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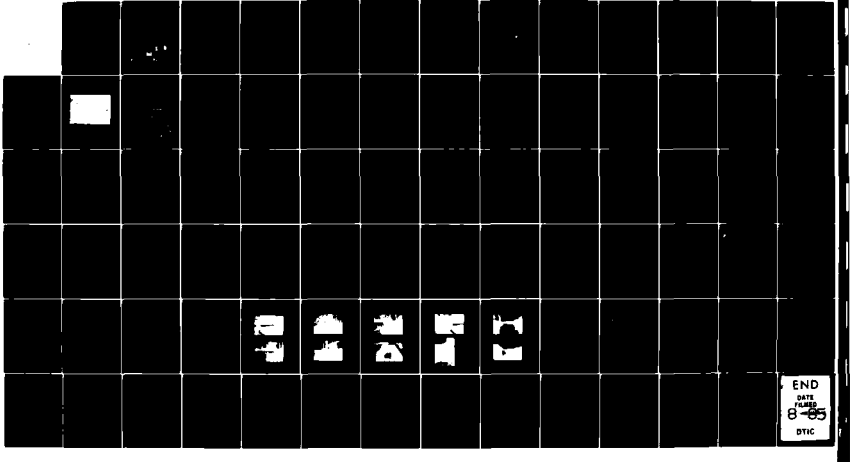

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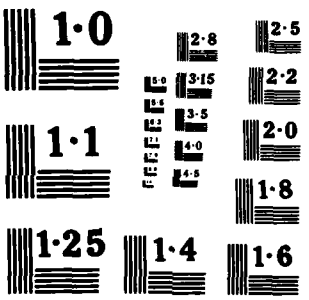
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WOONASQUATUCKET RIVER BASIN
SMITHFIELD, RHODE ISLAND

SLACK RESERVOIR DAM
RI 03104

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

JUNE 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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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,

Woonasquatucket River Basin
Smithfield Rhode Island
Unnamed Stream

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

The dam is an earth embankment about 250 ft. long and 17 ft. high. The dam is judged to be in fair condition with several maintenance items that require attention to insure the long term performance of the dam. It is intermediate in size with a significant hazard potential. The test flood for the dam is the full PMF. Overtopping could result in the failure of this earth embankment. There are various remedial measures which must be implemented by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

JAN 27 1981

Honorable J. Joseph Garrahy
Governor of the State of Rhode Island
and Providence Plantations
State House
Providence, Rhode Island 02903

Dear Governor Garrahy:

Inclosed is a copy of the Slack Reservoir Dam (RI-03104) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Management, the cooperating agency for the State of Rhode Island. In addition, a copy of the report has also been furnished the owner, Woonasquatucket Reservoir Company, Worcester Textile Co., Inc., Centerdale, Rhode Island.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Management for your cooperation in carrying out this program.

Sincerely,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

Incl
As stated

SLACK RESERVOIR DAM

R.I. 03104

WOONASQUATUCKET RIVER BASIN

SMITHFIELD, RHODE ISLAND

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SLACK RESERVOIR DAM

R.I. 03104

WOONASQUATUCKET RIVER BASIN

SMITHFIELD, RHODE ISLAND

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

Identification No:	R.I. 03104
Name of Dam:	Slack Reservoir Dam
County and State:	Providence County Rhode Island
Stream:	Unnamed Stream
Date of Inspection:	6 November 1979

Brief Assessment

The dam at Slack Reservoir is an earth embankment about 250 feet long, 17 feet high with an average crest width of 17 feet. The upstream slope is protected by grouted stone armor from the crest (Elev. 276.5 feet) downslope for a distance of 18 feet. The upstream slope is 1V on 2.75 H. The downstream slope is grass covered and sloped at approximately 1V on 1.5 H. The overflow spillway, located at the right abutment, is an uncontrolled concrete box culvert 1.6 feet high by 6.0 feet wide. The outlet works consists of an intake tower and gatehouse, a 3.5 W feet x 3.5 H feet stone box culvert through the dam and a masonry headwall at the downstream toe of the embankment. The gatehouse also contains an overflow capability above Elev. 270.78 MSL. Below that level the reservoir pool is controlled manually by a vertically mounted sluice gate. All discharges flow into a tailwater pond at the toe. The reservoir is used for recreation.

The assessment of the facility is based on the visual inspection, since engineering, operational and maintenance data are not available. The dam is judged to be in FAIR condition with several maintenance items that require attention to insure the long term performance of the structure. They include: deteriorated concrete of the overflow spillway; brush and trees on the embankments; wet and spongy areas at the left abutment on the downstream slope, apparent voids in the outlet works culvert masonry and bare and eroded zones along the crest and slopes of the embankment. The dam is further considered deficient because it has insufficient outflow capacity to prevent overtopping of the embankment by the "test flood".

The dam is classified as INTERMEDIATE in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The adopted "test flood" inflow for this dam is equal to the Probable Maximum Flood (PMF) of 1,900 cfs and the routed test flood outflow was approximately 1,275 cfs and would overtop the dam by 1.32 feet; therefore, the existing spillway capacity is considered to be inadequate and cannot meet the spillway design flood screening cri-

teria. The maximum spillway discharge of 100 cfs represents only 7.8 percent of the test flood outflow. Overtopping could result in the failure of this earth embankment.

It is recommended that the Owner engage the services of a registered professional engineer experienced in the design of dams to accomplish the following: perform more detailed hydrologic studies to evaluate the impact of the test flood on the facilities and to improve the capacity of the dam to pass the flood flows reducing the overtopping potential; remove the vegetation from the embankment; repair the overflow spillway; monitor the wet zones at the left abutment area and develop an emergency action plan.

Additional recommendations and remedial measures are detailed in Section 7 and should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

CE Maguire, Inc.

By: Richard W. Long
Richard W. Long, P.E.
Vice President

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

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

The Phase I Investigation does <u>not</u> 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.

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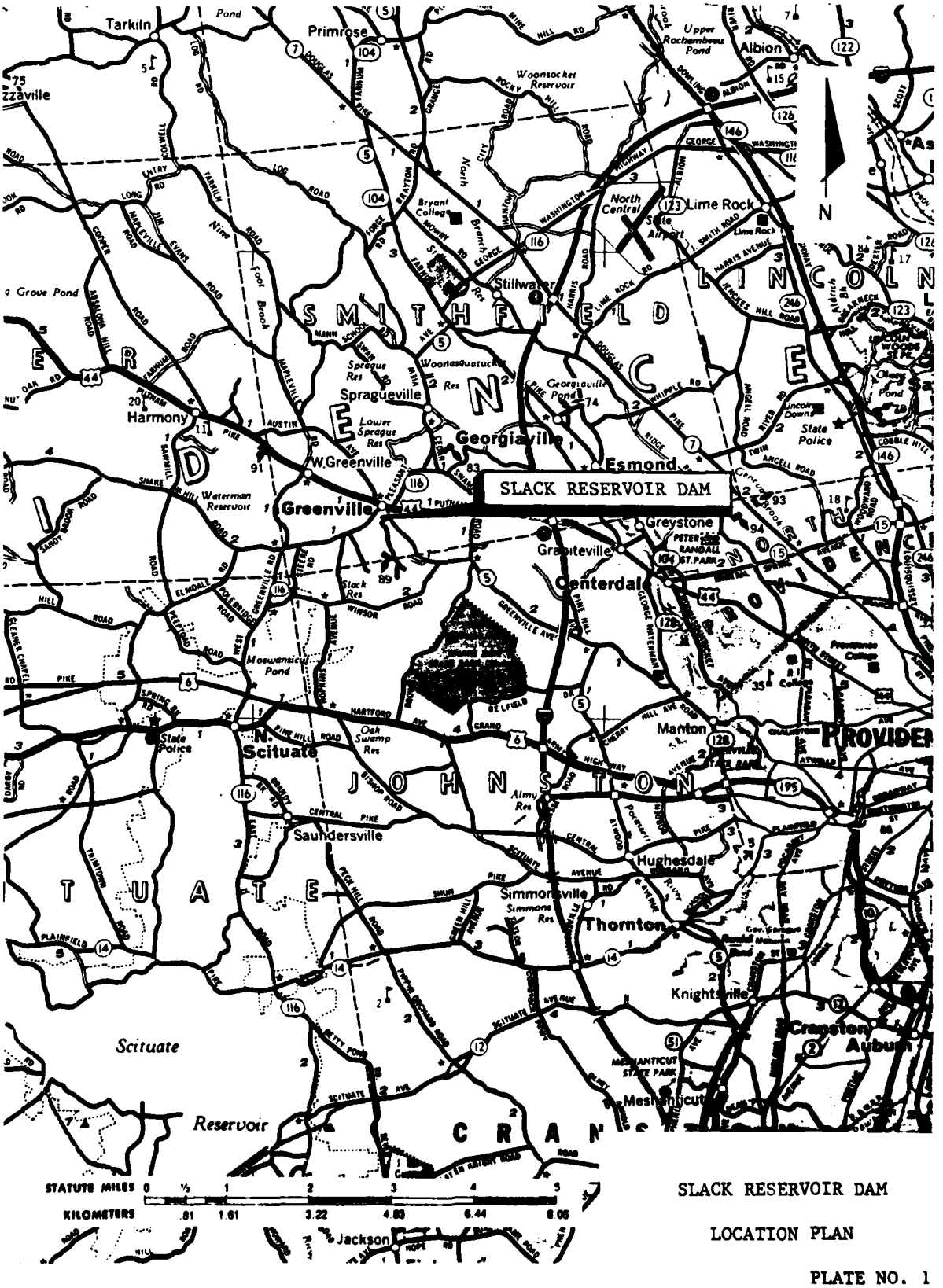
OVERVIEW PHOTO - SLACK RESERVOIR DAM



SLACK RESERVOIR DAM

LOCATION PLAN

PLATE NO. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

SLACK RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. CE Maguire, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to CE Maguire, Inc., under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection.

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 State 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. Slack Reservoir Dam is located in the Town of Smithfield, Providence County, in the center of the community of Greenville, Rhode Island. The dam is sited about 900 feet south from the intersections of Putnam Pike (U.S. Route 44) and R.I. Route 116. The dam impounds water from a 1.9 square mile watershed of rolling terrain. Approximate coordinates of the dam are 41° 52.1'N Latitude and 71° 33.3'W Longtitude. The reservoir is aligned along a north-south axis with the dam at the northerly extremity of the impoundment.

b. Description of Dam and Appurtenances. The Slack Reservoir Dam is an earth embankment approximately 250 feet long, 17 feet high with an average crest width of 17 feet. The upstream slope is protected by stone armor from the crest (Elev. 276.5 feet) downslope for a distance of approximately 18 feet. The slope is about 1V in 2.75H. The crest profile is relatively level and is a grassed surface. The downstream is unprotected, grass-covered and sloped at 1V on 1.5H. The overflow spillway structure is located at the right abutment and is a concrete box culvert sluiceway, uncontrolled, that is 1.6 feet H x 6.0 feet W. with a spillway crest at Elev. 273 feet above Mean Sea Level. The outlet works consists of an intake tower and gatehouse, a 3.5 feet square masonry box culvert conduit through the embankment and a masonry headwall structure at the downstream toe of the dam. Reservoir pool levels above Elev. 270.78 feet can be regulated by timber stop logs within the gatehouse and a 3.5 feet W x 3.5 feet H timber sluice gate. Below that level the pool is controlled by the sluice gate only. All spillway and outlet works discharges flow directly into Hopkins Pond at the toe of the embankment.

c. Size Classification. The dam has an impoundment storage capacity at the top of the dam equal to 1780 Ac-Ft. and a height of 17.0 feet. In accordance with guideline criteria developed by the Corps of Engineers the impoundment capacity governs that this dam be classified as INTERMEDIATE in size.

d. Hazard Classification. The dam is classified as having a SIGNIFICANT hazard potential because it is located in a predominently suburban area where failure could result in loss of a few lives and damage to 1-2 dwellings and 1-4 commercial properties. Flooding and potential damage may also occur to Greenville Road and Putnam Pike (U.S. Route 44) and cause temporary disruption of utility service for those utilities located with the rights of way of those respective roadways. Water depths due to the dam failure discharge of 6014 cfs are estimated to be approximately 8.0 feet. The failure will cause flooding conditions downstream and high velocities of flow which will carry trees, vegetation and other debris that will increase the damage potential.

e. Ownership. The dam is presently owned by the Woonasquatucket Reservoir Company, a corporation of textile mill owners, located at Worcester Textile Co., Inc., Greystone Avenue, Centerdale, Rhode Island. The Slack Reservoir Association, an organization of shoreline owners, assists the Owner in the management of the impoundment for recreation purposes. The Woonasquatucket Reservoir Company is presently proceeding with plans to turn ownership over to the State of Rhode Island.

f. Operator. Operating staff are under the direction of:

Mr. Raymond Gregson, President
Worcester Textile, Co.
Greystone, Rhode Island 02911
(401)-231-4500

g. Purpose of Dam. To store water for recreational use.

h. Design and Construction History. The dam at Slack Reservoir was reportedly constructed about 1885 to provide a dependable supply of process water for downstream textile mills. There is no documentation regarding the original construction or subsequent repair work until November, 1974 when the Slack Reservoir Association rehabilitated the gatehouse control tower and armored the upstream slope of the embankment. No additional work has been recorded since that time.

i Normal Operational Procedure. The reservoir is normally unregulated and all discharges are the result of flow through the uncontrolled spillway and the gatehouse overflow. The pool level is lowered in the fall, after the summer recreation season ends, to prevent ice damage to shoreline structures, to provide shore property owners an opportunity to maintain their frontage and to increase the storage capacity for spring runoff and snow melt.

1.3 Pertinent Data.

a. Drainage Area. The Slack Reservoir drainage basin is located in Smithfield and Johnston, Rhode Island and is generally triangular in shape with a base length of 6,000 feet, a height of 10,000 feet and a total drainage area equal to 1.9 square miles. (See Appendix D for Basin Map). The topography is generally, moderately sloped with elevations ranging from a maximum of 480 feet at Sickkibunkiaut Hill to 273 feet at the dam. Approximately 10 percent of the watershed is swampy providing natural storage. Basin slopes average 0.015 feet per feet. The time of concentration for the basin is estimated to be 30 minutes and is considered relatively small; resulting in the probability that all surface runoff will peak at the damsite simultaneously during a high intensity rainfall event.

b. Discharge at Damsite. There is limited discharge data available for this dam. The estimated extreme freshet recorded in the files of Rhode Island Department of Environmental Management for this dam is equal to 301 CFS. Listed below are other discharge data for spillway and outlet works:

1. Outlet Works:

Conduit size	3.5'H x 3.5'W Box Culvert Invert Elevation 260.44
i. Discharge capacity	194 CFS at Spillway crest Elevation 273.0 feet
ii) Discharge capacity	224 CFS at top of dam Elevation 276.5 feet
iii) Discharge capacity	234 CFS at test flood Elevation 277.82 feet
2. Maximum known flood at damsite	Unknown
3. Ungated spillway capacity at top of dam	100 CFS
4. Ungated spillway capacity at test flood elevation	1,170

Note: Test flood elevation 277.82 is higher than the top of dam elevation 276.5

5. Gated spillway capacity at normal pool elevation	N/A
6. Gated spillway capacity at test flood elevation	N/A
7. Total spillway capacity at test flood elevation	N/A
8. Total project discharge at top of dam	324 CFS
9. Total project discharge at test flood elevation (Includes Outlet Flow)	1,509 CFS

c. Elevations (Feet above NGVD)

1. Streambed at toe of dam	259.50
2. Bottom of cutoff	Unknown
3. Maximum tailwater	Unknown
4. Recreation pool	273.0

5.	Full flood control pool	N/A
6.	Spillway crest	273.0
7.	Design discharge (original design)	Unknown
8.	Top of dam	276.5
9.	Test Flood level	277.82

d. Reservoir Lengths (in feet)

1.	Normal pool	5,000
2.	Flood control pool	N/A
3.	Spillway crest pool	5,000
4.	Top of dam pool	5,200
5.	Test Flood pool	5,400

e. Storage (Acre-Feet)

1.	Normal pool	1,300
2.	Flood control pool	N/A
3.	Spillway crest	1,300
4.	Top of dam	1,780
5.	Test flood pool	2,013

f. Reservoir Surface Area (Acres)

1.	Normal pool	150
2.	Flood control pool	N/A
3.	Spillway crest	150
4.	Test flood pool	150
5.	Top of Dam	150

g. Dam

1.	Type (based on visual inspection)	Earth embankment

2.	Length	250 ft.
3.	Height	17.0 ft.
4.	Top width	17.0 ft.
5.	Side slopes	Upstream 1V on 2.75H donstream 1V on 1.5 H
6.	Zoning	Unknown
7.	Impervious core	Unknown
8.	Cutoff	Unknown
9.	Grout curtain	Unknown
10.	Other	-----

h. Diversion and Regulating Tunnels — N/A

i. Spillway

1.	Type	Rectangle box culvert
2.	Size	6.0 ft. wide x 1.6 ft. high
3.	Crest elevation	273.0 feet
4.	Gates	None
5.	U/S Channel	Natural bed of reservoir
6.	D/S Channel	Natural bed of Hopkins Pond
7.	General	Concrete box culvert

j. Regulating Outlets

Refer to Paragraph 1.2b "Description of Dam and Appurtenances" Page 1-2 for description of outlet works.

1.	Downstream invert	260.44 feet
2.	Size	3.5 ft x 3.5 ft.

3.	Description	Stone masonry box culvert
4.	Control Mechanism	Manually operated sluice gate
5.	Other	Controls housed in concrete block gate-house. Gatehouse has provision for overflow above Elev. 270.78. feet

SECTION 2

ENGINEERING DATA

2.1 Design Data

The following documents which contain the principal information regarding this dam were reviewed in the preparation of this report.

1. Slack Reservoir - Rhode Island Department of Public Works, Division of Harbors and Rivers by the Works Projects Administration Plan No. W-9, dated 6-10-40.

2. Improvements and Modifications to R.I. Dam No. 115 - Plan and Typical Slope Protection - Slack's Dam - Smithfield, R.I. August 1, 1973.

3. Rough dimensional drawing of gatehouse - Dam No. 115 - Slack Reservoir indicating rehabilitation of timber sluice gate, dated 7-20-73.

2.2 Construction Data

No record of construction or repairs exists to supplement the above information.

2.3 Operation Data

No record of operation for this facility has been maintained.

2.4 Evaluation of Data

a. Availability. The information noted above for this facility is available in the files of the Dam Section, Land Resources Department of Environmental Management - State of Rhode Island.

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

c. Validity. The validity of the limited data must be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The Phase I Inspection of the dam at Slack Reservoir was performed on 6 November, 1979, by representatives of CE Maguire, Inc. and Geotechnical Engineers, Inc. A field inspection checklist and photographic record of that inspection are included in Appendix A & C, respectively, of this report. Based on the visual inspection and general appearance, the dam at Slack Reservoir is judged to be in FAIR condition.

b. Dam. The dam is an earth embankment with a tailwater pond (Hopkins Pond) along the downstream toe.

The crest of the dam is predominantly grass-covered except in areas of heavy trespassing near the spillway. There is a 16-in. diameter tree growing on the upstream side of the crest near the right side of the spillway and a 20-in. diameter tree growing on the downstream side of the crest near the center of the dam (See photos C-1, 2, 3, 4).

The upstream face of the dam between the spillway and gatehouse is covered with grouted riprap in good condition (See photos C-1, 2).

Between the right abutment and the right side of the spillway entrance some erosion has taken place in the splash zone on the upstream face. An 8-in. diameter tree is growing from the riprap in this area.

An 18-in. diameter rotting tree stump is present on the upstream face at the right abutment.

The downstream face is heavily vegetated from the dam crest to the tailwater pond with brush and large trees to 36 inches in diameter (See photos C-3, 4).

Surface erosion was observed to the left of the left spillway training wall and just to the right of the gatehouse structure on the downstream face.

The toe of the embankment could not be observed due to the presence of a tailwater pond along the full length of the toe.

On the downstream side of the left abutment, the soil was wet and spongy between the remnants of two concrete walls. No water flow was observed.

c. Appurtenant Structures

1. Overflow Spillway The bottom of the downstream spillway channel is in very poor condition with most of the concrete floor apparently washed away. Erosion of the embankment soil exposed at the spillway floor is now occurring. A large pile of stone and concrete debris was observed at the downstream end of the spillway channel, possibly placed to try to limit erosion of the embankment soil (See photo C-6).

2. Outlet Works and Gatehouse Cracks in the concrete and stone masonry wall at the gatehouse intake structure were observed. Some concrete deterioration is also present in the left side of the gatehouse wing wall (See photo C-7).

Minor concrete spalling was noted on the left side of the upstream spillway wall. Many voids were observed in the dry masonry walls of the outlet structure. These gaps were up to 24" x 14" in size and extended up to 30" back into the embankment. Small vegetation was also observed growing from some of these void spaces (See photo C-8). The dry masonry wall parallel to the axis of the dam appeared slightly bowed downstream. The gatehouse was locked at the time of the inspection and therefore the gates were not tested.

d. Reservoir Area. The reservoir formed by the dam is approximately 150 acres and provides a storage of approximately 1,300 Ac-Ft. of water. The reservoir extends a distance of 5,000 feet to the south from the damsite and has an average width of 1,500 feet. One half of the lake formed lies within the boundaries of the Town of Smithfield and the remainder in Johnston, Rhode Island. The shoreline is developed with numerous dwellings scattered around the perimeter. The shoreline is grass and tree-covered and flat to moderately sloped. The stand of trees and vegetation cover around the perimeter should inhibit sloughing of the shoreline and resulting sedimentation (See photo C-10).

e. Downstream Channel

The downstream channel is a tailwater pond. Several trees were observed overhanging the pond (See photo C-9).

3.2 Evaluation

Based on visual observations, the dam appears to be in FAIR condition. The following features could adversely affect the future performance of the dam:

a. Erosion of the embankment soil on the bottom of the downstream spillway channel due to the lack of the protective concrete floor.

b. Large trees growing on the embankment which could be uprooted during wind storms leaving large depressions in the dam. In addition, if the trees die, rotting tree roots can provide seepage paths for water from the reservoir if they extend back into the saturated zone of the dam.

c. Unless grass cover is provided on exposed soil, further erosion of the downstream slope embankment soils will occur.

d. Erosion of the upstream face of the dam to the right of the spillway will continue unless repairs to the riprap are made.

e. Erosion of the embankment soil through the large voids in the dry stone masonry outlet walls could occur.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The Slack Reservoir facility is regulated by personnel of the Woonasquatucket Reservoir Company, who are located at the Worcester Textile Co., in Greystone, Rhode Island, approximately 3 miles from the dam. Reservoir operation is infrequent and entails mainly the release of stored water from the reservoir at the end of the summer-fall recreation season. The pool level would normally remain lowered during the winter period to reduce ice damage to shoreline piers and docks and to provide storage capacity for spring runoff. The outlet to the reservoir is regulated manually and the control is located at the left abutment of the dam within a concrete block gatehouse structure. No documented operating procedures have been prepared.

b. Description of Any Warning System in Effect. There is no warning system in effect at Slack Reservoir.

4.2 Maintenance Procedures.

a. General. Little regular maintenance has occurred at the dam. Slope protection was added in 1974. Erosion on the crest from pedestrian traffic is evident. Trees and vegetation are unattended maintenance items. No documented maintenance has occurred.

b. Operating Facilities. Except for the refurbishing of the gate in 1974 no specific maintenance has occurred. The overflow spillway is badly spalled and eroded and the left abutment area of the dam has evidence of spongy, wet zones on the downstream slope adjacent to the gatehouse outlet. Lack of maintenance is apparent.

4.3 Evaluation. The Slack Reservoir facility is a small dam with simple operating mechanisms and, as such, requires only basic operating procedures. Maintenance involves periodic removal of growth from the embankment and surveillance regarding seepage zones, slope damage, animal burrows and debris removal. An emergency action plan should be developed that will outline procedures to follow for dewatering, authorities to contact, locations of emergency equipment, material and personnel and downstream areas that are affected.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. Slack Reservoir, with a drainage area of 1.90 square miles, is one of several impoundments located in the headwaters of the Woonasquatucket River Basin. The damsite is located in the center of the community of Greenville, Rhode Island. Typical basin characteristics of the watershed are moderate slopes, small storage capacity (about 10 percent natural swamp or valley storage) and terrain that is wooded with a large degree of urban development.

The total length of the dam is 250 feet. The storage capacity is equal to 1,300 Ac.-Ft. at the spillway crest (elev. 273.0 feet) and can accommodate 15.1 inches of runnoff from the watershed. Each foot of depth in the reservoir pool above the spillway crest represents 150 Ac.-Ft. of storage or 1.48 inches of runoff.

Because the surcharge storage capacity is equal to 525 Ac.-Ft., or 5.18 inches of runoff, this dam is considered to have a large storage potential. The maximum spillway capacity is equal to 100 cfs which is 7.8 percent of the expected test flood outflow, therefore the dam is a low spillage facility and would be overtopped. Since the embankment is earth, the dam is less stable against overtopping flows because of erosion of the soil materials.

5.2 Design Data. Limited data is available for this watershed. In lieu of existing design information U.S.G.S. topographic maps (scale 1" = 2,000 ft.) were utilized to develop hydrologic parameters such as drainage area, reservoir surface area, basin slope, time of concentration and other runnoff characteristics. Elevation/storage relationships were estimated. Surcharge storage was calculated assuming the surface area of the pool remained constant above the spillway crest. Some of the pertinent hydraulic data was obtained and/or verified by actual field measurements. Test flood inflow/outflow values and dam failure profiles were determined in accordance with the Corps of Engineers guidelines. Final values used in this report are quite approximate and are no substitute for actual detail analysis.

5.3 Experience Data. No historical data for recorded discharges or water surface elevations is available for this dam or the watershed.

5.4 Test Flood Analysis. Recommended guidelines for the Safety Inspections of Dams by the Corps of Engineers were used for the selection of the Test Flood. Under those guidelines, the dam is classified as a SIGNIFICANT hazard and INTERMEDIATE size structure and warrants testing by a storm event ranging from one half the Probable Maximum Flood (PMF) to the full PMF. The watershed has a total drainage area equal to 1.9 sq. miles of which 10 percent or 0.19 sq. miles is

swampy or natural storages. This drainage area is sparsely populated and largely wooded with hilly and rolling terrain. The average basin slope is approximately 0.015 feet per foot and is considered moderate to steep. The overall hydrologic parameters of the basin indicate that the watershed should be classified as flat to rolling terrain. A test flood equal to the full PMF of 1,000 CSM or 1,900 CFS was adopted because of the potential downstream hazards. Outflow discharges were also developed using Corps of Engineers criteria for approximate routing. The routed outflow discharge for the test flood is 1,275 CFS. The spillway and outlet rating curves are illustrated in Appendix D. Flood routings were performed with an assumed full pond condition (at spillway crest level).

The spillway capacity is hydraulically inadequate to pass the "test flood" outflow and the test flood would overtop the dam by approximately 1.32 feet. The maximum outflow capacity of the spillway, in a still reservoir condition is 100 cfs or 7.8% of the routed "test flood" outflow discharge. At the spillway crest elevation, the capacity of the outlet structure is 194 cfs. Using the outlet works it will require 9 hours to lower the pool one foot. For the total storage to be drained through the outlet it will require approximately 4 days. Because one foot of depth in the reservoir at the spillway crest is equal to 1.48 inches of runoff it is estimated that overtopping of the dam by the test flood can be eliminated by lowering the pool level prior to storm inflow.

5.5 Dam Failure Analysis. An instantaneous full depth-partial width breach of 55 feet was assumed to have occurred in the dam. This would result in an unsteady flow condition, causing a failure wave to travel downstream and its reflection wave travelling into the reservoir and rebounding to reinforce the downstream wave passing through the valley. The calculated dam failure discharge of 6014 cfs presumes the reservoir level was at the top of the dam before failure and will result in a water surface elevation of 267.3 feet immediately below the dam (about 6.5 feet above the depth just prior to failure). The estimated damage reach extends downstream 2,500 feet where normal uniform flow would occur. The failure could result in loss of a few lives and inundation of 1-2 dwellings and 1-4 commercial properties. It is estimated the the depth of water at the dwellings and commercial properties will range from 1-5 feet. Flooding and potential damage may also occur to Greenville Road and Putnam Pike (U.S. Route 44) and cause temporary disruption to utility services located within the rights of way of those roadways. It is estimated that water depths would average 8.0 feet and that high velocities of flow could result in erosion and stripping of vegetation. The prime impact area has been estimated, if the dam were to fail, and has been delineated on the drainage basin map in Appendix D. As a result of the failure analysis the dam has been classified as a SIGNIFICANT hazard structure.

SLACK RESERVOIR DAM

Inflow, Outflow, and Surcharge Data

STORM EVENT	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR** EFF. RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
1/2 PMF	11.9	9.5	950	550	3.90	276.90
PMF = Test Flood	21.4	19.0	1,900	1,275	4.82	277.82

* Infiltration assumed as 0.1"/hour
** Lake assumed initially full at spillway crest elevation 273.0
(top of dam = 276.50)

NOTES:

1. 1/2 PMF and "test flood" equal to PMF computation based on COE instructions and guidelines.

2. Maximum capacity of the spillway without overtopping the dam (elevation 276.50) is equal to 100 CFS.

3. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.

4. Test flood = Full PMF = 1,000 CSM = 1900 CFS
(D.A. = 1.90 square miles).

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation. The visual observations did not disclose any immediate stability problems of the dam. However, the following features could adversely affect the future performance of the dam:

a. Erosion of the embankment soil on the bottom of the downstream spillway channel due to the lack of the protective concrete floor.

b. Large trees growing on the embankment which could be uprooted during wind storms leaving large depressions in the dam. In addition, if the trees die, rotting tree roots can provide seepage paths for water from the reservoir if they extend back into the saturated zone of the dam.

c. Unless grass cover is provided on exposed soil, further erosion of the downstream slope embankment soils will occur.

d. Erosion of the upstream face of the dam to the right of the spillway will continue unless repairs to the riprap are made.

e. Erosion of the embankment soil through the large voids in the dry stone masonry outlet walls could occur.

6.2 Design and Construction Data. No design or construction data pertaining to the dam were available.

6.3 Post-Construction Changes. An application for the approval of construction plans submitted by the Woonasquatucket Reservoir Co., Inc. on July 20, 1973 to the R.I. Department of Natural Resources and related correspondence indicate that a new gate was installed and that pressure grouting behind the granite walls for the gate well was performed in late 1973 to correct leakage through the old gate and granite walls. These changes could not be confirmed during the visual inspection.

This same application also included new riprap, grouted in place, installed on the upstream face between the spillway and left abutment area and the installation of new concrete downstream spillway walls. These changes appear to have been made as indicated in the application.

6.4 Seismic Stability. The dam is located near the boundary of Seismic Zones 1 and 2 and according to Corps of Engineers Guidelines does not warrant a seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment.

a. Condition. Based on the visual inspection and review of available information, the dam appears to be in FAIR condition. There are several features, however, which adversely affect the future condition of the dam:

1. Hydraulic analysis indicates that the outflow spillway can discharge 100 cfs which represents only 7.8% of the routed test flood outflow which will result in overtopping of the dam.

2. Vegetation including large diameter trees on the embankment.

3. Overflow spillway floor badly spalled and eroded.

4. Large voids apparent in the outlet works conduit at the toe of the dam.

5. Wet, spongy zones near the left abutment area.

b. Adequacy of Information. The information available is such that the assessment of the safety of the dam must be based on the visual inspection.

c. Urgency. The recommendations and remedial measures described below should be implemented within one year after receipt of this Phase I inspection report by the Owner.

7.2 Recommendations

The following should be accomplished under the supervision of a qualified registered engineer, experienced in the design of dams:

1. Perform detailed hydrologic and hydraulic studies to further assess the need for and means to increase the project discharge capacity.

2. The floor of the overflow spillway structure should be backfilled with sand and gravel and the concrete floor replaced where it has been eroded.

3. All brush and trees on the embankment should be cut and all stumps and roots removed and backfilled with proper material. Caution should be exercised in the removal of the large

diameter trees and their attendent root systems to insure that the cavities are properly backfilled and compacted with appropriate soil materials. This work should be accomplished during low reservoir stages, and refilling at the pool should be closely monitored.

4. Riprap on the upstream face to the right of the spillway should be repaired.

5. The large voids in the downstream dry masonry stone walls of the outlet works should be filled with stone of the proper size and grouted.

6. Monitor the wet, spongy areas adjacent to the outlet works at the left abutment.

7. Inspect the downstream toe of the dam when tailwater conditions permit.

The Owner should implement any recommendations resulting from the above investigations.

7.3 Remedial Measures

a. Operation and Maintenance Procedures.

1. Areas of erosion adjacent to the spillway and downstream of the gatehouse should be backfilled and grassed.

2. The Owner should maintain proper vegetation for erosion control of the crest and downstream slopes.

3. An annual program of technical inspection by a qualified, registered engineer should be implemented.

4. Develop an "Emergency Action Plan" that will include an effective preplanned downstream warning system, locations of emergency equipment, materials and manpower, dewatering procedures, authorities to contact and potential areas that require evacuation. The Owner should also provide surveillance of the dam during intense rainfalls.

5. Exercise gate to verify operation of the gate.

6. Repair all spalled, cracked and deteriorated concrete and masonry on the gatehouse and spillway walls.

7. Inspect the downstream toe of the dam when tailwater conditions permit.

7.4 Alternatives

There are no alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Slack Reservoir Dam DATE November 6, 1979

TIME PM

WEATHER Fair

W.S.ELEV. _____ U.S. _____ D.S.

PARTY:

1. A. Reed, CEM
2. E. Dessert, CEM
3. L. Topp, CEM
4. G. Castro, GEI
5. J. Engels, GEI
6. S. Khanna, CEM
7. _____
8. _____
9. _____
10. _____

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

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	276.5
Current Pool Elevation	270.62
Maximum Impoundment to Date	Unknown
Surface Cracks	Few in grouted riprap upstream slope.
Movement or Settlement of Crest	None observed
Lateral Movement	Apparent downstream bulge in cut stone wall on downstream slope above outlet.
Vertical Alignment	Too irregular to judge.
Horizontal Alignment	Too irregular to judge.
Condition at Abutment and at Concrete Structures	Good at abutments and gatehouse. Erosion along left spillway downstream training walls.
Indications of Movement of Structural Items on Slopes	None observed.
Trespassing on Slopes	Few footpaths on downstream slope.
Sloughing or Erosion of Slopes or Abutments	Adjacent to left spillway downstream training wall.
Rock Slope Protection - Riprap Failures	None observed. Repairs apparently performed in past few years.
Unusual Movement or Cracking at or Near Toe	None observed. Tailwater pool.
Unusual Embankment or Downstream Seepage	None observed on dam. Wet spongy area at left abutment downstream of dam.

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT (cont.)	
Piping or Boils	None observed.
Foundation Drainage Features	None known or observed.
Toe Drains	None known or observed.
Instrumentation System	None known or observed.
Vegetation	Large trees to 36-inch diameter on downstream slope.

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	None observable. Natural bed of reservoir.
b. Intake Structure	Intake opening of gatehouse is protected by trash screen.
Condition of Concrete	Fair
Stop Logs and Slots	Located within gatehouse to regulate overflow through gatehouse.

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good. Concrete block structure.
Condition of Joints	Good
Spalling	None observed.
Visible Reinforcing	None observed.
Rusting or Staining of Concrete	None observed.
Any Seepage or Efflorescence	None observed. Wet well chamber full at time of inspection.
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None
Cracks	None. Some cracking at outside wingwall
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	Gatehouse locked. Sluicegate was reportedly repaired in 1973. Wet well chamber also grouted and sealed.

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	Conduit through embankment is a 3.5 x 3.5 ft. stone masonry box culvert.

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	No outlet structure. Cut stone masonry retaining walls.
Channel	Tailwater reservoir. Hopkins Pond.
Loose Rock or Trees Overhanging Channel	Several trees overhanging channel.
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Slack Reservoir Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	No approach channel. Natural reservoir bed and upstream embankment slope.
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Natural
b. Box Culvert	1.6'H x 6.0'W box culvert.
General Condition of Concrete	Good, minor spalling.
Rust or Staining	None
Spalling	Minor
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None observed.
c. Discharge Channel	
General Condition	Poor. Concrete pavement at bottom of channel removed by erosion for most of length.
Loose Rock Overhanging Channel	None observed.
Trees Overhanging Channel	None
Floor of Channel	Concrete floor, see above.
Other Obstructions	Large block at end of channel.

APPENDIX B

ENGINEERING DATA

APPENDIX B-1

Correspondence pertaining to the history, maintenance and modifications to the Slack Reservoir Dam as well as copies of past inspection reports are located at:

Department of Environmental Management
State of Rhode Island
83 Park Street
Providence, Rhode Island 02903
Department of Land Resources - Dam Section

Woonasquatucket Reservoir Company
Worcester Textile Company
Greystone, Rhode Island 02911

APPENDIX B-2

SELECTED COPIES OF PAST INSPECTION REPORTS

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: 115 RIVER: Slack Res. Brk WATERSHED: Woonasquatucket

NAME: Slack Reservoir TOWN: Smithfield

OWNER: Woonasquatucket Res. Co., Inc c/o William Garriepy
P. O. Box 5078
Esmond, RI 02917

Interested Party: Slack's Reservoir Assoc.
c/o Donald C. Webster, Chairman
Dam Repair Committee

REPORT ON: General Condition of Dam

REASON FOR INSPECTION: N.P.S.I.D. Significant/Intermediate Hazard
Annual Inspection

INSPECTION BY: Earle Prout
Carmine Asprinio

DATE OF INSPECTION: April 13, 1978

REPORT: Existing Conditions:

Spillway: Inlet - good condition; very little signs of scouring of concrete at sluice abutment. Outlet - base (or apron) of sluiceway spalling and at least 6' has eroded away. Some concrete on south-east abutment wall chipping and scouring. Application for repair work dated 10/74 (see photo #1)

Embankment: Earthen embankment in good condition on pond side. Pond side has been stabilized by cemented fieldstone. This condition has existed since prior to 1940 (W.P.A. "as is" drawing) and shows no sign of disrepair. Also, repaired in 1974. Downstream side of dam (near outlet of sluiceway) showing some signs of soil erosion at top of embankment. This is undoubtedly due to heavy rains and does not presently jeopardize the stability of the bank. The bank itself does not show any indication of seepage of water.

Gatehouse: Concrete block gatehouse needs repointing of blocks, patching of concrete lintel over metal door, repair of spalling concrete roof on three sides and repair of metal door frame which shows much rust and decay. (see photo 2)

Comments

Dam is in generally good condition. Confirming letter of inspection to owner should call attention to the need for repair work at gatehouse and sluiceway.

E.A.P.

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: #115 RIVER: Slack Reservoir Brook WATERSHED: Woonasqutucket

NAME: Slack Reservoir TOWN: Smithfield

OWNER: Raymond S. Gregson, President Woonasquatucket Reservoir Co., Inc.
% Worcester Textile Co., Inc. Greystone Avenue, Centredale, RI 02911
Phone: 231-4500

INTERESTED PARTIES: Donald Webster, President, Slack Rservoir Assoc. Ph; B: 722-0343
H: 949-1113
H.W. Klang and Son, Contractor for Gate Repairs 500 Woodland Ave.
Seekonk, MA 02771
Ph: (617) 761-8394

REPORT ON: Condition of gate and gate-well

REASON FOR INSPECTION: Proposed maintenance

INSPECTION BY: P. M. Janaros
W. B. Brinson

DATE OF INSPECTION: 11 July 73

REPORT:

Met with Donald Webster and Walter Morris, a member of the Assoc., Mr. Janaros examined the leaking gate and gate-well. Discussed application procedure with Mr. Webster.

17 July 73

I talked with Klaing about gate repair job. Don Webster wants to work in phases. Phase I to include only gate repair. The procedure sounds OK. Phase II to include grouting. I called Don Webster to tell him to submit Phase I application. Could not reach him.

P.M.J.

18 July 73

Talked to Webster. He will submit application for both phases at the same time (Gate repair and grouting). I will stipulate that I will observe during grouting and will limit approval to one year.

P.M.J.

December 23, 1970

MEMORANDUM

To: Mr. Henry Isé, Chief

From: Charles F. Replinger

Subject: Inspection Dam No. 115, Slack Reservoir Dam

On December 7, 1970 I inspected subject dam pursuant to a request made to the Director by a Mrs. Mary DeMelim.

I talked with her and ascertained that the dam is owned by the Woonasquatucket Reservoir Co. who have advised the local home owners association that they do not intend expending any time or effort in repairing the dam and that the local association may repair the dam providing it will be at no cost or expense to the Woonasquatucket Reservoir Co. The home owners association apparently has some self-styled experts who claim to know what repairs are required. Mrs. DeMelim wishes this division to state what repairs should be done to permit the present water level to be raised to its former height, a distance of approximately 5 ft.

The attached photos show the condition of the dam. The riprap on the upstream side of the dam has been seriously displaced in two locations and should be restored. Brush, shrubs and trees have been allowed to grow unimpeded to such an extent that large roots of trees without doubt are providing channels for seepage. Due to the slope of the downstream side of the dam and the icy-snow coverage it was impossible to define exact locations of seepage. The brush, shrubs and small trees should be eliminated and care taken to prevent re-growth. Because of the size of the large trees it would be impractical to fell them as disintegration of the roots would leave sizeable channels for additional seepage. It might be possible to face the upstream side of the dam with impervious water resistant concrete.

C. F. Replinger

cc. General File

R. I. DEPARTMENT OF PUBLIC WORKS
DIVISION OF HARBORS AND RIVERS

SPECIAL INSPECTION REPORT

DAM NO. 115

INSPECTED BY J. V. KEILY

TOWN - SMITHFIELD

DAM NO 115 NAME SLACK RESERVOIR ON BROOK SLACK RESERVOIR BROOK / RIVER / [redacted]

WATERSHED WOONASQUATUCKET

OWNER WOONASQUATUCKET RESERVOIR CO.

ADDRESS 52 VALLEY STREET, PROVIDENCE, C/O DR. HOLDSWORTH, PREST. C/O PROV. D. B. & C CO. TEL. GE 1242

REPORT ON—NEW CONSTRUCTION REPAIRS INSPECTION ONLY X

PLANS BY APPROVED CONTRACTOR

TICKLER

SPILLWAY
- TYPE
- CONDITION

DRAW-OFF GATES
- NUMBER
- CONDITION

TRENCHES & WHEELS

EMBANKMENT
- TYPE
- CONDITION
- APPROACHES
- EROSION
- BRUSHES & TREES
- RIPRAP

PRESENT USE

WHO CONTROLS

WHO CONTACTED AT SITE

INSTRUCTIONS LEFT

IN EMERGENCY CALL

INSPECTION REPORT BY JOHN V. KEILY REASON ROUTINE DATE 11/1/46

EMERGENCY:

1. A. W. ANDERSON, ENGR. REG. 90 AUSDALE RD. CRANSTON, R.I. TEL. AT 2623 ; OFFICE c/o FID. & CASUALTY CO. 511 IND. TRUST BLDG. TEL. (8-10 A.M.) DA 9220

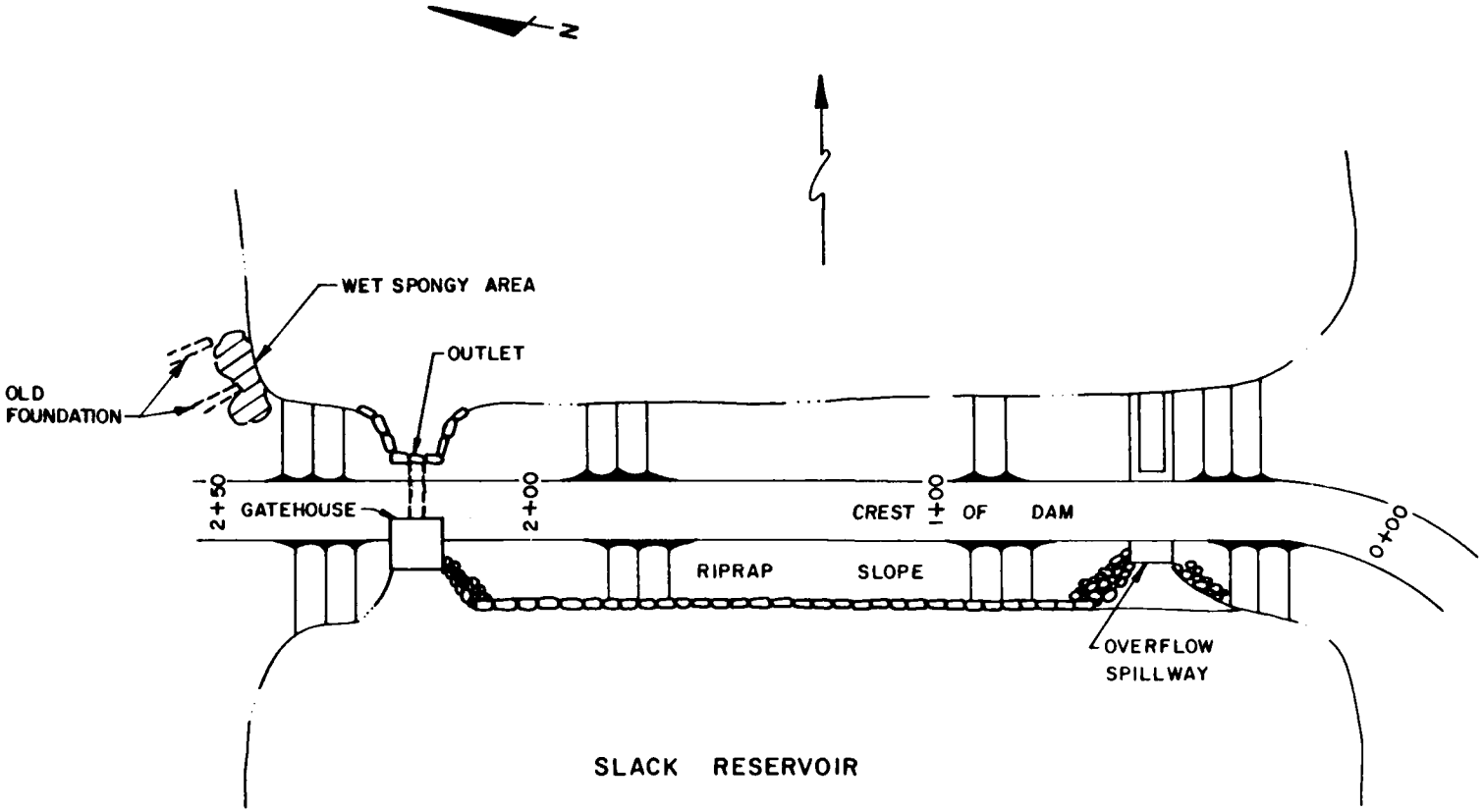
2. HENRY F. FULLER, GREENVILLE (SNAKE HILL RD, GLOCESTER) TEL. SCIT. 4316

11/1/46 Condition Good

SHORT EARTH DAM AT NORTH END OF RESERVOIR; CONDITION GOOD; UNDER CONSTANT SUPERVISION OF RESERVOIR CO. POND 2 FEET LOW TO-DAY; NO WATER OVER SPILLWAY. SOME WATER BEING RELEASED THROUGH GATEHOUSE. FEW LARGE TREES ON SLOPES; SMALL AMOUNT OF BRUSH SHOULD BE CUT. RIPRAP ON POND SIDE HAS BEEN GROUTED AND 2' ABOVE MEAN HIGH WATER. CONDITION GOOD. CONCRETE SPILLWAY GOOD.

APPENDIX B-3

PLANS, SECTIONS, DETAILS

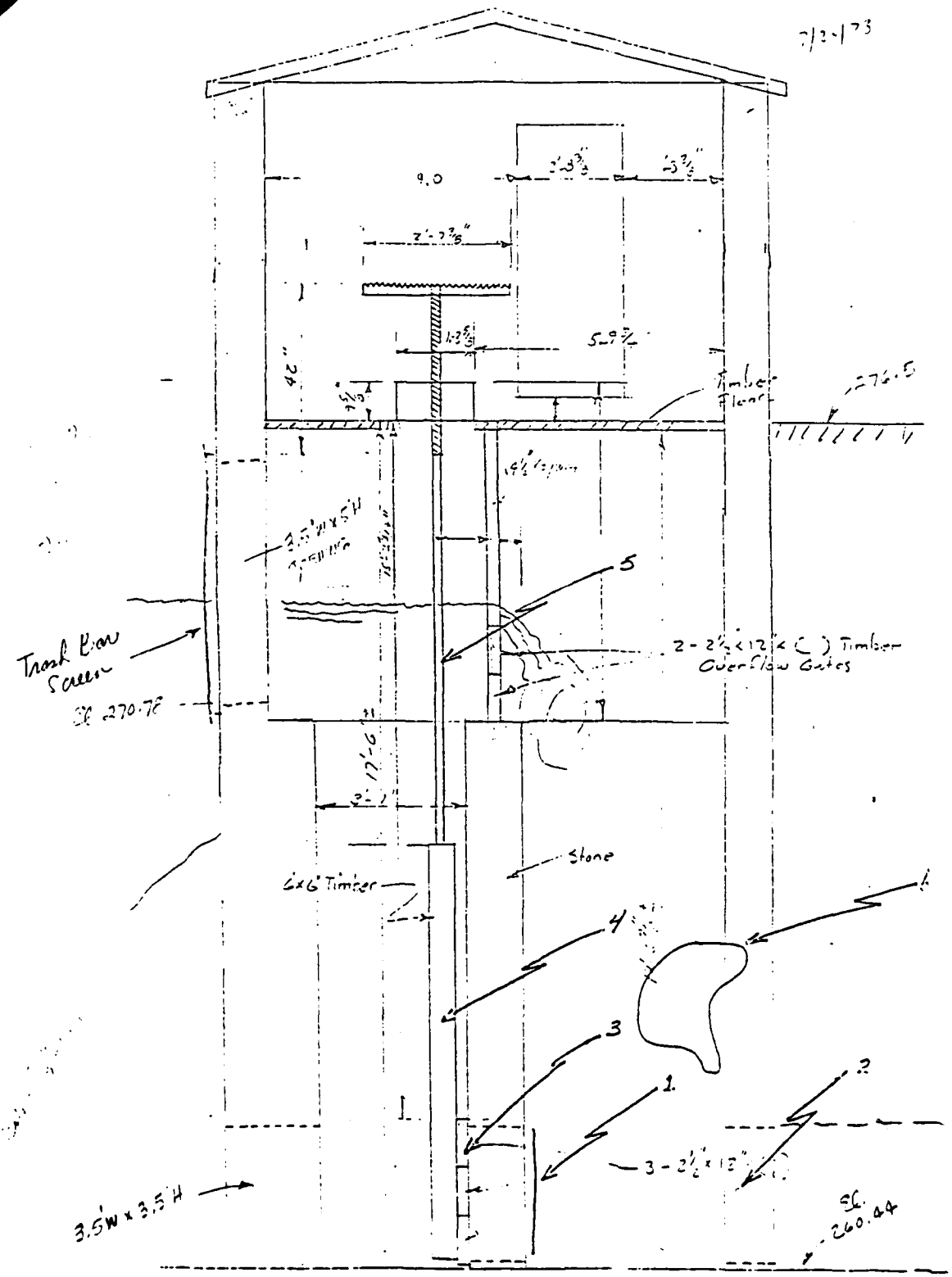


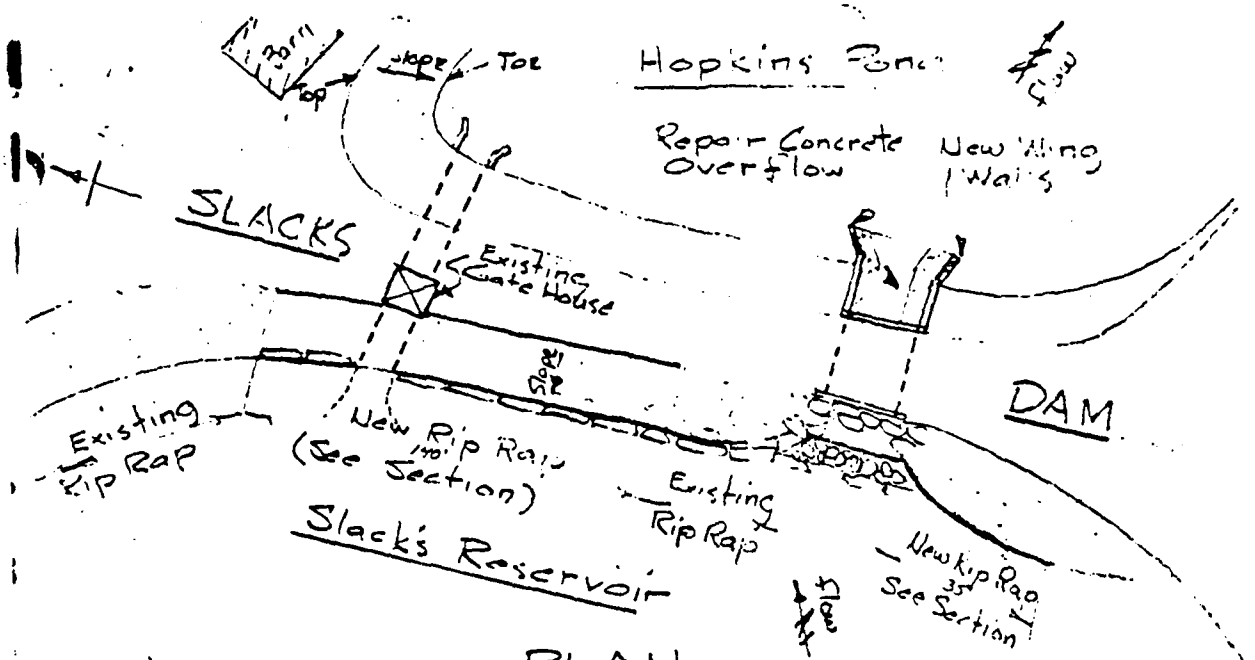
PLAN

NOT TO SCALE

SLACK RESERVOIR DAM

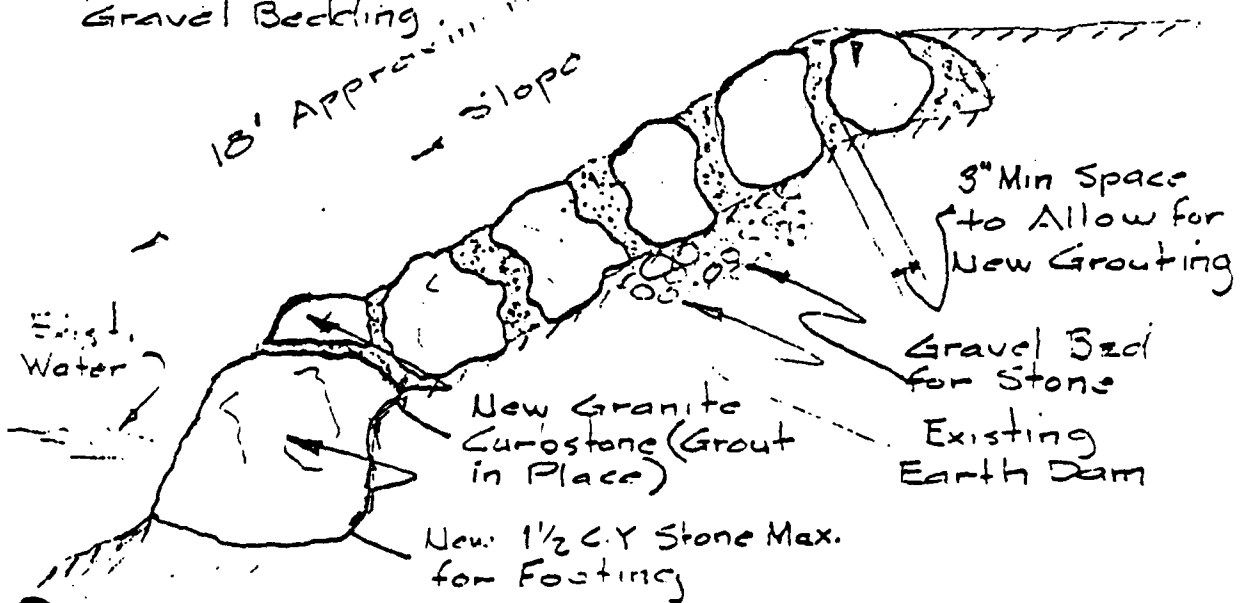
GENERAL PLAN


7/2-1/73
9.0
2'-3 3/8"
2'-3 3/8"
2'-2 3/8"
5'-9 1/2"
42"
Timber Floor
276.5
5
2 - 2 1/2" x 12" x ( ) Timber Overflow Gates
Trash Bar Screen
Sl. 270.78
17'-6"
Stone
6x6 Timber
4
1
3
2
3 - 2 1/2" x 12"
3.5'W x 3.5'H
Sl. 260.44



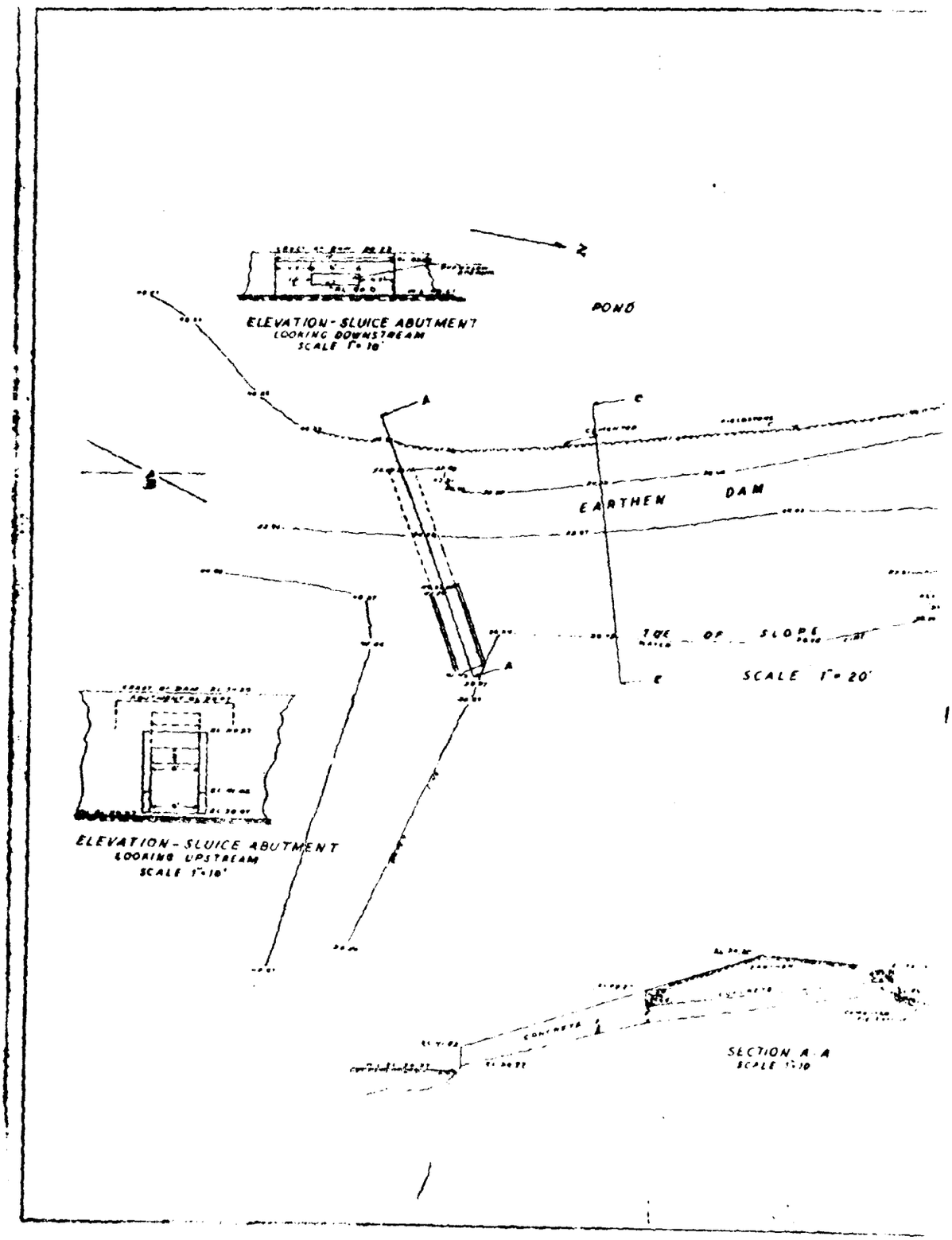
PLAN
Not to Scale

Note:
Before Placing Stone on Existing Slope, Ground must be Clear of Loam, Grass, Shrubs or Debris. Rip & Shaped with Clean Gravel Bedding.



TYPICAL SLOPE SECTION
Not to Scale

SLACK'S DAM SMITHFIELD, R.I.


N
POND
ELEVATION - SLUICE ABUTMENT
LOOKING DOWNSTREAM
SCALE 1" = 10'
A
C
EARTHEN DAM
TOE OF SLOPE
SCALE 1" = 20'
ELEVATION - SLUICE ABUTMENT
LOOKING UPSTREAM
SCALE 1" = 10'
SECTION A-A
SCALE 1" = 10'

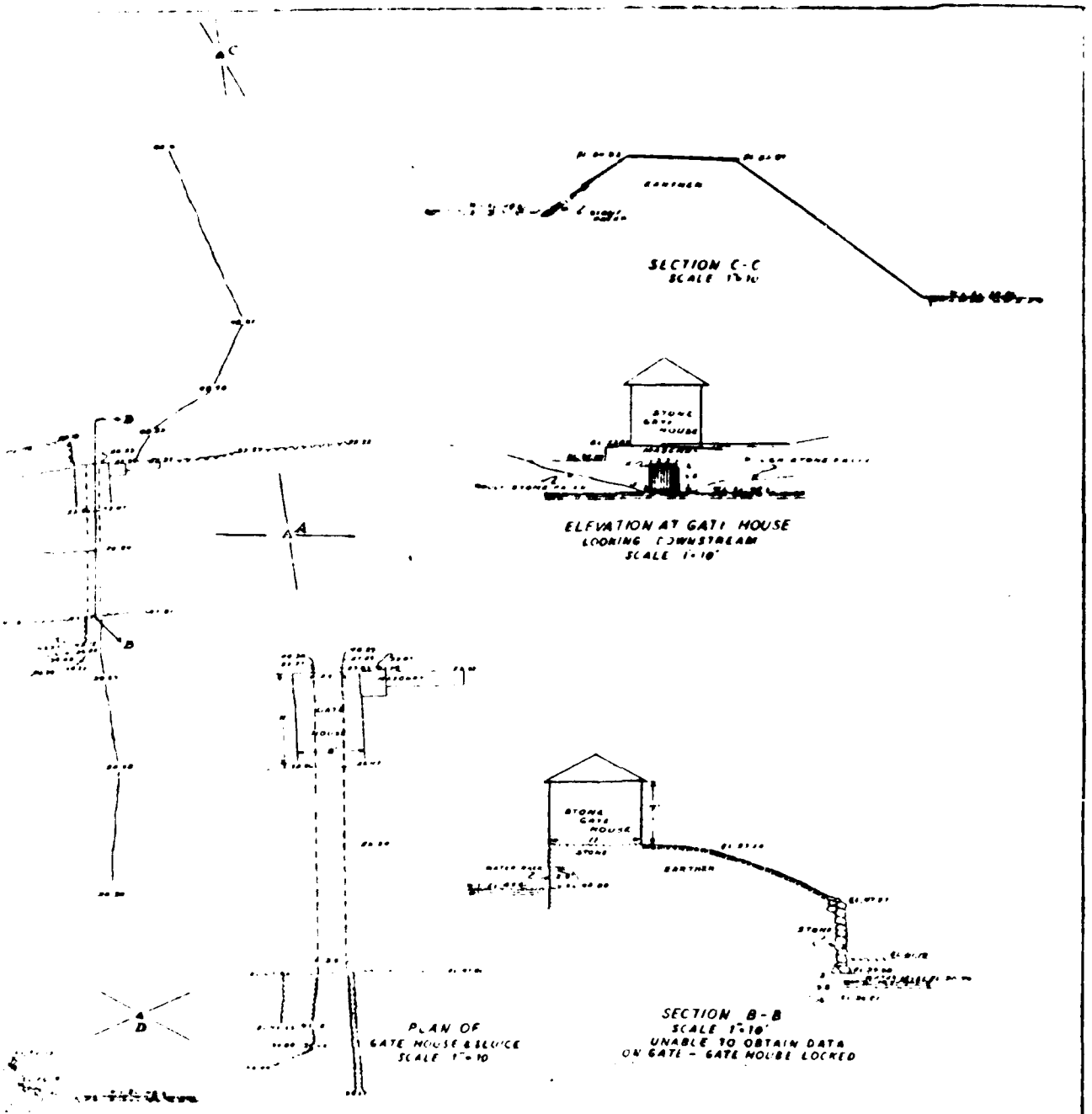


PHOTO REDUCED

NOT TO SCALE

2

SLACK'S

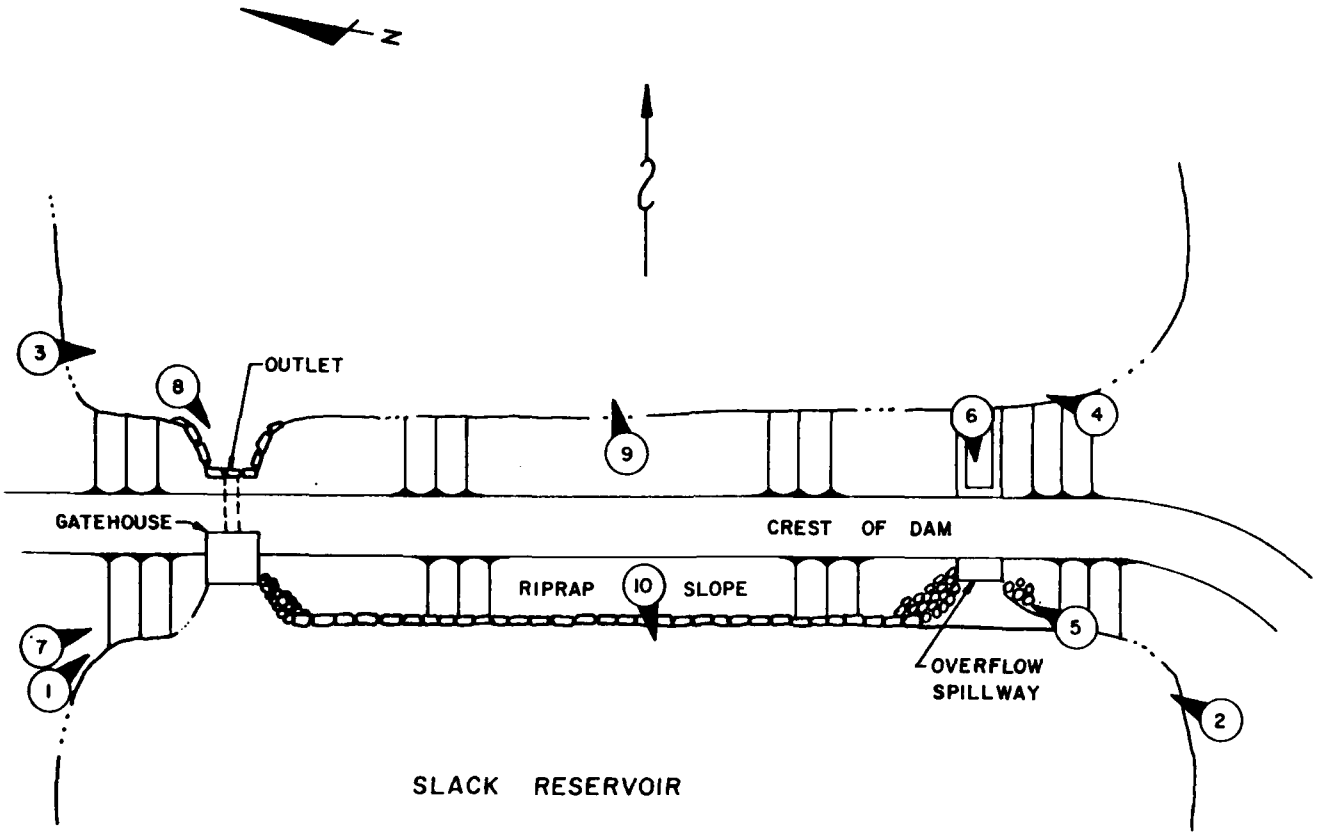
#115

#115

W-9

APPENDIX C

PHOTOGRAPHS



SLACK RESERVOIR

PLAN

NOT TO SCALE

SLACK RESERVOIR DAM

PHOTO INDEX

PHOTO C-1 Upstream slope of dam looking from left abutment.

PHOTO C-2 Upstream slope of dam looking from right abutment.

PHOTO C-3 Downstream slope of dam looking toward right abutment.

PHOTO C-4 Downstream slope of dam looking toward left abutment.

PHOTO C-5 Upstream Inlet to Spillway.

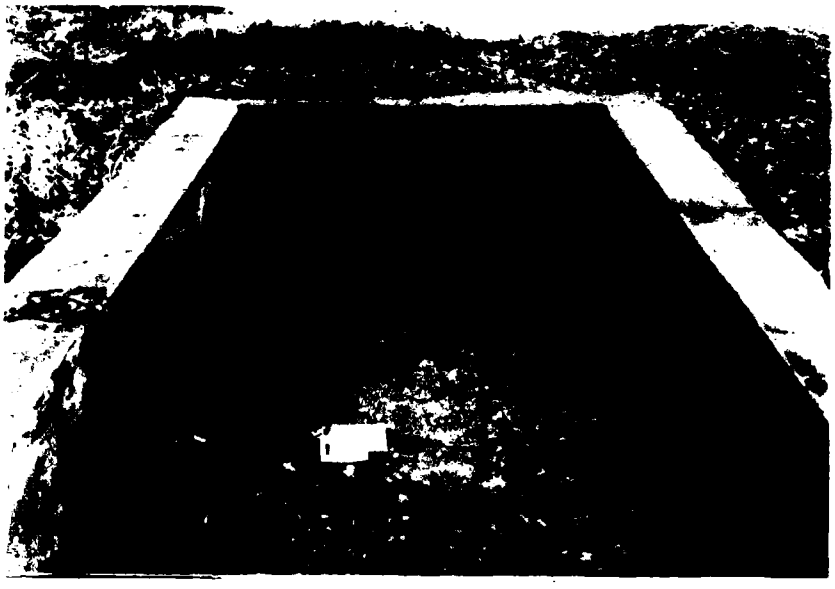


PHOTO C-6 Downstream outlet for uncontrolled overflow spillway.

PHOTO C-7 Outlet works gatehouse and upstream inlet.

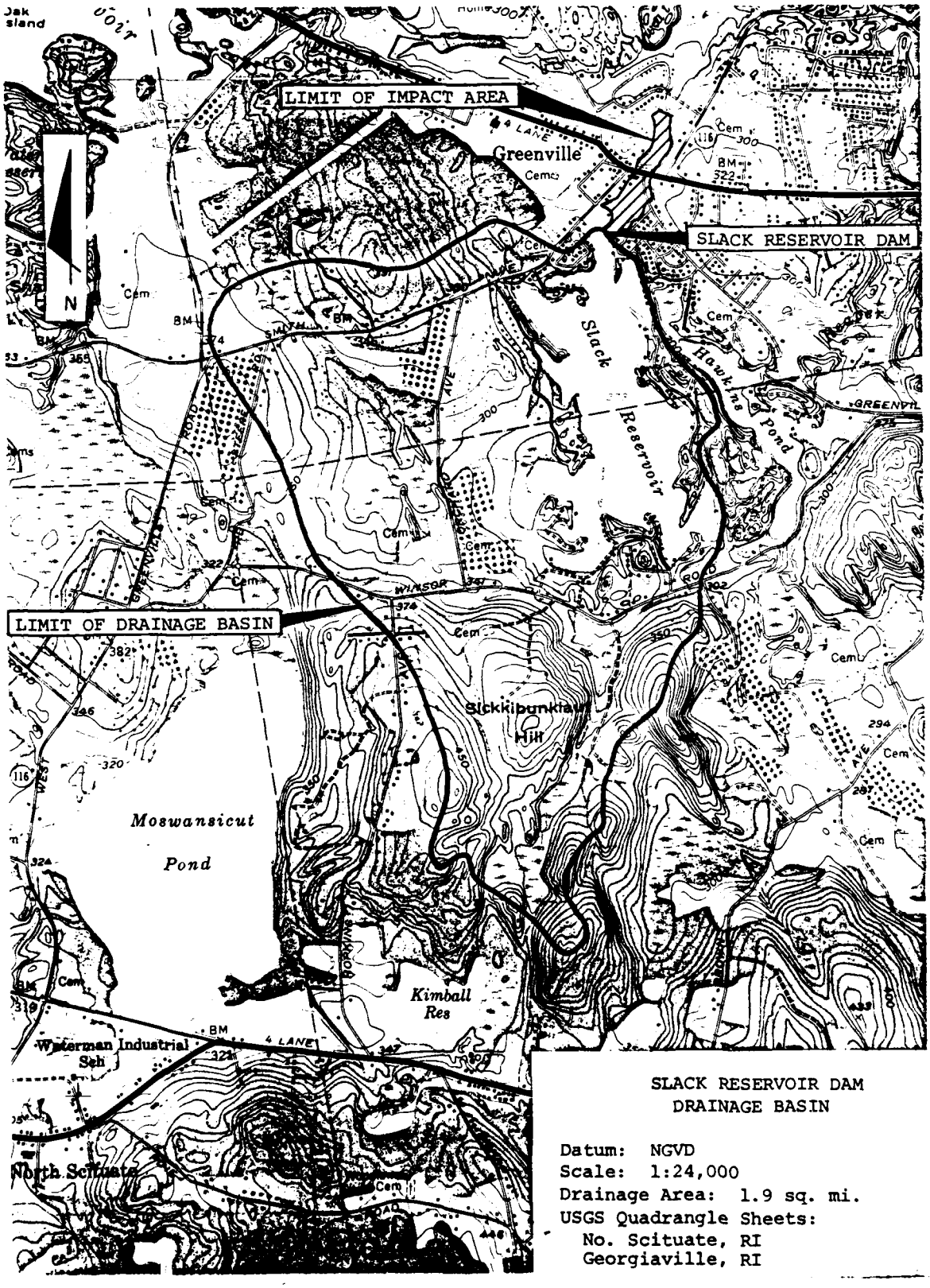
PHOTO C-8 Downstream outlet for gatehouse.

PHOTO C-9 Looking downstream from crest of dam.

PHOTO C-10 Slack Reservoir

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



SLACK RESERVOIR DAM
DRAINAGE BASIN

Datum: NGVD
Scale: 1:24,000
Drainage Area: 1.9 sq. mi.
USGS Quadrangle Sheets:
No. Scituate, RI
Georgiaville, RI

PLATE D-1

SLACK RESERVOIR DAM

A. Size Classification

Height of dam = 17.0 ft.; hence SMALL

Storage capacity at top of dam (elev.) = 1780 AC-FT.; hence INTERMEDIATE

Adopted size classification INTERMEDIATE

B. Hazard Potential

The dam is located in a predominantly suburban area and failure may result in the loss of a few lives and inundation of 1 to 2 dwellings and 1 to 4 commercial properties. Flooding and damage may also occur at Greenville Road and Putnam Pike (U.S. Route 44), as well as disruption of service of the utilities located within the rights of way of these roadways. The failure will cause flooding conditions downstream and high velocities of flow which carry trees, vegetation and other debris will also increase the damage potential due to scouring, undermining and ultimate deposition of debris in the bed of the channel.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	INTERMEDIATE	Half PMF to Full PMF

Adopted Test Flood = Full PMF = 1000 CSM

= 1950 CFS

D. Overtopping Potential

Drainage Area 1.90 = 1.90 sq. miles

Spillway crest elevation = 273.0 NGVD

Top of Dam Elevation = 276.5 NGVD

Maximum spillway discharge Capacity without overtopping of dam = 100 CFS

"test flood" inflow discharge = 1900 CFS

"test flood" outflow discharge = 1275 CFS

% of "test flood" overflow carried by spillway without overtopping = 7.8 %

"test flood" outflow discharge portion which overflows over the dam = 1175

% of test flood which overflows over the dam = 92.2 %

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: November 6, 1979
SLACK RESERVOIR

Name of Dam SLACK RESERVOIR DAM ; Location of Dam BROOK ; Town SMITHFIELD

Watershed Characterization Rolling terrain; swampy; moderate slopes ; 0.19 sq. miles of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Full PMF = 1000 CSM = 1900 CFS; Re = Effective Rainfall = 19.5 inches

D.A. = Drainage Area (Gross) = 1.90 Square Miles; Basin Slope = 0.04 hence; moderate

S.A. = Surface Area of Reservoir = 0.234 Square Miles; Time of Concentration 30 minutes

Shape and Type of Spillway = Rectangular 6' x 1.6' culvert type located 1.6' below top of dam

B = Width of Spillway = 6.0 feet; C = Coefficient of Discharge = 0.95

Maximum Capacity of Spillway Without Overtopping = 100 CFS = 7.8 % of test flood

Top of Dam Elevation = 276.5 ; Spillway Crest Elevation = 273.0

Overflow portion of Length of Dam = 250 ; C = Coefficient of discharge for Dam = 3.00

Name of Dam	Test Flood Q_p CSM	Test Flood Q_p CFS	Inflow Characteristics h_0 in feet	Inflow Characteristics S_0 in in.	Outflow Characteristics First Approximation Q_{p1} CFS	h_1 in ft.	S_1 in in.	Outflow Characteristics Second Approximation S_2 in in.	h_2 in ft.	Q_{p2} CFS	Outflow Characteristics Third Approximation (Adopted) S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
SLACK RESERVOIR DAM	PMF=1000	1900	5.0	7.18	-	-	-	-	-	-	7.02	4.82	1275
	½PMF=500	950	4.3	6.40	-	-	-	-	-	-	5.80	3.90	550

Q_p = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

NAME OF DAM: SLACK RESERVOIR DAM

ESTIMATING EFFECT OF SURCHARGE STORAGE ON "TEST FLOOD"

A. This routing of floods through the reservoir was carried out according to the guidelines established by the Corps of Engineers in Phase 1 Inspection for Dam Safety Investigations issued in March, 1978.

B. Formulas used are as follows:

i. For no overtopping:
For overtopping: $Q = CBH^{3/2} + C_d A \sqrt{2g} \sqrt{h - h_f}$
For open channel flow: $Q = C_1 B_1 H_1^{3/2}$
For orifice flow: $Q = C_d A \sqrt{2g} \sqrt{h - h_f}$

where: $C_1 = 3.09$; $B = 6.0$ ft.; $h = 1.6$ ft.
$C_d = 0.95$; $A = 9.6$ ft.^{2}; h = head in feet over ℄ of spillway culvert
$h_f = 0$

ii. Surcharge storage in inches = $S = 12\ (h_1 + h_2) \frac{S.A.}{D.A.} = 1.478h$
where S.A. = surface area =
D.A. = drainage area =

iii. $Q_{outflow} = Q_{inflow}\ (1 - \frac{S}{Re})$; where Re = effective rainfall = 19.0"

iv. Length of dam = 250 ft. ; Top of Dam elev. = 276.50 ; c for dam = 3.0
Length of spillway = 6.0 ft. ; Spillway crest el. = 273.0 ; c for spillway = 0.95 for culvert and 3.10 when acting as open channel

$Q = 3 \times 250\, h_2^{1.5} + 72(h_2 + 1.6)^{0.5}$ for $h_2 \geq 0$

S = Storage in inches = $12h \times \frac{SA}{DA} = 1.478h$

v. Q_{inflow} = 1900 CFS

Q in CFS	Elevation	Total Head over crest $h_1 + h_2 = h$	Storage in inches = S	Remarks
1752	274	1.0	1.478	
1604	275	2.0	2.956	
1457	276	3.0	4.434	
1309	277	4.0	5.912	
1161	278	5.0	7.390	
1013	279	6.0	8.868	
1275	277.82	4.82	7.02	

"Rule of Thumb Guidance for Estimating
Downstream Dam Failure Discharge"

BASIC DATA

Name of dam SLACK RESERVOIR DAM Name of town SMITHFIELD

Drainage area = 1.90 sq. mi., Top of dam 276.5 NGVD

Spillway type = RECTANGULAR CULVERT Crest of spillway 273.0 NGVD

Surface area at crest elevation = 150 acres = 0.234 sq. mi.

Reservoir bottom near dam = 260.0 NGVD

Assumed side slopes of embankments 2:1

Depth of reservoir at dam site = y_o = 16.0 ft.

Mid-height elevation of dam = 268.0 NGVD

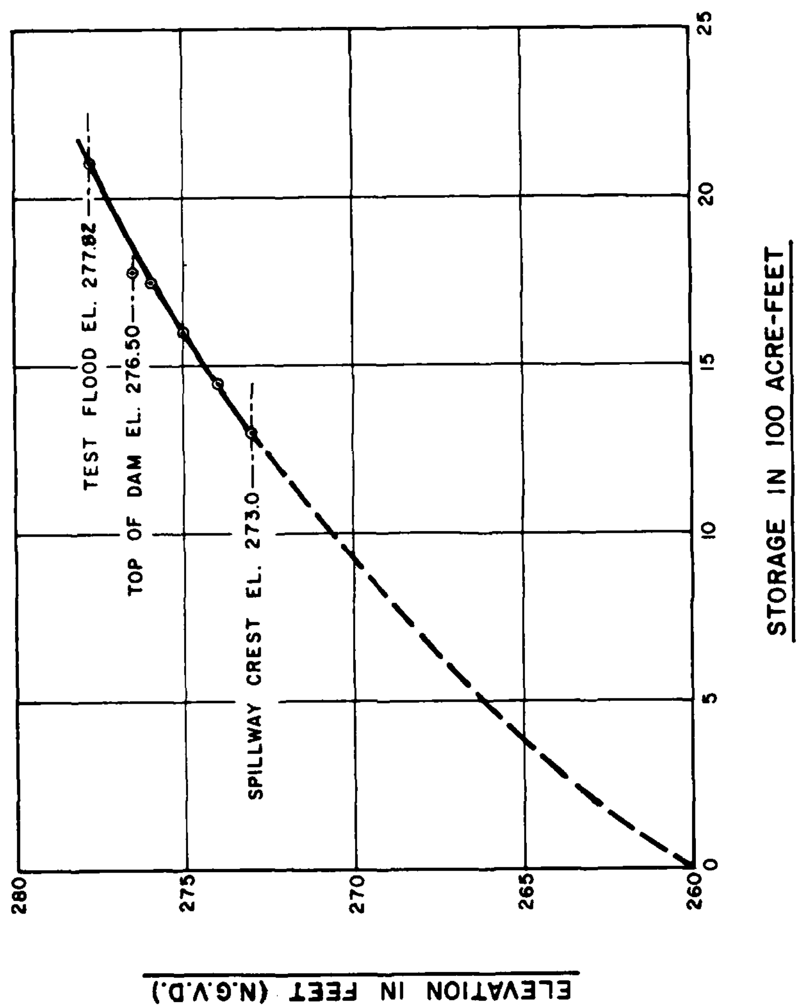
Length of dam at crest = 250.0

Length of dam at mid-height = 218.0

___ of dam length at mid-height = W_b = 55.0

Width of channel immediately downstream = B = 55.0 ft.; Shape of Breach= rectangular

Elevation (NGVD)	Estimated Storage in AC-FT	
273.0	1300	Spillway Crest Elevation
274.0	1450	
275.0	1600	
276.0	1750	
276.5	1780	Top of Dam Elevation
277.82	2013	Test Flood Elevation



STORAGE-ELEVATION CURVE

SLACK RESERVOIR DAM

SLACK RESERVOIR DAM

i. DAM FAILURE ANALYSIS

A. Failure Analysis
Discharge = $\frac{8}{27} W_B \sqrt{g}\, y_o^{1.5}$ C.F.S.

$= 1.68\, W_B\, y_o^{1.5}$

$= 5914$ CFS

B. Maximum Spillway

Discharge with W.S.E.

At top of Dam @ 276.5 100 C.F.S.

C. Total Dam Failure Discharge = 5914 + 100 = 6014 C.F.S.

D. Reservoir - Storage Data:

Volume of storage at spillway crest = 1300 AC-ft. @ Elev. 273.0

Surcharge storage at top of dam = 1780 AC-ft. @ Elev. 276.5

Storage Total = 480 AC-ft. @ Elev. 276.5

E. Flood Discharge Channel

i. Maximum depth of flow just D/S of Dam = $\frac{4}{9} y_o$ = 7.0 feet

Notes:

1. Failure of dam is assumed to be instantaneous. When pool reaches top of dam, and is a full-depth partial width rectangular shape failure with a width of failure = W = 55 feet and depth of failure y_o = ____ 16.0 feet.
2. Steady, uniform flow phenomenon is assumed for determination of failure profile and is based on Manning's formulae.
3. Failure profile for impacted area determination is determined at three typical cross sections in the downstream channel. Reduction in discharge due to available storage has been taken into account.

ii. Reach 1

Length = 2500 feet; Station 0 to Station 25+00. n = 0.05

Bed slope = $S_o \simeq S_f$ = 0.004; Bed width = b = 315 ft.

Bed width is scaled from U.S.G.S. map; scale 1" = 2,000 feet

As bed width is large and 1" = 2,000 feet and 10-foot contour interval scale maps are being used for various channel parameters, it is appropriate to assume that d = R = Hyd Radius = depth, hense Manning's formulae is transformed in this case with downstream channel parameters adopted as below:

$$Q = A \frac{1.49}{n} R^{2/3} \sqrt{S} = bd \frac{1.49}{n} d^{2/3} \sqrt{S}$$

$$Q = b \frac{1.49}{n} \sqrt{S}\, d^{5/3} = Kd^{5/3} = 188\, d^{5/3}$$

State Discharge Relationship for Reach 1

Depth = d in Feet	Stage of Elevation	Discharge in CFS = Q	Velocity in ft./sec.	Storage Volume in AC-ft. = V
0	255	0	0	0
2	257	596	0.95	36
4	259	1893	1.50	72
6	261	3720	1.96	108
8	263	6007	2.38	144
10	265	8713	2.76	180
12	267	11805	3.12	216

F. Water surface profiles resulting from maximum spillway discharge and also from dam failure discharge are shown on Page D-9B for comparison purposes. This figure also shows the rise in water depth due to failure of dam.

Also, Discharge -- Depth and Storage-depth curves are shown on Page D-9C for downstream channel.

Notes: 1. Storage volume in AC-ft = $\frac{\text{(Length of Reach) (Bed Width) (Depth)}}{43{,}560}$

2. Failure discharge being large will mostly be overbank flow on existing channel.

G. For Q_1 = 5014 CFS; depth = 8.0 ft. V_1 = 144 AC-ft.

Trial $Q_2 = Q_1 \left(1 - \frac{V_1}{\text{Storage}}\right) = 6014\left(1 - \frac{144}{480}\right) = 4210$ CFS

$\therefore V_2$ = 116 AC-ft.

Avg $V = \frac{V_1 + V_2}{2}$ = 130 AC-ft.

$\therefore Q = Q \left(1 - \frac{V \text{ Avg.}}{\text{Storage}}\right)$ = 4385 CFS; y_2 = 6.5 ft.

Depth at center of flood as adopted = 8.0 ft.

H. Balance reservoir storage = 480 - 130 = 350 AC-ft.

Additional dam failure analysis beyond Reach 1 is not undertaken because the depth of flow of 6.5 feet at the end of Reach 1 will not cause any hazardous conditions further downstream except downstream flooding conditions. Moreover, failure discharge and depth will continually go on decreasing beyond Reach 1. However almost total impacted area due to failure of dam is shown on Plate D-1. No signifcant damages in life and/or property are anticipated beyond Reach 1 because no houses, roads or establishments are located below the anticipated depths beyond Reach 1 of 6.5 feet.

SUMMARIZED AND ADOPTED VALUES

FOR

DAM FAILURE ANALYSIS

i. Name of Dam SLACK RESERVOIR DAM

ii. Dam Failure Discharge _____ = 5914 cfs.

iii. Maximum Spillway Discharge _____ = 100 cfs.

iv. Total Dam Failure Discharge _____ = 6014 cfs.

v. Normal (Manning Depth) for _____ = 8.0 feet

vi. Normal (Manning Depth) for _____ = 1.5 feet

vii. Increase in depth due to failure of dam = 6.5 feet

viii. W.S.E. prior to failure = Ground Elevation + 1.5

ix. W.S.E. after failure = Ground Elevation + 8.0

Note: The adopted depth of flow values are assumed to be accurate representations of damages in the impacted areas. Professional judgement is used in these final adopted values.

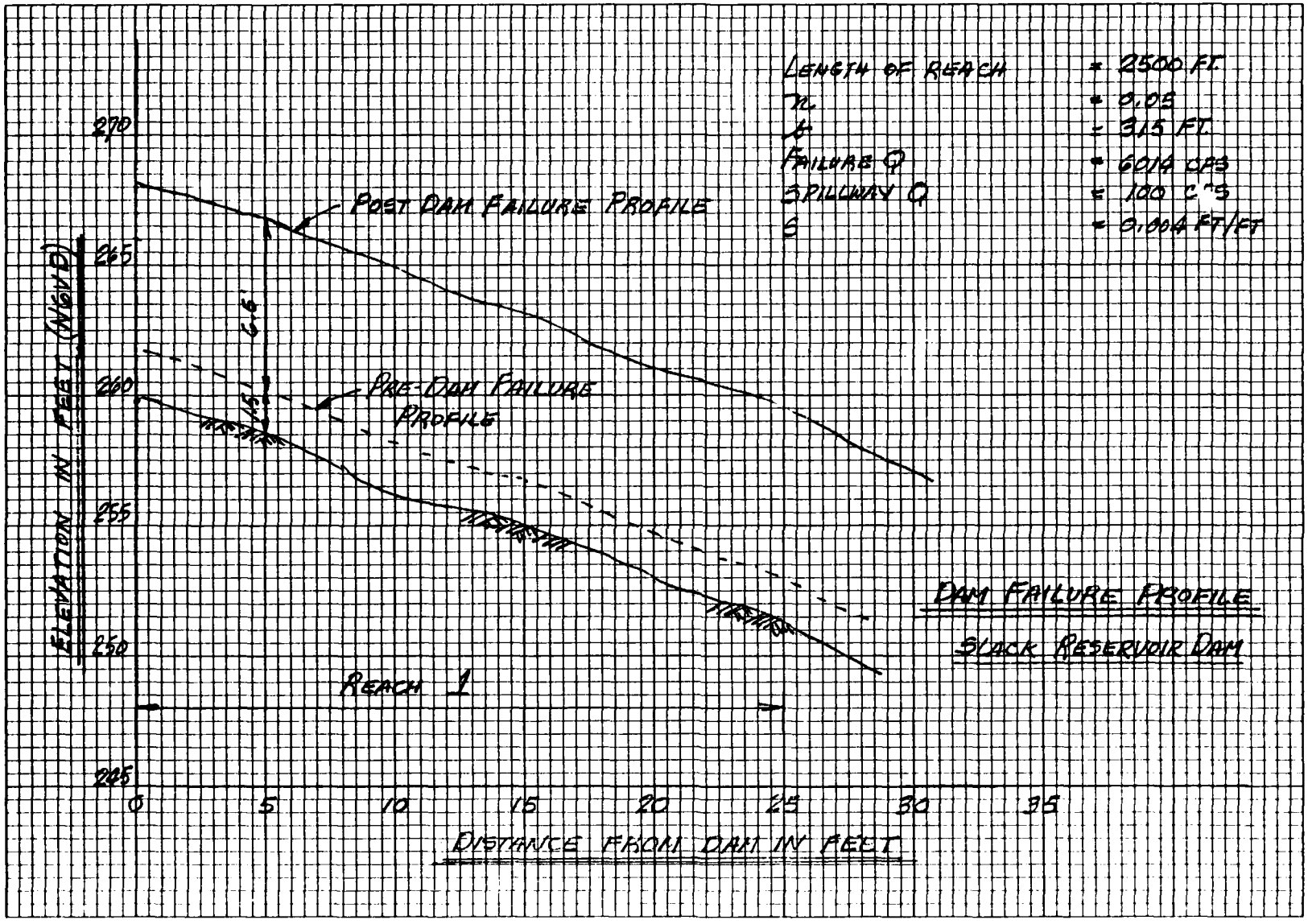


PLATE O-9B

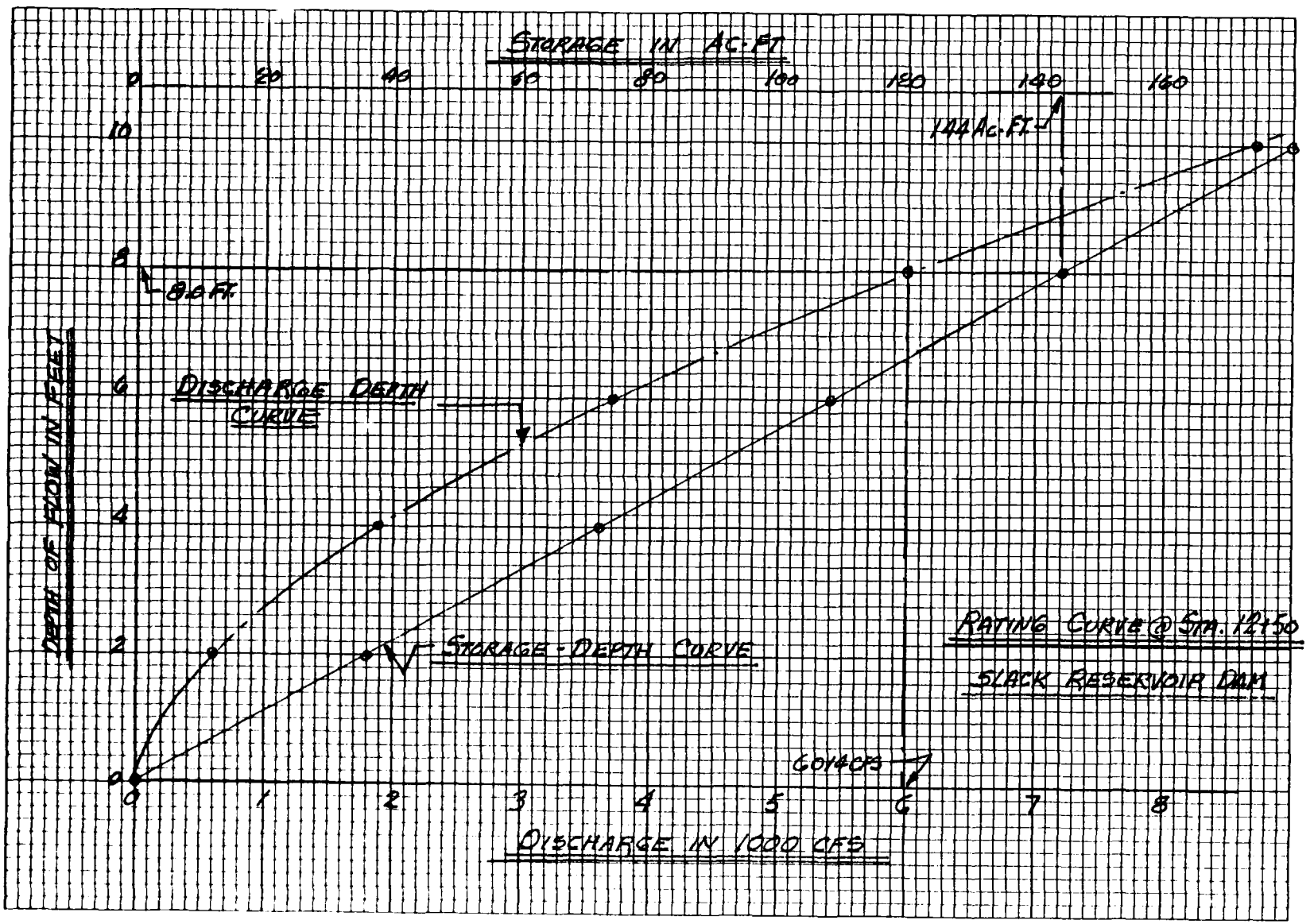

STORAGE IN AC. FT.
0
20
40
60
80
100
120
140
160
144 Ac. Ft.
10
8
8.0 Ft.
6
4
2
0
DISCHARGE DEPTH CURVE
DEPTH IN FEET
STORAGE - DEPTH CURVE
RATING CURVE @ STA. 12+50
SLACK RESERVOIR DAM
CONTROL
0
1
2
3
4
5
6
7
8
DISCHARGE IN 1000 CFS

PLATE 9C

SLACK RESERVOIR DAM

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Spillway width = 6W x 1.6H feet; Spillway crest elevation = 273.0 NGVD

Length of dam = 250 feet; Top of dam elevation = 276.5 NGVD

C = 3.10 for open channel flow; C = 0.95 for spillway (culvert); C = 3.0 for dam

i) SPILLWAY RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
273.0	0	Spillway Crest Elevation
274.0	36	
275.0	59	
276.0	92	
276.5	100	Top of Dam Elevation
277.0	369	
277.5	886	
277.82	1170	
278	1505	
279	3111	

ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
260.44	0	Invert of Outlet
265.0	95	
273.0	194	Spillway Crest Elevation
275.0	212	
276.5	224	Top of Dam Elevation
277.82	234	Test Flood Elevation
280.0	251	

Size of outlet = 3.5'W x 3.5'H; Area of outlet = 12.25 sq. ft.

Invert of outlet = 260.44; Center line of outlet = 262.19

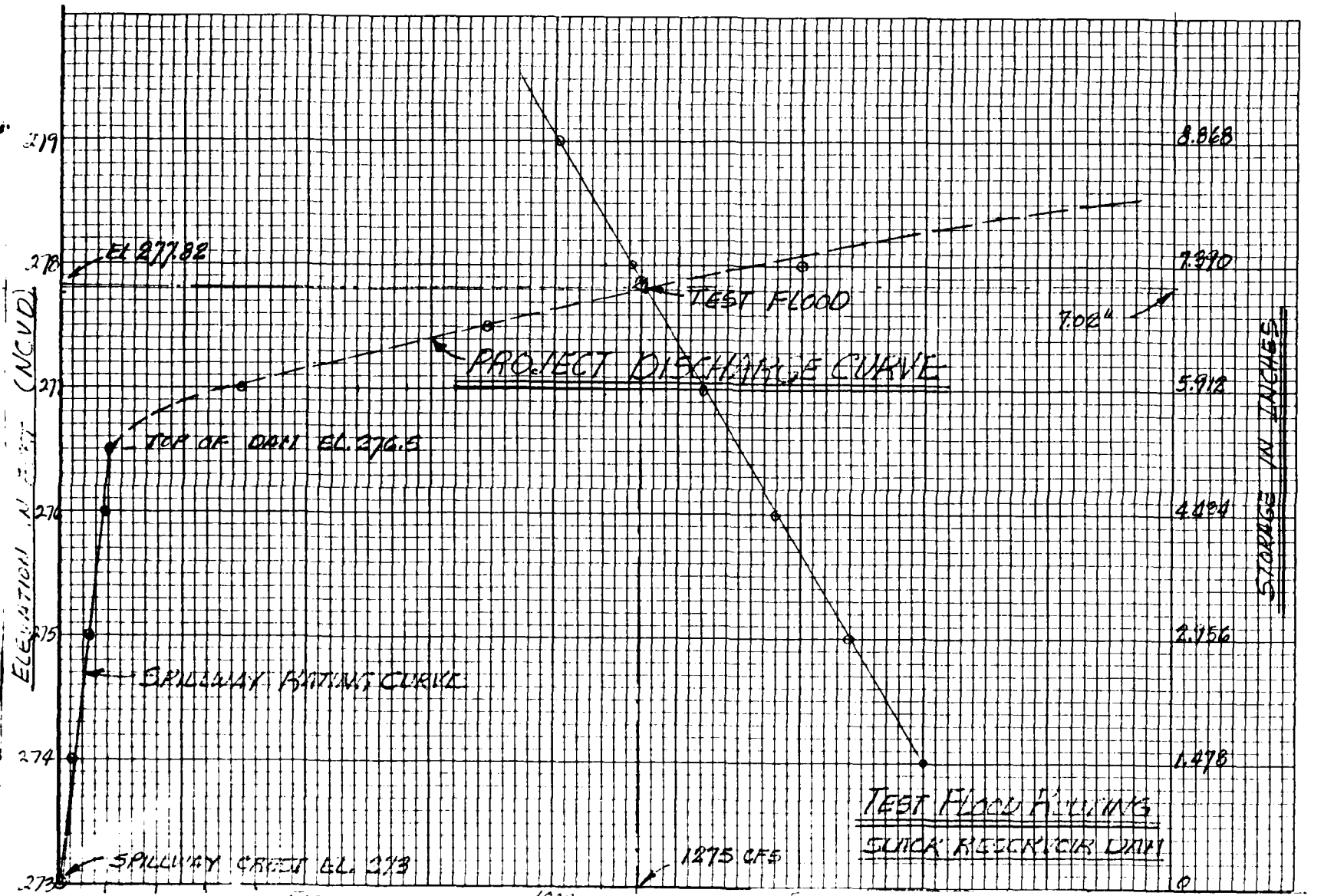


PLATE D-11

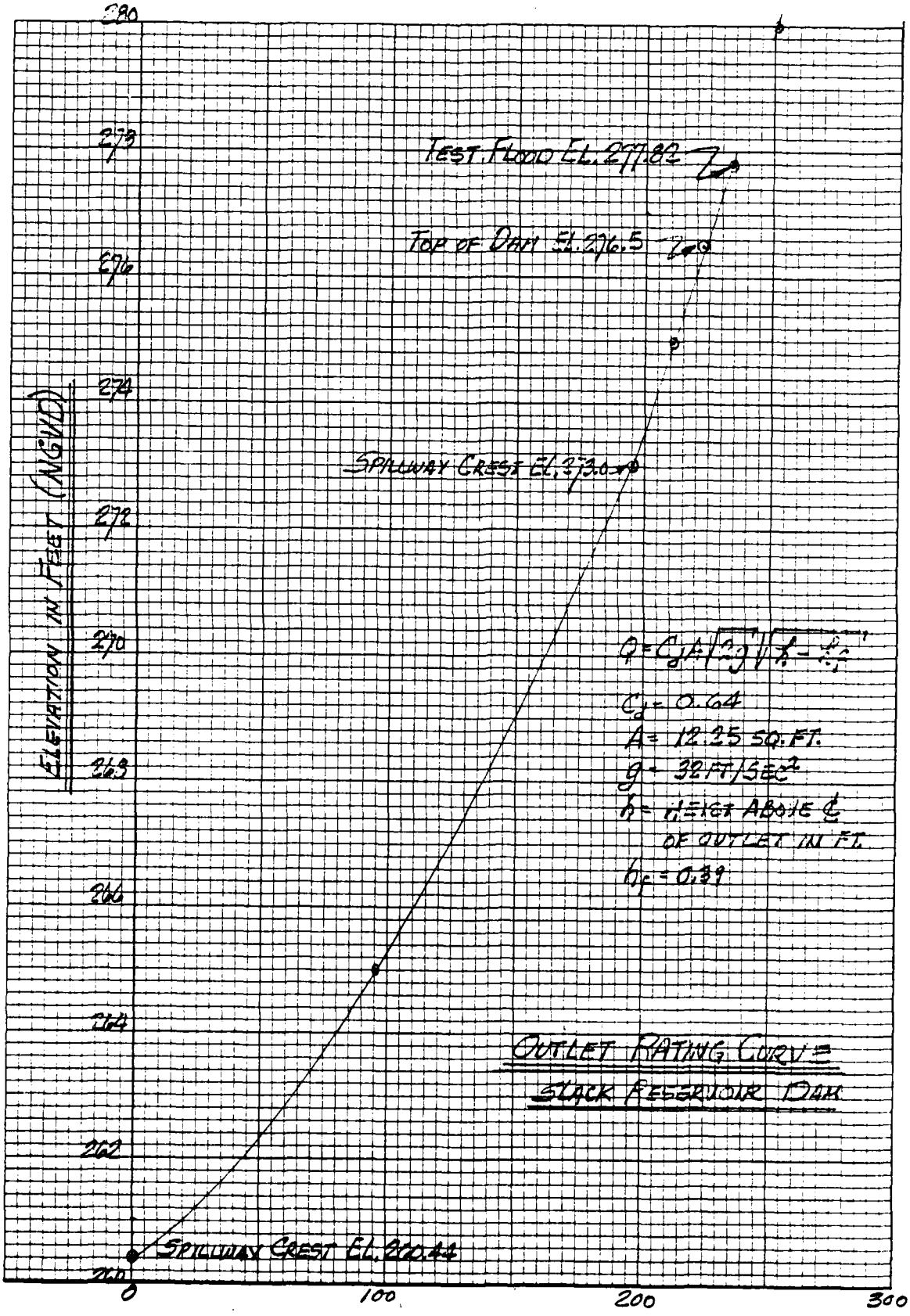

280
278
276
274
272
270
268
266
264
262
260
ELEVATION IN FEET (NGVD)
0
100
200
300
DISCHARGE IN (CFS)
TEST FLOOD EL. 277.82
TOP OF DAM EL. 276.5
SPILLWAY CREST EL. 270.0
SPILLWAY CREST EL. 260.44
$Q = C_d A \sqrt{2g} \sqrt{h - \frac{h_f}{2}}$
$C_d = 0.64$
$A = 12.25$ SQ. FT.
$g = 32$ FT/SEC^2
h = HEIGHT ABOVE ℄ OF OUTLET IN FT.
$h_f = 0.39$
OUTLET RATING CURVE = STACK RESERVOIR DAM

PLATE D-12

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
RI	3124	NED	RI	007	01				SLACK RESERVOIR DAM	4152.1	7133.3	11	APR	80

POPULAR NAME	NAME OF IMPOUNDMENT
	SLACK RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	09	UNNAMED STREAM	GREENVILLE	0	5000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
[illegible]T	1885	R	17	14	1760	1300	NED	N	N	N	N	

REMARKS
21-0/S MASONRY FACE

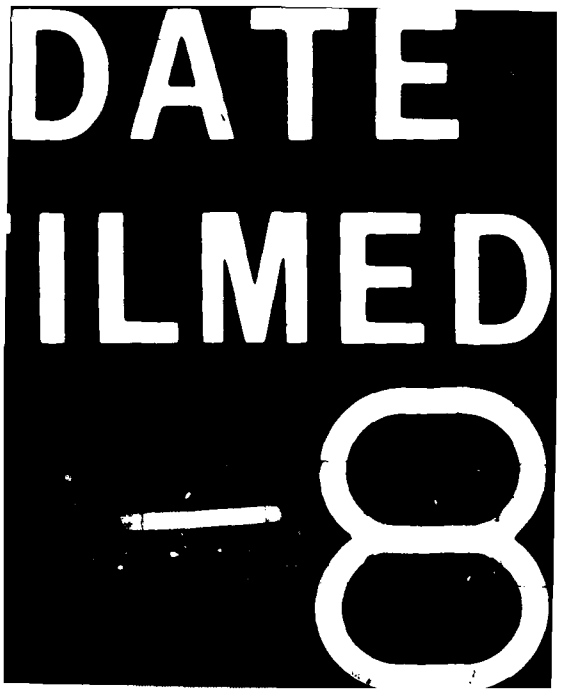
DIS HAS	SPILLWAY LENGTH	SPILLWAY TYPE	WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
Y	250	U	6	100												

OWNER	ENGINEERING BY	CONSTRUCTION BY
ASSONAS QUATICKET RES.CO.	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
C E MAGUIRE INC.	06	NOV	79	PUBLIC LAW 92-367

REMARKS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