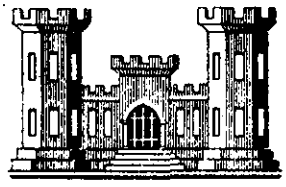
407-443

LOWER CONNECTICUT RIVER BASIN
BERLIN , CONNECTICUT

KENMERE RESERVOIR DAM
CT - 00251

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

FEBRUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00251	2. GOVT ACCESSION NO. AD-A143488	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Kenmere Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE February 1980 13. NUMBER OF PAGES 75
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

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

18. SUPPLEMENTARY NOTES

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

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

DAMS, INSPECTION, DAM SAFETY,

Lower Conn. River Basin
Berlin, Conn.

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

The Kenmere Reservoir Dam is an earthen embankment with a clay puddle core about 700 feet in length, with a maximum height of 25 feet. Adike is located southeast of the dam and has a maximum height of 15 feet. The dam and dike are judged to be in poor condition. For the combination of dam size (small) and downstream hazard (significant), a range in the magnitude of the spillway test flood of 100 year frequency flood to the ½ PMF is given.

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

KENMERE RESERVOIR DAM

CT 00251

LOWER CONNECTICUT RIVER BASIN

BERLIN, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00251
Name of Dam:	Kenmere Reservoir Dam
Town:	Berlin
County and State:	Hartford, Connecticut
Stream:	John Hall Brook
Date of Inspection:	30 October, 1979

BRIEF ASSESSMENT

The Kenmere Reservoir Dam is an earthen embankment with a clay puddle core about 700 feet in length, with a maximum height of 25 feet. A dike is located southeast of the dam and has a maximum height of 15 feet. A 135 foot wide spillway, consists of an approach channel, stone masonry crest, sloping downstream face, apron and wasteway. A 12 inch blow-off pipe provides a low level outlet.

Kenmere Reservoir is used for public water supply. It has a storage of 594 acre-feet; the size classification is thus small. A breach of the dam or dike could affect several homes, Connecticut State Highway Route 364 and a golf course. With the possibility of some loss of life and the probability of serious economic losses, the dam has been classified as having a significant hazard potential.

The dam and dike are judged to be in poor condition. The crest of the dam is in poor condition with large vehicle ruts. A deep hole on the crest was observed in the vicinity of the service bridge. No movement or settlement of the crest was indicated and the vertical and horizontal alignment was generally good. The riprap on the upstream face has many gaps leaving the embankment unprotected. Numerous tree stumps were observed on the upstream face. The slopes are extensively overgrown with brush, grass and large trees. The downstream slope has an undulating surface in many locations. A considerable wet area is located along the downstream toe. Numerous small streams were noted carrying water from seeps eminating on the downstream face. The spillay is in very poor condition. The dike's upstream face is unprotected. Extensive vegetation and stumps exist on the upstream and downstream slopes. A large erosion gully approximately four feet deep has formed on the downstream slope. Seepage is evident along the majority of the downstream toe. A small scarp was observed along the downstream toe probably due to continued seepage. A small boil was observed approximately 20 feet downstream of the toe.

For the combination of dam size (small) and downstream hazard (significant), a range in the magnitude of the spillway test flood of 100-year frequency flood to the 1/2 PMF is given. A spillway test flood of 1/2 PMF was selected for this project. The maximum spillway capacity is 2700 CFS at a stage of 4 feet above the spillway crest (equal to the top of dam).

The capacity of the spillway is inadequate to pass the one half PMF test flood outflow of 3206 CFS without overtopping the dam and dike. The test flood would overtop the dam by about 0.2 feet. The spillway is adequate to pass about 84 percent of the test flood outflow without overtopping the dam and dike.

Since delay could adversely effect the stability of the dam and dike, the owner should immediately retain a qualified registered engineer to accomplish the following: 1) inspect the downstream slope of the dam and dike after the grass brush, weeds, and brambles have been cleared; 2) the source of the discharge observed near the downstream toe of the main dam and dike should be investigated and appropriate recommendation for remedial measures developed and implemented. The investigation should also determine the quality of seepage and turbidity associated with the discharge; 3) design and oversee the repair of the slope failure adjacent to the left spillway wingwall approximately 80 feet downstream from the spillway crest. In addition, the failure of the stone paving located on the spillway channel bottom should be investigated and repaired. Repairs should be made to the spillways left training wall and the erosion of the downstream channel must be controlled; 4) design and oversee the repair of erosion on the upstream slope of the dam and the installation of required erosion protection measures; 5) specifify and oversee procedure to restore eroded areas on the crest and downstream slope of the dam and dike. Within one year of receipt of the Phase I Inspection Report, the owner should retain a qualified registered engineer to accomplish the following: 1) Specify procedures for removal of trees, tree stumps and their root systems on the upstream and downstream slopes and in the zone within 25 feet downstream of the toe of the dam and dike; 2) specify and oversee procedures for establishing additional grassy vegetation and repair the erosion on the crest of the dam; 3) specify procedures for filling animal burrows on the downstream slope of the dam and on the downstream slope of the dike if any are located after the slopes have been cleared of grass, weeds, brush and brambles; 4) restore eroded areas on the crest and downstream slope of the dam and dike and 5) conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.

The owner should also carry out the following operational and maintenance procedures: 1) develop and implement a program of regular operation and maintenance procedures to assure consistent long-term performance of the facility; 2) the abandoned low-level outlet should be repaired to provide a means for controlling the reservoir level; 3) engage a qualified professional engineer to make a

comprehensive technical inspection of the dam once every year after the recommendations made in 7.2 have been carried out; 4) establish a surveillance program for use during and immediately after heavy rainfall, and also a warning program to follow in case of emergency conditions.

S. Giavara, P.E.
President

Registered Ct. 7634

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.

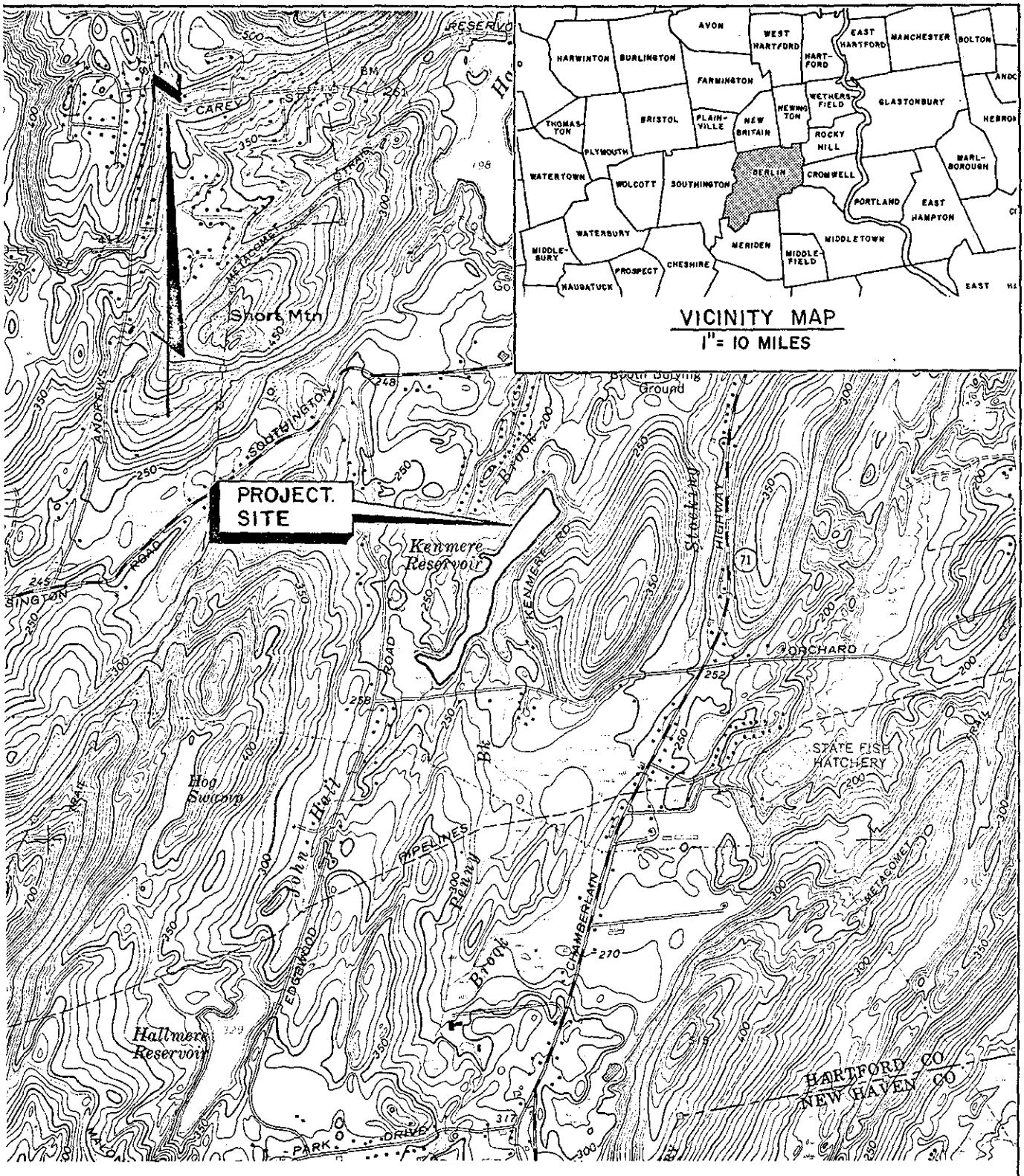
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because 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.

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

TABLE OF CONTENTS

APPENDIXES

Overview Photo
Kenmere Reservoir Dam



VICINITY MAP
1" = 10 MILES

SCALE IN FEET
2000 1000 0. 2000

KENMERE RESERVOIR DAM

LOCATION MAP

BERLIN, CONNECTICUT

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
KENMERE RESERVOIR DAM - CT 00251

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 through 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. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 19 October 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0001 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 assist 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 THE PROJECT:

a. Location. Kenmere Reservoir Dam is located in Berlin, Connecticut on John Hall Brook, a tributary stream to the Mattabasset River. Access to the reservoir is from Kenmere Road. The reservoir is located approximately 3 miles southwest of the center of Berlin, 3 miles east of the center of Southington and 4 miles north of the center of Meriden. The reservoir is shown on the U.S.G.S. Topographic Map "Meriden, Connecticut" at a latitude of 41° 35' 46" and a longitude of 72° 47' 58". The Location Map on Page vi shows the location of the structure.

b. Description of Dam and Appurtenances. The Kenmere Reservoir Dam is an earth embankment dam 700 feet in length and 25 feet in maximum height. The width of the dam crest is 6-7 feet at an elevation of 229. NGVD. The upstream face of the dam varies in slope from 1.5 - 2.5 horitontal to 1 vertical. The face of the dam

is partially riprapped for one half the height of the embankment. The downstream embankment slope varies from 2.0-3.5 horizontal to 1 vertical. The embankment has a clay puddled core.

A dike consisting of a combination of earthen embankment and natural ground 600 feet in length and 15 feet in maximum height is located along the northeast end of the reservoir. Original low areas at its northern end (280± feet) and southern end (150± feet) contain the earth embankment sections. The upstream and downstream slopes of the earth embankment dike sections are variable and inconsistent. There is no riprap protection on the upstream face of the dike. Plans obtained of the dam indicate that riprap was originally designed for the upstream face.

The spillway is located 180 feet south of the left abutment and is separated from the dam by natural ground. The spillway is 135 feet in length and consists of an approach channel, stone masonry crest, sloping downstream face, apron and wasteway. The approach channel has a gravel and cobble bottom with stone masonry training walls. The spillway crest consists of large masonry stones. The downstream face of the spillway consists of mortared stone masonry 78 feet in length at a slope of 4 horizontal to 1 vertical. There are 4 feet high stone masonry training walls on each side of the spillway face. At the base of the spillway face is the remains of a stone and mortar apron. This was originally followed by a wasteway with chestnut crib training walls filled with cobbles with a series of below grade concrete cut-off walls traversing the bed. This wasteway is deteriorated and has failed extensively.

The outlet works consists of an intake structure located within the reservoir off the face of the centerline of the dam. A service bridge connects the intake structure to the dam crest. Plans obtained of the dam indicate that two conduits pass through the dam. Both conduits are indicated on the plans to be 20 inches in diameter, one transmitting water to the pump station, the other a waste pipe to one outlet channel. Although not visible at the dam, the plans also indicate a 12" blow-off on the conduit to the pump station. A valve box was observed at the toe of the slope. The pumping station transmits water via a 20 inch conduit south to the City of Meriden.

c. Size Classification. Kenmere Reservoir Dam has a storage of 594 acre-feet and a dam height of 25 feet. Storage of less than 1,000 acre-feet and a height of less than 40 feet classifies this structure in the "small" category according to guidelines established by the Corps of Engineers.

d. Hazard Classification. The dam is classified as having a "significant" hazard potential. The probable impact areas include portions of the Blue Hills Heights development, Connecticut State Highway Route 364, and a golf course. A breach of the dam would result in flooding of about 7 houses. The depth of flooding would generally be about 1 foot, however two houses would be flooded to depths of 2 to 4 feet. With the possibility of some loss of life and the probability of serious economic losses, the dam has been classified as having a significant hazard potential.

e. Ownership. City of Meriden, c/o Water Department, 117 Parker Avenue, Mr. William Freedman, Manager, telephone 238-3304.

f. Operator. The City Engineer, Mr. Bruce Soroka, P.E. (203-634-0003) and Mr. William Freedman, Water Department Manager (203-238-3304) are responsible for the operation of this dam.

g. Purpose of Dam. The purpose of this dam is to impound the reservoir for use as a public water supply.

h. Design and Construction History. Design information consists of plans for the spillway/wasteway of the dam, dated August, 1898. A schematic plan view of the dam, dike, spillway, pumping station and appurtenances is undated. There was no other design or construction information recovered for this dam.

i. Normal Operating Procedures. The dam is presently operated to provide water supply for the City of Meriden. Water feeds by gravity from the intake structure to the pump station, from which it is pumped to the City of Meriden.

1.3 PERTINENT DATA:

a. Drainage Area. The drainage area of Kenmere Reservoir consists of a total of 3.25 square miles of wooded mountainous to hilly terrain. The southwest portion of the watershed contains Hubbard Park and West Peak State Park, both of which are undeveloped. The remaining watershed is sparsely developed indicative of its hilly terrain. The watershed contains several upstream reservoirs, canals, and diversions. Maloney Canal divers water from an unnamed tributary of Hallmere Reservoir to Merimere Reservoir. Water which flows from Merimere Reservoir forms Stockling Brook which historically bypassed the Kenmere Reservoir. Currently, this water is diverted to Penny Brook which is a tributary to Kenmere Reservoir. Water from Hallmere Reservoir forms John Hall Brook which flows directly into Kenmere Reservoir.

b. Discharge at Dam Site.

1) Plans indicate a 20" diameter waste pipe passing through the dam. Additionally a 20" diameter pipe passes through the dam from the intake structure to the pump station. Plans of the dam indicate that there is a 12 inch diameter blow-off located on this conduit. The discharge capacity of the outlet works is unknown.

2) There are no known records of past floods or flood stage heights at the dam.

3) The ungated spillway capacity at the top of dam - 2700 cfs @ El. 229.

4) The ungated spillway capacity at the test flood elevation - 2905 cfs @ El. 229.2.

5) The gated spillway capacity at normal pool elevation is not applicable at this dam.

6) The gated spillway capacity at test flood elevation is not applicable at this dam.

7) The total spillway capacity at test flood elevation - 2905 @ El. 229.5.

8) The total project discharge at the top of dam - 2700 cfs @ El. 229.

9) The total project discharge at test flood elevation - 3206 cfs @ El. 229.2.

c. Elevation (Ft. above NGVD).

1) Streambed at toe of dam.....204±

2) Bottom of cutoff.....Unknown

3) Maximum tailwater.....N/A

4) Recreation pool.....N/A

5) Full flood control pool.....N/A

6) Spillway crest.....225±

7) Design surcharge.....Unknown

8) Top of dam.....229±

9) Test flood design surcharge.....229.2

d. Reservoir (Length in Feet).

1) Normal pool.....3,000±

2) Flood control pool.....N/A

3) Spillway crest pool.....3,000±

4) Top of dam.....3,400±

5) Test flood pool.....3,400±

e. Storage (Acre-Feet).

1) Normal pool.....500

2) Flood control pool.....N/A

3) Spillway crest pool.....500

4) Top of dam.....594

5) Test flood pool.....596

f. Reservoir Surface (Acres).

1) Normal pool.....20.2

2) Flood control pool.....N/A

3) Spillway crest.....20.2

4) Test flood pool.....28.8

5) Top of dam.....28.5

g. Dam.

1) Type.....Earth embankment with stone masonry spillway

Dike: earth embankment

2) Length.....Dam: 700 Feet

Dike: 600 Feet

3) Height.....Dam: 25 Feet

Dike: 15 Feet

4) Top Width.....Dam 6-7 Feet

Dike 6-7 Feet

5) Side Slopes.....Upstream: 1.5-2.5 horizontal to 1 vertical
(Dam and Dike) Downstream: 2.0-3.5 horizontal to 1 vertical

6) Zoning.....Puddle Core

7) Impervious Core.....Puddle Core

8) Cutoff.....Unknown

9) Grout Curtain.....Unknown

h. Diversion and Regulating Tunnel.

1) Type.....N/A

2) Length.....N/A

3) Closure.....N/A

4) Access.....N/A

5) Regulating Facilities.....N/A

i. Spillway.

1)	Type	Broad crested stone masonry sloping U/S, D/S face
2)	Length of weir	135 Feet
3)	Crest elevation	225 Feet NGVD
4)	Gates	None
5)	U/S channel	Reservoir
6)	D/S channel	Deteriorated wasteway followed by natural channel

j. Regulating Outlets.

1)	Invert	Unknown
2)	Size	20" dia. supply main 12" dia. blow-off 20" dia. waste pipe
3)	Description	Conduit: material unknown
4)	Control mechanism	Manually operated gates

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No engineering data has been found to provide any information about the design of Kenmere Reservoir Dam and Dike. A drawing showing a plan view of the dam is available in the City of Meriden files. A drawing entitled "Plan of Waste Way at Kenmere" dated Aug. 1897 was also reviewed.

2.2 CONSTRUCTION:

No information relative to the construction of the dam is available. Information presented in this report was primarily obtained by interviews and direct field measurements of the existing dam and dike.

2.3 OPERATION:

Formal operation records are not available for this dam.

2.4 EVALUATION:

a. Availability. Only minimal engineering information is available for this dam.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of the dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance, and sound engineering judgement.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. Based on the visual inspection the Kenmere Reservoir dam and dike appear to be in poor condition. The crest of the dam is in poor condition with large vehicle ruts noted. A hole on the crest was observed in the vicinity of the service bridge. No movement or settlement of the crest was indicated and the vertical and horizontal alignment was generally good. The riprap on the upstream face has many gaps leaving the embankment unprotected. Numerous tree stumps were observed on the upstream face. The slopes are extensively overgrown with brush, grass and large trees. The downstream slope has an undulating surface in many locations. A considerable wet area is located along the downstream toe. Numerous small streams were noted carrying water from seeps eminating on the downstream face.

The spillway is in very poor condition. The left (south) training wall has a collapsed section and a major portion of the spillway channel floor below the first cutoff wall has also failed. The spillway channel contains extensive tree growth, overturned trees and the remains of cutoff walls that have been undermined. A dike access road traverses the crest with accompanying tire tracks. The upstream slope is not protected with riprap and the earth face was eroded. Extensive vegetation and stumps exist both on the upstream and downstream slopes and indicated a lack of maintenance. A large erosion gully approximately 4 feet deep has formed on the downstream slope. Seepage is evident along the majority of the downstream toe. A small scarp was observed along the downstream toe probably due to continued seepage. A small boil was observed approximately 20 feet downstream of toe. (near Sta. D3+25) The gate house and bridge were in a state of disrepair.

b. Dam.

1) Upstream slope - The exposed part of the upstream slope of the main dam is partially covered with riprap.(Photo No. 1 and Photo No. 2) The riprap only extends approximately halfway up the slope from the reservoir surface and is missing or has been eroded away at many locations. Numerous tree stumps up to 3 ft. diameter were observed on the upstream slope. (as shown on Photo No. 3 and Photo No. 4)

2) Crest - The crest of the dam appears fairly constant in elevation. Two paths which are partially bare of vegetation as a result of vehicular and pedestrian traffic can be seen in Photo No. 5. A hole approximately 12 inches square by 8 in. deep was observed on the crest near the service bridge foundation.

3) Downstream slope - The downstream slope is overgrown with brush, grass and tree stumps as indicated in Photo No. 6. The surface appears dry and firm. Some undulations of the surface may indicate previous sloughing. Occasional animal burrow holes were observed. The ground is wet and marshy downstream of the dam and along the toe, extending from the area adjacent to the pumping station at the right toe to the intersection of the dam with the left abutment. Ponded water at the downstream toe is shown in Photo No. 10. It appears that the source of the water may be a combination of seepage from the dam and surface water runoff that accumulates in the low area downstream of the dam. Water has ponded in several large pools downstream of the dam toward the spillway channel. The bed is carrying a sediment load of fine white sand in sufficient quantities to create small bed forms (dunes) as indicated in Photo No. 11. The sediment was recent enough to be burying fallen leaves. Despite considerable search in the field, no external source could be found.

4) Spillway - The spillway approach channel bottom is natural soil and is covered with grass and brush. The channel bottom downstream of the crest consists of stone paving with brush growing in the voids between the individual blocks. Approximately 80 ft. downstream from the spillway crest, there has occurred extensive undermining of the channel bottom as seen on Photo No. 8. A large section of the earth slope, approximately 100 ft. long by 50 ft. wide, has collapsed adjacent to the left side of the spillway channel as shown in Photo No. 9. A scour hole about 10 ft. deep has developed just downstream of this wall. As a result of this slope failure, numerous trees have fallen into the spillway channel.

The spillway section is a broad, flat area 135 feet wide by 100 feet long. The top is gravel and cobble stone with low dry stone masonry training walls on both sides. The spillway is overgrown with weeds and shrubs up to five feet high in some areas. The bottom appears to be stable, and shows no evidence of erosion. Some areas, particularly near the training walls, have filled in and mounds of earth that reduce the effective width of the spillway were observed. Large cut stones place along the crest of the spillway, adjacent to the top of the sloping face, are in good condition. The four foot high stone masonry training walls at both sides of the spillway were generally in good condition, although a portion of the right (north) wall has collapsed.

The remnants of the apron at the toe of the spillway indicate that it extended the full width (135 feet) of the spillway, had a length of 35 feet, and was constructed of stone and mortar with stone and mortar sides. The apron has been almost completely destroyed.

5) Dike - There is a 15 foot high earth dike located to the right of the dam. The upstream face is overgrown with numerous

trees and stumps as shown in Photo No. 12. No riprap was observed on the upstream face. Photo No. 13 shows the unprotected earth face and a typical large tree stump that was noted. An access road traverses the crest of the dike as seen in Photo No. 14.

The downstream face is heavily overgrown with weeds, bushes and trees as indicated in Photo No. 15. The ground is wet and boil along a large portion of the toe. Near Sta. D3+25, a small spring was seen discharging approximately 20 ft. downstream of the toe. (Photo No.17) A large erosion gully, approximately 12 ft. wide and 4 to 5 ft. deep, extends from the crest to the toe of the dike, at Sta. D2+85.

c. Appurtentant Structures. The freestanding control tower is in disrepair. The plywood floor is unsafe. Two valve stems without operator handles were observed extending to the floor.

d. Reservoir Area. The land around the perimeter of the reservoir has a mild well vegetated slopes. No visible slides or unstable slopes were observed. (see Photo No. 18.) The reservoir did not have any visible deposits of sediment.

e. Downstream Channel. The natural open channel downstream of the spillway is in very poor condition. The channel is undergoing rapid degradation, and is an average of six feet (maximum of ten feet) below its apparent original elevation. The degradated channel is approximately 20 feet deep with near vertical sides in earth. Many trees have been undermined along its banks, and are lying in, over, and adjacent to the downstream channel.

Four 6-foot-deep concrete cut-off walls were found crossing the channel downstream of the spillway. All have failed, and the degradation of the channel bed has continued below the bottom elevation of the cut-off walls.

f. Footbridge. The prestressed concrete T-beam that serves as the access bridge to the control tower is deteriorating and steel reinforcing bars are exposed. The bridge is in generally poor condition.

3.2 EVALUATION:

On the basis of the visual inspection, the dam and dike are in poor condition. The following observed features could adversely affect the long-term performance of the dam.

a. Seepage exiting and flowing immediately downstream of the dam and dike could lead to continued piping and erosion.

b. Undermining of a portion to the left wall of the spillway channel and various portions of the spillway bottom can lead to futher collapse of these structures.

c. Rotting tree roots and animal holes in the downstream slope

can provide pathways for seepage, causing erosion and piping of the embankment soils.

d. Large trees growing on the embankment and in the immediate vicinity of the toe could be uprooted during heavy winds, leaving large depressions. In the upstream face of the dam, such depressions could permit erosion into the crest by wave action. In the downstream toe area, the depressions could cause concentration of seepage and serious "piping" problems.

e. Incomplete riprap protection on the upstream face of the dam and dike could lead to erosion into the crest during times of severe wave action.

f. If the seepage veolocities at the "boil" noted near the downstream toe of the dike are sufficient, soil particles may erode, forming a hole or "pipe".

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General. Since the outlet structure for the dam is not operable, the water level impounded by Kenmere Dam is not controlled and no formal operational procedures are followed. The 12" dia. blow-off could not be located.

b. Description of any Warning System in Effect. There is no warning system of any kind in effect at the dam. There are no formal emergency operation plans in effect for lowering the water level in anticipation of severe storms.

4.2 MAINTENANCE PROCEDURES

a. General. Maintenance of the dam appears to be completely lacking. Periodic growth removal from the embankment, repair of damage to the crest and slopes, and surveillance relative to seeps, animal burrows etc. apparently has not been undertaken in several years.

b. Operating facilities. There are no formal maintenance procedures followed for the operating facilities.

4.3 EVALUATION

Regular operational maintenance for this dam and its appurtenances has not been developed or implemented. In view of the apparent lack of drawdown capability at the dam, it is important that the owner make arrangements to have the handle for the valve stems brought to the dam and operate the valves to ensure that the blow-off is operational.

An emergency action plan should be prepared to prevent or minimize the impact of failure. This plan should list the expedient actions to be taken and authorities to be contacted.

It is important to maintain the water supply and assure a consistent long-term performance of the facility that a regular monitoring, inspection and maintenance program be developed and implemented in the near future.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL:

The Kenmere Reservoir Dam is an earth embankment dam with a supplemental dike. The crest length of the main dam is 700± feet; approximately 25 feet high. The dike is approximately 15 feet high. The stone masonry spillway is separated from the left abutment of the dam by about 200 feet of natural ground.

The spillway has a stone masonry face, sloping at 25 percent, discharging downstream onto the remains of a horizontal stone masonry apron.

The drainage area of the Kenmere Reservoir Dam is quite complex due to several man-made flow diversions constructed as part of the City of Meriden water supply system. The Kenmere Reservoir receives runoff from an area of about 1.0 square mile, plus the discharge flow from the Hallmere Reservoir (1.0 square mile) and potentially flows diverted from the Stocking Brook.

After reviewing the water works, it is apparent that the various flow diversion structures, canals, and dikes have only limited capacity, and would not be able to divert all inflow from one watershed to another. The effective watershed area could thus vary in size, as described below:

Condition A - The original natural watershed area draining directly to Kenmere Reservoir Dam is 2.0 square miles.

Condition B - Assumes all known diversion points direct runoff away from the Kenmere Reservoir. This would leave Kenmere Reservoir with an effective drainage watershed area of 1.0 square mile.

Condition C - Assumes all known diversion points direct runoff into Kenmere Reservoir, creating an effective watershed area of 3.25 square miles.

5.2 DESIGN DATA:

No specific data is available for this watershed or the structures at Kenmere Reservoir Dam. In lieu of existing design information, U.S.G.S. Topographic maps (scale 1" to 2000') were utilized to develop hydrologic parameters. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of the visual field inspection.

5.3 EXPERIENCE DATA

Historical data for recorded discharges is not available for this

dam. Although no formal experience records are available, the very poor condition of the spillway indicates that significant spillway discharge flows have probably been experienced at the dam site.

5.4 TEST FLOOD ANALYSIS:

The test flood for determining the spillway adequacy is based upon Corps of Engineers guidelines. The size classification of the dam is "small" based upon a height of 25 feet and storage volume of 594 acre-feet. The hazard potential is "significant" due to the land use downstream, of the dam.

The spillway test flood required by Corps of Engineers guidelines for this size dam and hazard potential can range from the 100 year return frequency flood to the 1/2 probable maximum flood.

The spillway test flood selected for this project is the ½ PMF, due to the possibility of some loss of life and the probability of appreciable economic loss due to dam failure, and the relative size of the dam and reservoir.

The magnitude of the PMF (and ½ PMF spillway test flood) is based upon "Preliminary Guidance for Estimating PMF Discharges" by the New England Division, Corps of Engineers, dated December 1977. As indicated in Section 5.1, there is insufficient data to determine the exact watershed area due to the possible diversion of some watersources. The analysis is based upon the largest watershed area (condition C) of 3.25 square miles. The watershed is rolling to steep, and has floodwater storage areas in upstream impoundments. The flood magnitude was based on the "rolling" watershed curve. The ½ PMF (spillway test flood inflow) is 3250 CFS.

The maximum spillway capacity is 2700 CFS at a stage of 4 feet above the spillway crest (equal to the top of the dam).

The spillway test flood was formed into a triangular hydrograph with a peak inflow of 3250 CFS and a duration of 10.5 hours. The duration was selected so that the triangular hydrograph would contain the same volume of water as the estimated storm runoff.

The hydrograph was routed through the reservoir using a computer program based on stage-storage and stage-discharge data. The reservoir was assumed to be full and level with the spillway prior to the storm event. The result of the flood routing computations indicate that the spillway test flood peak inflow rate of 3250 CFS is reduced to a peak outflow rate of 3206 CFS by the storage of water in the reservoir. The spillway can pass 84 percent of the spillway test flood outflow without overtopping the dam.

The peak flood stage at the spillway is at elevation 229.2, which is 0.2 feet above the crest of the dam. The duration of the overflow is approximately 3 hours. The actual flood stage could be less than this if significant runoff is diverted.

5.5 DAM FAILURE ANALYSIS:

The downstream impact of a dam failure was analyzed using the COE "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" dated April 1978.

Based upon an assumed width of 132 feet which is equal to 40% of the width of the main dam at mid-height, the peak flood flow due to failure would be 27,700 CFS in addition to a base flow of 2700 CFS, which results in a total flow of 30,400 CFS at the dam. Note that the breach width of 132 feet would also be representative of a complete spillway failure (width is 135 feet).

Using topography data from U.S.G.S. maps (scale 1" = 2000', 10' contours), the evaluation indicates that the dam failure flood-wave would flood an area containing 7 houses with one foot or more of water above the ground surface. Two houses would have 2.0 feet to 4.0 feet of water above the first floor sill (1.5 feet above base flood flow).

The primary impact areas include Connecticut Route 364, a secondary State Highway, which would experience 15 feet of floodwater, a golf course, and the above mentioned houses that are concentrated in the Blue Hills Heights development. It should be noted that a dike failure would affect the same downstream hazard area as the dam. With the possibility of some loss of life and the probability of serious economic losses, the dam has been classified as having a significant hazard potential.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS:

The visual observations did not disclose any evidence of present structural instability other than the slope failure adjacent to the left spillway training wall approxiamtely 80 ft. downstream from the spillway crest.

The discharges observed near the downstream toe of the main dam and dike showed some evidence of sediment transport and warrant further investigation.

Rotting tree roots and animal holes in the downstream slope can provide pathways for seepage, causing erosion and piping of the embankment soils.

Large trees growing on the embankment and in the immediate vicinity of the toe could be uprooted during heavy winds, leaving large depressions. In the upstream face of the dam, such depressions could permit erosion into the crest by wave action. In the downstream toe area, the depressions could cause concentration of seepage and serious "piping" problems.

Incomplete riprap protection on the upstream face of the dam and dike could lead to erosion into the crest during times of severe wave action.

6.2 DESIGN AND CONSTRUCTION DATA:

There is insufficient design and construction data to permit a formal evaluation of stability.

6.3 OPERATING RECORDS:

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

6.4 POST-CONSTRUCTION CHANGES:

No information concerning post-construction changes is available.

6.5 SEISMIC STABILITY:

Kenmere Reservoir Dam and Dike are located in Seismic Zone 1 and, in accordance with the Phase I guidelines, do not warrant seismic analysis.

SECTION 7 -ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. The visual examination indicates that the Kenmere Reservoir Dam and Dike are in poor condition. The major concerns with respect to the long-term performance of the dam are: 1) Slope failure adjacent to the left spillway training wall approximately 80 ft. downstream from the spillway crest. 2) Spillway channel bottom failures approximately 80 ft downstream from the spillway crest. 3) Soft wet discharge areas along the toe of the dam, which showed evidence of sediment transport. 4) Numerous tree stumps on the upstream and downstream slopes of the embankment. 5) Numerous standing trees adjacent to the downstream toe. 6) Poor condition of the riprap on the upstream slope. 7) Standing water in a depression near the downstream toe of the dam.

The major concerns with respect to the long-term performance of the dike are: 1) Numerous standing trees and tree stumps on the upstream and downstream faces of the dike embankment. 2) Soft wet area along the toe of the dike. 3) Large gully extending from the crest to the toe near Sta. D2+85. 4) Small spring located 20 ft. downstream from the toe near Sta. D3+25. 5) Absence of riprap on the upstream face of the dike.

The capacity of the spillway is inadequate to pass the ½ PMF test flood outflow of 3210 CFS without overtopping the dam and dike. The test flood would overtop the dam by about 0.2 ft. The spillway is adequate to pass about 84 percent of the test flood outflow without overtopping the dam and dike.

b. Adequacy. The engineering information available was very limited and thus assessment of the condition of the dam was based primarily on the results of the visual inspection, past operational performance of the structure and sound engineering judgement.

c. Urgency. Since delay could adversely effect the stability of the dam and dike, recommendations 1 through 5 in Section 7.2 require immediate implementation. The remainder of the recommendations and remedial measures presented in Section 7.2 and 7.3 should be implemented by the owner within one year of receipt of this Phase I inspection report.

7.2 RECOMMENDATIONS:

The owner should retain a qualified registered engineer to accomplish the following:

1) Inspect the downstream slope of the dam and dike after the grass, brush, weeds and brambles have been cleared.

2) The source of the discharge observed near the downstream

toe of the main dam and dike should be investigated and appropriate recommendations for remedial measures developed and implemented. The investigation should also determine the quality of seepage and turbidity associated with the discharge.

3) Design and oversee the repair of the slope failure adjacent to the left spillway wing wall approximately 80 ft. downstream from the spillway crest. In addition, the failure of the stone paving located on the spillway channel bottom should be investigated and repaired. Repairs should be made to the spillway's left training wall and the erosion of the downstream channel must be controlled.

4) Design and oversee the repair of erosion on the upstream slope of the dam and the installation of required erosion protection measures.

5) Specify and oversee procedure to restore eroded areas on the crest and downstream slope of the dam and dike.

6) Specify procedures for removal of trees, tree stumps and their root systems on the upstream and downstream slopes and in the zone within 25 feet downstream of the toe of the dam and dike.

7) Specify and oversee procedures for establishing additional grassy vegetation and repair the erosion on the crest of the dam.

8) Specify procedures for filling animal burrows on the downstream slope of the dam and on the downstream slope of the dike if any are located after the slopes have been cleared of grass, weeds, brush and brambles.

9) Restore eroded areas on the crest and downstream slope of the dam and dike.

10) Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures. The owner should:

1) Develop and implement a program of regular operation and maintenance procedures to assure consistent long-term performance of the facility.

2) The abandoned low-level outlet should be repaired to provide a means for controlling the reservoir level.

3) Engage a qualified registered engineer to make a comprehensive technical inspection of the dam once every year after the recommendations made in 7.2 have been carried out.

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

5) Repair gatehouse and service bridge.

7.4 ALTERNATIVES:

There are no practical alternatives to the recommendations contained in Sections 7.2 and 7.3.

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Kenmere Reservoir Dam

DATE Oct. 30, 1979

TIME 0930

WEATHER Sunny 60°F

W.S. ELEV.____ U.S.____ DN.S.

PARTY:

1. R. Smith, FGA, Project Manager
2. J. MacBroom, FGA, Hydraulics/Hydrology
3. R. Jackson, FGA, Survey
4. R. Murdock, GEI, Geotechnical
5.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam **DATE:** Oct. 30, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	Poor. Large ruts, one hole on crest near bridge to gatehouse.
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.
Trespassing on Slopes	Slopes are extensively overgrown with brush, grass and trees.
Sloughing or Erosion of Slopes or Abutments	Downstream slope has undulating surface at many locations.
Rock Slope Protection - Riprap Failures	Riprap has many windows and large tree stumps (24" d. to 48" d.).
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Considerable wet area along downstream toe.
Piping or Boils	None observed.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.
Vegetation	Extensive vegetation on U/S and D/S slopes.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam DATE: Oct. 30, 1979

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	Tire tracks, roadway over crest.
Movement or Settlement of Crest	None observed.
Lateral Movement	None.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	Good.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	Extensive vegetation.
Sloughing or Erosion of Slopes or Abutments	Large erosion gully approximately 4 ft. deep on downstream slope near Sta. D 2+85.
Rock Slope Protection - Riprap Failures	No riprap.
Unusual Movement or Cracking at or near Toes	Small scarp along downstream toe due to continued seepage.
Unusual Embankment or Downstream Seepage	Seepage evident along majority of downstream toe.
Piping or Boils	Small boil approximately 20 ft. downstream of toe near Sta. D 3+25.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.
Vegetation	Extensive vegetation and tree stumps both upstream and downstream.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam DATE: Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	Not applicable.
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam DATE: Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Brownstone base, brick at upper portion both in fair condition. Wood flooring in poor condition.
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	None observed.
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	Manual operation, gate stem has no handle. Guides for screen racks in generally good condition.
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam DATE: Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	Not applicable.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam **DATE:** Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Not applicable.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam **DATE:** Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair, extensive grass and brush.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Natural soil and gravel bottom.
b. Weir and Training Walls	Training wall collapse for approximately 8 ft.
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	None observed.
c. Discharge Channel	
General Condition	Poor, large collapse of left embankment and a large portion of the spillway channel floor.
Loose Rock Overhanging Channel	
Trees Overhanging Channel	Overhanging trees on both sides of channel.
Floor of Channel	Extensive tree growth, several overturned cutoff walls.
Other Obstructions	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Kenmere Reservoir Dam DATE: Oct. 30, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Superstructure	Pre-stress concrete "T" beam in generally poor condition.
Bearings	
Anchor Bolts	
Bridge Seat	Poor condition at dam.
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	Cracks, severe deterioration, spalling.
Drainage System	None observed.
Railings	Fair condition.
Expansion Joints	
Paint	Badly rusted.
b. Abutment & Piers	
General Condition of Concrete	Concrete in poor condition.
Alignment of Abutment	
Approach to Bridge	
Condition of Seat and Backwall	

APPENDIX B

ENGINEERING DATA

ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

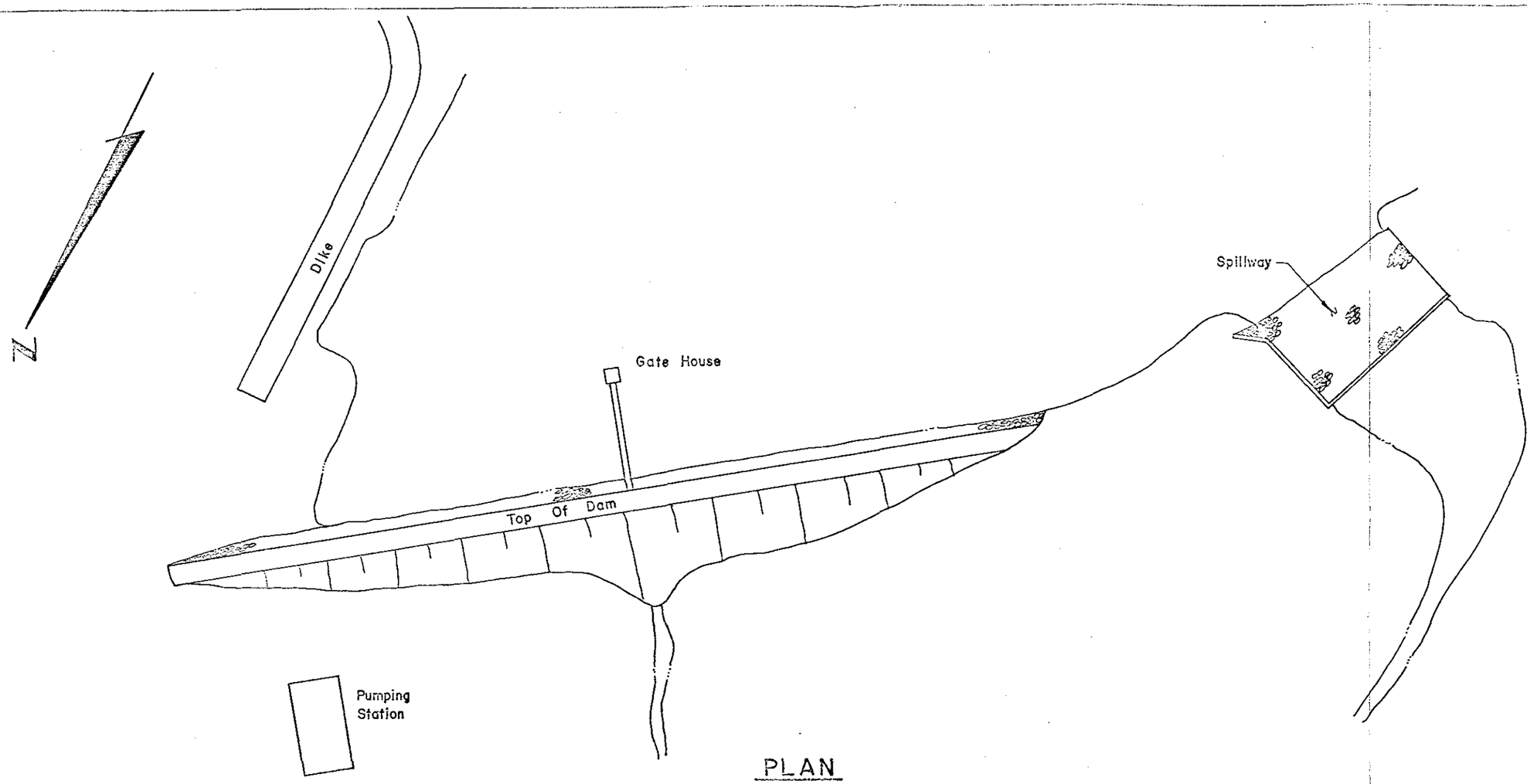
I.D. NO. CT-00251

ITEM	REMARKS
AS-BUILT DRAWINGS	Plan of dam available from Meriden
REGIONAL VICINITY MAP	Available from U.S.G.S.
CONSTRUCTION HISTORY	None available
TYPICAL SECTIONS OF DAM	Field measurements
OUTLETS - Plan	Not available
- Details	Not available
- Constraints	Unknown
- Discharge Ratings	None available
RAINFALL/RESERVOIR RECORDS	Unavailable
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

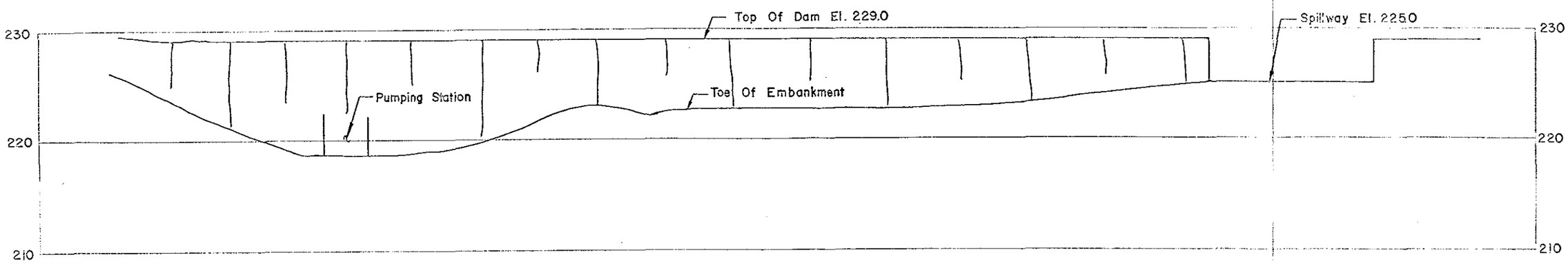
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

I.D. NO. CT-00251

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
MONITORING SYSTEMS	None
MODIFICATIONS	Unknown
HIGH POOL RECORDS	None available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION	Failure of cutoff wall spillway outlet channel
REPORTS	None
MAINTENANCE OPERATION RECORDS	None
SPILLWAY PLAN	
SECTIONS	From plans and field measurements
DETAILS	None
OPERATING EQUIPMENT PLANS & DETAILS	Unknown



PLAN
NTS



DOWNSTREAM ELEVATION OF DAM
NTS

KENMERE RESERVOIR DAM

MERIDEN, N.H.
LOCATION OF PUDDLE CORE
KENNETH
FEB. 1959

SHORT DAM PUDDLE WALL	
STA	DEPTH OF CLAY PUDDLE
2+20	115
+40	138
+60	190
+80	165
3	150
+20	122
+40	108
+60	98
+80	75
4	85
+20	75
+40	65
END OF PUDDLE CORE	

	170	
	140	
+20	139	34
+40	185	26
+60	210	20
+80	228	20
1	262	
+20	295	95
+40	290	100
+60	308	98
+80	310	78
2	300	130
+20	2	70
+40	375	67
+60	420	90
+80	430	90
3	420	90
+20	410	90
+40	390	90
+60	395	70
+80	395	"
4	295	"
+20	292	"
+40	263	"
+60	257	"
+80	257	"
5	260	"
+20	220	"
+40	193	"
+60	175	"
+80	175	"
6	165	"
+20	155	"
+40	137	"
+60	125	"

JOSEPH SPAULDING
12 IN BLOW OFF
END OF PUDDLE CORE
STA 4+20
STA 4+00
STA 3+80
STA 3+60
STA 3+40
STA 3+20
STA 3+00
STA 2+80
STA 2+60
STA 2+40
STA 2+20
STA 2+00
STA 1+80
STA 1+60
STA 1+40
STA 1+20
STA 1+00
STA 0+80
STA 0+60
STA 0+40
STA 0+20
STA 0+00
STA 6+60
STA 6+40
STA 6+20
STA 6+00
STA 5+80
STA 5+60
STA 5+40
STA 5+20
STA 5+00
STA 4+80
STA 4+60
STA 4+40
STA 4+20
STA 4+00
STA 3+80
STA 3+60
STA 3+40
STA 3+20
STA 3+00
STA 2+80
STA 2+60
STA 2+40
STA 2+20
STA 2+00
STA 1+80
STA 1+60
STA 1+40
STA 1+20
STA 1+00
STA 0+80
STA 0+60
STA 0+40
STA 0+20
STA 0+00
BACKFILL OF PUDDLE CORE
20 INCH GATE
20 INCH WASTE PIPE
12 INCH BLOW OFF
PUMPING STATION

DAVID BAGLEY

MRS. PATRICK MILLER

LIMIT OF WATERSHED

JOHN CONLAN

SAMUEL HART

STORAGE RESERVOIR

"KENMERE"

12" BLOW OFF

PUMPING STATION.

20" GATE

20" PIPE

12" BLOW OFF

MRS. PATRICK MILLER

EDWIN H. BUTLER

DAVID BAGLEY ROAD TO RESERVOIR

AIR VALVE

DAVID BAGLEY

LIMIT OF WATERSHED

12" BLOW OFF

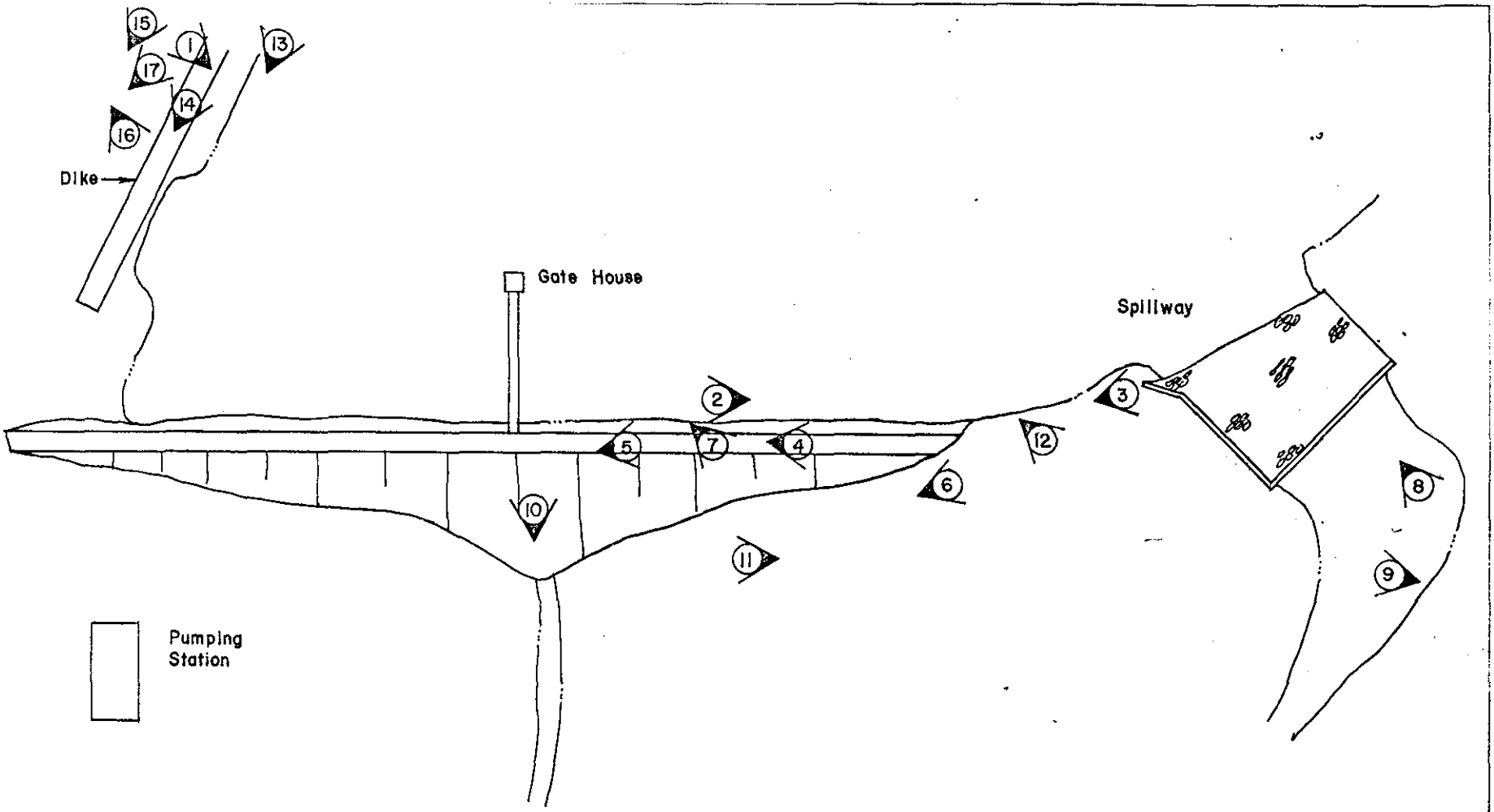
ROAD TO RESERVOIR

GEO. TAYLOR

AIR VALVE

GEO. TAYLOR

JOSEPH STURMER



LEGEND

5 Number refers to caption. Arrow indicates direction of photograph.

KENMERE RESERVOIR DAM

PHOTO LOCATION MAP

PHOTO #1: Upstream face of dam from dike.

PHOTO #2: Upstream face of dam from gatehouse looking toward spillway.

PHOTO #3: Upstream face of dam from vicinity of spillway.

PHOTO #4: Upstream face and crest of dam from vicinity of spillway.

PHOTO #5: Crest of dam from right (north) abutment.

PHOTO #6: Downstream slope looking toward right (north) abutment.

PHOTO #7: Gatehouse and service bridge.

PHOTO #8: Cutoff wall at end of downstream face of spillway. Rule extended 4 ft. to spillway channel surface.

PHOTO #9: Large bank failure. Lower spillway cutoff wall in the foreground.

PHOTO #10: Large wet area at toe of downstream slope.

PHOTO #11: Seepage at toe of slope. Note fine sand deposited.

PHOTO #12: Upstream face of dike.

PHOTO #13: Upstream face of dike. No riprap protection.

PHOTO #14: Crest of dike from right (east) side.

PHOTO #15: Downstream face of dike from right (east) side.

PHOTO #16: Toe of slope at Sta. D5+0. Standing and flowing water.

PHOTO #17: Small spring approximately 20 ft. from toe.

PHOTO #18: Reservoir Area.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MERE RES DAM
CT
10

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

SHEET NO. 1 OF
BY RAC DATE 1-30-80
CHK'D. BY JGM DATE 2-14-80

DETERMINATION OF SPILLWAY TEST FLOOD*

A. SIZE CLASSIFICATION

Storage Volume (Ac.-Ft.) 594

Height of Dam (Ft.) 25

Size Classification SMALL

B. HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life	Economic Loss
Low	None expected	Minimal
Significant	(Few)	(Appreciable)
High	More than few	Excessive

Hazard Classification SIGNIFICANT

C. HYDROLOGIC EVALUATION GUIDELINES

Hazard	Size	Spillway Test Flood
Low	Small	50 to 100-Year Frequency
	Intermediate	100-Year Frequency to 1/2 PMF
	Large	1/2 PMF to PMF
(Significant)	(Small)	100-Year Frequency to (1/2 PMF)
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

Spillway Test Flood 1/2 PMF

*Based upon "Recommended Guidelines for Safety Inspection of Dams" Department of the Army, Office of the Chief of Engineers, November 1976.

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

DETERMINATION OF THE

MAXIMUM PROBABLE FLOOD (MPF)

A. Drainage Area in Square Miles 3.25 (ASSUMES ALL FLOW DIVERSIONS DIRECT FLOWS TO KENMERE)

B. Watershed Characteristic: Flat & Coastal

(Rolling)

Moutainous

C. M.P.F. in CFS/Square Mile,* 2000 CFS/$M1^2$

M.P.F. = (CFS/Square Mile) x (Area in Square Miles)

2000 x 3.25 = 6500 CFS

1/2 PMF = 1/2 (6500) = 3250 CFS

*Based upon the figure "Maximum Probable Flood Peak Flow Rates" U.S. Army Corps of Engineers, December 1977.

THE PMP RAINFALL IS 23.5 INCHES FOR A 6 HR DURATION 24 HR. STORM. USING A 20% FACTOR FOR IMPERFECT FIT, THE EFECTIVE RAINFALL IS 18.8 INCHES, (SEE FIG. 15, DESIGN OF SMALL DAMS.

VOLUMN OF RUNOFF

BASED ON AN ASSUMED CN VALUE OF 80 (FOR GLACIAL TILL SOILS), RUNOFF FOR THE PMP IS 16.5 INCHES (FIG A-9, DESIGN OF SMALL DAMS)

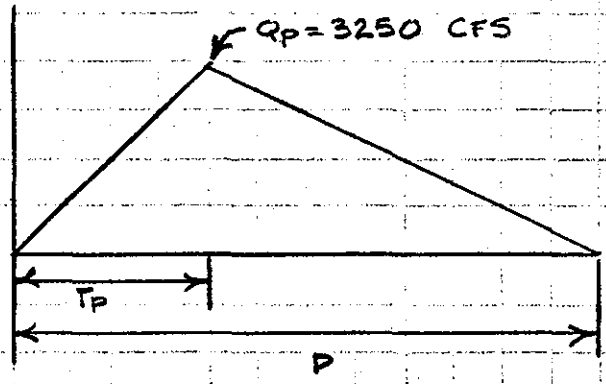
SPILLWAY TEST FLOOD RUNOFF = 16.5"/2 = 8.25"

VOLUMN OF RUNOFF =

$$\left(\frac{8.25}{12''/FT}\right)\left(3.25\ mi^2\right)\left(\frac{640\ Ac}{mi^2}\right) = 1430\ AC\text{-}FT$$

TEST FLOOD HYDROGRAPH

A TRIANGULAR HYDROGRAPH IS TO BE USED FOR THE ROUTING OF THE TEST FLOOD THROUGH THE RESERVOIR. PEAK FLOW EQUALS 3250 CFS, SET DURATION OF RUNOFF SO AS TO CONTAIN VOLUMN OF RUNOFF, AND RECEEDING LIMB EQUALS TWICE THE RISING LIMB.



FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

HYDROGRAPH VOL. = $\frac{1}{2} Q_p D$ = 1430 AC-FT

$$D = \frac{(1430 \text{ AC-FT})(2)}{Q_p} = \frac{(1430 \text{ AC-FT})(2)(43560 \text{ FT}^3/\text{AC-FT})}{(3250 \text{ CFS})(60 \text{ S/M})(60 \text{ M/HR})} = 10.6 \text{ HRS.}$$

SAY D = 10.5 HRS & T_p = 3.5 HRS

HYDROGRAPH FORMATION

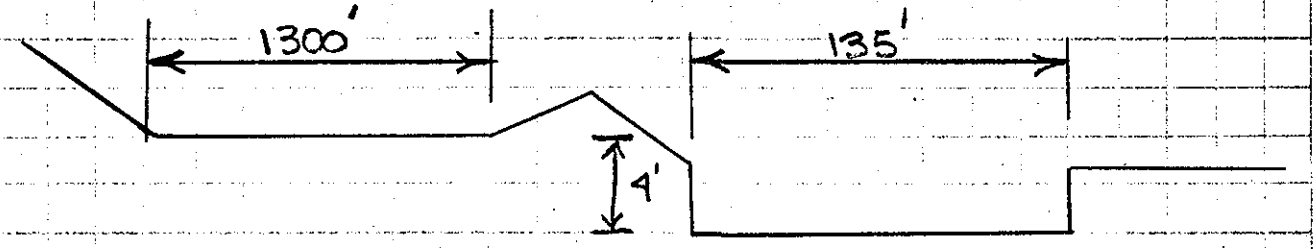
Q_p = 3250
T_p = 3.5 HRS
D = 10.5 HRS

TIME (HRS)	INFLOW (CFS)
0	0
1	929
2	1061
3	2786
3.5	3250
4	3018
5	2554
6	2089
7	1625
8	1167
9	696
10	232
10.5	0

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

SHEET NO. ____ OF ____
BY E.A.C. DATE 1-16-
CHK'D. BY JGM DATE 3/28/80

SPILLWAY AND OVERFLOW SECTION DATA



SEGMENT	ITEM	"C"	LENGTH	ELEV
1	STONE CAP SPILLWAY	2.5	135'	225
2	EARTH DAM	2.5	1300'	229

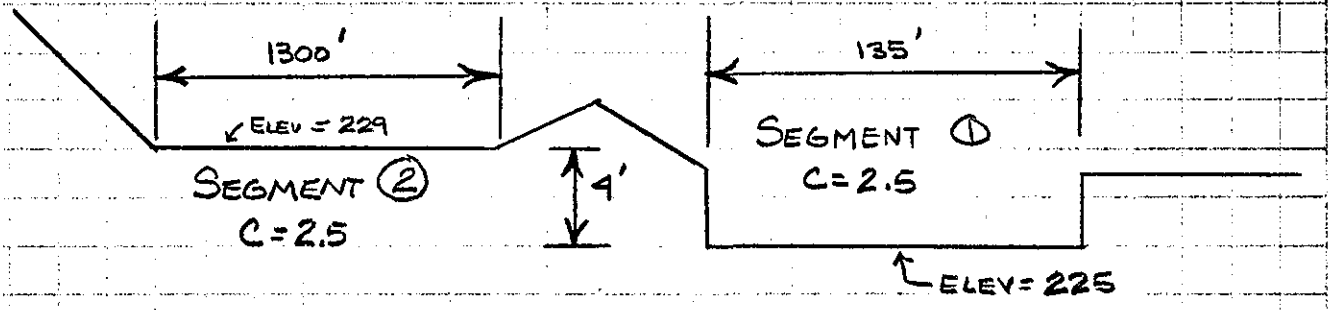
IE = 225.0'
IV = 0.0
E = 225 A = 20.2 ACRES
E = 230 A = 30.5 ACRES

① 330 (A) = 132' ASSUMED BREACH WIDTH FOR FAILURE ANALYSIS

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

SHEET NO. 6 OF
BY RAC DATE 1-22-80
CHK'D. BY DKS DATE 2-14-80

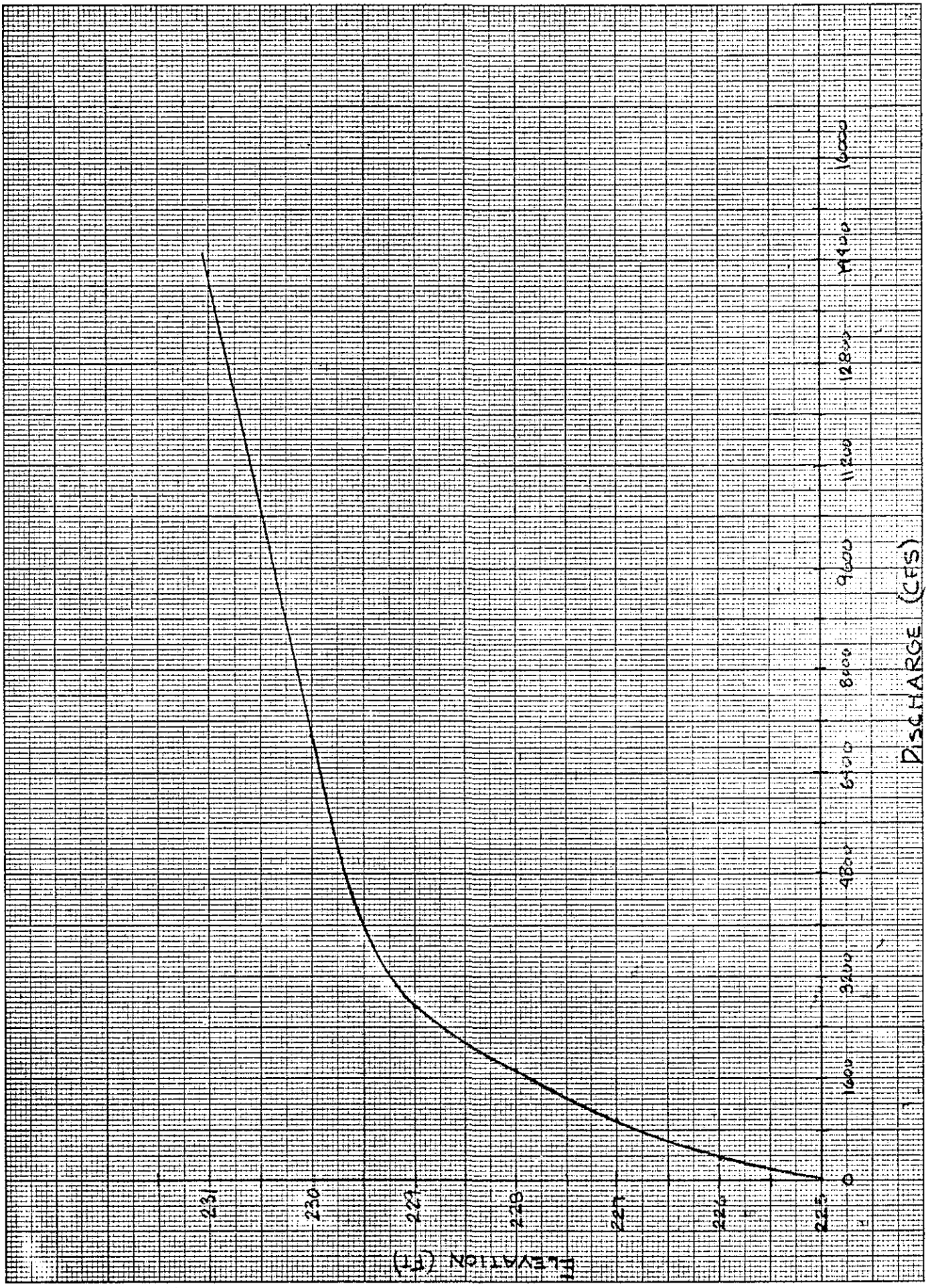
STAGE DISCHARGE DATA



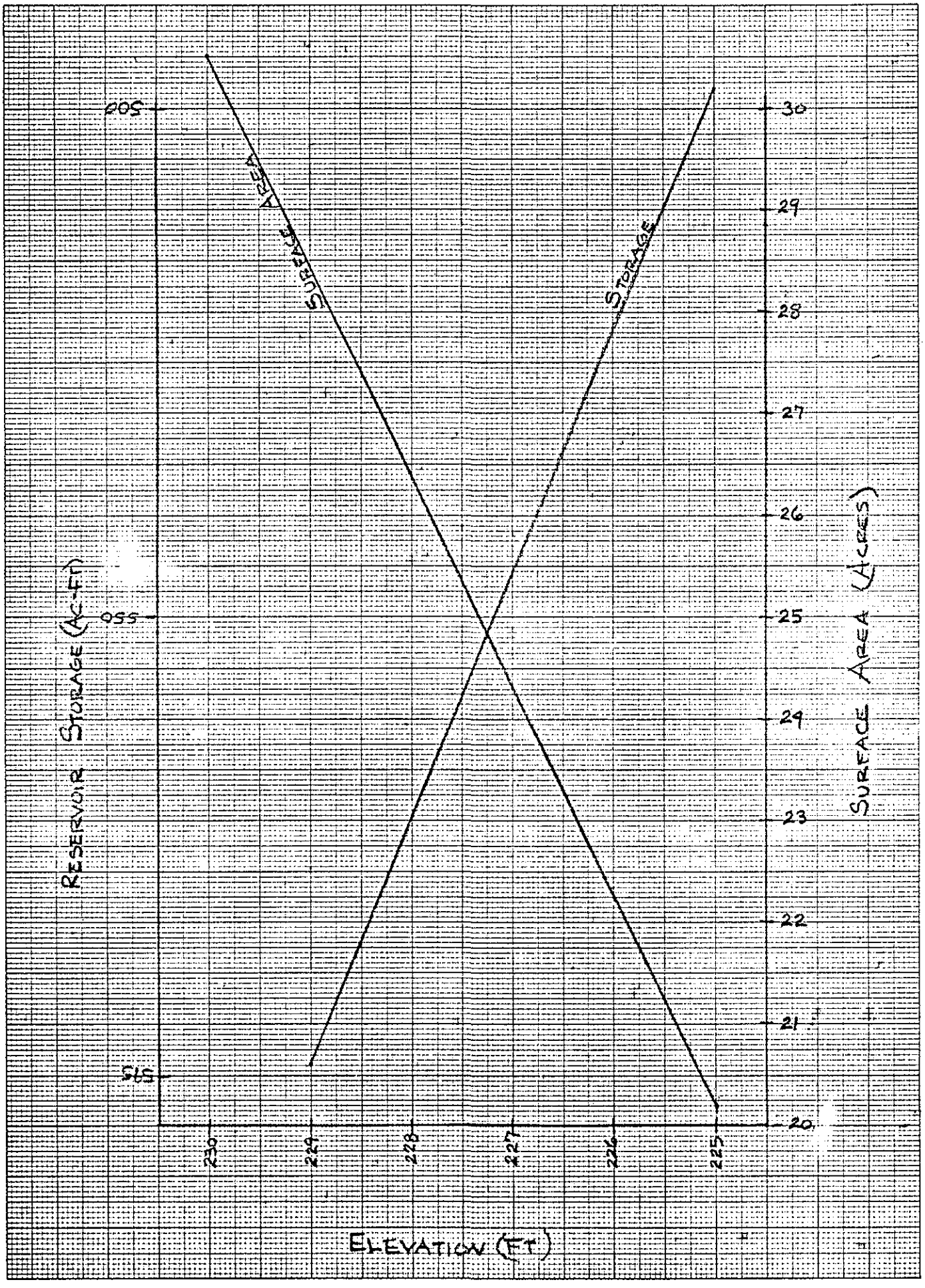
ELEV	226	227	228	229	230	231
$Q_1 = C_1 L_1 H_1^{3/2}$	338	955	1754	2700	3773	4960
$Q_2 = C_2 L_2 H_2^{3/2}$					3250	9192
TOTAL	338	955	1754	2700	7023	14152

KENMERE RES DAM

RAC 1-22-80



RENMERE RES DAM



KENMORE DAM 79-90-10 FLOOD ROUTING JGM 3/28/80

INPUT DATA: UNSUBMERGED WEIR
SEGMENT 1 DISCHARGE COEFFICIENT = 2.5 LENGTH OF WEIR = 135 ELEVATION OF WEIR = 225
SEGMENT 2 DISCHARGE COEFFICIENT = 2.5 LENGTH OF WEIR = 1300 ELEVATION OF WEIR = 229
IE=225.0 IV= 0.0 E=225.0 A= 20.20 E=230.0 A= 30.50

HOUR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	225.00FT	.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
1.00	929CFS	38.38AC-F	226.07FT	0.00FT	375CFS	15.51AC-F	22.87AC-F	22.87AC-F
2.00	1,061CFS	120.61AC-F	227.10FT	0.00FT	1,029CFS	73.57AC-F	47.04AC-F	47.04AC-F
3.00	2,786CFS	279.58AC-F	228.33FT	0.00FT	2,051CFS	200.88AC-F	78.70AC-F	78.70AC-F
3.50	3,250CFS	404.29AC-F	229.11FT	0.00FT	2,932CFS	303.85AC-F	100.43AC-F	100.43AC-F
4.00	3,018CFS	533.80AC-F	229.20FT	0.00FT	3,206CFS	430.69AC-F	103.10AC-F	103.10AC-F
5.00	2,554CFS	764.04AC-F	228.88FT	0.00FT	2,584CFS	670.01AC-F	94.03AC-F	94.03AC-F
6.00	2,089CFS	955.90AC-F	228.56FT	0.00FT	2,273CFS	870.76AC-F	85.14AC-F	85.14AC-F
7.00	1,625CFS	1,109.38AC-F	228.03FT	0.00FT	1,786CFS	1,038.52AC-F	70.85AC-F	70.85AC-F
8.00	1,167CFS	1,224.75AC-F	227.50FT	0.00FT	1,338CFS	1,167.66AC-F	57.08AC-F	57.08AC-F
9.00	696CFS	1,301.73AC-F	226.90FT	0.00FT	885CFS	1,259.57AC-F	42.15AC-F	42.15AC-F
10.00	232CFS	1,340.08AC-F	226.19FT	0.00FT	441CFS	1,314.43AC-F	25.65AC-F	25.65AC-F
10.50	0CFS	1,344.87AC-F	225.78FT	0.00FT	234CFS	1,328.40AC-F	16.47AC-F	16.47AC-F

FGA FLOOD WAVE ROUTING

APPROXIMATE FLOOD WAVE ROUTING BASED UPON U.S. ARMY CORPS OF ENGINEERS' "RULE OF THUMB GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS" DATED APRIL, 1978.

INITIAL STATION = 0 +0
INITIAL BASE FLOW = 2,700 CFS
INITIAL WAVE HT = 25.0 FT
ASSUMED BREACH WIDTH = 132.0 FT
INITIAL RESERVOIR STORAGE = 594 ACRE-FT
COMPUTED FLOOD WAVE PEAK FLOW = 27,724 CFS
TOTAL FLOOD WAVE PEAK FLOW = 30,424CFS

STATION 10 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
230.0 FT	220.0 FT	-150.0 FT	200.0 FT	-5.0 FT	195.0 FT
		N = 0.040			
-5.0 FT	195.0 FT	5.0 FT	195.0 FT		
		N = 0.080			
5.0 FT	195.0 FT	120.0 FT	200.0 FT	310.0 FT	240.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
125.6 SF	165.4 FT	0.080	12.3 FPS	13,845CFS
99.2 SF	10.0 FT	0.040	31.6 FPS	3,141CFS
911.9 SF	139.0 FT	0.080	12.0 FPS	10,944CFS

NVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
05.0 FT	9.9 FT	204.9 FT	2,136 SF	13.0 FPS	27,932 CFS	0.0340

SE FLOW = 2,700 CFS BASE STAGE = 198.8 FT.

STATION 19+70

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
.060.0 FT	250.0 FT	-820.0 FT	230.0 FT	-620.0 FT	210.0 FT
·500.0 FT	200.0 FT	-5.0 FT	190.0 FT		
		N = 0.050			
-5.0 FT	190.0 FT	5.0 FT	190.0 FT		
		N = 0.080			
5.0 FT	190.0 FT	250.0 FT	200.0 FT	470.0 FT	210.0 FT
550.0 FT	220.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
,198.0 SF	512.3 FT	0.080	4.4 FPS	14,239CFS
114.3 SF	10.0 FT	0.050	10.6 FPS	1,219CFS
,599.4 SF	276.8 FT	0.080	4.2 FPS	6,764CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
90.0 FT	11.4 FT	201.4 FT	4,911 SF	4.5 FPS	22,223 CFS	0.0050

SE FLOW = 2,700 CFS BASE STAGE = 195.1 FT.

STATION 30 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
550.0 FT	220.0 FT	-480.0 FT	210.0 FT	-150.0 FT	200.0 FT
-50.0 FT	190.0 FT	-5.0 FT	186.0 FT		
		N = 0.050			
-5.0 FT	186.0 FT	5.0 FT	186.0 FT		
		N = 0.080			
5.0 FT	186.0 FT	100.0 FT	190.0 FT	250.0 FT	200.0 FT
400.0 FT	210.0 FT	600.0 FT	220.0 FT		

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
325.8 SF	200.4 FT	0.080	4.1 FPS	5,488CFS
156.5 SF	10.0 FT	0.050	11.7 FPS	1,842CFS
316.9 SF	270.3 FT	0.080	4.9 FPS	11,398CFS

NVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
6.0 FT	15.6 FT	201.6 FT	3,799 SF	4.9 FPS	18,729 CFS	0.0040

E FLOW = 2,700 CFS BASE STAGE = 192.9 FT.

STATION 38 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
-600.0 FT	200.0 FT	-520.0 FT	190.0 FT	-80.0 FT	190.0 FT
-5.0 FT	183.0 FT				
		N = 0.050			
-5.0 FT	183.0 FT	5.0 FT	183.0 FT		
		N = 0.080			
5.0 FT	183.0 FT	250.0 FT	190.0 FT	450.0 FT	200.0 FT
600.0 FT	220.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
337.4 SF	546.8 FT	0.080	3.0 FPS	7,232CFS
109.1 SF	10.0 FT	0.050	9.2 FPS	1,008CFS
968.4 SF	323.4 FT	0.080	3.9 FPS	7,708CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
33.0 FT	10.9 FT	193.9 FT	4,414 SF	3.6 FPS	15,949 CFS	0.0040

SE FLOW = 2,700 CFS BASE STAGE = 189.2 FT.

STATION 52 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
-600.0 FT	200.0 FT	-550.0 FT	190.0 FT	-450.0 FT	180.0 FT
400.0 FT	180.0 FT	600.0 FT	190.0 FT	700.0 FT	200.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
4,241.6 SF	988.7 FT	0.080	2.8 FPS	11,949CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
80.0 FT	4.6 FT	184.6 FT	4,241 SF	2.8 FPS	11,949 CFS	0.0033

SE FLOW = 2,700 CFS BASE STAGE = 181.9 FT.

STATION 60 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
-750.0 FT	200.0 FT	-700.0 FT	190.0 FT	-600.0 FT	180.0 FT
550.0 FT	180.0 FT	900.0 FT	190.0 FT	1050.0 FT	200.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
5,333.5 SF	1342.8 FT	0.080	1.8 FPS	9,938CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
80.0 FT	4.2 FT	184.2 FT	5,333 SF	1.8 FPS	9,938 CFS	0.0016

SE FLOW = 2,700 CFS BASE STAGE = 181.9 FT.

STATION 68+50

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
-220.0 FT	190.0 FT	-150.0 FT	180.0 FT	600.0 FT	180.0 FT
1000.0 FT	190.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
,275.5 SF	982.4 FT	0.080	1.9 FPS	8,467CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
80.0 FT	4.9 FT	184.9 FT	4,275 SF	1.9 FPS	8,467 CFS	0.0016

SE FLOW = 2,700 CFS BASE STAGE = 182.5 FT.

STATION 76+50

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
-1100.0 FT	190.0 FT	-950.0 FT	180.0 FT	250.0 FT	180.0 FT
500.0 FT	190.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
4,390.2 SF	1338.5 FT	0.080	1.6 FPS	7,200CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
180.0 FT	3.4 FT	183.4 FT	4,390 SF	1.6 FPS	7,200 CFS	0.0016

ASE FLOW = 2,700 CFS BASE STAGE = 181.9 FT.

STATION 34+50

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.080			
1600.0 FT	190.0 FT	-1500.0 FT	180.0 FT	150.0 FT	180.0 FT
300.0 FT	190.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
4,437.5 SF	1716.1 FT	0.080	1.3 FPS	6,211CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
80.0 FT	2.6 FT	182.6 FT	4,437 SF	1.3 FPS	6,211 CFS	0.0016

SE FLOW = 2,700 CFS BASE STAGE = 181.5 FT.

SCALE IN FEET

2000 1000 0 2000

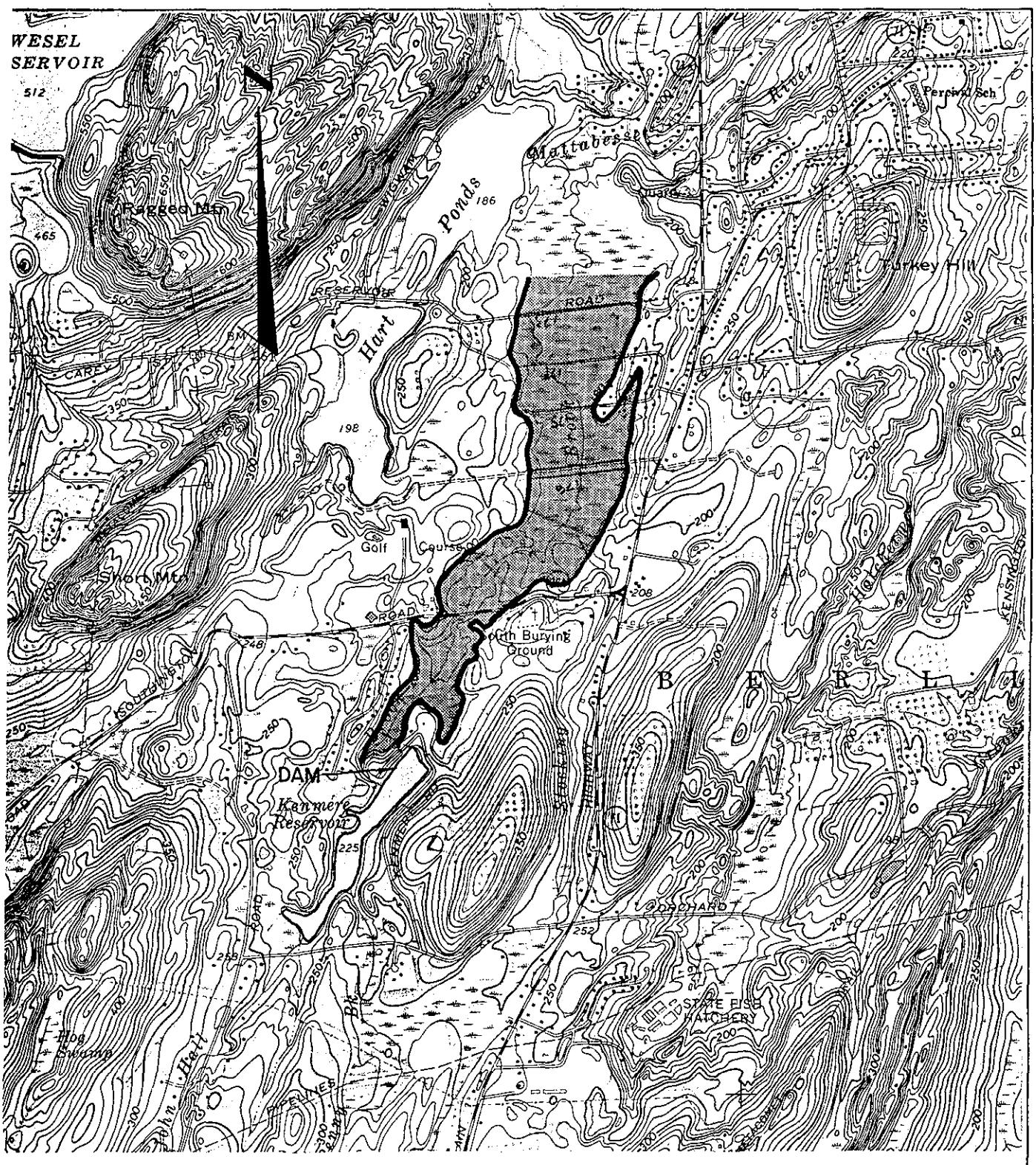
KENMERE RESERVOIR DAM

DRAINAGE MAP

BERLIN, CONNECTICUT

* WATERSHED CONDITION "C"
SEE TEXT SECTION 5.1

FLAHERTY • GIAVARA ASSOCIATES, P.C.



IMPACT AREA

SCALE IN FEET

2000 1000 0 2000

KENMERE RESERVOIR DAM

DAM FAILURE ANALYSIS

IMPACT AREA

BERLIN, CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS