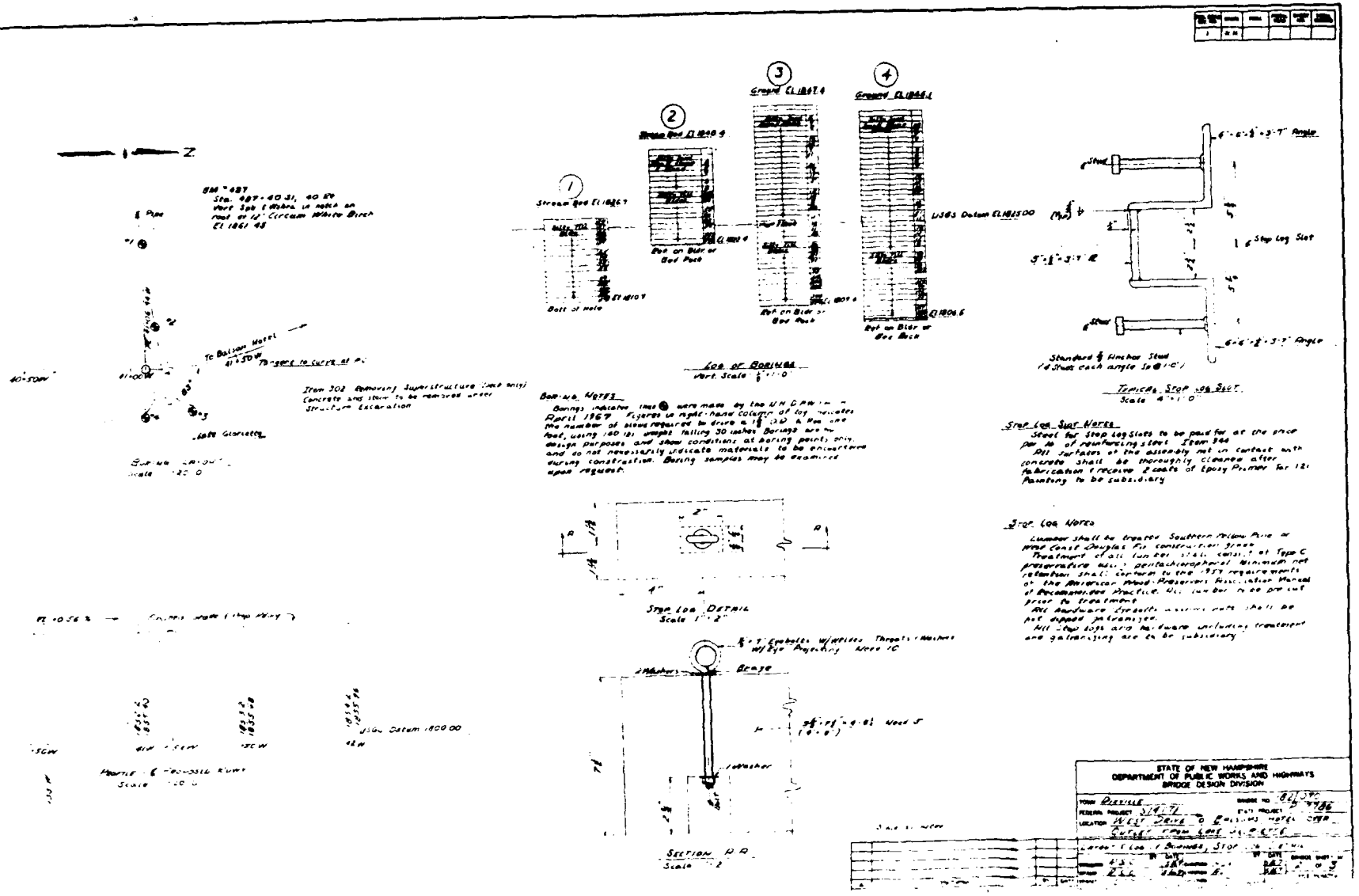
R The Balsams, Inc., Dixville, N. H.

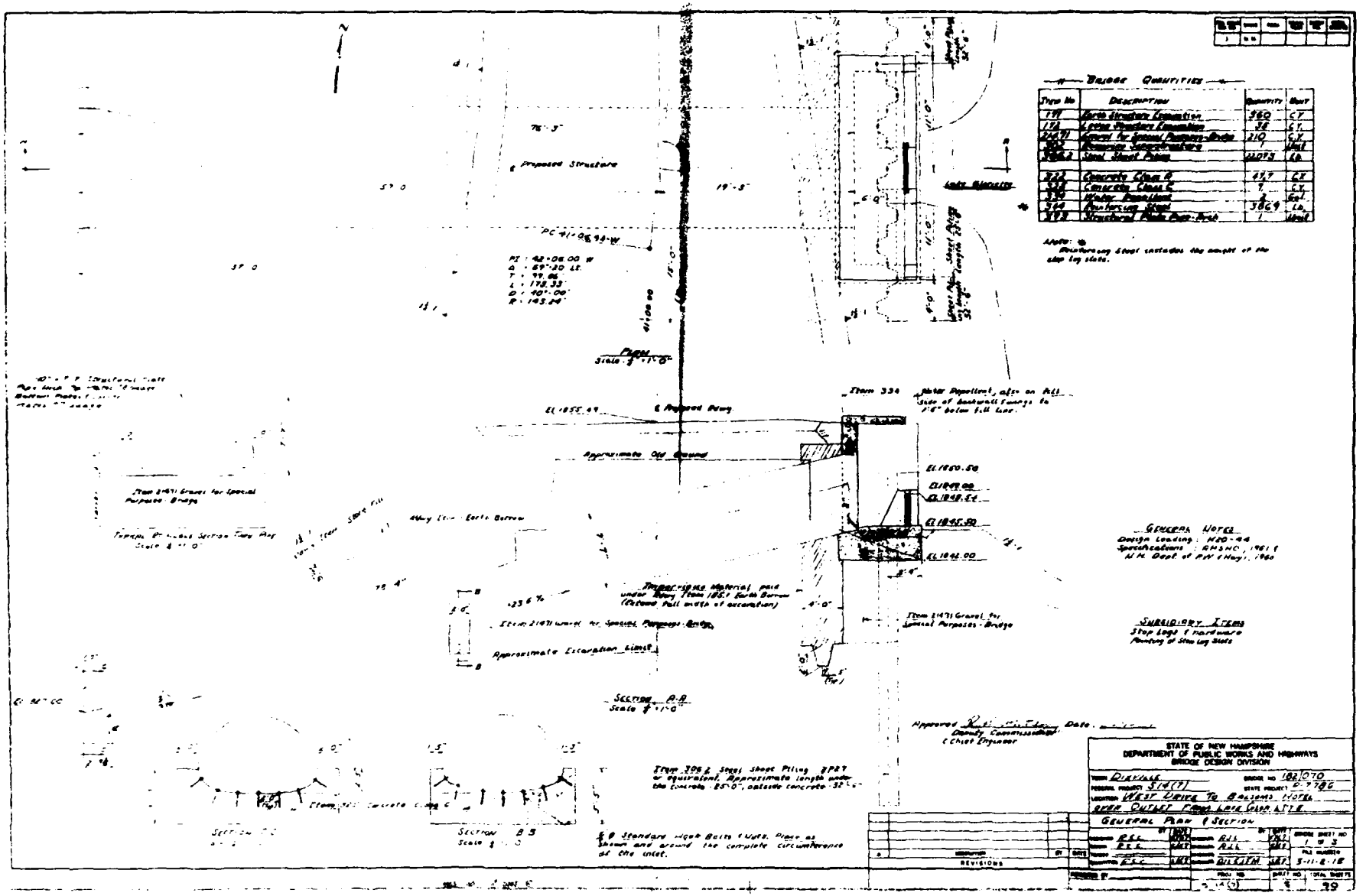
RKS Use - recreation. One of two outlets to Lake Iloriette.

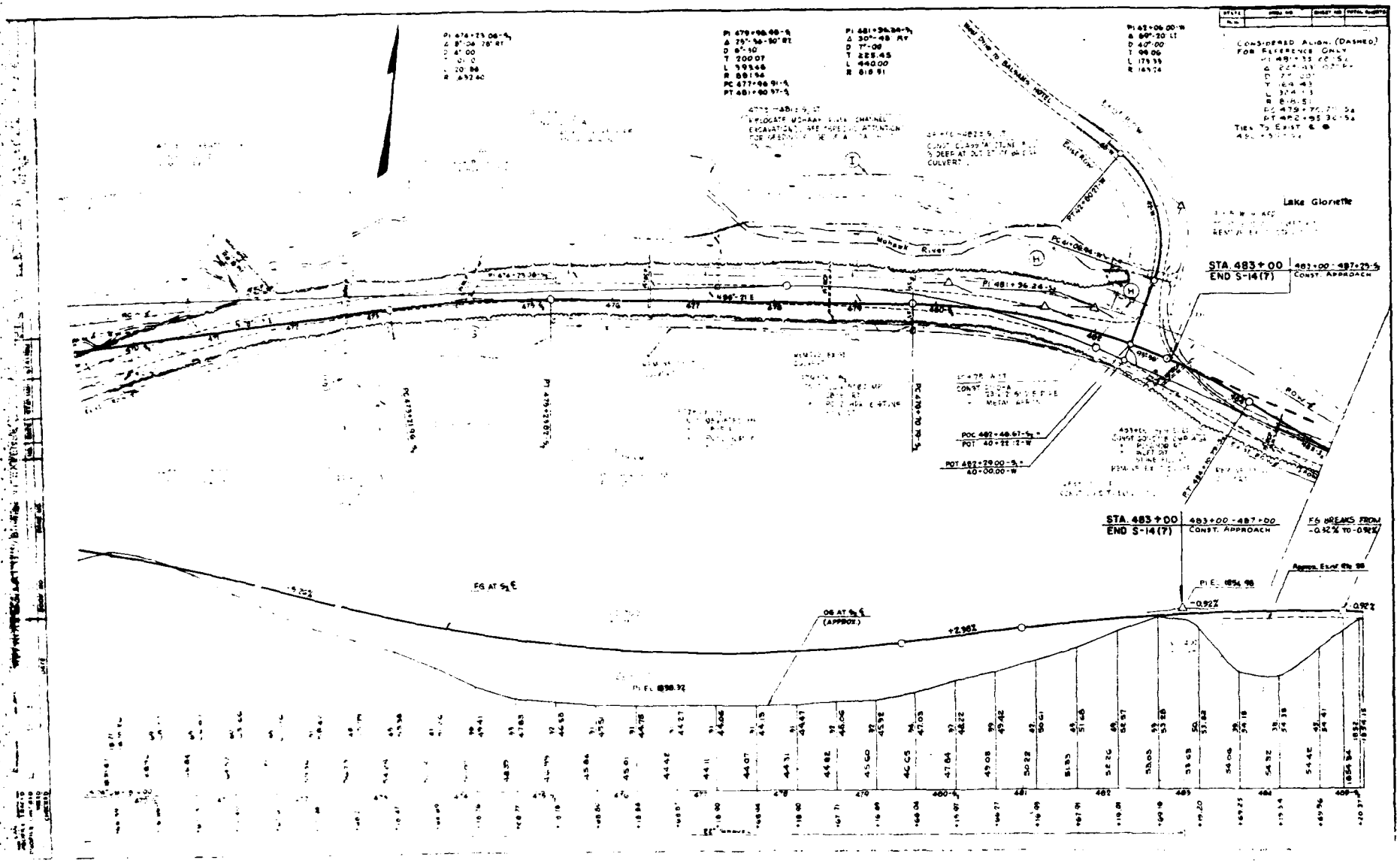
tion By Richard A. Kalmaran Date June 1, 1941

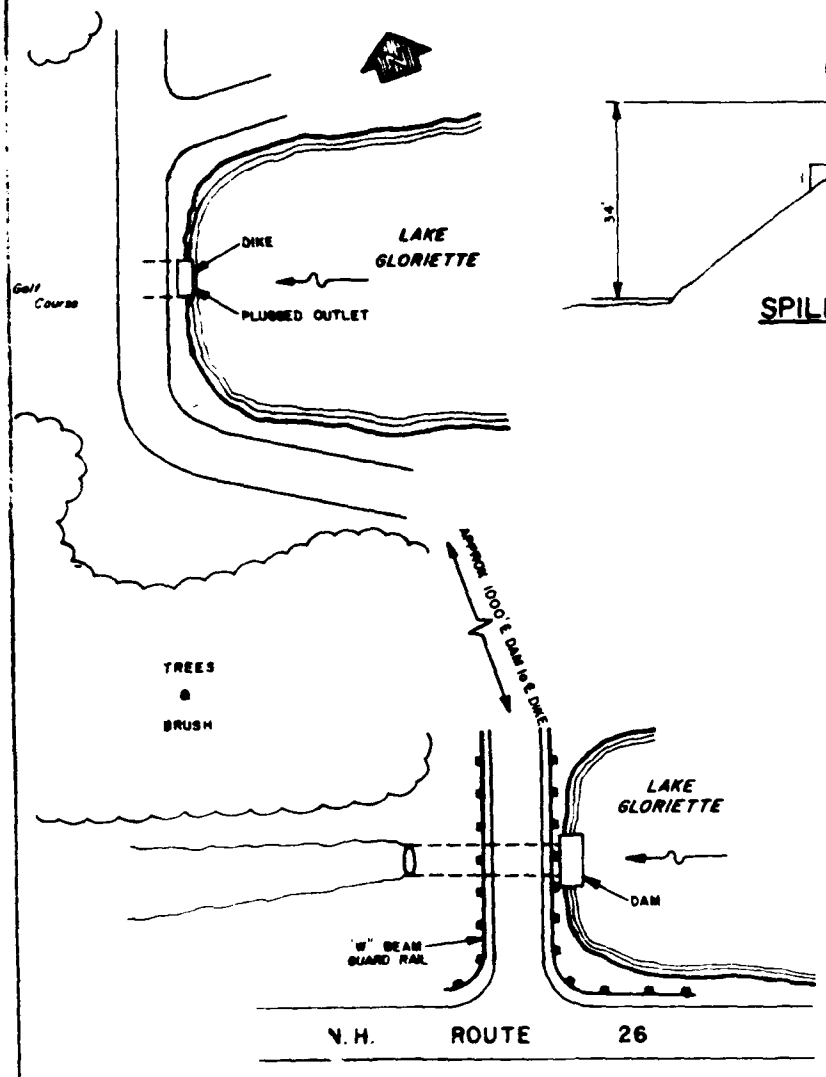


Plan of Dam
Scale 1/8" = 1'-0"
Footing Reinforcing
Scale 3/8" = 1'-0"
Plan of Dam (Reinforcing)
Scale 3/8" = 1'-0"
Section B-B
Section A-A
Section C-C
Section D-D (Section D-D Opposite Hand)
Note: Cut #5B4 to receive the Steel Sheet Piling
STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BRIDGE DESIGN DIVISION
FEDERAL PROJECT S14(7)
LOCATION
STATE PROJECT
BRIDGE SHEET NO
Dam Masonry & Dam Reinforcing

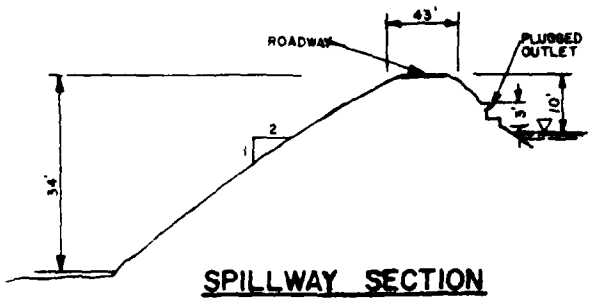

BM "48T"
Sta. 48T+40.31, 40 Rt.
Iron Pipe Emb. in notch on root of 16" Circum White Birch
El 1861.48
Item 302 Removing Superstructure (Lump sum)
Concrete and Stone to be removed under Structure Excavation
Log of Borings
Vert. Scale 1"=10'
Boring Notes
Step Log Detail
Scale 1"=2"
Section A-A
Scale 1"=2"
Typical Step Log Sect.
Scale 4"=1'-0"
Step Log Steel Notes
Step Log Notes
STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BRIDGE DESIGN DIVISION


Bridge Quantities
Item No | Description | Quantity | Unit
Proposed Structure
Pipe
Section A-B
Section B-B
General Notes
Design Loading: H20-44
Specifications: AASHTO, 1961 &
N.H. Dept. of Pub. Works, 1960
Subsidiary Items
Stop Logs & Hardware
Mounting of Stop Log Slots
Approved
County Commissioners
Chief Engineer
STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BRIDGE DESIGN DIVISION
General Plan & Section
REVISIONS

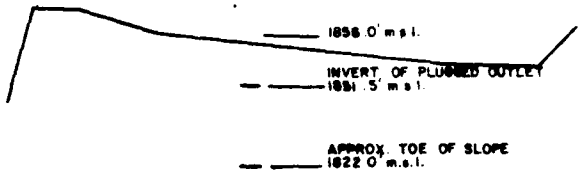

Lake Gloriette
Mohave River
STA. 483+00
END S-14(7)
483+00 - 487+29.5
CONST. APPROACH
STA. 483+00
END S-14(7)
483+00 - 487+00
CONST. APPROACH
FG BREAKS FROM
-0.92% TO -0.92%
FG AT 5% ℄
+2.96%
-0.92%
-0.92%



PLAN



SPILLWAY SECTION



ELEVATION

DIKE (NORTH OUTLET)

FOR SPILLWAY SECTION AND ELEVATION OF DAM (SOUTH OUTLET)
SEE FOLLOWING N.H.D.P.W.H. PLANS AND SKETCHES.

Anderson - Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LAKE GLORIETTE DAM & DIKE

MOHAWK RIVER — NEW HAMPSHIRE

Town No. 3 Town Dixville No.

Data by L.W.B File

Owner Dixville Notch Corp Co-Lo5

River or Stream

Public Utility No Drainage area 0.5 sq. mi.

Wheel Capacity H. P. { Primary H. P. / 90% time }

Type of Construction

Height 15 ft. Operating Head ft.

Length 200 ft. Spillway Length (No. 1) ft. (No. 2) ft.

Would Failure of Dam do Harm?

Present Condition Date

7374

Town No. 5 Town Dixville No.

Data by S.J.L Let 12-7-26 File I 1847

Owner J.J. Lennon Co.

River or Stream Mud Pond

Public Utility No Drainage area 1.0 - sq. mi.

Wheel Capacity H. P. ——— { Primary H. P. / 90% time } Storage

Type of Construction Rock Filled Log Crib

Height 10 - ft. Operating Head ft.

Length 246 ft. Spillway Length (No. 1) 190 ft. (No. 2) ft.

[illegible] Dam do Harm? No

Lake Gloriette - Both N & S outlets
Source - General File of Dixville

B-14

Town No. 2 Town Dixville No.

Data by L.W.B. File I-329

Owner Dixville Notch Corp. (Balsams Valley Pond)

River or Stream

Public Utility No Drainage area 2.0 sq. mi.

Wheel Capacity H. P. { Primary H. P. / 90% time }

Type of Construction Earth with Concrete Core

Height 30 ft. Operating Head 3 75 ft.

Length 1575 ft. Spillway Length (No. 1) 40 ft. (No. 2) ft.

Would Failure of Dam do Harm? See Let S.J.L 12-30-26

Present Condition Date

7374

DIXVILLE, Dams in

1. Dixville Notch Corporation No Plan Dixville Notch, N.H.
2. Dixville Notch Corporation "The Balsams" - Construction of, 1913 - (unincorporated) I-329 Balsams Valley Dam Plan D-7 "
3. Dixville Notch Corporation Proposed dam at the Golf Links Dixville Notch, " Plan D-11
4. Dixville Notch Corporation Construction of dam at Dixville Notch (I-1174) Dixville Notch " Plan D-34
5. Dixville Notch Corp. No Plan I-1847 Built 1926 Mill Pond

B-13

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

OCATION AT DAM NO. 65.01

Town Dixville : County Coos

Stream Lake Gloriette

Basin—Primary Conn R : Secondary Mohawk R.

Local Name

)RAINAGE AREA

Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total ..... Sq. Mi.

:LEVATION vs. WATER SURFACE AREA vs. VOLUME

Point		Head Feet	Surface Area Acres	Volume Acre Ft.
(1)	Max. Flood Height			
(2)	Top of Flashboards			
(3)	Permanent Crest			
(4)	Normal Drawdown		31	
(5)	Max. Drawdown			
(6)	Original Pond	U.S.G.S. 1871		

Base Used .....: Coef. to change to U.S.G.S. Base .....

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	ft.
Volume	ac. ft.	ac. ft.
Acre ft. per sq. mi.		
Inches per sq. mi.		

JSE OF WATER Rec- Recreation

)WNER The Balsams Inc Dixville Notch N H

REMARKS

B-12

'abulation By A A N & R L T **Date** November 15, 1938.

D.S.H. June 6. 1941

M-10

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

65.02

BASIN Connecticut NO. 2 — I-54.04
RIVER Lake Glorietta MILES FROM MOUTH D.A.SQ.MI.
TOWN Dixville OWNER Frank Boudreau Co., Inc.
LOCAL NAME OF DAM
BUILT DESCRIPTION Earth Dike—Concrete & Earth on Earth

POND AREA-ACRES DRAINAGE SQ.MI. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. 35± MAX. MIN.
OVERALL LENGTH OF DAM-FT. 200± MAX.FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE
TAILWATER ELEV.U.S.G.S. LOCAL GAGE
SPILLWAY LENGTHS-FT. 3.4 17 FREEBOARD-FT. 4.5 and 3.9 17
FLASHBOARDS-TYPE, HEIGHT ABOVE CREST 1.5 ft Removable stop planks
WASTE GATES-NO. WIDTH MAX. OPENING DEPTH SILL BELOW CREST

REMARKS Conditions Good
6B into Lake Abenaki, Moose Br, Mohawk R.

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Domestic, Recreation

REMARKS Menace

B-11

DATE 5/7/36

106

M-9

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

65.01

BASIN Connecticut NO. + — — ~~I-5400~~

RIVER Lake Gloriette MILES FROM MOUTH D.A.SQ.MI.

TOWN Dixville OWNER Frank Doudera Co. Inc. Dixville Notch

LOCAL NAME OF DAM

BUILT DESCRIPTION Gravity — Split Stone, Concrete. Earth ou Earth

POND AREA-ACRES 30.9± DRAWDOWN FT. POND CAPACITY-ACRE FT.

HEIGHT-TOP TO BED OF STREAM-FT. 18± MAX. MIN.

OVERALL LENGTH OF DAM-FT. 130± MAX.FLOOD HEIGHT ABOVE CREST-FT.

PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE

TAILWATER ELEV.U.S.G.S. LOCAL GAGE

SPILLWAY LENGTHS-FT. 4.33 and 4.2 FREEBOARD-FT. 5.75

FLASHBOARDS-TYPE, HEIGHT ABOVE CREST 3.25 Remov3ble stop planks

WASTE GATES-NO. WIDTH MAX. OPENING DEPTH SILL BELOW CREST

REMARKS Condition Good

6B Into Lake Aboneki, Moose Bk. Mohawk R.

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Domestic, Recreation

REMARKS Menace

DATE 8/7/36

Form EIA
4845

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD I-5401

TOWN	DIXVILLE	TOWN NO. 2	STATE NO. 65.02
RIVER STREAM	Lake Gloriette	DIKE	
DRAINAGE AREA		POND AREA	
DAM TYPE	Earth	FOUNDATION NATURE OF	Earth
MATERIALS OF CONSTRUCTION	Earth, Concrete		
PURPOSE OF DAM	POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
HEIGHTS, TOP OF DAM TO BED OF STREAM	Approx. 35'	TOP OF DAM TO SPILLWAY CRESTS	4'-6"
SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM	3'-5"wide, 3'-11" deep	LENGTH OF DAM	Approx. 200'
FLASHBOARDS TYPE, HEIGHT ABOVE CREST	Removable stop planks 19"		
OPERATING HEAD CREST TO N. T. W.		TOP OF FLASHBOARDS TO N. T. W.	
WHEELS, NUMBER KINDS & H. P.			
GENERATORS, NUMBER KINDS & K. W.			
H. P. 90 P. C. TIME 100 P. C. EFF.		H. P. 75 P. C. TIME 100 P. C. EFF.	
REFERENCES, CASES, PLANS, INSPECTIONS			

REMARKS

OWNER: Frank Doudera Co., Inc.

CONDITION: Good

MENACE: Yes. Will be subject to periodic inspection.

To the Public Service Commission:

The foregoing memorandum on the above dam is submitted covering inspection made Aug. 7, 1936, according to notification to owner dated July 28, 1936, and bill for same is enclosed.

D. Waldo White
Chief Engineer

Aug. 11, 1936
Copy to Owner

Form E1A
4843

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD I-5400

TOWN	DIXVILLE	TOWN NO. 1	STATE NO. 65.01
RIVER STREAM	Lake Gloriette		
DRAINAGE AREA		POND AREA 31	
DAM TYPE	Gravity	FOUNDATION NATURE OF	Earth
MATERIALS OF CONSTRUCTION	Split Stone - Concrete - Earth		
PURPOSE OF DAM	POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
HEIGHTS, TOP OF DAM TO BED OF STREAM	Approx. 18'	TOP OF DAM TO SPILLWAY CRESTS	
SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM	4'-2½" wide x 5'-9" deep 4'- 4" wide x 5'-9" deep		LENGTH OF DAM Approx. 130'
FLASHBOARDS TYPE, HEIGHT ABOVE CREST	Removable stop planks 5'-3"		
OPERATING HEAD CREST TO N. T. W.		TOP OF FLASHBOARDS TO N. T. W.	
WHEELS, NUMBER KINDS & H. P.			
GENERATORS, NUMBER KINDS & K. W.			
H. P. 90 P. C. TIME 100 P. C. EFF.		H. P. 75 P. C. TIME 100 P. C. EFF.	
REFERENCES, CASES, PLANS, INSPECTIONS			

REMARKS

OWNER: Frank Doudera Co. Inc.

CONDITION: Good

MENACE: Yes. Will be subject to periodic inspection.

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D. Waldo White
Chief Engineer

Aug. 11, 1936
Copy to Owner

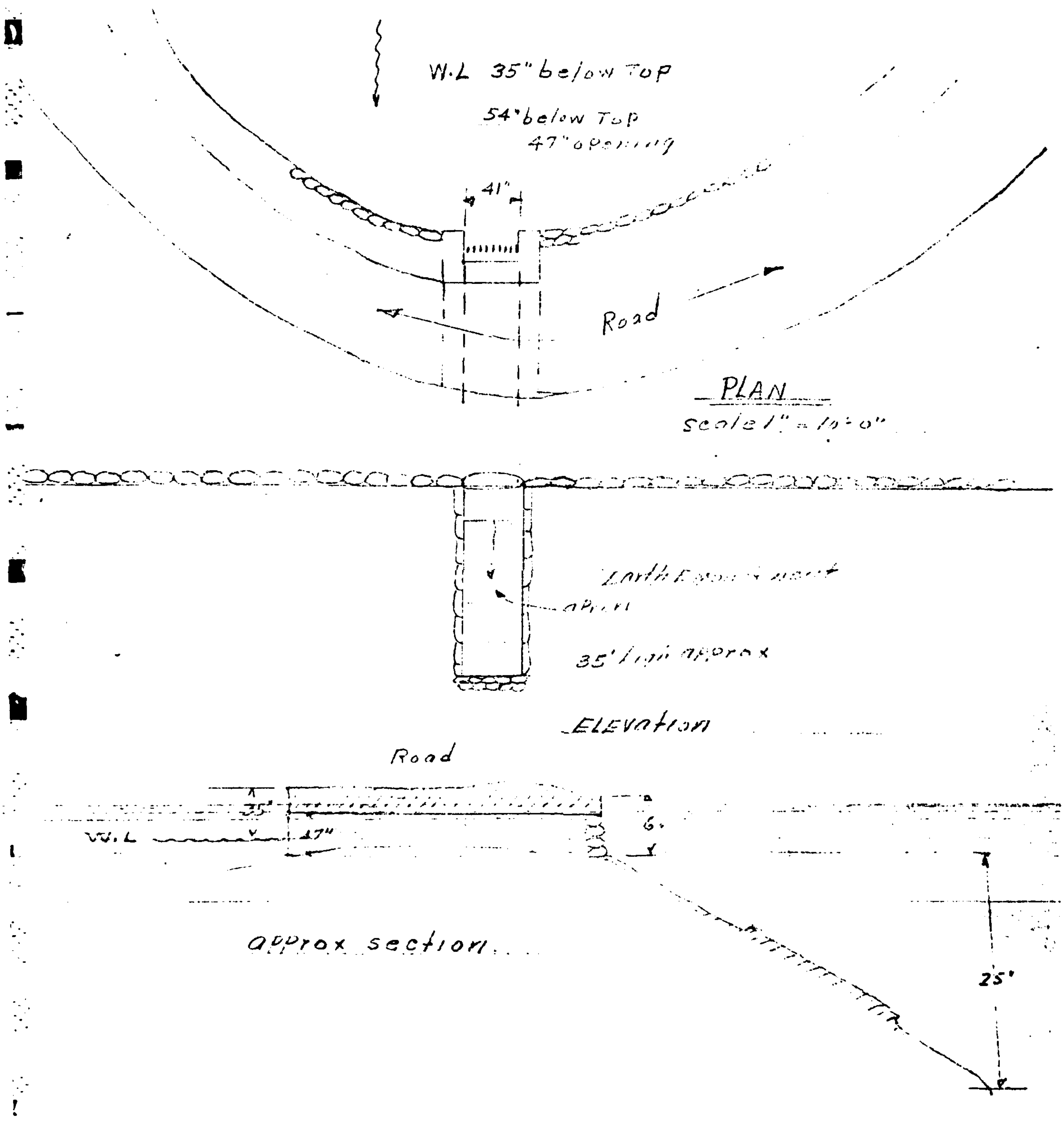
HAMPSHIRE
ER ESOURCES
BOARD
NCORD, N. H.

PROJECT .... FILE 65.02

SUBJECT Lake Gloriette Dyke   Dixville

... Mohawk R.   ...   Dixville Notch N.H.

COMPUTER G.S.W. CHECKER R.L.T. CONT. FROM ACC. ... CONT. ON ACC. ... SUMMARY ON ACC. ... DATE 10/9/39



6252

AMPSHIRE RESOURCES OARD ORD, N. H.

PROJECT

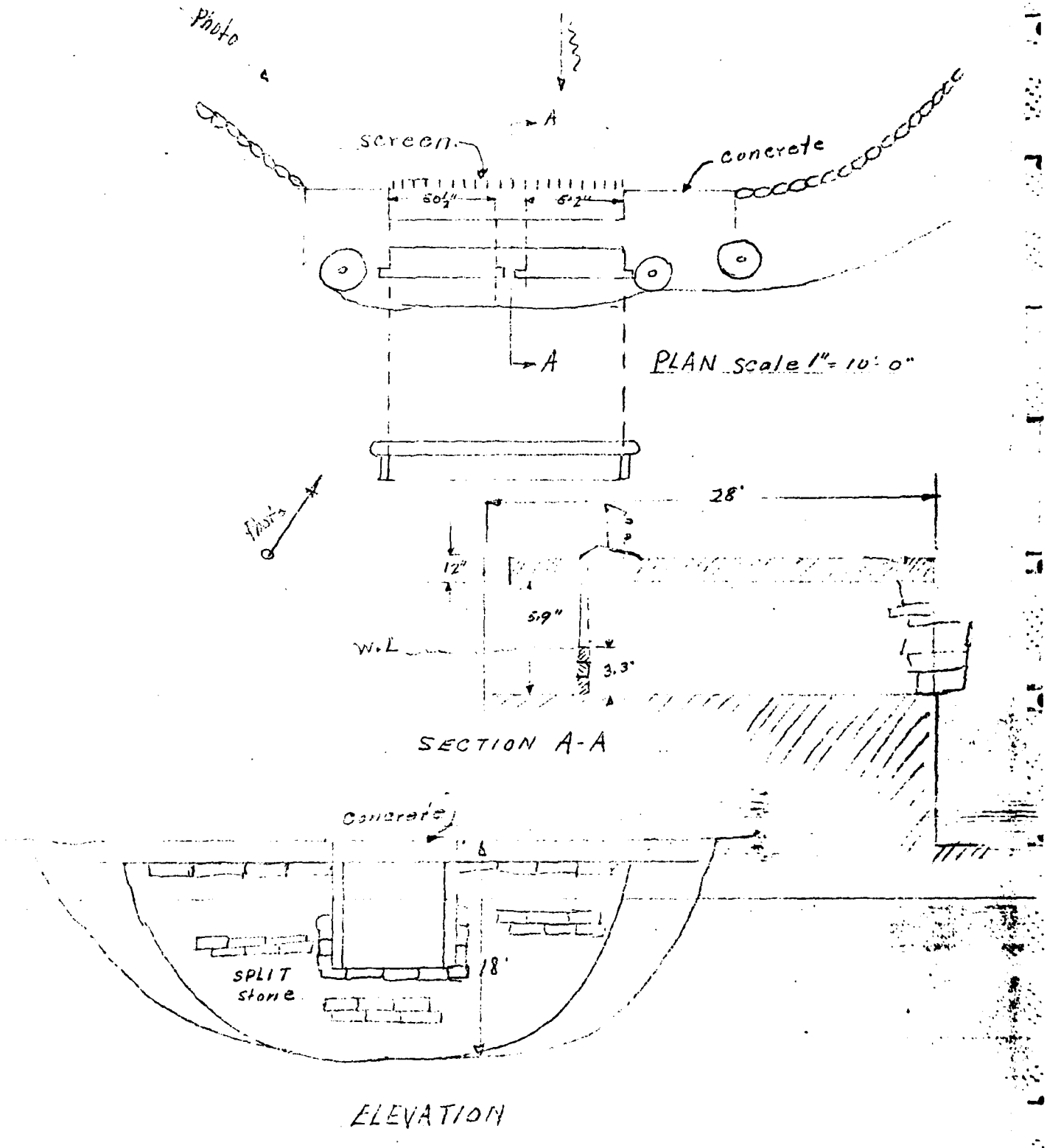
FILE 65.01

SUBJECT LAKE SUNAPEE DIXVILLE ACC.

Dixville Notch, N.H.

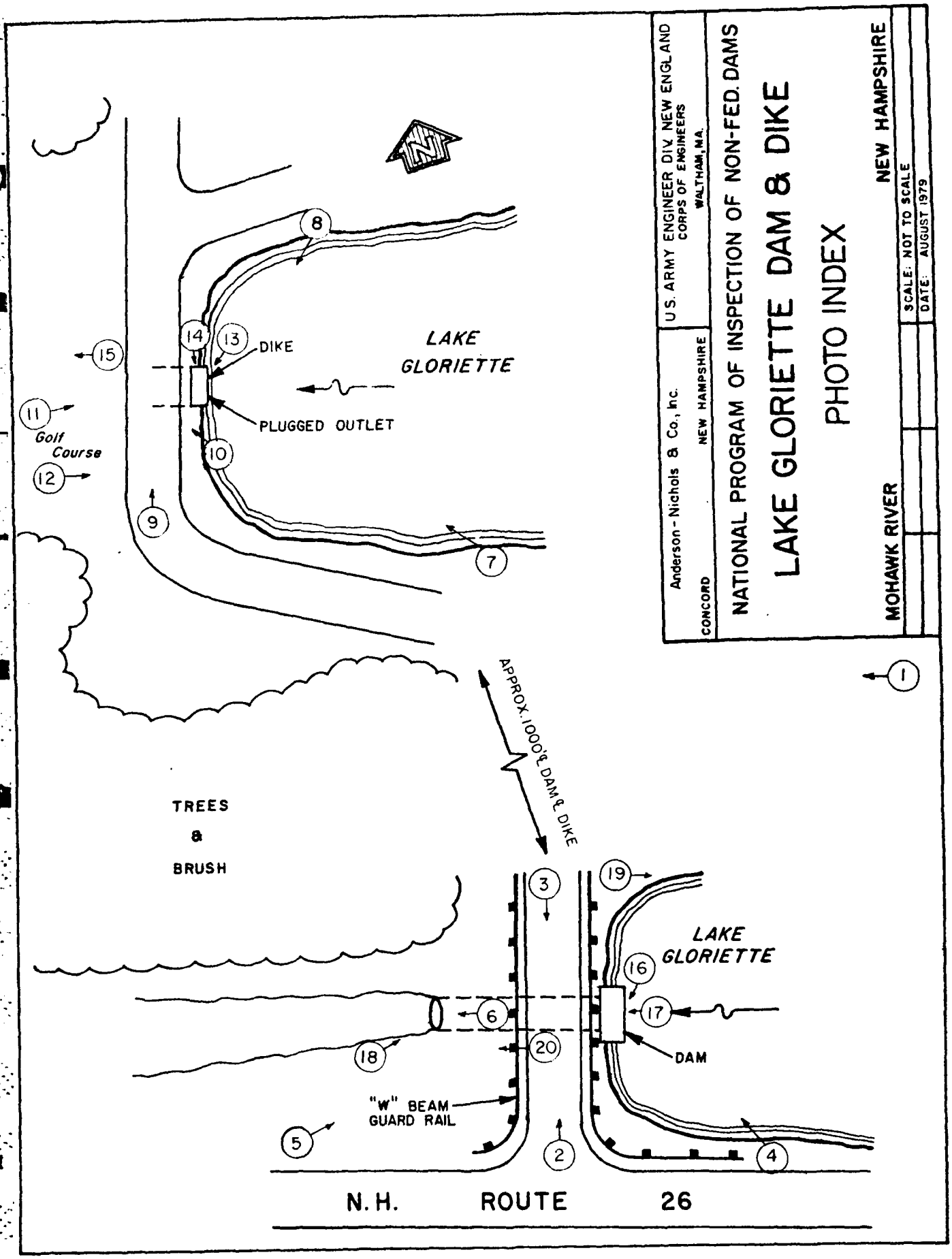
Dixville Notch FRANK SOUDERA INC.

COMPUTER G.S.M. CHECKER R.L.T. CONT. FROM ACC. CONT. ON ACC. SUMMARY ON ACC. DATE 10/9/69



APPENDIX C

PHOTOGRAPHS


U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MA.
Anderson-Nichols & Co., Inc.
CONCORD NEW HAMPSHIRE
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
LAKE GLORIETTE DAM & DIKE
PHOTO INDEX
NEW HAMPSHIRE
MOHAWK RIVER
SCALE: NOT TO SCALE
DATE: AUGUST 1979
N
LAKE GLORIETTE
DIKE
PLUGGED OUTLET
Golf Course
TREES & BRUSH
APPROX. 1000'℄ DAM ℄ DIKE
LAKE GLORIETTE
DAM
"W" BEAM GUARD RAIL
N.H. ROUTE 26
1
2
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10
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15
16
17
18
19
20

Figure 2 - Looking north across the crest of Lake Gloriette Dam.

Figure 3 - View south across the crest.

Figure 4 - Upstream face of the spillway.

Figure 5 - Downstream face of Lake Gloriette Dam.

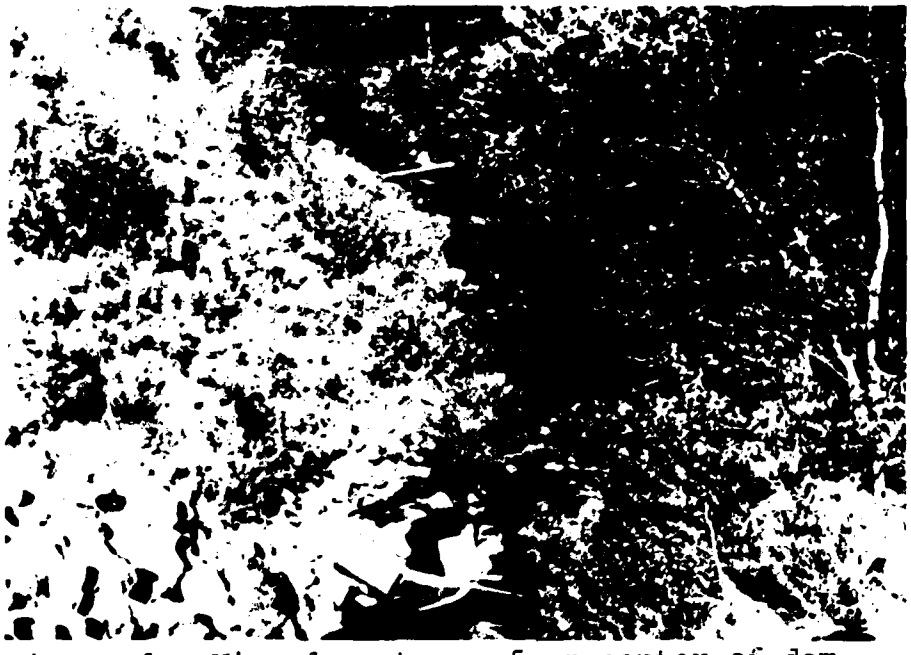


Figure 6 - View downstream from center of dam.

Figure 7 - Upstream face of the dike from south side of reservoir.

Figure 8 - Small trees and brush growing on upstream face of dike.

Figure 9 - View north along crest of dike.

Figure 10 - Erosion on upstream face near edge of roadway.

Figure 11 - Trees and brush growing on downstream face of dike.

Figure 12 - Animal burrow on downstream face of dike.

Figure 13 - Filled inlet to culvert showing TV cable.

Figure 14 - Filled culvert. Note riprap extending about one foot above and one foot below water level.

Figure 15 - Downstream from center of dike.

Figure 16 - View across spillway and stoplog notches at Lake Gloriette Dam.

Figure 17 - Looking downstream through corrugated metal spillway pipe.

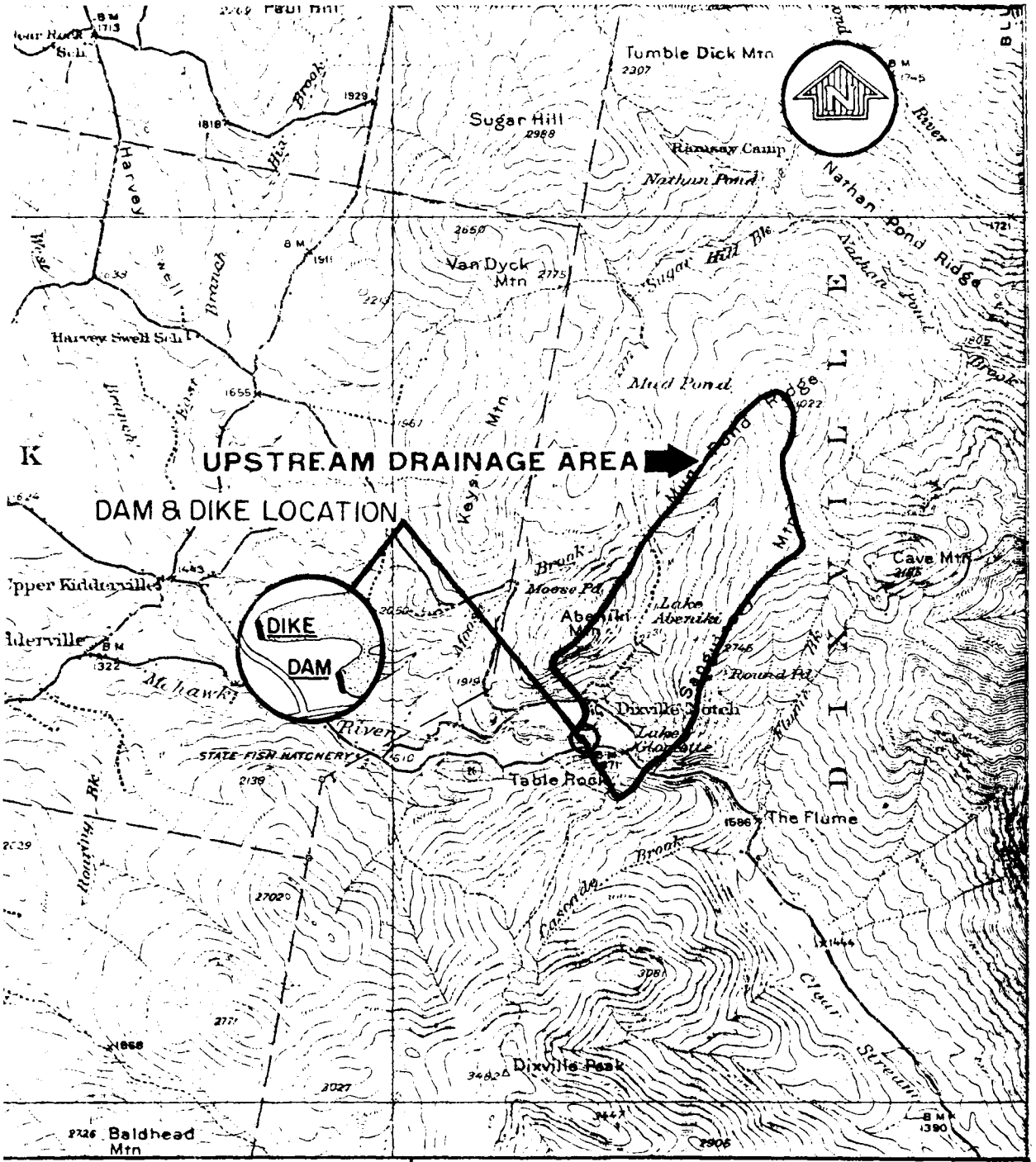
Figure 18 - Downstream toe of dam on right side of spillway.

Figure 19 - Upstream view towards the Balsams Hotel.

Figure 20 - Downstream channel from center of dam.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



IAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LAKE GLORIETTE DAM AND DIKE
DIXVILLE, NEW HAMPSHIRE

GIONAL VICINITY MAP

DEPARTMENT OF THE ARMY
IGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

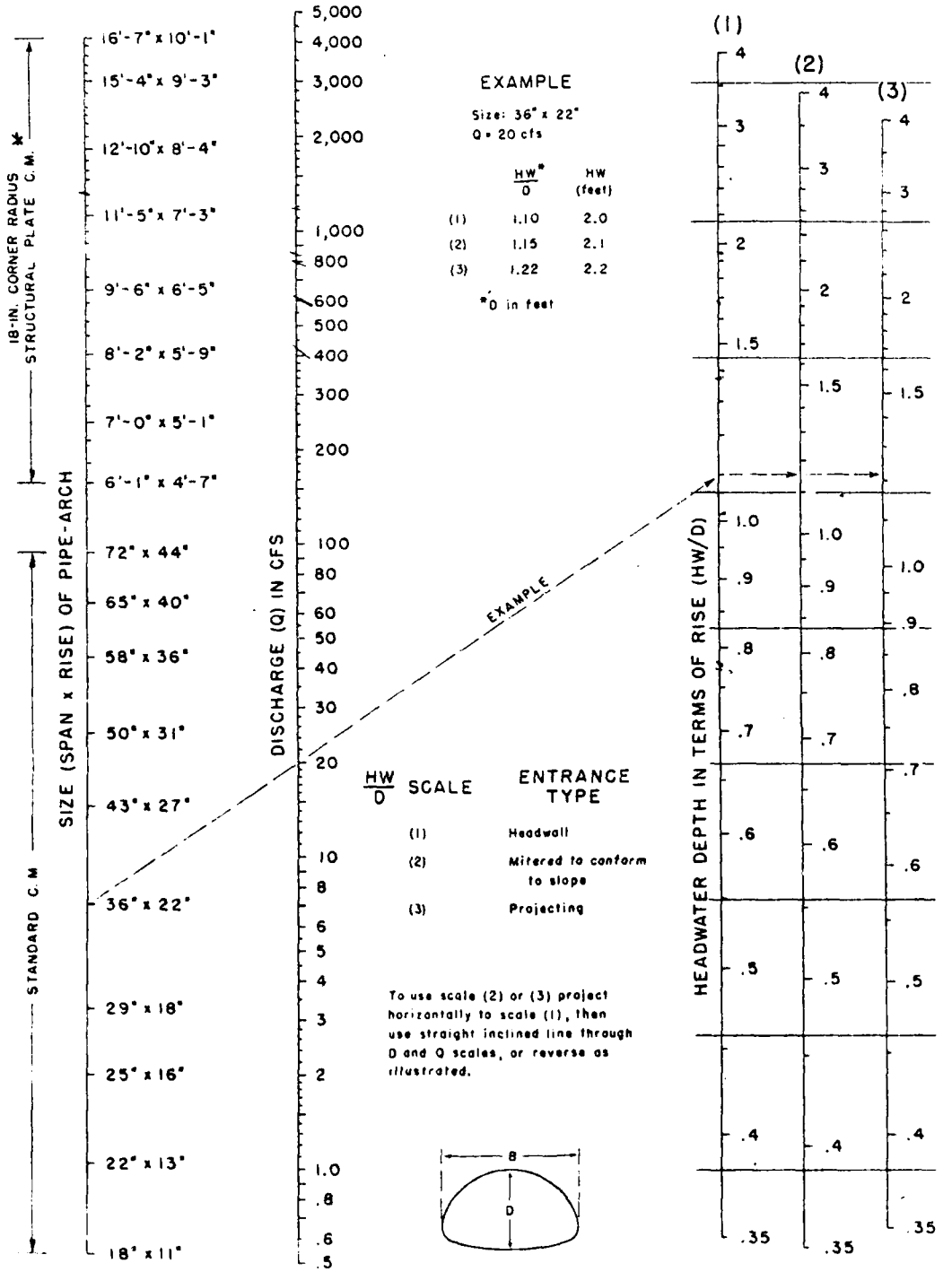
NICHOLS & CO., INC. CONCORD, NH

MAP BASED ON U.S.G.S. 15 MINUTE QUADRANGLE SHEET. DIXVILLE, N.H., 1930

Hydraulic Charts for the Selection of Highway Culverts (HPC-5)
Attachment "A"

7 of 12

CHART 6



*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

5-?

PROJECT: 3273-04 DESIGNER: JMR

Lake Gloriette DATE: 8-1-79

HYDROLOGIC AND CHANNEL INFORMATION

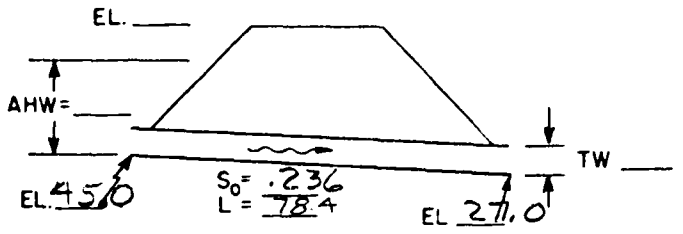
Q_1 = _____ TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
Trial #5 Elev. = 1851	436		.77	6.0												

SUMMARY & RECOMMENDATIONS:

Assuming Inlet Control (See Page 1)

Figure 7

D-14

5-18

Attachment "A"

6 of 12

Rating Curve for [illegible]

PROJECT: 3273-04 Lake Glenayre

DESIGNER: JMR

DATE: 8-1-79

HYDROLOGIC AND CHANNEL INFORMATION

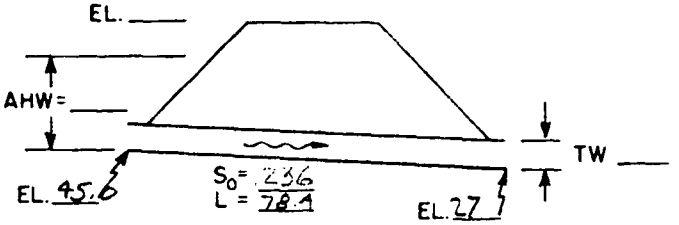
Q_1 = _____ TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	Chart #6 HEADWATER COMPUTATION — INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o K_e	H	d_c	$\frac{d_c+D}{2}$	TW[1]	h_o	LS_o	HW	Chart #14 CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
Trial #1 Assume Elev = 1858	1000		1.68	13 (Assume)	.5	4.7	5.5	6.6	0	6.6	18.5	-6.7	13			
Trial #2 Assume Elev = 1860	1190		1.95	15	.5	10.8	6.6	7.2	0	7.2	18.5	-0.5	15			
Trial 3 Assume Elev = 1855	820		1.36	10.5	}				Trials #1 & #2 demonstrate that inlet controls for the smaller discharges							
Trial 4 Elev = 1853	600		1.03	8.0	}											

SUMMARY & RECOMMENDATIONS:

1 Assume no tailwater

Assume H

Calculate Q

D-13

5-13

Figure 7

Attachment A

5 of 12

3273-04 Lake Okeechobee "A"
Attachment "A"

$H_1 = 7.5$ $H_2 = 4.0$

$= 2.6(1.0)(7.5)^{3/2} + 2.6(15.0)(4.0)^{3/2}$

214 312

$= 526$ cfs

Trial #6 Elev. = 1855.4 (.1 below l.c. of spillway outlet box)

$Q =$

$Q =$

$Q = \underline{\underline{800}}$ cfs ← NOTE: Pipe arch becomes the controlling feature, @ higher elevs. (See Figure "A")

@ 1855.5 pressure flow governs @ concrete spillway section. Discharge capacity of spillway increases greatly as change in flow condition occurs. (From weir to pressure)

Trial #2 Elev. = 1847.0

$Q = CLH^{3/2}$ C = 2.6 (assuming broad-crested weir)

$Q = 2.6(4.0)(1.5)^{3/2}$ H_1 = 1.5'

Q = 19 cfs L = 4.0'

Trial #3 Elev = 1849.0 (INVERT of concrete weir)

$Q = CLH^{3/2}$ H = 3.5'

L = 4.0'

$Q = 2.6(4.0)(3.5)^{1.5}$

Q = 68 cfs

Trial #4 Elev = 1851.0

$Q = C_1L_1H_1^{3/2} + C_2L_2H_2^{3/2}$

$H_1 = 5.5'$

C_2, L_2, H_2 - pertain to 19' conc. weir

$C_2 = 2.6$ (assuming broad crested weir)

$L_2 = 15'$

$Q = (2.6)(4.0)(5.5)^{3/2} + (2.6)(15)(2.0)^{3/2}$

$= 134 + 110$

Q = 234 cfs

Trial #5 Elev = 1853.0

$Q = C_1L_1H_1^{3/2} + C_2L_2H_2^{3/2}$

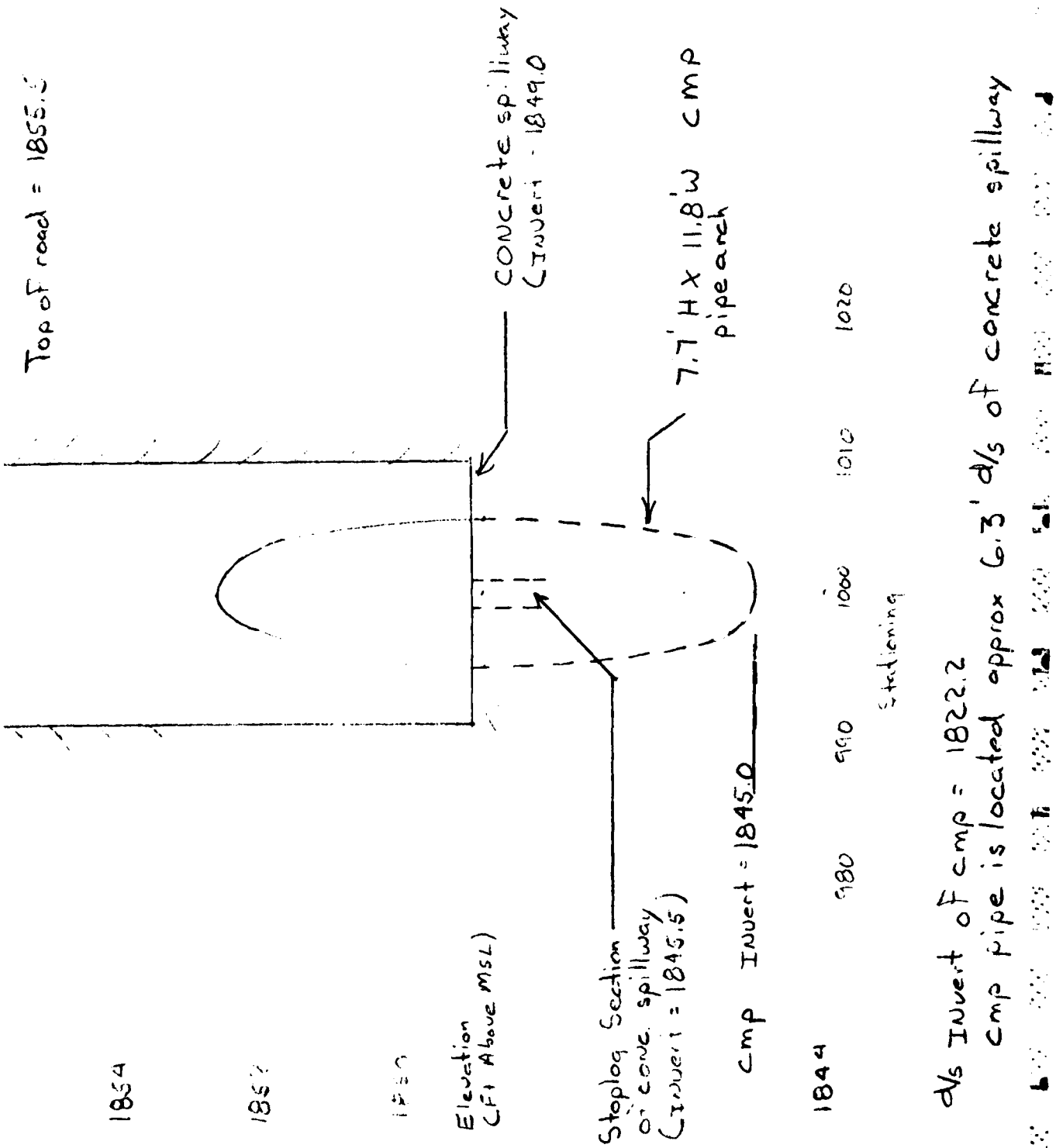
Nichols & Company, Inc.

Subject

Sheet No. 2 of 12
Date 10-18-99
Computed JMR
Checked

JOB NO. Lake Glonetta 3273-05

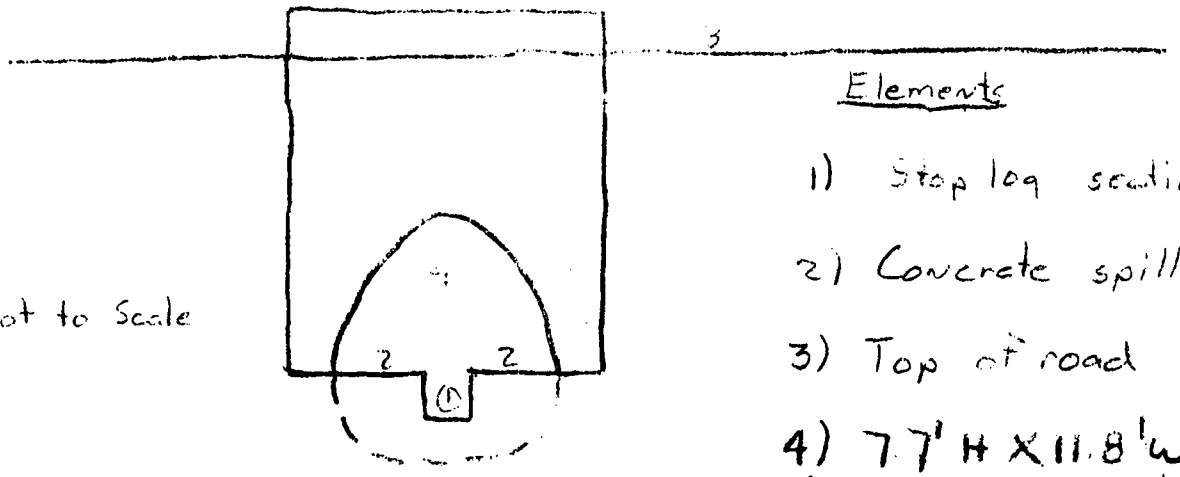
Outlet Works - Dam (South Outlet)



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Rating Curve Calcs. - Attachment "A"

Sketch of Lake Glendale Outlet Structure



Not to Scale

Elements

1) Stop log section

2) Concrete spillway

3) Top of road

4) 7.7' H X 11.8' W CMP PIPE located 6.3' downstream of concrete spillway

Rating Curve is a composite curve resulting from constrictions from elements 1, 2, and 4 or 3 and 4 whichever combination controls for a particular range of elevations. (Refer to x-section of outlet works which provides elevation and geometric data)

CONCRETE SPILLWAY SECTION

Trial #1 Elev = 1845.5 (invert of stop log section)

Q = 0 cfs

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Lake Gloriette Dam and Dike - Test Flood Elev.

Drainage Area = 1.82 mi^2
Size Classification = intermediate
Hazard Classification = Significant
Test Flood - Full PMF

Calculate PMF Using "Preliminary Guidance For Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations, March, 1978"

Average slope of the watershed is 413 ft/mi. A mountainous curve will be used to compute the PMF. Use a CSM value of 2600,

$1.82\ mi^2 \times 2600 = 4732\ cfs = PMF$

$Q_{P_1} = \frac{1}{2}$ PMF = 2366 cfs (test Flood inFlow)

$Q_{P_1} = 2366\ cfs \rightarrow 1857.4\ MSL \rightarrow 705\ ac\text{-}Ft\ (.11")$ ← STOR1

$Q_{P_2} = Q_{P_1} \times \left(1 - \frac{STOR1}{9.5"}\right)$ ← ½ PMF runoff

$Q_{P_2} = 2366\left(1 - \frac{11}{9.5}\right) = 2339\ cfs$

$Q_{P_2} = 2339\ cfs \rightarrow 1857.2 \rightarrow 705\ ac\text{-}ft\ (.11")$ ← STOR2

Aug. Surcharge Storage = $\frac{STOR1 + STOR2}{2}$ = .11" = 705 ac-Ft

2350 cfs ← Elev = 1857.2

Q_{P_3} = 2350 cfs TEST Flood Outflow

Anderson-Nichols & Company, Inc.

Subject

Sheet No. 6 of 6

Date

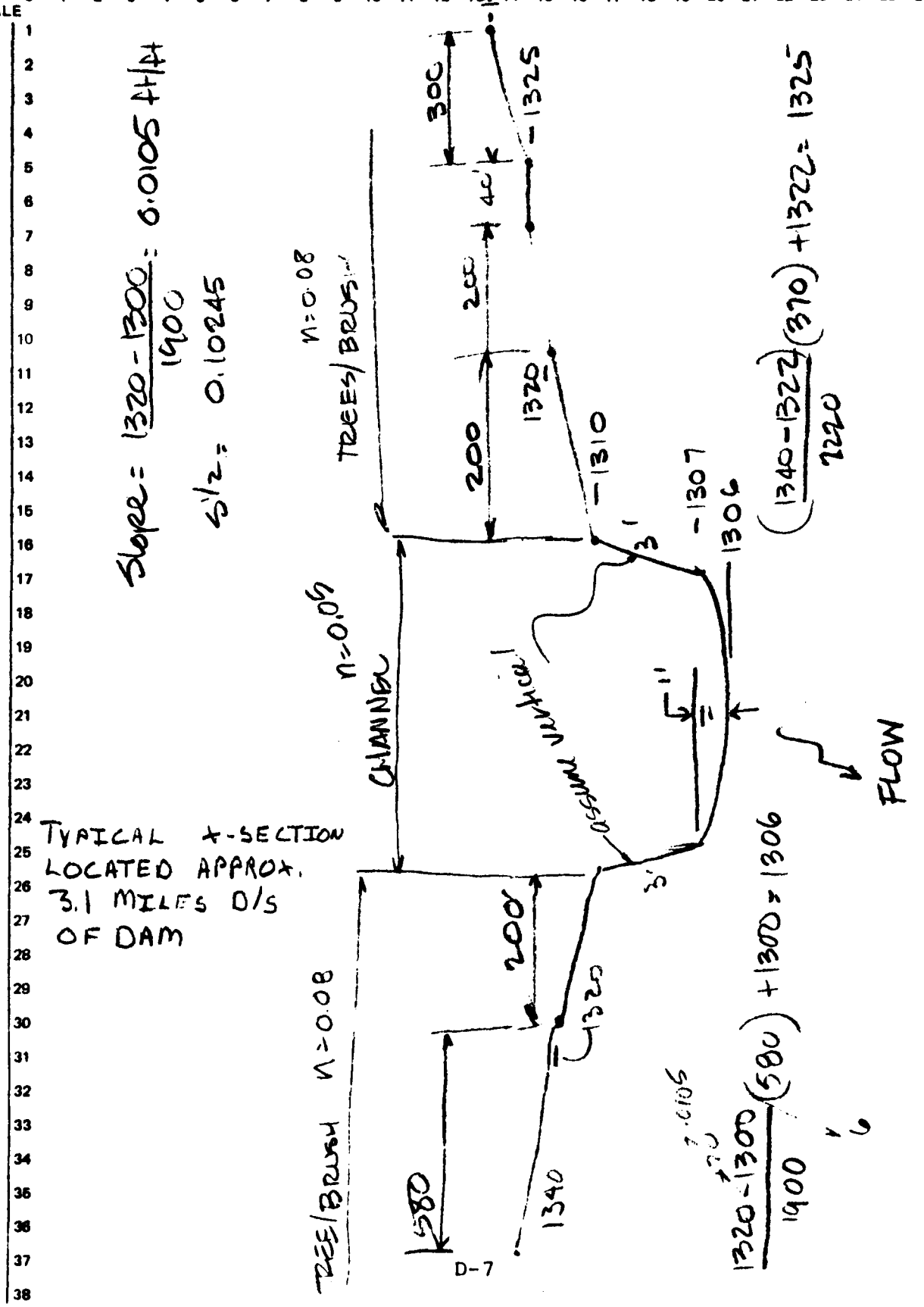
Computed

Checked

JOB NO.

POSSIBLE SKETCH OF HAZARD X-SECTION

SQUARES /4 IN. SCALE



JOB NO. D/S Rating Curve 5 of 6 Checked

ELEV	DEPTH
1306	0

CALCULATION

Q = 0 CFS

1307 | 1' (NORMAL FLOW)

$A = \frac{2}{3} T y$ (parabolic shape)

$A = \frac{2}{3}(20)(1) = 13.33$ ft²

$W.P. = T + \left(\frac{8}{3}\right)\left(y^2/T\right)$

$W.P. = 20 + \left(\frac{8}{3}\right)\left(1^2/20\right) = 20.13$

$R = A/W.P. = 13.33/20.13 = 0.662$

$R^{2/3} = 0.76$

$Q = \frac{1.49}{0.05}(0.76)(0.1025)(13.33)$

$Q = 31$ CFS

1310 | 4' (Top of bank)

$A = 13.33 + 3(20) = 73.33$ ft²

$W.P. = 20.13 + 2(3) = 26.13$

$R = A/WP = 73.33/26.13 = 2.81$

$R^{2/3} = 1.99$

$Q = \frac{1.49}{0.05}(1.99)(0.1025)(73.33)$

$Q = 446$ CFS

1320 | 14'

$A = 73.33 + 10(20) + 2\left(\frac{1}{2}\right)(10)(200)$

$A = 2273$ ft²

$W.P. = 26.13 + 2\left(\sqrt{(10)^2 + (200)^2}\right)$

$W.P. = 426.6$

$R = A/WP = 2273/426.6 = 5.33$

$R^{2/3} = 3.05$

$n = \frac{26.13}{426.6}(0.05) + \frac{0.08}{1}(0.08) = 0.047$

D-21

D-6

$$Q = \frac{1.49}{0.08}(3.05)(0.1025)(2273)$$

$$Q = 13,235 \text{ cfs}$$

1315/9'

$$A = 73.33 + 5(20) + 2\left(\tfrac{1}{2}\right)(5)(100)$$
$$A = 673 \text{ ft}$$

$$W.P. = 26.13 + 2\sqrt{(5)^2 + (100)^2}$$
$$W.P. = 226.4$$

$$R = A/W.P. = 673/226.4 = 2.97$$
$$R^{2/3} = 2.07$$

$$n = \frac{26.13}{226.4}(0.05) + \frac{200.3}{226.4}(0.08)$$
$$n = 0.08$$

$$Q = \frac{1.49}{0.08}(2.07)(0.1025)(673)$$
$$Q = 2660 \text{ cfs}$$

1325/19'

$$A = 73.33 + 15(20) + 2\left(\tfrac{1}{2}\right)(10)(200) + \tfrac{1}{2}(200)(5) + \tfrac{1}{2}(145)(5) + (2)(5)(200)$$
$$= 5235.8 \text{ ft}^2$$

$$W.P. = 426.6 + \sqrt{200^2 + 5^2} + \sqrt{145^2 + 5^2}$$
$$= 426.6 + 200.1 + 145.1$$
$$= 771.8 \text{ ft}$$

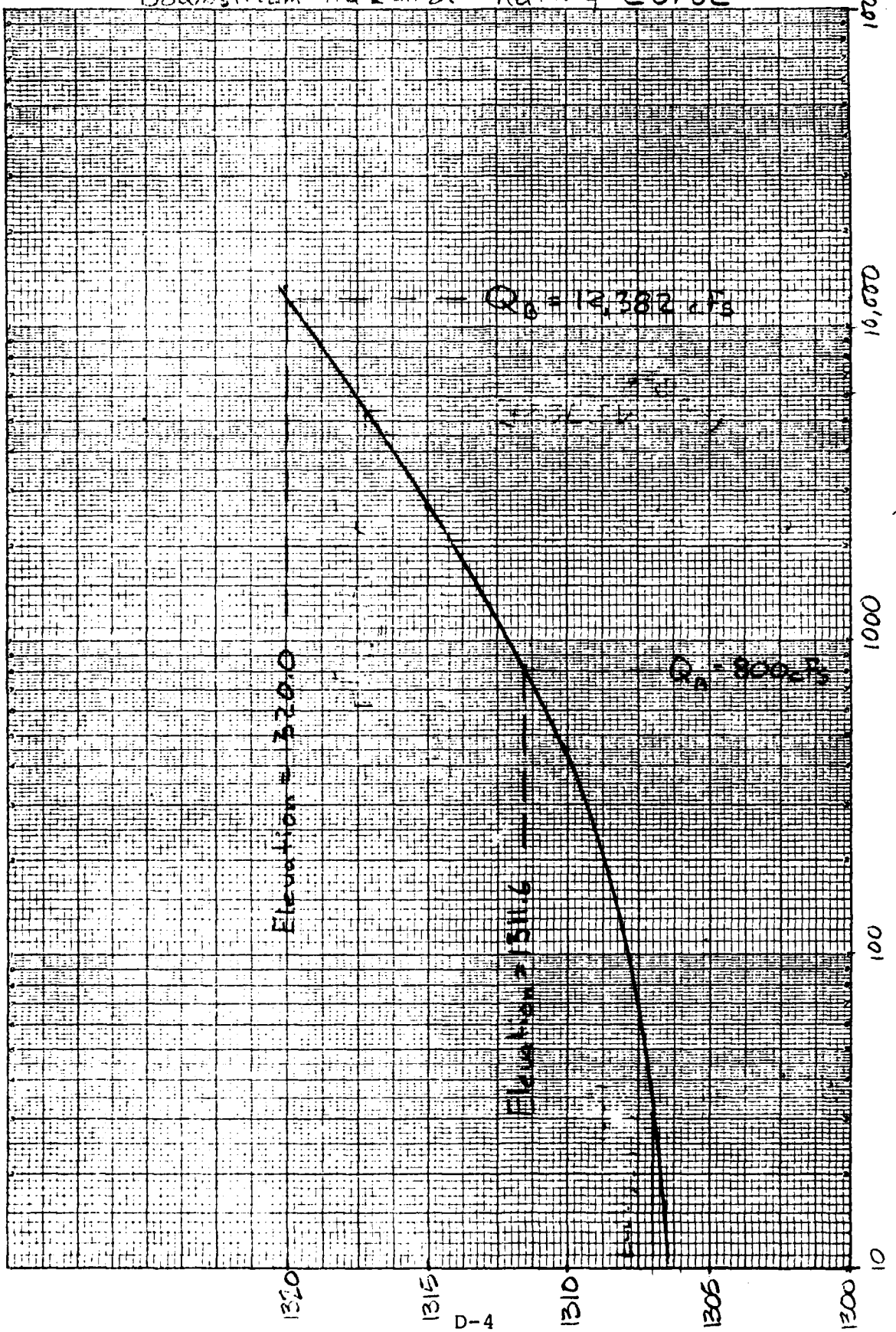
$$R = 6.78$$
$$R^{2/3} = 3.58$$

$n = 0.08$

$$Q = \frac{1.49}{.08}(3.58)(.1025)(5235.8) = 35,785 \text{ cfs}$$

Lake Gloriette

Downstream Hazard Rating Curve



-FIELD NOTE REDUCTION - 6/29/79 FIELD TRIP
JRL / SM

- TRAILER - 150 yds EAST OF KIDDERVILLE INT.
± 1322 (Ed) (FROM QUAD SHT)
SILL = 1322 + 1 = 1323' MSL

- YOGI'S CAFE -

$$\frac{(1340-1322)}{2220'}(845') + 1322 = 1329'(Ed)$$

SILL = 1329 + 2' = 1331' MSL

- HSE'S WEST OF MOHAWK R. ON RD LEADING TO UPPER KIDDERVILLE

$$-\frac{(1320-1300)}{2535}(210) + 1320 = 1318(Ed)$$

SILL = 1318 + 2 = 1320 WESTERLY HSE

1318 + 12 = 1330 EASTERLY HSE

- $ELEV_{BREACH}$ = 1320 W/ Q_B = 12,382 CFS

- STAGE INCREASE ABOVE ANTECEDENT FLOW =
1320 - 1311.6 = 8.4

- CONC:

HAZARD CLASSIFICATION - SIGNIFICANT
POSSIBLE LOSS OF LIFE (1 HOUSE)
APPRECIABLE DAMAGE TO FARMS AND FARMLAND IN FLOOD PLAIN; AS WELL AS LOSS OF MAJOR SECTIONS OF ROUTE 26 WHICH WOULD BE SUSCEPTIBLE TO HIGH EROSIVE VELOCITIES W/ A FLOW EQUAL TO THE BREACH DISCHARGE

SQUARES 1/4 IN. SCALE

BREACH ANALYSIS — 1 of 6

A. Breach analysis performed assuming breach occurs with reservoir level @ top of dam (elev = 1355.5)

B. Determine peak Failure outflow - Q_{p_1}

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

W_b = breach width
g = 32.2 ft/sec^2
Y_o = breach height

W_b = 80' (based on field inspection)
Y_o = pool elev. - invert @ midpoint of dam embankment
Y_o = 1855.5 - 1836 = 19.5'

NOTE: Invert of dam @ midpoint of dam embankment obtained by using NH DPW & H plans for pipe arch extending under dam and taking invert elevation @ intake/exit point.

$$Q_{p_1} = 8/27\,(80)\sqrt{32.2}\,(19.5)^{3/2}$$
$$Q_{p_1} = 11,582 \text{ cfs}$$

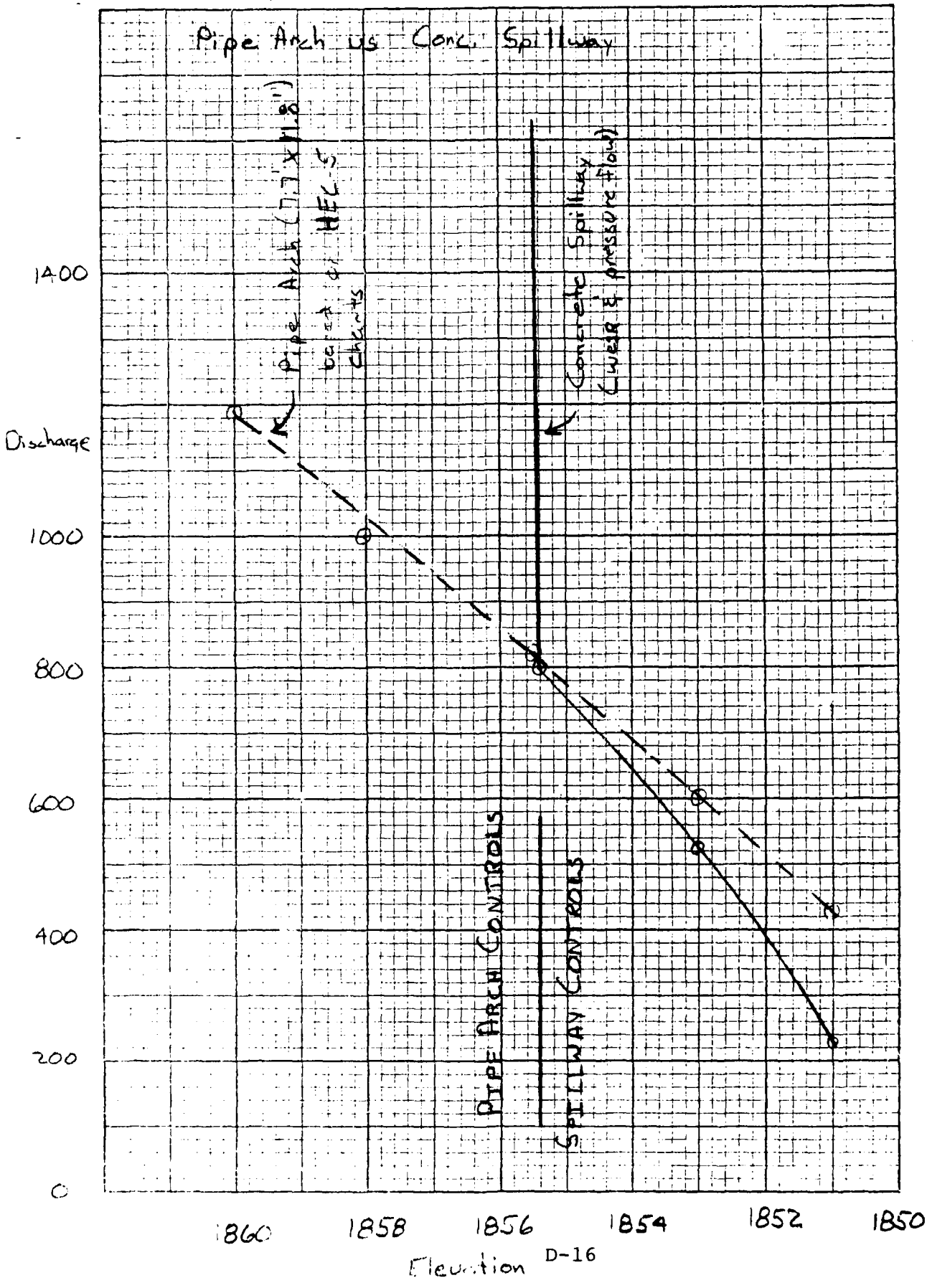
Total Breach Discharge = Q_{p_1} + Flow thru spillway @ time of breach

Q_t = 11,582 + 800 ← obtain from outlet rating curve.

Q_t = 12,382 cfs

Lake Gloriette - Figuire A

Outlet Rating Curve - Controlling Feature



COMBINED DISCHARGE (Outlet Structure & Flowover Earth Embankments)

Trial #7 Elev = 1856.0 (top of dike)

$Q = C_3 L_3 H_3^{3/2} + Q_{pa}$

$Q = (2.6)(150')(0.5)^{3/2} + 840$

$Q = 138 + 840$

$= 978$ cfs

Q_{pa} = discharge thru 7.7'H x 11.8'W cmp pipe arch

C_3 = 2.6 (assuming broad crested weir)

H_3 = avg. head over roadway weir (dam)

L_3 = length of roadway weir (dam)

Q_{pa} = discharge thru pipe arch - See Figure "A"

Trial #8 Elev = 1857.0

$Q = C_3 L_3 H_3^{3/2} + Q_{pa} + C_4 L_4 H_4^{3/2}$

$Q = (2.6)(150)(1.5)^{3/2} + 920 + 2.6(200)(1.0)^{3/2}$

$Q = 716 + 920 + 520$

$= 2156$ cfs

C_4 = 2.6 (assuming broad-crested weir)

H_4 = avg. head over roadweir (dike)

L_3 = length of effective weir (dike)

Trial #9 Elev = 1858.0

$Q = C_3 L_3 H_3^{3/2} + Q_{pa} + C_4 L_4 H_4^{3/2}$

$Q = 2.6(150)(2.5)^{3/2} + 1000 + (2.6)(200)(1.5)^{3/2}$

$Q = 1542 + 1000 + 955$

$= 3497$ cfs

Trial #10 Elev = 1859.0

$Q = C_3 L_3 H_3^{3/2} + Q_{pa} + C_4 L_4 H_4^{3/2}$

$Q = (2.6)(150)(3.5)^{3/2} + 1100 + (2.6)(200)(2.5)^{3/2}$

$Q = 2554 + 1100 + 2055$

$= 5709$ cfs

Trial #11 Elev = 1860.0

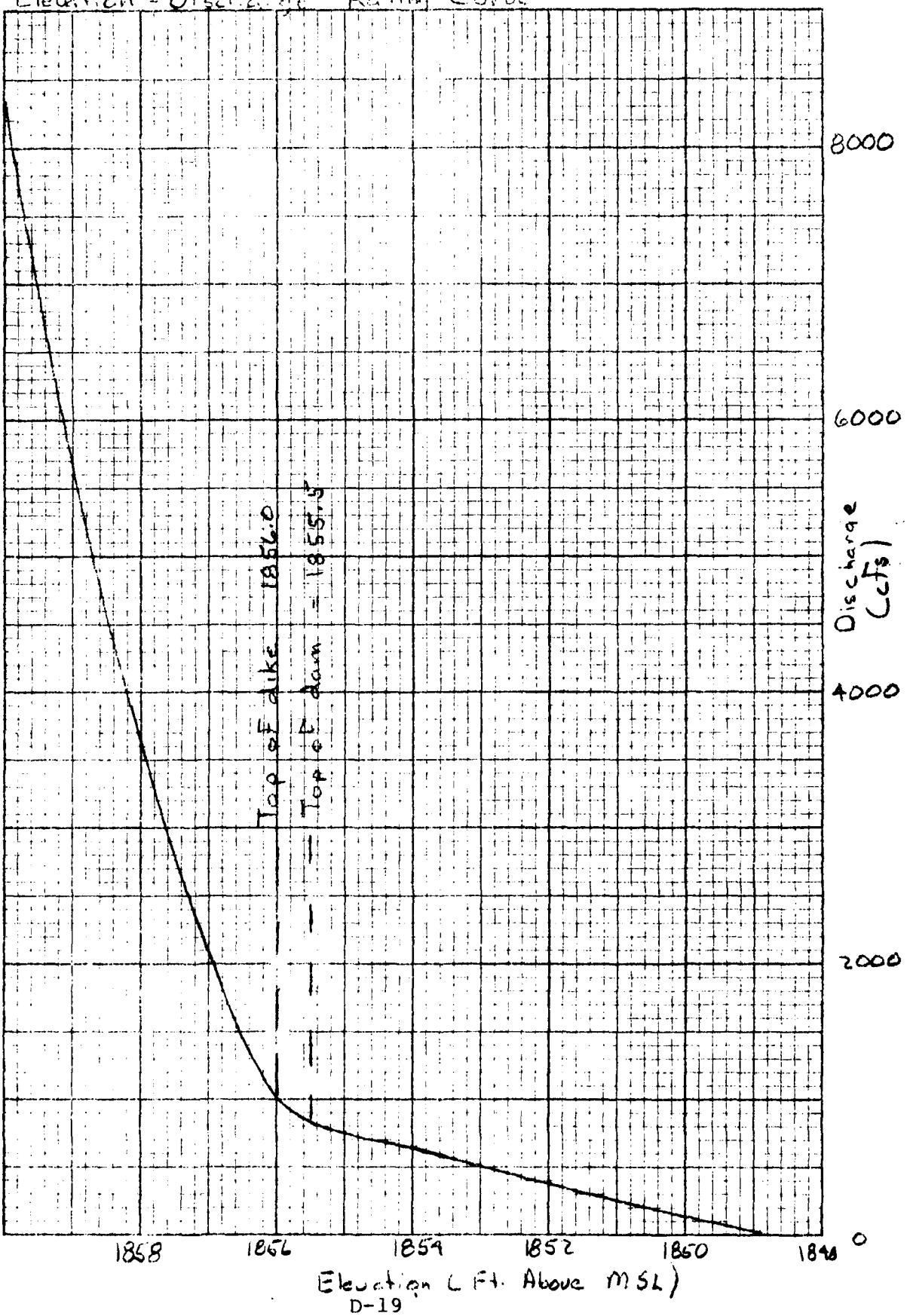
$Q = C_3 L_3 H_3^{3/2} + Q_{pa} + C_4 L_4 H_4^{3/2}$

$Q = 2.6(150)(4.5)^{3/2} + 1190 + (2.6)(200)(3.5)^{3/2}$

$= 3723 + 1190 + 3405$

$= 8318$ cfs

Elevation - Discharge Rating Curve



Effective Weir Lengths

Dam (South Outlet)

1) Assume constant weir elevation = 1855.5'
2) Assume effective weir length = 150'

DIKE (North Outlet)

1) Assume constant weir elevation = 1856.0
2) Assume effective weir length = 200'

Storage Calcs

@ Normal Pool Elev. - 1845.5 (invert of stoplog section)

Sfc Area @ 1845.5 = 25.6 acres (obtained from U.S.G.S. topo)
Assumed Avg Depth = 15.0 ft
Assumed Sfc @ Lake Invert = 15 acres (1830.5)

Calculate Storage using Frustrum of pyramid formula

$$V = \frac{1}{3} h \left(B_1 + B_2 + \sqrt{B_1 B_2} \right)$$

B_1 = lower base (15 acres)
B_2 = upper base (25.6 ac)
h = 15'

@ 1845.5 V = 301 acre-ft

@ 1860.0

Sfc Area @ 1860.0 = 41.6 acres (obtained from U.S.G.S. topo)

$V = \frac{1}{3} h (B_1 + B_2 + \sqrt{B_1 B_2})$ (Frustrum of pyramid)

$V = \frac{1}{3}(15.5)[25.6 + 41.6 + \sqrt{(25.6)(41.6)}]$ B_1 = 25.6 acres
B_2 = 41.6 acres
h = 15.5 Feet

V = 515 ac-ft

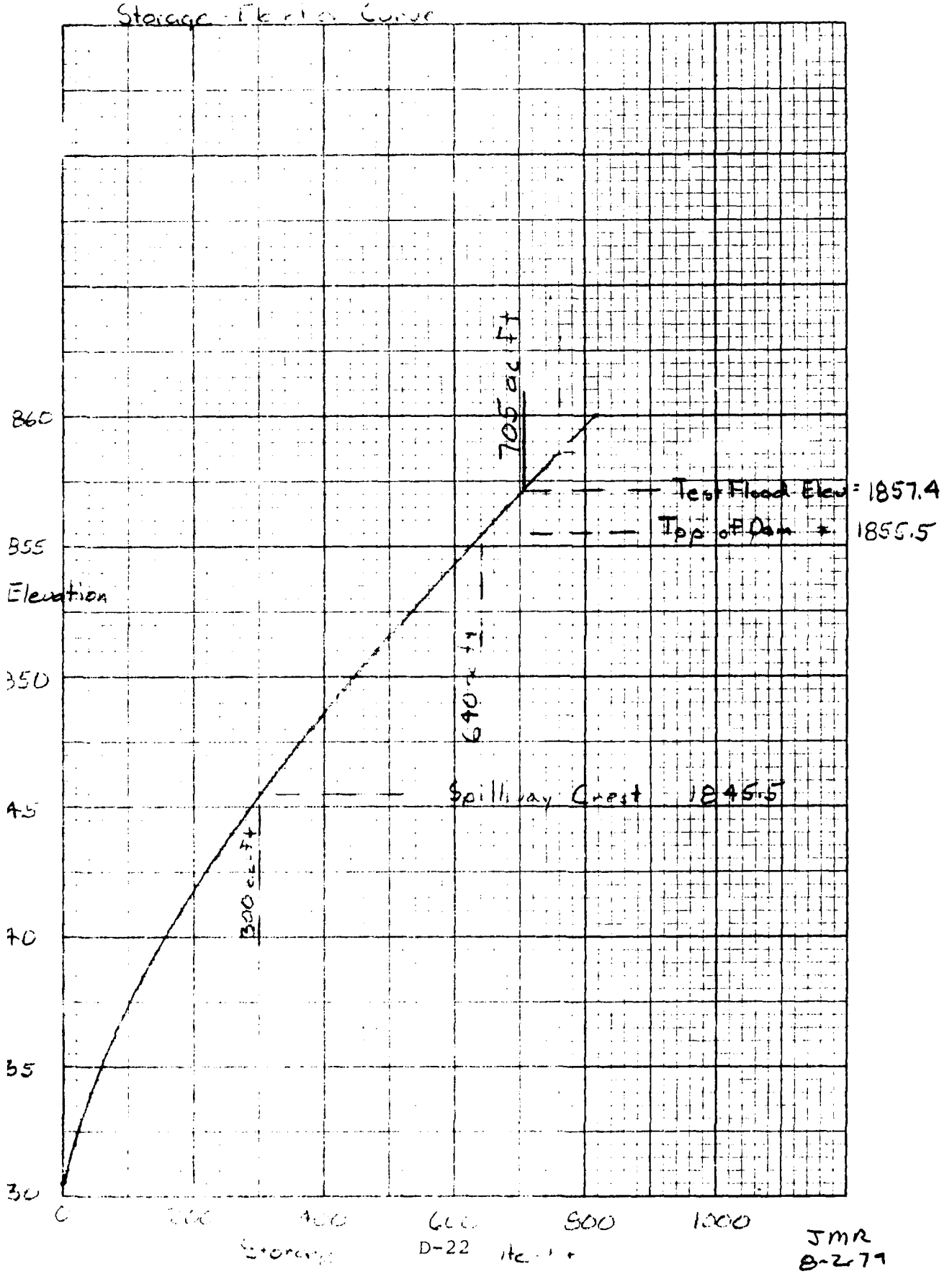
V_T = 515 + 301
= 816 ac-ft @ 1860.0

Attachment "B"

Pg 20 of 22

Lake Gloriette

Storage - Elevation Curve



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Lake Gloriette Dixville, New Hampshire

Surface Area Calcs.

Drainage Area

1 sq in = .973 mi^2

Total D.A = 1.87 in^2

= 1.82 mi^2

Slope = $\frac{3022 - 1849}{2.84}$

= 413 ft/mi

Source: U.S G.S. 15' Quad Sheet

Surface Area

Normal Pond Area = 4 squares

= 25.6 acres

1 sq in = .973 mi^2 = 100 squares = 640 acres

= 1 square = 6.4 acres

1860 contour area = 6.5 squares

= 41.6 acres

Setting = 10

R_1 = 1.85

R_2 = 1.89

R_{avg} = 187

Results

a) Surface Area @ normal pool elev (1845.5) = 25.6 acres

b) Surface Area @ elev = 1860 = 41.6 acres

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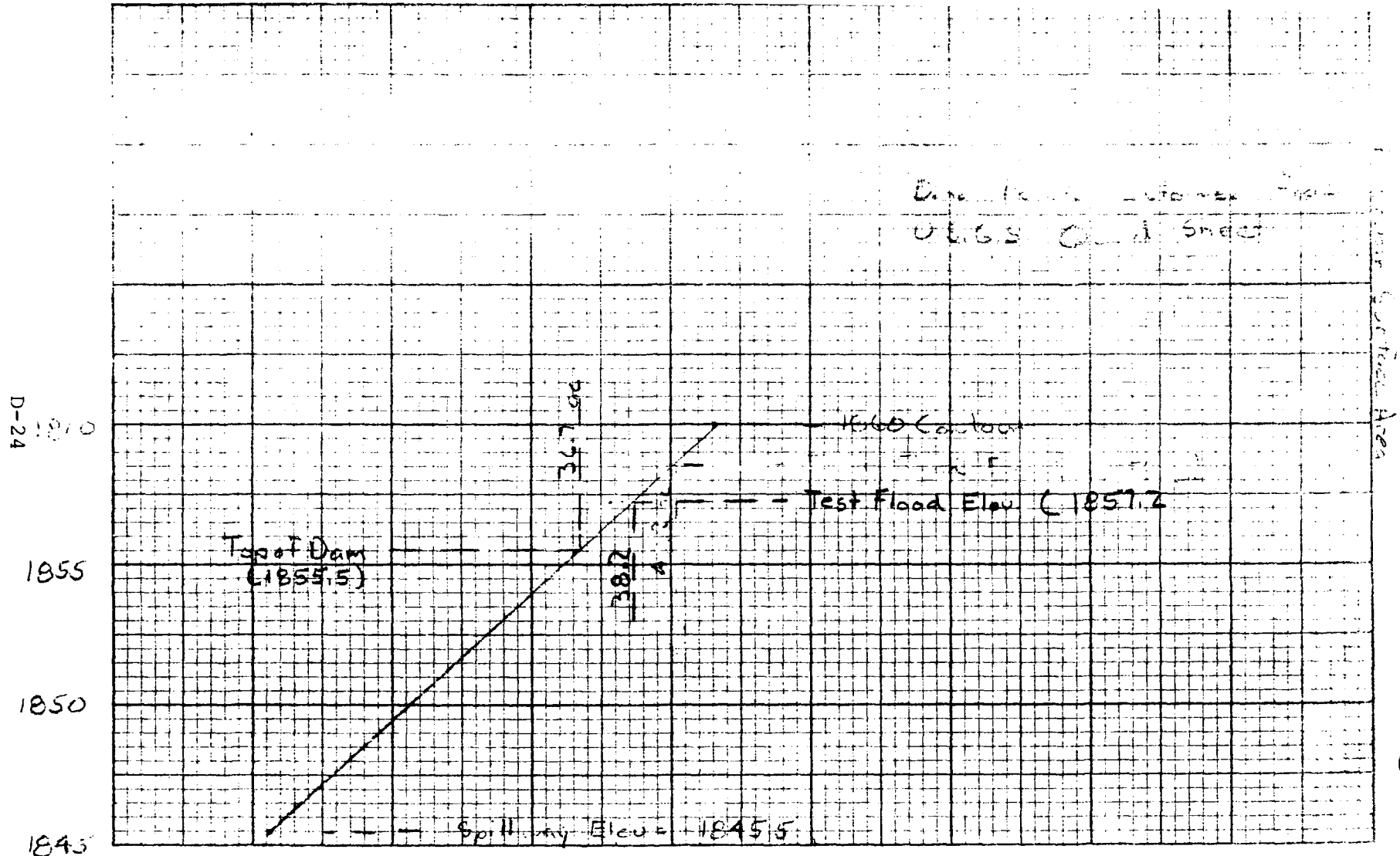
Attachment C = 1 of 2



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Attachment "C"
2 of 2

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APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

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