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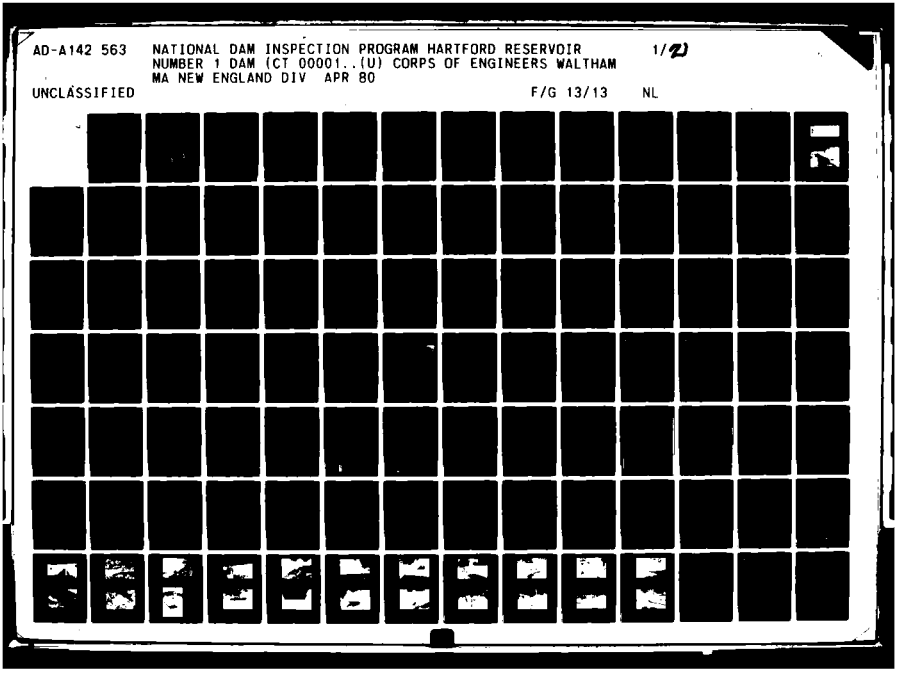
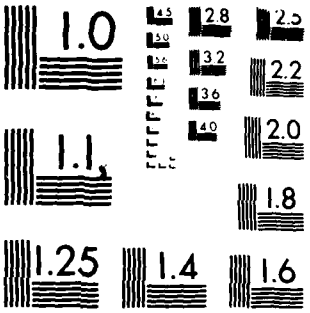
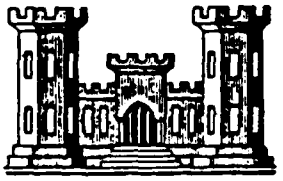




PARK RIVER BASIN
WEST HARTFORD, CONNECTICUT

HARTFORD RESERVOIR NO. 1 DAM
CT 00001

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

APRIL 1980

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

DAMS, INSPECTION, DAM SAFETY,

PARK RIVER BASIN
HARTFORD CONN.

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

HARTFORD RESERVOIR NO. 1 DAM IS A 113-YEAR OLD EARTH EMBANKMENT, APPROXIMATELY 500 FEET LONG WITH A MAXIMUM HEIGHT OF 42 FEET , WHICH CURRENTLY IMPOIUNDS WATER FOR USE AT A DOWNSTREAM POWER GENERATION FACILITY. IT IS ESTIMATED THAT ENOUGH SURPLUS WATER FROM THE IMPOUNDMENT IS AVAILABLE TO OPERATE THE POWER FACILITIES BETWEEN 40 TO 60% OF THE YEAR. POWER PRODUCED ATH THE FACILITY IS USED AT A NEARBY WATER FILTRATION PLANT.NO. 1 DAM APPEARED TO BE IN FAIR CONDITUOON. HOWEVER, SEVERAL DEFICIENCIES WERE OBSERVED DURING THE INSPECTION. APERMANENTLY SATURATED CONDITION EXISIS AT THE DOWNSTREAM TOE WHICH HAS BEEN PARTIALLY CORRECTED DWTIUHJKLJKLJLKJK
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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

MAY 30 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Hartford Reservoir No. 1 Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Metropolitan District, Hartford, Connecticut 06101.

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 Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

HARTFORD RESERVOIR NO. 1 DAM

CT 00001

PARK RIVER BASIN
HARTFORD, CONNECTICUT

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.:	CT00001
Name of Dam:	Hartford Reservoir No. 1
Town:	West Hartford
County and State:	Hartford County, Connecticut
Stream:	Spice Brook
Date of Inspection:	November 13, 1979

BRIEF ASSESSMENT

Hartford Reservoir No. 1 Dam is a 113-year old earth embankment, approximately 500 feet long with a maximum height of 42 feet, which currently impounds water for use at a downstream power generation facility.

It is estimated that enough surplus water from the impoundment is available to operate the power facilities between 40 and 60 percent of the year. Power produced at the facility is used at a nearby water filtration plant.

From 1867 to 1922 the reservoir functioned as part of the Hartford water supply system. In case of emergency, the reservoir could still be used to supplement the water supply system.

The watershed area for Hartford Reservoir No. 1 Dam encompasses approximately 3.9 square miles of mostly forested, mountainous land. With the water level at the primary spillway crest, Reservoir No. 1 covers approximately 27 acres and provides a storage capacity of 284 acre-feet. The maximum storage capacity of the reservoir is 619 acre-feet. Hartford Reservoirs 2, 3 and 5 are also located within the watershed and, in conjunction with Reservoir No. 1, account for 6 percent of the surface area.

Due to the 42-foot height of the dam, Hartford Reservoir No. 1 is classified in the "Intermediate" size category. The initial potential damage area in the event of a dam breach is the power generation facility located 100 feet downstream of the dam. The first residential hazard area is located about 2,000 feet downstream of the dam. A failure of the dam would result in excessive property damage at both of these locations and the possible loss of more than a few lives in the residential hazard area. Therefore, the dam is classified in the "High" hazard potential category.
The recommended test flood for an "Intermediate" size, "High" hazard dam is the full Probable Maximum Flood (PMF).

The test flood peak inflow to Hartford Reservoir No. 1 was computed to be 5,590 cfs. The routed test flood outflow of 5,440 cfs would be contained below the top of the dam by 0.5 feet. The spillway system is capable of discharging 100 percent of the routed test flood outflow.

On the date of the inspection, Hartford Reservoir No. 1 Dam appeared to be in fair condition. However, several deficiencies were observed during the inspection. A permanently saturated condition exists at the downstream toe which has been partially corrected with the installation of a portion of the toe drain system. A depression of the downstream face of the embankment extends from the crest to the toe of the dam in the vicinity of the outlet works. An undulated area at the downstream toe of the slope was also observed. Animal burrow holes were observed in the downstream face, and trees are growing in the vicinity of the downstream toe and in the abutment regions. Some riprap has been displaced from the upstream face of the dam.

Within one year after receipt of this Phase I Inspection Report, the Owner should retain the services of a qualified registered professional Engineer to direct the removal of the trees in the vicinity of the abutments and at the toe of the downstream face of the dam. Voids left in the embankment by the removal of the trees should be filled with suitable, thoroughly compacted material.

The Owner should implement the following operation and maintenance measures: (1) Complete all work on the toe drain system; (2) the disturbed area at the downstream toe of the dam and the depression in the downstream face should be regraded and reseeded and monitored for future movement; (3) The stone riprap on the upstream face of the dam should be replaced where necessary; (4) Animal burrows on the downstream face of the dam should be backfilled; (5) A formal flood warning plan should be developed; and (6) a program of annual periodic technical inspection should be instituted.

O'BRIEN & GERE ENGINEERS, INC.

John J. Williams, P.E.
Vice President
New York Registration No. 050794

Date: 28 April 1980

This Phase I Inspection Report on Hartford Reservoir No. 1 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.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of theses 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 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 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.

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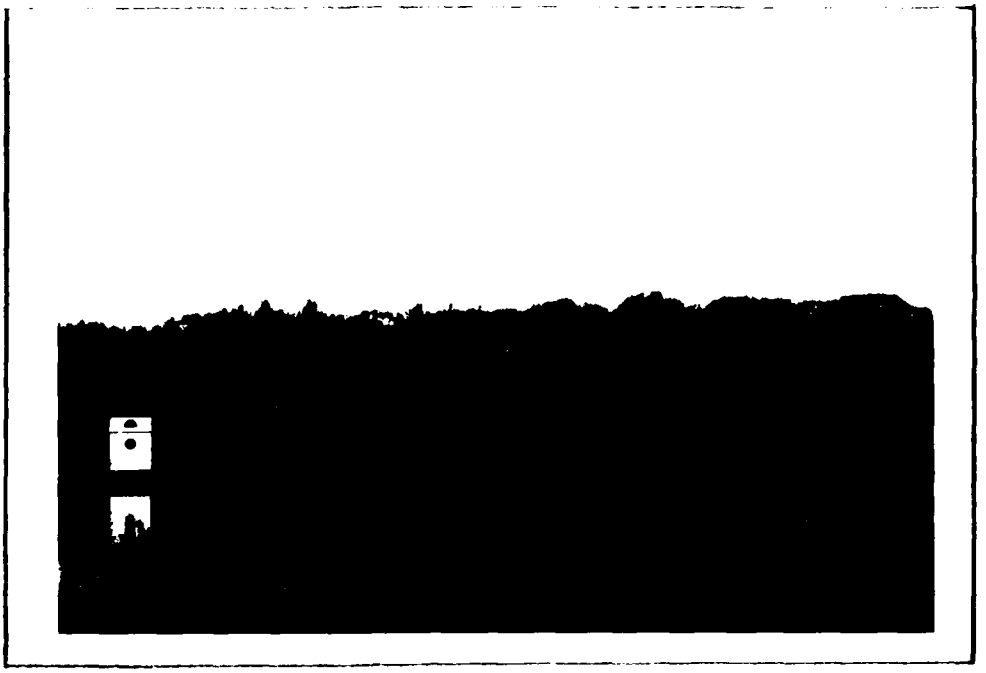
APPENDICES



UPSTREAM OVERVIEW AS OBSERVED FROM THE RIGHT ABUTMENT. (11/13/79)

DOWNSTREAM OVERVIEW AS OBSERVED FROM THE RIGHT ABUTMENT. (11/13/79)

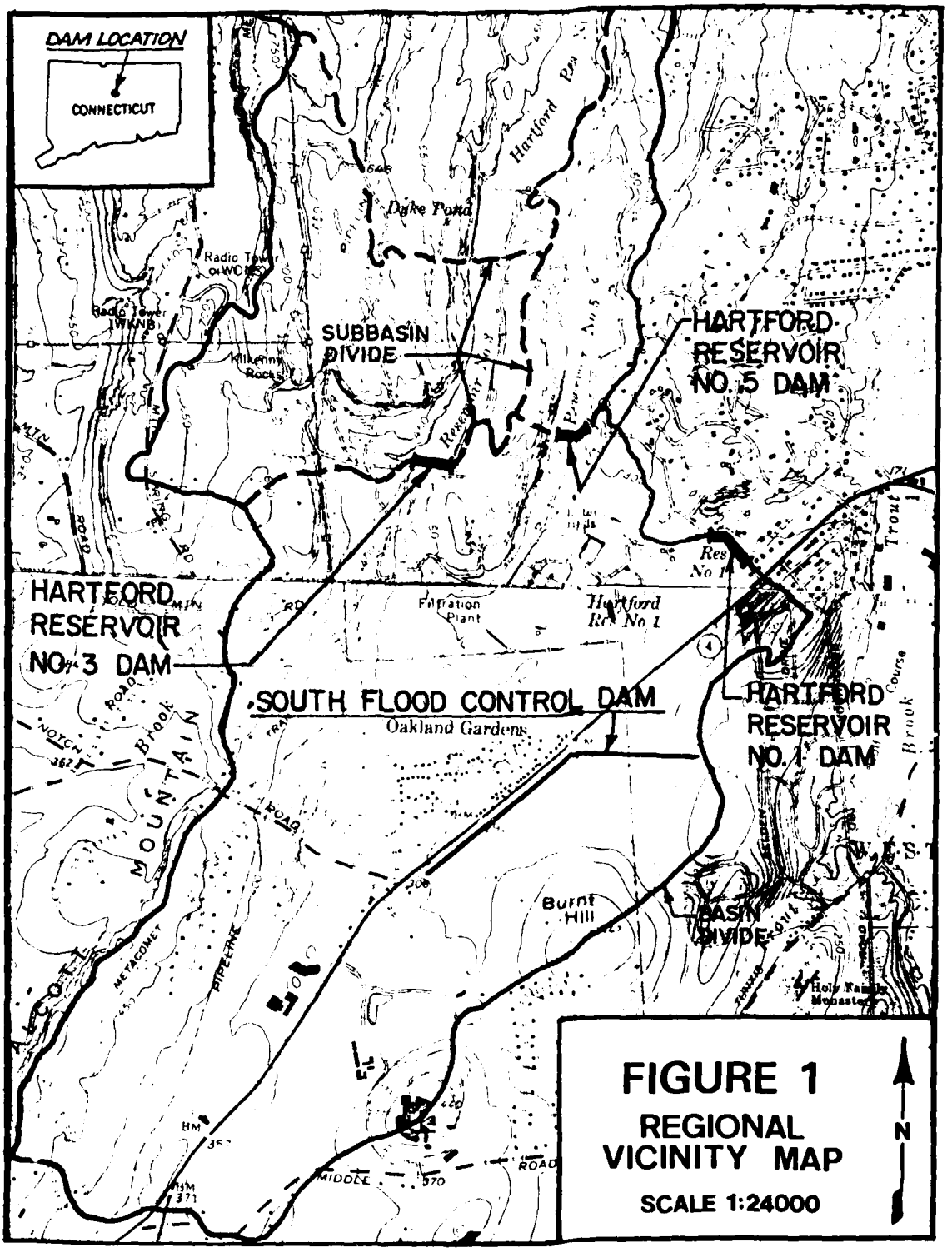


FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
HARTFORD RESERVOIR NO. 1 DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The National Dam Inspection Act (Public Law 92-367) was passed by Congress on August 8, 1972. Under this Act, the Secretary of the Army was authorized to initiate, through the Corps of Engineers, the National Program for Inspection of Dams throughout the United States. Responsibility for supervising inspection of dams in the New England Region has been assigned to the New England Division of the Corps of Engineers.

O'Brien & Gere Engineers, Inc. has been retained by the New England Division to inspect and report on selected non-federal dams in the State of Connecticut. Authorization and Notice to Proceed were issued to O'Brien & Gere by a letter dated November 6, 1979 and signed by Col. William E. Hodgson, Jr. Contract No. DACW 33-80-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose. The purpose of inspecting and evaluating non-federal dams is to:

1. Identify conditions which threaten public safety and make the Owner aware of any deficiencies so that he may correct them in a timely manner.

2. Encourage and prepare the State to initiate an effective dam safety program for non-federal dams as soon as possible.

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

1.2 Description of Project (Information with regard to this dam was obtained from the Hartford, Connecticut, Metropolitan District).

a. Location. Hartford Reservoir No. 1 Dam is located on Spice Brook in the Town of West Hartford, Connecticut. Spice Brook flows into Trout Brook an estimated 4,000 feet downstream of the dam. Trout Brook discharges into the South Branch of Park River about 8 miles downstream of the dam. To illustrate the location of the structure, portions of the USGS quadrangle maps entitled "Avon, Conn." and "New Britain, Conn." have been incorporated and included as Figure 1 on page vi of this report, USGS reference coordinates for this dam are N41°45.1' and W72°46.5'.

The initial damage center is the Metropolitan District power generating facilities 100 feet downstream from the dam. The initial residential flood impact area is an estimated 2,000 feet downstream from the dam. Many residential flood impact areas are located in the ensuing miles along Trout Brook.

b. Description of Dam and Appurtenances. The dam is located on the northeastern side of Hartford Reservoir No. 1. It is an earth embankment approximately 500 feet long with a maximum height of 42 feet. The dam has the following major features:

1. The upstream grass-covered face of the dam is on a slope of approximately 3H:1V. The lower portion of the upstream face of the dam, extending from an elevation of about 3 feet above pool elevation to an undetermined depth beneath the water surface, is protected with small riprap stones.

2. The dam crest is approximately 25 feet wide. A 14-foot wide paved road is located along the crest of the dam with a row of shrubbery on each side of the roadway.

3. The downstream face of the dam is on a slope of approximately 2H:1V and is grass-covered.

A section drawing and several photos of the features described above have been included in Appendix B and Appendix C, respectively.

The primary spillway is located at the northwestern end of the reservoir. The inlet consists of a 45-foot wide concrete weir and the outlet consists of a stone-lined channel about 20 feet wide and 1,700 feet long which outlets into Spice Brook an estimated 800 feet downstream of the dam.

A 108-foot wide auxiliary (emergency) spillway is located just to the left of the left abutment of the dam. This spillway is grass-covered and partially formed by a gabion wall along its right side. The elevation of the auxiliary spillway is an estimated 5.4 feet above the primary spillway elevation. Further information relative to the spillways is given in Appendices B, C and D.

The outlet works provide a means of conveying water to the downstream power generation facilities in addition to providing a means of draining the reservoir. The inlet facilities for the outlet works are located in the intake structure near the right abutment of the dam (constructed in 1978) and in the intake tower in the impoundment near the center of the dam. The outlet facilities are located in a gatehouse immediately downstream. Further downstream, a gate chamber houses valves which direct the flow towards the power generating facilities or towards Spice Brook.

c. Size Classification. Hartford Reservoir No. 1 Dam has a maximum height of 42 feet which places it in the "Intermediate" size category for height because it is greater than 40 feet but not greater than 100 feet high. It falls into the "Small" size category for storage because its maximum storage capacity of 619 acre-feet is less than the 1,000 acre-foot upper limit for "Small" size structures. Since the dam is considered "Intermediate" in size for height, it must be classified in the "Intermediate" size category for this report.

d. Hazard Classification. Several areas downstream of the dam could be identified as potential flood impact zones. The initial damage center is the Metropolitan District power generating facilities 100 feet downstream of the dam. These facilities would probably be destroyed by floodwaters resulting from a dam failure. The first residential area is located approximately 2,000 feet downstream of the dam near the point where Spice Brook flows under Old Mill Lane. The sill elevation of the lowest houses at this location was estimated to be 2 feet above the channel banks of the stream. The failure analysis indicated that a breach of Hartford Reservoir No. 1 Dam with the reservoir surface at the test flood elevation (0.5 feet below the top of the dam) would result in a flow depth of 5.7 feet above the channel banks, or 3.7 feet above the sill elevation of the lowest houses, at this initial residential damage area. A flood of this magnitude would cause excessive property damage and possible loss of life in this location. The failure analysis also indicated that a breach of the dam with the reservoir surface at the spillway crest would result in a flow depth of 2.8 feet above the low sill evevation, which would also cause excessive property damage and the possible loss of more than a few lives. Several other residential areas are located further downstream and could also be subjected to damage. The depth of flow immediately prior to failure was computed to be 1.7 feet above the low sill elevation with the reservoir at the top of the dam and estimated at 3.5 feet below the low sill elevation with the reservoir surface at the spillway crest. Therefore, a significant increase in hazard to loss of life downstream would result from a failure of the dam. Due to the conditions described above, Hartford Reservoir No. 1 is classified in the "High" hazard category.

e. Ownership. The dam is owned by the Metropolitan District, 555 Main Street, Hartford, Connecticut, 06101: Telephone: 203-278-7850.

f. Operator. Mr. Richard Allen, Purification Engineer for the Hartford Metropolitan District, is responsible for operation of the West Hartford reservoir system. His address is Metropolitan District, 555 Main Street, P.O. Box 800, Hartford, Connecticut, 06101; Telephone: 203-278-7850, ext. 332.

g. Purpose of Dam. The dam was originally constructed for Hartford water supply purposes. Since 1922, however, water from Reservoir No. 1 Dam has been primarily used to drive turbines for the production of hydroelectric power. In case of emergency, the reservoir could be used to supplement the water supply reservoirs.

h. Design and Construction History. The dam was originally constructed between 1864 and 1867 and was subsequently rebuilt in 1868. Modifications to the project, since that time, include the power generating facilities including the 30-inch diameter transfer pipe which was constructed in 1922, the raising of the primary spillway crest one foot and the construction of the auxiliary spillway in 1967 and the partial installation of the toe drain system and the reconstruction of the intake structure on the 30-inch transfer pipe which carries water to the power generation facilities, in 1978 and 1979. According to Mr. Allen, details of the original design and construction are not available.

i. Normal Operating Procedures. According to Mr. Allen, discharge from Reservoir No. 1 is normally directed to the power generation facility located about 100 feet downstream of the dam. Depending upon precipitation, flows for this purpose are generally available for 40 to 60 percent of the year. The primary spillway, whose crest was 1.5 feet above the reservoir surface at the time of inspection, is used only when all available upstream storage has been exhausted.

In anticipation of excessive runoff, personnel from the Metropolitan District will open valves on the low level discharge pipes to help lower the reservoir surface. However, Mr. Allen feels that such operations do not accomplish a great deal other than to exercise the valves.

1.3 Pertinent Data

a. Drainage Area. The area draining to Hartford Reservoir No. 1 encompasses 3.9 square miles of primarily forested, mountainous land. Included in this area are Hartford Reservoir Nos. 1, 2, 3 and 5 which account for about 6 percent of the drainage area. Elevations range from 800 along the Talcott Mountain Range to 256.5 at the normal reservoir surface of Hartford Reservoir No. 1.

b. Discharge at Damsite.

1. Outlet Works. Water may be drawn from the reservoir at two locations. One outlet is a set of two 24-inch diameter gate controlled pipes which originate in the intake tower and convey water to the gate house. Valves in the gate house may be opened to allow for the discharge to continue via twin 20-inch diameter pipes to a gate chamber located next to the power generation building. In the gate chamber discharge can be turned off, directed to the power generation facility, or diverted to Spice Brook. The estimated discharge capacity of the twin outlet pipes with the reservoir surface at the top of the dam is 190 cfs.

The second outlet consists of a 30-inch diameter cast iron pipe which extends from a new intake structure located at the right abutment of the dam to the gate chamber located next to the power generation building. The extimated discharge capacity of this pipe with the reservoir surface at the top of the dam is 100 cfs.

2. Maximum Known Flood. The flood of record at Hartford, Connecticut occurred over a three-day period in August, 1955 when the primary spillway was overtopped by 3 feet. Since that time the spillway crest has been raised one foot.

3. Ungated Spillway Capacity at Top of Dam. The ungated spillway capacity at the top of dam Elevation 265.3, is 6,130 cfs.

4. Ungated Spillway Capacity at Test Flood Elevation. At test flood Elevation 264.8, the ungated spillway capacity is 5,440 cfs.

5. Gated Spillway Capacity at Normal Pool Elevation. Not Applicable.

6. Gated Spillway Capacity at Test Flood Elevation. Not Applicable.

7. Total Spillway Capacity at Test Flood Elevation. See 4 above.

8. Total Project Discharge at Top of Dam. The total project discharge at top of dam Elevation 265.3, including the outlet works, is 6,320 cfs.

9. Total Project Discharge at Test Flood Elevation. The total project discharge at test flood Elevation 264.8, including outlet works, is 5,630 cfs.

c. Elevation. (NGVD)

Streambed at Toe of Dam	223.0
Bottom of Cutoff	Unknown
Maximum Tailwater	Unknown
Normal Pool	256.5
Full Flood Control Pool	NA
Spillway Crest (Gated)	NA
Spillway Crest (Primary)	256.5
Spillway Crest (Auxiliary)	261.9
Design Surcharge (Original Design)	Unknown
Top of Dam	265.3
Test Flood Surcharge	264.8

d. Reservoir Length. (Feet)

Normal Pool	1,880
Flood Control Pool	NA
Primary Spillway Crest Pool	1,880
Top of Dam Pool	1,940
Test Flood Pool	1,930

e. Storage. (Acre-Feet)

Normal Pool	284
Flood Control Pool	NA
Primary Spillway Crest Pool	284
Top of Dam Pool	619
Test Flood Pool	591

f. Reservoir Surface Area. (Acres)

Normal Pool	27
Flood Control Pool	NA
Primary Spillway Crest Pool	27
Top of Dam Pool	52
Test Flood Pool	51

g. Dam Data.

Type	Earth Embankment
Length	500 feet
Height	42 feet
Top Width	25 feet
Side Slopes (Upstream)	3H:1V
(Downstream)	2H:1V

Zoning	Unknown
Impervious Core	Unknown
Cutoff	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Tunnel. None

i. Spillways.

1. Primary Spillway

Type	Overflow Drop Spillway
Length of Weir	45 feet
Crest Elevation	256.5
Gates	None
Upstream Channel	None
Downstream Channel	45-foot wide at headwall, narrows to 20 feet wide 300 feet downstream of headwall with stone lined side.

2. Auxiliary Spillway

Type	Overflow Broad-Crested
Length of Weir	108 feet
Gates	None
Upstream Channel	None
Downstream Channel	Grass covered outlets into primary spillway downstream channel.

j. Regulating Outlets.

1. From Intake Tower

Invert Elevation	218 ±
Size	(2) 24-inch diameter
Description	Cast Iron Pipe
Control Mechanism	Sluice gates in the intake Tower and gate valves in the gatehouse and gate chamber.

2. From Intake Structure

Invert Elevation	250 ±
Size	30-inch diameter
Description	Cast Iron Pipe
Control Mechanism	Gate Valve in the gate chamber

SECTION 2

ENGINEERING DATA

2.1 Design

According to Mr. Peter Revill, Chief Design Engineer for the Hartford Metropolitan District, none of the original design information with respect to the construction of Hartford Reservoir No. 1 dam (from 1864 to 1867) is available. Design information, for the primary and auxiliary spillway modifications made in 1967 and the water intake and toe drain system improvements of 1978 and 1979, is available from the Hartford Metropolitan District. Several of the available drawings have been reproduced and included in Appendix B.

2.2 Construction

Construction information exists for the primary and auxiliary spillway modifications made in 1967, the water intake improvements made in 1978 and the toe drain system which is still not completely installed in the downstream portion of the dam.

2.3 Operation

Normal operation of the dam consists of opening and closing valves in the downstream gate chamber, depending upon the availability of surplus water. If water is available, the appropriate valves are opened to direct the flow to the power generation facilities. If water is not available the valves are closed. In the event high inflow to the reservoir is anticipated valves are opened to permit discharge into Spice Brook to help lower the pool level.

2.4 Evaluation

a. Availability. Several drawings of Hartford Reservoir No. 1 Dam and related appurtenances and records of piezometer readings of groundwater levels from July, 1977 to December, 1977 are available from the Hartford Metropolitan District. Many of the drawings and related data have been included, at least in part, in Appendix B.

b. Adequacy. Sufficient information has been obtained during the field investigation, from the available drawings and data, and through subsequent telephone conversations with Metropolitan District personnel, to conduct a Phase I dam evaluation.

c. Validity. Other than the 2.1-foot elevation difference between Hartford Metropolitan District datum and NGVD, it appears that the information obtained from the Metropolitan District is valid.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. Hartford Reservoir No. 1 Dam was inspected on November 13, 1979. At the time of inspection, the reservoir level was approximately 1.5 feet below the crest of the primary spillway. Underwater areas were not inspected.

A checklist of observations and comments made during the field inspection is included as Appendix A of this report.

b. Dam. The dam, which appears to be in fair condition, is approximately 500 feet long with a maximum height of 42 feet. The following features were noted during the field inspection:

1. The upstream face of the embankment is grass-covered with some riprap protection on the lower portion of the slope. The riprap extends from an elevation approximately 3 feet above the observed pool level to an undetermined depth below the water surface. Several small bushes were observed growing along the top edge of the riprap portion of the slope. Some riprap stone is missing on the upstream face of the dam.

2. The crest of the dam is approximately 25 feet wide and, at the time of the inspection, was 10.3 feet above the reservoir surface. A 14-foot wide paved access road along the crest of the dam appears to be in good condition. Rows of shrubbery line each side of the roadway.

3. The downstream face of the embankment is grass-covered; however, the following deficiencies were noted during the inspection: a) A permanently saturated condition at the downstream toe; b) Several evergreen trees were observed in the vicinity of the abutments and at the toe of the slope in the vicinity of the gate house; c) Animal burrows were observed in the downstream embankment face; d) An undulated area at the downstream toe of the slope near the gate house was observed. It could not be determined if the irregularities at the downstream toe of the slope were caused by embankment movement or the recent installation of a toe drain system; and e) a depression in the downstream slope, which extends from the crest of the dam to the toe and parallels the alignment of the outlet pipes through the embankment, was observed.

Several photos of the dam have been included in Appendix C.

c. Appurtenant Structures. The primary and auxiliary spillways appeared to be in good condition on the date of the inspection. The intake tower, the access bridge, the intake structure and the downstream gate house appear to be well maintained and in good condition. Some minor spalling was noted on the gate house near the water surface. The gate valves inside these structures were not inspected; however, Metropolitan District personnel said they are operable. The gate chamber and the gate valves at the downstream power house also appeared to be in good condition at the time of inspection. Drawings and photos of the primary and auxiliary spillways, the intake tower, the downstream gate house, the intake structure, the gate chamber and the power generation building are included in Appendix B and Appendix C, respectively.

d. Reservoir Area. The terrain along the perimeter of the pond is well vegetated and appears to be stable and free of erosion. The slope of the terrain around the pond varies from 2 percent to 25 percent.

e. Downstream Channel. Water discharging from the power generation building or through the low level outlet enters Spice Brook. The Brook flows through a well defined natural stream channel which is relatively clear of major obstructions. Spice Brook discharges into Trout Brook an estimated 4,000 feet downstream from the dam.

3.2 Evaluation. The deficiencies noted during inspection of the dam were the permanently saturated condition at the downstream toe (apparently due to seepage through the embankment) which has been partially corrected with the installation of a portion of the toe drain system, the disturbed area at the toe of the downstream face of the dam and the depression in the downstream face of the dam. The disturbance at the toe was most likely created during installation of the toe drains in 1978 and should be renovated as recommended in Section 7. The depression is probably the result of improper compaction around the outlet pipes.

Other observed deficiencies include evergreen trees growing in the vicinity of the abutments on the downstream face of the dam and in the vicinity of the downstream toe of the dam. Some riprap stone is missing on the upstream face of the dam and brush was observed growing from between riprap stones. Animal burrows were noted in the downstream embankment face. These conditions should also be improved as recommended in Section 7.

SECTION 4

OPERATION AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. According to Mr. Allen, the primary function of Hartford Reservoir No. 1 is to impound water for the power generation facilities located about 100 feet downstream of the dam. Normal operation consists of discharging water through the power generation building when surplus water is available. Generally, water is available for power generation between 40 and 60 percent of the year.

Three sets of gates control low level discharges from the reservoir. An intake tower is located in the reservoir near the center of the dam. The operator may control the pool level from this structure by operating the appropriate sluice gates. However, the valves on the low level discharge pipes in the downstream gatehouse must also be opened for discharge to occur. Still further downstream, valves may be operated at a gate chamber to direct the flow either to the power generation facilities or to Spice Brook. The gates in the intake tower are normally closed so that the pipes through the embankment are not under pressure.

b. Description of Any Warning System in Effect. Currently, there is no formal warning system in effect. According to the Owner's representative, Mr. Peter Revill, the Labor Foreman will monitor reservoir levels during periods of unusually heavy runoff and/or rainfall.

4.2 Maintenance Procedures

a. General. The Metropolitan District employs a maintenance crew, headed by Mr. Rudy Wegscherder, who operates and maintains the West Hartford reservoir system. Maintenance of the dams and grounds is performed on a routine basis.

In 1972, the Metropolitan District installed three piezometers at the toe of the downstream slope to monitor groundwater levels. The owner had become aware that the downstream toe was constantly saturated and the piezometers were installed to assess the need for a toe drain. Records of groundwater levels were kept from July, 1977 to December, 1977 and are available from the Metropolitan District. Based upon an analysis of the data collected during this 6-month period, it was decided that a toe drain could alleviate the seepage problem. A toe drain was designed and, at the time of the inspection, approximately half of the proposed system had been installed.

b. Operating Facilities. According to the Owner's representative, valves and sluice gates controlling discharge from Reservoir No. 1 are kept in good operating condition and are serviced as required.

4.3 Evaluation

The current operation and maintenance program appears to be good with the following exceptions:

1. Growth of large trees on the dam, or any other type of vegetation with an extensive root system, should not be permitted. In addition, any growth which prohibits good visibility of the slope should be removed from the dam.

2. Animal burrow holes, observed on the downstream face of the dam, should be properly backfilled.

3. All surfaces of the dam should be kept in good condition. In particular, the rough area at the toe of the downstream slope should be regraded and seeded.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The drainage area for Hartford Reservoir No. 1 Dam encompasses 3.9 square miles which are mostly forested. The local drainage area (excluding the area drained by the other Hartford Reservoirs) is approximately 2.2 square miles. However, South Flood Control Dam drains 1.3 square miles of this local drainage area, limiting the direct runoff area for Hartford Reservoir No. 1 to 0.9 square miles. Hydraulic information for South Flood Control Dam is included in Appendix D. The normal water surface area of Hartford Reservoirs 1, 2, 3 and 5 accounts for an estimated 6 percent of the total drainage area.

The portion of the watershed draining to Reservoirs 2, 3, and 5 is undeveloped and almost entirely forested. The only development within the entire drainage basin is located 0.5 to 1.0 miles to the southwest of Reservoir No. 1 in an area called Oakland Gardens.

The topography is predominantly mountainous, ranging in elevation from 800 along the Talcott Mountain range to 256.5 at the normal reservoir surface of Hartford Reservoir No. 1.

5.2 Design Data

According to the Owner's representative, hydraulic and hydrologic data used for the original design of the Hartford Reservoir No. 1 Dam, is not available. The design of the auxiliary spillway, built in 1967, was based upon the peak runoff anticipated during a 34-hour, 18.25-inch rainfall.

5.3 Experience Data

The flood of record in Hartford occurred in August, 1955, as a result of rain which fell over a three day period during Hurricane Diane.

The maximum water surface observed at Reservoir No. 1 was approximately three feet above the primary spillway crest. Since that time the primary spillway crest has been raised one foot.

5.4 Test Flood Analysis

The recommended test flood for an "Intermediate" size, "High" hazard dam is the full Probable Maximum Flood (PMF).

Hydraulic and hydrologic calculations were performed with the assistance of the HEC-1-DB computer program. The flood hydrographs were constructed from Snyder unit hydrographs using average coefficients, an initial infiltration of zero and a constant loss rate of 0.05 inches per hour. The Hop Brook Adjustment Factor was used to reduce the Probable Maximum Precipitation based upon the size of the drainage area.

Stage-discharge and stage-storage relationships were developed for each of the upstream reservoirs and input into the computer for the purpose of routing the test flood to Hartford Reservoir No. 1 Dam. Water surface elevations at all upstream reservoirs were assumed to be at their respective spillway crests at the beginning of the hypothetical storm event.

The peak inflow and outflow rates for the test flood at Hartford Reservoir No. 1 Dam were computed to be 5,590 cfs and 5,440 cfs, respectively. The peak outflow corresponds to a reservoir stage of 8.3 feet above the primary spillway crest (0.5 feet below the top of the dam). The spillway system is capable of discharging 100 percent of the routed test flood outflow.

5.5 Dam Failure Analysis

Failure of the dam at Hartford Reservoir No. 1 was simulated through the use of the HEC-1-DB computer program, assuming that a 300-foot wide and 35.3-foot deep breach with vertical side slopes would develop within 2 hours from the start of the failure. Failure was assumed to occur with the pool level at the test flood elevation in the first case and at the spillway crest for the second case. The resulting outflow for each case was routed to the first major residential damage center, located approximately 2,000 feet downstream of the dam at the point where Spice Brook flows under Old Mill Lane. The flow at the damage center immediately prior to failure of the embankment was computed by routing the test flood spillway discharge to the hazard center for the reservoir at test flood elevation case and was assumed to be equivalent to the flow observed during the visual inspection for the reservoir at spillway crest case. These flows were compared to the breach flows to assess the increase in hazard caused by a failure of the embankment. Refer to Appendix D for the assumed channel cross-section at this point.

The failure analysis indicated that a breaching of the dam with the reservoir surface at the top of the dam would result in a stream depth of 7.7 feet, or 5.7 feet above the channel banks, with a corresponding flow of 6,000 cfs at the damage area. The estimated sill elevation of the lowest houses in this area is 2 feet above the channel banks. Therefore, the breach flood would inundate the house with 3.7 feet of water causing excessive property damage and the possible loss of more than a few lives. With the reservoir surface at the spillway crest, a breach flood would result in a stream depth of 6.8 feet and a corresponding flow of 4,480 cfs. This flood would also cause excessive property damage and the possible loss of more than a few lives.

The stream depth and quantity of flow at the hazard center immediately prior to failure of the dam were computed to be 5.7 feet and 3,070 cfs, respectively, with the reservoir surface at the test flood elevation. A stream depth of 0.5 feet and flow of 35 cfs were estimated with the reservoir surface at the spillway crest. Therefore, a dam breach would result in a significant increase in hazard to loss of life downstream.

The initial damage center is the Metropolitan District power generating facilities 100 feet downstream of the dam. These facilities would probably be destroyed by floodwaters resulting from a dam failure.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

A permanently saturated condition exists at the downstream toe which has been partially corrected with the installation of a portion of the toe drain system. An undulated area was observed at the downstream toe of the dam, near the location where toe drains were installed in 1978. It could not be determined if the area was undulated as a result of the toe drain installation or because of embankment displacement. A depression of the downstream face which follows the alignment of the outlet pipes and extends from the crest to the toe of the dam was also observed during the inspection. This depression appears to be a result of improper compaction around the outlet pipes. However, seepage could have been a contibuting factor.

Several other deficiencies which were observed during the inspection, such as trees growing on the downstream face of the dam near the abutments and near the downstream toe, riprap displacement on the upstream face, and animal burrow holes on the downstream face, could lead to structural damage if they are not removed and/or repaired.

No other indications of structural deficiency were observed. Photos of the dam are included in Appendix C.

6.2 Design and Construction Data

According to the Owner's representative, no data with regard to the original design and construction of the dam at Hartford Reservoir No. 1 is available.

6.3 Post Construction Changes

Since the original construction of the dam between 1864 and 1867, there have been three major construction changes: 1) According to Metropolitan District records, the dam was rebuilt in 1868; 2) Power generation facilities (and presumably the 30-inch transfer pipe) were constructed in 1922; and 3) The auxiliary spillway was built and the primary spillway was raised one foot in 1967. In addition, recent modifications to the dam include the installation of a toe drain (construction not yet completed) and reconstruction of the intake structure on the 30-inch transfer pipe which carries water to the power generation facilities.

6.4 Seismic Stability

Hartford Reservoir No. 1 Dam is located in Seismic Zone 1 on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 need not be evaluated for seismic stability, according to the Recommended Guidelines for Phase I Dam Inspections.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The dam appears to be in fair condition. The Owner has been cognizant of a seepage problem at the site for at least 3 years because of the permanently saturated conditions observed at the toe of the dam. This condition was observed during the inspection of the site but, because of the installation of the drains in 1978, the situation has improved, but still exists. Additional drain installation work is planned. The undulated area at the downstream toe of the dam, where the toe drains were installed in 1978, could be the result of the toe drain installation or embankment displacement. The depression on the downstream face of the dam which follows the alignment of the outlet pipes and extends from the crest of the dam to the toe could be the result of improper compaction or seepage around the outlet pipes.

Other deficiencies include trees growing on the downstream face of the dam, near the abutments and near the downstream toe, riprap displacement on the upstream face and animal burrows in the downstream face.

Recommendations and operation and maintenance measures which should be implemented are discussed in Sections 7.2 and 7.3.

b. Adequacy of Information. Sufficient information has been obtained through field observations, from data supplied by the Metropolitan District and through subsequent telephone conversations with Metropolitan District personnel to conduct a Phase I dam evaluation.

c. Urgency. The recommendations and remedial measures presented in this Section should be implemented within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the Owner retain a qualified registered professional engineer, experienced in the design and construction of dams, to direct the removal of the trees in the vicinity of the abutments and at the toe of the downstream face of the dam. Voids left in the embankment by the removal of the trees should be filled with suitable, thoroughly compacted material.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The Owner should implement the following operation and maintenance measures:

1. The toe drain construction should be completed.

2. The area at the downstream toe of the dam, in the vicinity of the new toe drain installation, should be regraded, seeded and monitored for future movements.

3. The depression in the downstream face should also be regraded, reseeded, and monitored for future settlement.

4. Extraneous vegetation should be removed from the riprapped portion of the upstream face of the dam and riprap should be replaced where necessary.

5. Animal burrows, in the downstream face of the dam, should be backfilled to eliminate possible seepage paths.

6. A formal surveillance and flood warning plan should be developed.

7. A program of periodic annual technical inspection should be instituted.

7.4 Alternatives

No valid alternatives to the recommendations described above are considered feasible for this site.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

INSPECTION TEAM ORGANIZATION

Project: Hartford Reservoir No 1 Dam

National I.D. #: CT 00001

Location: Hartford, Connecticut

Type of Dam: Earth Embankment

Inspection Date(s): November 13, 1979

Weather: Overcast, Mid 50's

Pool Elevation: 256.5 ± MSL

Inspection Team

Leonard Beck	O'Brien & Gere	Structures
Steven Snider	O'Brien & Gere	Foundations & Materials
Alan Hanscom	O'Brien & Gere	Structures
Rodney Georges	Bryant & Associates	Hydrology/Hydraulics

*Mr. John J. Williams, Vice-President, O'Brien & Gere has visited the site but not necessarily in conjunction with the inspection team.

Owner's Representative

Mr. Peter Revill, Chief Design Engineer;
Metropolitan District; 555 Main Street;
P.O. Box 800; Hartford, Conn.; 06100

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	265.3±
Current Pool Elevation	256.5±
Maximum Impoundment to Date	1955 - Main Spillway overtop by 3 feet ~ 360 ac-ft
Surface Cracks	None Observed
Pavement Condition	Very Good
Movement or Settlement of Crest	None Observed
Lateral Movement	None Observed
Vertical Alignment	No Misalignment Observed
Horizontal Alignment	" " "
Condition at Abutment and at Concrete Structures	Large Evergreen Trees @ Each Abutment downstream face
Indications of Movements of Structural Items on Slopes	None Observed
Trespassing on Slopes	Negligible
Vegetation on Slopes	Some weeds, slight brush growth on u/s face
Sloughing or Erosion of Slopes or Abutments	Sloughing @ d/s toe - Apparently caused by toe drain installation - '78
Rock Slope Protection - Riprap Failures	Some misalignment u/s face

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Con't)	
Unusual Movement or Cracking at or near Toes	Rough area & wet to the SE of lower gate house.
Unusual Embankment or Downstream Seepage	No flowing seepage observed - saturated @ d.s. toe
Piping or Boils	None Observed
Foundation Drainage Features	Unknown
Toe Drains	Half of proposed toe drains installed - see Appendix B
Instrumentation System	None
Miscellaneous	Few Animal Burrows & Trees @ Toe of d/s slope (See photos)

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	None
General Condition	NA
Loose Rock Overhanging Channel	"
Trees Overhanging Channel	"
Floor of Approach Channel	"
b. Weir and Training Walls	
General Condition of Concrete	Very Good
Rust or Staining	None Observed
Spalling	Slight
Any Visible Reinforcing	No
Any Seepage or Efflorescence	None Observed
Drain Holes	None
c. Discharge Channel	
General Condition	Clear of major obstructions Dry - seldom used

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Con't)	
Loose Rock Overhanging Channel	Few - along small stone walls on each side of channel
Trees Overhanging Channel	None observed
Floor of Channel	Fairly smooth - mostly dry
Other Obstructions	Fallen tree & nearby d/s bridge

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1980

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Slight - near pool elev.
Visible Reinforcing	None
Rusting or Staining of Concrete	None Observed
Any Seepage or Efflorescense	None Observed
Joint Alignment	Very Good
Unusual Seepage or Leaks in Gate Chamber	None Observed
Cracks	Superficial Cracking
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air Vents	@ Side of Tower
Float Wells	NA
Crane Hoist	NA

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER (Con't)	
Elevator	NA
Hydraulic System	NA
Service Gates	Good Operating Condition
Emergency Gates	" " "
Lighting Protection System	Unknown
Emergency Power System	None
Wiring and Lighting System in Gate Chamber	Good Condition
Miscellaneous	Tower - very well maintained

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	(Intake for power facility)
a. Approach Channel	
Slope Conditions	Training walls - submerged
Bottom Conditions	Submerged
Rock Slides or Falls	None Observed
Log Boom	None
Debris	Large tree stump
Condition of Concrete Lining	Unknown
Drains or Weep Holes	None Observed
b. Intake Structure	
Condition of Concrete	New
Stop Logs and Slots	No stop logs - only trash rack & screens

VISUAL INSPECTION CHECK LIST

Project: Hartford Reservoir No. 1 Dam

National I.D. #: CT 00001

Date(s): November 13, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	(Power Facility)
General Condition of Concrete	Good
Rust or Staining	@ outlet drain (d/s side)
Spalling	slight
Erosion or Cavitation	No significant erosion
Visible Reinforcing	None
Any Seepage or Efflorescence	None Observed
Condition at Joints	Very Good
Drain Holes	Roof drains - d/s side
Channel	Spice Brook - good
Loose Rock or Trees Overhanging Channel	Several of each
Condition of Discharge Channel	Generally clear, but small

APPENDIX B

ENGINEERING DATA

O'BRIEN & GERE
ENGINEERS, INC.

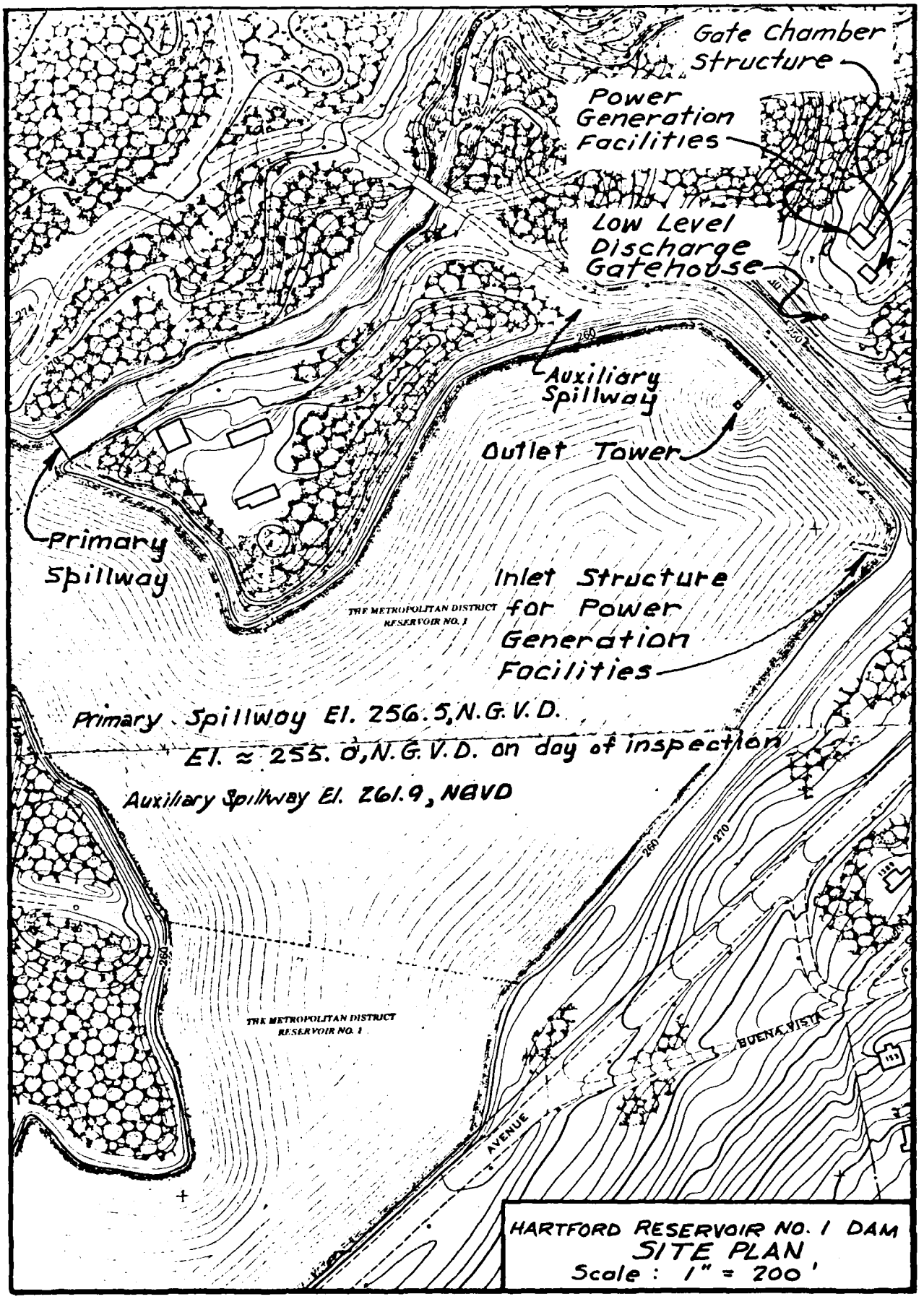
SUBJECT	SHEET	BY	DATE	JOB NO
HARTFORD RESERVOIR #1 DAM				

APPENDIX B

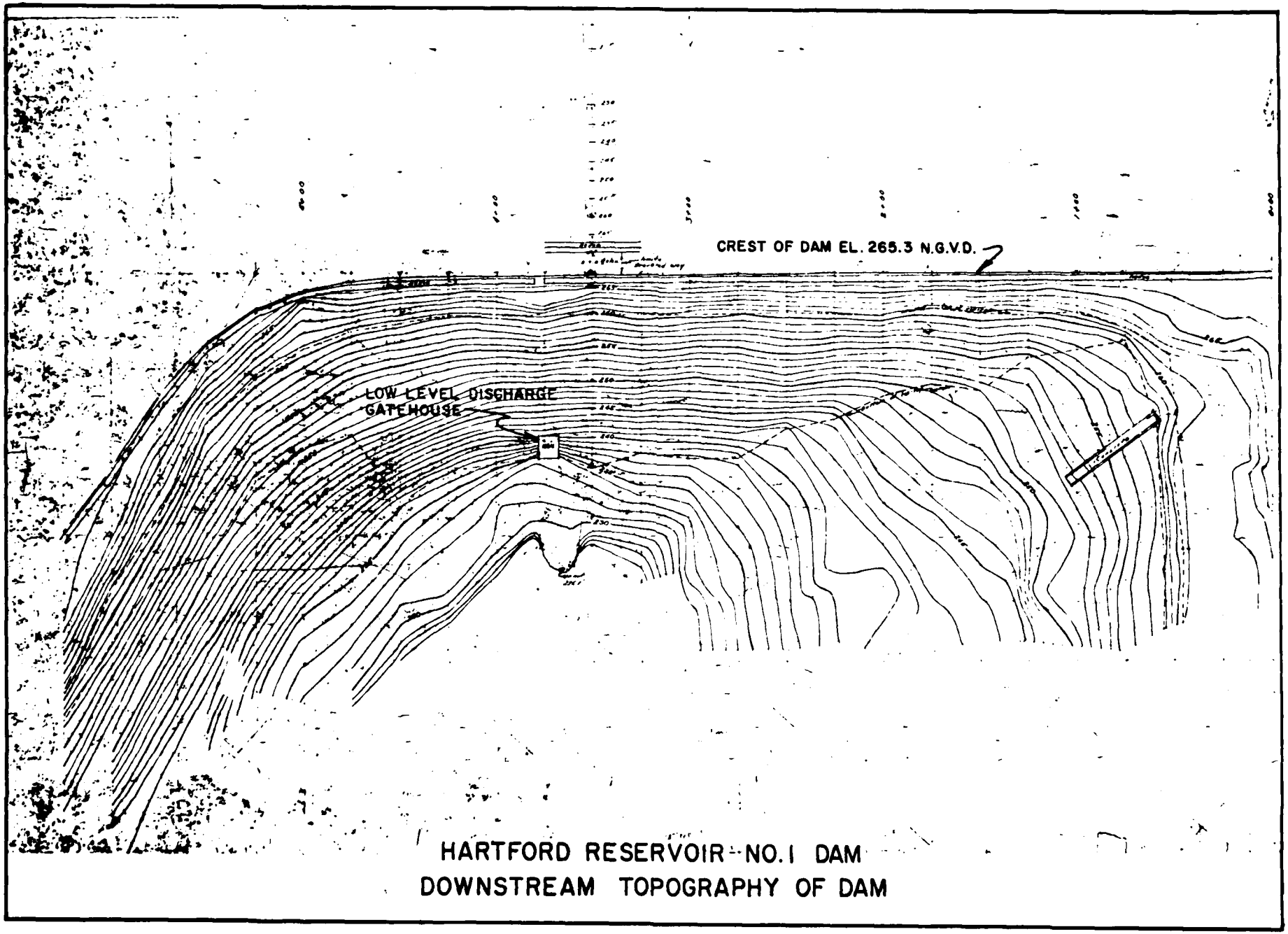
ENGINEERING DATA

TABLE OF CONTENTS

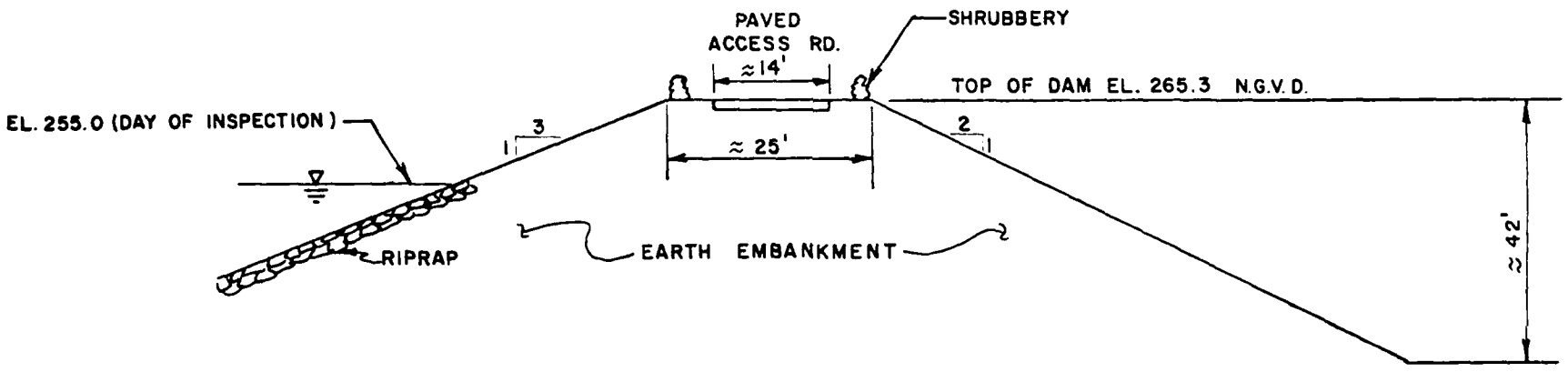
NOTE: INFORMATION INCLUDED IN THIS APPENDIX WAS OBTAINED FROM THE HARTFORD METROPOLITAN DISTRICT. UNLESS OTHERWISE NOTED, ELEVATIONS REFER TO METROPOLITAN DISTRICT DATUM.


Gate Chamber Structure
Power Generation Facilities
Low Level Discharge Gatehouse
Auxiliary Spillway
Outlet Tower
Primary Spillway
Inlet Structure for Power Generation Facilities
THE METROPOLITAN DISTRICT RESERVOIR NO. 1
Primary Spillway El. 256.5, N.G.V.D.
El. ≈ 255.0, N.G.V.D. on day of inspection
Auxiliary Spillway El. 261.9, NGVD
THE METROPOLITAN DISTRICT RESERVOIR NO. 1
BUENA VISTA
AVENUE
HARTFORD RESERVOIR NO. 1 DAM
SITE PLAN
Scale: 1" = 200'

B-1



HARTFORD RESERVOIR - NO. 1 DAM
DOWNSTREAM TOPOGRAPHY OF DAM



TYPICAL DAM SECTION

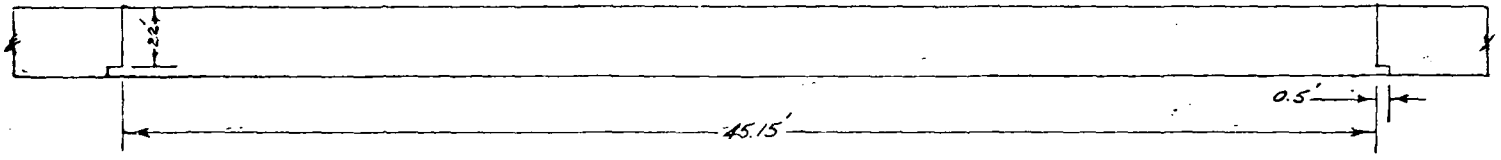
SCALE: NONE

NOTE: ALL DIMENSIONS ARE APPROXIMATE.

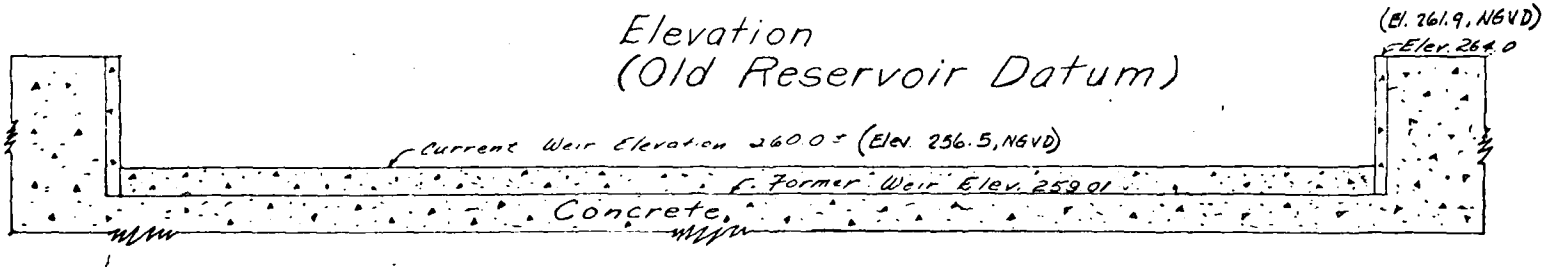
HARTFORD RESERVOIR NO. 1 DAM

B-3

Plan View of Overflow Weir
Reservoir No. 1



Elevation
(Old Reservoir Datum)



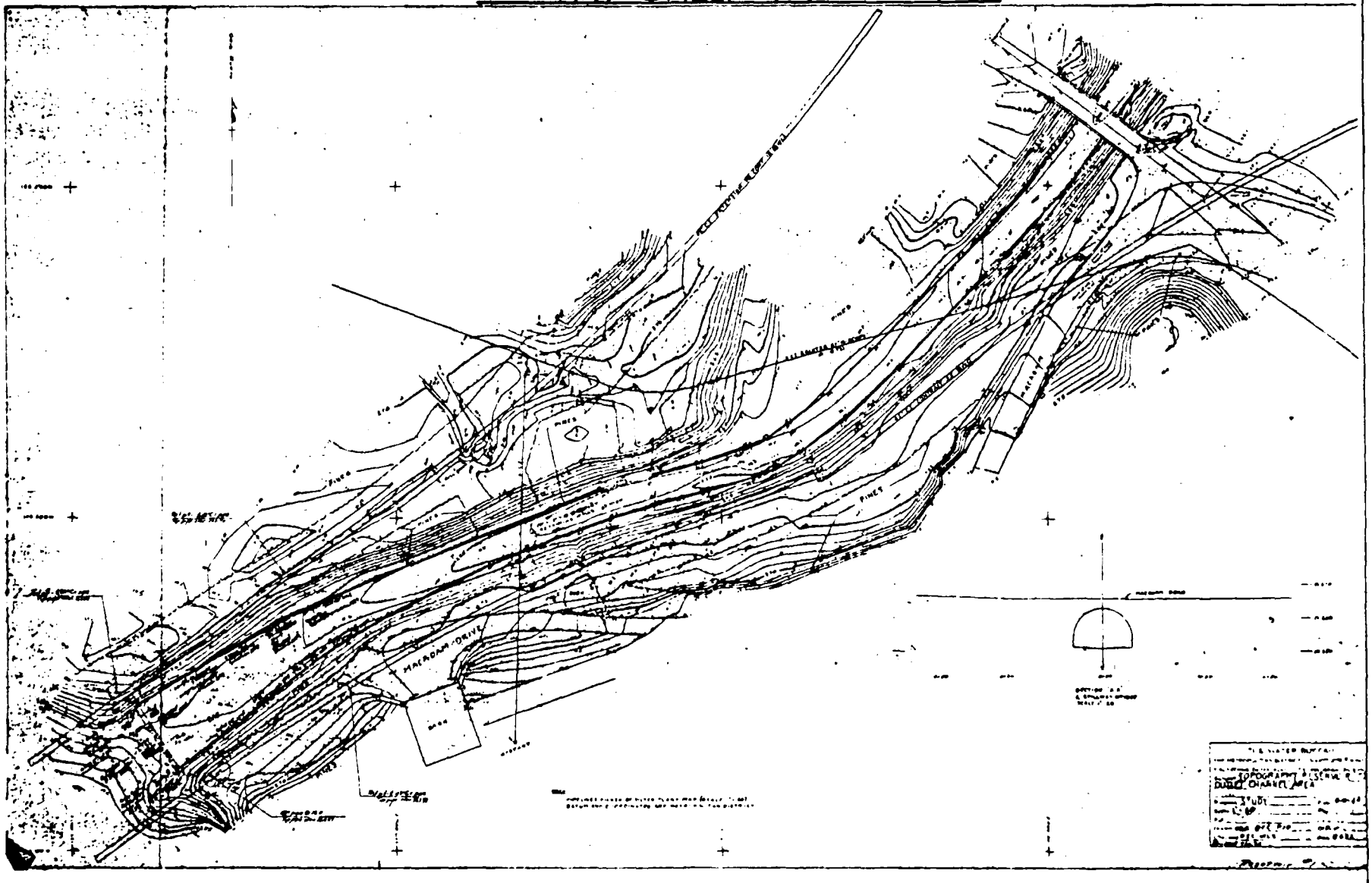
Side Elevation – Overflow Weir
Reservoir No. 1

HARTFORD RESERVOIR NO. 1 DAM
PRIMARY SPILLWAY PLAN & ELEVATION

SCALE: NONE

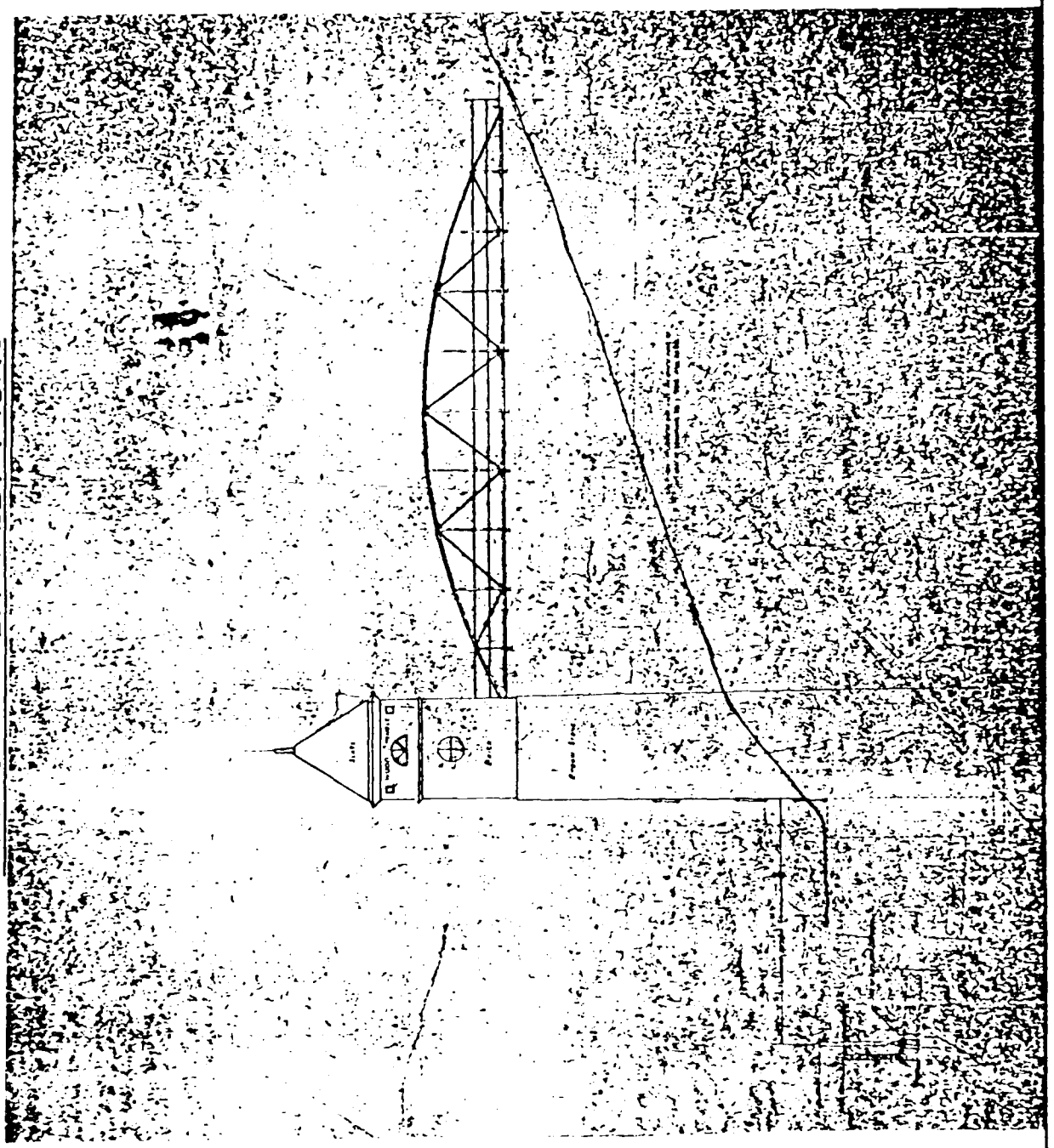
B-4

PRIMARY SPILLWAY TOPOGRAPHY

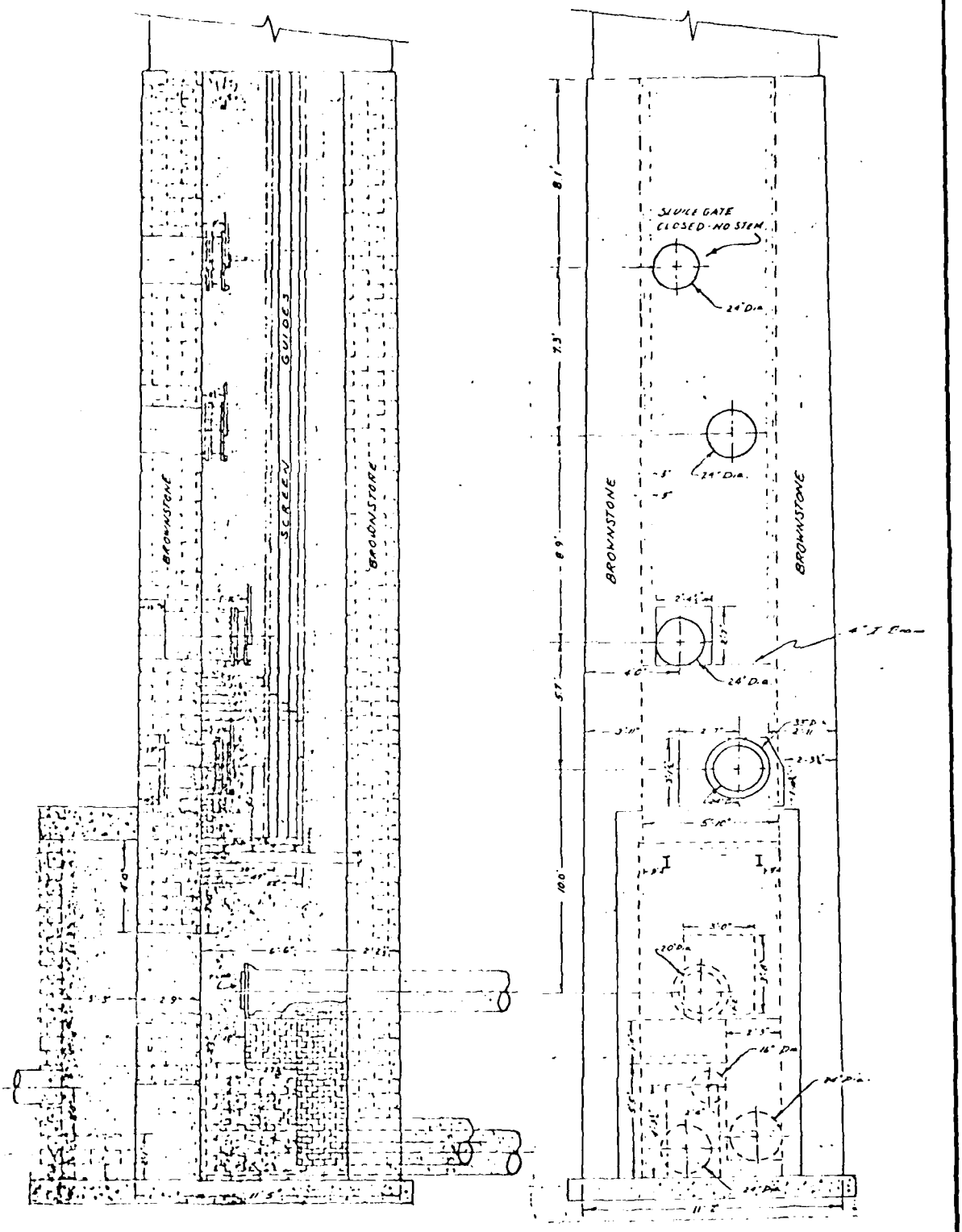


HARTFORD RESERVOIR NO. 1 DAM

INTAKE TOWER ELEVATIONS

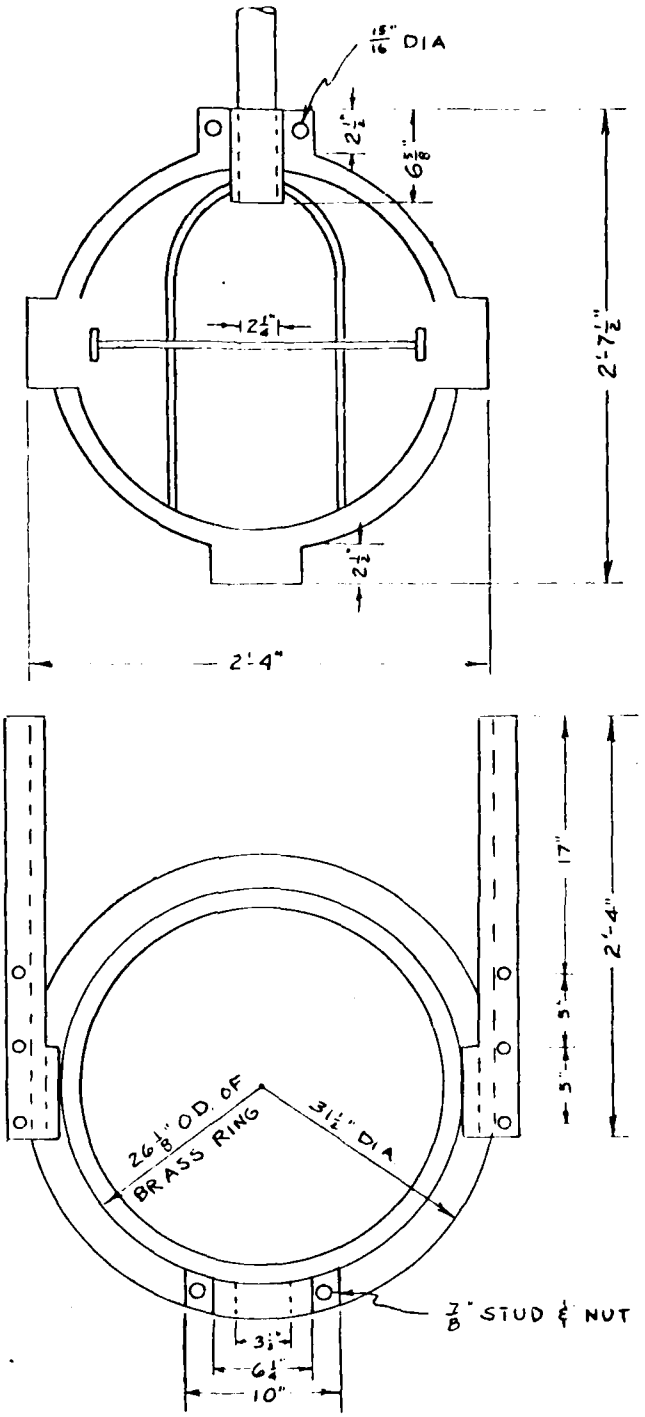


HARTFORD RESERVOIR NO. 1 DAM



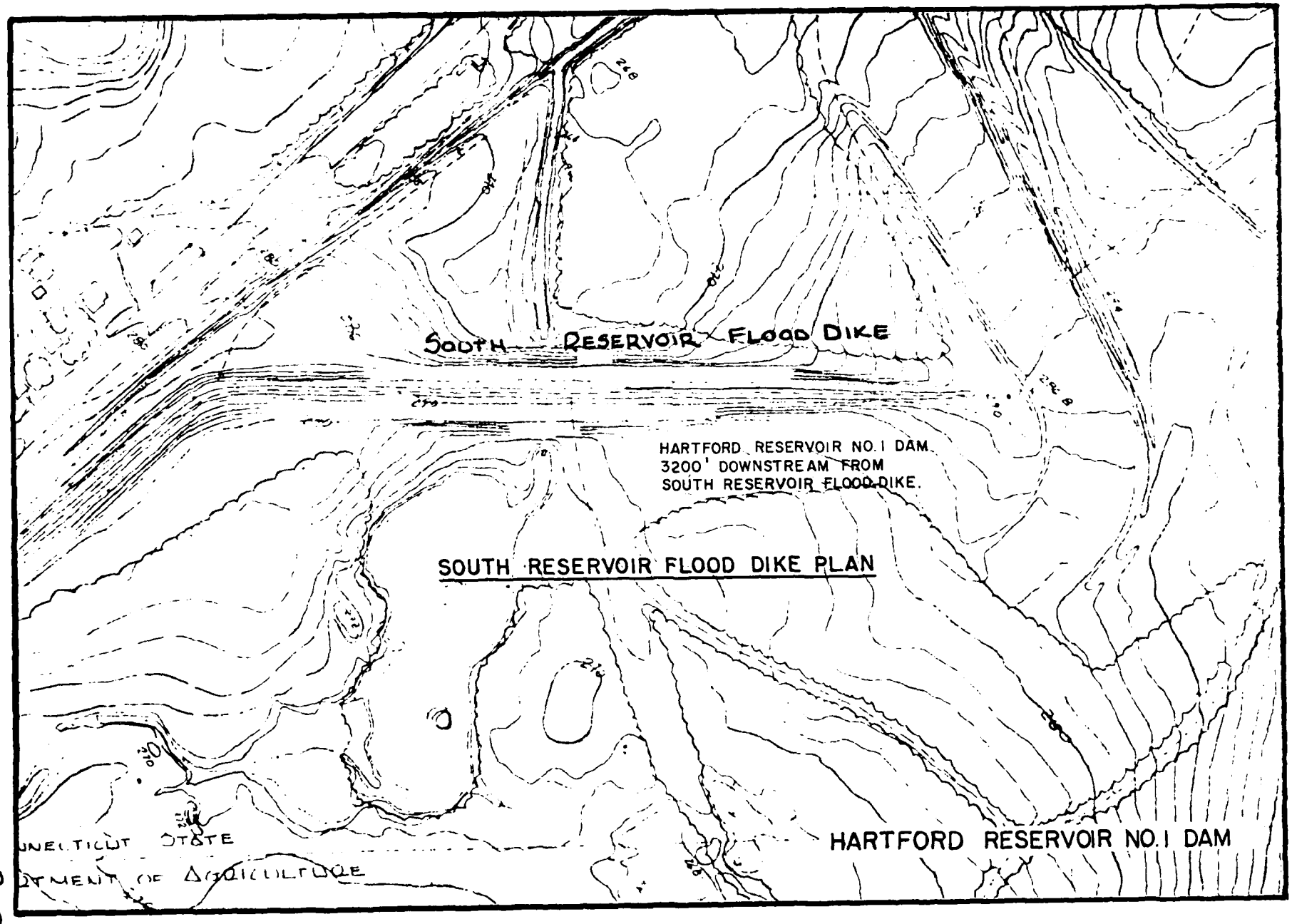
INTAKE TOWER SECTIONS

HARTFORD RESERVOIR NO. 1 DAM



INTAKE TOWER SLUICE GATE DETAILS

HARTFORD RESERVOIR NO.1 DAM


SOUTH RESERVOIR FLOOD DIKE
HARTFORD RESERVOIR NO. 1 DAM
3200' DOWNSTREAM FROM
SOUTH RESERVOIR FLOOD DIKE.
SOUTH RESERVOIR FLOOD DIKE PLAN
HARTFORD RESERVOIR NO. 1 DAM

B-9

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
NE DAM INSPECTIONS	1/2			2060.001

HARTFORD RESERVOIRS 1, 3 & 5

PERTINENT DATA

	HARTFORD RESERVOIR NO: 1	3	5
I. GENERAL:			
Main River	Trout Brook & S. Branch Park River		
Use	Power pond Waste Pool	Reserve Water Supply	Water Supply Balancing
When Built	1864 - 1867 Rebuilt 1868	1875	1884
Comments	Improved 1967	Improved 1964	Improved 1964
II. ELEVATIONS & DATUMS:			
USGS Flow Line	256.5'	391.2'	319.7'
MDC: Flow Line	258.6'	393.3'	321.8'
Const: Flow Line	259.0'	393.7'	322.3'
Const.: Bottom	225.0'	357.0'	303.0'
III. CAPACITY (MG):			
Available for Stored Use	13.2	96	68
Below Avail Level	5.5	50	15
IV. MISCELLANEOUS:			
Flow Line Area (Ac)	27	28	25
Maximum Depth (Ft.)	34	36	19
Watershed Area (mi^2)	4.3	0.6	1.4

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
NE DAM INSPECTIONS	2/2			2060.001

HARTFORD RESERVOIRS 1, 3 & 5

PERTINENT DATA (Cont.)

	HARTFORD RESERVOIR NO: 1	3	5
IV. MISCELLANEOUS (CONT.)			
Ave. Annual Rainfall	44.3" (61.4" Max. & 28.9 Min.)		
Ave. Annual Runoff	NA	1.9 Billion Gallons	
Design Fld. Runoff	1964 improvements: 18¼" in 34 hours		
V. SPILLWAY INFORMATION:			
Length (Feet)	45	23	62
Design Flow Head (Feet)	8.3*	3.9*	2.5
Design Flow (cfs)	4,000*	400*	700
Freeboard Above Crest (Feet)	8.8	5.2	5.2

* With Emergency Spillway.

FORM D-4

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
State Office Building
Hartford, Connecticut

CONSTRUCTION OF EMERGENCY SPILLWAY ON HARTFORD RES #1 DAM

APPLICATION FOR CONSTRUCTION PERMIT FOR DAM

Owner The Metropolitan District Date January, 1967

P.O. Address 115 Broad Street

Hartford, Connecticut 06105 Tel. No. 525-0841

Location of Structure:

Town West Hartford Shown on USGS Quadrangle Avon

Name of Stream Reservoir No. 1 at 0 inches south of Lat. 41°-45'
north
and 0 inches east of Long. 72°-47'
west

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side)

See locality Plan attached

This is an application for: Construction of an emergency spillway on an existing reservoir. (New Construction) (Alteration) (Repair) (Removal)
(check one or more of above)

This pond is presently used for clarification of treatment plant waste water and ~~to be used for:~~ intermittent generation of electric power.

Dimensions of Pond: width 600'± length 1,800' area 25± acres

Maximum depth of water immediately above dam: 33'±

Total length of dam: 600'±

Length of spillway: 45' (principal spillway)

Height of abutments above spillway: 5.0' (8.8' freeboard on dam)

Type of spillway construction: Concrete

Type of dike construction:

Spillway section will be set on: (Bedrock) (Gravel) (Clay) (Till)
(check one of above)

Remarks: Attached are a statement of purpose, presentation plans and statistics, and proposed contract and construction drawings.

Signed: The Metropolitan District
(owner)

Name of Engineer, if any G. U. Gustafson
G. U. Gustafson,
Deputy Manager for Engineering

Note: Show details of construction on reverse side

B-12

Water Bureau of the Metropolitan District

PROPOSED HYDROLOGIC IMPROVEMENTS TO THE WEST HARTFORD RESERVOIRS
TABLE OF FINAL STATISTICS

H-3546.A
June 1964

RESERVOIR STATISTICS	Unit Watershed	Res. No. 6	Res. No. 2	Res. No. 5	Res. No. 3	Res. No. 1
Independent Watershed Area	1.00 Sq. mi.	2.00 Sq.mi.	0.65 Sq.mi.	0.30 Sq.mi.	0.60 Sq.mi.	1.00 Sq.mi.
Receives Spillway Discharge from Upstream Reservoirs as Noted	—	None	Talcott(SCS)	No. 2	None	No. 5 & South(SCS)
Proposed Level of Top of Dams & Dikes	—	El. 407.5	El. 392.0	El. 327.0	El. 398.5	— ϕ
Proposed Spillway Crest Level	—	El. 400.6	El. 387.6	El. 321.8	El. 393.5*	— ϕ
Surcharge Storage - Acre feet / foot	—	135	42	24	24	26
PROJECT STORM						
Total Rainfall	18.24"					
Storm Duration	34 hrs					
Maximum One-Hour Rainfall	1.61"					
Maximum Run-Off Rate (Independent area)	900 cfs	1,880 cfs	590 cfs	270 cfs	520 cfs	900 cfs
Maximum Inflow Rate		1,880 cfs	620 cfs	690 cfs	520 cfs	1,960 cfs
Maximum Reservoir Level		El. 404.2	El. 389.6	El. 324.3	El. 397.2*	— ϕ
Maximum Discharge Rate		1,080 cfs	490 cfs	670 cfs	420 cfs*	— ϕ
EMERGENCY STORM						
Total Rainfall	18.24"					
Storm Duration	24 hrs					
Maximum One-Hour Rainfall	6.35"					
Maximum Run-Off Rate (Independent area)	2,900 cfs	5,960 cfs	1,930 cfs	880 cfs	1,730 cfs	2,970 cfs
Maximum Inflow Rate		5,960 cfs	1,980 cfs	2,110 cfs	1,730 cfs	6,190 cfs
Maximum Reservoir Level		El. 407.0	El. 391.6	El. 326.5	El. 398.1*	— ϕ
Maximum Discharge Rate		1,460 cfs	1,300 cfs	1,770 cfs	1,730 cfs*	— ϕ

Notes: All elevations are referred to Met. Dist. Datum.
(SCS) Indicates Flood Detention Reservoirs presently being built by the Soil Conservation Service.
* Reservoir No. 3 discharges include flows over bituminous surfaced emergency spillway with crest at El. 396.5.
ϕ Present discharge capability of Res. No. 1 is approximately 3,500 cfs over existing spillway crest at El. 258.6. No revisions are proposed at this time due to the need for additional field information and engineering study (currently in progress).

PROJECT STORM - The reservoir proposals are based on passing this storm with normal freeboard for wave and wind action. The storm is basically a repeat of the August 1955 storm, as it occurred over West-field, Mass., relocated to occur over the West Hartford reservoirs.

EMERGENCY STORM - The reservoir proposals are based on passing this storm with nominal freeboard. The storm is arbitrary and synthetic consisting of a 2-hour rainfall total of 13.55" (2/3 of maximum possible), preceded and followed by light rainfall.

B-13

WEST HARTFORD RESERVOIR NO. 1

Statistics Pertinent to PROPOSED EMERGENCY SPILLWAY

Watershed Area -

1.30	Sq. mi.	above	South Flood Control Reservoir
0.60	"	"	" Reservoir No. 3
1.50	"	"	" Reservoir No. 5 (including Reservoir No. 2 and 30% of Talcott Flood Control Reservoir)
1.00	"	"	Independent
4.40	"	"	TOTAL

Capacity of Reservoir - 137 Million Gallons or 420 Acre-Feet

Dam - Earth fill type, completed in 1868, maximum height of about 43 feet, top width of about 25 feet, top at El. 267.4 Met. Dist. Datum, 8.8-foot freeboard on principal spillway.

Principal Spillway - Concrete weir, crest at El. 258.6, about 45 feet long. Discharge channel in earth cut, base width about 18 feet, dry rubble toe walls, average invert slope of about 0.01. Stone masonry arch bridge over spillway channel, 18-foot span and 12-foot height.

Proposed Emergency Spillway - Earth cut, 100-foot base width, invert crest at El. 264.0 with 0.01± slope.

Maximum Flood on Record (99-years of record) -

Occurred in August 1955 when the reservoir was empty and resulted in maximum water level at El. 261.6±, or 3.0 feet above crest of principal spillway and leaving 5.8 feet of freeboard. Principal spillway peaked at 600 to 700 cubic feet per second (cfs).

Repeat of Maximum Flood on Record -

If the August 1955 storm reoccurred with the reservoir full at the start of the storm and including the effects of upstream reservoirs and improvements built since 1955, the reservoir level would again crest at El. 261.6, or 3.0 feet above crest of principal spillway and leaving 5.8 feet of freeboard on the dam. This maximum water level would still be 2.4 feet below the crest of the emergency spillway.

Water Bureau's Project Storm -

This storm is a reconstruction of the August 1955 rainfall over a 20-square mile area in Westfield, Mass. transposed to our West Hartford Reservoirs. This storm totals 18.24 inches in 34 hours and is the design storm used for the Park River Flood Detention Reservoirs. The reservoir level would crest at El. 264.7, or 6.1 feet above crest of principal spillway and leaving 2.7 feet of freeboard. Principal spillway would peak at 1,650 cfs and the emergency spillway, with an 0.7-foot overflow head, would peak at 170 cfs with 0.4-foot flow depth and 4.0-foot per second (fps) velocities.

Maximum Spillway Capacities -

With the reservoir level a nominal 6" below the top of the dam, the principal spillway would discharge about 2,500 cfs and the emergency spillway would discharge about 1,500 cfs with about 2-foot flow depth and velocities of about 8 fps. This 4,000 cfs total discharge capacity is approximately two times the peak inflow rate from the project storm and three times the peak inflow rate from a repeat of the August 1955 storm.

WEST HARTFORD RESERVOIR NO. 1

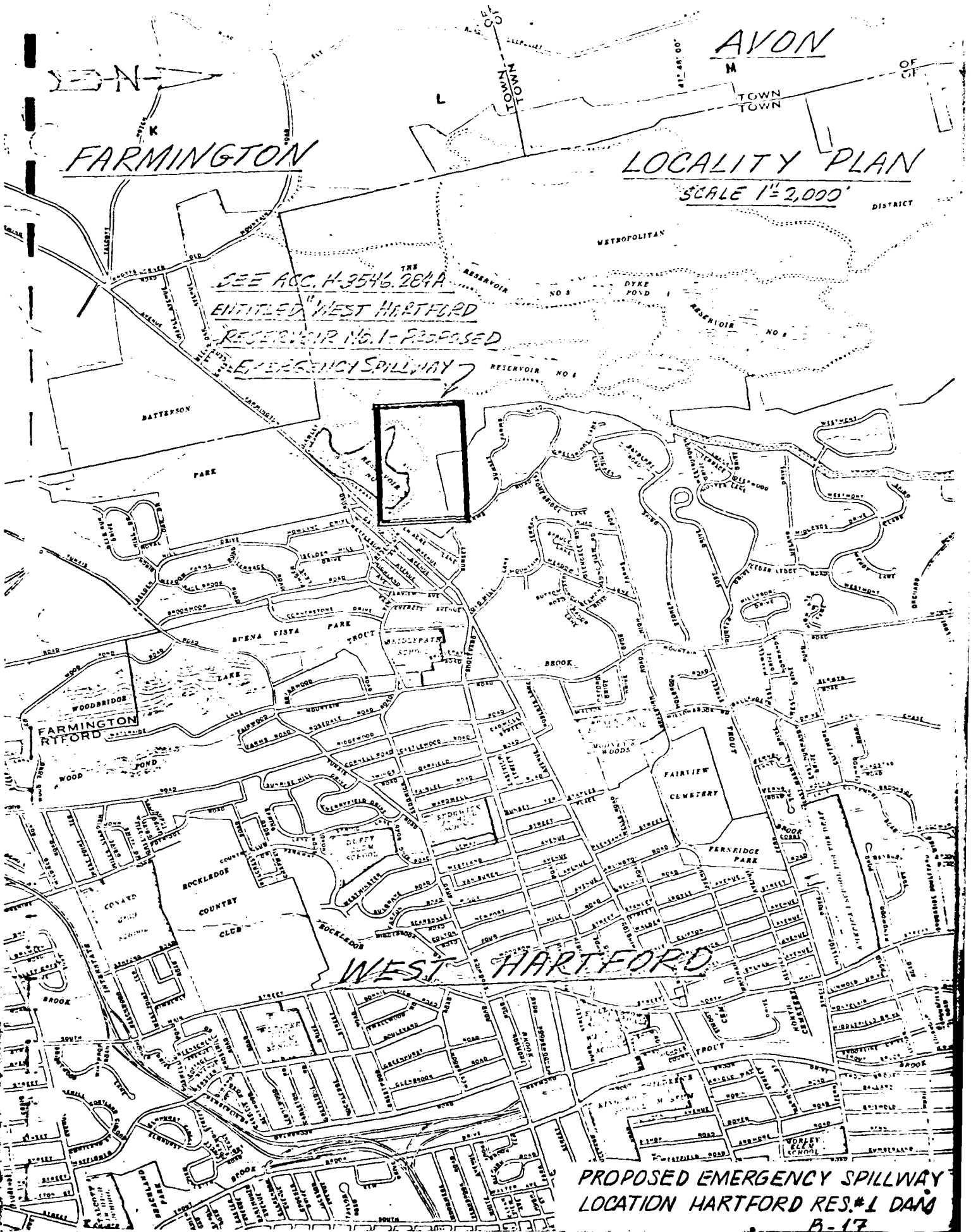
Statement of Purpose for PROPOSED EMERGENCY SPILLWAY

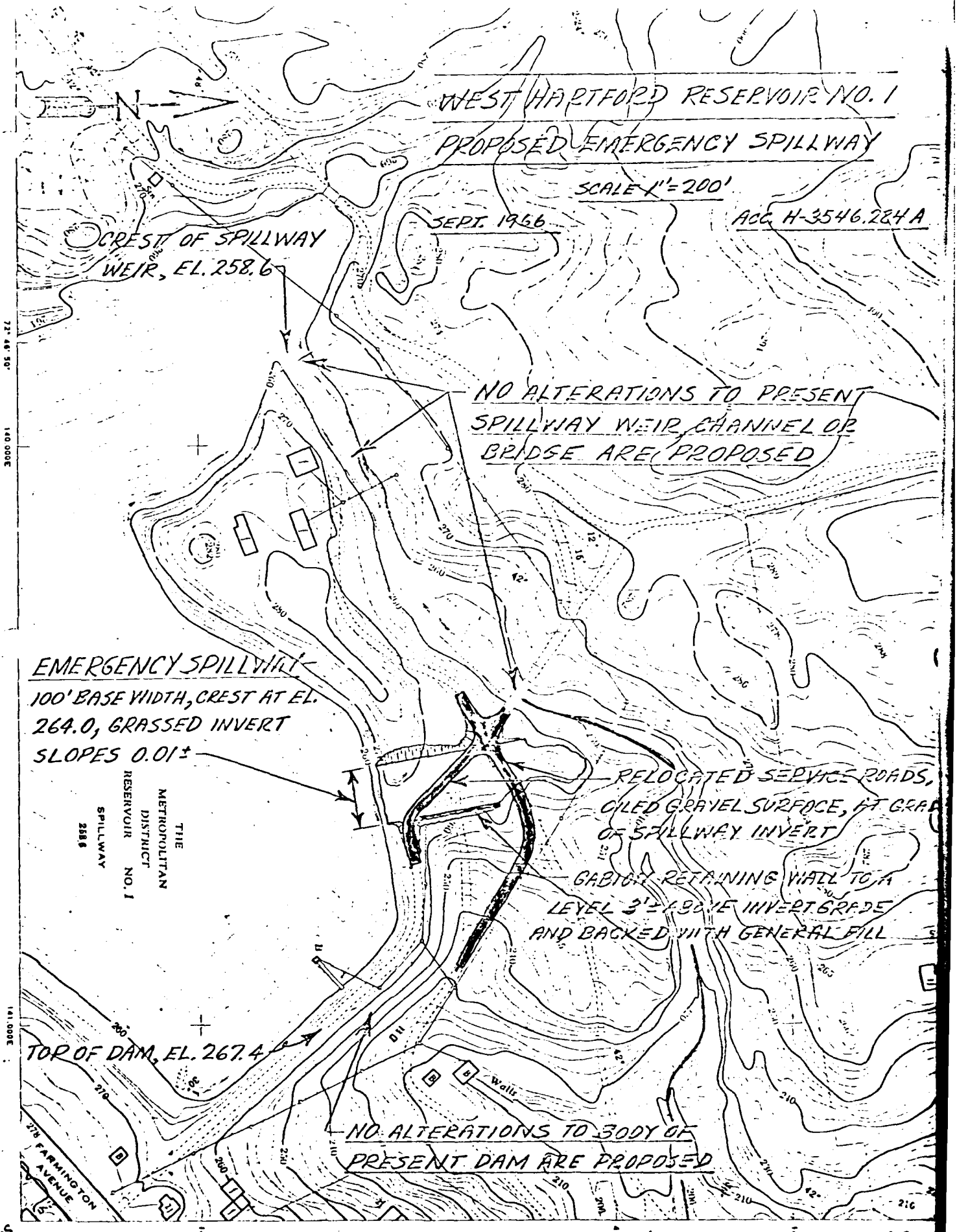
In the fall of 1964, the Water Bureau made certain revisions to its Reservoirs 2, 3, 5 and 6 in West Hartford and Bloomfield, to improve their hydrologic capacity and safety. Since major structural changes to a dam were required only on Reservoir 5, a formal construction permit was issued by your Commission for that project and the balance of the improvements were authorized without formal permits.

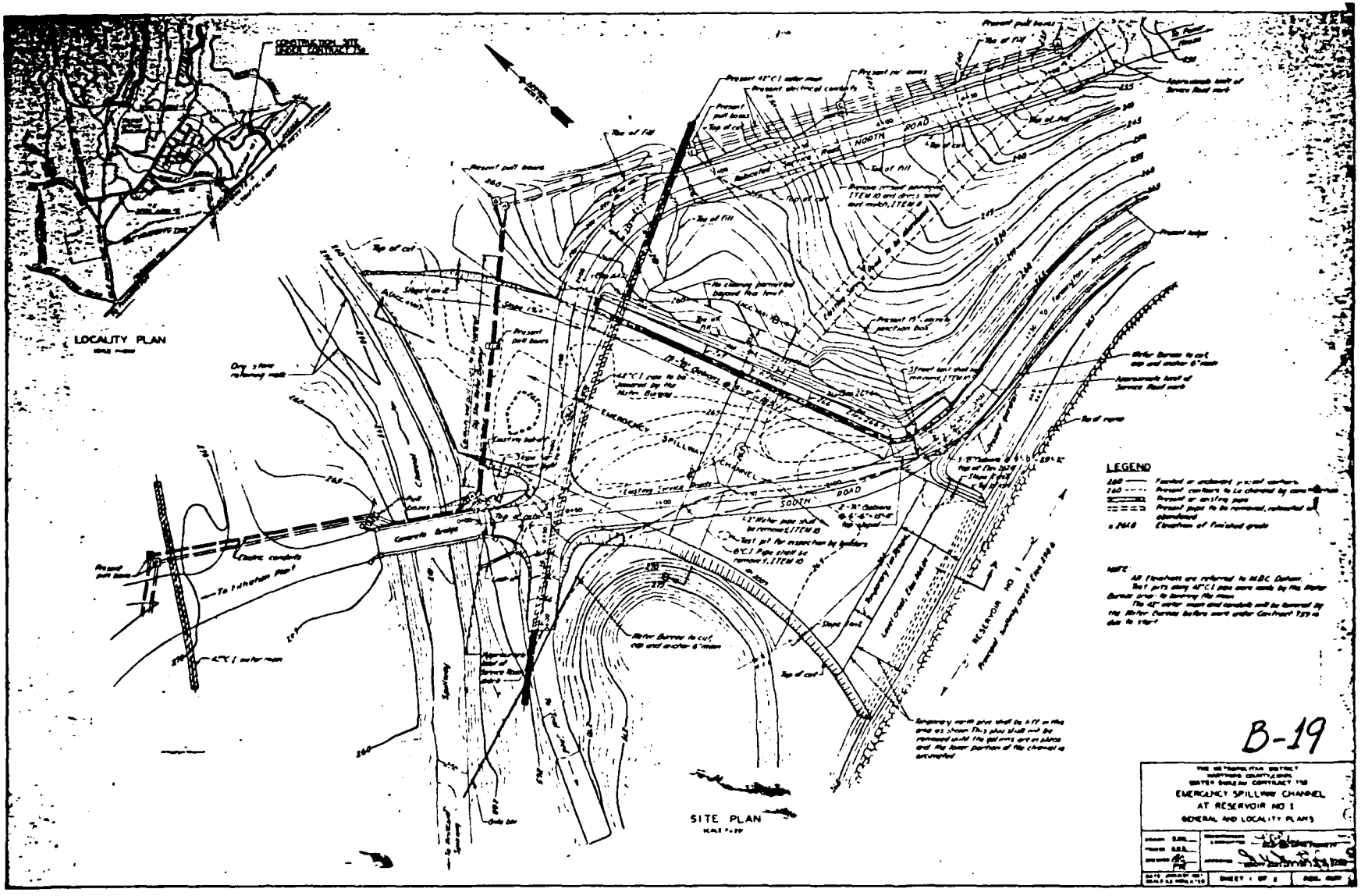
No improvements to Reservoir 1 were made at that time since the necessary field work and engineering studies were not complete. Unlike the other reservoirs, Reservoir 1 is not vital to the operations and safety of our Water Treatment Plant, so that the expense of any improvements must be justified only by the increased safety to property downstream thereof. To this end, we propose to construct an emergency spillway to augment the existing principal spillway. It would be constructed at such a level that the existing principal spillway would discharge twice its maximum flow on record before the emergency spillway would start to function. The emergency spillway would function to prevent overtopping of the dam proper for larger flows.

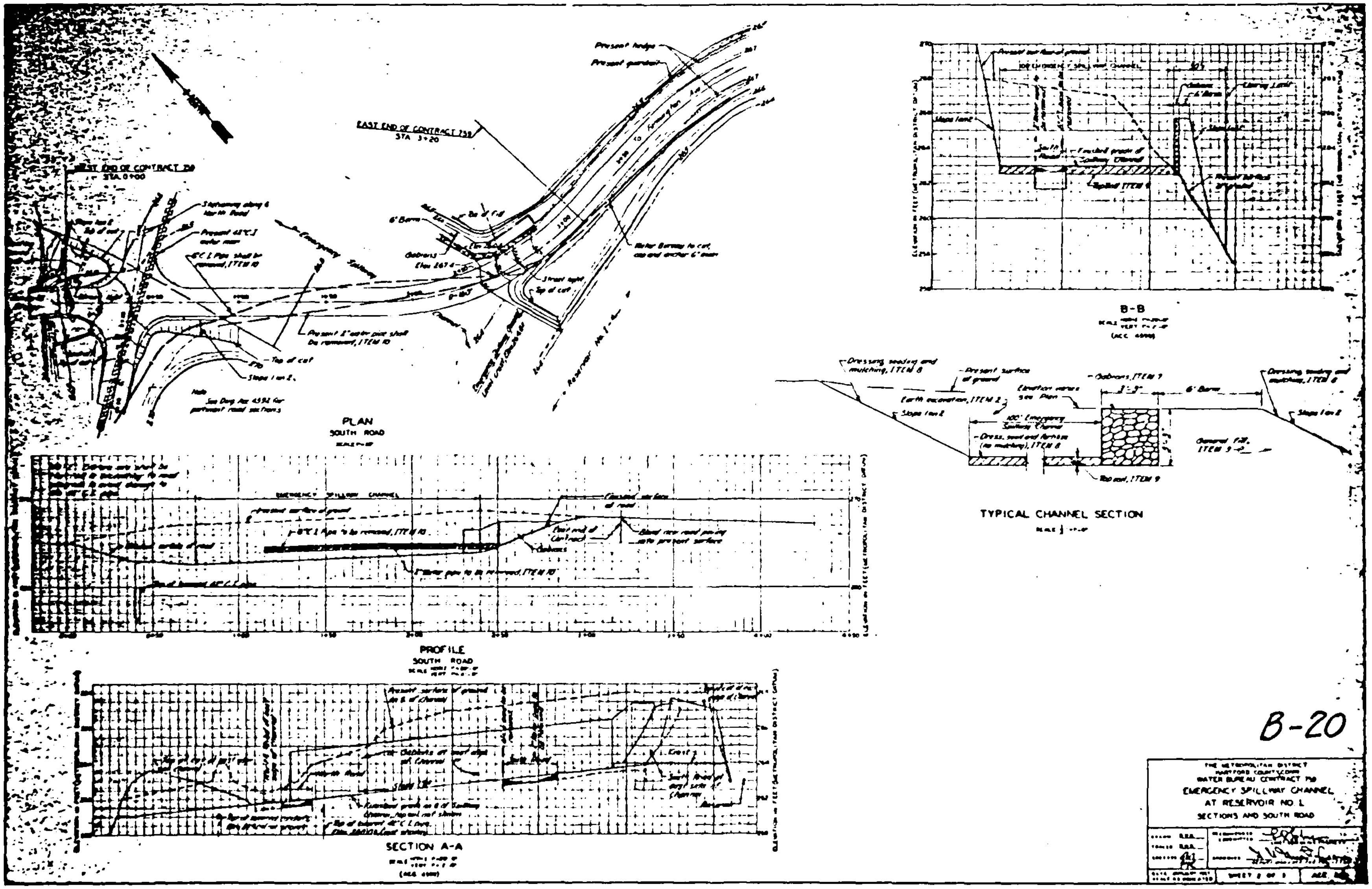
Attached is a locality plan, a plan of the proposed improvements, a tabulation of pertinent physical and hydrologic statistics, and a set of the proposed contract and construction drawings. This proposal was discussed in general in October 1965 with Mr. Curry and our engineering staff. The "gabions" are galvanized wire mesh baskets filled with quarry stone and would prevent flow and scour along the toe of the dam. The overflow velocities are within the design range of the Soil Conservation Service flood detention dams and the oiled gravel roads across the invert would minimize the chance of scour.

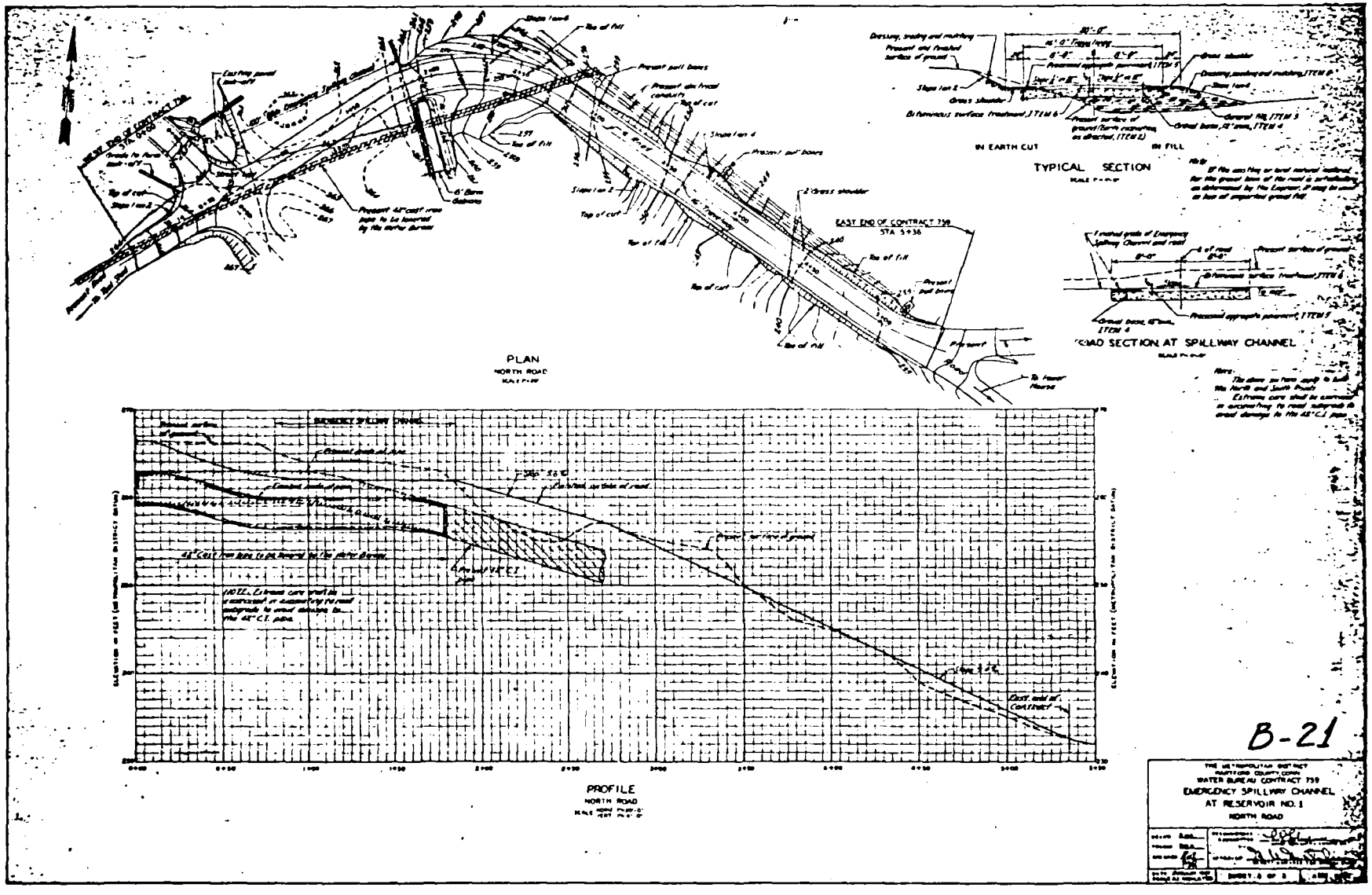
Funds are available in the 1967 Water Bureau budget for this work and it should be completed before the 1967 hurricane season if possible. To accomplish this, we must lower the 42-inch water main crossing the spillway area by April 1 so that early receipt of the permit is vital.

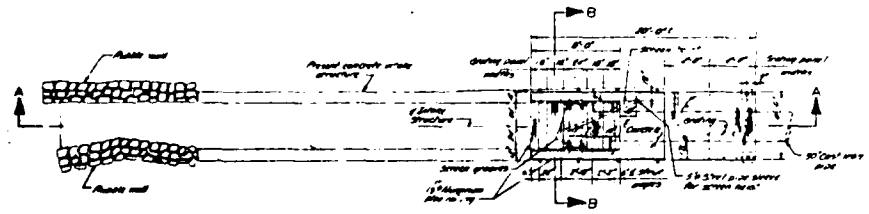

AVON
FARMINGTON
LOCALITY PLAN
SCALE 1"=2,000'
SEE ACC. H-3546.284A
ENTITLED "WEST HARTFORD
RESERVOIR NO. 1 - PROPOSED
EMERGENCY SPILLWAY"
WEST HARTFORD
FARMINGTON
RYFORD
PROPOSED EMERGENCY SPILLWAY
LOCATION HARTFORD RES.#1 DAM
B-17


WEST HARTFORD RESERVOIR NO. 1
PROPOSED EMERGENCY SPILLWAY
SCALE 1"=200'
SEPT. 1966
ACC. H-3546.284A
CREST OF SPILLWAY WEIR, EL. 258.6
NO ALTERATIONS TO PRESENT SPILLWAY WEIR, CHANNEL OR BRIDGE ARE PROPOSED
EMERGENCY SPILLWAY
100' BASE WIDTH, CREST AT EL. 264.0, GRASSED INVERT SLOPES 0.01±
THE METROPOLITAN DISTRICT RESERVOIR NO. 1 SPILLWAY 258.6
RELOCATED SERVICE ROADS, OILED GRAVEL SURFACE, AT GRADE OF SPILLWAY INVERT
GABION RETAINING WALL TO A LEVEL 3'± ABOVE INVERT GRADE AND BACKED WITH GENERAL FILL
TOP OF DAM, EL. 267.4
NO ALTERATIONS TO BODY OF PRESENT DAM ARE PROPOSED
Walls
278 FARMINGTON AVENUE
Sheet 3
B-18

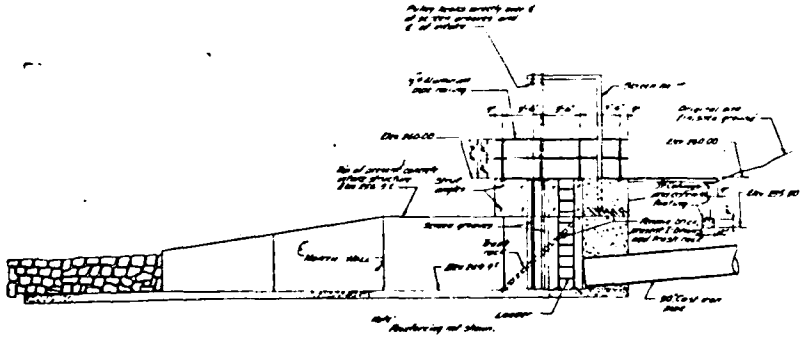

LOCALITY PLAN
SITE PLAN
LEGEND
EMERGENCY SPILLWAY CHANNEL
AT RESERVOIR NO 1
GENERAL AND LOCALITY PLANS
B-19


EAST END OF CONTRACT 739
STA 3+20
WEST END OF CONTRACT 739
STA 0+00
Present hedge
Present guardrail
PLAN
SOUTH ROAD
PROFILE
SOUTH ROAD
EMERGENCY SPILLWAY CHANNEL
SECTION A-A
B-B
TYPICAL CHANNEL SECTION
Dressing, seeding and mulching, ITEM 8
Present surface of ground
Gabions, ITEM 7
6' Berm
Earth excavation, ITEM 2
Slope 1 on 2
General Fill, ITEM 3
Topsoil, ITEM 9
B-20
THE METROPOLITAN DISTRICT
HARTFORD COUNTY, CONN.
WATER BUREAU CONTRACT 739
EMERGENCY SPILLWAY CHANNEL
AT RESERVOIR NO. 1
SECTIONS AND SOUTH ROAD

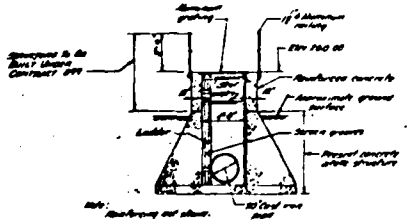

EAST END OF CONTRACT 739
STA 5+36
IN EARTH CUT
IN FILL
TYPICAL SECTION
PLAN
NORTH ROAD
ROAD SECTION AT SPILLWAY CHANNEL
PROFILE
NORTH ROAD
B-21
THE METROPOLITAN WATER DIST. OF SOUTHERN CALIF.
WATER BUREAU CONTRACT 739
EMERGENCY SPILLWAY CHANNEL
AT RESERVOIR NO. 1
NORTH ROAD



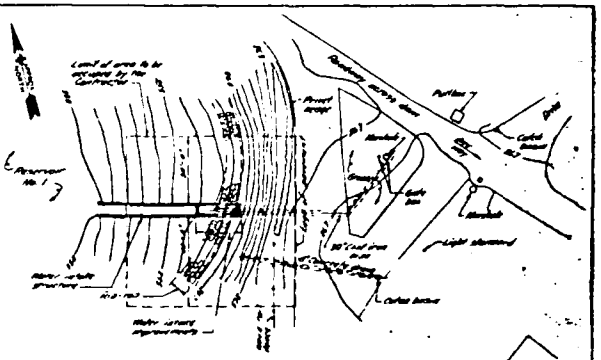
PLAN



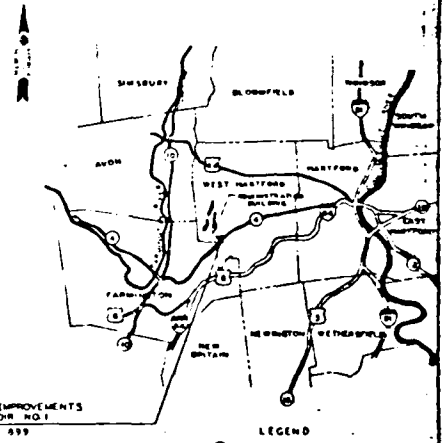
SECTION A-A



B-B



SITE PLAN



LOCALITY PLAN

LEGEND

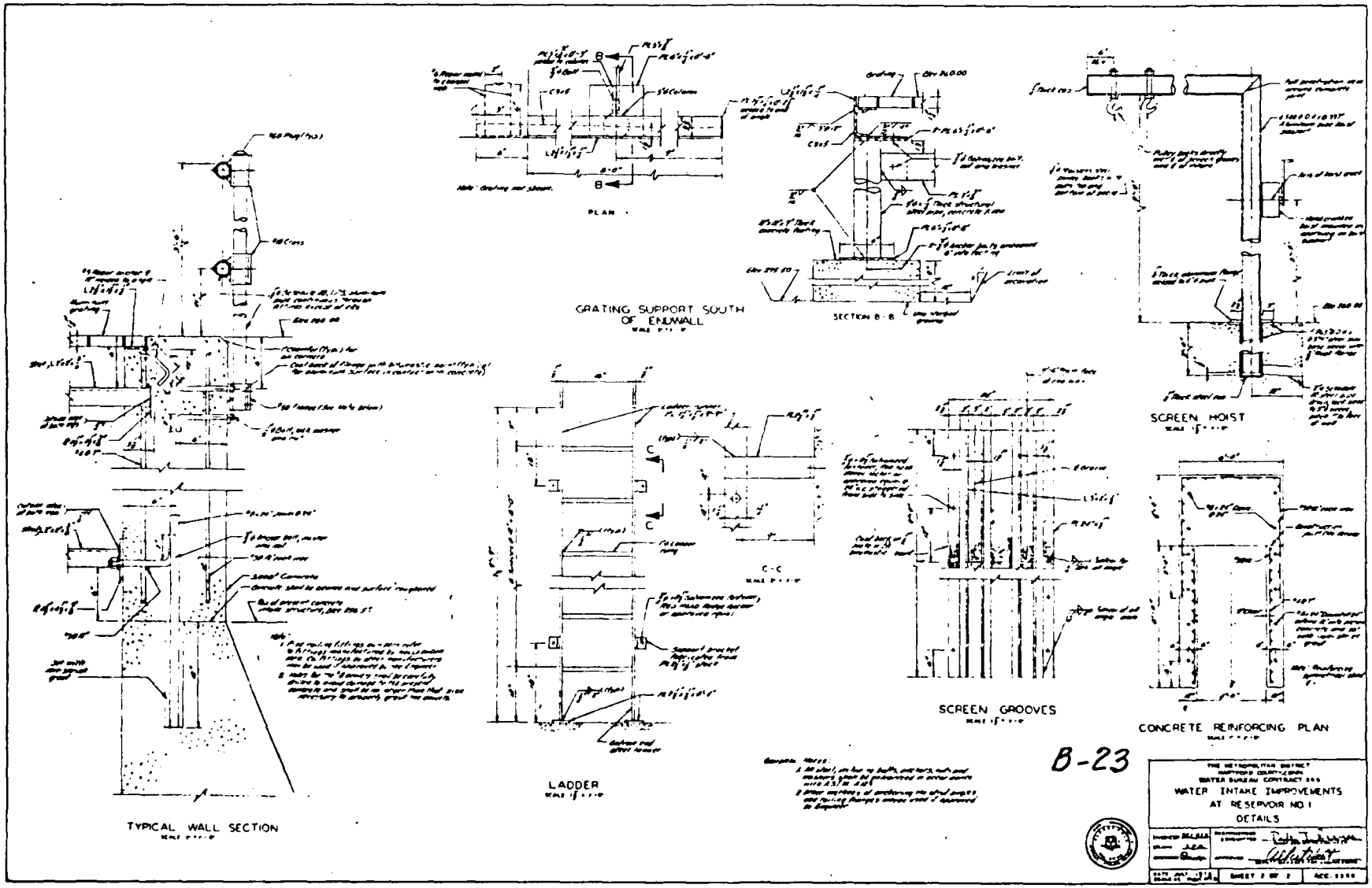
WATER INTAKE IMPROVEMENTS
AT RESERVOIR NO. 1
CONTRACT 699

B-22

THE METROPOLITAN DISTRICT
HARTFORD COUNTY, CONN.
WATER BUREAU CONTRACT 699

WATER INTAKE IMPROVEMENTS
AT RESERVOIR NO. 1
PLAN AND SECTIONS

SHEET 1 OF 2



B-23

THE METROPOLITAN DISTRICT
WATER BUREAU CONTRACT
WATER INTAKE IMPROVEMENTS
AT RESERVOIR NO 1
DETAILS

Elevations Top of Piezometer Pipes, M.D.C. Datum

	P-1 T		P-2 (M)		P-3 (B)		P-4 T		P-5 (M)		P-6 (B)	
Top of Piezometer →	El. 268.05		El. 247.71		El. 226.04		El. 268.31		El. 249.99		El. 229.10	
Ground El →	El. 267.3		El. 245.9 ±		El. 225.2		El. 267.3		El. 248.6 ±		El. 228.1	
Date ↓	Reading	El. Water	Reading	El. Water	Reading	El. Water	Reading	El. Water	Reading	El. Water	Reading	El. Water
July 18, 77	20.7	Dry	21.9	Dry	3.0	223.0	20.2	Dry	21.2	@ 228.8 Wet	5.1	224.0
July 19, 77	20.7	Dry	21.9	Dry	3.0	223.0	20.2	Dry	21.2	@ 228.8 Wet	5.5	223.6
1:35 PM					8.7	Pumped						
1:36 "					7.5							
1:37 "					6.8							
1:38 "					6.2							
1:39 "					5.6							
1:40 "					5.2							
July 20, 77	20.7	Dry	21.9	Dry	2.8±	223.2	20.2	Dry	21.2	@ 228.8 Wet	5.2	223.9
				Note:	Rain previous day and last night							
July 26, 77	20.7	Dry	21.9	Dry	2.55	223.49	20.2	Dry	21.2	@ 228.8 Wet	5.0	224.1
July 29, 77	20.7	0.2' muck	21.9	Dry	2.9	223.14	20.2	Dry	20.8	229.19	5.5	223.6
Aug 2, 77	20.7	0.1 muck	21.9	Dry	3.0	223.04	20.2	Dry	20.7	229.29	5.25	223.85
Rain previous night Aug 8, 77	20.7	0.1 muck	21.9	Damp	2.6	223.44	20.2	Dry	20.7	229.29	4.9	224.2
				Note:	Rain previous		day and last night					
Aug 15, 77	20.7	Damp	21.9	Damp	2.4	223.64	20.2	Dry	20.6	229.37	4.95	224.15
				Note:	Rain							
Aug 22, 77	20.7	0.1 muck	21.9	Damp	2.1	223.94	20.2	Dry	20.6	229.37	4.6	224.5
Elevation Bottom of Piezometer	El. 247.0±		El. 226.0±		El. 215.0±		El. 248.1±		El. 228.5±		El. 218.8 ±	

Water level in Piezometer rose 3.5' in 5 minutes

Subject: Piezometers at Reservoir No. 1 Dam

Computer | Checked by | Date | Acc. No. | File No.

B-24

Elevations Top of Piezometer Pipes, M.D.C. Datum

	P-1 Top		P-2 Mid		P-3 Base		P-4 Top		P-5 Mid		P-6 Base	
Top of Piezometer	El. 268.05		El. 247.71		El. 226.04		El. 268.31		El. 249.99		El. 229.10	
Ground El.	El. 267.3		El. 245.9		El. 225.2		El. 267.3		El. 248.6		El. 228.1	
Date	Reading	El. Water	Reading	El. Water (2518)	Reading	El. Water	Reading	El. Water	Reading	El. Water	Reading	El. Water
Aug. 29, 1977	20.8	Dry	21.9	Damp	2.0	224.0	20.2	Dry	20.6	229.4	5.2	223.9
9/6		"		"		223.9		"		229.4		223.8
9/12		"		"		223.5		"		229.25		223.55
9/19	20.8	Dry	21.9	"	2.0	224.0	20.2	"	20.5	229.5	Rained previous night 4.7	224.2
9/26					1	224.09						225.8
					Rain previous days & presently							
9/27	20.8	Damp	21.9	"		224.4	20.2	Damp	19.4	230.6		225.8
					Res high							
10/3	20.8	Damp	21.9	Damp		224.0		248.8		230.6		224.3
10/11	20.8	Dry	21.9	"		224.0	18.3	250.0		230.6		224.4
10/17	20.8	Damp	21.9	"		224.2		249.8		230.7		224.9
						Rained	Pr.	night				225.4
10/24	20.8	"	"	"		224.2		248.8		230.6		223.9
10/31	20.8	"	21.9	"		224.0		248.7		230.2		223.7
11/7/77	20.8	"	21.9	"		223.9		248.3		229.9		224.0
11/14/77	247	"	226 21.9	"		224.2		249.1		230.4		
Elevation bottom of Piezometer	El. 247.0±		El. 226.0±		El. 215.0 ±		El. 248.1 ±		El. 228.5 ±		El. 218.8 ±	

Computer | Checked by | Date

Subject: Piezometer Readings at Res #1 Dam

File No. B-25

Acc. No.

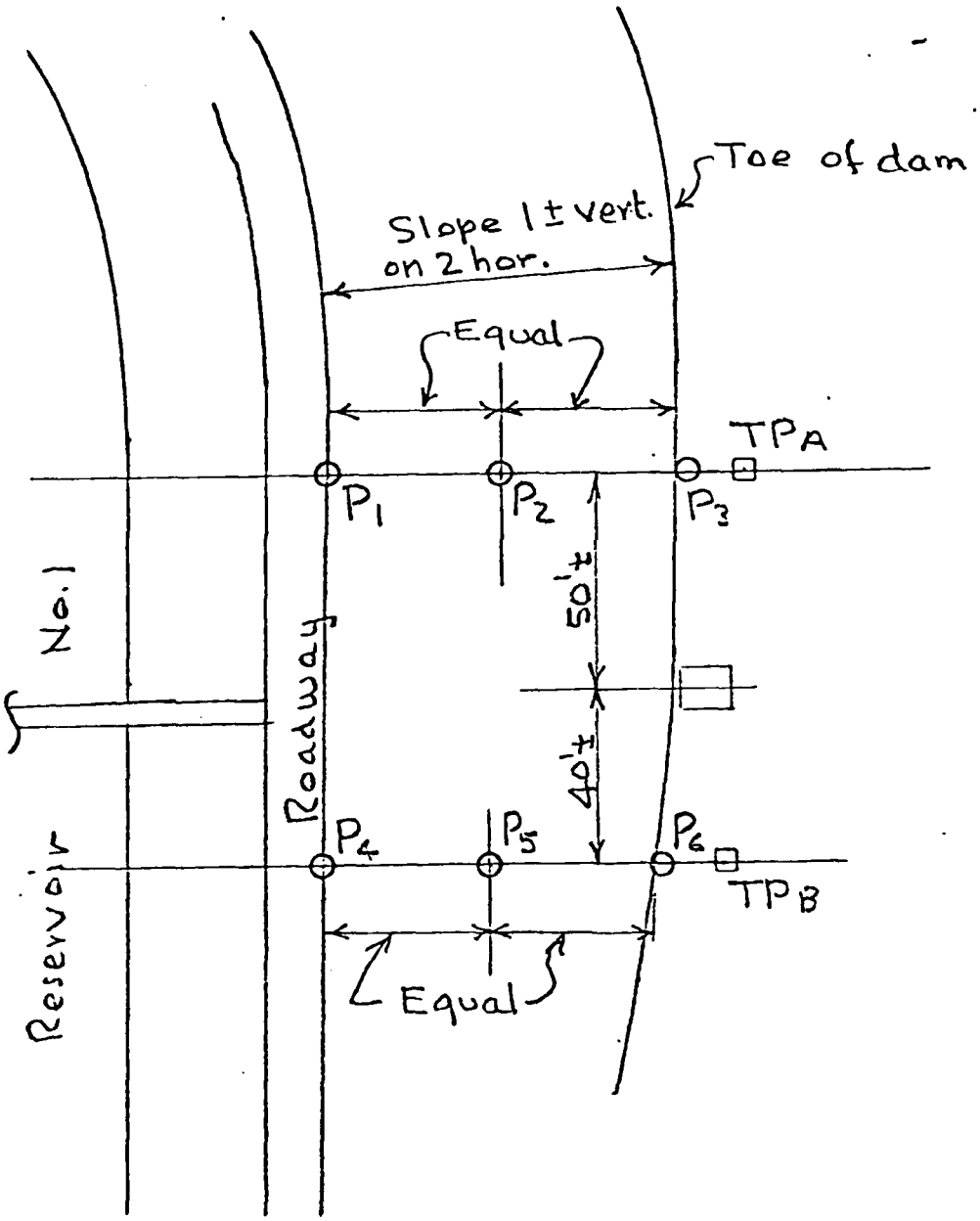
[redacted] Canal or Tan District Ring Office

Piezometer Readings

	P-1	P-2	P-3	P-4 (Surface Water ?)	P-5	P-6
Sept 6	Dry	Damp	223.9	Dry	229.4	223.8
Sept 12	Dry	Damp	223.5	Dry	229.25	223.55
Nov. 21 ???	20.8 Dup	21.9 Dup	224.2	248.6	230.3	223.9
Nov 28	20.8 Damp	21.9 Dp.	224.3	248.9	230.3	223.9
Dec 5	Dry	Damp	224.4	249.8	230.6	224

THE WATER BUREAU OF THE METROPOLITAN DISTRICT ENGINEERING OFFICE	SUBJECT Resvr No. 1 Dam - Toe Drainage Study - Piezometer & Test Pit Locations		S-1407
			FILE NO.
			ACC. NO. H-4530
	COMPUTER PJK	CHECKED BY	DATE Apr. '77

B-27

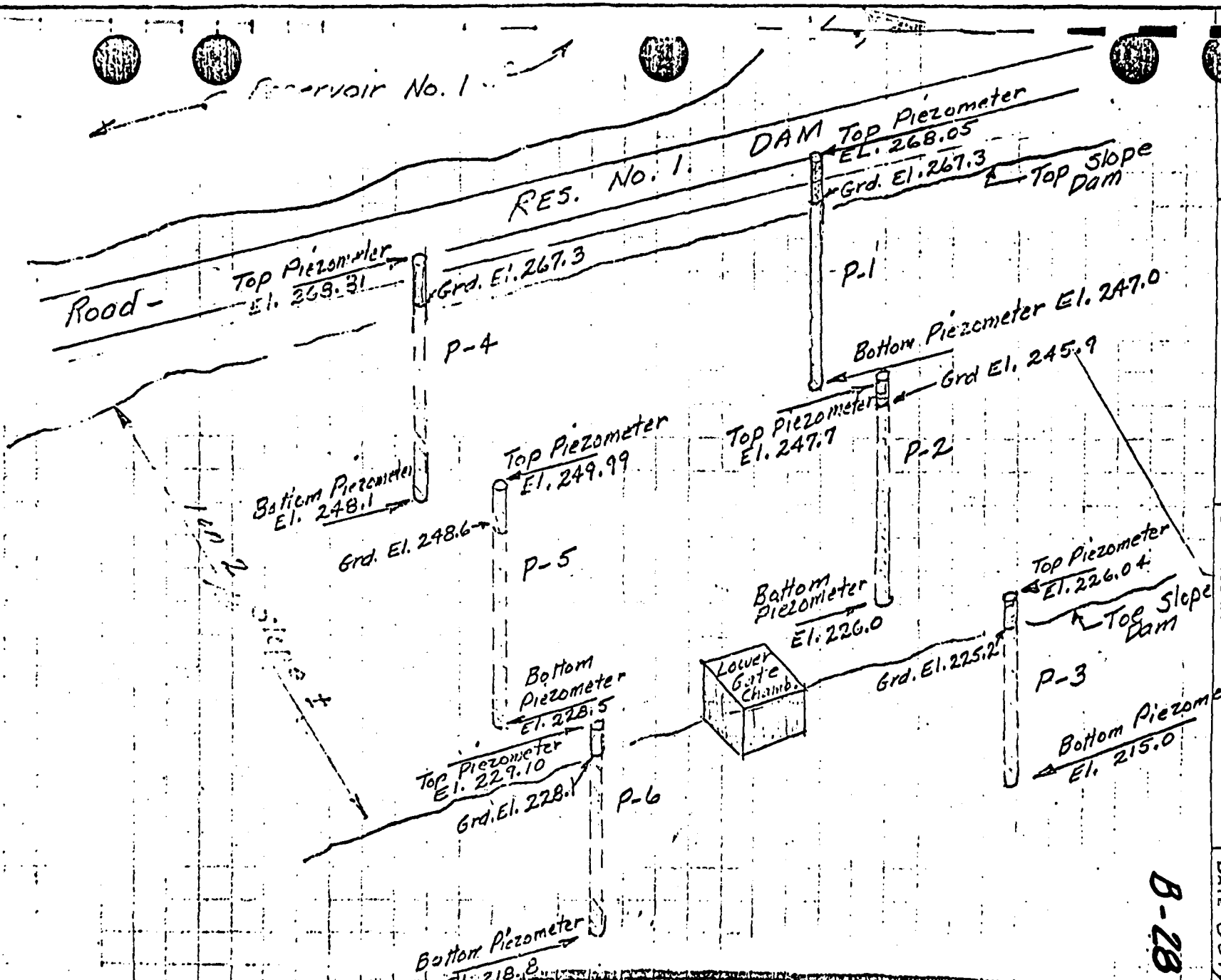


Piezometers

P_1, P_2, P_4, P_5	20 ft deep.
P_3, P_6	10 ft deep.

Test Pits

Hand dug, 4 ft deep, samples at 1, 2, 3, 4 ft.



B-28

METROPOLITAN WATER BUREAU OF METROPOLITAN DISTRICT ENGINEERING OFFICE

SUBJECT: Piezometers, Res. No. 1 Dam West Hartford

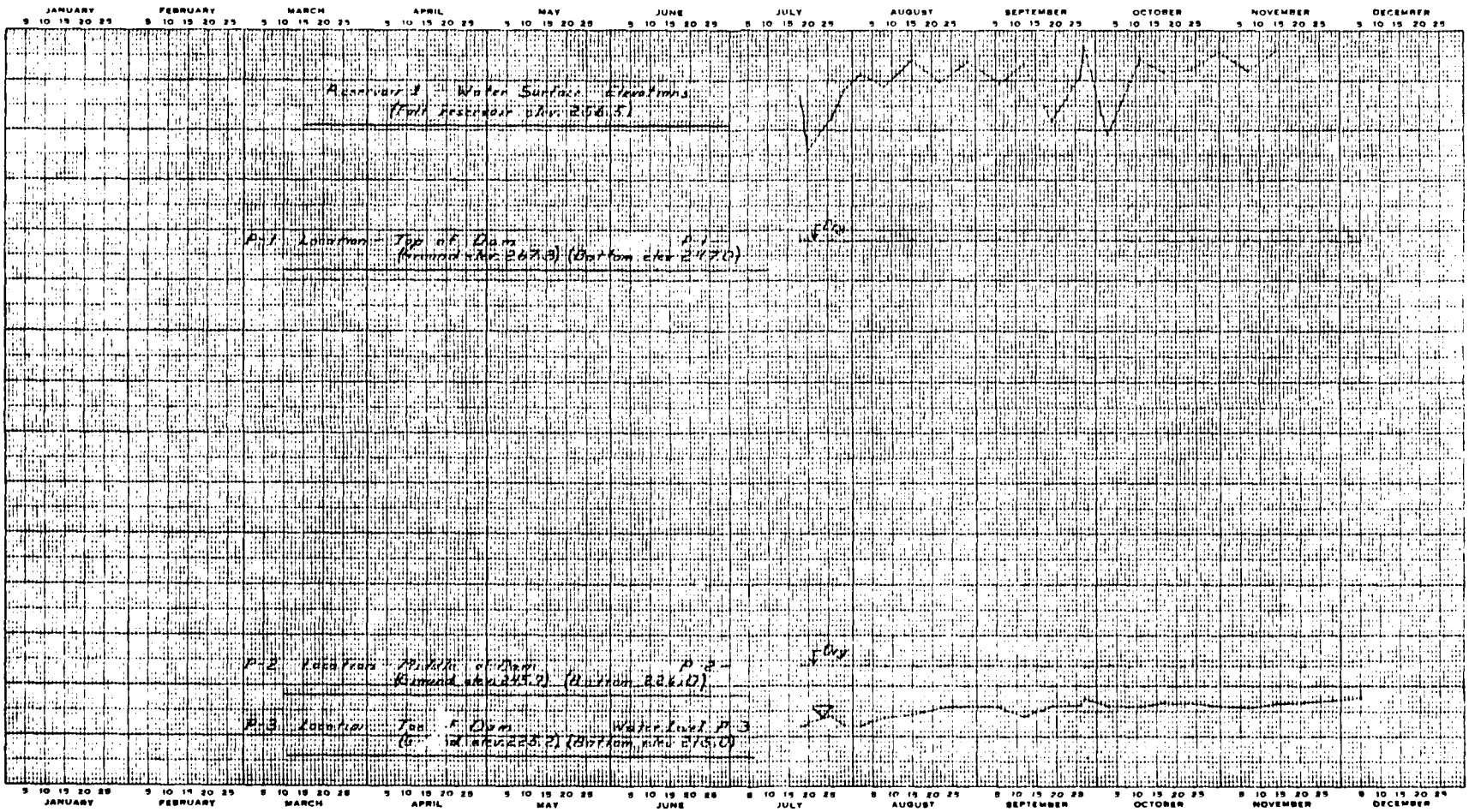
COMPUTER RJF | CHECKED BY | DATE July, 1977

FILE NO. | ACC. NO.

RESERVOIR 1 DAM PIEZOMETER WATER LEVELS

H-4630-19

1977

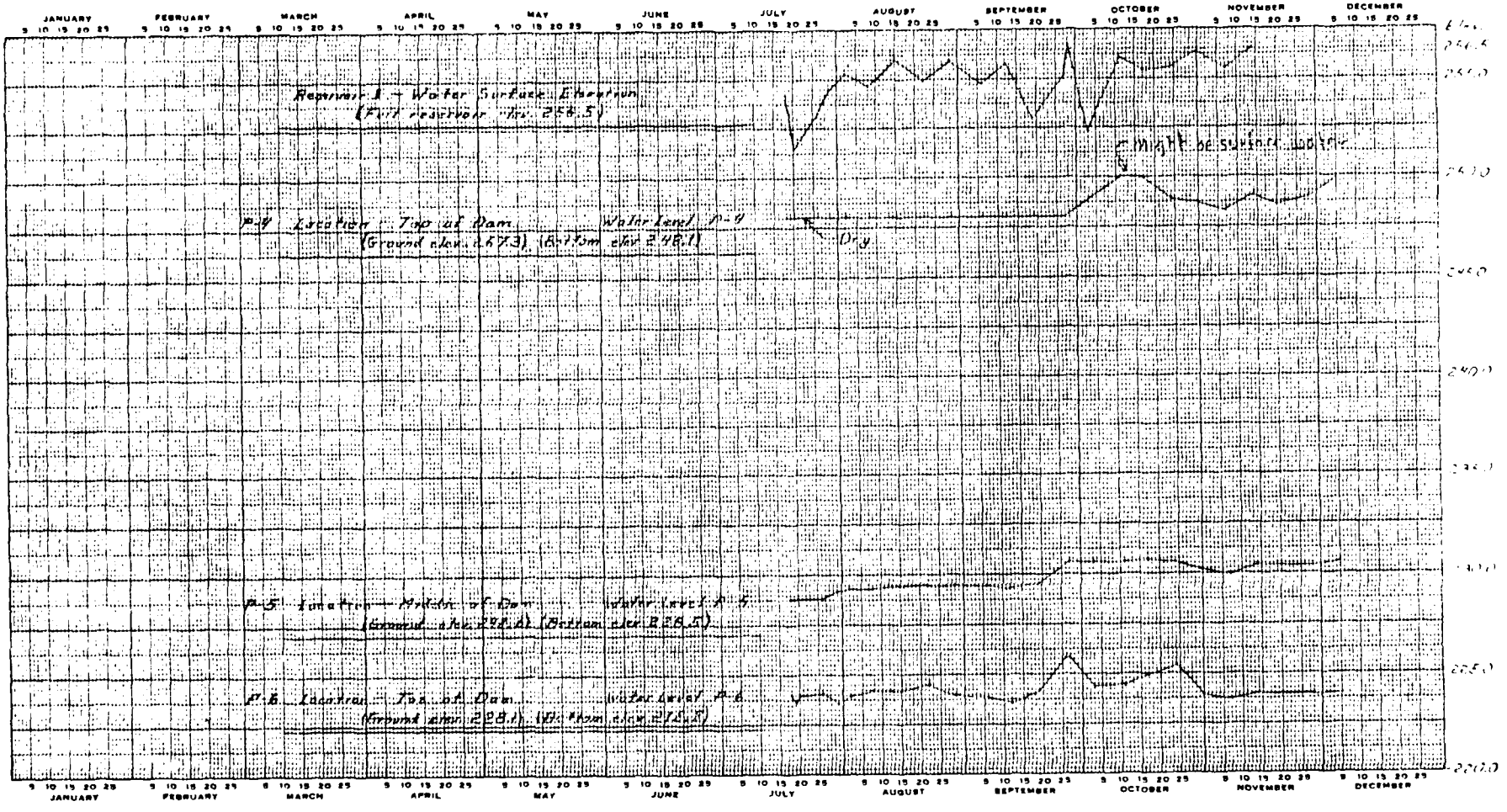


8-29

RESERVOIR 1 DAM PIEZOMETER WATER LEVELS

H-4630-17

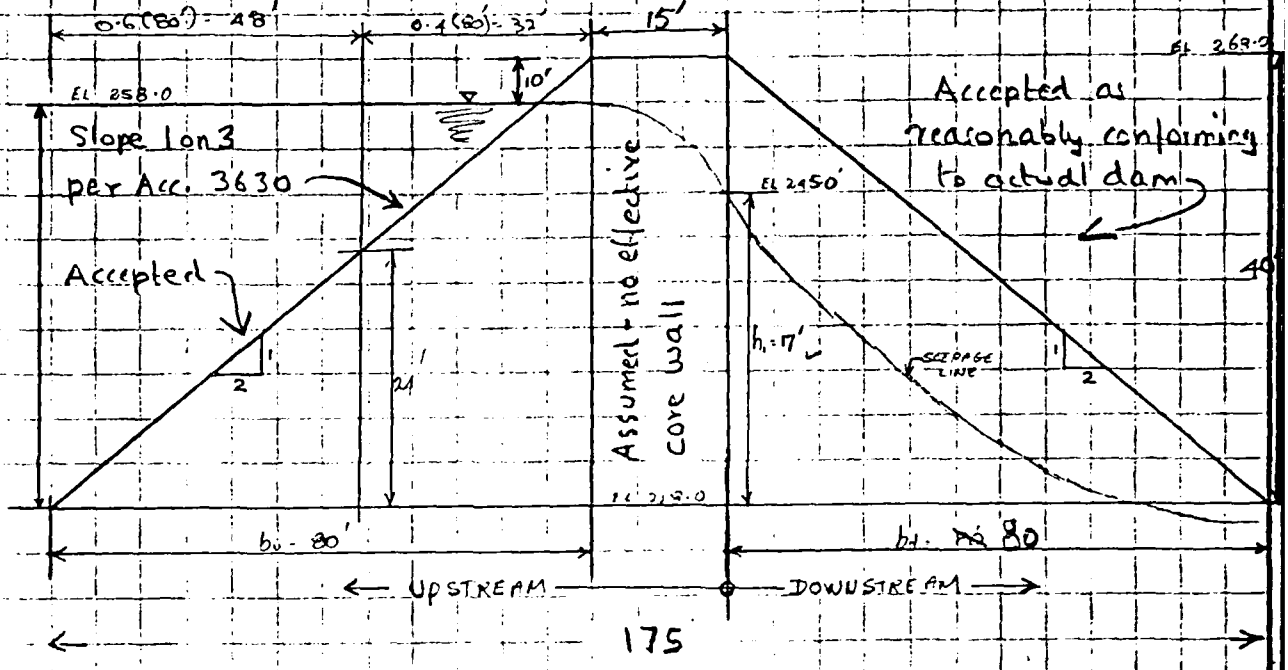
1977



B-30

FORM 3-8
THE WATER BUREAU OF
THE METROPOLITAN DISTRICT
ENGINEERING OFFICE

SUBJECT RESERVOIR #1 DAM	
STABILITY ANALYSIS	FILE NO.
	ACC. NO. H-4631-1
COMPUTER DED / CHECKED BY TTK	DATE AUGUST, 1978



REFERENCES:-(1) ENGINEERING FOR DAMS, JUSTIN HINDS & CREAGER Vol II
(2) SOIL MECHANICS & ENGINEERING PRACTICES, TERZAGHI & PECK.

ASSUMPTIONS: BASED ON SIEVE ANALYSIS CLASSIFICATION OF SOIL IN THE VICINITY (TOE DRAIN PROJECT) THE SOIL CHARACTERISTICS SHOULD CLOSELY APPROXIMATE THOSE CHARACTERISTICS WHICH ARE DISPLAYED BY CATEGORY #4 OF TABLE 6.3 ON PAGE 28 OF TERZAGHI AND PECK (par. 30%, e = 0.43, 116 lb/c.f. dry, 135 lb/c.f. sat.) – Also 12% moist –

FROM LACK OF READILY AVAILABLE INFORMATION ASSUME THAT THE ADJUNCTS OF THE MAIN EMBANKMENT HAVE A NEGLEGIBLE EFFECT ON THE STRUCTURE. WHEN TAKEN INTO ACCOUNT THESE ADJUNCTS WILL HAVE A POSITIVE INFLUENCE ON THE SAFETY OF THE STRUCTURE.

THE MAIN DIMENSIONS OF THE STRUCTURE ARE AS IN THE DIAGRAM ABOVE. MOST OF THESE DIMENSIONS WERE TAKEN FROM THE PRELIMINARY TOE DRAIN PROJECT STUDIES.

FORM 3-B
THE WATER BUREAU OF
THE METROPOLITAN DISTRICT
ENGINEERING OFFICE

SUBJECT RESERVOIR #1 DAM
STABILITY ANALYSIS

FILE NO.
ACC. NO. H-4631-2

COMPUTER D.F.D. CHECKED BY PTK

DATE AUGUST 1978

STABILITY OF EARTH DAM AGAINST FULL WATER PRESSURE

ASSUME THAT 65% OF MATERIAL IS SUBMERGED (Reasonable)

UNIT WEIGHT $0.65\left(135\ \#/ft^3 - 62.5\ \#/ft^3\right) = 47.13\ \#/ft^3$ (72.5 #/ft³)

ASSUME THAT 35% OF MATERIAL IS MOIST

UNIT WEIGHT $= 0.35(132\ \#/ft) = 43.4\ \#/ft^3$

AVERAGE EFFECTIVE UNIT WT OF X-SECTION $= 90.53\ \#/ft^3$ ✓

X-SECTIONAL AREA $= \frac{175 + 15}{2} \times 10 = 1800\ ft^2$

EFFECTIVE WEIGHT OF SECTION 1 FT WIDE $= 1800\ ft^2 \times 1\ ft \times 90.53\ \#/ft^3$

$= 344,014\ \# = 172\ TON$ ✓

AVERAGE PRESSURE $= \frac{172\ TON}{175\ ft^2} = 0.98\ TON/ft^2$ ✓

SHEAR RESISTANCE $= 172\ TON \times \tan 26°$ ← Conservative *

$= 172\ TON \times 0.49 = 85.83\ TON$

$\tan 26\frac{1}{2}°$ for $26\frac{1}{2}°$

HEADWATER PRESSURE $= \frac{62.5 \times 30^2}{2} = 28125\ \#/ft = 14.06\ TONS/ft^2$

OVERALL F.O.S. $= \frac{85.83}{14.06} = 6.1$ — Very safe.

AVERAGE SHEAR $= \#/L = \frac{14.06}{175} = 0.08\ TON/ft^2$

* At Hogback for sandy gravel used 38° (Acc. H-2630, DS-1)
However Peck, Hanson & Thornburn "Foundation Engineering" 1965, p. 91 give 27°-30° for silt, loose, 30°-35° dense silt.

FORM 3-6
THE WATER BUREAU OF
THE METROPOLITAN DISTRICT
ENGINEERING OFFICE

SUBJECT: RESERVOIR #1 DAM — STABILITY ANALYSIS

FILE NO.

ACC. NO. H-4631-3

COMPUTER D.C.S. CHECKED BY PJF DATE AUGUST 1958

HORIZONTAL SHEAR ON DOWNSTREAM PORTION OF DAM.

J.H.& C book, p. 717

$H_d = \frac{h_w^2 \tan^2(45^\circ - \frac{\phi}{2})}{2} + \frac{W_{sh} \cdot h}{2}$

$= \frac{(40')^2 (50.53\ \#/ft^3) \tan^2(45^\circ - 12.25^\circ)}{2} + \frac{62.5\ \#/ft^3 \times (17')^2}{2}$

$= 27,233.81 + 9031.25 = 36,765.06\ \# = 18.38$ TON

$S_d = \frac{(40')^2 (50.53\ \#/ft^3) \tan^2(45^\circ - 12.25^\circ)}{2 \times 80} + \frac{62.5\ \#/ft^3 \times (17')^2}{2 \times 80} = \frac{18.38}{ep}$

$= 0.23$ TON/ft AVERAGE UNIT STRESS

S_{md} = MAXIMUM UNIT STRESS $= 2 \times S_d = 2 \times 0.23 = 0.46$ TON/ft

No cohesion assumed below.

RESISTING FORCE $= R_d = W_{od} \times \tan\phi + C_{bd}$

TOTAL AREA OF DOWNSTREAM PORTION OF DAM $= \frac{80 \times 40}{2} = 1600\ ft^2$

AREA UNDER STRUCTURE $= \frac{17 \times 80}{2} = 680\ ft^2$

2, error small.

$W_{od} = 680\ ft^2 \times 72.5\ \#/ft^3 \times 1\ ft + 980\ ft^2 \times 1 \times 124\ \#/ft^3$

$= 24.65$ TONS $+ 60.76$ TONS $= 85.41$ TON

$R_d = 85.41 (0.499) = 42.62$ TON

$F_p = \frac{R_d}{H_d} = \frac{42.62}{18.38} = 2.32$ (2 min. desirable)

UNIT STRESS @ FT OF MAX STRESS $= 24\ ft \times 124\ \#/ft^3 \times 1\ ft \times 0.499 = 0.74$ TON/ft

F.O.S @ THIS POINT $= \frac{0.74}{0.46} = 1.61$ (1.5 desirable min.)

Adequate

FORM 5-B
THE WATER BUREAU OF THE METROPOLITAN DISTRICT
ENGINEERING OFFICE

SUBJECT: RESERVOIR # 1 DAM
STABILITY ANALYSIS

FILE NO.
ACC. NO. H-4631-4
COMPUTER [illegible] CHECKED BY PJK
DATE AUGUST 1955

HORIZONTAL SHEAR ON UPSTREAM PORTION OF DAM (Drawdown condition)

$$H_U = \frac{h^2 w \tan^2(45° - 13.25°)}{2} + \frac{w_w h^2}{2}$$

0.615

$$= \frac{(40')^2 \times 135\ \#/ft^3 \tan^2(45° - 13.5°)}{2} + 62.5\ \#/ft^3 \times \frac{17^2}{2}$$

$$= 41357.161 + 9031.25 = 50388.41\ \# = 25.2\ \text{TON}$$ ✓

Slope Section

AREA OF UPSTREAM PORTION OF DAM = 60' × 40' = 1600 Ft² + 15' × 40'

EFFECTIVE WEIGHT (UNIT) UNDER SUBMERGED CONDITIONS

$= 135\ \#/ft^3 = 67.5\ \#/ft^3$

TOTAL EFFECTIVE WEIGHT = (600 + 1600) Ft² × 1 Ft × 72.5 #/ft³

= 159,500 # = 79.75 TON

RESISTING SHEAR STRENGTH S_r = 79.75 sin φ = 79.75 × 0.499 = 39.8 TON

$$F_U = \frac{39.8}{25.2} = 1.58$$ ✓ (1.5 desired min.)

AVERAGE UNIT SHEAR = $S_U = \frac{h^2 \tan^2(45° - \frac{1}{2}\phi)}{2(b)} + \frac{w_w h^2}{2b}$

$$= \frac{(40')^2 \times 135\ \#/ft^3 \tan^2(45° - 13.5°)}{2(60')} + \frac{17' \times 17' \times 62.4\ \#/ft^3}{2 \times 60'}$$

$$= \frac{25.2\ \text{TON}}{80\ ft^2} = 0.315\ \frac{\text{TON}}{ft^2}$$

MAXIMUM UNIT SHEAR = $S_{MU} = 2 S_U = 2(0.315) = 0.63\ \text{TON}/ft^2$

UNIT SHEAR @ PT OF MAX SHEAR = 29' × 72.5 #/ft³ × 0.499

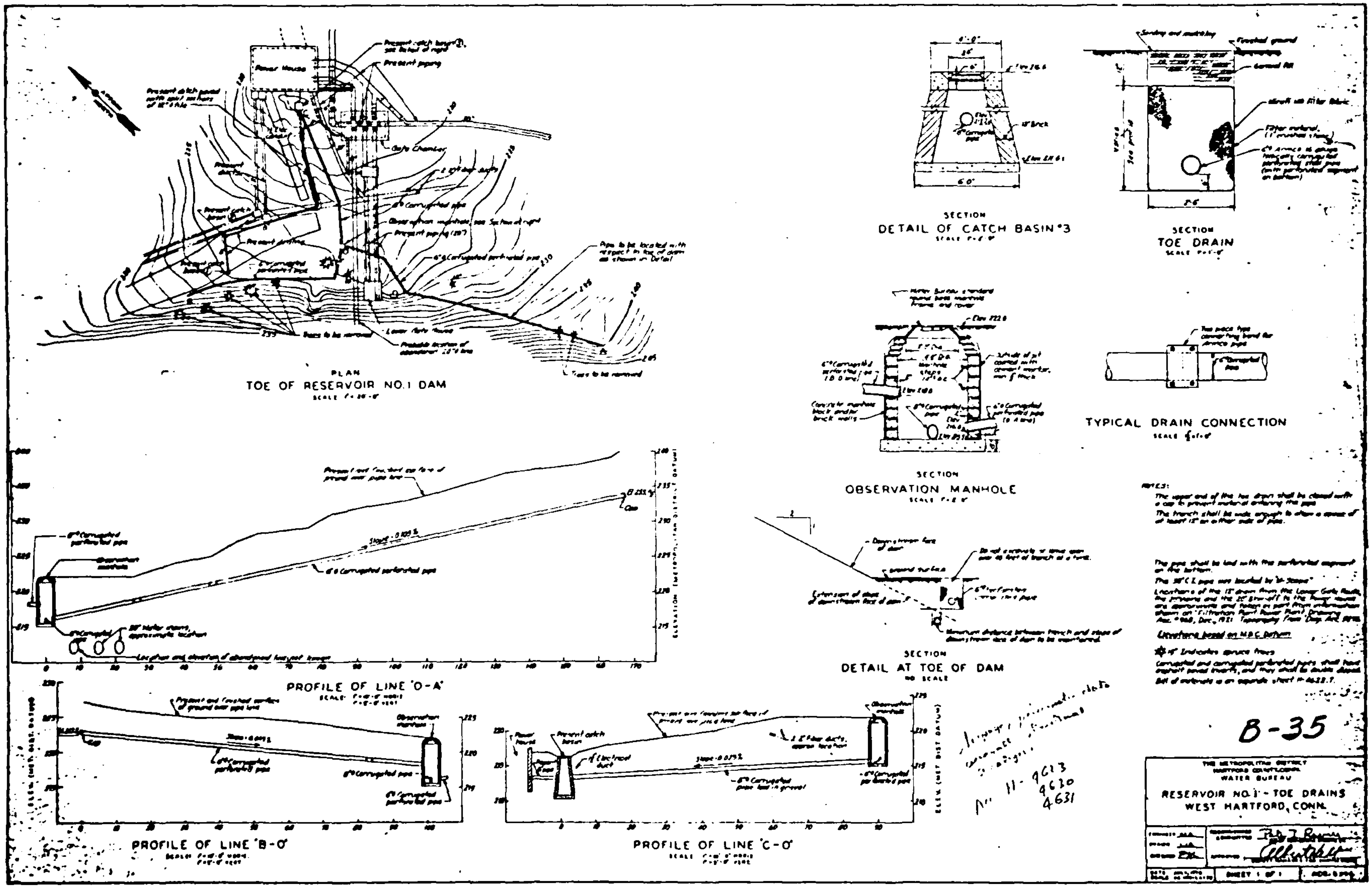
= 858.6 #/ft² = 0.43 TON/ft²

$$F.O.S. = \frac{0.63}{0.43} = 1.46$$

$\frac{0.9^3}{0.63} = 0.7$ { Not too serious according to J H + C book p. 729

SUMMARY

STABILITY FACTOR	AVERAGE	MINIMUM
STABILITY AGAINST HEADWATER PRESSURE	6.1 ✓	
HORIZONTAL SHEAR DOWNSTREAM	2.32 ✓ } overall	1.61 ✓ } local
HORIZONTAL SHEAR UPSTREAM (SUBJECT TO DRAWDOWN)	1.58 ✓	1.46
		0.7 ✓


PLAN
TOE OF RESERVOIR NO.1 DAM
Present catch basin
Present piping
Power House
Gate Chamber
Present drains
Present piping
Trees to be removed
Lower Gate House
Trees to be removed
SECTION
DETAIL OF CATCH BASIN No. 3
6'-0"
6'-0"
SECTION
TOE DRAIN
Finished ground
Filter material
SECTION
OBSERVATION MANHOLE
TYPICAL DRAIN CONNECTION
6" Corrugated perforated pipe
Observation manhole
6" Corrugated perforated pipe
PROFILE OF LINE 'O-A'
PROFILE OF LINE 'B-O'
PROFILE OF LINE 'C-O'
Present catch basin
SECTION
DETAIL AT TOE OF DAM
NO SCALE
NOTES:
B-35
THE METROPOLITAN DISTRICT
WATER BUREAU
RESERVOIR NO.1 - TOE DRAINS
WEST HARTFORD, CONN.
SHEET 1 OF 1
9613
9630
4631

WATER SUPPLY
SEWERAGE

THE METROPOLITAN DISTRICT
555 MAIN STREET - P.O. BOX 800
HARTFORD, CT 06101

TELEPHONE
278-7850

3-PJR:jok

February 15, 1980

File: West Hartford Dam Inspection

Mr. Leneord Beck
O'Brien and Gere
1617 J. F. Kennedy Blvd.
Suite 1760
Philadelphia, PA 19103

Dear Len:

In reply to your request for data on the Talcott Reservoir, I have taken the following data from the construction drawings. (I assume you have our 1" = 200 ft. scale maps of the area for location purposes.)

South Dam: principal spillway is a 30" pipe through dam, emergency spillway is 40 ft. wide, crest at Elev. 452.5.

North Dam: principal spillway is a 30" pipe through the dam, emergency spillway is 90 ft., crest at Elev. 452.5.

Both emergency spillways are grassed earth with crests 30' long (i.e. parallel to flow) and approach and discharge slopes ranging from 2 to 7%. The design high water level is at Elev. 455.4.

As I recollect, the spillways are designed to drain their proportionate share of the watershed. Our records state that 0.5 sq. mile of Reservoir No. 2 watershed lies above the flood control dam. I hope this information is of help to you.

Sincerely,

Peter J. Revill,
Chief Design Engineer

B-36

APPENDIX C

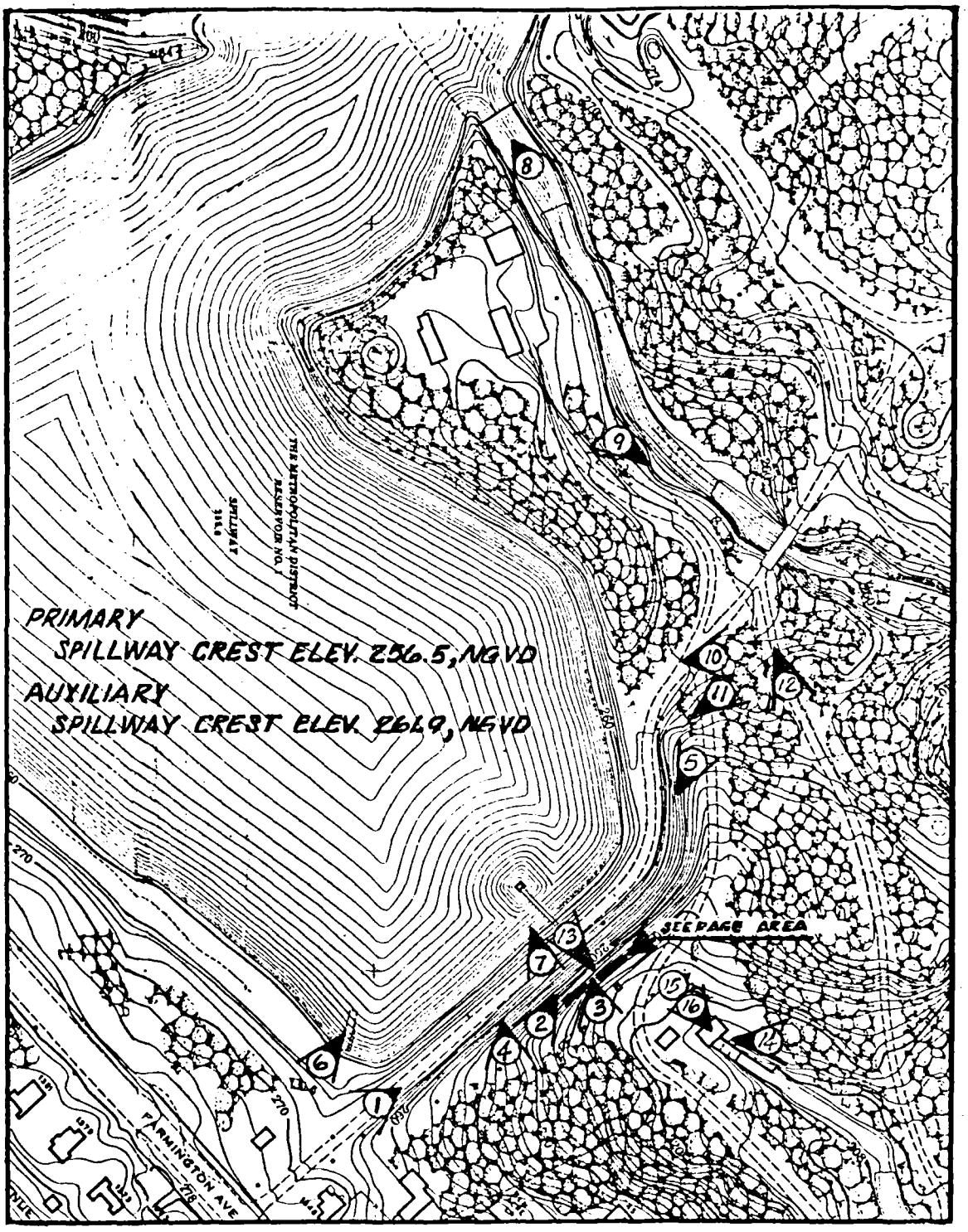
PHOTOGRAPHS

APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT

PHOTOGRAPHS

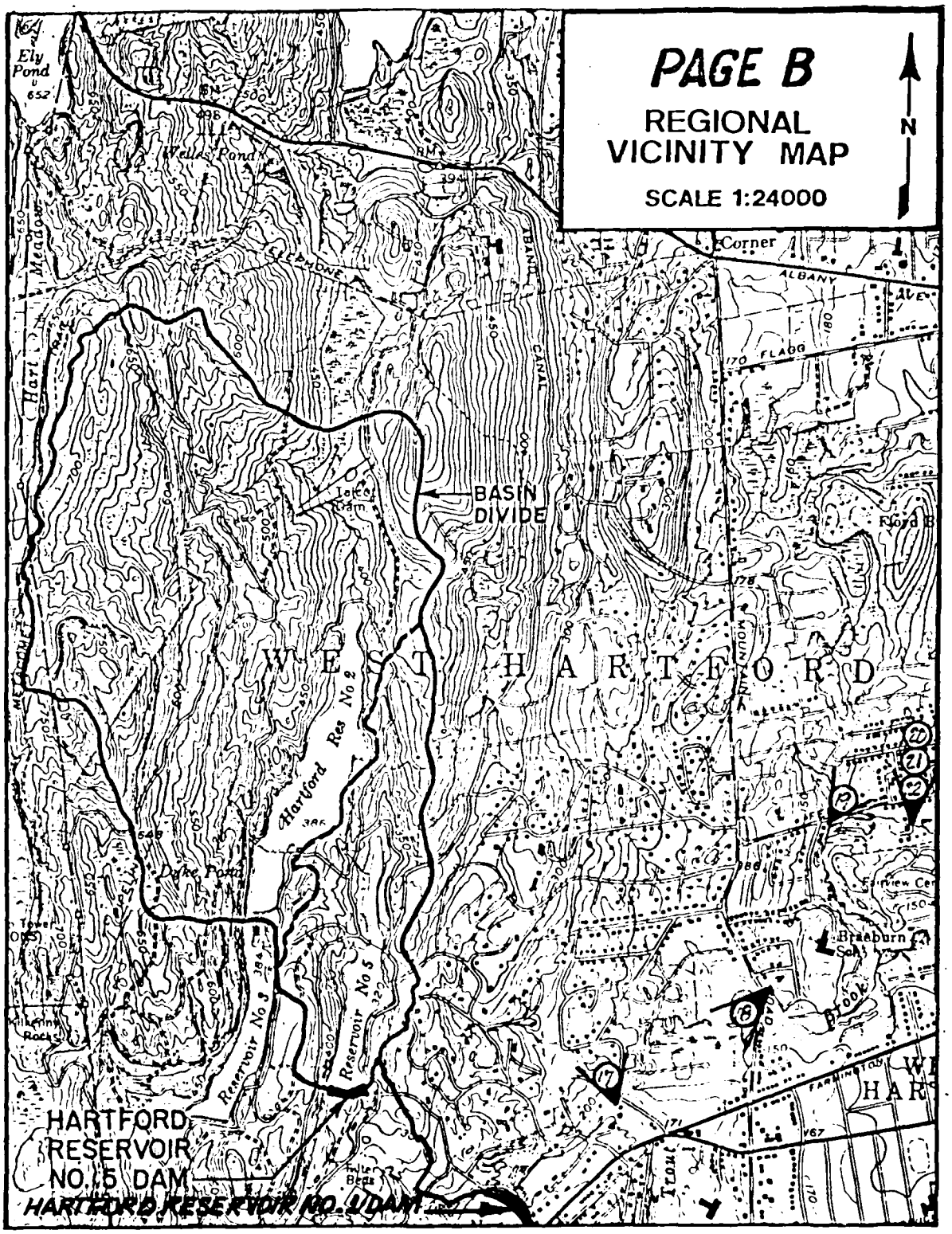
Appendix C, Cont'd.

PHOTOGRAPHS



LEGEND (1) THE LOCATION AND DIRECTION IN WHICH PHOTO WAS TAKEN AND THE NUMBER OF THE PHOTO

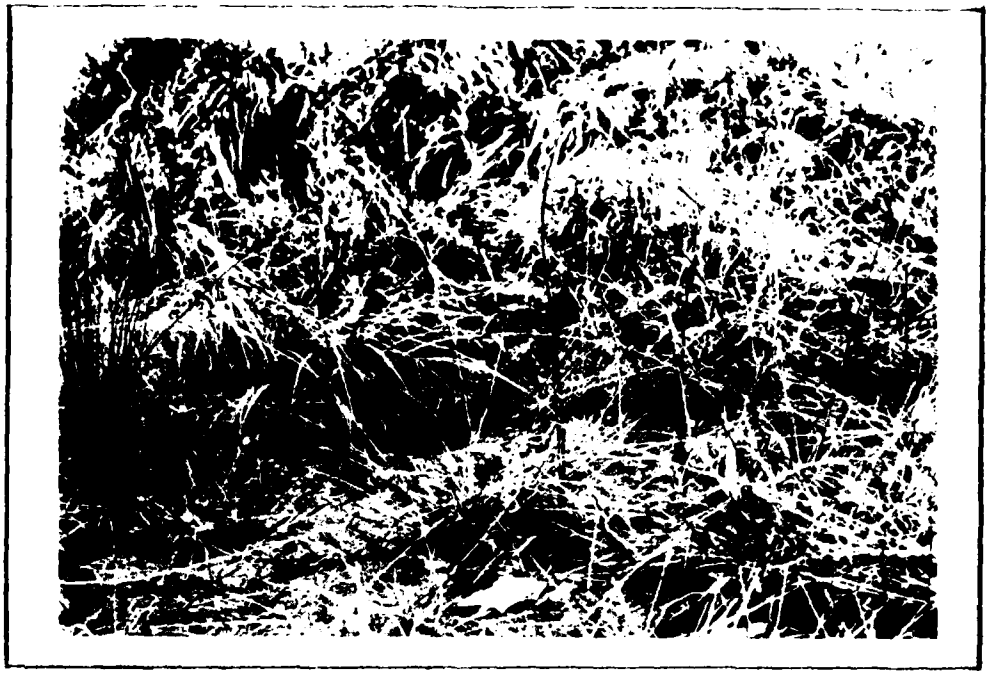
PG. A



LEGEND (17) THE LOCATION AND DIRECTION IN WHICH EACH PHOTO WAS TAKEN AND THE NUMBER OF THE PHOTO

1. VIEW FROM THE RIGHT ABUTMENT ALONG THE TOP OF THE DAM WITH THE GATEHOUSE AND CATWALK SHOWN ON THE LEFT. (11/13/79)

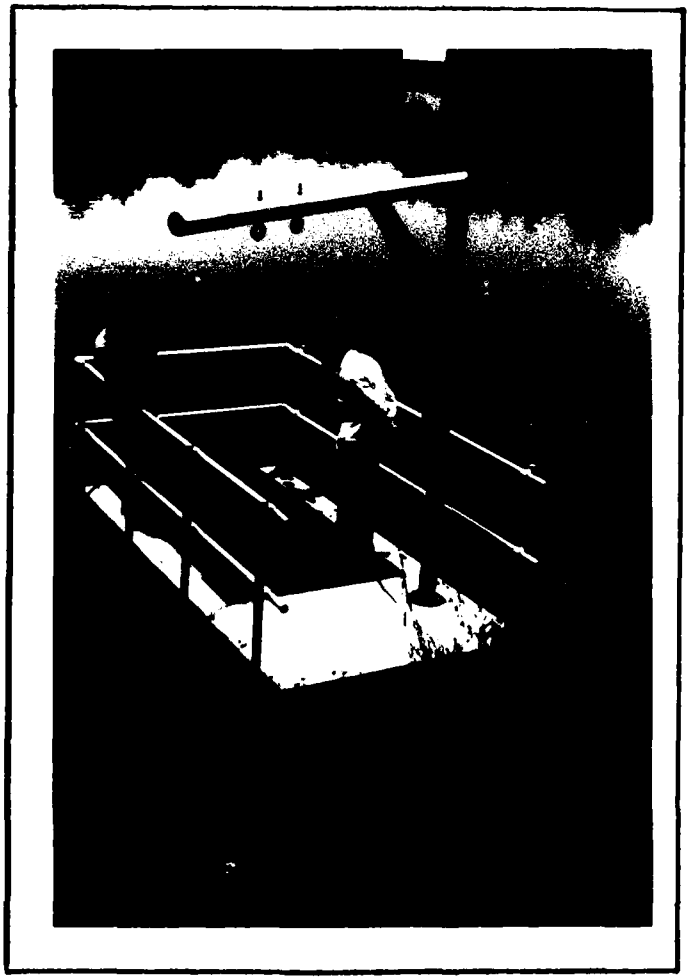
2. DOWNSTREAM FACE OF THE DAM SHOWING VEGETATIVE COVER AND A DEPRESSION IN THE EARTH EMBANKMENT. (11/13/79)



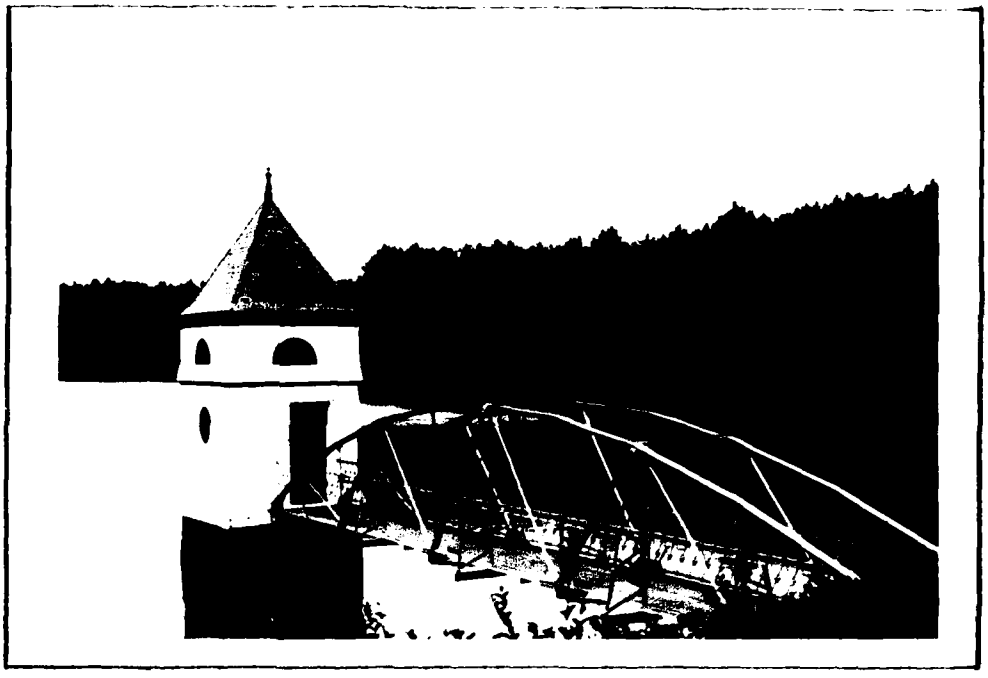
3. SEEPAGE OBSERVED AT THE DOWNSTREAM TOE OF THE DAM. (11/13/79)

4. TYPICAL RODENT HOLE IN THE DOWNSTREAM FACE OF THE DAM. (11/13/79)

5. DOWNSTREAM FACE OF THE DAM NEAR THE LEFT ABUTMENT SHOWING TREES GROWING ON THE EMBANKMENT. (11/13/79)



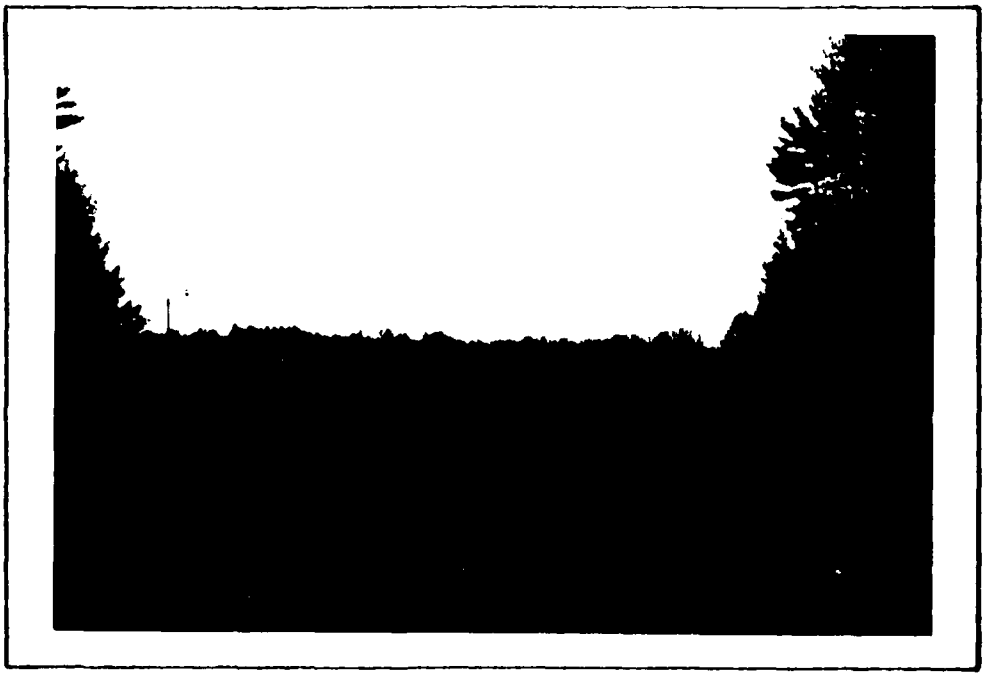
6. RECENTLY RECONSTRUCTED INLET FOR THE POWER HOUSE WATER SUPPLY PIPE. (11/13/79)



7. GATEHOUSE AND CATWALK. (11/13/79)

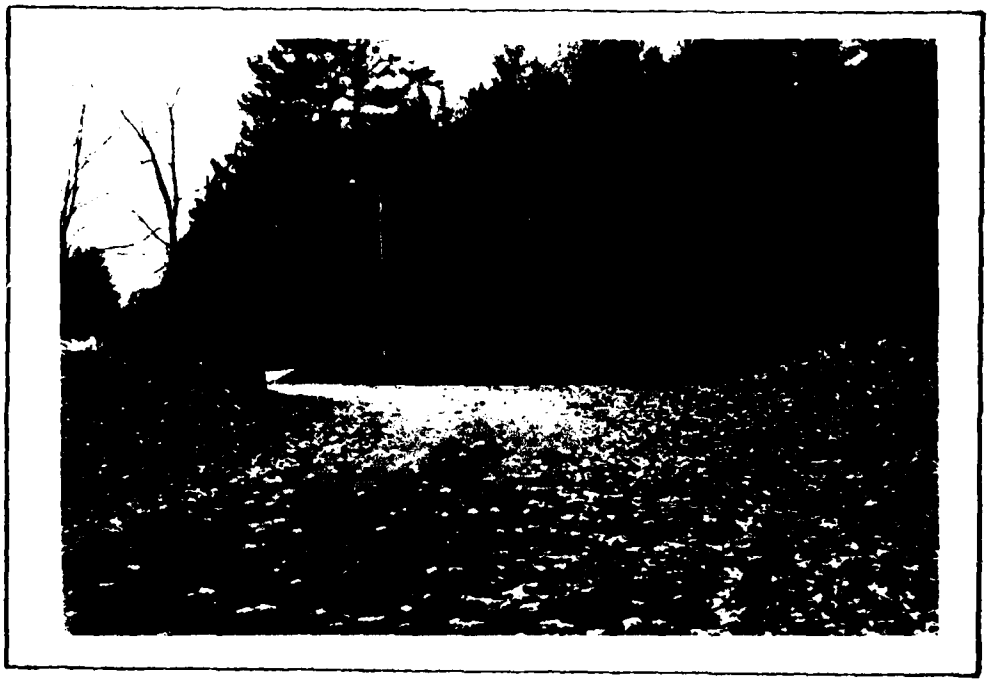
8. LOOKING UPSTREAM AT THE PRIMARY SPILLWAY WEIR SECTION. (11/13/79)

9. TYPICAL VIEW OF THE PRIMARY SPILLWAY OUTLET CHANNEL. (11/13/79)



10. LOOKING UPSTREAM IN THE EMERGENCY SPILLWAY OUTLET CHANNEL TOWARDS THE RESERVOIR. (11/13/79)

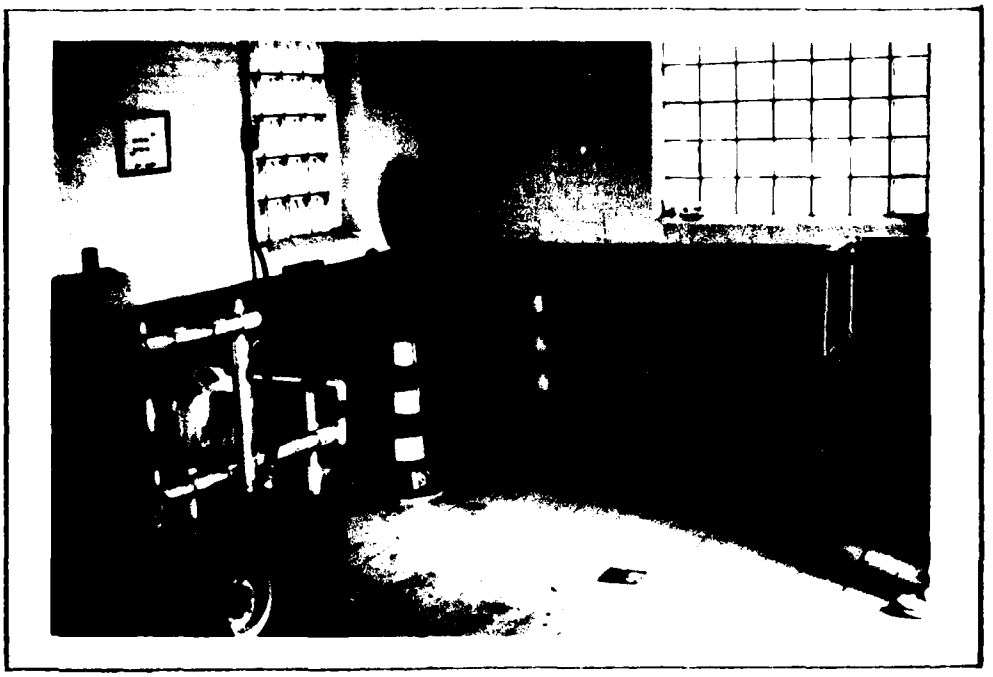
11. GABION SIDE SLOPE PROTECTION ALONG THE RIGHT SIDE OF THE EMERGENCY SPILLWAY OUTLET CHANNEL. (11/13/79)



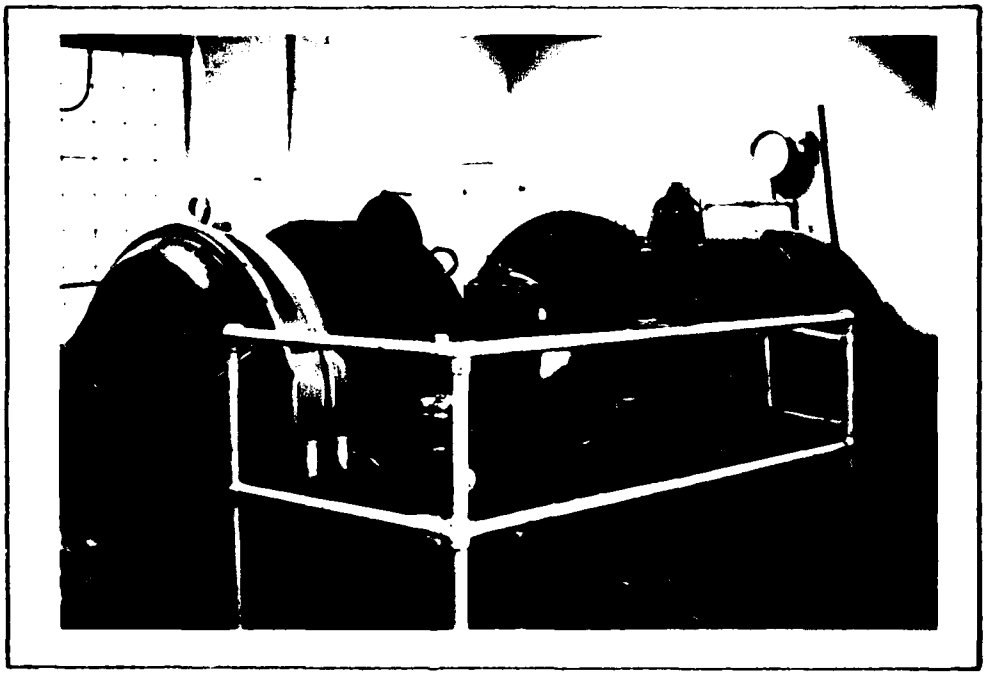
12. OPENING IN THE LEVEE ALONG THE RIGHT SIDE OF THE EMERGENCY SPILLWAY OUTLET CHANNEL WHICH WOULD BE SANDBAGGED IN THE EVENT OF IMPENDING EMERGENCY SPILLWAY FLOW. (11/13/79)

13. POWER HOUSE TO THE LEFT AND PUMP HOUSE TO THE RIGHT ABOUT 100 FEET DOWNSTREAM OF THE DAM. (11/13/79)

14. DOWNSTREAM SIDE OF THE POWER HOUSE WITH THE TAILRACE IN THE FOREGROUND. (11/13/79)



15. INSIDE THE POWER HOUSE SHOWING THE GATE HOIST PEDESTALS IN THE BACKGROUND AND THE POWERED HOIST UNIT IN THE FOREGROUND. (11/13/79)



16. ELECTRIC POWER GENERATING UNIT. (11/13/79)

17. POTENTIAL DAMAGE AREA ABOUT 0.5 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

18. POTENTIAL DAMAGE AREA ABOUT 1.0 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

19. POTENTIAL DAMAGE AREA ABOUT 1.9 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

20. POTENTIAL DAMAGE AREA ABOUT 2.1 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

21. POTENTIAL DAMAGE AREA ABOUT 2.1 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

22. POTENTIAL DAMAGE AREA ABOUT 2.1 MILES DOWNSTREAM FROM THE DAM. (11/13/79)

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Hartford Reservoir #1 Dam				

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

TABLE OF CONTENTS

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Hartford Reservoir #1 Dam				

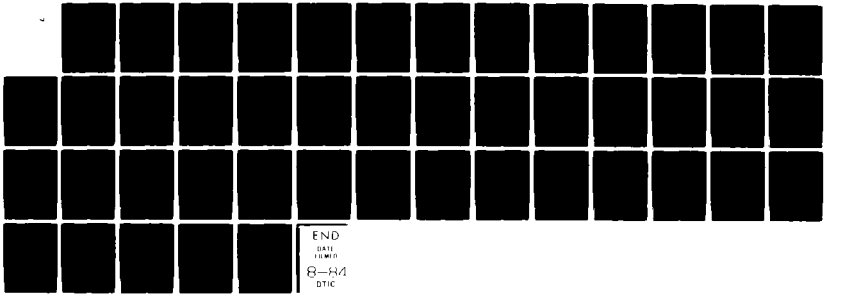
APPENDIX D

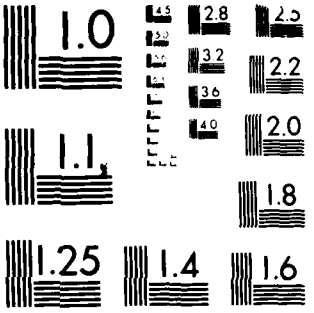
HYDROLOGIC & HYDRAULIC COMPUTATIONS

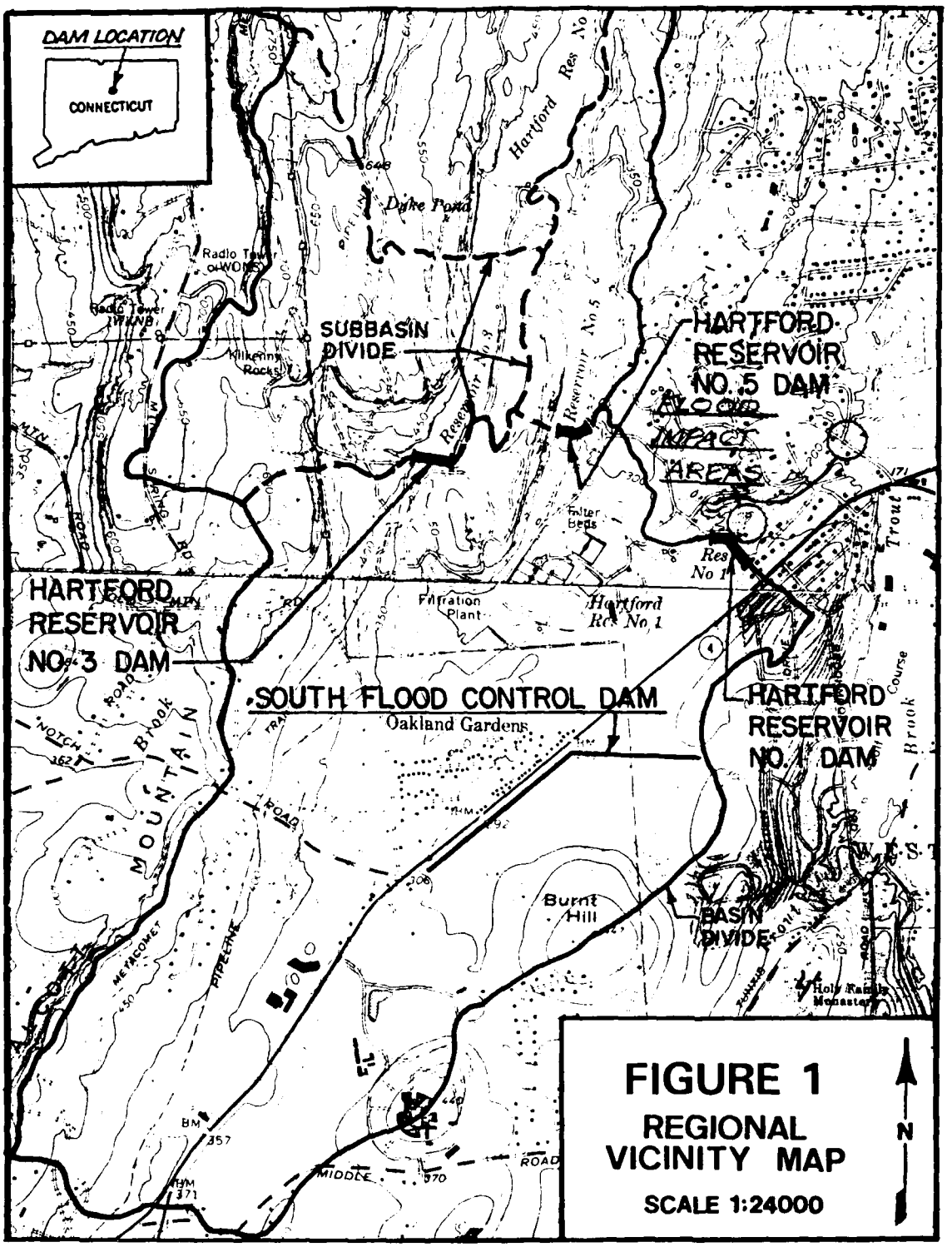
TABLE OF CONTENTS (CONTINUED)

AD-A142 563 NATIONAL DAM INSPECTION PROGRAM HARTFORD RESERVOIR NUMBER 1 DAM (CT 00001..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV APR 80 2/2

UNCLASSIFIED F/G 13/13 NL






DAM LOCATION
CONNECTICUT
SUBBASIN DIVIDE
HARTFORD RESERVOIR NO. 5 DAM
FLOOD IMPACT AREAS
HARTFORD RESERVOIR NO. 3 DAM
SOUTH FLOOD CONTROL DAM
Oakland Gardens
HARTFORD RESERVOIR NO. 1 DAM
Burnt Hill
BASIN DIVIDE
Dyke Pond
Hartford Res No 5
Hartford Res No 1
Filtration Plant
Filter Beds
Trout Brook
Mountain Brook
Notch Road
Spring Rd
Middle Road
Holy Family Monastery
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N

D-1

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO D-2 OF D-43
CALCULATED BY R.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

HARTFORD RESERVOIR DAM #1 H&H

DRAINAGE AREA (SUB-BASIN INCLUDING SOUTH RESERVOIR) = 2.23 SQ. MI.
SOUTH RESERVOIR DA = 1.3 SQ. MI.; #1 SUB-AREA = 0.93 SQ. MI.
TOTAL DRAINAGE AREA = 3.89 MI.^{2}

SNYDER HYDROGRAPH COEFFICIENTS

$C_t = 2.0$ $C_p = 0.5$

T_p COMPUTATIONS

$L = 0.9$ Mi. $L_{ca} = 0.4$ Mi.

$$T_p = C_t \times (L \times L_{ca})^{.3}$$

$$T_p = 2 \times (0.9 \times 0.4)^{.3} \simeq 1.50 \text{ HOURS}$$

PMP DATA

FROM HMS #33 THE 24 HOUR 200 Sq.Mi. INDEX RAINFALL IS 21.5

6hr % OF INDEX FOR THIS BASIN = 111
12hr % " " " " = 124
24hr % " " " " = 133

STAGE-STORAGE

	ELEV. (MSL)	AREA (AC.)	STORAGE (AC. FT.) (COMPUTED BY HEC-1 PROGRAM)
	225.0	0	0
NORMAL POOL	256.5	27	284
	260.0	35	392
	270.0	68	898

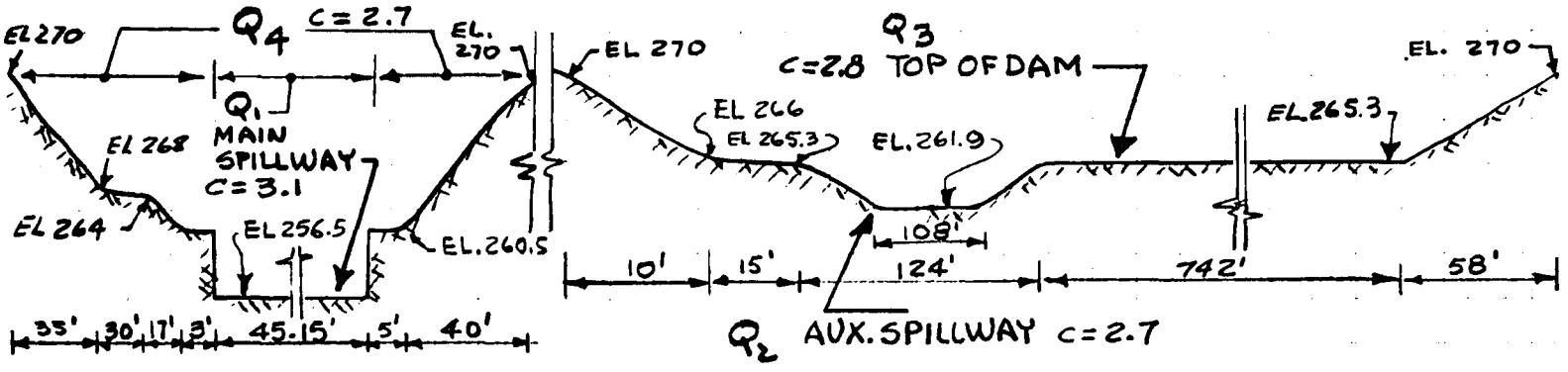
BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 3210-001
SHEET NO D-3 OF D-43
CALCULATED BY E.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

HARTFORD RESERVOIR DAM #1 H&H

TOP OF DAM & SPILLWAYS ELEVATION

H=0 @ CORRESPONDING CREST



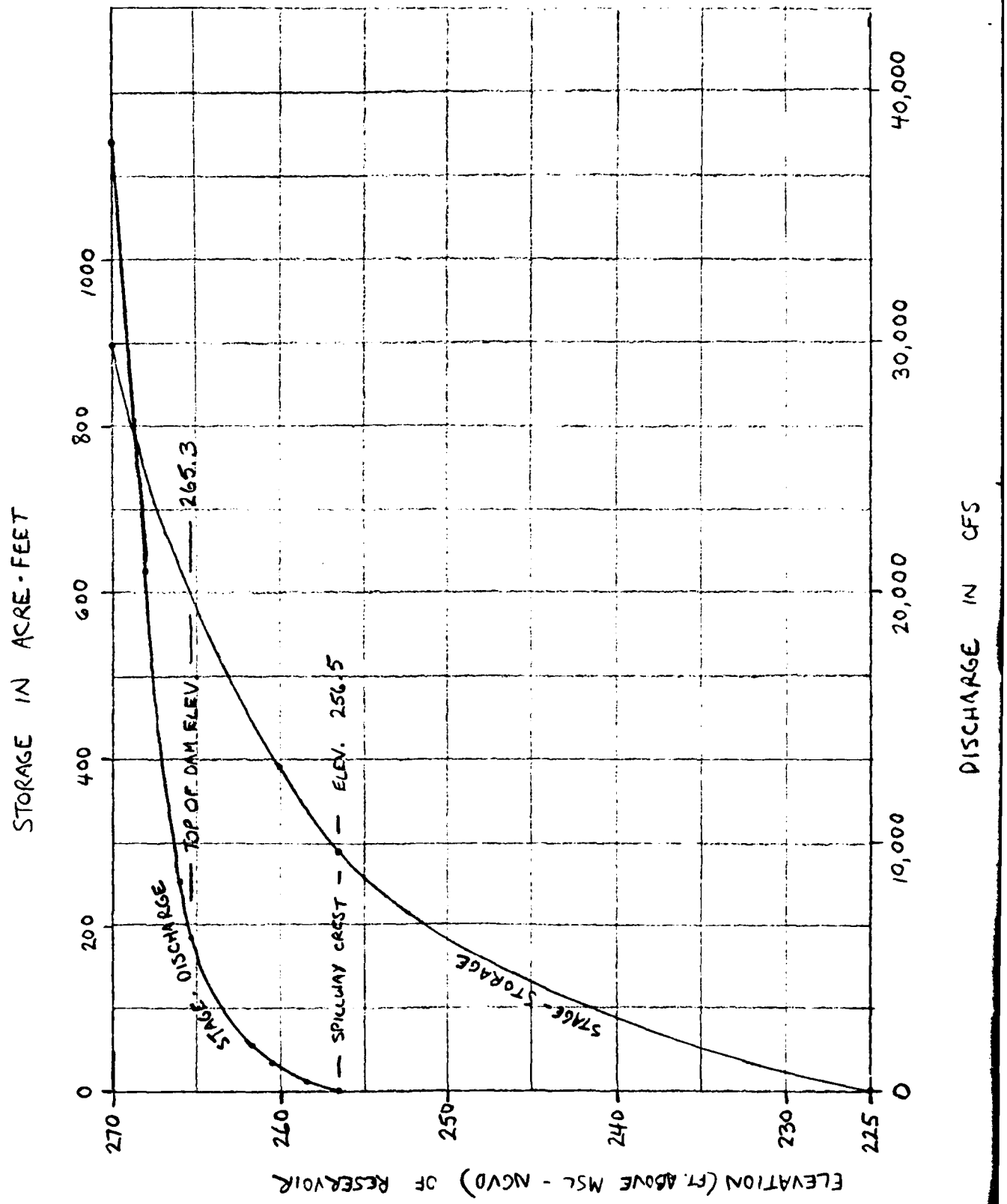
STAGE DISCHARGE

$Q = CLH^{1.5}$

ELEVATION NGVD	H Ft.	Q_1 CFS	H	Q_2 CFS	H	Q_3 CFS	H	Q_4 CFS	ΣQ CFS
256.5	0	0							0
257.5	1	140							140
258.5	2	396							396
259.5	3	727							727
260.5	4	1,120					0	0	1,120
261.9	5.4	1,756	0	0			1.4	48	1,804
265.3	8.8	3,654	3.4	1,871	0	0	4.8	604	6,129
266.0	9.5	4,098	4.1	2,490	0.7	1,236	5.5	702	8,526
268.0	11.5	5,458	6.1	4,595	2.7	9,404	7.5	1,375	20,832
270.0	13.5	6,942	8.1	7,149	4.7	21,597	9.5	2,330	38,018

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
STAGE - STORAGE & STAGE - DISCHARGE CURVES	D-4	RRB	7/80	2060-001



O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
HARTFORD RESERVOIR DAM # 1	D-5	RRB	R.B.	2060-001

SOUTH FLOOD CONTROL RESERVOIR

THE SOUTH FLOOD CONTROL RESERVOIR IS LOCATED UPSTREAM OF HARTFORD RESERVOIR DAM # 1 WITHIN THE DRAINAGE AREA.

SUB-AREA DA = 1.3 SQ. MI.

Tp COMPS.: $L = 2.0$ MILES $\quad L_{CA} = 0.9$ MILES

$T_p = C_T (L \cdot L_{CA})^{0.3} = 2.0 (2 \cdot 0.9)^{0.3} =$ 2.4 HOURS ; $C_p =$ 0.5

PMP DATA : FROM HMS # 33, 24 HR. 200 SQ. MI. INDEX RAINFALL = 21.5 INCHES

6 HR. RATIO = 111 %
12 HR. RATIO = 124 %
24 HR. RATIO = 133 %

STAGE-DISCHARGE DATA (OBTAINED FROM MDC)

PRINCIPAL SPILLWAY DISCHARGE CAPACITY = 114 CFS (CREST ELEV. ≅ 264)
EMERGENCY SPILLWAY → 120 FT. CREST LENGTH; 3:1 SIDE SLOPES; CREST ELEV. = 284.7 (DISCHARGES CALCULATED FROM DWG. ES-24, SCS HYDRAULICS HANDBOOK 5)
TOP OF DAM ELEVATION = 289.5, LENGTH ≅ 2000 FT., C ≅ 2.9

RESERVOIR SURF. ELEV.	Q_P (CFS)	H_E (FT.)	d_c (FT.)	Q_E (CFS)	H_{TOP} (FT)	Q_{TOP} (CFS)	Q_{TOTAL} (CFS)
264	0	0	0	0	0	0	0
284.7	114	0	0	0	0	0	114
285.5	115	0.8	0.53	276	0	0	391
286.5	116	1.8	1.2	912	0	0	1,028
287.5	117	2.8	1.87	1,824	0	0	1,941
288.5	118	3.8	2.53	2,832	0	0	2,950
289.5	119	4.8	3.2	3,960	0	0	4,079
290	120	5.3	3.53	4,560	0.5	2,050	6,730
292	122	7.3	4.87	7,200	2.5	22,927	30,249

STAGE-STORAGE DATA →	ELEV.	SURF. AREA (ACRES)	FLOOD STORAGE (COMP. BY HEC-1 PROGRAM ACRE-FT.
	264	7.3	0
	284.7	65	650
	290	75	1,020

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2040-001
SHEET NO D-6 OF D-12
CALCULATED BY E.G. DATE 1/80
CHECKED BY R.B. DATE 2/80

HARTFORD RESERVOIR DAM # 1 - UPSTREAM RESERVOIRS SCALE

HARTFORD RESERVOIR DAM #2 H&H

DRAINAGE AREA = 0.81 Sq.Mi

THIS DRAINAGE AREA REFLECTS THE EFFECTS OF DRAINAGE FROM A PORTION OF THE TALCOTT FLOOD CONTROL RESERVOIR LOCATED UPSTREAM OF HARTFORD RESERVOIR #2.

SNYDER HYDROGRAPH COEFFICIENTS

$C_t = 2.0$ $C_p = 0.5$

T_p COMPUTATIONS

$L = 1.0$ Mi. $L_{ca} = 0.4$ Mi.

$$T_p = C_t \times (L \times L_{ca})^{.3}$$

$$T_p = 2 \times (1.0 \times 0.4)^{.3} \simeq 1.5 \text{ HOURS}$$

PMP DATA

FROM HMS #33 THE 24 HOUR 200 Sq.Mi. INDEX RAINFALL IS 21.5

6hr % OF INDEX FOR THIS BASIN = 111
12hr % " " " " = 124
24hr % " " " " = 133

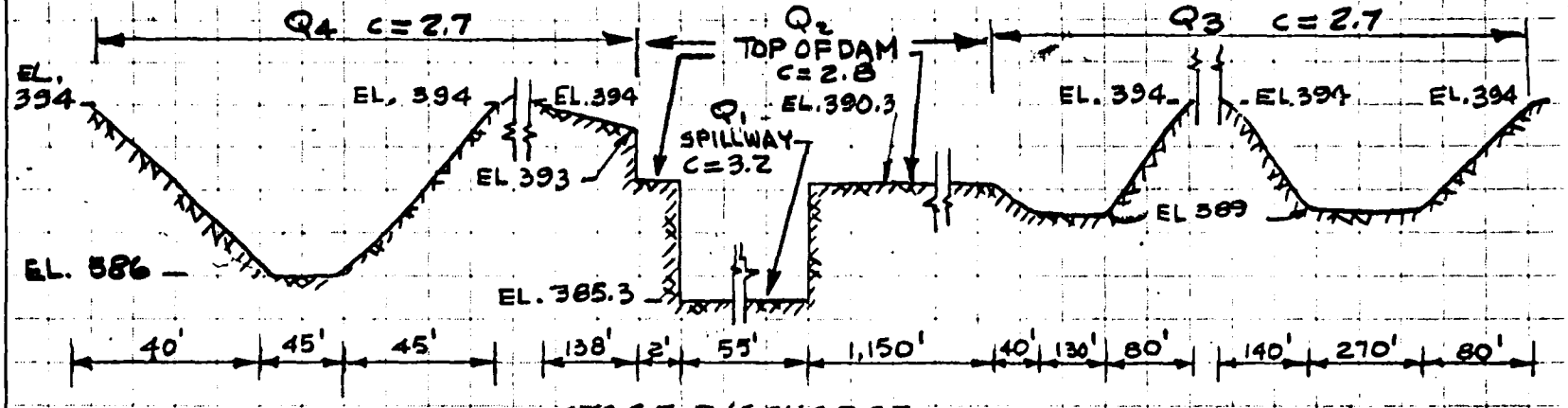
STAGE STORAGE

SURCHARGE CAPACITY

	ELEV. (NGVD)	AREA (AC)	STORAGE (A-FT.) (COMPUTED BY HEC-1 PROGRAM)
NORMAL POOL	385.3	44	0
	390.0	152	225
	400.0	270	833

HARTFORD RESERVOIR DAM # 1 - UPSTREAM RESERVOIRS

HARTFORD RESERVOIR DAM #2 H&H



STAGE DISCHARGE

$Q = CLH^{1.5}$ H=0. @ CORRESPONDING CREST

ELEVATION NGVD	H Ft.	Q1 CFS	H Ft.	Q2 CFS	H Ft.	Q3 CFS	H Ft.	Q4 CFS	ΣQ CFS
385.3	0	0							0
386.0	.7	103					0	0	103
387.0	1.7	390					1	125	515
388.0	2.7	781					2	370	1,151
389.0	3.7	1,253			0	0	3	707	1,960
390.3	5.0	1,968	0	0	1.3	1,634	4.3	1,277	4,879
392.0	6.7	3,052	1.7	7,150	3.0	5,920	6.0	2,247	18,369
393.0	7.7	3,760	2.7	14,310	4.0	9,294	7.0	2,940	30,304
394.0	8.7	4,516	3.7	22,957	5.0	13,247	8.0	3,724	44,444

NOTE: ABOVE 394.0 RESERVOIR #2 SPILLS INTO RESERVOIR #3

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060 - 001
SHEET NO D-7 OF D-43
CALCULATED BY E.G. DATE 1/50
CHECKED BY P.B. DATE 2/80
SCALE

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BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO D-8 OF D-43
CALCULATED BY E.G. DATE 1/80
CHECKED BY R.B DATE 2/80
SCALE

HARTFORD RESERVOIR DAM #5 H&H

DRAINAGE AREA (SUB AREA) = 0.27 Sq.Mi

TOTAL DRAINAGE AREA = 3.89 SQUARE MILES

SNYDER HYDROGRAPH COEFFICIENTS

$C_t = 2.0$ $C_p = 0.5$

T_p COMPUTATIONS

$L = 0.57$ Mi. $L_{ca} = 0.15$ Mi.

$$T_p = C_t \times (L \times L_{ca})^{.3}$$

$$T_p = 2 \times (0.57 \times 0.15)^{.3} \simeq 0.96 \text{ HOURS}$$

USE $T_p = 1.0$ HOURS

PMP DATA

FROM HMS #33 THE 24 HOUR 200 Sq.Mi. INDEX RAINFALL IS 21.5

6hr % OF INDEX FOR THIS BASIN = 111
12hr % " " " " = 124
24hr % " " " " = 133

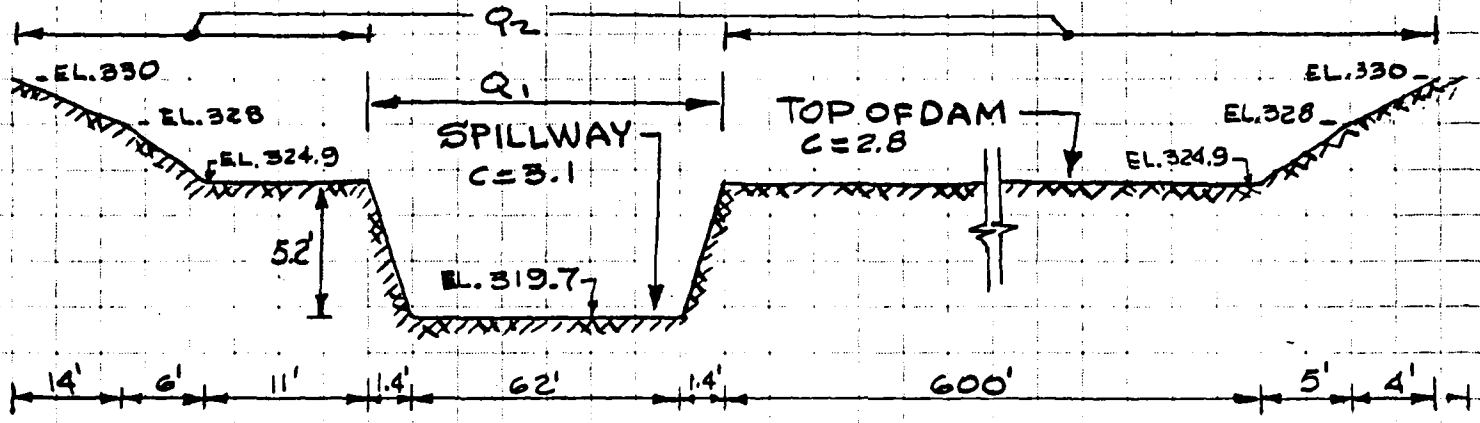
STAGE STORAGE

	ELEV. (MSL)(NVGD)	AREA (AC.)	STORAGE (AC.FT.) (COMPUTED BY HEC-1 PROGRAM)
	301.0	0	0
NORMAL POOL	319.7	25	156
	330.0	37	473

HARTFORD RESERVOIR DAM # 1 - UPSTREAM RESERVOIRS

HARTFORD RESERVOIR DAM # 5 H&H

TOP OF DAM & SPILLWAY ELEVATION



STAGE DISCHARGE

$Q = CLH^{1.5}$ $H = 0$ @ CORRESPONDING CREST

ELEVATION NGVD	H Ft.	Q1 CFS.	H Ft.	Q2 CFS.	EQ CFS.
319.7	0	0			0
320.7	1	193			193
321.7	2	548			548
322.7	3	1,012			1,012
323.7	4	1,564			1,564
324.9	5.2	2,330	0	0	2,330
326.0	6.3	3,040	1.1	1,980	5,020
328.0	8.3	4,596	3.1	9,353	13,949
330.0	10.3	6,353	5.1	19,736	26,089

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(617) 247-1800

JOB 2062-001
SHEET NO D-9 OF D-43
CALCULATED BY E.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

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BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO D-10 OF D.43
CALCULATED BY P.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

HARTFORD RESERVOIR DAM # 3 H&H

SUB-BASIN DRAINAGE AREA = 0.58 Sq.Mi

TOTAL WATERSHED = 3.89 SQUARE MILES

SNYDER HYDROGRAPH COEFFICIENTS

$C_t = 2.0$ $C_p = 0.5$

T_p COMPUTATIONS

$L = 1.21$ Mi. $L_{ca} = 0.40$ Mi.

$$T_p = C_t \times (L \times L_{ca})^{.3}$$

$$T_p = 2. \times (1.21 \times 0.40)^{.3} \simeq 1.60 \text{ HOURS}$$

PMP DATA

FROM HMS # 33 THE 24 HOUR 200 Sq.Mi. INDEX RAINFALL IS 21.5

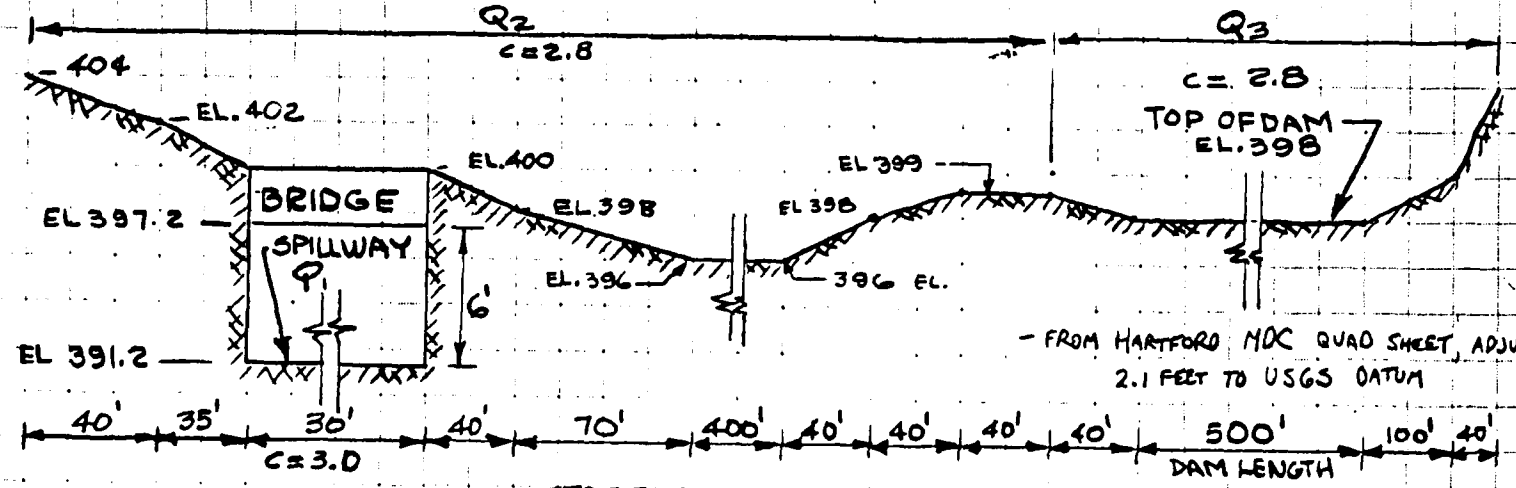
6hr % OF INDEX FOR THIS BASIN = 111
12hr % " " " " = 124
24hr % " " " " = 133

STAGE STORAGE

ELEV. (NGVD)	AREA (AC.)	STORAGE (Ac.Ft.) (COMPUTED BY HEC-1 PROGRAM)
355	0	0
NORMAL POOL - 391.2	28	338
400	40	636

HARTFORD RESERVOIR DAM # 1 - UPSTREAM RESERVOIRS

HARTFORD RESERVOIR DAM # 3 H&H



STAGE DISCHARGE

$Q = CLH^{1.5}$ FOR DAM AND SURROUNDING AREAS; $Q_1 = CLH^{1.5}$ FOR $0 < H \leq 6$; $Q_1 = .65 \times 180\sqrt{2g}(H-3)^{1/2}$ FOR $H > 6$

H=0 @ CORRESPONDING CREST

ELEVATION NGVD	H FT.	Q_1 CFS.	H Ft.	Q_2 CFS.		Q_3 CFS.	EQ CFS
391.2	0	0					0
393.2	2	255					255
395.2	4	720					720
396.0	4.8	946	0	0			946
397.2	6.0	1,323	1.2	1,508			2,831
398.0	6.8	1,596	2.0	3,294	0	0	4,890
399.0	7.8	1,961	3.0	6,200	1	1,526	9,687
400.0	8.8	2,349	4.0	9,778	2	4,356	16,483
402.0	10.8	2,622	6.0	18,848	4	12,320	33,790
404.0	12.8	2,939	8.0	30,428	6	22,633	56,000

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JOB 2060-001
SHEET NO D-11 OF D-43
CALCULATED BY E.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

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JOB 2060-001
SHEET NO D-12 OF D-43
CALCULATED BY R.G. DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

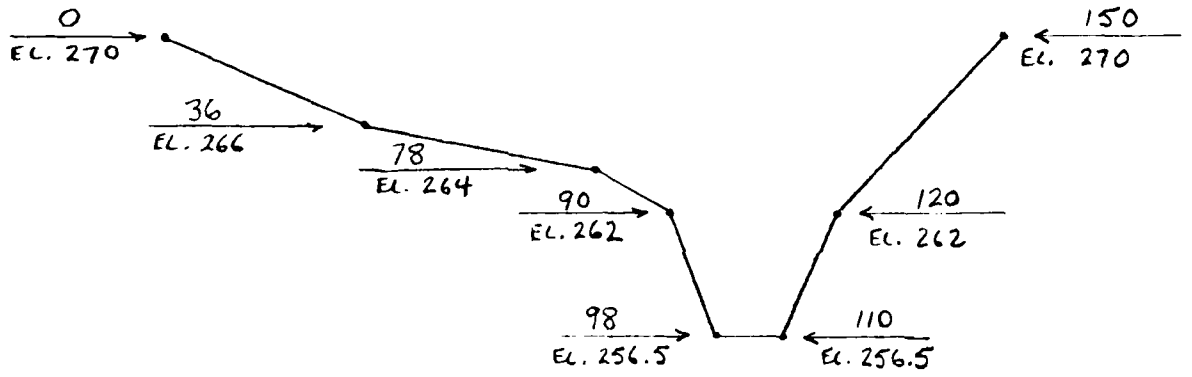
HARTFORD RESEVOIR DAM #1 H&H cont'd

1) VALLEY X-SEC. BETWEEN RESERVOIR # 1 & # 5

CHANNEL LENGTH = 2,200'

SLOPE = 0.025

LEFT OVERBANK	CHANNEL	RIGHT OVERBANK
0.08	0.035	0.08

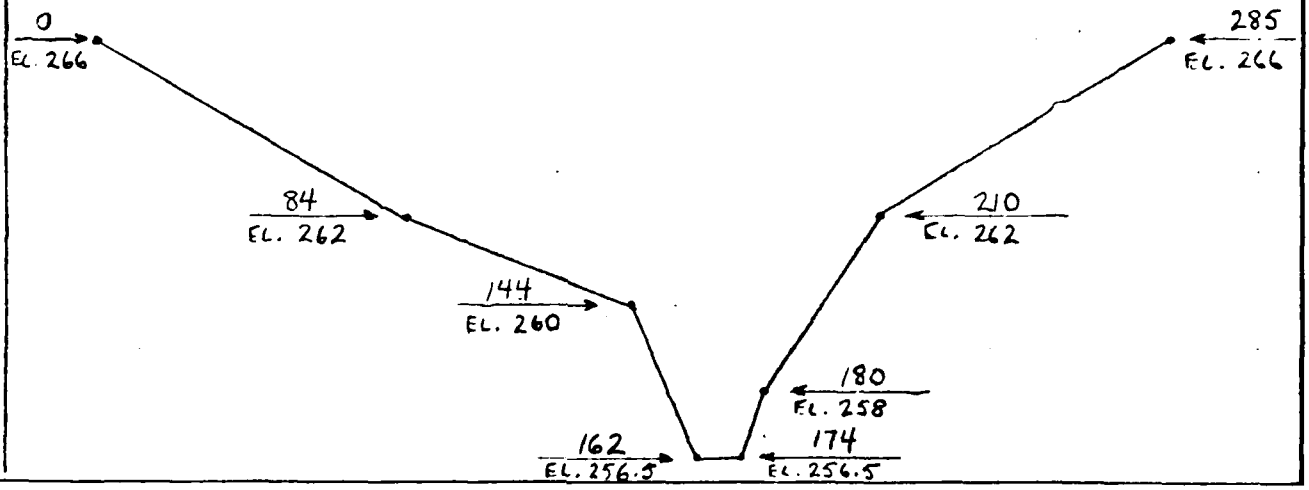


2) VALLEY X-SEC BETWEEN RESERVOIR # 1 & # 3

CHANNEL LENGTH = 6,000'

SLOPE = 0.025

LEFT OVERBANK	CHANNEL	RIGHT OVERBANK
0.08	0.04	0.08



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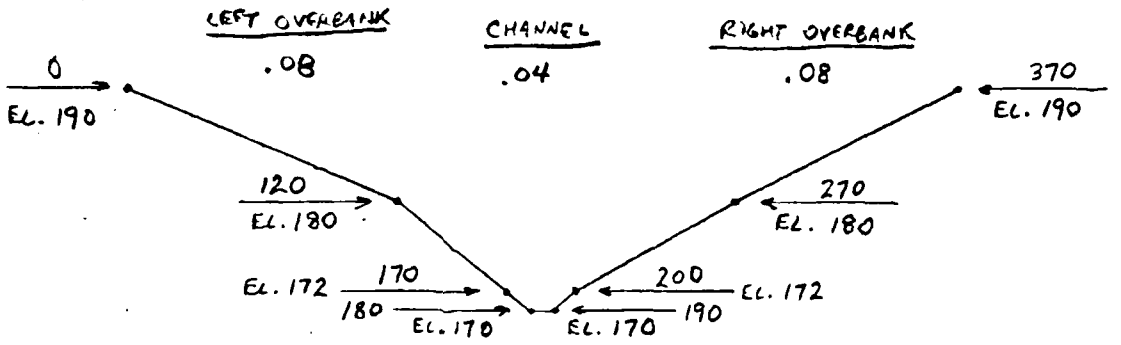
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

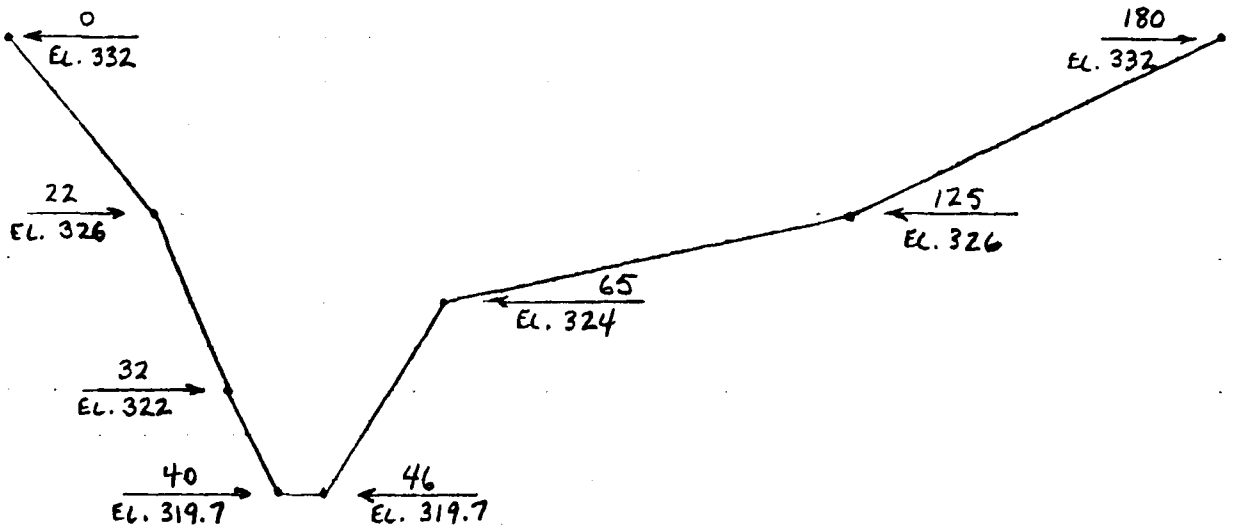
JOB 2060.001
SHEET NO D-13 OF D.43
CALCULATED BY RRB DATE 1/80
CHECKED BY R.B. DATE 2/80
SCALE

HARTFORD RESERVOIR DAM #1-H & H Cont'd.

(3) CROSS-SECTION AT HAZARD AREA DS-1
2,000' DOWNSTREAM OF DAM #1
SLOPE OF CHANNEL = 0.025



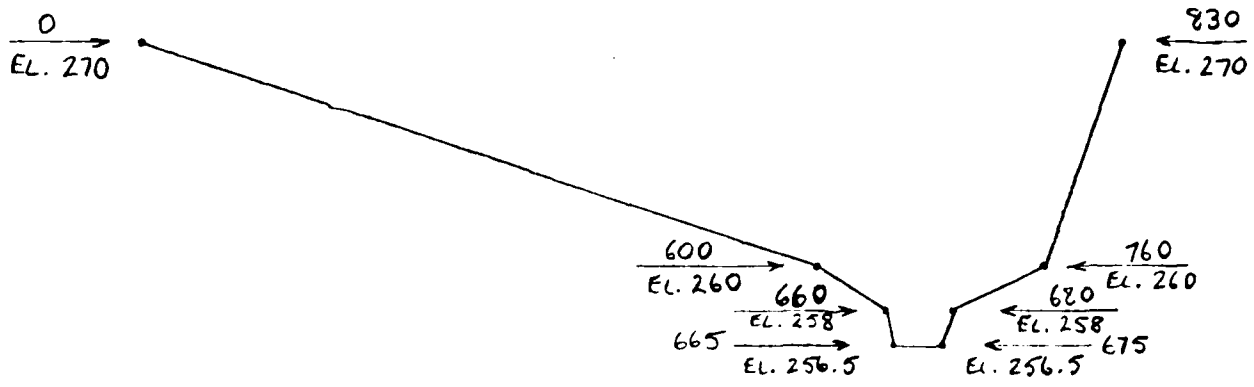
(4) VALLEY X-SEC BETWEEN RESERVOIR # 5 & RESERVOIR # 2:
CHANNEL LENGTH = 1,350'
SLOPE = 0.04



O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
HARTFORD RESERVOIR DAM # 1	D-14	RRB	2/80	2060-001

CHANNEL CROSS-SECTION BETWEEN SOUTH RESERVOIR AND RES. NO. 1



CHANNEL LENGTH = 1,300 FEET

CHANNEL SLOPE = .006 FT./FT.

MANNING'S COEFFICIENTS : OVERBANKS → .08

CHANNEL → .04

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

FLOOD ROUTINGS THROUGH HARTFORD RESERVOIR #1 WITHOUT DAM BREACH

INPUT

```
     1          H1                HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
     2          H2                     NATIONAL DAM INSPECTION PROGRAM
     3          H3                  NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4          N       300       0       15        0        0        0        0        0       -4        0
     5          H1      5
     6          J       1         9       1
     7          J1      .2        .3      .4       .5       .6       .7       .8       .9      1.0
     8          K       0    HAD-2                                              1
     9          K1                     INFLOW TO RESERVOIR 2
    10          M       1         1       .01               3.89                                        1
    11          P       0      21.5      111      124      133
    12          T                                                          0      .05
    13          W     1.5       0.5
    14          X    -1.7      -0.1       2
    15          K       1    HAD-2                                              1
    16          K1                    ROUTED OUTFLOW FROM RESERVOIR 2
    17          Y                                        1        1
    18          Y1      1                                                -385.3      -1
    19          Y4  385.3       386      387      388      389    390.3      392      393      394
    20          Y5      0       103      515     1151     1960     4879    18369    30304    44444
    21          $A     44        52       70
    22          $E  385.3       390      400
    23          $S  385.3
    24          $D  390.3
    25          K       1    EHA-1                                              1
    26          K1                    CHANNEL ROUTING 2 TO 5
    27          Y                                        1        1
    28          Y1      1                                                   -1
    29          Y6    .04      .04      .08    319.7      332     1350      .04
    30          Y7      0      332       22      326       32      322       40    319.7       46    319.7
    31          Y7     65      324      125      326      180      332
    32          K       0    HAD-5                                              1
    33          K1                  INFLOW TO RES. 5 LESS RES. 2
    34          M       1         1      .27               3.89                                        1
    35          P       0      21.5      111      124      133
    36          T                                                          0     0.05
    37          W     1.0       0.5
    38          X    -1.7      -0.1       2
    39          K       2    TOTAL                                              1
    40          K1                    COMBINE HYDROGRAPHS
    41          K       1    HAD-5                                              1
    42          K1                ROUTED OUTFLOW FROM RESERVOIR 5
    43          Y                                        1        1
    44          Y1      1                                                -319.7      -1
    45          Y4  319.7    320.7    321.7    322.7    323.7    324.9    326.0    328.0    330.0
    46          Y5      0      193      544     1012     1564     2330     5020    13949    26089
    47          $A      0       25       37
    48          $E    301    319.7      330
    49          $S  319.7
    50          $D  324.9
```

INPUT (CONT.)

```
K       1    DS-B                                                    1
K1           CHANNEL ROUTING FROM RES. 5 TO RES. 1
Y                                        1       1
Y1      1                                                       -1
Y6  0.08    0.035    0.08    256.5     270     2200     .025
Y7     0      270      36      266      78      264      90      262      98    256.5
Y7  110    256.5     120      262     150      270
K       0    MAD-3                                                   1
K1           INFLOW TO HARTFORD NO 3
M       1       1    0.58              3.89                                1
P       0    21.5     111      124     133
T                                                               0    0.05
W    1.60     0.5
X   -1.7     -0.1       2
K       1    MAD-3                                                   1
K1           ROUTED OUTFLOW FROM HARTFORD RESERVOIR NO 3
Y                                        1       1
Y1      1                                                   391.2    -1
Y4  391.2   393.2    395.2    396.0    397.2    398.0    399.0    400.0    402.0    404.0
Y5      0     255      720      946     2831     4890     9687    16483    33790    56000
Y8      0      24       40
$E    355   391.2      400
$$  391.2
$0  396.0
K       1    DS-A                                                    1
K1           CHANNEL ROUTING FROM RES. 3 TO RES. 1
Y                                        1       1
Y1      1                                                       -1
Y6  0.08    0.04    0.08    256.5     264     6000     .025
Y7     0      264      44      262     144      260     162    256.5     174    256.5
Y7  180    256.5     210      262     285      266
K       0  I-SFCR                                                  1
K1           INFLOW TO SOUTH FLOOD CONTROL RESERVOIR
M       1       1    1.3              3.89                                1
P       0    21.5     111      124     133
T                                                               0     .05
W    2.4     0.5
X   -1.7     -0.1       2
K       1  O-SFCR                                                  1
K1           OUTFLOW FROM SOUTH FLOOD CONTROL RESERVOIR
Y                                        1       1
Y1      1                                                   -264    -1
Y4  264   284.7    285.5    286.5    287.5    288.5    289.5     290      292
Y5      0     114      391     1028     1941     2950     4079    6730    30249
Y8    7.3      46       75
$F    264   284.7      290
$$    264
$0  285.5
K       1    DS-C                                                    1
K1           CHANNEL ROUTING FROM SOUTH RESERVOIR TO RESERVOIR 1
```

INPUT (CONT.)

```
101              Y                                    1       1
102              Y1     1                                                -1
103              Y6   .08      .04      .08    256.5     270     1300    .006
104              Y7     0      270      600      260     660      258     665   256.5     675   256.5
105              Y7   640      258      760      260     830      270
106              K      0   MAD-1                                        1
107              K1         INFLOW TO RESERVOIR 1 LESS RESERVOIRS 3, 5 AND SOUTH
108              M      1        1     0.93             3.89                                    1
109              P      0     21.5      111      124      133
110              T                                                      0    0.05
111              W    1.5      0.5
112              R   -1.7     -0.1        2
113              K      4   TOTAL                                        1
114              K1         COMBINE HYDROGRAPHS
115              K      1   MAD-1                                        1
116              K1         ROUTED OUTFLOW FROM RESERVOIR 1
117              Y                                    1       1
118              Y1     1                                            256.5      -1
119              Y4 256.5    257.5    258.5    259.5    260.5    261.9    265.3   266.0    268.0   270.0
120              Y5     0      140      396      727     1120     1804     6129    8526    20832   38018
121              Y8     0       27       35       60
122              $E   225    256.5      260      270
123              $$ 256.5
124              $D 265.3
125              K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT        MAD-2
ROUTE HYDROGRAPH TO         MAD-2
ROUTE HYDROGRAPH TO         CHA-1
RUNOFF HYDROGRAPH AT        MAD-5
COMBINE  2 HYDROGRAPHS AT  TOTAL
ROUTE HYDROGRAPH TO         MAD-5
ROUTE HYDROGRAPH TO          OS-4
RUNOFF HYDROGRAPH AT        MAD-3
ROUTE HYDROGRAPH TO         MAD-3
ROUTE HYDROGRAPH TO          OS-3
RUNOFF HYDROGRAPH AT       I-SFCR
ROUTE HYDROGRAPH TO        O-SFCR
ROUTE HYDROGRAPH TO          OS-C
RUNOFF HYDROGRAPH AT        MAD-1
COMBINE  4 HYDROGRAPHS AT  TOTAL
ROUTE HYDROGRAPH TO         MAD-1
END OF NETWORK
```

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATED 02/27/80.
TIME 14.42.01.

HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
NATIONAL DAM INSPECTION PROGRAM
NEW ENGLAND DIVISION - CORPS OF ENGINEERS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

PERCENTAGES OF PMF USED → RTIOS= .20 .30 .40 .50 .60 .70 .80 .90 1.00

INFLOW HYDROGRAPH DEVELOPMENT FOR HARTFORD RESERVOIR #2 (UPSTREAM)

SUB-AREA RUNOFF COMPUTATION
INFLOW TO RESERVOIR 2

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
NO 2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.81	0.00	3.89	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSDA COMPUTED BY THE PROGRAM IS .81

LOSS DATA

LOSS	STRTL	CNSTL	RTIOL	ERAIN	STRKS	RTIOK	STRTK	CNSTK	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.50 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.70 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 96 END-OF-PERIOD ORDINATES, LAG= 1.51 HOURS, CP= .50 VOL= 1.00

10.	38.	77.	119.	154.	174.	174.	158.	140.	123.
109.	96.	85.	75.	66.	58.	51.	45.	40.	35.
31.	27.	24.	21.	19.	17.	15.	13.	11.	10.
9.	8.	7.	6.	5.	5.	4.	4.	3.	3.
3.	2.	2.	2.	2.	1.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
0													

SUM 22.88 21.88 1.20 58299.
(581.)(551.)(30.)(1310.65)

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM RESERVOIR 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	3	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	385.	-1

STAGE	385.30	386.00	387.00	388.00	389.00	390.30	392.00	393.00	394.00
FLOW	0.00	103.00	515.00	1151.00	1960.00	4879.00	18369.00	30304.00	44444.00

STAGE – DISCHARGE DATA FOR HARTFORD RESERVOIR #2 DAM

SURFACE AREA=	44.	52.	70.
CAPACITY=	0.	225.	833.
ELEVATION=	385.	390.	400.

STAGE – STORAGE DATA FOR H.R. #2 DAM

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
385.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SPILLWAY CREST ELEVATION →

DAM DATA

TOPEL	COQD	EXPD	DAMWID
390.3	0.0	0.0	0.

TOP OF DAM ELEVATION →

PEAK OUTFLOW IS	313.	AT TIME	18.50 HOURS
PEAK OUTFLOW IS	480.	AT TIME	18.50 HOURS
PEAK OUTFLOW IS	672.	AT TIME	18.25 HOURS
PEAK OUTFLOW IS	856.	AT TIME	18.25 HOURS
PEAK OUTFLOW IS	1035.	AT TIME	18.25 HOURS
PEAK OUTFLOW IS	1220.	AT TIME	18.00 HOURS
PEAK OUTFLOW IS	1413.	AT TIME	18.00 HOURS
PEAK OUTFLOW IS	1594.	AT TIME	18.00 HOURS
PEAK OUTFLOW IS	1782.	AT TIME	18.00 HOURS

ROUTED OUTFLOWS FROM H.R. #2 FOR VARIOUS FLOODS

FLOOD ROUTING FROM H.R. #2 TO H.R. #5

HYDROGRAPH ROUTING

CHANNEL ROUTING 2 TO 5

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CHA-1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	319.7	332.0	1350.	.04000

} CHANNEL CHARACTERISTICS

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	332.00	22.00	326.00	32.00	322.00	40.00	319.70	46.00	319.70
	65.00	324.00	125.00	326.00	180.00	332.00				

} CHANNEL CROSS-SECTION AT UPSTREAM END OF H.R. # 5

STORAGE	0.00	.17	.45	.82	1.30	1.87	2.53	3.30	4.43	5.97
	7.93	10.13	12.49	15.02	17.71	20.57	23.60	26.79	30.16	33.68
OUTFLOW	0.00	25.69	97.63	225.32	428.00	713.53	1075.27	1546.71	2176.91	2950.30
	3899.00	5046.22	6367.40	7863.18	9533.74	11381.86	13410.52	15623.11	18023.21	20614.58
STAGE	319.70	320.35	320.99	321.64	322.29	322.94	323.58	324.23	324.88	325.53
	326.17	326.82	327.47	328.12	328.76	329.41	330.06	330.71	331.35	332.00
FLOW	0.00	25.69	97.63	225.32	428.00	713.53	1075.27	1546.71	2176.91	2950.30
	3899.00	5046.22	6367.40	7863.18	9533.74	11381.86	13410.52	15623.11	18023.21	20614.58

} STAGE-STORAGE AND STAGE-DISCHARGE CHARACTERISTICS FOR THE CHANNEL BETWEEN RESERVOIRS 2 & 5

MAXIMUM STAGE IS 321.9
MAXIMUM STAGE IS 322.4
MAXIMUM STAGE IS 322.8
MAXIMUM STAGE IS 323.2
MAXIMUM STAGE IS 323.5
MAXIMUM STAGE IS 323.8

} MAXIMUM WATER DEPTHS IN CHANNEL FOR VARIOUS FLOODS

MAXIMUM STAGE IS 324.0
MAXIMUM STAGE IS 324.3
MAXIMUM STAGE IS 324.5

LOCAL RUNOFF TO HARTFORD RESERVOIR #5

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RES. 5 LESS RES. 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAD-5	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.27	0.00	3.89	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .400

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.00 CP= .50 NTA= 0

RECESSION DATA

STRTQ= 1.70 QRCSN= .10 RTIOR= 2.00

UNIT HYDROGRAPH 30 END-OF-PERIOD ORDINATES, LAG= 1.00 HOURS, CP= .50 VOL= 1.00

9.	33.	63.	85.	96.	74.	61.	50.	41.	34.
28.	23.	19.	16.	13.	11.	9.	7.	6.	5.
4.	3.	3.	2.	2.	2.	1.	1.	1.	1.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.88	21.68	1.20	15596.
										(581.)	(551.)	(30.)	(**1.63)

COMBINING LOCAL RUNOFF TO H.R. #5 AND ROUTED OUT-FLOW FROM H.R. #2

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
TOTAL	2	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM RESERVOIR 5

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	HAD-5	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-320.	-1

STAGE	319.70	320.70	321.70	322.70	323.70	324.90	326.00	328.00	330.00
FLOW	0.00	193.00	544.00	1012.00	1564.00	2330.00	5020.00	13449.00	26089.00

STAGE-DISCHARGE DATA FOR HARTFORD RESERVOIR #5 DAM

SURFACE AREA=	0.	25.	37.
CAPACITY=	0.	156.	473.
ELEVATION=	301.	320.	330.

STAGE-STORAGE DATA FOR H.R. # 5 DAM

SPILLWAY CREST ELEVATION →

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
319.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOP OF DAM ELEVATION →

TOPEL	COQD	EXPD	DAMWID
324.9	0.0	0.0	0.

Peak outflow is 342. at time 19.00 hours

Peak outflow is 600. at time 18.75 hours

Peak outflow is 842. at time 18.75 hours

Peak outflow is 1082. at time 18.50 hours

Peak outflow is 1320. at time 18.50 hours

Peak outflow is 1559. at time 18.50 hours

Peak outflow is 1800. at time 18.25 hours

Peak outflow is 2051. at time 18.25 hours

Peak outflow is 2280. at time 18.25 hours

ROUTED OUTFLOWS FROM H.R. # 5 DAM FOR VARIOUS FLOODS

FLOOD ROUTING FROM HARTFORD RESERVOIR # 5 TO RESERVOIR # 1

HYDROGRAPH ROUTING

CHANNEL ROUTING FROM RES. 5 TO RES. 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-B	1	0	0	0	0	1	0	0

ROUTING DATA

RLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		ESTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMXT	ELMAX	XLNTH	SEL
.0800	.0350	.0800	256.5	270.0	2200.	.02500

} CHANNEL CHARACTERISTICS FOR CHANNEL BETWEEN RESERVOIRS 5 AND 1

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 270.00 36.00 265.00 78.00 264.00 90.00 262.00 98.00 256.50
110.00 256.50 120.00 262.00 150.00 270.00

} CHANNEL CROSS-SECTION AT UPSTREAM END OF RESERVOIR # 1

STORAGE	0.00	.47	1.03	1.67	2.39	3.20	4.09	5.06	6.12	7.39
	8.90	10.70	13.07	16.08	19.65	23.57	27.81	32.38	37.28	42.50
OUTFLOW	0.00	46.50	150.65	302.75	500.63	744.06	1033.70	1370.64	1718.46	2041.95
	2469.72	3096.70	3951.86	4941.43	6092.44	7403.76	8870.55	10495.92	12283.64	14237.82
STAGE	256.50	257.21	257.92	258.63	259.34	260.05	260.76	261.47	262.18	262.89
	263.61	264.32	265.03	265.74	266.45	267.16	267.87	268.58	269.29	270.00
FLOW	0.00	46.50	150.65	302.75	500.63	744.06	1033.70	1370.64	1718.46	2041.95
	2469.72	3096.70	3951.86	4941.43	6092.44	7403.76	8870.55	10495.92	12283.64	14237.82

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR CHANNEL

MAXIMUM STAGE IS 259.6
MAXIMUM STAGE IS 260.3
MAXIMUM STAGE IS 261.4
MAXIMUM STAGE IS 261.9
MAXIMUM STAGE IS 262.9
MAXIMUM STAGE IS 263.3

} PEAK WATER ELEVATIONS IN CHANNEL FOR VARIOUS FLOODS

LOCAL RUNOFF TO HARTFORD RESERVOIR #3

SUB-AREA RUNOFF COMPUTATION

INFLOW TO HARTFORD NO 3

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPNT	INAME	ISTAGE	IAUTO
HAD-3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.58	0.00	3.89	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.60 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.70 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 1.61 HOURS, CP= .50 VOL= 1.00

6.	23.	47.	74.	98.	113.	118.	112.	99.	88.
79.	70.	62.	56.	49.	44.	39.	35.	31.	28.
25.	22.	20.	17.	15.	14.	12.	11.	10.	9.
8.	7.	6.	5.	5.	4.	4.	3.	3.	3.
2.	2.	2.	2.	2.	1.	1.	1.	1.	1.

END-OF-PERIOD FLOW

	MO.DA	HR:MN	PERIOD	RAIN	EXCS	LOSS	COMP Q		MO.DA	HR:MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
											SUM	22.48	21.68	1.20	99095.
												(581.)	(551.)	(30.)	(937.15)

D-24

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM HARTFORD RESERVOIR NO 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAD=3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-991.	-1

STAGE	391.20	393.20	395.20	396.00	397.20	398.00	399.00	400.00	402.00	404.00
FLOW	0.00	255.00	720.00	946.00	2431.00	4890.00	9687.00	16483.00	33790.00	56000.00

STAGE-DISCHARGE DATA FOR HARTFORD RESERVOIR #3 DAM

SURFACE AREA=	0.	28.	40.
CAPACITY=	0.	338.	636.
ELEVATION=	355.	391.	400.

STAGE-STORAGE DATA FOR H.R. #3 DAM

	CREL	SPWID	COQW	EXPW	FLEVL	COQL	CAREA	EXPL
SPILLWAY CREST ELEVATION →	391.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

	TOPEL	COQD	EXPD	DAMWID
TOP OF DAM ELEVATION →	396.0	0.0	0.0	0.

PEAK OUTFLOW IS 145. AT TIME 19.25 HOURS
PEAK OUTFLOW IS 246. AT TIME 19.25 HOURS
PEAK OUTFLOW IS 407. AT TIME 19.00 HOURS
PEAK OUTFLOW IS 521. AT TIME 19.00 HOURS
PEAK OUTFLOW IS 632. AT TIME 18.75 HOURS
PEAK OUTFLOW IS 744. AT TIME 18.75 HOURS
PEAK OUTFLOW IS 864. AT TIME 18.75 HOURS
PEAK OUTFLOW IS 1038. AT TIME 18.50 HOURS
PEAK OUTFLOW IS 1235. AT TIME 18.00 HOURS

ROUTED OUTFLOW FROM H.R. #3 DAM FOR VARIOUS FLOODS

FLOOD ROUTING FROM HARTFORD RESERVOIR # 3 TO RESERVOIR # 1

HYDROGRAPH ROUTING

CHANNEL ROUTING FROM RES. 3 TO RES. 1

ISTAU	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-A	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.010	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	256.5	266.0	5000.	.02500

} CHARACTERISTICS OF CHANNEL BETWEEN RESERVOIRS 3 AND 1

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00, 266.00, 84.00, 262.00, 144.00, 260.00, 162.00, 256.50, 174.00, 256.50

} CHANNEL CROSS-SECTION AT UPSTREAM END OF RESERVOIR # 1

STORAGE	0.00	.98	2.28	3.90	5.88	8.31	11.17	14.46	18.62	24.07
OUTFLOW	0.00	23.90	82.40	176.03	317.51	501.48	731.49	1011.00	1394.50	1851.68
STAGE	256.50	257.00	257.50	258.00	258.50	259.00	259.50	260.00	260.50	261.00
FLOW	0.00	23.90	82.40	176.03	317.51	501.48	731.49	1011.00	1394.50	1851.68

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE CHANNEL

MAXIMUM STAGE IS 258.0
MAXIMUM STAGE IS 258.4
MAXIMUM STAGE IS 258.7
MAXIMUM STAGE IS 259.0
MAXIMUM STAGE IS 259.3
MAXIMUM STAGE IS 259.5
MAXIMUM STAGE IS 259.7
MAXIMUM STAGE IS 260.0
MAXIMUM STAGE IS 260.3

} MAXIMUM WATER ELEVATIONS IN CHANNEL FOR VARIOUS FLOODS

LOCAL RUNOFF TO SOUTH FLOOD CONTROL RESERVOIR

SUB-AREA RUNOFF COMPUTATION

INFLOW TO SOUTH FLOOD CONTROL RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
I-SFCR	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.39	0.00	1.89	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.40 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.70 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 75 END-OF-PERIOD ORDINATES, LAG= 2.40 HOURS, CP= .50 VOL= 1.00

5.	20.	41.	66.	93.	120.	144.	163.	174.	179.
174.	162.	150.	138.	128.	119.	110.	102.	94.	87.
81.	75.	69.	64.	59.	55.	51.	47.	44.	40.
37.	35.	32.	30.	27.	25.	23.	22.	20.	19.
17.	16.	15.	14.	13.	12.	11.	10.	9.	9.
8.	7.	7.	6.	6.	5.	5.	5.	4.	4.
4.	3.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	1.	1.	1.					

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.88	21.68	1.20	73081.
										(-581.)	(-551.)	(30.)	(-2049.42)

HYDROGRAPH ROUTING

OUTFLOW FROM SOUTH FLOOD CONTROL RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0-SFCH	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPHAT
1	0	0	0.000	0.000	0.000	-264.	-1

STAGE	264.00	284.70	285.50	286.50	287.50	288.50	289.50	290.00	292.00
FLOW	0.00	114.00	341.00	1028.00	1941.00	2958.00	4079.00	6730.00	30249.00

} STAGE - DISCHARGE DATA FOR SOUTH FLOOD CONTROL RESERVOIR

SURFACE AREA=	7.	65.	75.
CAPACITY=	0.	649.	1020.
ELEVATION=	264.	285.	290.

} STAGE - STORAGE DATA FOR SOUTH FLOOD CONTROL RESERVOIR

SPILLWAY CREST ELEVATION →

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EAPL
264.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOP OF DAM ELEVATION →

TOPEL	COOD	EXPD	DAMWID
289.5	0.0	0.0	0.

PEAK OUTFLOW IS 87. AT TIME 20.25 HOURS

PEAK OUTFLOW IS 84. AT TIME 26.75 HOURS

PEAK OUTFLOW IS 99. AT TIME 27.25 HOURS

PEAK OUTFLOW IS 111. AT TIME 27.50 HOURS

PEAK OUTFLOW IS 334. AT TIME 24.25 HOURS

PEAK OUTFLOW IS 652. AT TIME 22.50 HOURS

PEAK OUTFLOW IS 952. AT TIME 21.50 HOURS

PEAK OUTFLOW IS 1292. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 1616. AT TIME 20.50 HOURS

} ROUTED OUTFLOWS FROM SOUTH FLOOD CONTROL RESERVOIR FOR VARIOUS FLOODS

FLOOD ROUTING FROM SOUTH FLOOD CONTROL RESERVOIR TO HARTFORD RESERVOIR # 1

~~HYDROGRAPH ROUTING~~

CHANNEL ROUTING FROM SOUTH RESERVOIR TO RESERVOIR 1

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-C	1	0	0	0	0	1	0	0

~~ROUTING DATA~~

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

~~NORMAL DEPTH CHANNEL ROUTING~~

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	256.5	270.0	1300.	.00600

CHARACTERISTICS OF CHANNEL BETWEEN SOUTH FLOOD CONTROL RESERVOIR AND HARTFORD RESERVOIR # 1

~~CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC~~

0.00 270.00 600.00 260.00 660.00 258.00 665.00 256.50 675.00 256.50
680.00 258.00 760.00 260.00 830.00 270.00

CHANNEL CROSS-SECTION AT UPSTREAM END OF H.R. # 1

STORAGE	0.00	.26	.62	1.47	3.35	6.30	10.27	15.25	21.24	28.24
	36.25	45.27	55.30	66.34	78.39	91.45	105.51	120.59	136.68	153.77
OUTFLOW	0.00	17.80	62.54	154.79	325.89	607.24	1034.83	1628.31	2404.66	3381.92
	4577.88	6009.84	7694.59	9648.46	11887.33	14426.71	17281.72	20467.14	23997.46	27886.87
STAGE	256.50	257.21	257.92	258.63	259.34	260.05	260.76	261.47	262.18	262.89
	263.61	264.32	265.03	265.74	266.45	267.16	267.87	268.58	269.29	270.00
FLOW	0.00	17.80	62.54	154.79	325.89	607.24	1034.83	1628.31	2404.66	3381.92
	4577.88	6009.84	7694.59	9648.46	11887.33	14426.71	17281.72	20467.14	23997.46	27886.87

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR CHANNEL

MAXIMUM STAGE IS 258.0
MAXIMUM STAGE IS 258.1
~~MAXIMUM STAGE IS 258.2~~
MAXIMUM STAGE IS 258.3
MAXIMUM STAGE IS 259.4
~~MAXIMUM STAGE IS 260.1~~
MAXIMUM STAGE IS 260.6
MAXIMUM STAGE IS 261.1
~~MAXIMUM STAGE IS 261.5~~

MAXIMUM WATER ELEVATIONS IN CHANNEL FOR VARIOUS FLOODS

LOCAL RUNOFF TO HARTFORD RESERVOIR #1

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR 1 LESS RESERVOIRS 3, 5 AND SOUTH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
MAD-1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.43	0.00	3.89	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.50 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.70 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 46 END-OF-PERIOD ORDINATES, LAG= 1.51 HOURS, CP= .50 VOL= 1.00

12.	44.	89.	136.	177.	208.	208.	182.	160.	141.
125.	110.	97.	86.	76.	67.	59.	52.	46.	40.
36.	31.	29.	24.	22.	19.	17.	15.	13.	12.
10.	9.	8.	7.	6.	5.	5.	4.	4.	3.
3.	3.	2.	2.	2.	2.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.88	21.68	1.20	53143.
										(581.)	(551.)	(30.)	(1504.8&)

COMBINE HYDROGRAPHS

COMBINING ROUTED OUTFLOWS FROM S.F.C.R., H.R. # 3, AND H.R. # 5 WITH H.R. # 1 LOCAL RUNOFF

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
TOTAL	4	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM RESERVOIR 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAD-1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

	NSTPS	VSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	-257.	-1

STAGE	256.50	257.50	258.50	259.50	260.50	261.90	265.30	266.00	268.00	270.00
FLOW	0.00	140.00	396.00	727.00	1120.00	1804.00	6129.00	8526.00	20832.00	38018.00

STAGE-DISCHARGE DATA FOR HARTFORD RESERVOIR #1 DAM

SURFACE AREA=	0.	27.	35.	68.
CAPACITY=	0.	284.	342.	848.
ELEVATION=	225.	257.	260.	270.

STAGE-STORAGE DATA FOR H.R. # 1 DAM

SPILLWAY CREST ELEVATION →

CHEL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
256.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
265.3	0.0	0.0	0.

TOP OF DAM ELEVATION →

PEAK OUTFLOW IS 875. AT TIME 19.50 HOURS

PEAK OUTFLOW IS 1367. AT TIME 19.25 HOURS

PEAK OUTFLOW IS 1946. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 2551. AT TIME 18.75 HOURS

PEAK OUTFLOW IS 3105. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 3644. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 4213. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 4742. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 5241. AT TIME 18.50 HOURS

ROUTED OUTFLOWS FROM HR. # 1 DAM FOR VARIOUS FLOODS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	MAD-2	.81	1	397.	595.	794.	992.	1190.	1389.	1587.	1785.	1984.
		(2.10)		(11.23)	(16.85)	(22.47)	(28.09)	(33.70)	(39.32)	(44.94)	(50.56)	(56.17)
ROUTED TO	MAD-2	.81	1	313.	480.	672.	856.	1035.	1220.	1413.	1599.	1782.
		(2.10)		(8.86)	(13.60)	(19.03)	(24.25)	(29.31)	(34.56)	(40.01)	(45.28)	(50.45)
ROUTED TO	CHA-1	.81	1	313.	480.	672.	856.	1035.	1221.	1413.	1599.	1782.
		(2.10)		(8.86)	(13.59)	(19.02)	(24.25)	(29.32)	(34.56)	(40.01)	(45.27)	(50.45)
HYDROGRAPH AT	MAD-5	.27	1	164.	246.	328.	410.	491.	573.	655.	737.	819.
		(.70)		(4.64)	(6.96)	(9.28)	(11.60)	(13.92)	(16.24)	(18.55)	(20.87)	(23.19)
2 COMBINED	TOTAL	1.08	1	415.	639.	893.	1141.	1383.	1628.	1888.	2139.	2384.
		(2.80)		(11.76)	(18.10)	(25.30)	(32.32)	(39.17)	(46.10)	(53.47)	(60.58)	(67.51)
ROUTED TO	MAD-5	1.08	1	382.	600.	842.	1082.	1320.	1555.	1806.	2051.	2288.
		(2.80)		(10.81)	(17.00)	(23.83)	(30.65)	(37.34)	(44.03)	(51.15)	(58.07)	(64.80)
ROUTED TO	OS-B	1.08	1	381.	600.	842.	1081.	1320.	1555.	1807.	2048.	2286.
		(2.80)		(10.80)	(16.98)	(23.84)	(30.62)	(37.37)	(44.04)	(51.16)	(58.00)	(64.74)
HYDROGRAPH AT	MAD-3	.58	1	274.	412.	549.	686.	823.	961.	1098.	1235.	1372.
		(1.50)		(7.77)	(11.66)	(15.54)	(19.43)	(23.32)	(27.20)	(31.09)	(34.97)	(38.86)
ROUTED TO	MAD-3	.58	1	185.	286.	407.	521.	632.	744.	864.	1038.	1235.
		(1.50)		(5.23)	(8.10)	(11.53)	(14.74)	(17.88)	(21.07)	(24.46)	(29.39)	(34.97)
ROUTED TO	OS-A	.58	1	184.	285.	406.	520.	631.	743.	862.	1028.	1234.
		(1.50)		(5.22)	(8.07)	(11.49)	(14.73)	(17.87)	(21.04)	(24.40)	(29.10)	(34.94)
HYDROGRAPH AT	I-SFCH	1.30	1	492.	738.	984.	1230.	1476.	1722.	1968.	2214.	2460.
		(3.37)		(13.93)	(20.90)	(27.86)	(34.83)	(41.80)	(48.76)	(55.73)	(62.69)	(69.66)
ROUTED TO	O-SFCH	1.30	1	67.	84.	99.	111.	338.	652.	952.	1292.	1616.
		(3.37)		(1.88)	(2.39)	(2.80)	(3.15)	(9.58)	(18.45)	(26.96)	(36.57)	(45.76)
ROUTED TO	OS-C	1.30	1	67.	84.	99.	111.	338.	651.	951.	1290.	1611.
		(3.37)		(1.88)	(2.39)	(2.80)	(3.15)	(9.57)	(18.42)	(26.94)	(36.53)	(45.61)
HYDROGRAPH AT	MAD-1	.93	1	456.	683.	911.	1139.	1367.	1594.	1822.	2050.	2278.
		(2.41)		(12.90)	(19.35)	(25.80)	(32.25)	(38.70)	(45.15)	(51.60)	(58.05)	(64.50)
4 COMBINED	TOTAL	3.89	1	956.	1466.	2041.	2605.	3161.	3705.	4285.	4862.	5509.
		(10.08)		(27.08)	(41.50)	(57.80)	(73.76)	(89.50)	(104.93)	(121.32)	(137.67)	(156.27)
ROUTED TO	MAD-1	3.89	1	875.	1367.	1946.	2551.	3105.	3648.	4213.	4782.	5441.
		(10.08)		(24.78)	(38.71)	(55.11)	(72.24)	(87.93)	(103.30)	(119.30)	(135.42)	(154.07)

PEAK INFLOWS TO H.R. # 1 DAM FOR VARIOUS FLOODS

ROUTED OUTFLOWS FROM H.R. # 1 DAM FOR VARIOUS FLOODS

HARTFORD RESERVOIR #2 DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	385.30	385.30	390.30
STORAGE	0.	0.	241.
OUTFLOW	0.	0.	4879.

RATIO OF PMP	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	386.51	0.00	54.	313.	0.00	18.50	0.00
.30	386.92	0.00	73.	480.	0.00	18.50	0.00
.40	387.25	0.00	89.	672.	0.00	18.25	0.00
.50	387.54	0.00	103.	856.	0.00	18.25	0.00
.60	387.82	0.00	116.	1035.	0.00	18.25	0.00
.70	388.09	0.00	129.	1220.	0.00	18.00	0.00
.80	388.32	0.00	141.	1413.	0.00	18.00	0.00
.90	388.56	0.00	152.	1599.	0.00	18.00	0.00
1.00	388.78	0.00	163.	1782.	0.00	18.00	0.00

CHANNEL BETWEEN RESERVOIRS 2 AND 5 → PLAN 1 STATION CHA-1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	313.	321.9	18.75
.30	480.	322.4	18.50
.40	672.	322.8	18.25
.50	856.	323.2	18.25
.60	1035.	323.5	18.25
.70	1221.	323.8	18.00
.80	1413.	324.0	18.00
.90	1599.	324.3	18.00
1.00	1782.	324.5	18.00

HARTFORD RESERVOIR #5 DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	319.70	319.70	324.90
STORAGE	156.	156.	301.
OUTFLOW	0.	0.	2330.

RATIO OF PMP	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	321.23	0.00	195.	382.	0.00	19.00	0.00
.30	321.61	0.00	211.	600.	0.00	18.75	0.00
.40	322.33	0.00	225.	842.	0.00	18.75	0.00
.50	322.83	0.00	239.	1082.	0.00	18.50	0.00
.60	323.26	0.00	252.	1320.	0.00	18.50	0.00
.70	323.68	0.00	264.	1555.	0.00	18.50	0.00
.80	324.04	0.00	276.	1806.	0.00	18.25	0.00
.90	324.44	0.00	287.	2051.	0.00	18.25	0.00
1.00	324.83	0.00	299.	2288.	0.00	18.25	0.00

CHANNEL BETWEEN RESERVOIRS 5 AND 1 → PLAN 1 STATION DS-8

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	341.	258.9	19.00
.30	600.	259.6	18.75
.40	842.	260.3	18.75
.50	1081.	260.9	18.50
.60	1320.	261.4	18.50
.70	1555.	261.9	18.50
.80	1807.	262.4	18.50
.90	2044.	262.9	18.25
1.00	2288.	263.3	18.25

HARTFORD RESERVOIR # 3 DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	391.20	391.20	396.00
STORAGE	336.	336.	487.
OUTFLOW	0.	0.	946.

RATIO OF PMP	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	392.65	0.00	390.	185.	0.00	19.25	0.00
.30	393.33	0.00	408.	286.	0.00	19.25	0.00
.40	393.86	0.00	417.	407.	0.00	19.00	0.00
.50	394.34	0.00	432.	521.	0.00	19.00	0.00
.60	394.82	0.00	448.	632.	0.00	18.75	0.00
.70	395.28	0.00	463.	744.	0.00	18.75	0.00
.80	395.71	0.00	477.	864.	0.00	18.75	0.00
.90	396.06	.06	489.	1038.	1.00	18.50	0.00
1.00	396.18	.18	493.	1235.	1.75	18.00	0.00

CHANNEL BETWEEN RESERVOIRS 3 AND 1 → PLAN 1 STATION OS-A

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	184.	258.0	19.50
.30	285.	258.4	19.25
.40	406.	258.7	19.25
.50	520.	259.0	19.00
.60	631.	259.3	19.00
.70	743.	259.5	19.00
.80	862.	259.7	19.00
.90	1028.	260.0	18.75
1.00	1234.	260.3	18.25

SUMMARY OF DAM SAFETY ANALYSIS

SOUTH FLOOD CONTROL RESERVOIR

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	264.00	264.00	289.50
STORAGE	0.	0.	983.
OUTFLOW	0.	0.	4079.

RATIO OF PMP	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	276.08	0.00	230.	67.	0.00	26.25	0.00
.30	279.32	0.00	356.	84.	0.00	26.75	0.00
.40	281.95	0.00	446.	99.	0.00	27.25	0.00
.50	284.21	0.00	618.	111.	0.00	27.50	0.00
.60	285.35	0.00	692.	338.	0.00	24.25	0.00
.70	285.91	0.00	729.	652.	0.00	22.50	0.00
.80	286.38	0.00	761.	952.	0.00	21.50	0.00
.90	285.79	0.00	749.	1292.	0.00	21.00	0.00
1.00	287.14	0.00	814.	1616.	0.00	20.50	0.00

CHANNEL BETWEEN SOUTH FLOOD CONTROL RESERVOIR AND HARTFORD RESERVOIR #1 → PLAN 1 STATION OS-C

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	67.	258.0	26.25
.30	84.	258.1	26.75
.40	99.	258.2	27.25
.50	111.	258.3	27.75
.60	334.	259.4	24.50
.70	651.	260.1	22.50
.80	951.	260.6	21.75
.90	1290.	261.1	21.00
1.00	1611.	261.5	20.75

HARTFORD RESERVOIR # 1 DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	256.50	256.50	265.30
STORAGE	284.	284.	619.
OUTFLOW	0.	0.	6129.

SPILLWAY CAPACITY

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	259.88	0.00	387.	875.	0.00	19.50	0.00
.30	261.01	0.00	428.	1367.	0.00	19.25	0.00
.40	262.01	0.00	468.	1946.	0.00	19.00	0.00
.50	262.49	0.00	488.	2551.	0.00	18.75	0.00
.60	262.92	0.00	506.	3105.	0.00	18.50	0.00
.70	263.35	0.00	525.	3648.	0.00	18.50	0.00
.80	263.79	0.00	545.	4213.	0.00	18.50	0.00
.90	264.24	0.00	566.	4782.	0.00	18.50	0.00
1.00	264.76	0.00	591.	5441.	0.00	18.50	0.00

TEST FLOOD ELEVATION

ROUTED TEST FLOOD OUTFLOW

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 20 FEB 79

HARTFORD RESERVOIR # 1 DAM BREACH OUTFLOW (RESERVOIR SURFACE @ TOP OF DAM)
ROUTED TO THE DOWNSTREAM DAMAGE CENTER

INPUT

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     1                A1       HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
     2                A2                  NATIONAL DAM INSPECTION PROGRAM
     3                A3            NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4                M    300       0       15        0        0        0        0        0       -4        0
     5                M1     5
     6                J      2       1        1
     7                J1     0
     8                K      1  BASIN
     9                K1       ROUTED OUTFLOW FROM RESERVOIR 1
    10                Y                                 1        1
    11                Y1     1                                                 =264.8       -1
    12                Y4  256.5    257.5    258.5    259.5    260.5    261.9    265.3    266.0    268.0    270.0
    13                Y5     0      140      345      727     1120     1804     6129     8526    20832    38018
    14                Y8     0       27       35       58
    15                YF   225    256.5      250      270
    16                YY  254.5
    17                YD  265.3
    18                BR   300     .01      230        2    264.8    264.8
    19                BR   300     .01      230        2    264.8      270
    20                K      1  HAZARD                                          1
    21                K1       CHANNEL ROUTING TO HAZARD CENTER 1
    22                Y                                 1        1
    23                Y1     1                                                 =1
    24                Y6   0.04     0.04     0.04      170      190     2000     .025
    25                Y7     0      190      120      180      170      172      180      170      190      170
    26                Y7   200      172      270      180      370      190
    27                K     99
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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
 LAST MODIFICATION  25 FEB 79
**********************************

 RUN DATED 08/01/80.
      TIME= 04.47.19.

                HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
                        NATIONAL DAM INSPECTION PROGRAM
                    NEW ENGLAND DIVISION - CORPS OF ENGINEERS

                              JOB SPECIFICATION
      NO      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
     300       0       15        0        0        0        0        0       -4        0
                    JOPER      NWT    IEXPT    ITRACE
                        5        0        0        0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 2  NRTIO= 1  LRTIO= 1
NO INFLOW →  RTIOS=   0.00

**********  **********  **********  **********  **********

                          HYDROGRAPH ROUTING

                    ROUTED OUTFLOW FROM RESERVOIR 1

                ISTAO    ICOMP    IECON    ITAPE    JPLT     JPRT    INAME   ISTAGE   IAUTO
                HAD-1        1        0        0       0        0        1        0       0

                          ALL PLANS HAVE SAME
                            ROUTING DATA
                 QLOSS    CLOSS     AVG     IRES   ISAME    IOPT    IPMP             LSTR
                   0.0    0.000    0.00        1       1       0       0                0

                 ISTPS   NSTOL     LAG    AMSKK        X     TSK   STORA   ISPRAT
                     1       0       0    0.000    0.000   0.000    -265.       1

STAGE      256.50   257.50   258.50   259.50   260.50   261.90   265.30   266.00   268.00   270.00   } STAGE-DISCHARGE DATA
FLOW         0.00   140.00   396.00   727.00  1120.00  1804.00  6129.00  8526.00 20832.00 38018.00   }

SURFACE AREA=    0.      27.      45.      68.   } STAGE-STORAGE
CAPACITY=        0.     284.     332.     398.   } DATA
ELEVATION=     225.     257.     260.     270.   }

                  CPEL    SPWID     COOW     EXPW    ELEVL     COOL    CAREA     EXPL
SPILLWAY CREST ELEVATION → 256.5      0.0      0.0      0.0      0.0      0.0      0.0      0.0

                                DAM DATA
                              TOPEL     COOD     EXPD   DAMWID
TOP OF DAM ELEVATION →       265.3      0.0      0.0       0.

                            DAM BREACH DATA
                            BRWID        Z     ELBM    TRAIL     WSEL   FAILEL   } BREACH DIMENSIONS - FAILURE
                             300.      .01   230.00     2.00   264.80   264.80   } BEGINS IMMEDIATELY WITH RESERVOIR
                                                                                  SURFACE AT TEST FLOOD ELEVATION
BEGIN DAM FAILURE AT   0.00 HOURS

PEAK OUTFLOW IS     6115. AT TIME     .54 HOURS
   ↳ MAXIMUM BREACH DISCHARGE

                            DAM BREACH DATA
                            BRWID        Z     ELBM    TRAIL     WSEL   FAILEL   } BREACH DIMENSIONS - NO
                             300.      .01   230.00     2.00   264.80   270.00   } FAILURE OCCURS

PEAK OUTFLOW IS     2411. AT TIME    0.00 HOURS
   ↳ MAXIMUM DISCHARGE PRIOR TO BREACH

                                                                  UNITED COMPUTING SYSTEMS, INC.
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D-37

ROUTING BREACH OUTFLOW TO DOWNSTREAM HAZARD AREA

HYDROGRAPH ROUTING

CHANNEL ROUTING TO HAZARD CENTER 1

	ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	HAZARD	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

	QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
	0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

	QN(1)	QN(2)	QN(4)	ELNVT	ELMAX	RLNTH	SEL
	.0800	.0400	.0800	170.0	190.0	2000.	.02500

DOWNSTREAM CHANNEL CHARACTERISTICS

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	190.00	120.00	180.00	170.00	172.00	180.00	170.00	190.00	170.00
	200.00	172.00	270.00	180.00	370.00	190.00				

CHANNEL CROSS-SECTION AT DAMAGE AREA

STORAGE	0.00	.74	1.99	3.89	6.56	10.00	14.20	19.16	24.88	31.37
	38.66	47.03	56.52	67.12	78.85	91.70	105.66	120.74	136.95	154.27
OUTFLOW	0.00	79.83	321.14	822.33	1557.50	2549.67	3821.33	5396.56	7290.94	9531.51
	12072.80	14978.34	18352.22	22223.78	26623.11	31580.21	37124.56	43285.11	50090.16	57567.45
STAGE	170.00	171.05	172.11	173.16	174.21	175.26	176.32	177.37	178.42	179.47
	180.53	181.58	182.63	183.68	184.74	185.79	186.84	187.89	188.95	190.00
FLOW	0.00	79.83	321.14	822.33	1557.50	2549.67	3821.33	5396.56	7290.94	9531.51
	12072.80	14979.34	18352.22	22223.78	26623.11	31580.21	37124.56	43285.11	50090.16	57567.45

STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL

MAXIMUM STAGE IS 177.7 → STREAM ELEVATION AT DAMAGE CENTER DUE TO BREACH OUTFLOW

MAXIMUM STAGE IS 175.7 → STREAM ELEVATION AT DAMAGE CENTER DUE TO SPILLWAY OVERFLOW

HARTFORD RESERVOIR #1 DAM
BREACH OUTFLOW RESULTS

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	264.40	256.50	265.30
STORAGE	593.	284.	619.
OUTFLOW	5493.	0.	6129. → SPILLWAY DISCHARGE CAPACITY

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	264.43	0.00	593.	6135. → PEAK BREACH DISCHARGE	0.00	.54	0.00

SPILLWAY OVERFLOW RESULTS

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	264.40	256.50	265.30
STORAGE	593.	284.	619.
OUTFLOW	5493.	0.	6129.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	262.99	0.00	593.	5493. → PEAK SPILLWAY DISCHARGE PRIOR TO BREACH	0.00	0.00	0.00

BREACH FLOW AT DOWNSTREAM DAMAGE AREA → PLAN 1 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	5997. → BREACH FLOW AT HAZARD AREA	177.7	.75

SPILLWAY FLOW AT DOWNSTREAM DAMAGE AREA → PLAN 2 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	3069. → SPILLWAY FLOW AT HAZARD AREA	175.7	.25

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

HARTFORD RESERVOIR # 1 DAM BREACH OUTFLOW (RESERVOIR SURFACE AT PRIMARY SPILLWAY CREST) ROUTED TO DOWNSTREAM DAMAGE CENTER

INPUT

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     1  A1   HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
     2  A2       NATIONAL DAM INSPECTION PROGRAM
     3  A3     NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4  B    300    0      5      0      0      0      0      0     -4      0
     5  H1     5
     6  J      1      1      1
     7  J1     0
     8  K      1   HAD-1                                        1
     9  K1       ROUTED OUTFLOW FROM RESERVOIR 1
    10  Y                                    1      1
    11  Y1     1                                          -256.5     -1
    12  Y4  256.5   257.5   258.5   259.5   260.5   261.9   265.3   266.0   268.0   270.0
    13  Y5     0     140     395     727    1120    1804    8129    8525   20832   38018
    14  SA     0      27      35      68
    15  SF   225   256.5     260     270
    16  S1  256.5
    17  SO  265.3
    18  S9   300    0.01     230       2   256.5   256.5
    19  K      1   HAZARD                                       1
    20  K1       CHANNEL ROUTING  TO HAZARD CENTER 1
    21  Y                                    1      1
    22  Y1     1                                          -1
    23  Y5  0.08    0.08    0.08     170     190    2000    .025
    24  Y7     0     190     120     180     170     172     180     170     190     170
    25  Y7   270     172     270     180     370     190
    26  K     99
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D-40

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

 RUN  DATE= 02/26/80.
      TIME= 08.49.52.

                    HYDROLOGIC ANALYSIS OF HARTFORD RESERVOIR DAM NO. 1
                    NATIONAL DAM INSPECTION PROGRAM
                    NEW ENGLAND DIVISION - CORPS OF ENGINEERS

                                JOB SPECIFICATION
          NO      NHR     NMIN    IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
         300       0       5        0       0       0        0        0       -4        0
                                  JOPER     NWT   LROPT    TRACE
                                      5       0       0        0

                            MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1  NRTIO= 1  LRTIO= 1

 NO INFLOW --> RTIOS=   0.00

**********  **********  **********  **********  **********

                            HYDROGRAPH ROUTING

                    ROUTED OUTFLOW FROM RESERVOIR 1

                          ISTAO   ICOMP   IECON   ITAPE   JPLT    JPRT    INAME   ISTAGE   IAUTO
                            HAU=1       1       0       0       0       0       1        0       0
                                        ROUTING DATA
                    QLOSS   CLOSS     AVG    IRES   ISAME   IOPT    IPMP            LSTR
                      0.0   0.000    0.00       1       1       0       0               0
                          NSTPS   NSTOL     LAG    AMSKK       X     TSK    STORA   ISPHAT
                              1       0       0    0.000   0.000   0.000   -257.       -1

 STAGE      256.50   257.50   258.50   259.50   260.50   261.90   265.30   266.00   268.00   270.00
 FLOW         0.00   140.00   396.00   727.00  1120.00  1804.00  6129.00  8526.00 20832.00 38018.00

 SURFACE AREA=    0.      27.      35.      68.
 CAPACITY=        0.     284.     392.     898.
 ELEVATION=     225.     257.     258.     270.

                          CREL    SPWID    COOW    EXPW    ELEVL    COOL    CAREA    EXPL
 SPILLWAY CREST ELEVATION --> 256.5      0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                    DAM DATA
                                  TOPEL    COOD    EXPD   DAMWID
 TOP OF DAM ELEVATION ------------> 265.3     0.0     0.0      0.

                                DAM BREACH DATA
                          BRWID      Z    ELBM   TFAIL    WSEL  FAILEL
                          300.     .01  230.00    2.00  256.50  256.50

 BEGIN DAM FAILURE AT    0.00 HOURS

 PEAK OUTFLOW IS     9522. AT TIME    .88 HOURS
                  --> MAXIMUM BREACH DISCHARGE
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STAGE-DISCHARGE DATA

STAGE-STORAGE DATA

BREACH DIMENSIONS - FAILURE BEGINS IMMEDIATELY WITH RESERVOIR SURFACE AT SPILLWAY CREST ELEVATION

H-01

ROUTING BREACH OUTFLOW TO DOWNSTREAM HAZARD AREA

HYDROGRAPH ROUTING

CHANNEL ROUTING TO HAZARD CENTER 1

	ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	HAZARD	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMXT	ELMXA	WLNTH	SFL
.0400	.0400	.0400	170.0	190.0	2000.	.02500

} CHANNEL CHARACTERISTICS

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 190.00 120.00 180.00 170.00 172.00 180.00 170.00 190.00 170.00
200.00 172.00 270.00 190.00 370.00 190.00

} CHANNEL CROSS-SECTION AT DAMAGE AREA

STORAGE	0.00	.74	1.99	3.89	6.56	10.00	14.20	19.16	24.88	31.37
	38.66	47.03	56.52	67.12	78.85	91.70	105.66	120.74	136.95	154.27
OUTFLOW	0.00	79.83	321.14	822.33	1557.50	2549.67	3821.33	5394.56	7290.94	9531.51
	12072.80	14978.34	18352.22	22223.78	26623.11	31580.21	37124.56	43285.11	50090.16	57567.45
STAGE	170.00	171.05	172.11	173.16	174.21	175.26	176.32	177.37	178.42	179.47
	180.53	181.58	182.63	183.68	184.74	185.79	186.84	187.89	188.95	190.00
FLOW	0.00	79.83	321.14	822.33	1557.50	2549.67	3821.33	5394.56	7290.94	9531.51
	12072.80	14978.34	18352.22	22223.78	26623.11	31580.21	37124.56	43285.11	50090.16	57567.45

} STAGE-STORAGE AND STAGE-DISCHARGE DATA FOR THE DOWNSTREAM CHANNEL

MAXIMUM STAGE IS 174.8 → STREAM ELEVATION AT DAMAGE CENTER

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	256.50	256.50	265.30
STORAGE	284.	284.	619.
OUTFLOW	0.	0.	6129. → SPILLWAY DISCHARGE CAPACITY

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	256.50	0.00	284.	4522. → PEAK BREACH DISCHARGE	0.00	.88	0.00

PLAN 1 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	4485. → PEAK FLOW AT HAZARD AREA	176.8	.92

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME


DA
FILM