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NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
HARRIS POND DAM (RI D..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV FEB 79

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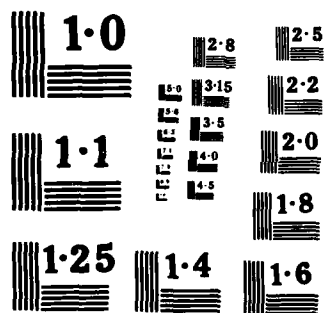
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AD-A156 587

PROVIDENCE RIVER BASIN
WOONSOCKET, RHODE ISLAND

HARRIS POND DAM
RI 03901

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is a zoned earth embankment about 1200 ft. long with a maximum height of about 40 ft. The dam is intermediate in size with a high hazard potential. Because of this the test flood is the full PMF. Both the dam and its appurtenant structures are judged to be in generally good condition. There are various remedial measures which must be undertaken by the owner.		



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

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

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

Dear Governor Garrahy:

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

A copy of this report has been forwarded to the Department of Environmental Management, the cooperating agency for the State of Rhode Island. In addition, a copy of the report has also been furnished the owner, City of Woonsocket, Rhode Island.

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

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

Sincerely,

Max B. Scheider
MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

HARRIS POND DAM

RI 03901

PROVIDENCE RIVER BASIN
WOONSOCKET, RHODE ISLAND



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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: RI 03901
Name of Dam: Harris Pond Dam
Town: Woonsocket
County and State: Providence County Rhode Island
Stream: Mill River
Date of Inspection: 27 September 1978

BRIEF ASSESSMENT

Harris Pond Dam is a zoned earth embankment about 1,200 ft. long, with a maximum height of about 40 ft. A low auxiliary dike about 300 ft. long is constructed across the right abutment. The present dam was reconstructed in 1969, incorporating the remains of a nineteenth century dam which was breached in 1955. The dam is operated as a water supply facility for the City of Woonsocket.

The spillway has a 150 ft. long ungated ogee crest which discharges into a stepped chute and stilling pool. Stored water is released to a pumping station via a 20 in. dia. pipe from a wet well shaft, and a 36 in. dia. outlet pipe discharges into a downstream channel.

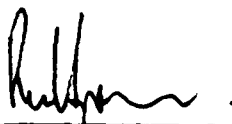
Maximum storage capacity of the reservoir to top of dam is about 2,850 acre-ft. and the drainage area is 32.5 square miles. The reservoir is about 1.85 miles long with a surface of 100 acres at spillway crest elevation. Based on both height and capacity criteria, the dam is classified as intermediate in size. Because of the threat to life and property which would result from the dam being breached, particularly in the Social area of Woonsocket, it has been classified as having a high hazard potential. Based on intermediate size and high hazard, the test flood is the full PMF.

Some seepage was observed along the downstream toe of the dam, and there is some minor erosion of the upstream slope. Brush and light tree growth are established in the outlet channel, and there is also some light brush on the upstream slope. One of the outlet control valves is inoperable. Both the dam and its appurtenant structures are judged to be in generally good condition.

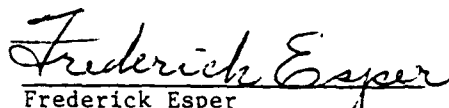
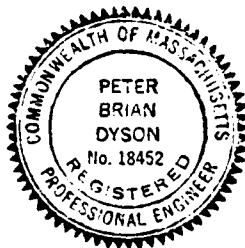
The test flood inflow is 17,500 cfs., while the test flood outflow is 17,200 cfs. The test flood surcharge elevation of 175.9 would overtop the lowest point of the sloping dike by 3.7 ft., with 2,900 cfs. of the outflow being discharged over the dike and 14,400 cfs. being released through the spillway. A 0.5 PMF event would also overtop the dike by a maximum of 1.3 ft. The spillway chute walls would be completely overtopped by the test flood outflow and partially overtopped by a 0.5 PMF outflow. The spillway would pass about 32 percent of test flood without overtopping the dike.

Within one year after receipt of this Phase I Inspection Report, the owner, the City of Woonsocket, should retain the services of a registered professional engineer to make further hydrologic and hydraulic evaluations, and should implement the results. These investigations should cover the potential overtopping of the dike and right abutment, whether the dike should be raised, and the spillway flow conditions below the crest and through the chute.

The owner should also implement the following measures: (1) repair minor erosion and restore displaced riprap on the upstream slope; (2) control growth on the upstream slope and in the outlet channel; (3) monitor seepage and toe drain discharges monthly during periods of high reservoir level; (4) repair the unserviceable 24 in. dia. outlet valve; (5) develop a formal surveillance and warning plan; and (6) institute procedures for a biennial periodic technical inspection.



Peter B. Dyson
Project Manager



Frederick Esper
Vice President



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

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

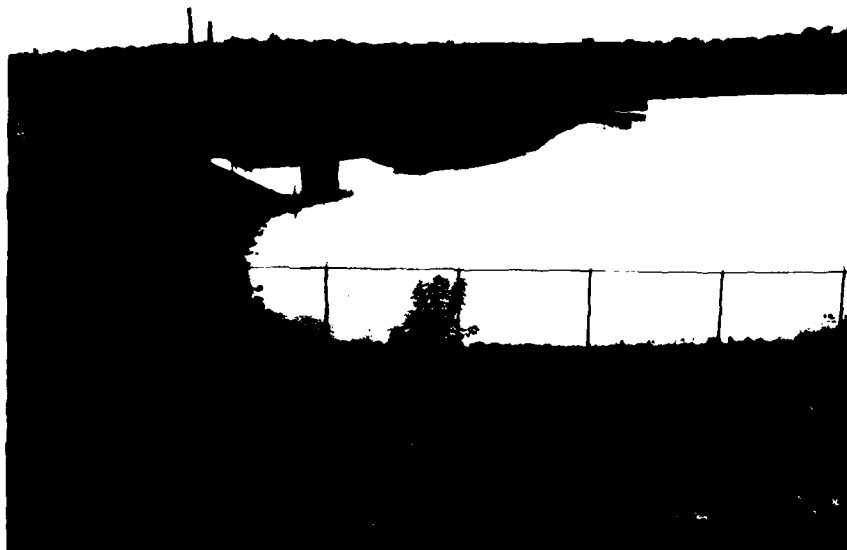
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because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

TABLE OF CONTENTS

	<u>Page</u>
NED LETTER OF TRANSMITTAL	
BRIEF ASSESSMENT	
REVIEW BOARD PAGE	
PREFACE	i
TABLE OF CONTENTS	ii
OVERVIEW PHOTOS	iv
LOCATION MAP	v
PHASE I INSPECTION REPORT	
SECTION 1 - PROJECT INFORMATION	
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	6
SECTION 2 - ENGINEERING DATA	
2.1 Design	11
2.2 Construction	11
2.3 Operation	11
2.4 Evaluation	11
SECTION 3 - VISUAL INSPECTION	
3.1 Findings	13
3.2 Evaluation	16
SECTION 4 - OPERATIONAL PROCEDURES	
4.1 Procedures	17
4.2 Maintenance of Dam and Dike	17
4.3 Maintenance of Operating Facilities	17
4.4 Warning System	17
4.5 Evaluation	17

	<u>Page</u>
SECTION 5 - HYDRAULIC/HYDROLOGIC	
5.1 Evaluation of Features	18
SECTION 6 - STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	26
SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES	
7.1 Dam Assessment	28
7.2 Recommendations	28
7.3 Remedial Measures	29
7.4 Alternatives	29
APPENDICES	
APPENDIX A - VISUAL INSPECTION CHECKLIST	
APPENDIX B - PLANS & RECORDS	
APPENDIX C - SELECTED PHOTOGRAPHS	
APPENDIX D - HYDROLOGIC & HYDRAULIC COMPUTATIONS	
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	

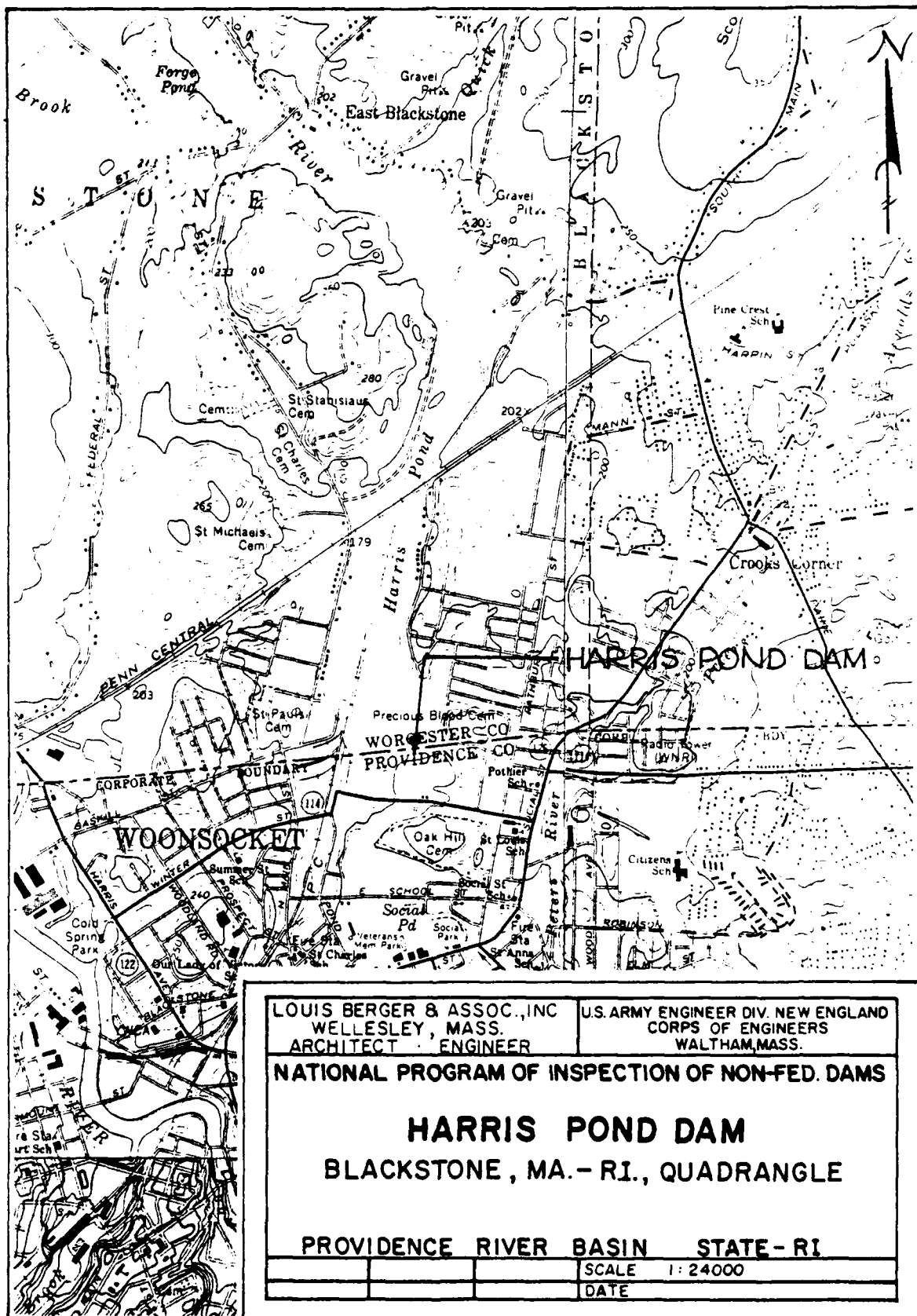
HARRIS POND DAM



Overview from Precious Blood Cemetery at left abutment



Overview from right abutment



PHASE I INSPECTION REPORT

HARRIS POND DAM RI 03901

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 24 August 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0371 has been assigned by the Corps of Engineers for this work.

b. Purpose

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
3. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Harris Pond Dam is located on Mill River at the Massachusetts-Rhode Island state boundary. The main dam is in the City of Woonsocket, Providence County, Rhode Island, although part of the downstream

The profile along the crest of the dam and dike is not horizontal, but ramped each way from the spillway to the dam abutments. This profile is delineated on Figure 1, Sheet D-1, Appendix D, and on the drawings in Appendix B. The crest of the dam varies from elevation 180.3 to 177.3, and the crest of the dike varies from elevation 177.3 to 172.2, the lowest point being at the right abutment. The minimum freeboard above normal storage for the main dam embankment is 9.8 ft.

The typical reconstructed cross section in the area encompassing the original dam has a $2\frac{1}{2}$ horizontal to 1 vertical upstream slope and a 2 to 1 downstream slope. The upstream slope basically consists of a sloping impervious earthfill blanket placed against the pre-existing earth dam, which is covered with a 12 in. layer of bank run gravel and a 6 in. layer of screened gravel. These layers are in turn overlain by an 18 in. thick riprap over the entire upstream slope. The downstream slope consists of a pervious earthfill and the crest width is 35 ft. A stone gutter was incorporated along the toe of the downstream slope. A drain blanket and a toe drain collector system were installed at the toe of the downstream slope as shown on the contract drawings. The typical dam section in the east abutment breached area is a continuation of the typical embankment section previously described, except that a random pervious fill material was used to fill the breached gap.

A cut-off trench was provided beneath the impervious zone along the toe of the upstream slope of the embankment. This cut-off trench was extended either to bedrock or to a maximum depth of approximately 10 ft. for the entire length of the dam. The dike from the right end of the dam apparently had no cut-off. Where the cut-off trench did not contact rock, a considerable thickness of natural granular soil overlies the rock. Seepage from the reservoir would, therefore, be expected to go through this layer. Analytical studies were made in 1968 by the dam designer and seepage was predicted through this area. A toe drainage system was incorporated to intercept this seepage.

2. Spillway

The spillway is located on the knoll between the main embankment to the right and the refilled breach gap to the left. The spillway channel is directed along the downstream face of the knoll, its centerline making an angle of about 69 degrees with the axis of the dam. The spillway has a 150 ft. long ungated ogee crest converging to a 90 ft. wide, three-stepped rectangular concrete-lined chute, and then to a trapezoidal riprap-lined stilling pool. The ogee crest is at elevation 167.5; the floor of the riprapped basin is at elevation 132. The total length of the concrete chute is about 250 ft. The spillway was designed for a normal capacity of 8,500 cfs. at a surcharge head of about 6 ft., which is 1.3 ft. higher than the low point on the dike. The spillway capacity when the dike would start to be overtopped is 5,500 cfs.

The spillway ogee crest structure, chute walls and floor slabs were placed on natural ground, with a gravel blanket and open-jointed vitrified pipe underdrainage system.

3. Outlets

Outlet pipes at three selective levels are provided for releasing stored waters from the reservoir. Two 16 in. dia. cast iron inlet pipes, at elevations 160.5 and 153.0, lead into a wet well shaft where inflows are controlled by butterfly valves. A 20 in. dia. pipeline conveys these flows from the shaft to a pumping station situated to the right of the spillway. A 36 in. dia. low-level outlet pipe at elevation 144.5 leads from the reservoir to empty into a downstream channel, with control regulated by two 24 in. dia. butterfly valves located in the wet well shaft.

c. Size Classification

Harris Pond Dam varies between 38 ft. and 41 ft. in height above downstream river level, and impounds a normal storage of about 1,050 acre-ft. to spillway crest level and a maximum of about 2,850 acre-ft. to top of dam. In accordance with the size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, the project falls into the intermediate category for both criteria and therefore is classified accordingly.

d. Hazard Classification

A breach failure of Harris Pond Dam would release water down the Mill River's rechannelized channel and through the flood control conduit constructed under the Social area of Woonsocket. The Mill River flood control conduit was designed for a discharge of 8,500 cfs, above which the inlet walls and dikes above the conduit entrance would be overtopped. Such overtopping would flood out the entire Social area behind the confining floodwall along the Blackstone River, causing extensive property damage and possible loss of life. In view of this, the dam has been classified as having a high hazard potential in accordance with the Recommended Guidelines for the Safety Inspection of Dams.

e. Ownership

Harris Pond Dam is owned by the City of Woonsocket, Rhode Island.

f. Operator

Makram H. Megalli, P. E.
Director of Public Works
City Hall
169 Main Street
Woonsocket, RI 02895

Hedley V. Patterson
Division Engineer

Russell S. Horne
Water & Sewer Superintendent

Telephone: (401) 762-6400

g. Purpose of Dam

Harris Pond is operated in conjunction with other facilities for water supply for the City of Woonsocket.

h. Design and Construction History

The present dam was constructed in 1968-69 on the site of a nineteenth century earth dam which was breached on 19 August 1955, during hurricane "Diane". The breach was about 100 ft. wide and included the spillway.

According to a report dated August 23, 1955 (Appendix B), the failure of the Spindleville Dam near Hopedale, Massachusetts, about 7 miles upstream, apparently began a chain reaction of dam failures down the Mill River.

No information has been recovered about the design and construction of the original dam in the nineteenth century. The files of the RI Department of Environmental Management show that in the 1930's the dam was owned by Woonsocket Rayon Co. and in the 1940's by Synthetic Yarns, Inc.

After the 1955 dam failure, the City of Woonsocket acquired the water rights from the previous owners. The present dam was designed by Metcalf & Eddy, Engineers (now Metcalf & Eddy, Inc., 50 Staniford St., Boston, MA 02114) for the city, and reconstruction incorporated the original earth dam into the new embankment. The normal reservoir level, however, is now 2 ft. lower than that maintained by the old spillway.

1. Normal Operational Procedure

There are no written operating procedures. According to Public Works Department personnel, Harris Pond is only utilized occasionally as a source of water. The pumps are tested once a year. If the water level falls below normal, the 6 in. dia. bypass valve is opened to provide some downstream flow.

1.3 Pertinent Data

a. Drainage Area

The drainage area above the Harris Pond Reservoir covers about 32.5 square miles, being about 14 miles long and an average of 2.3 miles wide. The area measures 3.8 miles at its widest point. Upstream from Harris Pond on the Mill River or its tributaries are the following impoundments: Forge Pond immediately upstream with a surface area of 16 acres at elevation 177; Lake Hiawatha about 1 mile upstream on Quick Stream with a surface area of 60 acres at elevation 229; Spindleville Pond about 6 miles upstream with a surface area of 12 acres at elevation 235; Hopedale Pond about 7½ miles upstream with a surface area of 92 acres at elevation 274; Fiske Millpond about 10½ miles upstream with a surface area of 16 acres at elevation 295;

and North Pond about 12½ miles upstream with surface area of 232 acres at elevation 348. A sketch of the area showing the location of the pondages and streams is shown on Sheet D-2, Appendix D.

The topography of the drainage area is mainly rolling hills, being generally wooded with occasional small swampy areas along the main stream course. The rim of the basin rises to an average of about 200 ft. above the stream valley, with individual hills rising to as much as 300 ft. above the valley floor. The watercourse upstream above Harris Pond Reservoir measures about 15.7 miles, with an average slope of about 13 ft. per mile. Except in the towns of Hopedale and Spindleville and in the areas surrounding North Pond, the area is sparsely developed, with residences scattered along the network of secondary roads in the area.

b. Discharge at Damsite

1. Outlet Works Conduit

The 36 in. dia. low-level outlet pipe can release about 125 cfs with reservoir at spillway crest level elevation 167.5. An average of about 80 cfs can be released through the range of reservoir levels from elevation 146 to 167.5. A discharge curve is shown on Sheet D-3, Appendix D.

2. Maximum Known Flood at Damsite

The maximum known flood at Harris Pond Dam occurred during the August 1955 storm, caused by a record rainfall amplified by the failure of the Spindleville Dam upstream. It was estimated that the flood inflow peaked at about 3,400 cfs and that the flow increased below the dam after the failure of the spillway and subsequent breaching.

3. Spillway Capacity at Top of Dam

The spillway was designed to pass about 8,500 cfs at a 6 ft. reservoir surcharge, to elevation 173.5. However, the low point on the dike is at elevation 172.2, so that at the start of an overtopping the spillway capacity is 5,500 cfs. If the dike was raised to the elevation of the low point of the dam (177.3), the spillway capacity is computed to be about 18,500 cfs for this surcharge elevation. A spillway discharge curve is shown on Fig. 2, Sheet D-4, and computations are shown on Sheet D-5, Appendix D.

4. Spillway Capacity at Test Flood Elevation

The spillway capacity at test flood elevation is computed to be about 14,400 cfs at reservoir surcharge elevation 175.9.

5. Total Project Discharge at Test Flood Elevation

In addition to the spillway discharge, about 2,900 cfs would be discharged over the end of the dike at the right abutment, giving a total project discharge at test flood elevation of about 17,200 cfs at reservoir surcharge elevation 175.9.

c. Elevation (ft. above MSL)

1. Streambed at centerline of dam - 139.5
2. Maximum tailwater for 8,500 cfs - Not calculated
3. Upstream portal invert, diversion conduit - 144.5
4. Recreation pool - Not applicable
5. Full flood control pool - Not applicable
6. Spillway crest - 167.5
7. Design surcharge - 173.5
8. Top of dam - 177.3 to 180.3
9. Top of dike - 172.2 to 177.3
10. Test flood design surcharge - 175.9

d. Reservoir

1. Length of maximum pool - 2.04 miles
2. Length of recreation pool - Not applicable
3. Length of flood control pool - Not applicable

e. Storage (acre-feet)

1. Recreation pool - Not applicable
2. Flood control pool - Not applicable
3. Spillway crest pool El 167.5 - 1,050
4. Top of dam El 177.3 - 2,850
5. Top of dike El 172.2 - 1,750
6. Test flood pool El 175.9 - 2,500

f. Reservoir Surface (acres)

1. Recreation pool - Not applicable
2. Flood control pool - Not applicable
3. Spillway crest - 100
4. Test flood pool - 238
5. Top of dam - 258

g. Dam

1. Type - Zoned earth embankment
2. Length - 1,018 ft.
3. Height - Variable, 38 ft. to 41 ft.
4. Top width - Variable width on right abutment bench.
35 ft. right of spillway to right abutment bench. 20 ft. left of spillway.
5. Side slopes - $2\frac{1}{2}$ to 1 upstream; 2 to 1 downstream
6. Zoning - Original dam: Impervious upstream and central zone, pervious downstream facing.
New dam at breached section - Impervious upstream zone, random pervious central core, pervious downstream zone.
7. Impervious core - Original dam: Impervious upstream and central zone
New dam at breached section:
Impervious upstream zone
8. Cut-off - Cut-off trench at upstream toe, backfilled with impervious fill. Trench depth to bedrock or maximum of 10 ft. in earth.
9. Grout curtain - None
10. Other - 18 in. riprap on filter bedding on upstream face.
Sodded downstream face.

Right (West) Abutment Dike

1. Type - Random pervious fill with upstream impervious blanket underlying riprap facing.
2. Length - 180 ft.
3. Height - 14 ft. maximum
4. Top width - 10 ft.
5. Side slopes - $2\frac{1}{2}$ to 1 upstream; 2 to 1 downstream
6. Zoning - Impervious upstream zone tied into upstream cut-off trench, random pervious central zone, pervious downstream zone.
7. Impervious core - Impervious upstream zone
8. Cut-off - 5 ft. deep cut-off trench at upstream toe, backfilled with impervious material.
9. Grout curtain - None.
10. Others - 18 in. riprap on filter bedding on upstream face.
Sodded downstream face.

h. Diversion and Regulating Tunnel - None

i. Spillway

1. Type - Ungated stepped-chute with riprapped trapezoidal stilling basin
2. Length of weir - 150 ft.
3. Crest elevation - 167.5 ft.
4. Gates - None
5. Upstream channel - 150 ft. wide channel, 100 ft. long from reservoir to ogee overflow.
6. Downstream channel - Converging chute from 150 ft. width to 90 ft. width in 60 ft. length. 90 ft. wide rectangular concrete chute 177 ft. long, stepped with 6 ft., 8 ft. and 16 ft. vertical drops.
7. General - Spillway flows directed into channelized river section through Social area of Woonsocket.

j. Regulating Outlets

1. Invert - 144.5
2. Size - 36 in. dia.
3. Description - Concrete pipe conduit
4. Control Mechanism - 24 in. dia. butterfly valves
5. Other - Two 16 in. dia. cast iron inlet pipes at elevations 160.5 and 153.0 lead into a wet well shaft where inflows are controlled by butterfly valves. A 20 in. dia. pipeline conveys these flows to a pumping station. There is a 6 in. dia. bypass valve on a tee in the 20 in. dia. pipe.

SECTION 2 - ENGINEERING DATA

2.1 Design

No data on the design of the original nineteenth century dam has been recovered and probably none exists. The 1968-69 rehabilitation of the remains of the original dam was designed by Metcalf & Eddy, Engineers (now Metcalf & Eddy, Inc.) of Boston, Massachusetts. Copies of drawings which are pertinent to considerations of dam safety are included in Appendix B. Design data is available on microfilm at the library of Metcalf & Eddy at 50 Staniford Street, Boston, where it has been reviewed by the inspection team.

2.2 Construction

No information relating to construction of the original dam has been found. The reconstructed dam was built in 1968-69 by contract under the supervision of the design engineers, but no construction records have been located.

2.3 Operation

The dam and reservoir are operated by personnel of the City of Woonsocket Department of Public Works, in conjunction with other water storage facilities in the city's water supply system. According to the Division Engineer, Harris Pond has only been utilized as a source of water occasionally for short periods since the dam was reconstructed. The 6 in. dia. bypass valve is opened when the reservoir storage level falls below normal and there is no discharge over the spillway. The pumps are tested annually.

2.4 Evaluation

a. Availability

The plans, specifications, boring logs and microfilm file of engineering data in the design engineer's library, supplemented by the visual observations of the inspection team, form the basis for the information presented in this report.

b. Adequacy

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

c. Validity

The validity of the engineering data acquired covering the dam and spillway structure is considered acceptable and is not challenged.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Harris Pond Dam took place on 27 September 1978. At that time the reservoir was about at normal storage level, with a small discharge over the spillway crest. Both the dam and the supplementary dike at the right abutment were judged to be in good condition. There was no evidence of any major maintenance problems, but several minor items require attention (see Section 7.3).

b. Dam

The profile of the crest of the dam is not horizontal, but slopes each way from the spillway. The original design drawings show the dam crest as level at elevation 177.3. Record drawings, however, show that the top of the dam is at elevation 180.3 at the abutments of the spillway, and that it ramps down to the left to elevation 177.3 about opposite the outlet control house, and to the right to elevation 177.3 at the right abutment.

The crest of the main embankment to the right of the spillway has a good horizontal and vertical alignment. No cracks were observed in the crest pavement, which is in good condition. The alignment of the crest of the dam to the left of the spillway is also good, while the crest pavement is in generally good condition, except for a transverse crack across the pavement about 20 ft. to the left of the gatehouse. The crack is about $\frac{1}{2}$ in. wide and 1 in. deep.

The riprap on the upstream slope of the dam is in excellent condition. There is some minor erosion of the embankment material at the intersections of both spillway training walls, where it appears that some of the rock riprap was removed by vandals (Appendix C, Photo No. 1).

The downstream slope of the dam is in excellent condition, with no evidence of bulges or movement (Appendix C, Photo No. 3). The downstream toe of the dam to the right of the spillway has a cobblestone facing for the bottom 3 ft., measured along the slope. These are rounded stones roughly 6 in. to 10 in. in diameter. The area immediately

below the toe of the dam for a width of 300 ft. is essentially flat, and the ground is wet where the cobblestone armor intersects the natural ground. However, no major springs or seeps in the embankment were observed. The seepage which is evident collects toward the right abutment along the intersection of the embankment and natural ground. An 8 in. dia. toe drain outlet pipe emerges from the toe of the dam near its intersection with the right abutment; the flow from this pipe was estimated at about 5 gpm.

At the toe of the dam near the left abutment, a small seep was noted on the downstream slope immediately to the left of the 36 in. conduit concrete outlet structure. This seepage was estimated to be of the order of 1 gpm. The 36 in. outlet pipe was not discharging at the time and was dry. Along the downstream toe of the dam, between the outlet structure and the spillway channel, the ground showed seeps totaling an estimated 20 to 30 gpm. Some surface drainage from the housing project, located downstream from the left abutment toe, also drains into the outlet channel, and some of the evident flow may originate from this source as well as from the seeps.

Considering the dam in its entirety, no major localized seeps were noted. Seepage flow was clear and was not carrying solids.

The top of the right abutment dike slopes from elevation 177.2 at the end of the dam to about elevation 172.1 at the end of the dike about 180 ft. away. The area downstream from the dike has been filled in and paved contiguous with the dike, and is now used for a parking lot for the mill building nearby. In the event of an encroachment on the reservoir freeboard above elevation 172, this saddle area would act as an auxiliary spillway for discharging flows from the reservoir. Any such discharges would flow back into the Mill River upstream of the Mill River Conduit headwall.

Riprap on the upstream slope of the dike and the crest paving on the dike is in good condition, except for some widely spaced shrinkage cracks in the pavement (Appendix C, Photo No. 4). Trespassers have displaced some riprap locally to form stepping stones around the fence. No seepage was observed along those parts of the downstream toe of the dike which were not paved over by the parking lot surfacing.

c. Appurtenant Structures

The spillway is founded on an earth knoll with undetermined overburden depth to bedrock. The spillway inlet channel is lined with a 3 ft. thick impervious earth blanket protected by a riprap surfacing. The downstream channel floor slabs are underlain with a gravel blanket and a sewer pipe drainage system. With about 1 in. of flow over the spillway crest and in the spillway channel, no seepage flow from the outlets of the underdrainage system could be observed (Appendix C, Photo No. 6).

The condition of the concrete at the spillway bridge, walls and floor, where not covered by flow, appeared to be excellent (Appendix C, Photo No. 5). For higher spillway flows, the stilling basin will perform as a plunge pool and some displacement of the riprap can be expected. The riprap appeared to be fairly well distributed and uniformly covering the basin surface.

The outlet works control shaft and gatehouse, where visible, appeared in excellent condition. Except for the possible seepage around the outside of the low-level outlet structure, as noted previously, the outlet conduit terminal appeared stable (Appendix C, Photo No. 7).

d. Reservoir Area

The banks upstream from the dam on both abutments slope gradually and appear stable against sloughing into the reservoir. The reservoir is crossed at several points by the Penn Central R.R. and an abandoned rail bed, and by the Farm Street roadway. These rail and road embankments divide the reservoir into separated pondages, interconnected by culverts at varying invert levels. Thus, below normal storage level, not all ponds are contiguous with the main reservoir. In the surcharge storage space, the levels in the auxiliary ponds and in the main reservoir would equalize.

e. Downstream channel

The Mill River below Harris Pond Dam has been straightened and channelized for about 0.6 miles (Appendix C, Photo Nos. 2, 9 & 10), after which it flows through a 12 ft. high by 42 ft. wide twin barrel conduit, to empty into the Blackstone River (Appendix C, Photo Nos. 11 & 12). The channelized portion of the river valley is diked above the conduit so as to prevent floods from overflowing onto the Social area of Woonsocket. The tops of the dikes are at about elevation 144, or about 8 ft. higher than the streambed below the dam.

Privilege Street and School Street bridges cross the river channel upstream from the flood control conduit. These bridges would provide some restrictions to large flows down the Mill River channel. The major restriction to such flows, however, would be that of backwater owing to the control capacities through the flood control conduit, dictated initially by the flow stage in the Blackstone River at the conduit outlet.

3.2 Evaluation

The visual inspection of the dam adequately revealed key characteristics as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. The Harris Pond Dam and appurtenant works are judged to be in generally good condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Harris Pond Dam is operated by personnel of the Woonsocket Department of Public Works. According to the Division Engineer, Harris Pond has only been used as a water source occasionally for short periods. The 6 in. dia. bypass valve is opened to provide some downstream flow whenever the reservoir storage level falls below normal. The pumps are tested annually. No documented operating procedures have been prepared.

4.2 Maintenance of Dam and Dike

Maintenance is carried out as required by city personnel. This consists principally of the periodic cutting of brush and other growth on the dam embankment, and repair of riprap and fences damaged by trespassers.

4.3 Maintenance of Operating Facilities

All manually operated valves are said to be serviceable and inspected regularly, except for the upstream 24 in. dia. butterfly valve, which is jammed in the open position. The gatehouse is kept locked and secure, but attempts have been made by unauthorized persons to break down the door.

4.4 Warning System

There is no formal warning system at this dam.

4.5 Evaluation

Operational procedures should be formalized and put into writing. The level of effort put into routine maintenance requires increasing slightly. Operating facilities should be repaired as necessary and a flood warning plan should be developed and implemented.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The drainage area above Harris Pond covers about 32.5 square miles. On the basis of envelope curve values given in the March 1978 Preliminary Guidance for Estimating Maximum Probable Discharges (NED), a range of CSM values between 600 and 1,500 (flat to rolling terrain) are suggested. If a CSM value of 1,000 is assumed, the resultant peak inflow into Harris Pond is about 33,000 cfs.

As noted in Section 1.3a, however, the Mill River and tributary streams encompass a number of sub-areas, each of which has differing configurations, slopes, lag times, impoundments and runoff characteristics. Since use of the guidance curves does not take into account these variations, and since the flood peak of the hydrograph is an important consideration in this case, it was decided to analyze the drainage basin by sub-areas. In this way the different runoff influences and retardations caused by the various reservoir impoundments, and the spillway outflow characteristics at these installations, are taken into consideration.

In 1960, prior to the reconstruction of Harris Pond Dam, the New England Division, Corps of Engineers, designed and constructed the Mill River flood control conduit below the dam. The design capacity of this conduit is indicated as being 8,500 cfs, equivalent to 262 CSM (not considering inflows from Peters River).

The rehabilitation of Harris Pond Dam was designed in 1968 by Metcalf & Eddy, Engineers, of Boston, MA. Microfilm files of design data have been reviewed, but no computations covering the hydrology of the drainage basin have been found. It was determined that, when the capacity of the new spillway was being considered, the designers decided to adopt the 8,500 cfs design capacity used for the Mill River conduit as appropriate for spillway design. Because such criteria as rainfall-duration, antecedent saturation conditions and infiltration losses on the area, lag times, etc. were apparently not considered in design studies, comparisons between the design procedure and those utilized for this Phase I Report cannot be made.

Harris Pond is basically a low surcharge-high spillage project. The dam is a rehabilitated nineteenth century earth embankment with new spillway and outlet structures.

b. Design Data

No design data, other than the spillway design capacity, was recovered.

c. Experience Data

As noted in Section 1.3b, the maximum recorded flood, which resulted in the breaching of the spillway at the original dam, occurred in August 1955. Other high flow runoffs occurred in 1968, but records of runoff magnitude were not retrieved.

d. Visual Observations

No evidence was noted to indicate possible high flows through the reservoir and in the downstream channel since the reconstruction of the dam and rechannelization downstream.

e. Test Flood Analysis

1. Drainage Areas

The 32.5 square mile basin drainage area above Harris Pond Dam was divided into 8 sub-areas for the hydrologic analysis. A flood hydrograph was prepared for each sub-area and flood routings were conducted where flows passed through reservoirs sited on the streams. These sub-areas are tabulated on Sheet D-2, noting location, size of drainage area, water course length and river slope.

2. Reservoir Areas and Capacities

The Harris Pond Reservoir at normal storage level impounds about 1,050 acre-ft. For determining reservoir surcharge storage capacity, planimetered areas were taken from contours delineated on the USGS 2,000 ft. per in. quadrangle sheets. Area-capacity curves for Harris Pond are shown on Figure 3, Sheet D-6, Appendix D. Computations for the area-capacities are shown on Sheet D-7.

Storage capacities of impoundments above Hopedale Reservoir Dam (Freedom Street Dam) are shown on Sheet D-8.

For determining surcharge storages at the upstream reservoirs for use in flood routings, areas were similarly planimetered and storages computed. North Pond areas and capacities are shown on Sheets D-9 and D-11, Appendix D; Hopedale Reservoir areas and capacities are shown on Sheets D-12 and D-13; Lake Hiawatha areas and capacities are shown on Sheet D-15.

3. Outflow discharge capacities

For use in the flood routings of the inflows through the various impoundments, discharges were computed through the spillways and over the tops of the dams on the several installations where outflows would be considerably retarded. These are shown for North Pond on Sheets D-10 and D-11; for Hopedale Reservoir on Sheets D-13 and D-14; and for Lake Hiawatha on Sheet D-15. Spillway and dam overtopping capacities for Harris Pond Dam are shown on Sheet D-4. The discharge and surcharge storage capacities for flood routing inputs are summarized on Sheet D-16.

4. Test Flood

Harris Pond Dam is about 40 ft. high and impounds about 2,850 acre-ft. to top of dam. As stated in Section 1.2, it is therefore classified as intermediate in size. Because of downstream conditions, the hazard potential is classified as high. The Recommended Guidelines for Safety Inspection of Dams requires that for hydraulic evaluation the dam adequacy be tested for a full PMF.

5. Precipitation Data

Precipitation data was obtained from Hydrometeorological Report No. 33, which for the Woonsocket area in Rhode Island approximates 23.5 in. of 6 hour point rainfall over a 10 square mile area. This value was reduced by 12 percent to apply to a 32.5 square mile total area, and by an additional 17 percent to conform to the area fit reduction criteria. The 6 hour rainfall was distributed into $\frac{1}{2}$ hour incremental periods as suggested in COE Publication EC 1110-2-1411. Infiltration losses of 1 in. during the first hour and 0.2 in. during each succeeding hour were assumed. The net rainfall excesses for developing the runoff hydrographs are shown on Sheet D-17, Appendix D.

6. Drainage Basin Criteria

To evaluate the sub-drainage basin characteristics for the lag and transport times required to develop the sub-basin hydrographs and upstream reservoir outflow patterns, a stream profile of the various water courses and pondages was prepared from the USGS quadrangle sheets. This profile is shown on Figure 4, Sheet D-18. The incremental stream lengths for each sub-drainage basin were then evaluated for time of concentration, lag time and resulting flow velocity. The resulting values are recorded on Sheets D-19 and D-20, Appendix D. Times of concentration and lag times were selected so as to produce a weighted average equivalent flow velocity within the various sub-basin streams of about 0.75 ft. per sec., and a transport velocity between sub-basins of about 1.2 ft. per sec.

7. Selected Unitgraphs

The unitgraph utilized for developing the various sub-basin inflow hydrographs is the curvilinear adaptation of a triangular unitgraph, shaped as described in Design of Small Dams. These unitgraphs for the variously adopted time-to-peak values selected for the differing sub-basins are shown on Sheets D-21 and D-22.

As a check on the validity of the time-of-concentration velocity values selected on Sheets D-19 and D-20, different cross sections and the average slope along the reach of the Mill River upstream from Forge Pond were measured from the USGS Quadrangle sheets, and a composite representative cross section was assumed. Based on an n value of 0.10, a stage-velocity and stage-discharge relationship was computed (see Sheet D-23). The computed velocity values varied from about 1 to 2 ft. per second, depending on river discharge. The values used for determining lag and time-of-concentration, being lower than this, thus appear to have been selected on the conservative side.

8. Runoff Hydrographs and Flood Routings

Runoff hydrographs were prepared for each of the sub-areas selected, and were combined to form the inflow hydrograph into Harris Pond reservoir, after the appropriate routings through North Pond, Hopedale

reservoir and Lake Hiawatha. This combination of sub-hydrographs is plotted on Fig. 5, Sheet D-24, to represent the PMF inflow for routing through Harris Pond reservoir and spillway. The maximum PMF inflow is 17,500 cfs. The resulting flood routing through Harris Pond reservoir shown on Figure 6, Sheet D-25, indicates a maximum outflow of 17,200 cfs at surcharge storage head elevation 175.9. Of this discharge, 14,400 cfs would be released through the spillway and 2,900 cfs would spill over the right end of the dike and along the mill parking lot (see plan and profile on Figure 1, Sheet D-1). For this flood, approximately 3,000 acre-ft. of the runoff would be spilled over the dike and right abutment during a duration of 20 hrs.

In the event that the dike and reservoir rim to the right were to be raised to forestall flows around the right abutment, the reservoir would rise to about elevation 176.8, with the total outflow of about 17,200 cfs spilling entirely through the spillway.

The 0.5 PMF hydrograph shows a peak inflow of about 8,750 cfs, approximately that of the Standard Project Flood used for the design of the dam and spillway. This hydrograph is shown on Fig. 7, Sheet D-26. The reservoir surcharge level resulting from a routing of this flood would be about elevation 173.5, which is about 3.8 ft. below the low point on the dam crest. However, the end of the right dike and reservoir rim to the right would be overtopped to a maximum of about 1.3 ft.

9. Downstream Channel Capacity

As noted in Section 1.2d and 3.1e, the Mill River channel downstream from Harris Pond Dam has been channelized and diked, and a floodway conduit has been constructed under the Social area of Woonsocket. The waterway and conduit were designed for a Standard Project Flood capacity of 8,500 cfs. Computed on Sheet D-27 and plotted on Figure 8, Sheet D-28, are capacities of the conduit for differing flood stage conditions in the Blackstone River, and their backwater effect on headwater level in the channel upstream. It will be noted that an overtopping of the dikes above the conduit would occur whenever outflows from Harris Pond Dam exceeded about

11,000 to 13,000 cfs, depending upon the stage of flow in the Blackstone River for these flows. It is thus evident that, although Harris Pond Dam could accommodate a PMF inflow without being overtopped if the dike was raised to the elevation of the dam, the downstream channel capacity is insufficient to avoid resultant flooding of the Social area of Woonsocket.

10. Spillway Adequacy

While the spillway crest has sufficient capacity to discharge up to 18,500 cfs with reservoir level to the low point of the dam's crest, it appears that the spillway chute would accommodate less than the design 8,500 cfs. outflow before its walls would be overtopped.

In the stepped spillway chute, much of the energy generated in the total drop from spillway crest to downstream river level will be dissipated at each successive floor level drop in the chute. Subcritical flows downstream from the jet trajectory at each drop will prevail, passing through critical flow only at the edges of the drops. Illustrated on Sheet D-29 is a graphic representation of flow conditions as they are expected to prevail, with computations of flow depths for various discharges through the chute. It will be noted that, disregarding swell owing to air entrainment and high turbulences from boil and wave action caused by dissipation below each free falling jet, the walls would be expected to be overtopped for discharges in excess of about 8,000 cfs.

A condition which further aggravates flows in the chute and would threaten an overtopping of the side walls is the sharp convergence of the chute upstream from the first step below the crest. This convergence will cause impingement and high waves, which will ride up and overtop the walls. Furthermore, the absence of aeration below each step will result in subatmospheric pressure under the overflowing jets, causing make-and-break action to further disturb the flow in the chute and threaten an overtopping of the walls. Thus, although the dam itself would not be overtopped from inflows of a magnitude up to the full PMF test flood, it is possible that the safety of the dam could be threatened by a washout of the spillway for inflows of even less than a 0.5 PMF.

f. Dam Failure Analysis

Although Harris Dam proper would not be overtopped for a PMF test flood, even with a flood inflow of less than a 0.5 PMF event, an overtopping of the right end of the right dike, and of the reservoir rim beyond, would occur. As illustrated in Section 5f, failure of the spillway at a flood event of about 0.5 PMF could threaten a breach in the main dam.

As noted in Para. 5.1e(6), any outflow from Harris Pond reservoir in excess of about 11,000 to 13,000 cfs, either from normal releases without failure of the structures or from a breach failure, will overtop the floodway channel and result in flooding of the Social area of Woonsocket.

Though an overtopping of the dam at its maximum section near the center of the dam, or at its left end where the 1955 breach occurred, is not indicated for floods up to a full PMF, a structural failure owing to piping or sloughing could occur. A breach from that cause would be similar to that from an overtopping and the "rule of thumb" criteria suggested in the NED March 1978 Guidance Report would be applicable, except that the reservoir at such a time would not be higher than the surcharge resulting from a PMF inflow. A reservoir water surface of about elevation 175 was therefore assumed for computing the breach outflow. Computations on Sheet D-30 show an outflow of the order of 24,000 cfs.

The waterway under the Privilege Street bridge about 700 ft. below the dam will form a constriction for high outflows from Harris Pond reservoir. Computed on Sheet D-31 and plotted on Sheet D-32 are stage-discharges upstream from the bridge, assuming the river bottom at the bridge to be at elevation 136.

For a breach outflow from the dam approaching 24,000 cfs. it is possible for the water level upstream from the bridge to rise to between elevation 157 and 163, depending on whether the bridge would remain in place under a flood surge onslaught. Within the area of inundation are a five story, high-rise apartment building whose base level is at about elevation 148, several warehouse buildings and other commercial establishments.

The rechannelized river floodway dikes and flood control conduit below the dam have their tops at elevation 142. Additionally, the valley storage in the reach from Harris Pond Dam to the upstream end of the conduit between the levee dikes is not large. Thus, a large flood surge from Harris Pond reservoir would prevail through the length of the rechannelized floodway, and would overtop the confining dikes when discharges exceeded about 10,000 to 12,000 cfs. This would result in flooding of the Social district of Woonsocket to a depth of at least 10 ft. This is a densely developed area of individual homes, high-rise apartment and office buildings, and commercial establishments.

Delineated on Sheet D-33, in Appendix D, are the areas which could be flooded by a breach failure of the dam (Quad sheet graphic).

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The field investigations of the earth embankment revealed no significant displacements or distress which would warrant the preparation of slope stability computations based on assumed soil properties and engineering factors. Data available on the engineering characteristics of the dam is limited to the new embankment material placed during reconstruction of the dam in 1968. The reconstruction incorporated the original embankment which was reported to consist of fine to coarse sand with gravel. The modifications utilized a sloping impervious base on the upstream side, consisting of silty sand with gravel and with pervious filter layers and riprap. The downstream slope was covered with pervious fill and a toe drainage collection system was added.

b. Design and Construction Data

Design plans for the 1968 reconstruction were reviewed. However, since shear strength data of the original embankment material and foundation were not available, a detailed stability analysis was not deemed worthwhile. The design of the reconstructed elements appear generally to be consistent with good earth dam embankment design practice. However, the use of a partial cutoff to bedrock under the upstream toe and the observed seepage indicate that periodic inspections are necessary during periods of high reservoir level, and at least once a year, to monitor the quantity and clarity of seepage from below the embankment.

The design drawings also indicate a minimum dimension of 3 ft. of impervious material at the junction of the cut-off trench and impervious upstream section. This value is considered to be less than that used in present day design practice. The actual "as built" minimum thickness is not known, however.

c. Operating Records

There are no formal operating records for this dam.

d. Post Construction Changes

The reconstruction of the dam accomplished in 1968 would not adversely affect the stability. The results of the field inspection and a check of the available records produced no evidence of other changes which might impair stability.

e. Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the Phase I visual examination, the Harris Pond Dam appears to be in good condition and functioning adequately. The spillway capacity, however, is not adequate to pass the test flood outflow. This study indicates that further investigations are required and that additional routine maintenance is also needed.

There is some seepage along the downstream toe of the dam, particularly in the area between the outlet structure and the spillway. One of the 24 in. dia. outlet control valves is unserviceable. There is some minor erosion of the upstream embankment slope adjacent to the spillway walls. Brush and light tree growth are established in the outlet channel, and there is some light brush on the upstream slope in the vicinity of the spillway.

b. Adequacy of Information

The information recovered is considered adequate for the purpose of making an assessment of the performance of the dam.

c. Urgency

The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of the Phase I Inspection Report.

d. Need for Additional Investigation

Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner should retain the services of a competent registered professional engineer to make investigations and studies of the following, and if proved necessary, to design appropriate remedial works:

1. Make a thorough study of the hydrology of the drainage basin. Review the situation regarding the potential overtopping of the dike and right abutment, and determine whether the dike should be raised and extended.
2. Review the spillway flow conditions below the crest of the dam through the converging section and through the chute reach. Study the feasibility of providing aeration below the overflow jets at each drop along the chute.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

1. Minor erosion of the upstream embankment slope adjacent to both the right and left spillway walls should be repaired. Riprap displaced by trespassers in the vicinity of the fences should be replaced.
2. Brush growth on the upstream slope near the crest of the embankment right of the spillway should be removed and controlled on a regular basis.
3. Brush and light tree growth in the outlet channel should be removed.
4. Seepage along the downstream toe of the embankment and toe drain discharges should be monitored monthly during periods of high reservoir level and at least once a year, for changes in seepage volume and turbidity.
5. The unserviceable 24 in. dia. outlet valve should be repaired.
6. A formal surveillance and flood warning plan should be developed. An operational procedure to be followed in the event of an emergency should also be adopted.
7. Procedures for a biennial periodic technical inspection of the dam and appurtenant works should be instituted.

7.4 Alternatives

There are no practical alternatives to the above recommendations.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION
PHASE I

Identification No. RI 03901 Name of Dam: Harris Pond Dam
Date of Inspection: 27 September 1978
Weather: Sunny, clear Temperature: 70°F ±
Pool Elevation at Time of Inspection: 167.5 MSL
Tailwater Elevation at Time of Inspection: 136 ± MSL

INSPECTION PERSONNEL

Peter B. Dyson	Louis Berger & Associates, Inc.	Project Manager
Carl J. Hoffman	Louis Berger & Associates, Inc.	Hydraulics, Structures
Thomas C. Chapter	Louis Berger & Associates, Inc.	Hydrology, Soils
William S. Zoino	Goldberg Zoino Dunnicliff & Assoc., Inc.	Soils

OWNER'S REPRESENTATIVES

Hedley V. Patterson	City of Woonsocket	Division Engineer
Norman Desjardins	City of Woonsocket	Plant Maintenance Mechanic

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901 Name of Dam: Harris Pond Dam Sheet 1

VISUAL EXAMINATION OF OBSERVATIONS AND REMARKS

EMBANKMENT

Vertical alignment and movement

No movement evident.

Horizontal alignment and movement

No movement evident.

Unusual movement or cracking at or near the toe

None evident.

Surface cracks

Minor sporadic cracks in asphalt pavement on crest; pavement generally good.

Animal burrows and tree growth

No burrows noted. No trees, some light brush.

Sloughing or erosion of slopes

None observed. Minor erosion adjacent to spillway walls.

Riprap slope protection

Crushed rock in generally good condition; some displacement due to trespassers climbing around fences.

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901 Name of Dam: Harris Pond Dam Sheet 2

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

Seepage

Seepage noted at both abutments, perhaps totaling 50-75 gpm.

Piping or boils

None observed.

Junction of embankment and abutment, spillway and dam

Minor erosion of upstream slope near left spillway training wall. Vandalism of fences.

Foundation drainage

Toe drains functioning and discharging 3-4 gpm.

OUTLET WORKS

Approach channel

N/A

Outlet conduit concrete surfaces

Tower concrete in good condition.

Intake structure

Two 16" Ø, one 36" Ø C.I. pipes. None visible.

Outlet structure

36" Ø C.I. pipe with R.C. headwall in good condition.

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901

Name of Dam: Harris Pond Dam

Sheet 3

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

Outlet channel

Overgrown with brush and weeds.

Drawdown facilities

Two 24" $\emptyset$ butterfly valves, one broken in open position, installed in 36" $\emptyset$ outlet pipe.

SPILLWAY STRUCTURES

Concrete weir

In good condition.

Approach channel

Sloped entrance retaining walls in good condition.

Discharge channel

Three-stepped chute; concrete in good condition.

Stillling basin

Riprap lined plunge basin; riprap fairly well distributed.

Bridge and piers

P.S.C. box beam bridge 15' wide over weir.

Control gates and operating machinery

None.

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901 Name of Dam: Harris Pond Dam Sheet 4

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
<u>INSTRUMENTATION</u>	
Headwater and tailwater gages	Tailwater gage unserviceable.
Embankment instrumentation	None.
Other instrumentation	None.
<u>RESERVOIR</u>	
Shoreline	Gently sloping, wooded, apparently stable.
Sedimentation	None observed.
Upstream hazard areas in event of backflooding	Houses close to shoreline on east side. Light industrial developments close to shoreline on west side.
Alterations to watershed affecting runoff	No recent alterations noted.

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901

Name of Dam: Harris Pond Dam

Sheet 5

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

DOWNSTREAM CHANNEL

Constraints on operation of dam

Privilege Street Bridge across discharge channel
80 ft. span, 11.3 ft. vertical clearance. Mill River
conduit to Blackstone River below dam.

Valley section

Channelized river section 50 ft. $\frac{1}{4}$ wide with 2:1 side
slopes. Wide valley above river section.

Slopes

Flat, some areas grass and trees, other areas
developed.

Approx. No. of homes/population

Large 5 story apartment building at foot of dam.
Businesses & homes on Privilege Street. Businesses
and homes throughout area between dam and
Blackstone River.

OPERATION & MAINTENANCE FEATURES

Reservoir regulation plan, normal
conditions

No formal plan. If discharge over weir ceases,
6" $\emptyset$ sump drain valve opened.

Reservoir regulation plan, emergency
conditions

No formal plan. No emergency has occurred since
reconstruction of dam.

VISUAL INSPECTION CHECKLIST

Identification No: RI 03901

Name of Dam: Harris Pond Dam

Sheet 6

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

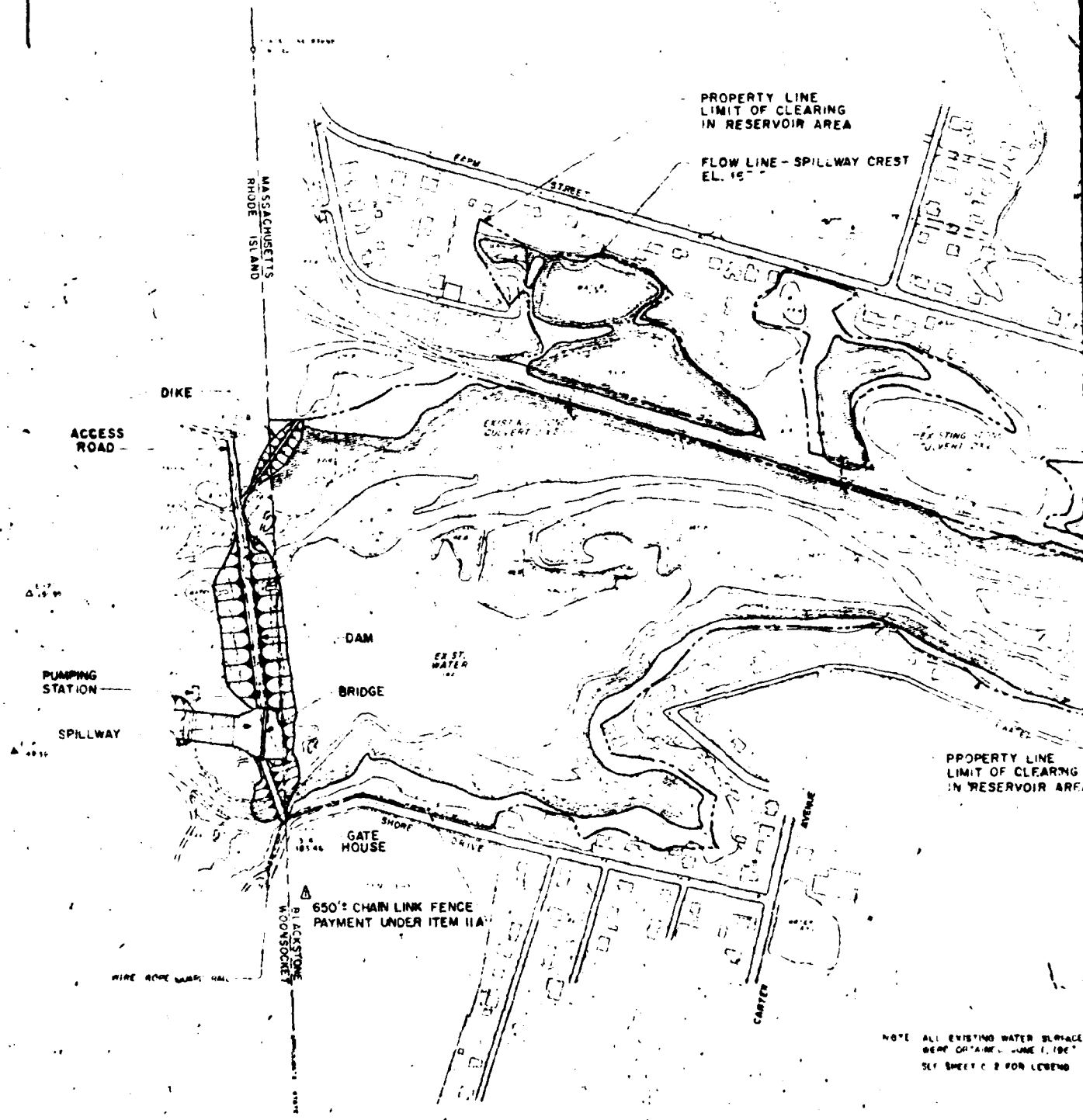
Maintenance features

No routine maintenance being performed.

APPENDIX B
PLANS & RECORDS

Drawings pertinent to dam safety were selected from files of
Woonsocket Department of Public Works:

"Harris Pond Dam Rehabilitation, Pumping Station,
Raw Water Main & Appurtenant Work,
Contract 1967-1, HUD Project No. WS-1-40-0008."



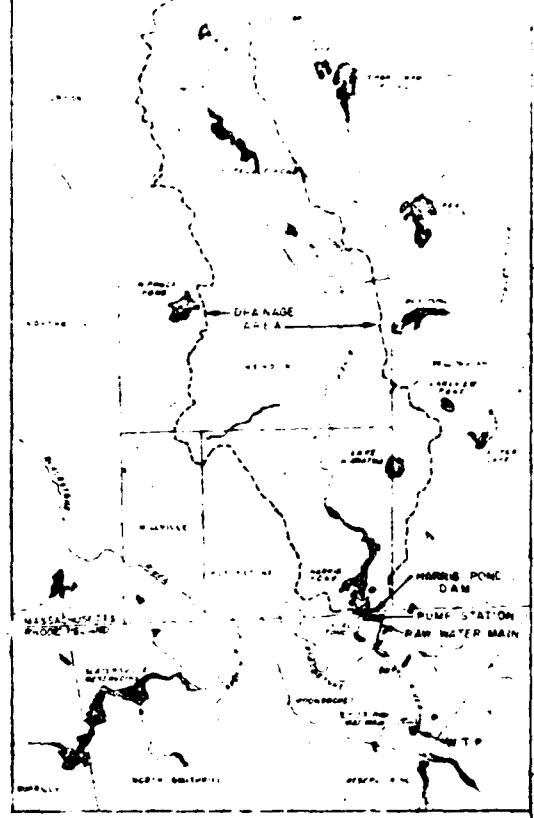
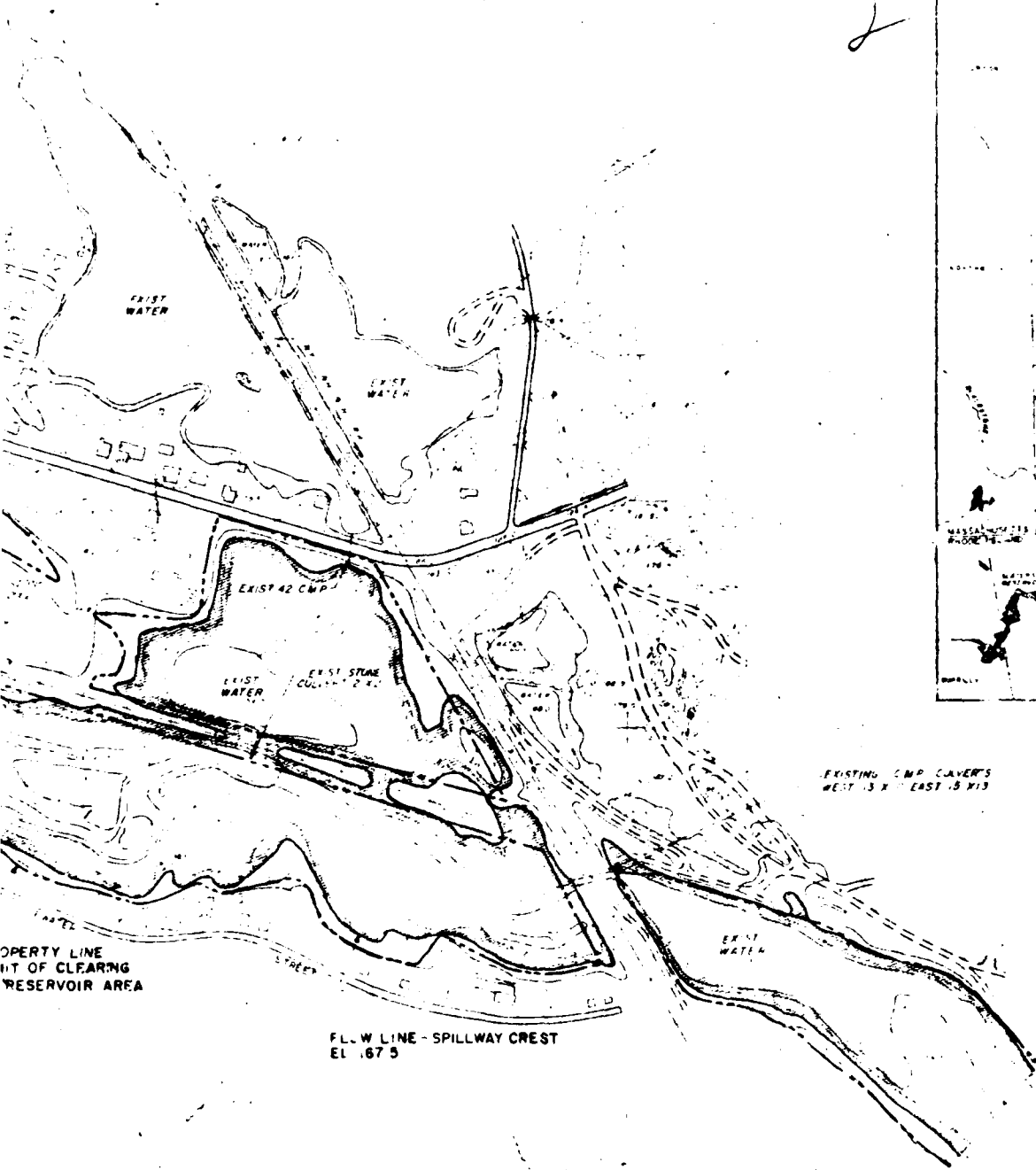
NOTE: ALL EXISTING WATER SURFACE
 BEING OBTAINED JUNE 1, 1967
 SEE SHEET C-2 FOR LEGEND

RECORD

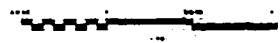
DATE BY
 DATE CHECKED
 DATE REVISION



2



VICINITY MAP



EXISTING CMP COVERS
WEST 13' X EAST 15' X 13'

EXISTING WATER SURFACE ELEVATIONS
AS OF JUNE 1, 1967
SEE 2 FOR LEGEND

RECORD DRAWING

MUD PROJECT NO. 140-0008

A	2-3-70	REG	RECORD DRAWING
REV.	NO	DATE	DESCRIPTION
SCALE		DATE: JANUARY, 1968	
UNLESS OTHERWISE NOTED OR CHANGED BY REVISIONS			
APPROVED			
FOR DETAILS & EDDY			
DESIGNED BY: <i>John S. Mitchell, Jr.</i>		DATE: 1/1/68	

CITY OF WOODBURY, FREE ISLAND	
2.4' HILL, 1.5' HILL, 1.5' HILL	
PUMP STATION, RAW WATER MAIN	
AND APPROPRIATE LAYOUT	
RESERVOIR SITE PLAN	
22-1688	

CONTRACT SHEET

* THESE POSSIBLE BORROW AREAS ARE NOT OWNED
BY THE CITY OF WOONSOCKET AND ARE NOTED
ONLY FOR THE CONVENIENCE OF THE CONTRACTOR
IN LOCATING POSSIBLE SOURCES OF MATERIAL.

POSSIBLE BORROW AREA FOR
PERVIOUS MATERIAL *

POSSIBLE BORROW AREA FOR
RANDOM PERVIOUS MATERIAL *

PROPERTY LINE
LIMIT OF CLEARING
IN RESERVOIR AREA

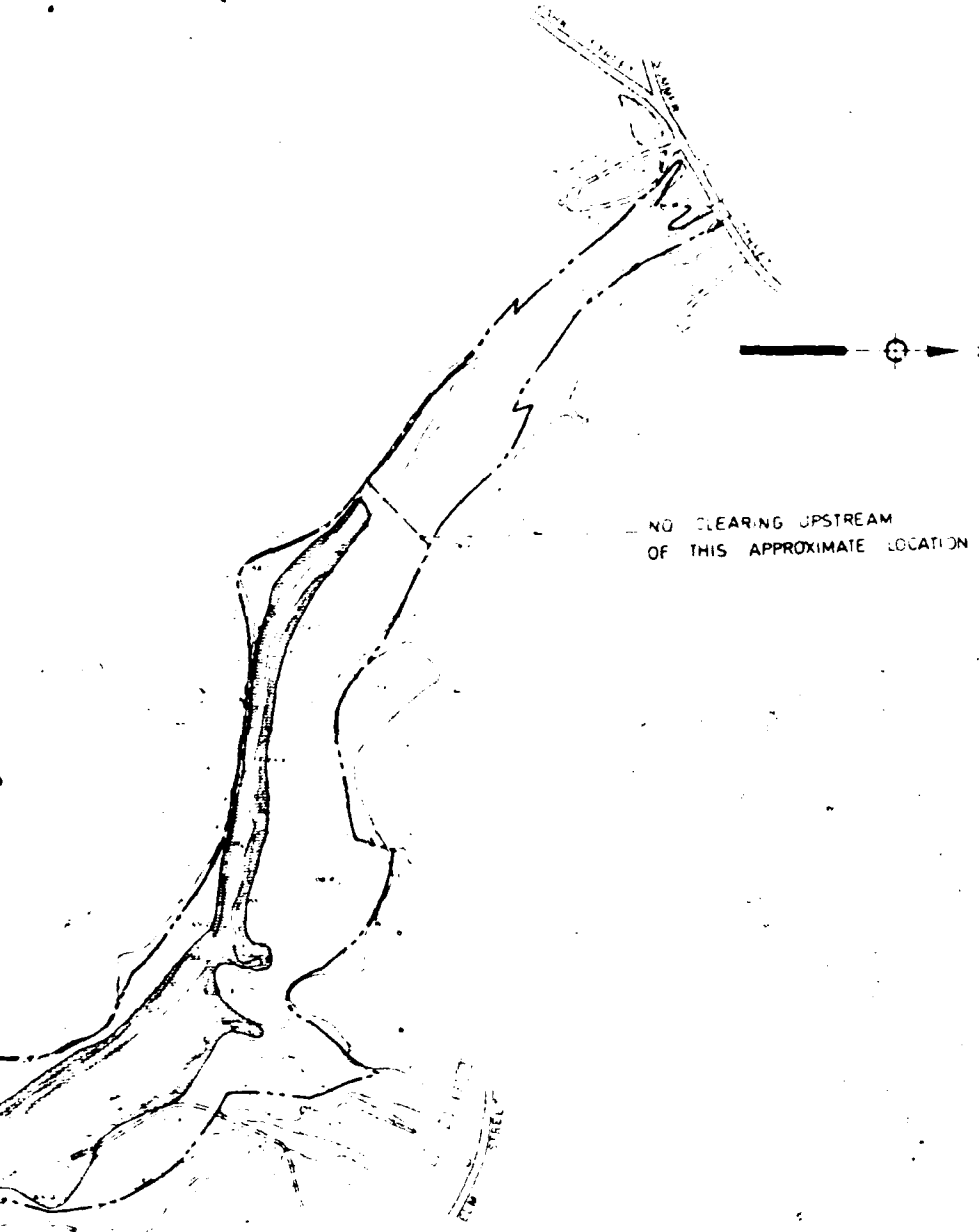
FLOW LINE
SPILLWAY CREST E. 1675

THESE POSSIBLE BORROW AREAS ARE NOT OWNED
BY THE CITY OF WOONSOCKET AND ARE NOTED
ONLY FOR THE CONVENIENCE OF THE CONTRACTOR
IN LOCATING POSSIBLE SOURCES OF MATERIAL.

DRAWN BY W. E.
CHECKED BY W. E.
DATE 9-6-62

RECORD DR.

2



LEGEND

◊SMH	EXISTING SEWER MANHOLE
◊DMH	EXISTING DRAIN MANHOLE
◊TMH	EXISTING TELEPHONE MANHOLE
⊕GG	EXISTING GAS GATE
⊕WG	EXISTING WATER GATE
⊕WSD	EXISTING WATER SHUT OFF VALVE
⊕HYD	EXISTING HYDRANT
---	PROPERTY LINE - LIMIT OF CLEARING
---	FLOW LINE - SPILLWAY - REST
---	EXISTING FLOW LINE
---	SWAMP
---	WOODS OR BRUSH
---	EXISTING CONTROL
---	EXISTING SPOT ELEVATION
---	PROPOSED EMBANKMENT
---	SPOT ELEVATION
---	BORINGS

GENERAL NOTES

1. ELEVATIONS IN FEET REFER TO MEAN SEA LEVEL - TUGA
2. GRID SYSTEM CONFORMS TO THAT USED BY THE U.S. ARMY OF ENGINEERS CORPS OF ENGINEERS FOR THE TUGA
3. FOR STRUCTURAL GENERAL STANDARDS SEE SHEET S-9
4. EXCAVATION FOR EMBANKMENTS TO BE PAD FOR AS STRIPPING UNLESS OTHERWISE SPECIFIED
5. FOR BORING LOGS SEE SPECIFICATIONS

PROPERTY LINE
OF CLEARING
SERVOIR AREA

1675

RECORD DRAWING

DATE	BY	CHECKED	APPROVED



PROJECT NO. ...

DATE ...

BY ...

CHECKED ...

APPROVED ...

22-1688

CONTRACT ... SHEET ...

1. 凡在本市行政区域内从事经营活动的个体工商户，均须依法办理税务登记。



A PAIR HOUSE SHIFTED TO
-VERT ALONG DAM BASELINE
WITH SUBSEQUENT SHIFTING
OF AIL INLET & OUTLET PIPING

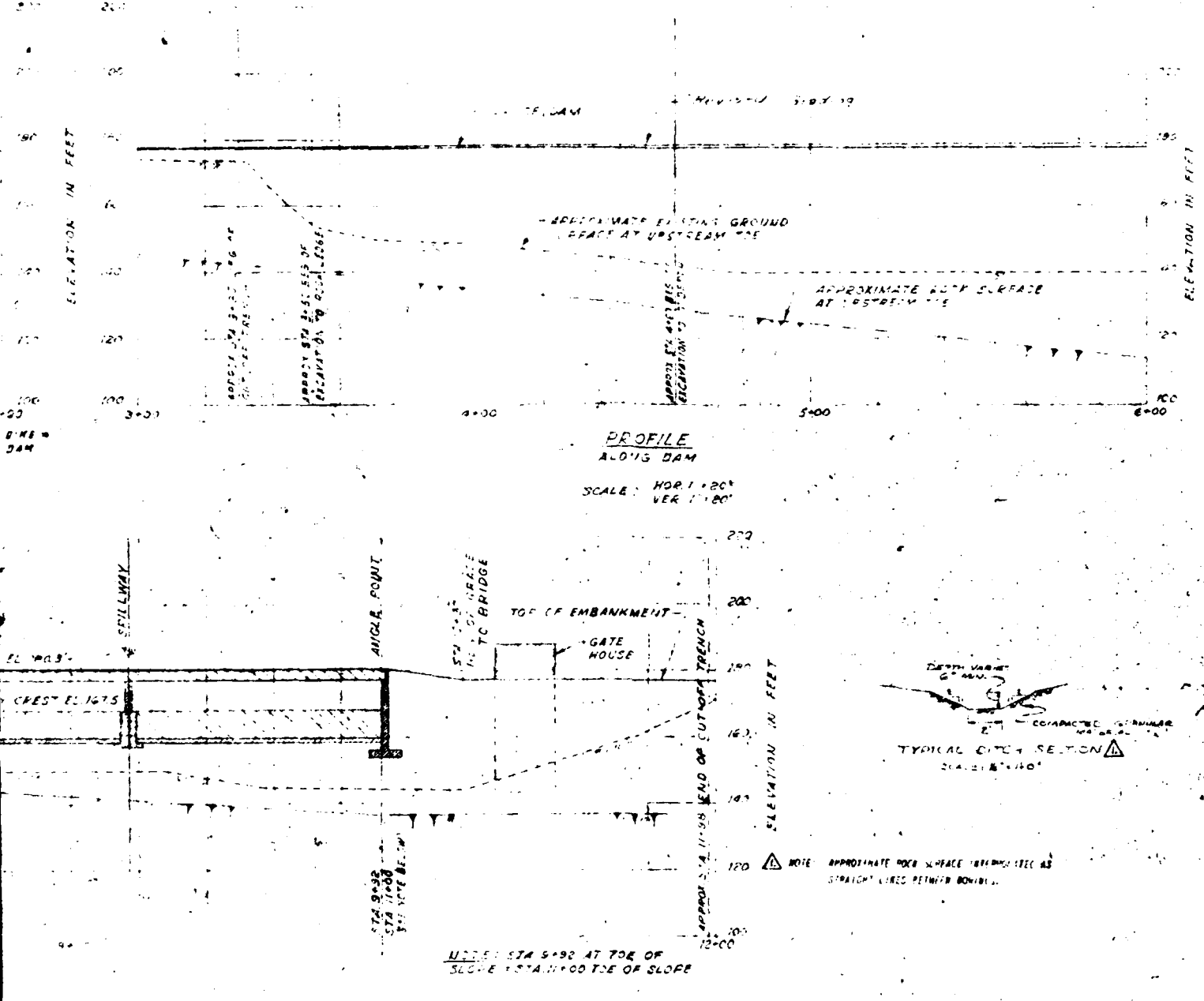
B ROCK FILLED J.D. MILL RIVER
CHANNEL BETWEEN NO. DRAIN CONDUIT
AND STILLING BASIN CUTTERS IN
NEW DAM AREA ELIMINATED BY
IMPROVEMENT OF SLOPE GRADING.

C UPPER ENDS OF VC PIPE IN TCE
DRAIN TO BE AT INV. EL. 187.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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22-1688

2



RECORD DRAWING

MUD PROJECT NO. WS-1-40-0008

CITY OF WORCESTER, MASSACHUSETTS
HARRIS POND DAM REHABILITATION,
PUMPING STATION AND WATER MAIN
AND APPURTENANT WORK

DAM EMBANKMENT
SECTIONS AND PROFILE

CIVIL

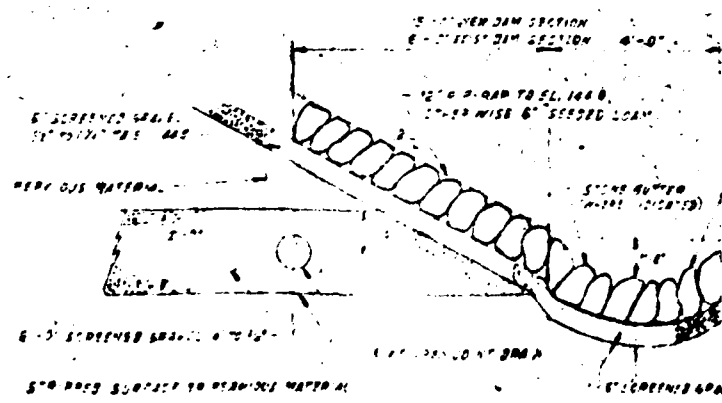
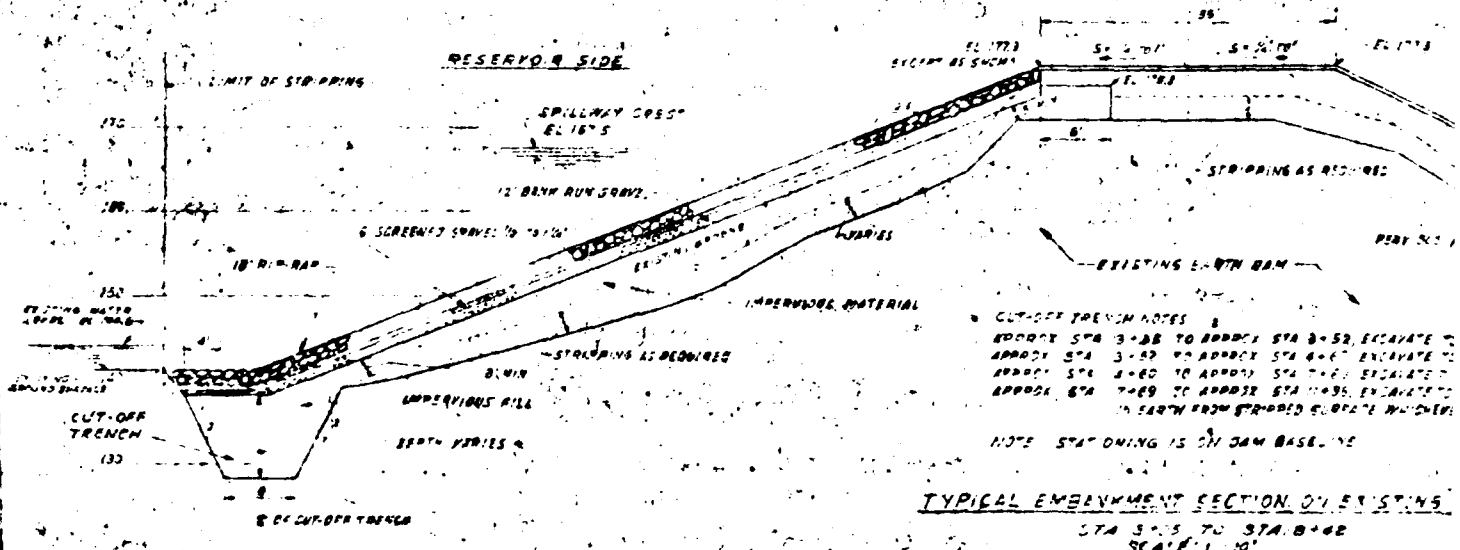
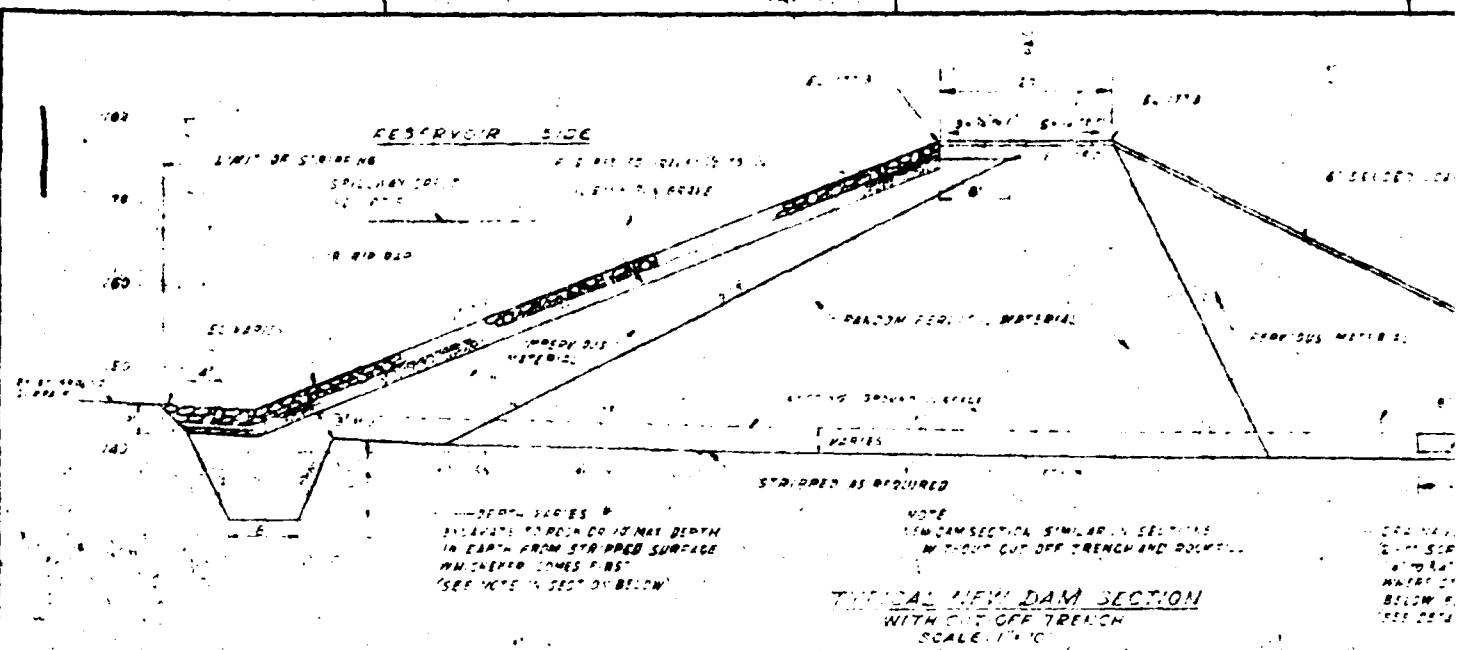
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REVISED	MADE BY	CHECKED BY	DESCRIPTION
SCALE	AS SHOWN	DATE	JANUARY, 1968
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN FEET AND INCHES.		APPROVED	
FOR DESIGN & CONSTRUCTION		DATE	
JAN 3-68		DATE	



M&E METCALF & EDDY ENGINEERS
22-1688

CONTRACT 1967 P

SHEET C-4



RECORD D

DRAWN BY: J.S.K.
CHECKED BY: J.S.K.
APPROVED BY: J.S.K.

DOWNSTREAM SIDE

6' SECT'D LOAM

6' 5" STAINED GRAVEL 8" MIN

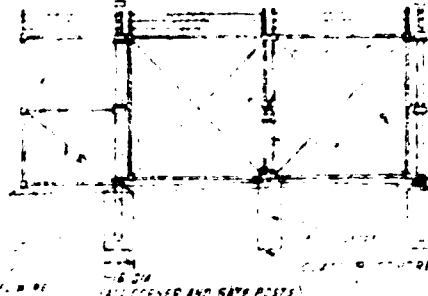
10' 8" RAP TO E 144.0

DETAIL 1' BELOW

2' WITH A 9' GAGE
STEEL WALL
AT 144' 0" E

PAPES
SEE SHEET
0-3

COAN BLANKET
2" 1/2" SCREENED GRAVEL
14" TO 14" 1/2" TO BE INSTALLED
WHEAT STAIRS 14" AT OR
BELOW E 147.5
(SEE DETAIL THIS SHEET)



CHAIN LINK FENCE DETAILS
SCALE 1" = 10'

DOWNSTREAM SIDE

6' SECT'D LOAM

PERKINS MATERIAL

VARIES

2' R/D RAP
TO E 144.7

STONE SUTTED
STA 144.3 TO 144.25 AND
STA 144.25 TO 144.20

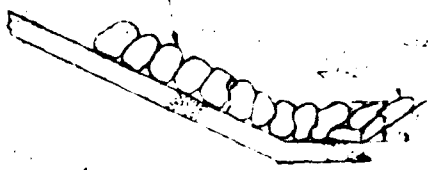
BY 2" 1/2" R/D RAP

6' SCREENED GRAVEL

PERKINS MATERIAL

10' 8" OPEN JOINT R/R

COAN BLANKET
14" TO 14" 1/2" R/D RAP EXIST EMBANKMENT,
2" 1/2" R/D RAP EXIST EMBANKMENT TO BE
INSTALLED WHEAT STAIRS 14" AT OR
BELOW E 147.5
(SEE DETAIL THIS SHEET)



DETAIL OF R/D RAP DOWNSTREAM TOE
WHERE MEETS 2" 1/2" R/D
NO 504.8

REPAIRED FROM EXIST
PERKINS MATERIAL

6' SCREENED GRAVEL

DETAIL OF R/D RAP DOWNSTREAM TOE

WHERE MEETS 2" 1/2" R/D
R/D RAP
NO 504.8

NOTES

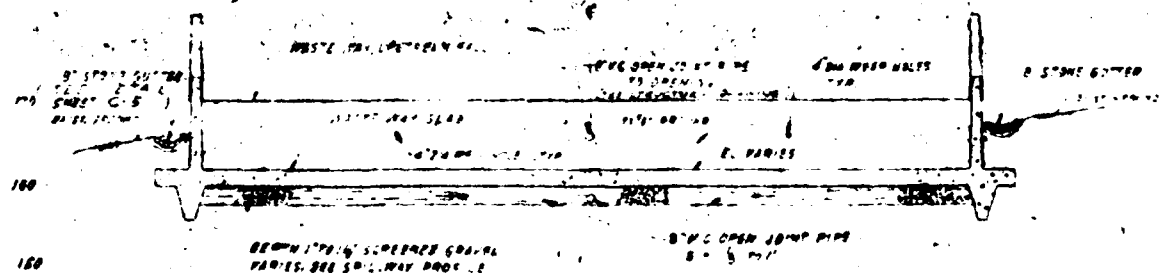
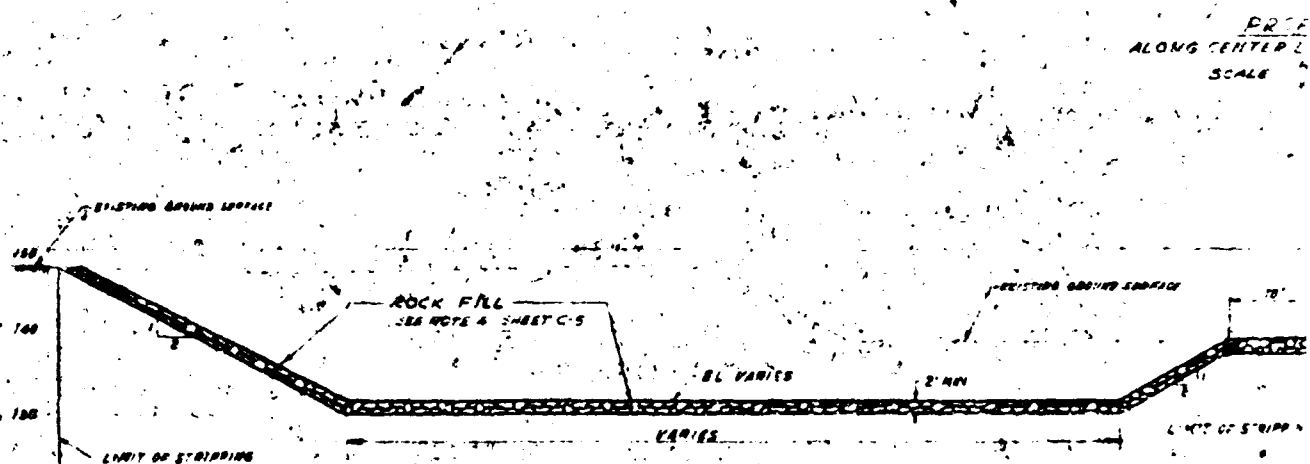
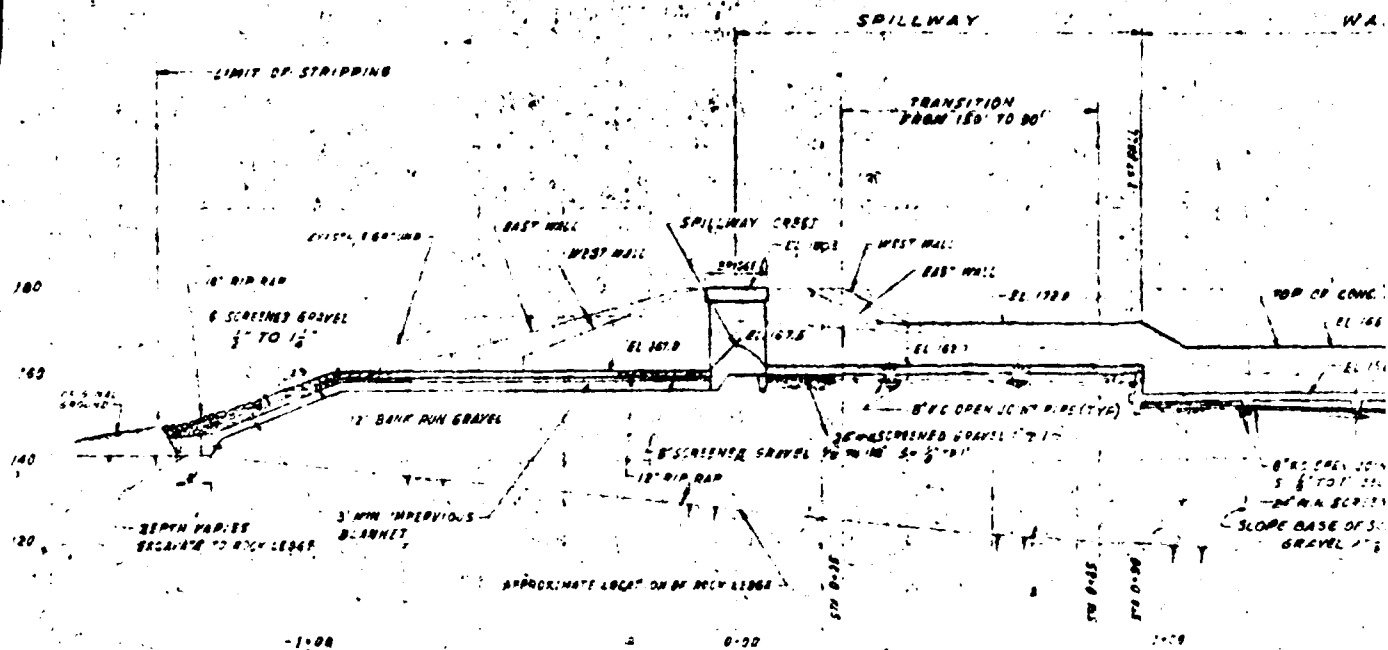
1. DIMENSIONS OF'S EXCEPT WHERE GIVEN.
2. EXCAVATION BY R/D RAP AND 3" 1/2" R/D RAP TO BE PAID FOR
AS PER PERKINS UNLESS OTHERWISE DESIGNATED
3. FOR GENERAL NOTES SEE SHEET 0-1
4. ALL ROCK SHALL BE STONE GRADED
AND 2" 1/2" R/D RAP TO BE PAID FOR AND
PAID AS PER PERKINS

MUD PROJECT NO. WS-1-40-0000

ORD DRAWING

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
2 3 TO R/R										RECORD DRAWING																																																																																									
REVISION										MADE BY										CHECKED BY										DESCRIPTION																																																																					
SCALE										DATE										JANUARY, 1968																																																																															
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4-3-68										DATE																																																																																									

OF MOORSOCKET, RUDE ISLAND	
POND DAM PENABILITATION, RAW WATER MAIN AND APPURTENANT WORK	
DAM EMBANKMENT SECTIONS AND DETAILS	
E1711	
MIE ENGINEERS & ARCHITECTS	
22-1688	
CONTRACT 1007-1	

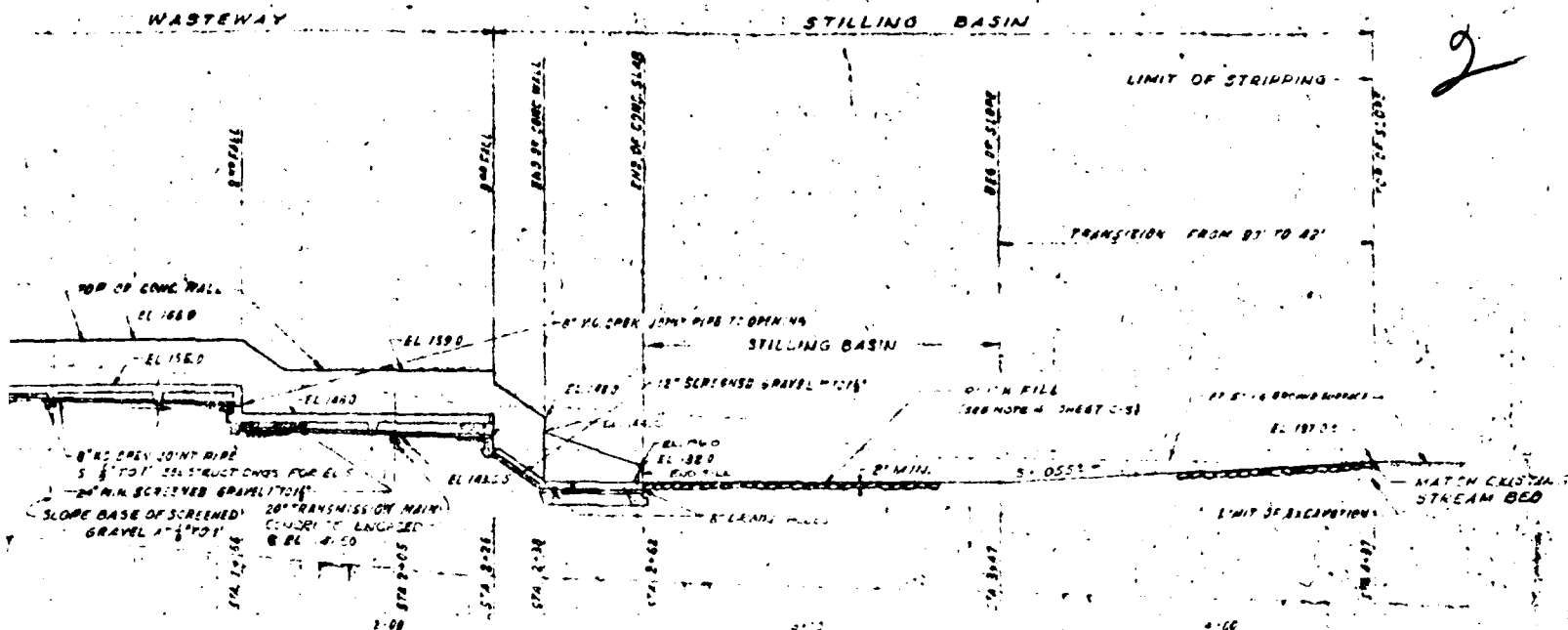


DRAWN BY 204
DEPT. CHECK 211
PRON. CHECK 200

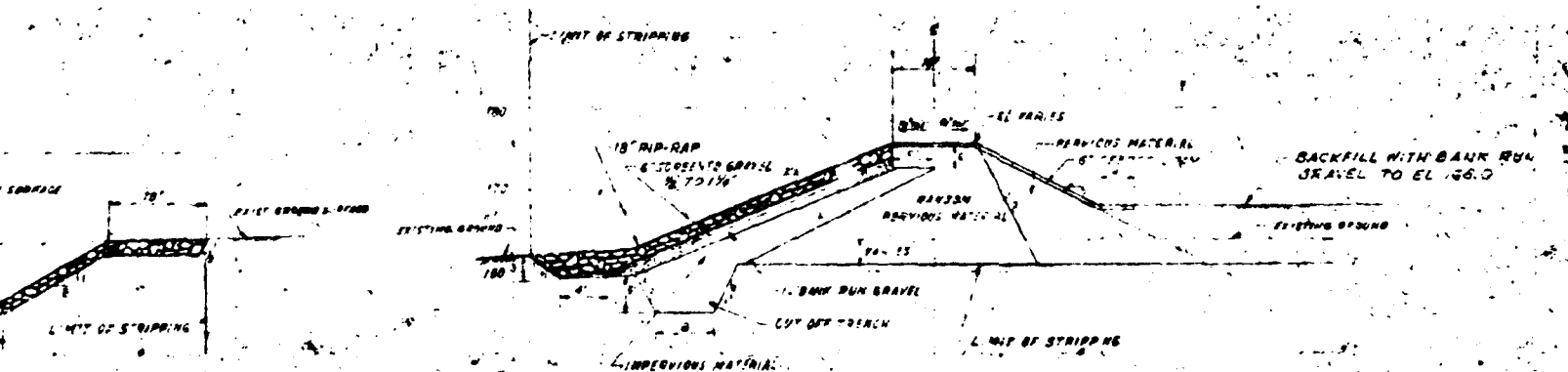
DEPT. CHECK

FROM OFFICE 5-20

2

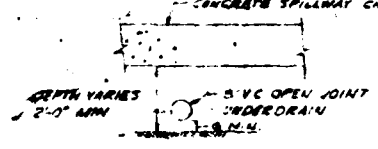


PROFILE
ALONG CENTER LINE OF SPILLWAY
SCALE H.P. 1"=20'
V.E. 1"=20'



NOTE: DIKE SECTION SIMILAR IN SECTIONS WITHIN CUT OFF TRENCH

TYPICAL DIKE SECTION
WITH CUT OFF TRENCH
SCALE 1"=10'



TYPICAL UNDERDRAIN SECTION
NOT TO SCALE

RECORD DRAWING

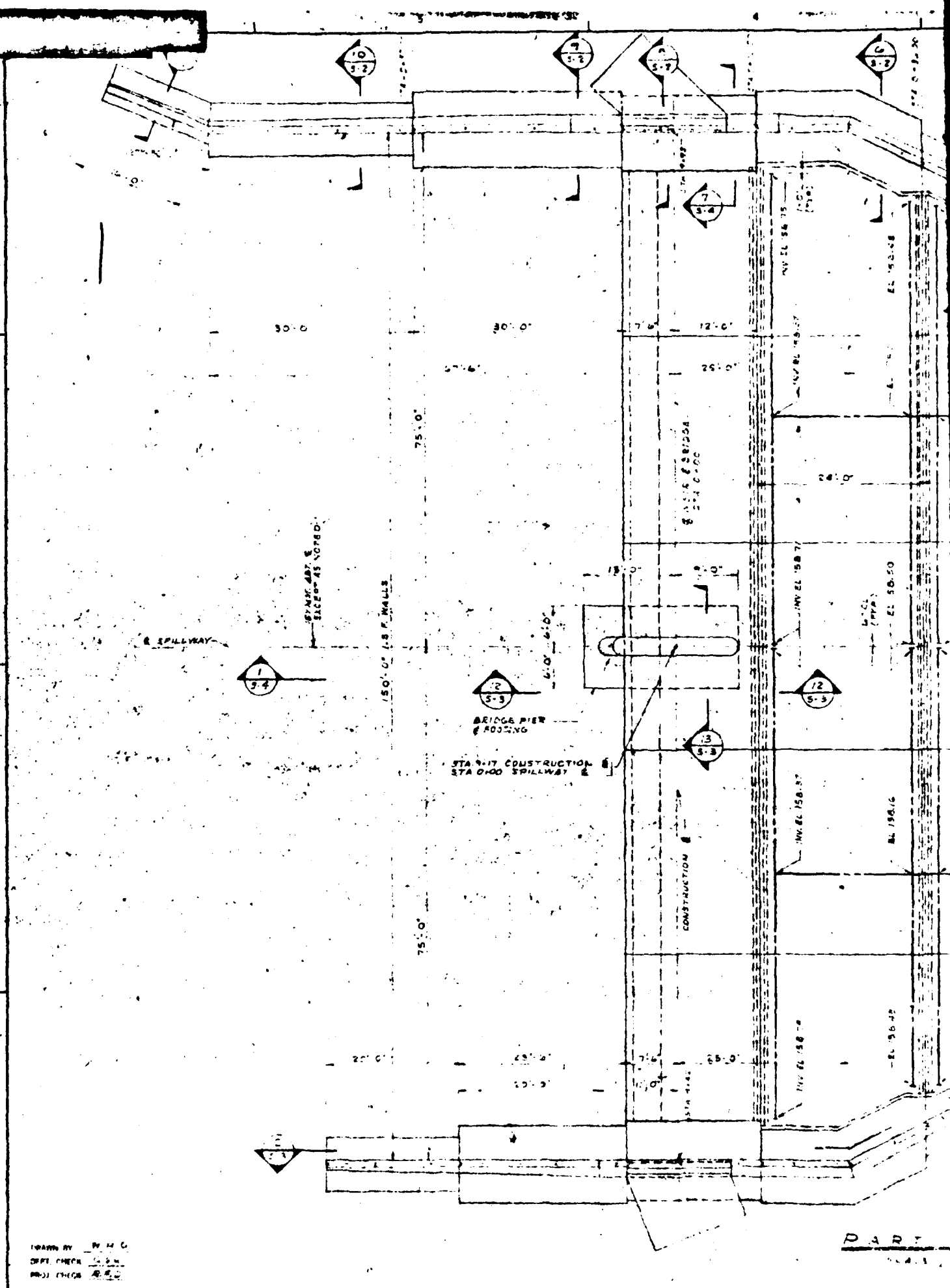
HUD PROJECT NO. US-140-0008

CITY OF WOODBURY, INDIANA
HARRIS POND DAM REHABILITATION,
PUMPING STATION, RAW WATER MAIN
AND APPURTENANT WORK

SPILLWAY PROFILE AND SECTIONS
DIKE SECTION

REVISION	MADE BY	CHECKED BY	DATE
1	2	3	4
SCALE		AS SHOWN	
UNLESS OTHERWISE NOTED OR CHANGED BY REVISION			
APPROVED			
FOR METCALF & EDDY			

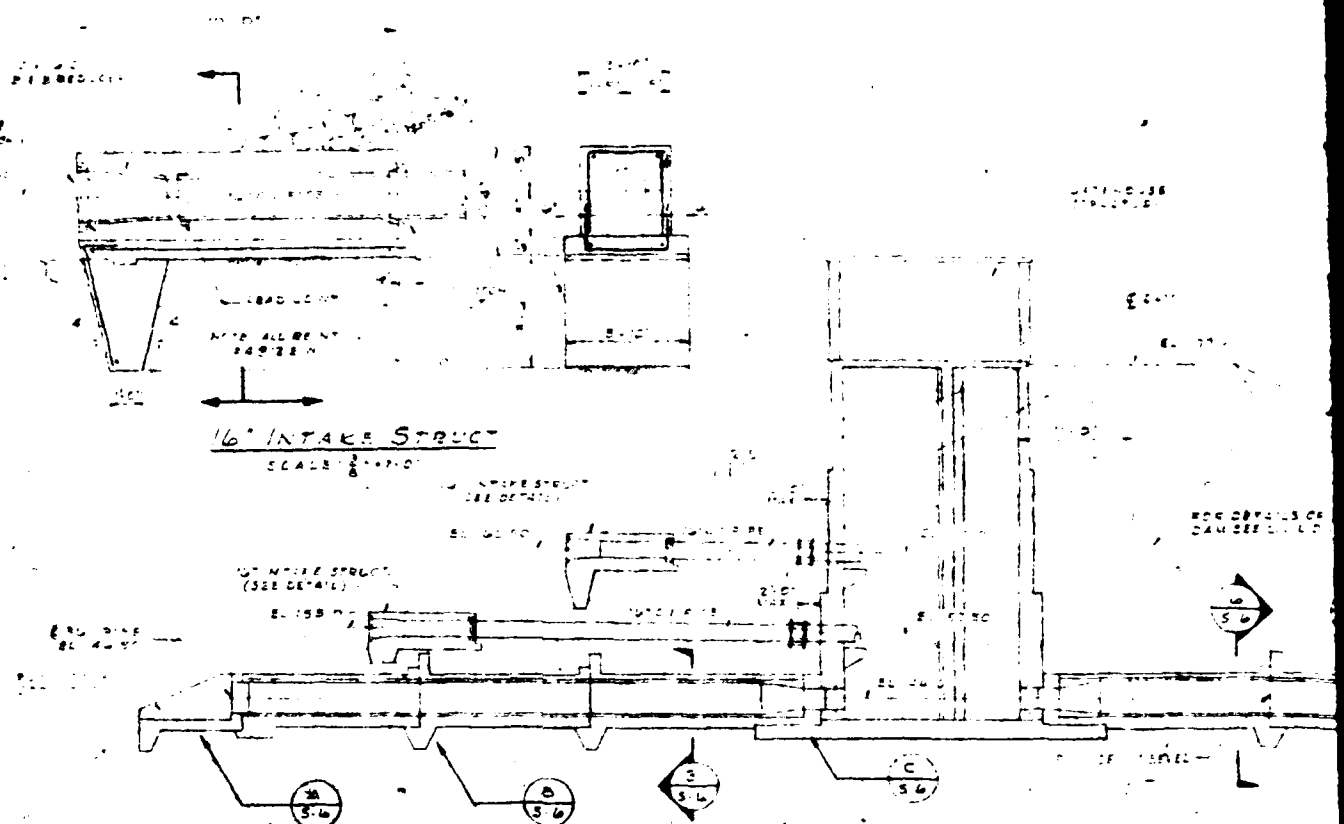
M&E METCALF & EDDY ENGINEERS
22-1688



DRAWN BY W. H. G.
 CHECKED J. H. G.
 REVISION 10/10/50

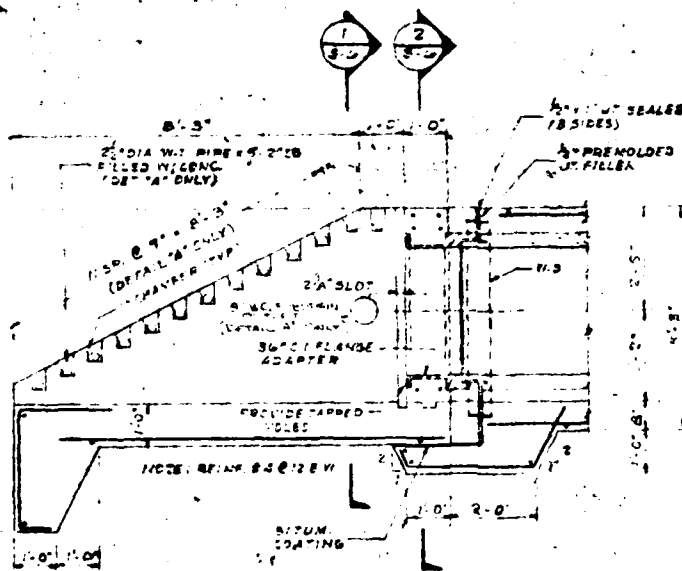
D. A. D. T.

DRAT 8
REV. 07-15-54

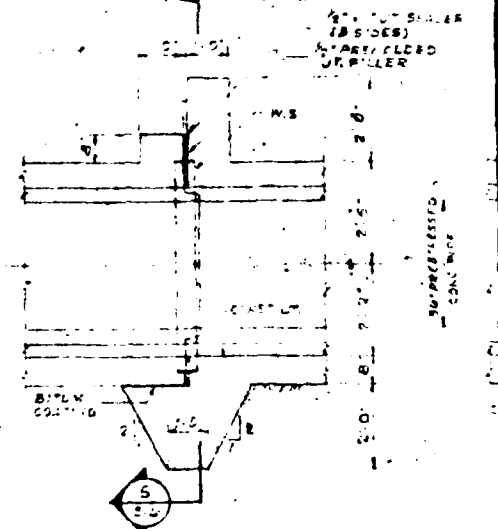


16' INTAKE STRUCT
SCALE: 1/8" = 1'-0"

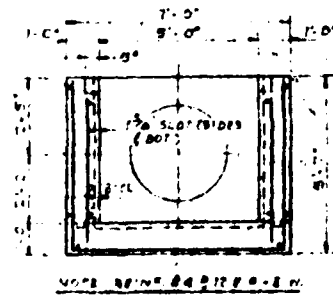
SECTION ALONG & 36' DRAIN P
SCALE: 1/4" = 1'-0"



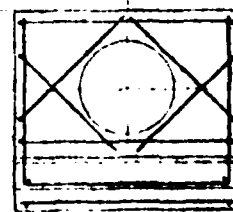
DETAIL A
SCALE: 1/4" = 1'-0"



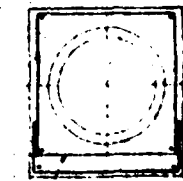
DETAIL B
SCALE: 1/4" = 1'-0"



SECTION 1
SCALE: 1/4" = 1'-0"



SECTION 2
SCALE: 1/4" = 1'-0"



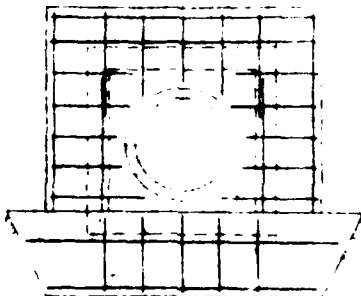
SECTION 3
SCALE: 1/4" = 1'-0"



SECTION 4
SCALE: 1/4" = 1'-0"

DRAWN BY: R.M.G.
CHKD. BY: C.C.C.
INSP. BY: R.F.D.

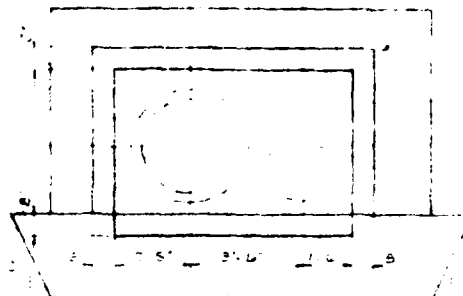
NOTE: ABOVE CONDITION TYP. FOR SINGLE PIPE



NOTE: REINFORCED CONCRETE ENCLOSURE

SECTION 1

SCALE: 1/4\"/>



NOTE: REINFORCED CONCRETE ENCLOSURE

SECTION 2

SCALE: 1/4\"/>

2



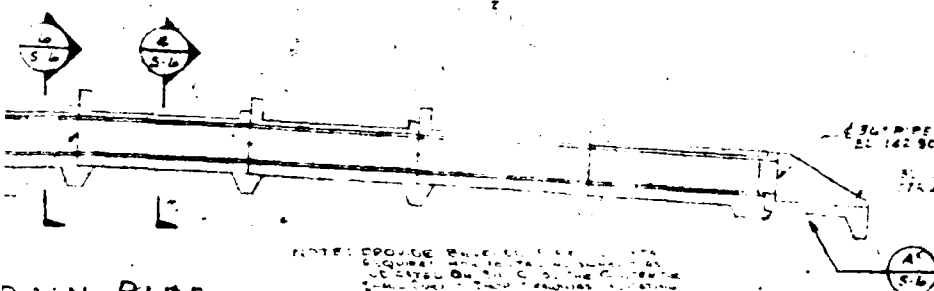
NOTE: REINFORCED CONCRETE ENCLOSURE

CONC. ENCLOSURE

FOR 20\"/>

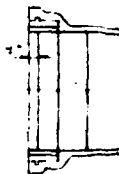
SCALE: 1/4\"/>

SEE DETAILS OF RAIN PIPE



NOTE: PROVIDE REINFORCED CONCRETE ENCLOSURE WITH 4\"/>

SCALE: 1/4\"/>

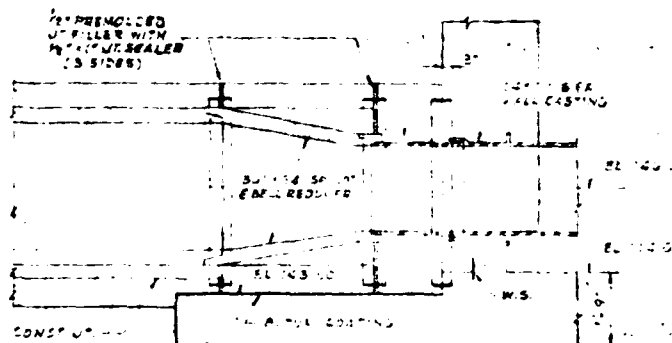


DET. OF CAST IRON GRATING

NO SCALE

SEE DETAILS OF RAIN PIPE

DET. CONC. TO CI ADAPTER, ADAPTER TO BE CI MATL.



DETAIL 1

SCALE: 1/4\"/>

NOTE: THE CONTRACTOR SHALL SUBMIT COMPLETE DETAILS IN THREE COPIES TO THE ENGINEER FOR APPROVAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF THE STRUCTURE.

RECORD DRAWING

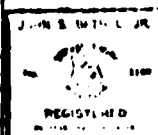
HUD PROJECT NO. BS-1-40-0008

CITY OF HOUSSEY, RHODE ISLAND

HARRIS POND DAM RENOVATION
PUMPING STATION, RAW WATER MAIN
AND APPURTENANT WORK
INTAKE AND OUTLET
SECTIONS AND DETAILS

STANDARD

DATE	JANUARY, 1960
MADE BY	CHECKED BY
SCALE	AS SHOWN
APPROVED	
FOR METAL & TOWN	
4-368	



M.E. DETAIL & COPY ENGINEERING

22-1688

CONTRACT 1067.1

SHEET 2-C

SECTION 1

SCALE: 1/4\"/>

NOTE: ABOVE CONDITION FOR DOUBLE PIPE

State of Rhode Island and Providence Plantations

DAMS AND RESERVOIRS

Application for Approval of Plans



April 11, 1968

Chief of the Division of Harbors and Rivers
~~211 State Office Building~~
~~Providence, R.I. 02903~~
106 Veterans Memorial Building
Providence, R. I. 02903

All plans submitted to the
DIVISION OF HARBORS AND RIVERS
are required by Section 3-8-26, of the General
Laws of 1956, to be stamped with the seal of a
"Registered Professional Engineer"

Dear Sir:

The undersigned respectfully requests the approval of the plans and specifications, herewith submitted,
~~construction~~ of a dam to be built in the ~~town~~ city of Woonsocket, Providence
~~at the dam~~ County, Rhode Island on Mill river.

(The applicant is to fill in the following items)

1. The drainage area at this dam is.....34.7.....square miles.
2. The spillway capacity of this dam at maximum discharge, is.....8500*.....cubic feet
per second.
3. Waste gate discharge, under freshet conditions is.....200.....cubic feet per second.
4. The estimated greatest freshet flow at this dam is.....3300**.....cubic feet per
second.

*Based on flood routing of Corps of Engineers' Standard Project
Flood for the Mill River.

**Estimated flood of record for the Mill River (without 1955 Harris
Pond Dam failure).

Plans (in triplicate) ~~to be submitted~~ showing details of construction and locality, and specifications of
construction of the proposed work must accompany this petition. Also plan of property involved and
proof of ownership.

Owner's signature *A. Edgar Lussier, May*
Address 169 Main Street
Woonsocket, Rhode Island Tel. 754-5400

(See other side)

August 23,

55

Henry Isé, Chief, Division of Harbors & Rivers

Public Works

John V. Keily, " " " " "

Public Works

Failure of Dams on Mill River at Woonsocket, R. I.

Yesterday I visited Harris Pond Dam #73 at Woonsocket, R. I. This earth dam had breached and the pond was virtually empty. This disaster was caused by the failure of the Spindleville Dam near Hopedale, Mass., about seven miles upstream from Harris Pond on the Mill River. This flood of water, occurring at the time of a heavy flow caused by hurricane "Diane", caused the water in Harris Pond to top the trench embankment leading to the Horseshoe Falls so-called and to erode the earth embankments until the east end of the main dike on Harris Pond gave away and left a breach between 100 and 200 feet wide. This torrent followed the course of the Mill River and washed out bridges on Privilege and School Streets directly below. There was a low dam across the Mill River some distance north of School Street, but it was impossible to reach this site due to tangled trees, etc. This Dam #75 may have been washed away. Below School Street, another earth dam at Social Pond (Dam #72) has also breached for a 60 foot width and the pond emptied into the Social area of Woonsocket, before reaching the Blackstone River. There were heavy deposits of sand and gravel on many areas until the Blackstone River was reached. In fact the entire stream bed of the Mill River is filled with gravel above and below School Street, and the river is now flowing thru a trench to the west of this river and thence into Social Pond.

We viewed the dams across the Blackstone River below Woonsocket, namely Manville #59, Albion #60, Ashton #61 and all seemed to be carrying the flood in a satisfactory manner. Minor floods had taken place at each location mainly due to overtopping of trench dikes. At Manville a weave-shed across the river and foundations under part of the wall had been washed away and have suffered serious damage.

At Pratt Dam #62 at Lonsdale,, the flood had taken out a section of the railroad, breached the trench to No. 4 Mill, and washed out part of the State Highway on Lonsdale Avenue. Considerable damage was done to small industries on the Blackstone River below this dam.

At Pawtucket the water is claimed to be 2 1/2 feet higher than any previously recorded flood. Flooded basements were the chief casualties in Pawtucket.

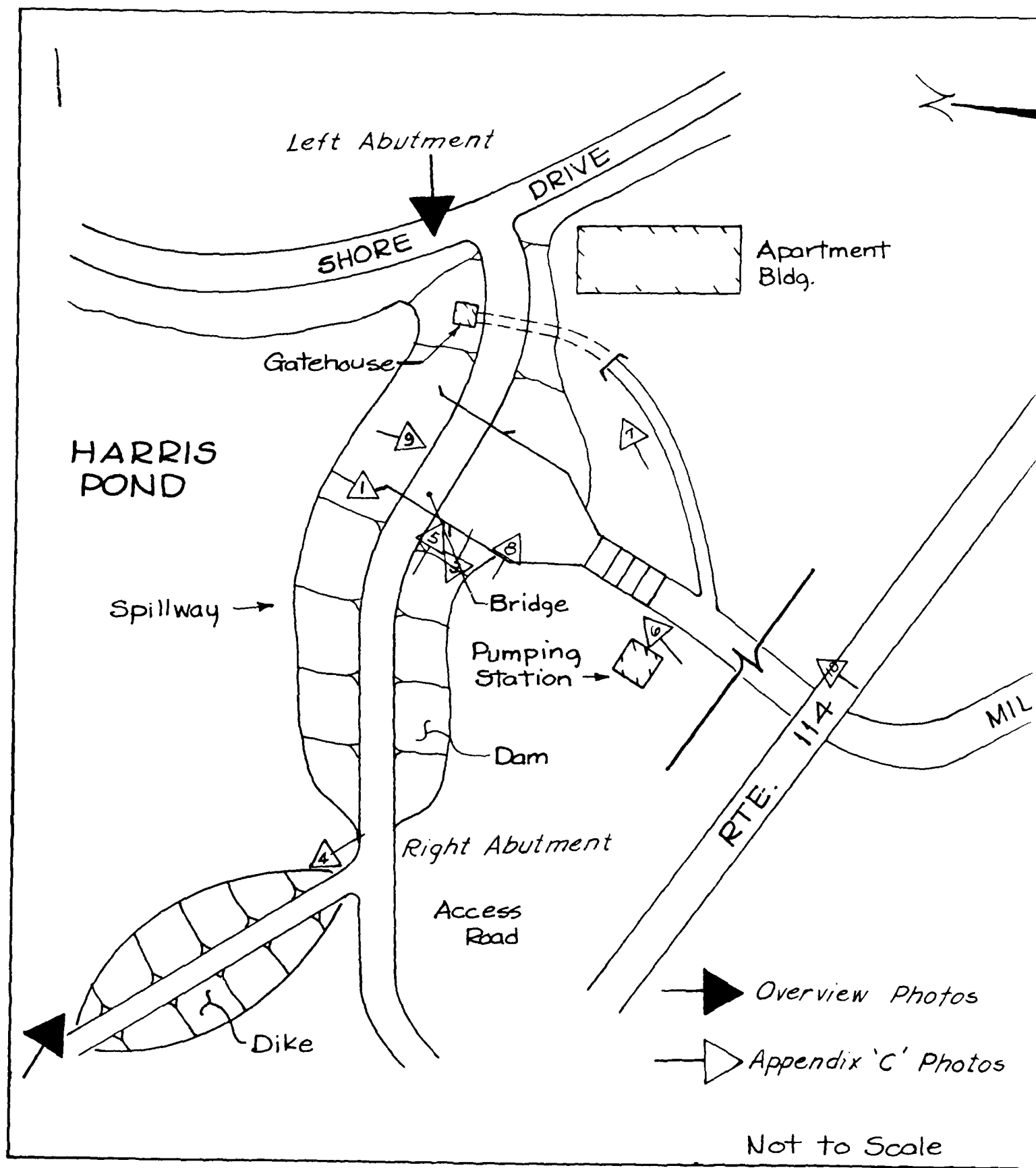
Apparently it was the breaking of the dam at Hopedale, Mass. that sent a flood wave down the Mill River on top of an already flooded condition. This wave over-taxed the existing earth structures at the various locations down stream and caused them to fail.

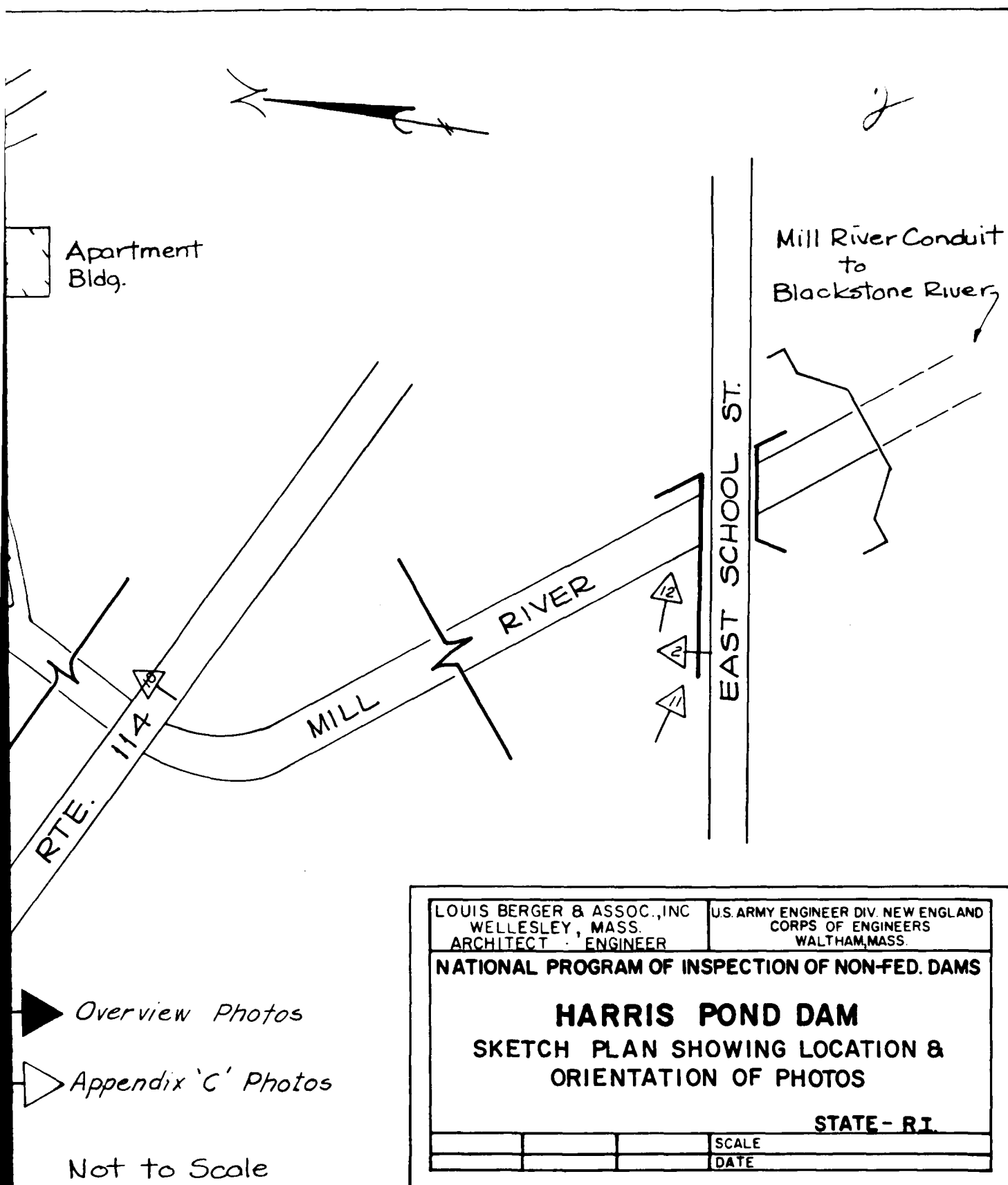
It can be readily seen that a large factor of safety will be required when these structures are rebuilt.

About 30 pictures were taken of the flood conditions some 72 hours after the peak of the flood.

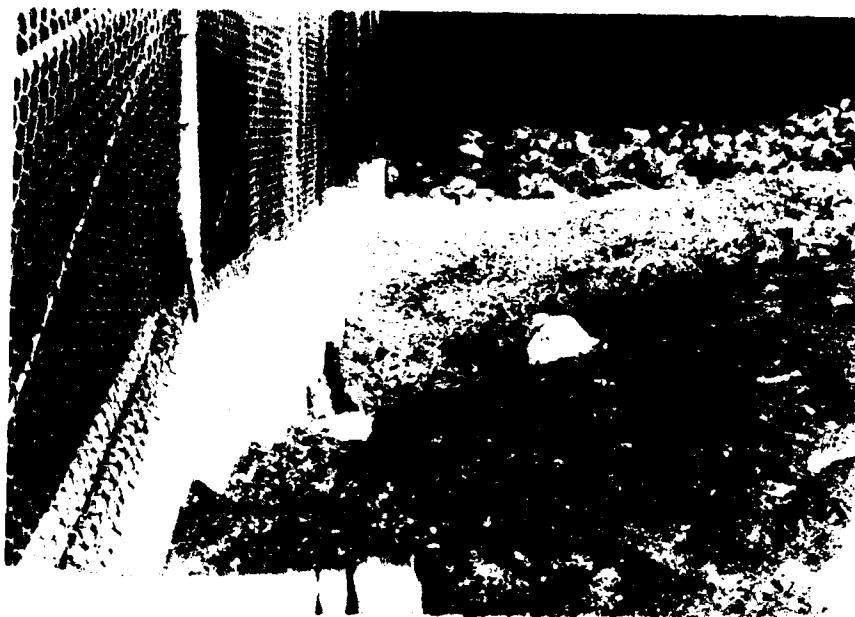
John V. Keily

APPENDIX C
SELECTED PHOTOGRAPHS





HARRIS POND DAM



1. Upstream slope at left training wall to spillway.



2. Mill River channel looking upstream from E. School Street.

HARRIS POND DAM

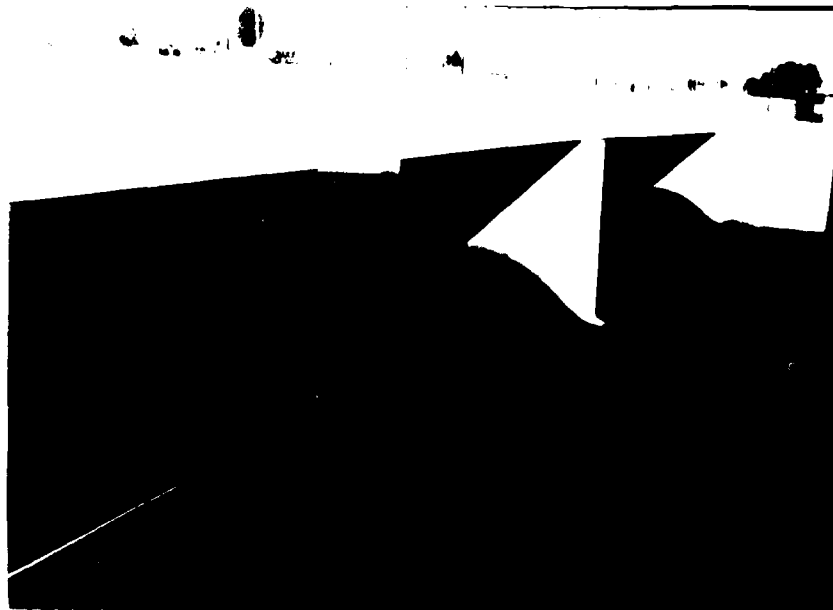


3. Downstream slope from right side of spillway.

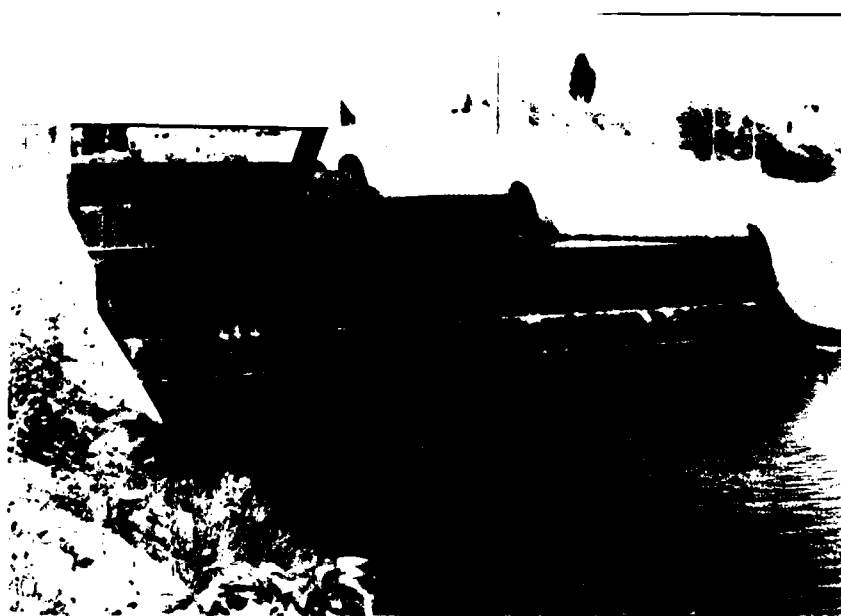


4. Upstream slope of dike at right abutment.

HARRIS POND DAM



5. Spillway weir from right training wall.



6. Stilling basin from right side of downstream channel.

HARRIS POND DAM



7. 36 in. dia. outlet pipe.



8. Downstream channel from 36 in. dia. outlet pipe.

HARRIS POND DAM

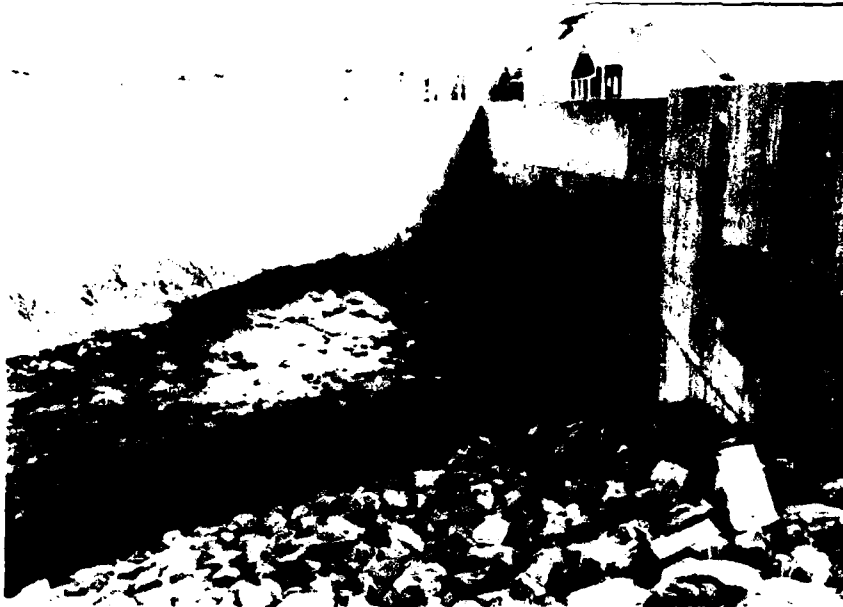


9. Stilling area and downstream channel from spillway bridge.



10. Downstream channel from Route 114 bridge looking towards spillway.

HARRIS POND DAM



11. Entrance to Mill River conduit under East School Street.



12. E. School St. and entrance to Mill River conduit (center) to Blackstone River.

APPENDIX D
HYDROLOGIC & HYDRAULIC COMPUTATIONS

PROFILE ALONG CREST OF DAM

Maindam GGD' 100' 125' 150'

Roadway El. 177.3

El. 180.3

El. 180.3 S=0.00445

S=0.00445

Spillway Crest El. 167.5

Approx. toe of

El. 167.5

El. 161.0

SPILLWAY CREST

Ground level ± El. 141

Footings level of 5 story apartment bldg. @ El. 147.8

Riprap -

Riprap pool @ El. 132

Outlet channel @ ± El. 140

Roadway El. ± 160

Spillway Crest El. 167.5

Riprap and stone gutter

Axis of Crest of dam slope = 0.00445

Ramp

Riprapped face

Roadway El. ± 160.9

Spillway approach El. 161.0

Reservoir Normal W.S. El. 167.5

GGD'

PLAN

D-1

PLAN

D-1

[illegible][illegible]

D-2

BY 27K DATE 2-3-79

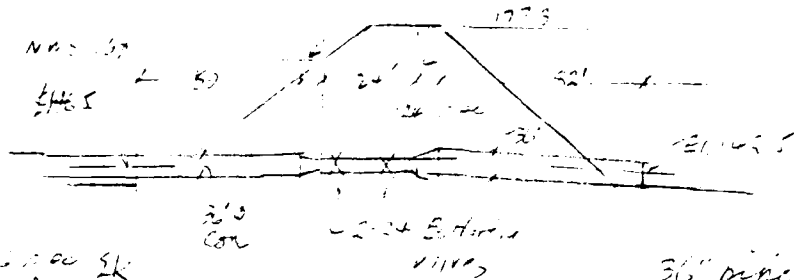
LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-3 OF

CHKD. BY _____ DATE _____

PROJECT _____

SUBJECT HAIRY ROAD - OUTLET DRAIN DISTANCE 56



2.000000 SK

1.000000 0.5

1.000000 3.25

1.000000 2.50

1.000000 2.00

1.000000 1.00

1.000000 0.25

5.15

50

175

105 - 4

145

150

155

160

165

170

175

240

40

69

90

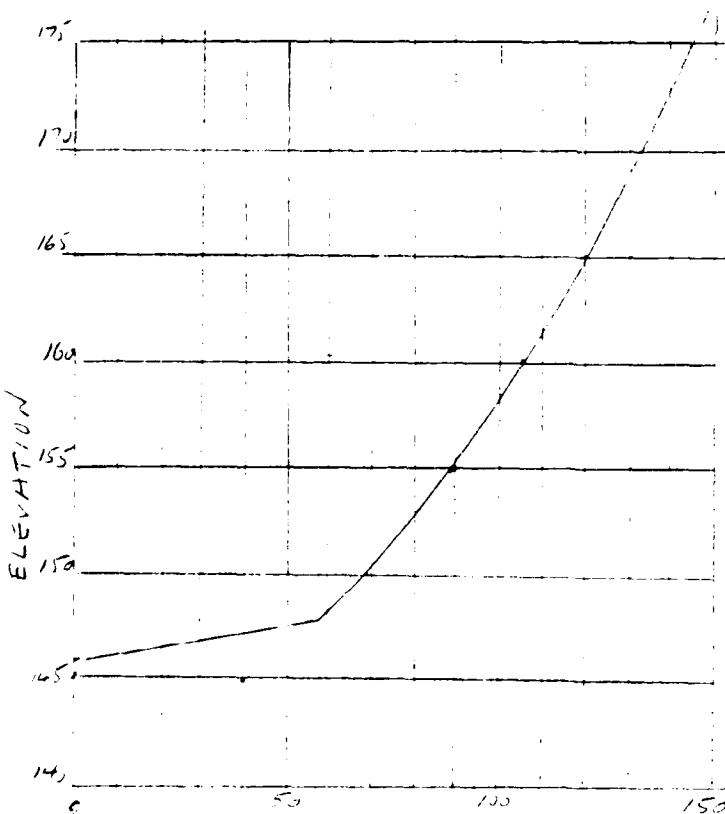
106

120

133

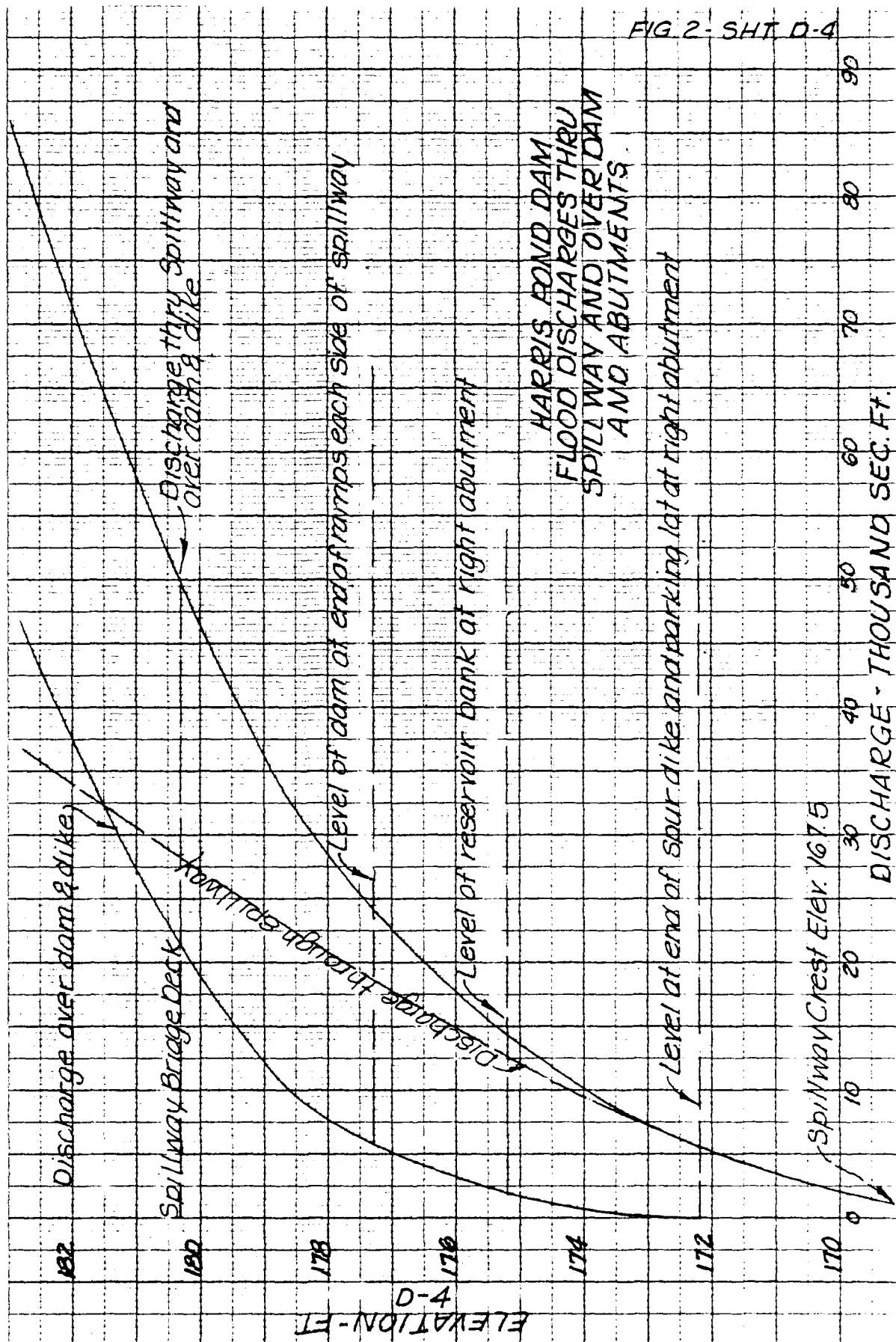
145

36" pipe A = 7.0704 ft.



36" LOW LEVEL OUTLET
DISCHARGE CURVE

D-3



BY: MB DATE: 10-9-71 LOUIS BERGER & ASSOCIATES INC. SHEET NO. D-5 OF ..
 CHKD. BY: .. DATE: .. INSPECTION OF DAMS - CORP. RI. PROJECT: ..
 SUBJECT: HAROLD RAND DAM - DISCHARGES THRU SPILLWAY & MAIN DAM

For shape of crest $H_0 = \pm 6.5'$ $P = 6.5'$ $\frac{P}{H_0} = 1.0$

Coeff of sloped crest = 0.99 x coeff for vertical crest

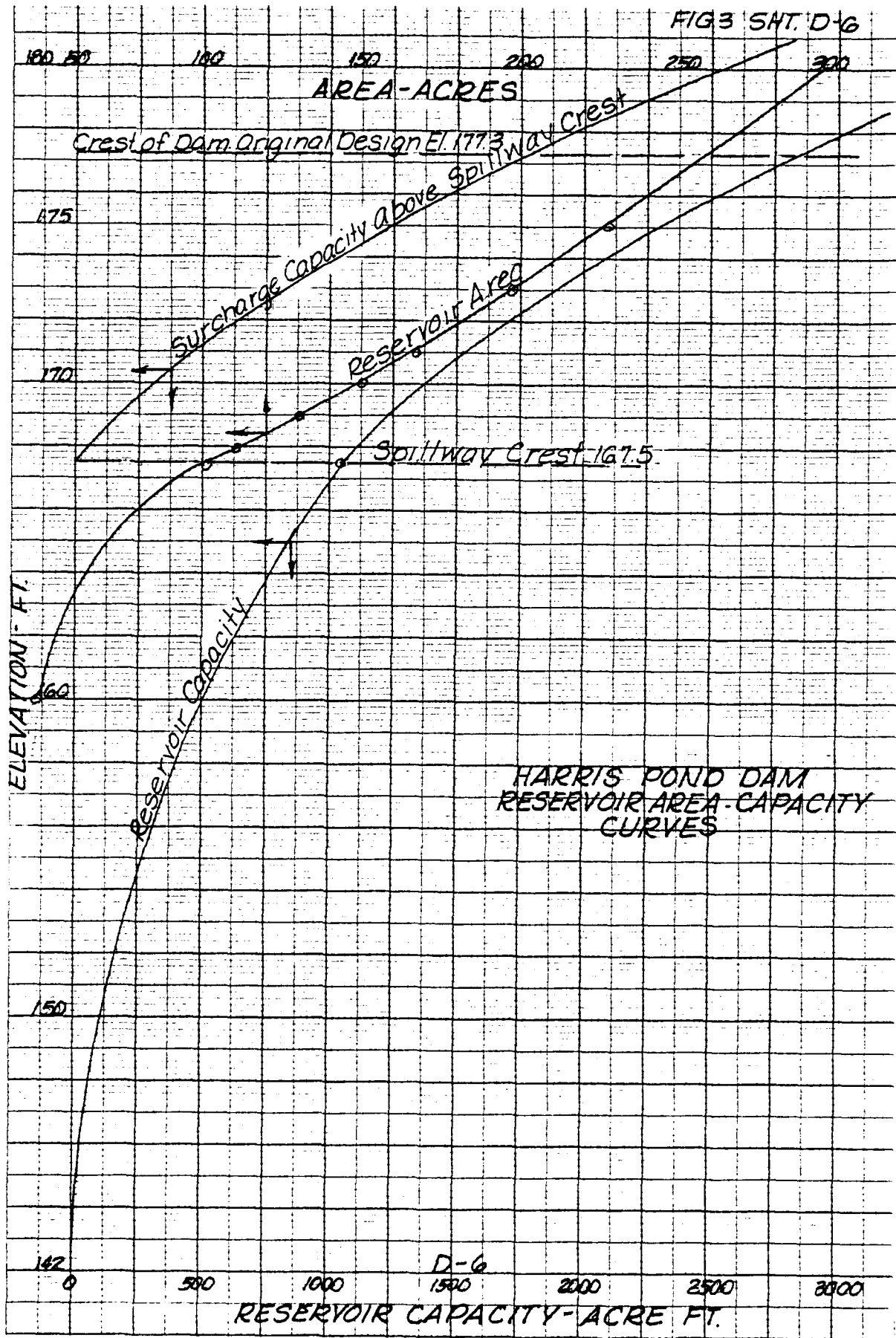
Therefore coeff of design head = $3.08 \times 0.99 = 3.05$ Say 3.8

SPILLWAY Q L=150						Right abutment L=80						Spur dike L=300					
ELV.	H	$\frac{H}{H_0}$	$\frac{C}{C_0}$	C	ΔQ	H	C	$\frac{H}{H_0}$	$\frac{C}{C_0}$	C	ΔQ	H	C	$\frac{H}{H_0}$	$\frac{C}{C_0}$	C	ΔQ
167.5	0																
168	0.5	0.08	0.81	3.08	163												
169	1.5	0.23	0.86	3.27	701												
170	2.5	0.38	0.85	3.40	2316												
171	3.5	0.54	0.73	3.52	3467												
172	4.7	0.72	0.76	3.65	5579	0						0					
173	5.0	0.77	0.79	3.70	8289	1.3	2.5	3.71	1.46	3.47	65	1.3	2.5	3.71	1.86	70.5	142
175	2.7	1.13	1.02	3.87	12403	3.0	2.5	12.99	8.35	80	668	3.0	2.5	12.99	6.50	170.5	1147
177.3	9.8	1.51	1.06	4.12	18545	5.1	2.5	28.77	3.20	80	1456	5.1	2.5	28.77	14.40	300	4320
178.8	11.3	1.74	1.08	4.11	23361	6.6	2.5	42.39	28.60	80	2295	6.6	2.5	42.39	23.40	300	5547
180.3	12.9	1.97	1.10	4.10	28474	8.1	2.5	59.53	34.21	80	3457	8.1	2.5	59.53	35.31	300	10525
181.5	14.1	2.15	1.10	4.10	32215	9.3	2.5	70.70	35.22	80	4204	9.3	2.5	70.70	46.21	300	13813
182.7	15.0	2.3	1.10	4.10	35728	10.3	2.5	82.24	35.77	80	5278	10.3	2.5	82.24	56.10	300	1842

MAIN DAM RIGHT OF SPILLWAY						DAMP LEFT OF SPILLWAY							
ELV.	H	$\frac{H}{H_0}$	$\frac{C}{C_0}$	C	ΔQ	ELV.	H	$\frac{H}{H_0}$	$\frac{C}{C_0}$	C	ΔQ		
167.5						167.5							
168						168							
169						169							
170						170							
171						171							
172						172							
173						173							
175						175							
177.3						177.3							
178.8	1.5	2.7	4.96	2.48	330	518	2.48	63	153	4.96	5	12	34185
180.3	3.0	2.8	14.35	7.25	600	4405	7.25	125	9.0	14.35	10	13	47725
181.5	4.2	2.9	24.92	14.30	100	9400	14.30	125	17.18	24.92	10	17	24240
182.7	5.0	2.9	30.31	21.20	100	4457	21.20	125	20.70	30.31	10	21	27000

0-5

FIG 3 SHT. D-6



1/8" STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH

BY 214 DATE 1/6/68

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-7 OF

CHKD. BY DATE INVEST. BY FE DA 15 - CONN + R -

PROJECT

SUBJECT HAPP J. POIND. RESERVOIR AREA - CAPACITY SURVEY

From 6 to 8 Sound sheet

Area of 138 111.02
170 150.23
180 290.22

Return of Reservoir El. ± 142 Storage to Spwy. ± 575
= 1050 AF

El. Area	Average Area	Area	Storage	Surf. Stor.
142	0		0	
150	18	9	72	72
155	38	28	140	212
160	55	40	240	452
165	87	72.5	363	815
170	121	94	535	1050
175	150	106	53	1103
180	130	121	121	1224
175	150	140	140	1364
170	135	153	153	1522
165	124	172	172	1694
160	103	157	87	1881
155	85	201	201	2082
150	63	216	216	2298
145	43	230	230	2528
140	25	244	244	2772
135	9	259	259	3031
130	0	273	273	3304
125	0	289	289	3593

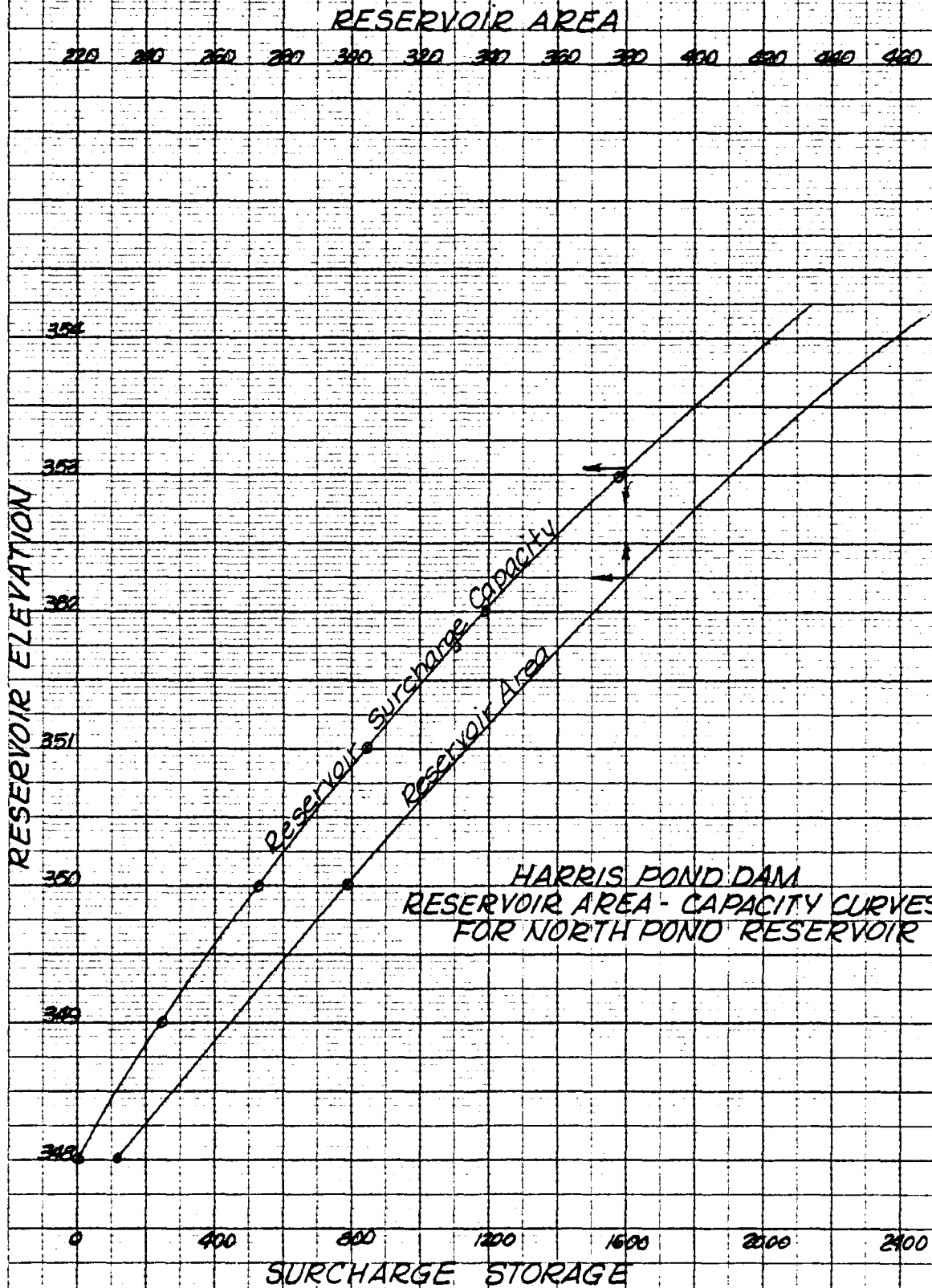
HARRIS POND DATA

UPSTREAM IMPROVEMENTS
ABOVE HARRIS POND
241 (FREEDOM ST. 241)

Source: Paper Division of
Rockwell International

Location	Area Sq. Ft.	Average Depth	Volume Gallons	Evaporation per year in inches	Average yearly rain fall	1" Drawdown from high water in gallons
North Pond	239 acres 10,410,840	10.0'	2396 acre feet 780,813,000	17"	40"	2396 acre feet 6,506,775
Fiske Mill	70 acres 871,200	3.0'	62.1 acre feet 20,243,743	17"	40"	62.1 acre feet 545,000
West Street	73 acres 3,310,560	1.5'	114 acre feet 37,243,800	17"	40"	644.4 acre feet 2,069,100
Hopkins (Freedom Street)	58.6 acres 3,850,704	4.43'	443 acre feet 144,401,400	17"	40"	744.4 acre feet 2,406,690

SHT D-9



KEUFFEL & ESSER CO
MADE IN U.S.A.

D-9

SHT D-10

KEIFFEL & ESSER CO
MADE IN U.S.A.

RESERVOIR ELEVATION

354

353

352

351

350

349

348

Top of Dam El. 350

Spillway Crest El. 348

2000

4000

6000

8000

10000

DISCHARGE - CU. FT. PER. SEC.

HARRIS POND DAM
DISCHARGE CAPACITY AT NORTH POND
DAM

D-10

BY 2/8 DATE 12-1-78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2-11 OF 2
 CHKD. BY DATE INSPECTION OF DAM - Conn. + PI PROJECT DATE
 SUBJECT HARRIS POND DAM - North Pond Reservoir - DISCHARGE - STORAGE CAPACITY

Discharges: 2.9 1.35 1.0
 Top of dam = 113

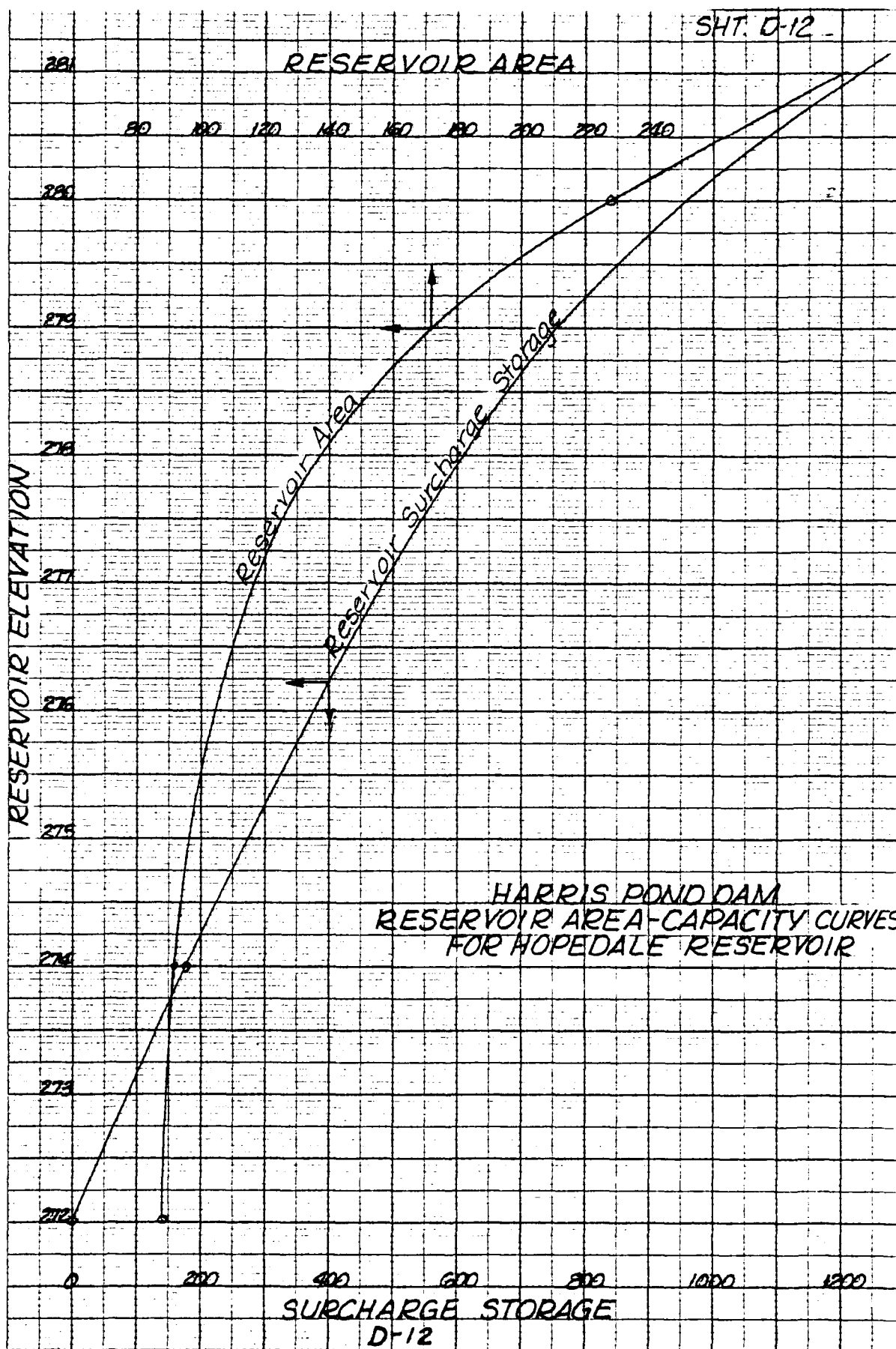
$C = 2.9$ $C = 5.9$ $C = 500$ $C = 5.9$ $C = 5.9$

Spillway	C = 2.9	C = 5.9	C = 500	C = 5.9	C = 5.9	Total
340	0	0	0	0	0	0
345	33	101	33	101	134	134
350	20	287	0	0	287	287
355	3	401	0.5	0.5	402	402
360	3	52	1.0	1.0	53	53
365	4	665	1.5	1.5	666	666
370	4	812	2.0	2.0	814	814
375	5	959	2.5	2.5	961	961
380	5	1135	3.0	3.0	1138	1138
385	5	1309	3.5	3.5	1312	1312
390	5	1502	4.0	4.0	1506	1506

RESERVOIR CAPACITY - SURCHARGE STORAGE

Spillway	Area	Vol.	Area	Vol.
340	232	0	0	0
345	264	248	248	248
350	297	281.5	281.5	530
355	334	316.5	316.5	846
360	370	352	352	1198
365	40	390	391	1588
370	457	435	435	2023


 STANDARD @ CROSS SECTION
 10 x 10 TO THE HALF INCH



SUBJECT HARRIS

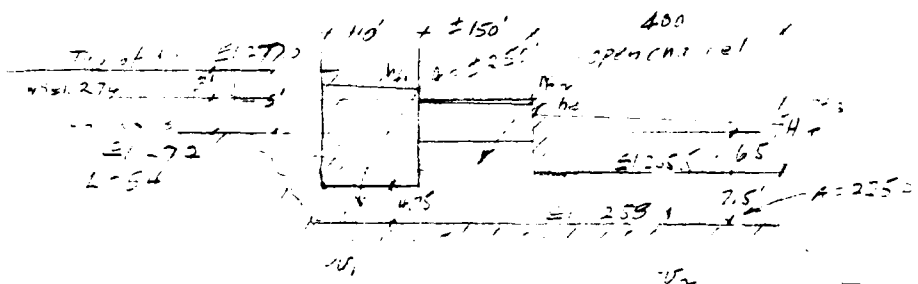
LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-13 OF _____

PROJECT _____

SUBJECT HARRIS POND DAM- Hoponole Res. Capacity & Disch. Curr. test & rep.

TABLE 2-1. Outlet Capacitors for any Circuit



Sp. 100, A. schwarz $c = 2.8$ $L = 54$

Summary

3. 54

275	2
276	425
275	786
276	1210
277	1690
278	2282
279	2800
280	3420
281	4032

3000	8.05	274.25
4000	15.00	281.2
5000		

Sum - 750.00

$$A_1 = 475 \times 52.6 = 25077.5 \quad r = 2.3 - 1.5 = 0.8$$

$$A_2 = 75 \times 30 = 2250 \quad r = 3.0 - 1.5 = 1.5$$

$$n = 0.4375$$

← 52 ft x 4.75 conductor → 30 ft x 7.5 conductor → 100 ft x 10 conductor

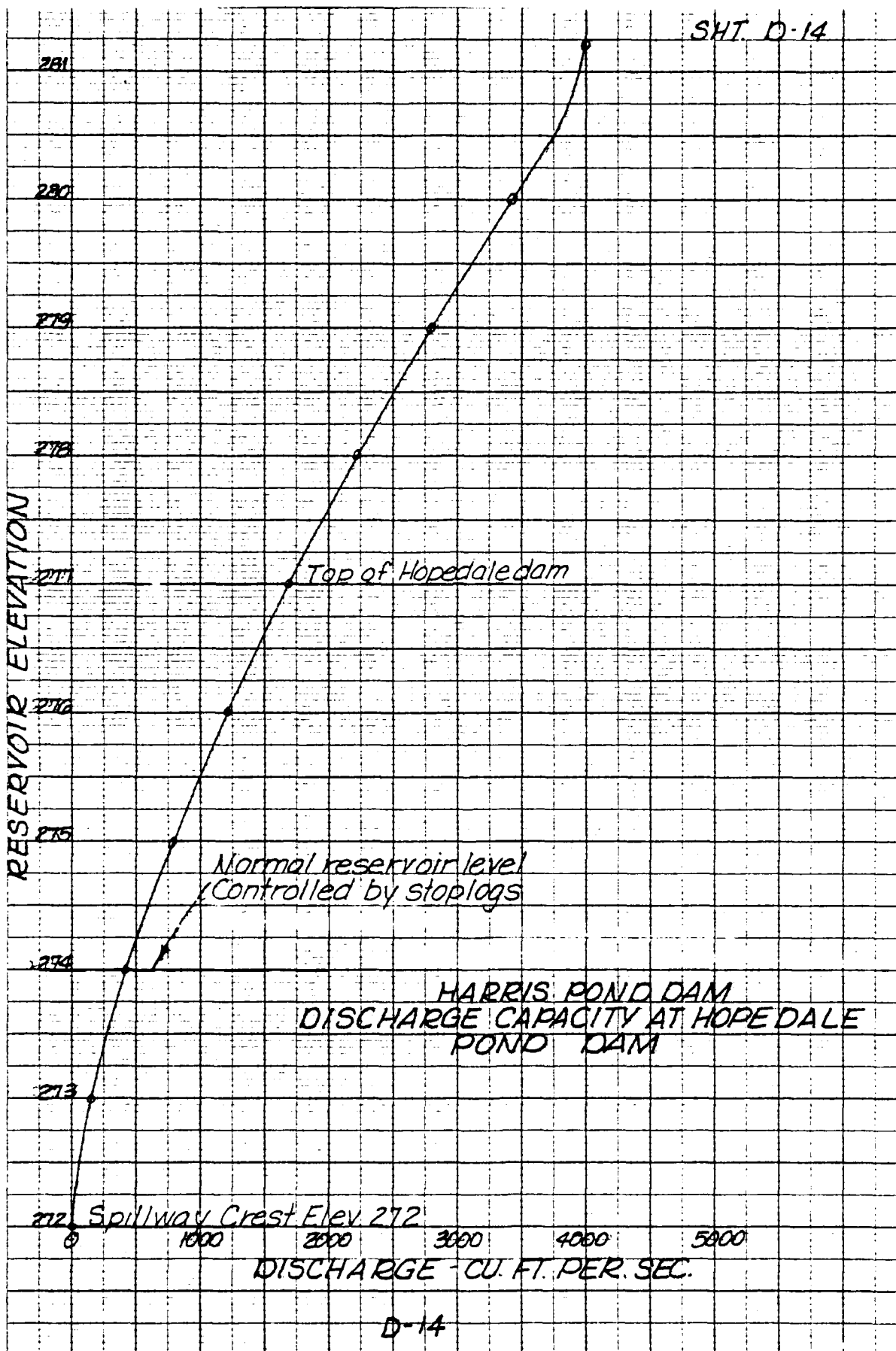
[illegible]

RESERVE CAPACITY

Elev	Area	A.C. Area	Diff	% Diff
272	55.0		0	0
273	90	89	59	59
274	102	91	91	180
275	90	94	90	270
276	104	120	120	370
277	117	140.5	125.5	431
278	130	127.5	127.5	512
279	152	150	150	760
280	220	180	180	900
281	300	200	200	220

D-13

SHT. D-14



KIEFFEL & ESSER CO
MADE IN U.S.A.

D-14

BY _____ DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-15 OF _____

CHKD. BY _____ DATE _____

INSPECTION OF DAMS - CONTINUED

PROJECT _____

SUBJECT _____

LAKE HAPARTON RESERVOIR DAM - LAKE - HAPARTON

LAKE HAPARTON RESERVOIR

Elev	H	C	g/f	ΔQ	Area	ΔQ	Area	ΔQ	Area
224	0	0.8	0	5					
230	1	2.8	2.8	143	1.40	310	434	1.4	0
231	2	2.5	7.72	396	5.30	310	1661	3.96	22
232	3	2.0	14.55	727	11.24	310	3483	7.27	40
233	4	2.5	22.4	1120	18.48	310	5728	11.2	56
234	5	2.5	31.3	1585	26.85	310	8224	15.85	81
235	6	2.5	41.16	2055	36.23	310	1231	20.55	100

RESERVOIR CAPACITY

ELEV	AREA	ΔQ	ΔQ	Σ Q
224	0			
230	14	62	62	62
231	34	66	66	128
232	73	70	70	198
233	112	75	75	273
234	158	80	80	353
235	205	84	84	437

BY: SR DATE: 1-29-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-16 OF

CHKD. BY: DATE:

INSPECTION: FEEDERS - CONN. R.E.

PROJECT:

SUBJECT: HARRIS POND RESERVOIR

HARRIS POND RESERVOIR

ELEV	STORAGE	OUTFLOW
341.0	0	0
342.5	120	33
344.0	248	101
345.5	385	186
350.0	530	287
350.5	680	396
351.0	846	1977
351.5	1010	3329
352.0	1192	4913
353.0	1588	8669

LIANA TUA LAGOON

ELEV	STORAGE	OUTFLOW
229	0	0
230	62	572
231	28	2140
232	198	4530
233	273	7587
234	353	11156
235	437	15553

HOPEDALE RESERVOIR

ELEV	STORAGE	OUTFLOW
272	0	0
273	89	150
274	180	428
275	272	755
276	374	1210
277	481	1690
278	592	2222
279	702	2800
280	907	3421
281	1221	4000

HARRIS POND RESERVOIR

ELEV	STORAGE	OUTFLOW
167.5	0	0
168.0	55	163
169.0	175	901
170.0	310	2016
171.0	450	3467
172.2	680	5570
173.5	930	8476
175.2	1285	14210
177.3	1890	24321
178.5	2185	34155

BY JH DATE 1-27-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-17 OF 1

CHKD. BY DATE

INSPECTOR OF DAMS DIVISION R.E.

PROJECT

SUBJECT HOOPER DAM - H-323-021

RAINFALL FOR 12.5 mi area 23.5 inches

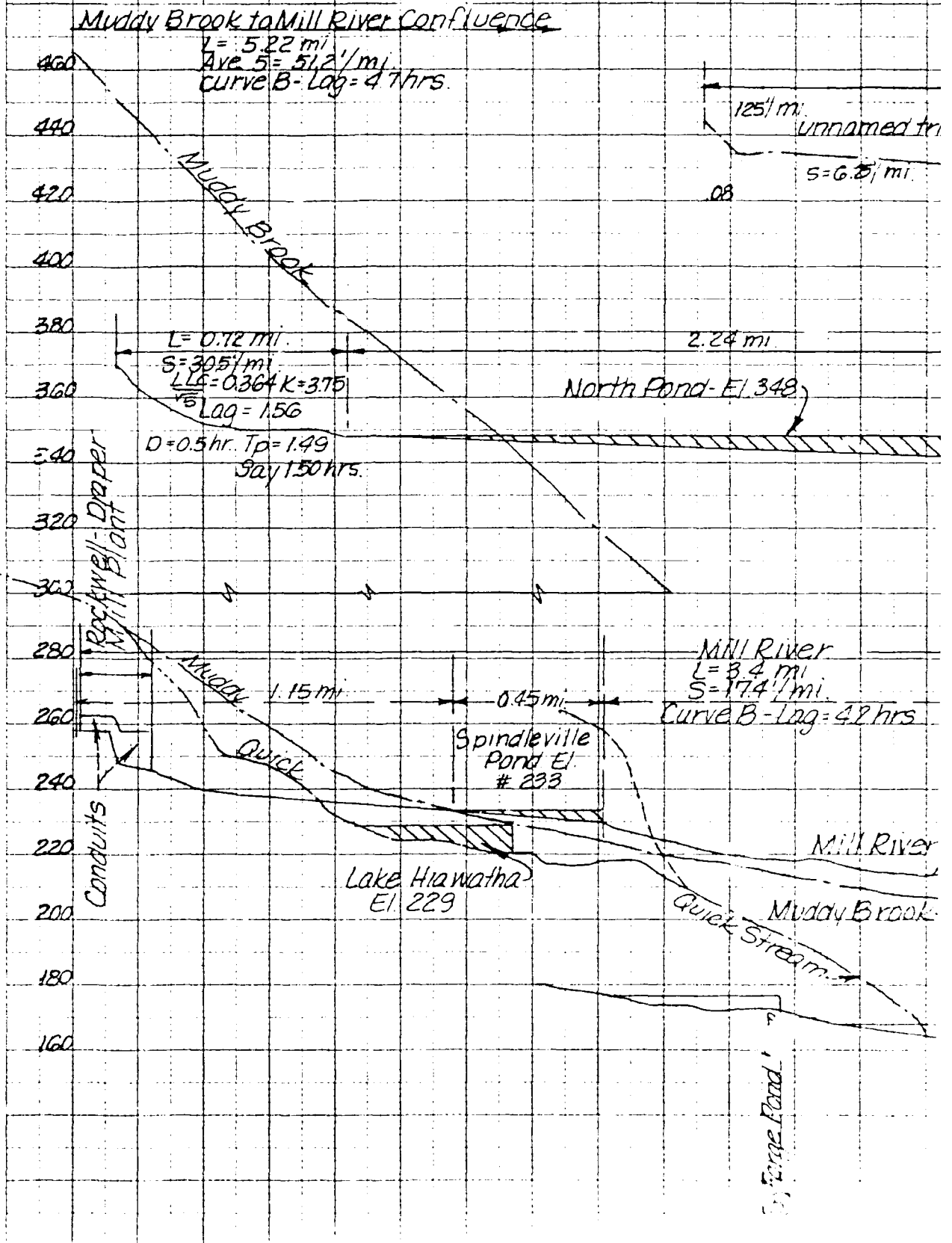
Retention factors for 32.5 mi = 17%

% of 12.5 mi area for 32.5 mi = 88%

1. Total adjusted rainfall = $57\% \times 9.7 = 76.5\%$ $23.5 \times .765 = 18.1$

Time	Obs Precip	Loss	Excess
0.5	5.0	0.9	4.1
1.0	5.0	0.9	4.1
1.5	5.5	0.9	4.6
2.0	6.5	0.9	5.6
2.5	7.0	0.9	6.1
3.0	8.0	0.9	7.1
3.5	10.0	0.9	9.1
4.0	28.0	0.9	27.1
4.5	7.0	0.9	6.1
5.0	7.0	0.9	6.1
5.5	6.0	0.9	5.1
6.0	5.0	0.9	4.1
	14.0	2.0	12.0

STANDARD & CROSS SECTION
10 X 10 TO THE HALF INCH



KEUFFEL &
MADE IN

AD-A156 587

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
HARRIS POND DAM (RI 0..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV FEB 79

2/2

UNCLASSIFIED

F/G 13/13

NL

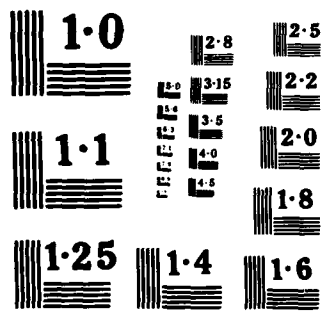
END

DATE

FILMED

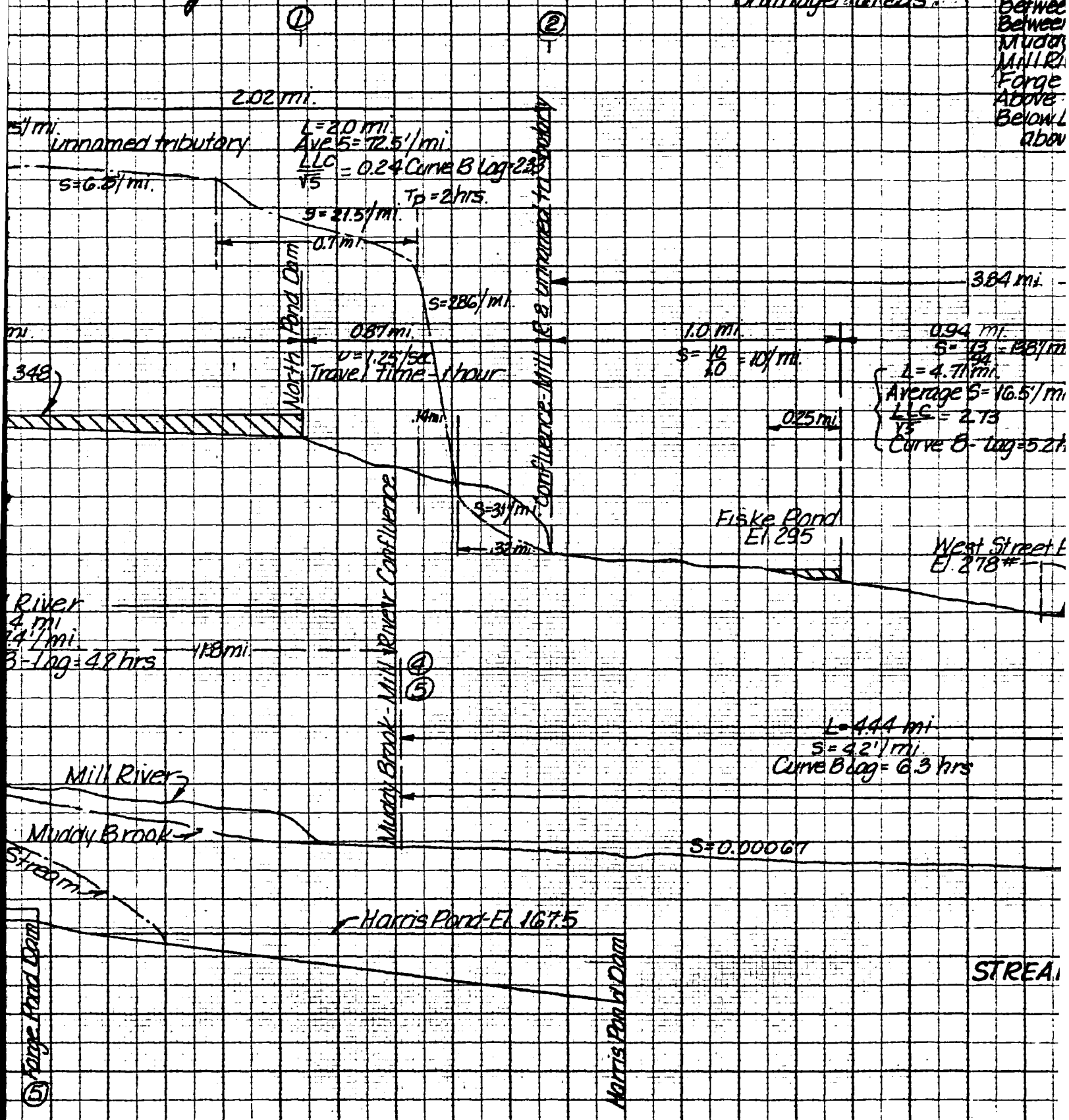
8-85

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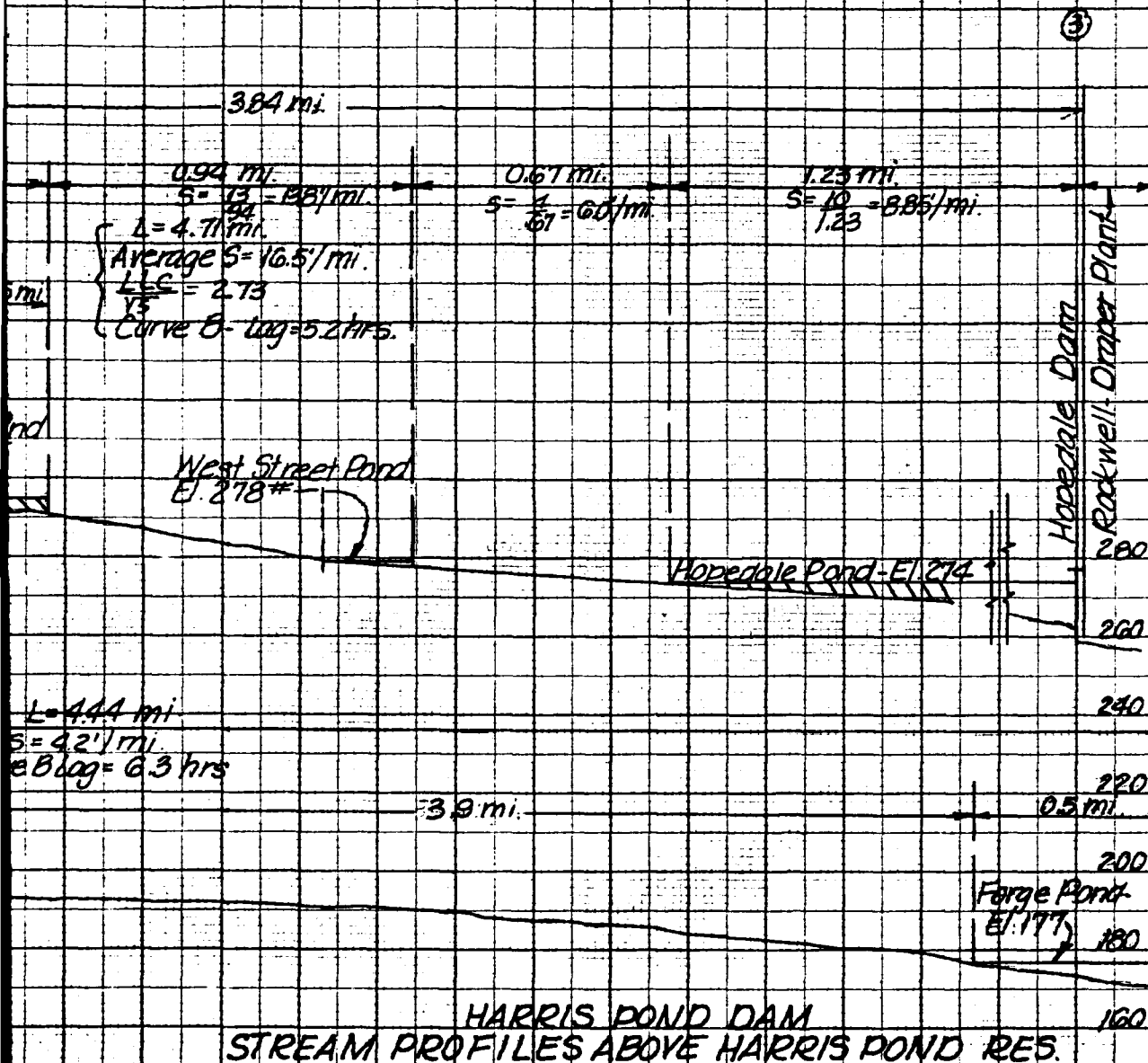


Above
Between
Between
Between
Muddy
Mill R.
Forge
Above
Below
Below

Drainage areas:



ge areas:	Above North Pond Dam	27.5 sq. mi.
	Between unnamed Brook confluence & North Pond Dam	1.7 sq. mi.
	Between Hopeville Dam & unnamed Brook Confluence	5.6 sq. mi.
	Between Muddy Brook Confluence & Hopeville Dam	2.8 sq. mi.
	Muddy Brook above Mill River Confluence	6.1 sq. mi.
	Mill River Below Muddy Confluence above	9.4 sq. mi.
	Forge Pond Dam	
	Above Lake Hiawatha Dam	1.1 sq. mi.
	Below Lake Hiawatha & Forge Pond Dam & above Harris Pond dam	3.1 sq. mi.
	total	32.5 sq. mi.



BY CSL DATE 1-29-75

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-19 OF

CHKD. BY DATE

PROJECT

SUBJECT HARRIS POND DAM - HYDROLOGY - DEVELOPMENT - 35 UNIT GRAPHS

$$L_{eq} = K \left(\frac{L \times 0.5L}{V^5} \right)^{.33} \quad T_p = 0.75 L_{eq} + 3.75D \quad T_c = 16.7 T_p - 0.83D$$

Reach	Longest St. Length Sub	St. Length Total	Friction Ff/mi Sub	Transmission Loss Sub	Curve Loss K=3.75 Sub	Lag-loss Total	Conduit Unit length TP-loss D=1.06r hr	Alphoid TP hr	Tc hr	Ave Velocity ft/sec	From Miles to	TRANSPORT TIME	
												Ave Velocity ft/sec	Time hrs
DA = 2.709 mi North Fork above Unmanned Brook above (2) DA = 1.709 mi	0.28 0.78 0.70 0.14 0.32	0.72	125.0 6.25 21.5 286 310	30.5	0.23 1.83 1.43 0.33 0.80	1.37	1.75	2.0	2.5	0.42	0-②	0.87	1.0
Hopedale Ponto Westst. Unmanned Brook (3) to (3) DA = 2.709 mi	1.0 0.44 0.67 1.23	2.02	100 13.8 6.0 8.85	72.5	2.04 1.86 1.70	4.26	3.87	4.0	5.85	0.51	-	-	-
North Fork above of South Fork above of North Fork (3) to (4) DA = 2.709 mi	0.40 0.75 0.45 1.40 0.10	3.84	850 8.3 8.3 14.0 1000	98.6	- 1.14 1.24 2.40 0.30	4.17	4.10	4.0	5.85	0.45	②-③	2.61	3.0
North Fork above of South Fork above of North Fork (4) to (4) DA = 2.709 mi	0.30 0.30 0.30 1.52	3.00	6.7 83.3 20 3.0	1.3	1.00 2.77 2.57 1.55	4.07	5.85 4.10	5.0	7.5	0.67	③-④	3.4	5.0
North Fork above of South Fork above of North Fork (4) to (4) DA = 2.709 mi	0.30 0.30 0.30 1.52	3.00	6.7 83.3 20 3.0	1.3	1.00 2.77 2.57 1.55	4.07	5.85 4.10	5.0	7.5	0.67	③-④	3.4	5.0

D-19

BY 27- DATE 1-20-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-20 OF

CHKD. BY DATE

PROJECT

SUBJECT HARRIS POND DAM - HYDROLOGY - DEVELOPMENT OF HYDROGRAPHS

REACH	Length stream length-miles	Stream slope ft/mile		Lag time hrs	Computed Time to peak Time to peak Time to peak	Adopted TP hrs	To hrs	Average Velocity ft/sec	Transport time	
		Sub	Total						From Miles	To Miles
Mud Run - Hill Country Pond to Forge Pond Dam DA = 9.4 mi.	Sub									
	3.9	5.38	5.55	5.55	4.50	5.0	7.5	0.86	44	1.29
Above Lake Harris Quick Dam. (8) DA = 1.1 sq. mile.	4.4	5.96	5.96	5.96	4.50	5.0	7.5	0.86	44	1.29
	1.23	65.1	1.71	1.71	1.66	2.0	2.5	0.71	1.26	1.23
Between Harris Pond Quick Dam and Forge Pond Quick Dam Below (6) and (7) DA = 3.1 sq. mile.	1.10	88.2	1.52	1.52	1.51	1.5	1.7	0.95	-	-
	21.53								12.54	1.2
Total C										

D-20

BY QTH DATE 1-29-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-21 OF

CHKD. BY DATE INSPECTION OF DAMS - CONN. T.R.E.

SUBJECT HARRIS POND DAM - HYDROLOGY

PROJECT

CURVILINEAR UNITGRAPHS

Time hrs	Tp = 4.0					Tp = 5.0				
	T/Tp	Q/Qp	Qp = 205.7	Qp = 677.6		T/Tp	Q/Qp	Qp = 271.0	Qp = 590.4	Qp = 909.2
0.5	0.125	1.030	6	20		0.1	0.015	4	9	14
1.0	0.25	1.116	24	80		0.2	0.075	20	44	68
1.5	0.375	1.250	51	169		0.3	0.16	43	94	146
2.0	0.50	1.430	88	291		0.4	0.28	76	165	255
2.5	0.625	1.642	132	435		0.5	0.43	117	254	391
3.0	0.75	1.830	170	562		0.6	0.60	163	354	546
3.5	0.875	1.950	195	644		0.7	0.77	209	455	701
4.0	1.00	1.000	206	678		0.8	0.80	241	526	810
4.5	1.125	1.365	199	654		0.9	0.97	263	573	883
5.0	1.25	1.880	181	596		1.0	1.00	271	590	910
5.5	1.375	1.773	159	524		1.1	0.98	266	579	892
6.0	1.50	1.600	136	447		1.2	0.92	249	543	837
6.5	1.625	1.543	112	368		1.3	0.84	228	496	764
7.0	1.75	1.455	94	308		1.4	0.75	203	443	682
7.5	1.875	1.382	79	259		1.5	0.66	179	390	601
8.0	2.00	1.320	66	217		1.6	0.56	152	331	510
8.5	2.125	1.270	56	183		1.7	0.49	133	289	446
9.0	2.25	1.225	45	152		1.8	0.42	114	248	382
9.5	2.375	1.187	38	127		1.9	0.37	100	218	337
10.0	2.50	1.155	32	105		2.0	0.32	87	189	291
10.5	2.625	1.126	26	85		2.1	0.28	76	165	255
11.0	2.75	1.106	22	72		2.2	0.24	65	142	218
11.5	2.875	1.090	19	61		2.3	0.21	57	124	191
12.0	3.00	1.075	15	51		2.4	0.18	49	106	160
12.5	3.125	1.065	13	44		2.5	0.155	42	92	141
13.0	3.25	1.0555	11	38		2.6	0.13	35	77	118
13.5	3.375	1.0457	9	31		2.7	0.114	31	67	104
14.0	3.50	1.035	7	24		2.8	0.094	27	58	89

Tp = 4.0	DA = 1.7	Qp / (DA)^5 = $\frac{454.4}{7.2}$	= 205.7	20	44	68	10
Tp = 4.0	DA = 5.6	Qp " = $\frac{454.4}{5}$	= 677.6	18	40	61	15
Tp = 5.0	DA = 2.8	Qp " = $\frac{454.4}{5}$	= 271.0	16	35	54	12
Tp = 5.0	DA = 6.1	Qp " = $\frac{454.4}{5}$	= 590.4	14	30	47	13
Tp = 5.0	DA = 9.4	Qp " = $\frac{454.4}{5}$	= 909.2	12	26	41	17

BY SBH DATE 1-29-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-22 OF

CHKD. BY DATE

INSPECTION OF DAMS - CONN T R E

SUBJECT HARRIS POND DAM - HYDROLOGY

PROJECT

CURVILINEAR UNIT GRAPHS							
T = 1.5		T = 2.0		T = 2.0		T = 2.0	
Q _p = 1000		Q _p = 266.2		Q _p = 266.2		Q _p = 653.4	
TIME HRS	T/T _p	Q	T/T _p	Q/Q _p	Q	T/T _p	Q
0.5	0.33	190	0.25	0.115	31		75
1.0	0.67	720	0.50	0.43	114		281
1.5	1.00	1000	0.75	0.84	224		549
2.0	1.33	810	1.00	1.00	266		653
2.5	1.67	510	1.25	0.88	234		575
3.0	2.00	320	1.50	0.66	176		431
3.5	2.33	200	1.75	0.45	120		294
4.0	2.67	115	2.00	0.32	85		209
4.5	3.00	75	2.25	0.225	60		147
5.0	3.33	45	2.50	0.153	41		100
5.5	3.67	30	2.75	0.104	28		68
6.0	4.00	18	3.00	0.075	20		49
6.5	4.33	11	3.25	0.052	14		34
7.0	4.67	5	3.50	0.035	9		23
7.5	5.00	2	3.75	0.025	7		16
8.0	5.33		4.00	0.018	5		12
8.5	5.67		4.25	0.013	3		8
9.0	6.00		4.50	0.009	2		6
9.5	6.33		4.75	0.005	1		3
10.0	6.67		5.00	0.002			1
10.5	7.00		5.25				
11.0	7.33		5.50				
11.5	7.67		5.75				
12.0	8.00		6.00				

$$T_p = 1.5 \text{ A} = 3.107 \text{ mi } Q_p / \text{inch} = \frac{4844 \text{ A}}{T_p} = 1000$$

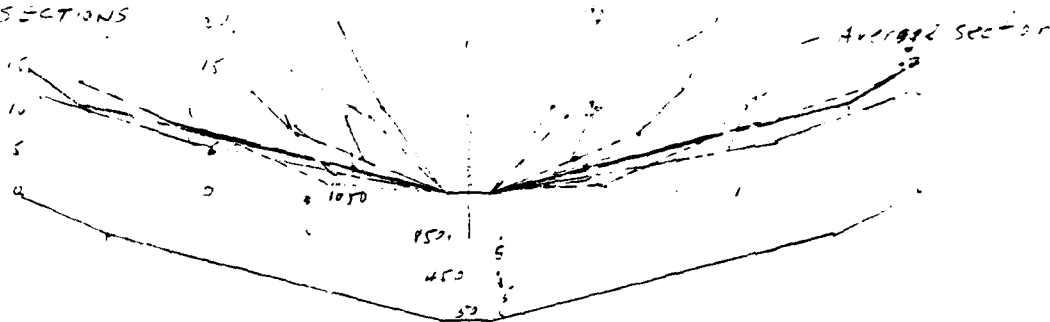
$$T_p = 2.0 \text{ A} = 1.149 \text{ mi } Q_p / \text{inch} = 266.2$$

$$T_p = 2.0 \text{ A} = 2.749 \text{ mi } Q_p / \text{inch} = 653.4$$

Above Pt. (1)

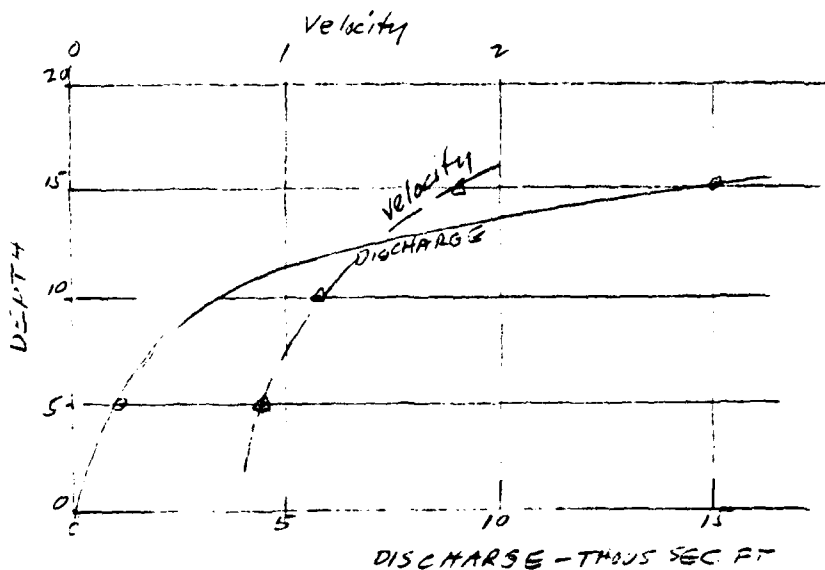
BY DLK DATE 11/20/78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-23 OF ...
 CHKD. BY ... DATE ... INSPECTION OF DAMS - CONT. R.I. PROJECT ...
 SUBJECT MILL RIVER - LAG TIME FOR CHANNEL UPSTREAM FROM HARRIS POND
MILL RIVER UPSTREAM FROM HARRIS POND

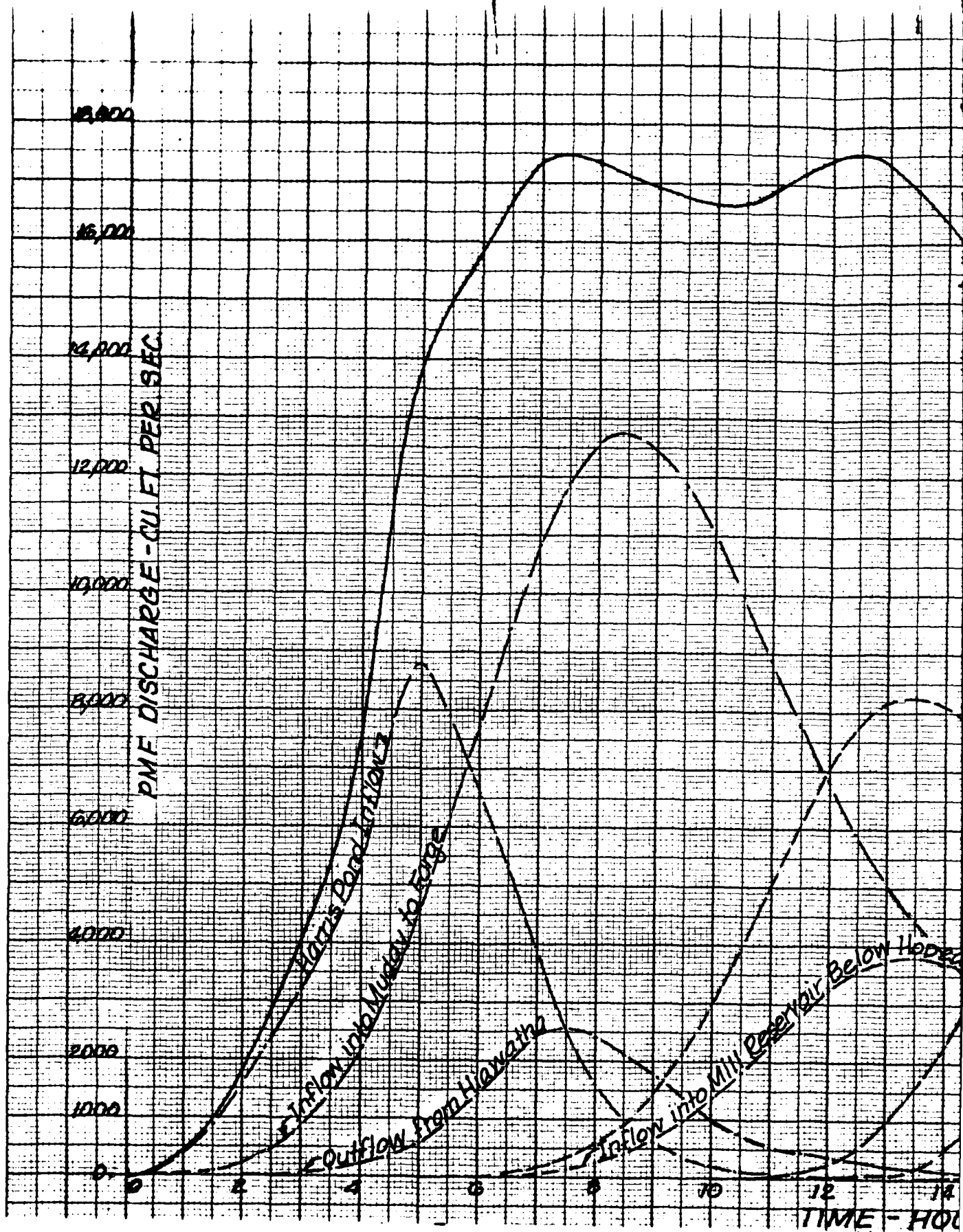
AT RIVER BETWEEN ST 150 AND 170 L = 20800 S = 0.00096 $\frac{1}{4} V = 2.03$
 SECTIONS 21.



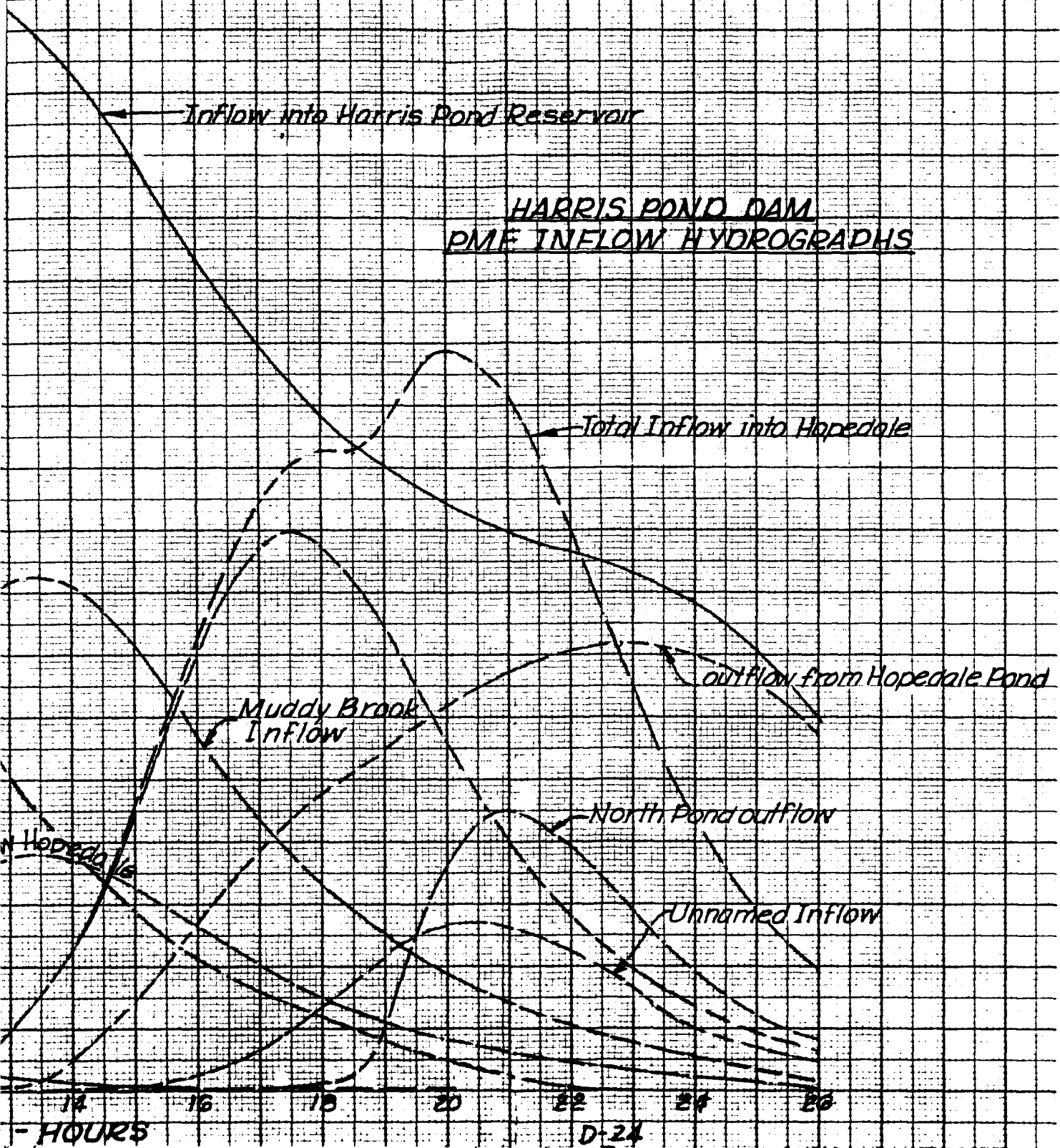
Average S = 0.00096 $S = 0.031 \eta = 0.10 \quad V = \frac{1.485}{7.4} R^{2/3} S^{1/2}$

Dist	Δ Area	Σ Area	Wp	r	$r^{\frac{3}{2}}$	v	$\frac{Q}{CS}$
0	0	0					
5	1250	1250	450.1	2.78	1.94	0.91	1138
10	2250	3500	850.2	4.12	2.57	1.18	2602
15	4750	8250	1050.5	7.85	3.95	1.82	15017





2



ELEV. M.S.L.

FIG. 6 SHT D-25

167 168 169 170 171 172 173 174

18,000 1800

16,000 1600

14,000 1400

12,000 1200

10,000 1000

8,000 800

6,000 600

4,000 400

2,000 200

0 0

PMF DISCHARGE CFS

Inflow Time Hyetograph for Harris Pond

outflow time

HARRIS POND DAM PMF ROUTING
THRU RESERVOIR AND OVER
DIKE

$Q = 17200 @ ELEV. 175.9$

Surcharge Storage Elev.

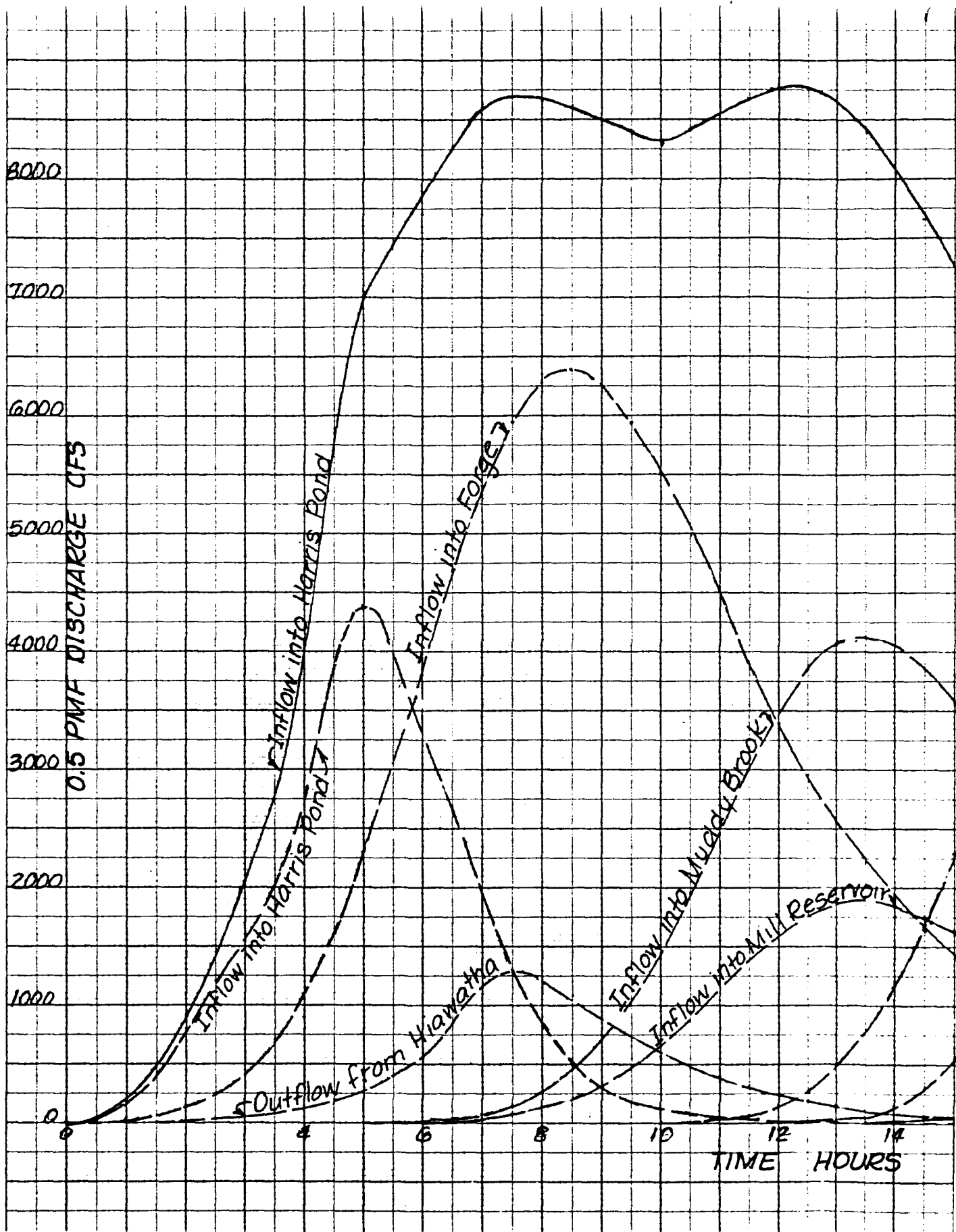
Discharge Elev.

STORAGE

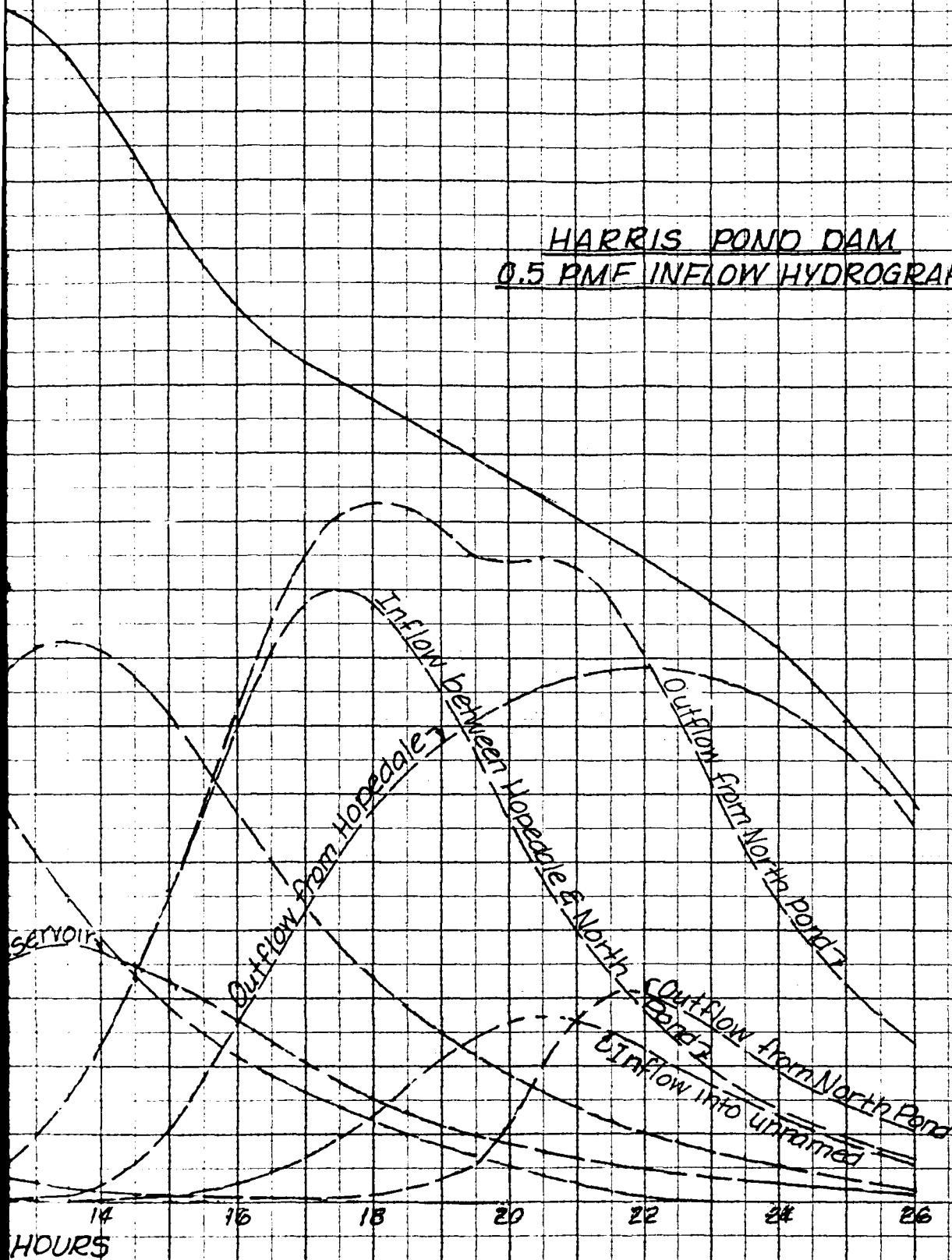
SURCHARGE

TIME HOURS D-25

0 2 4 6 8 10 12 14



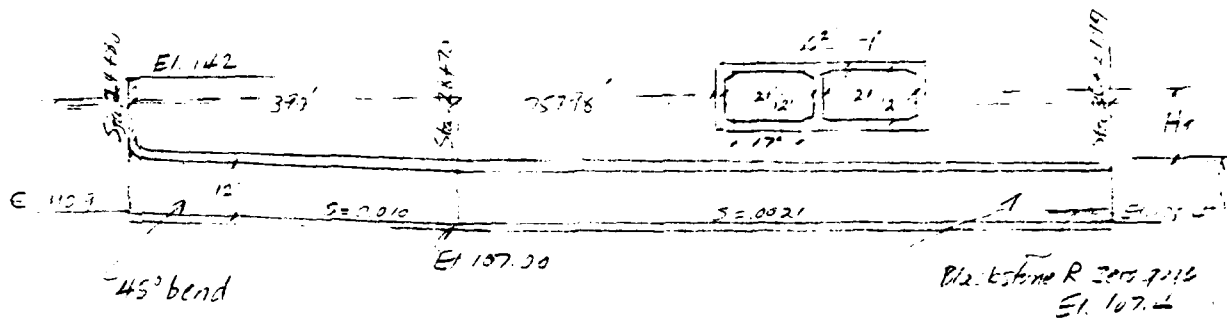
HARRIS POND DAM
0.5 PMF INFLOW HYDROGRAPH



BY 222 DATE 1-29-78
 CHKD. BY DATE
 SUBJECT HARRIS POND DAM - MILL RIVER COLLEGE

LOUIS BERGER & ASSOCIATES INC.
 INSPECTION OF DAMS - CONDUIT R.I.E.

SHEET NO. D-27 OF PROJECT
HARRIS POND



For flow in downstream leg of conduit
 $S = 0.0021$ $S_{1/2} = 0.0458$ $n = 0.014$

-45° Bend.
 Blackstone R. Sta. 7213
 El. 107.4

Q	Area	W.P.	F	1/2	S	Q	25th Percentile
10	175	18	2147	1.85	1.17	447	170
5	94	130	2707	3.50	2.30	1119	2305
100	115	208.0	3707	5.27	3.03	1479	3164
100	21	2290	4107	5.52	3.17	15.20	3480
100	14	2080	4542	5.39	3.18	14.97	3712
100	11	2080	6284	3.16	2.47		

Pressure conduit flow Entrance loss 0.1 hr, 45° Bend L = 0.05 hr
 $L = 1148$ $n = 0.014$ $H_p = SL = L \frac{V^2}{2g} = 12$ $H_t = 1.2 H_p + SL$

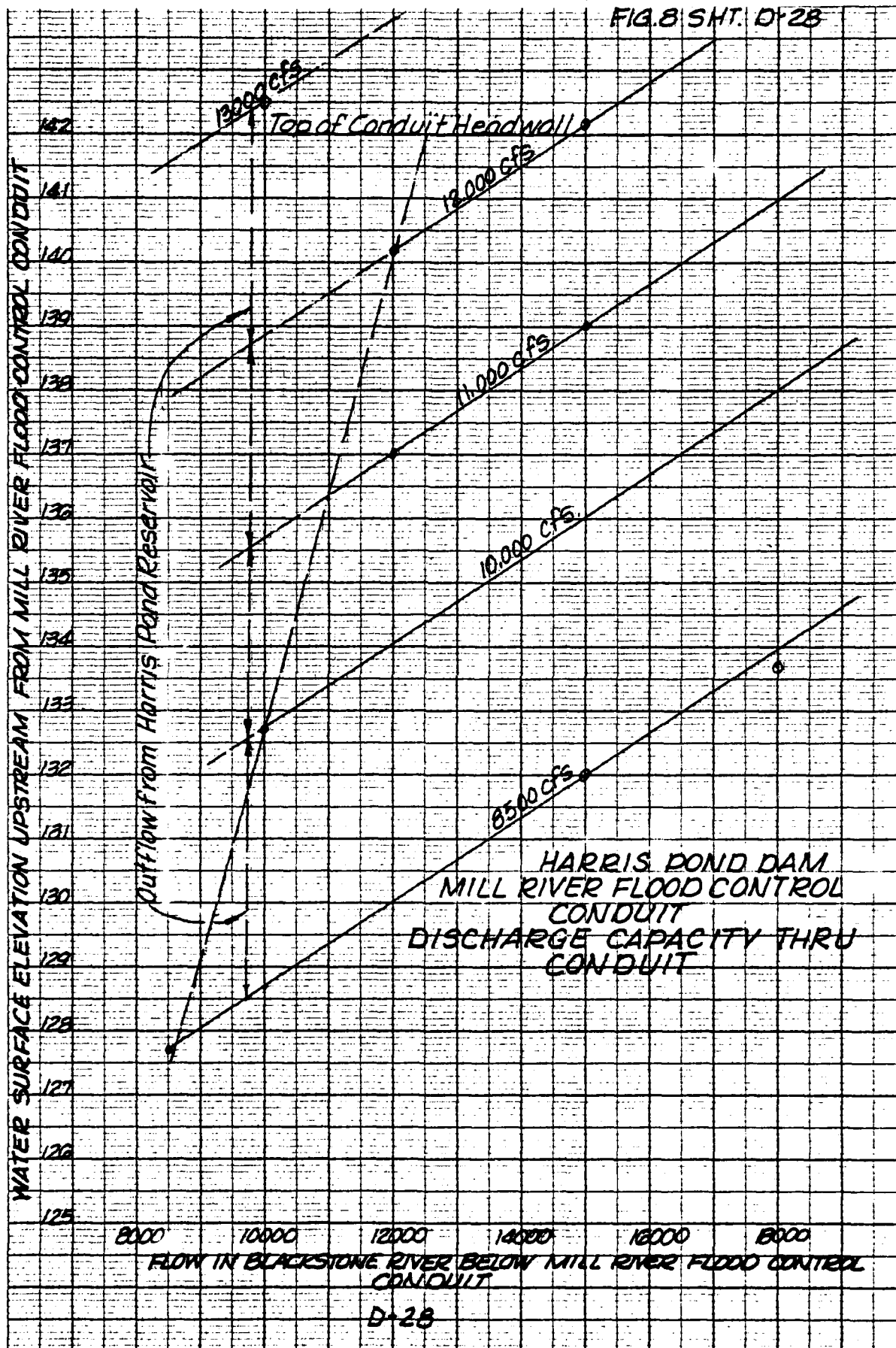
Total R	Area	A	V	h	1/2 h	R ^{2/3}	S	SL	H
550	4250	248	17.10	4.56	5.5	2.40	10042	4.8	17.3
1100	5000	24	20.15	1.31	7.6	2.40	10053	6.7	14.3
12000	6000	24	24.9	7.1	13.9	2.40	10034	9.6	21.5
13000	6500	24	26.21	12.67	12.8	2.40	10098	11.3	24
11000	5500	248	22.18	7.64	9.2	2.49	10070	8.1	17.3

Blackstone River Stage - Discharge below Mill River Culvert. AED Jan 25, 78
 Zero gage - El. 119.4

Sum Blackstone	Stage	El.
8500	12.0	117.4
10000	11.0	118.4
12000	12.3	119.7
15000	14.3	121.7
18000	16.0	123.0
21000	17.6	125.0
24000	19.9	126.3

KEUFFEL & ESSER CO.
MADE IN U.S.A.

STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH



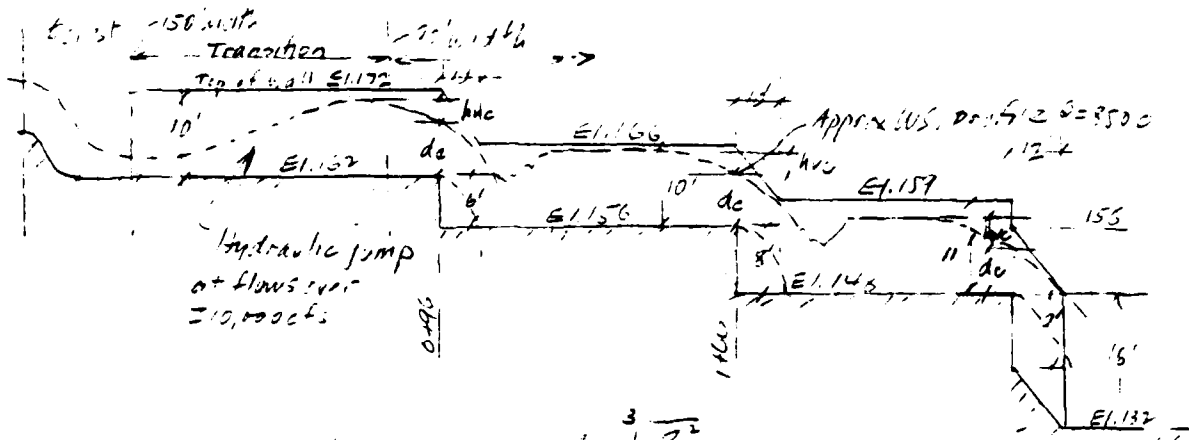
BY DATE 2-9-77
 CHKD. BY DATE
 SUBJECT HARRIS POND DAM SPILLWAY - HYDRAULICS

LOUIS BERGER & ASSOCIATES INC.

INSPECTION OF DAMS - CONTINUED

SHEET NO. D-29 OF

PROJECT



For 90' width - critical flow

$$d_c = \sqrt[3]{\frac{Q^2}{g \cdot b}}$$

Q	90' width	d_c	avg	$d_c + h_{sc}$	Remarks
8500	94.4	6.50	3.25	9.75	Water surface below wall - section or air entrainment.
9000	103.0	6.75	3.38	10.13	Overtops walls 2.3' (Not including air waves)
10,000	111.1	7.25	3.63	10.88	" " 0.38 "
11,000	122.2	7.72	3.86	11.58	" " 1.58 "
12,000	133.3	8.19	4.10	12.29	" " 2.20 "
14,400	160.0	9.24	4.62	13.86	" " 3.86 "
17800	191.1	10.40	5.20	15.60	" " 5.60 "

not considering wave section or air entrainment.

BY LJT DATE 2-13-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-30 OF

CHKD. BY _____ DATE _____ INSPECTION OF DAMS CONN. & R.I.

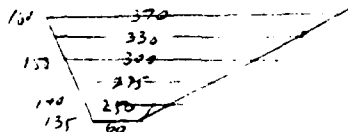
PROJECT _____

SUBJECT HARRIS POND DAM - RIVER CHANNEL BELOW DAM - HYDRAULICS

WATERWAY BELOW PRIVILEGE BRIDGE -

BRIDGE AND ABUTMENT FILL WASHED AWAY

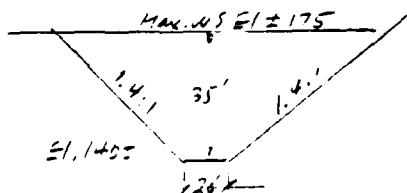
SECTION 550' DOWNSTREAM FROM BRIDGE (No backwater influence from Flood control conduit downstr.)



Critical flow $\frac{A^3}{T} = \frac{Q^2}{g}$

W.L. Elev.	A	ΣA	T	Qc	Vc	hvc	Backwater El. up ft.
140	775	775	250	7743	9.99	1.55	141.5
145	1312	2087	275	32624	15.63	3.79	148.8
150	1438	3525	300	68565	19.45	5.87	155.9

BREACH FAILURE OF DAM.



Q thru 20' L = $168 \times 20 \times 35^{3/4} = 6457 \text{ cfs}$
 Q thru 126' = $\frac{175 \times 5}{24} = 36.46 \text{ cfs}$

BY SJT DATE 2-13-79
LOUIS BERGER & ASSOCIATES INC.

SHEET NO. D-31 OF

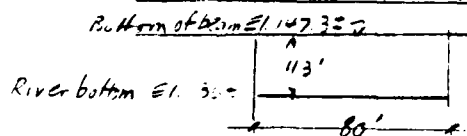
CHKD. BY _____ DATE _____

INSPECTION OF DAMS - CONN. T.R.E.

PROJECT _____

SUBJECT HARRIS POND DAM - RIVER CHANNEL BELOW DAM - HYDRAULICS

PRIVILEGE BRIDGE - FLOW THRU WATERWAY

Bridge deck $\text{El. } 153.95$


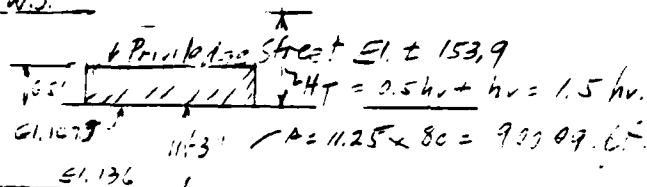
$$V_c = 1.7 V_{ac}$$

CRITICAL FLOWS

d_c	A_c	V_c	Q_c	d_{thr}	El. of Backwater upstr. from bridge
5	400	12.67	5070	7.5	143.5
7	560	15.01	8406	10.5	146.5
9	720	17.22	12254	13.5	149.5
11	880	19.52	16562	16.5	152.5

CONDUIT FLOWS UNDER BRIDGE (No overtopping flows)

upstr. W.S.

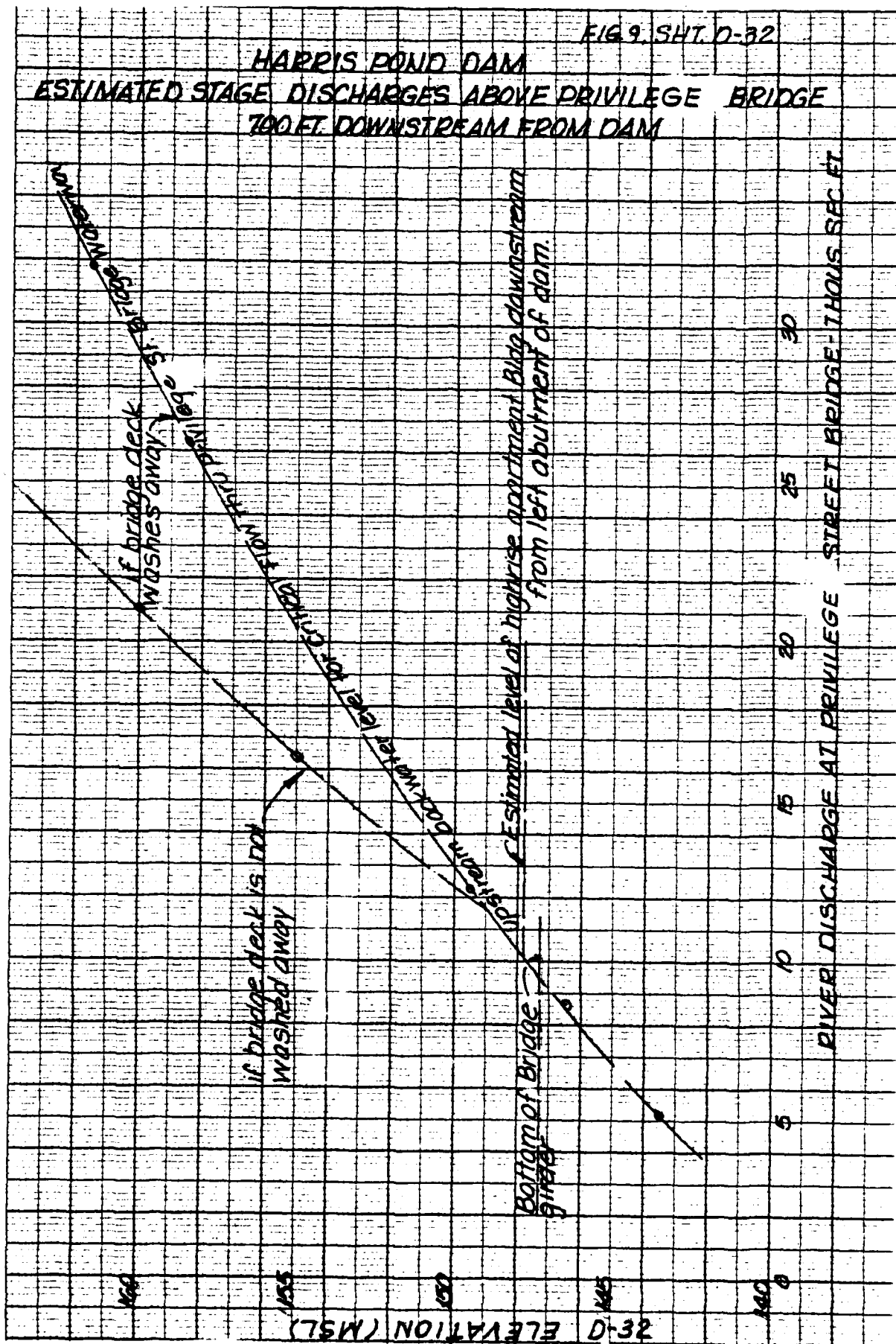


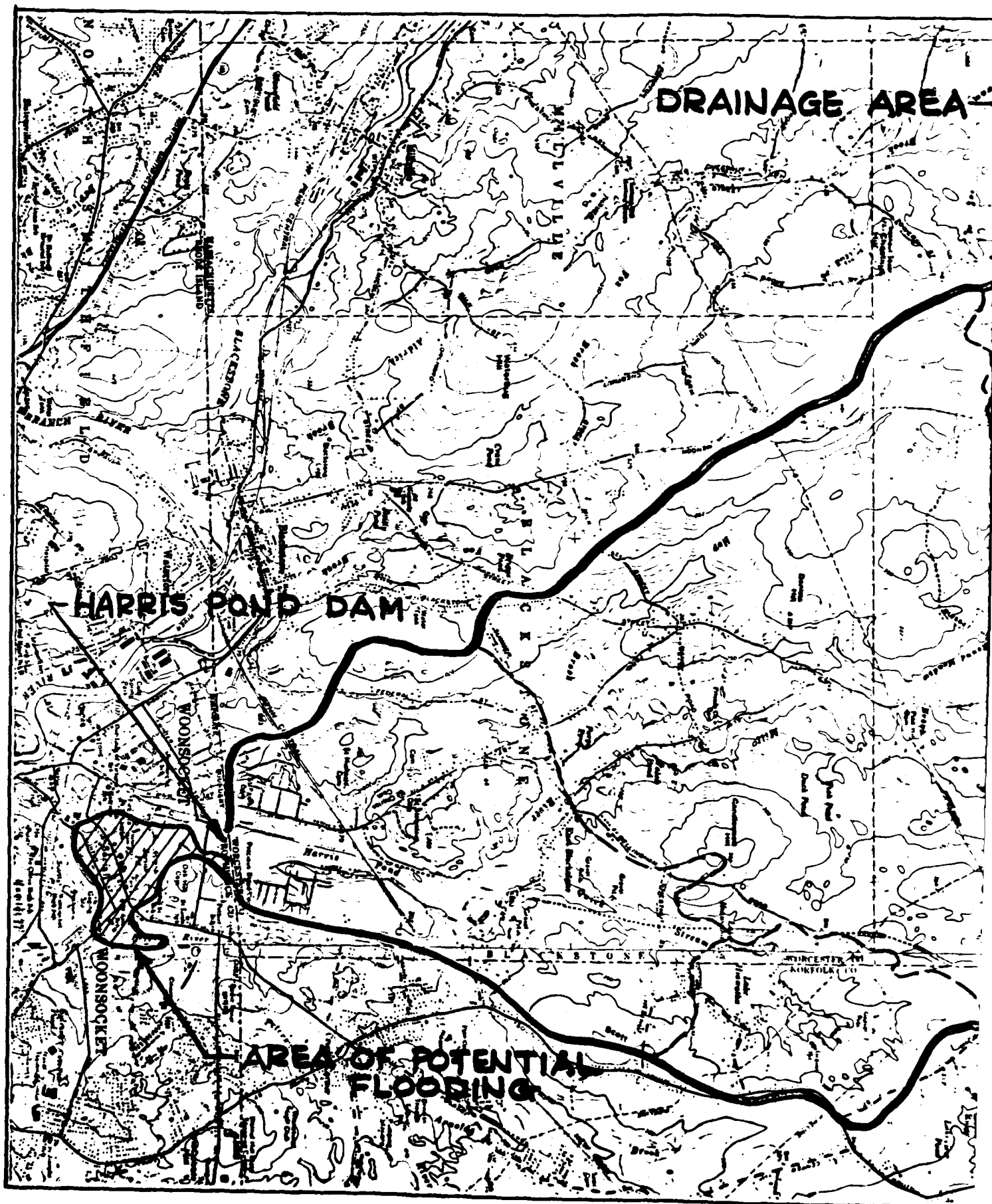
upstr. W.S.	h_r	h_v	V	Q
155	7.7	5.13	18.2	16334
160	12.7	8.47	23.36	21020
165	17.7	11.80	27.57	24800
170	22.7	15.13	31.72	28177

CRITICAL FLOWS THRU 80' WATERWAY IF BRIDGE DECK WASHES AWAY

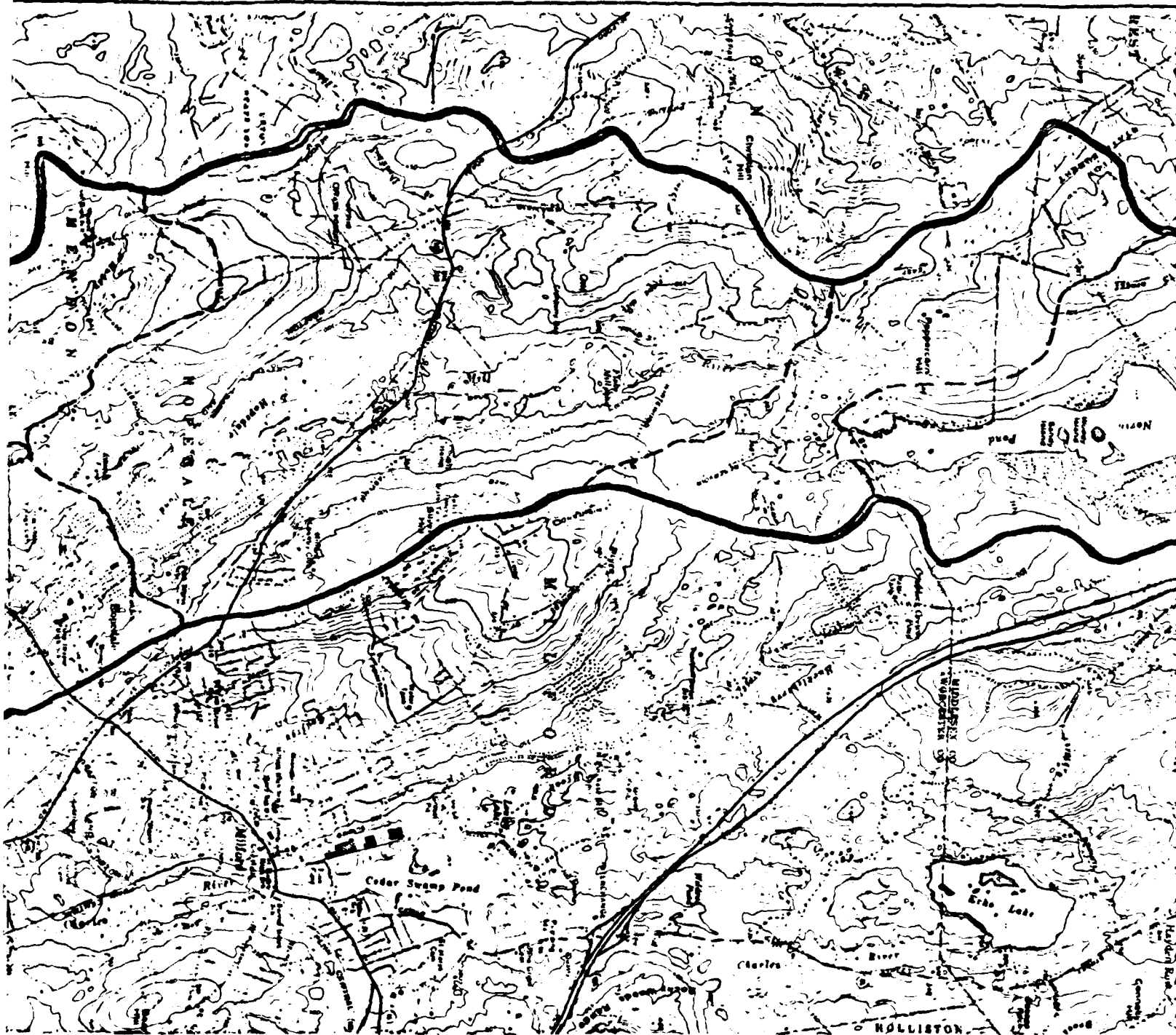
Q_c	A_c	V_c	Q_c	d_{thr}	El. of Backwater upstr. from bridge
13	1040	20.46	21278	19.5	155.5
15	1200	21.72	26.375	22.5	158.5
17	1360	23.40	31524	25.5	161.5
19	1520	24.73	37570	28.5	164.5
21	1680	26.00	43556	31.5	167.5

K&E STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH

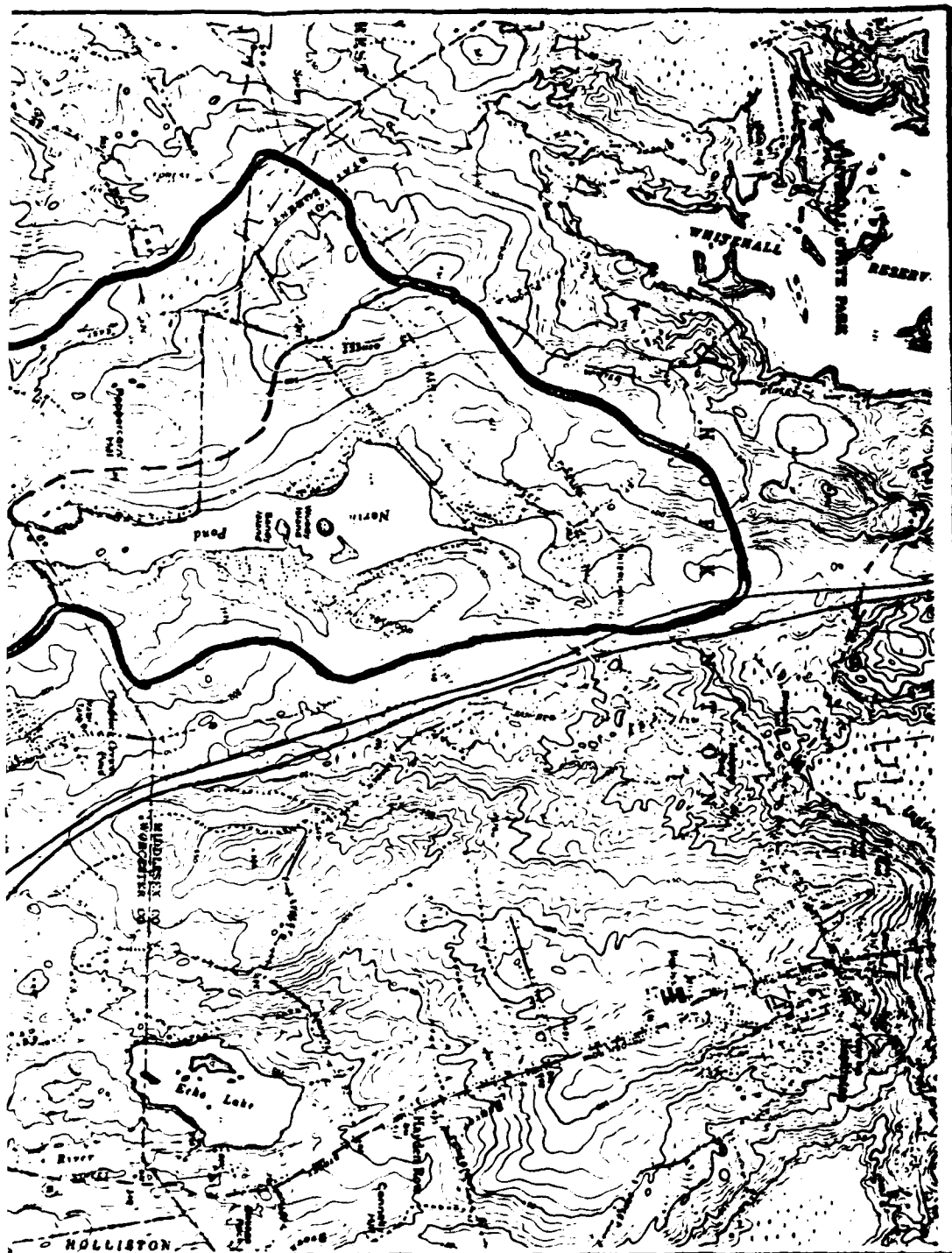




[illegible]



LOUIS BER
WELLE
ARCHITEC
NATIONAL



LOUIS BERGER & ASSOC., INC. WELLESLEY, MASS. ARCHITECT	US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
HARRIS POND DAM	
DRAINAGE AREA AND AREA OF POTENTIAL FLOODING	
STATE - RI	
SCALE	
DATE	

FIG. 10. - SHEET D-33

AREA 1
JAN 79

JOE SPECIFICATION
 NC NHR NNIN IDAY IHR IMIN MEIRC IPLT IPRT NSTAN
 150 0 50 0 0 0 200 0 0
 JOFPR NWT
 2 0

FULL PMF

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAG	ICOMP	IECCN	ITAPE	JPLT	JPRI	INAME
1	0	0	0	0	0	1

IMYUG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	2.70	0.0	2.70	0.0	0.0	0	0	0

D-33A

PRECIP DATA		LOSS DATA	
LP	STORM	DAJ	CAK
40	0.0	0.0	0.0
PRECIP PATTERN		1.34	1.70
0.40	0.40	0.89	1.07
0.98	0.80		

1.16

1.16

4.94

1.70

1.34

1.16

1.07

0.89

0.80

STKKA	DLTKR	RTIOL	EKATP	STKKS	RTIOK	SIRIL	CASTL	ALSMX	KTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
549.0	575.0	575.0	431.0	254.0	209.0	147.0	100.0	75.0	281.0
34.0	23.0	16.0	12.0	8.0	6.0	3.0	1.0	68.0	49.0

UNIT GRAPH TOTALS 3534. CFS OR 1.01 INCHES OVER THE AREA

H.P. 1.

COMPQ.

TIME	RAIN	EXCS.	COMPQ.
1	0.40	0.40	0.
2	0.40	0.40	0.
3	0.89	0.89	0.
4	1.07	1.07	0.
5	1.16	1.16	0.
6	1.34	1.34	0.
7	1.70	1.70	0.
8	4.94	4.94	0.
9	1.16	1.16	0.
10	1.16	1.16	0.
11	0.98	0.98	0.
12	0.80	0.80	0.
13	0.0	0.0	0.
14	0.0	0.0	0.
15	0.0	0.0	0.
16	0.0	0.0	0.
17	0.0	0.0	0.
18	0.0	0.0	0.
19	0.0	0.0	0.
20	0.0	0.0	0.
21	0.0	0.0	0.
22	0.0	0.0	0.
23	0.0	0.0	0.
24	0.0	0.0	0.
25	0.0	0.0	0.
26	0.0	0.0	0.
27	0.0	0.0	0.
28	0.0	0.0	0.
29	0.0	0.0	0.
30	0.0	0.0	0.
31	0.0	0.0	0.
32	0.0	0.0	0.
33	0.0	0.0	0.
34	0.0	0.0	0.
35	0.0	0.0	0.
36	0.0	0.0	0.
37	0.0	0.0	0.
38	0.0	0.0	0.

TIME	RAIN	EXCS	COMPQ
39	0.0	0.0	6580.
40	0.0	0.0	6232.
41	0.0	0.0	5468.
42	0.0	0.0	4505.
43	0.0	0.0	3520.
44	0.0	0.0	2578.
45	0.0	0.0	1807.
46	0.0	0.0	1251.
47	0.0	0.0	879.
48	0.0	0.0	809.
49	0.0	0.0	419.
50	0.0	0.0	290.
51	0.0	0.0	203.
52	0.0	0.0	137.
53	0.0	0.0	93.
54	0.0	0.0	57.
55	0.0	0.0	33.
56	0.0	0.0	17.
57	0.0	0.0	9.
58	0.0	0.0	3.
59	0.0	0.0	1.

SUM 16.00 16.00 56541.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
6580.	4149.	1178.	393.	56544.	
CFS	14.50	16.23	16.23	16.23	
INCHES	2059.	2338.	2338.	2338.	
AC-FT					

HP.2.

HP. 2.

HP3.

HYDROGRAPH ROUTING

ROUTING

ISTAG	ICOMP	IECON	ITAPE	JFLT	JPKT	INAME			
11	1	0	0	0	0	1			
		ROUTING DATA							
	GLUSS	CLOSS	AVG	IRIS	ISAME				
	0.0	0.0	0.0	1	0				
NTFS	NSTCL	LAG	ANSKK	X	TSK	STORA			
1	0	0	0.0	0.0	0.0	0.			
	248.	380.	530.	680.	846.	1010.	1198.	1588.	
	101.	186.	287.	896.	1977.	3329.	4913.	8669.	
STORAGE									
OUTPUT									

D-35

HP3.

HP4.

TIME	EOP STOR	AVG IN	EOP OUT	TIME	EOP STOR	AVG IN	EOP OUT
	0.	0.	0.	45	392.	0.	194.
				46	384.	0.	189.
1	1.	15.	0.	47	376.	0.	184.
2	4.	86.	1.	48	369.	0.	179.
3	15.	271.	4.	49	361.	0.	174.
4	40.	605.	11.	50	354.	0.	169.
5	84.	1089.	23.	51	347.	0.	165.
6	152.	1682.	50.	52	341.	0.	161.
7	245.	2313.	99.	53	334.	0.	156.
8	367.	3091.	178.	54	328.	0.	152.
9	530.	4179.	287.	55	322.	0.	148.
10	725.	5460.	1190.	56	316.	0.	144.
11	911.	6342.	2511.	57	310.	0.	141.
12	1048.	6406.	3651.	58	304.	0.	137.
13	1126.	5850.	4303.	59	298.	0.	133.
14	1150.	4987.	4506.	60	293.	0.	130.
15	1132.	4013.	4350.	61	288.	0.	126.
16	1086.	3043.	3971.	62	282.	0.	123.
17	1024.	2193.	3444.	63	277.	0.	120.
18	956.	1529.	2834.	64	272.	0.	117.
19	892.	1065.	2355.	65	268.	0.	114.
20	835.	744.	1903.	66	263.	0.	111.
21	784.	514.	1573.	67	259.	0.	108.
22	740.	354.	1284.	68	254.	0.	105.
23	702.	246.	1038.	69	250.	0.	102.
24	670.	170.	854.	70	246.	0.	100.
25	642.	115.	740.	71	242.	0.	98.
26	616.	75.	637.	72	238.	0.	96.
27	594.	45.	545.	73	234.	0.	93.
28	574.	25.	465.	74	230.	0.	91.
29	557.	13.	395.	75	226.	0.	89.
30	542.	6.	335.	76	223.	0.	87.
31	529.	2.	286.	77	219.	0.	86.
32	517.	0.	278.	78	215.	0.	84.
33	506.	0.	271.	79	212.	0.	82.
34	495.	0.	263.	80	209.	0.	80.
35	484.	0.	256.	81	205.	0.	78.
36	474.	0.	249.	82	202.	0.	77.
37	464.	0.	242.	83	199.	0.	75.
38	454.	0.	236.	84	196.	0.	73.
39	444.	0.	229.	85	193.	0.	72.
40	435.	0.	223.	86	190.	0.	70.
41	426.	0.	217.	87	187.	0.	69.
42	417.	0.	211.	88	184.	0.	67.
43	408.	0.	205.	89	182.	0.	66.
44	400.	0.	199.	90	179.	0.	64.
				91	176.	0.	63.
				92	174.	0.	62.
				93	171.	0.	60.
				94	169.	0.	59.

SUM

52488.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4506.	3062.	1013.	355.	52489.
INCHES		10.55	13.97	15.07	15.07
AC-FT		1519.	2011.	2173.	2173.

D-36

D-37

SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH FOR UNNAMED FLOOD

ISTAG ICDP IECUN ITAPE JPLT JPRT INAME
2 0 0 0 0 0 1

HYDROGRAPH DATA

IHYGC IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
6 -1 1.70 0.0 1.70 0.0 0.0 0 0 0

PRECIP DATA

NP STORM DAJ DAK
38 0.0 0.0 0.0

PRECIP PATTERN

0.40 0.40 0.69 1.07
1.16 1.34 1.70 4.94 1.16 1.16 0.98 0.80

LOSS DATA

STKR DLTKR RTIOL FRAIN STRKS RTIOK SRTL CNSTL ALSMX RTIMP
0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 0.0 0.0

GIVEN UNIT GRAPH, NUHGW= 54

0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	6.	24.	86.
132.	170.	195.	206.	199.	181.	159.	136.	94.
70.	66.	56.	46.	38.	32.	26.	22.	15.
13.	11.	7.	7.	7.	32.	26.	22.	19.

UNIT GRAPH TOTALS 2192. CFS OR 1.00 INCHES OVER THE AREA

HPS

RECESSION DATA
 STRTC= 0.0 ORCSN= 0.0 RTIOR= 1.00

HPG

TIME	RAIN	EXCS	COMP G
1	0.0	0.0	0.
2	0.0	0.0	2.
3	0.0	0.0	12.
4	0.0	0.0	35.
5	0.0	0.0	83.
6	0.0	0.0	166.
7	0.0	0.0	290.
8	0.0	0.0	459.
9	0.0	0.0	694.
10	0.0	0.0	1001.
11	0.0	0.0	1354.
12	0.0	0.0	1740.
13	0.0	0.0	2123.
14	0.0	0.0	2437.
15	0.0	0.0	2641.
16	0.0	0.0	2720.
17	0.0	0.0	2660.
18	0.0	0.0	2493.
	0.0	0.0	2259.
19	0.0	0.0	1988.
20	0.0	0.0	1703.
21	0.0	0.0	1447.
22	0.0	0.0	1219.
23	0.0	0.0	1020.
24	0.0	0.0	854.
25	0.0	0.0	711.
26	0.0	0.0	592.
27	0.0	0.0	495.

28	0.0	0.0	410.
29	0.0	0.0	340.
30	0.0	0.0	283.
31	0.0	0.0	228.
32	0.0	0.0	185.
33	0.0	0.0	148.
34	0.0	0.0	114.
35	0.0	0.0	83.
36	0.0	0.0	40.
37	0.0	0.0	26.
38	0.0	0.0	14.
39	0.0	0.0	6.
40	0.0	0.0	0.
41	0.0	0.0	0.

SUM 16.00 16.00 35075.

	PEAK	4-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2720.	2130.	731.	244.	35072.
INCHES		11.66	15.99	15.99	15.99
AC-FT		1057.	1450.	1450.	1450.

D-38

2d11

INFLUENCE OF HOPEDALF PCMI

UJRT	INAME	I
0		1

HYDROGRAPH DATA

INHYC	IUNG	TAREA	SNAP	TRSCA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
6	-1	5.60	0.0	5.60	0.0	0.0	0	0	0

PRECIP DATA

NP	STURM	LAJ	DAK
32	0.0	0.0	0.0

PRECIP PATTERN

	0.89	1.07	1.16	1.34	1.70	4.94	1.16
0.40	0.40	0.89	1.07	1.16	1.34	1.70	1.16
0.98	0.80	0.40	0.89	1.07	1.16	1.34	1.16

LOSS DATA

STRKR	CLTKR	RTIOL	EPAIN	STKKS	RTIOK	STRIL	UNSTL	ALSMX	HTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	0.0	0.0

GIVEN UNIT GRAPH, NUHGQ= 48

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
20.	80.	169.	391.	644.	678.
524.	447.	368.	308.	185.	152.
85.	72.	61.	51.	44.	24.

UNIT GRAPH TOTAL 7225. CFS OR 1.00 INCHES OVER THE AREA

D-40

HP 8

STRIC= 0.0 RECESION DATA
 QRSN= 0.0 RTIO= 1.00

HP 9

END-OF-PERIOD FLOW			
TIME	RAIN	EXCS	COMP
1	0.40	0.40	0.
2	0.40	0.40	0.
3	0.89	0.89	0.
4	1.07	1.07	0.
5	1.16	1.16	0.
6	1.34	1.34	0.
7	1.70	1.70	0.
8	4.94	4.94	0.
9	1.16	1.16	0.
10	1.16	1.16	0.
11	0.98	0.98	0.
12	0.80	0.80	0.
13	0.0	0.0	0.
14	0.0	0.0	0.
15	0.0	0.0	0.
16	0.0	0.0	0.
17	0.0	0.0	0.
18	0.0	0.0	0.
19	0.0	0.0	0.
20	0.0	0.0	0.
21	0.0	0.0	0.
22	0.0	0.0	0.
23	0.0	0.0	117.
24	0.0	0.0	277.
25	0.0	0.0	550.
26	0.0	0.0	558.
27	0.0	0.0	1518.
28	0.0	0.0	2293.
29	0.0	0.0	3308.
30	0.0	0.0	4473.
31	0.0	0.0	5741.
32	0.0	0.0	7000.
33	0.0	0.0	8040.
34	0.0	0.0	8707.
35	0.0	0.0	8958.
36	0.0	0.0	8755.
37	0.0	0.0	8207.
38	0.0	0.0	7433.
39	0.0	0.0	6536.
40	0.0	0.0	5598.
41	0.0	0.0	4752.
42	0.0	0.0	4003.
43	0.0	0.0	3351.
44	0.0	0.0	2803.
45	0.0	0.0	2340.
46	0.0	0.0	1955.
47	0.0	0.0	1628.
48	0.0	0.0	1351.
49	0.0	0.0	1123.
50	0.0	0.0	932.
51	0.0	0.0	761.
52	0.0	0.0	620.
53	0.0	0.0	500.
54	0.0	0.0	388.
55	0.0	0.0	283.
56	0.0	0.0	136.
57	0.0	0.0	69.
58	0.0	0.0	48.

SUM 16.00 16.00 11559.9.

PEAK 8958.

CFS 7017.

INCHES 11.66

AC-FT 5481.

6-HOUR 2408.

24-HOUR 16.00

72-HOUR 16.00

TOTAL VOLUME 115599.

16.00

4779.

D-41

0.	0.
2.	2.
5741.	5741.
5776.	5776.
7109.	7109.
1080.	1080.
262.	262.
194.	194.
148.	148.
114.	114.
89.	89.
72.	72.

COMPNAME	HOPEDALE	WITH	SUM	OF	ABOVE	ITYPE	JPLT	JPRY	INAME
	ISTAG	ICCP	2		IELUN	0	0	0	1

SUM OF 2 HYDROGRAPHS AT 0

[illegible]

019H

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISIAQ 4 ICCMP 0 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA

IHYG 0 IUNG -1 TARFA 2.80 SNAP 0.0 TRSDA 2.80 TKSPC 0.0 RATIO 0.0 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA

NP 22 STORM 0.0 DAK 0.0
 DAJ 0.0
 PRECIP PATTERN

0.40 0.89 1.07 1.16 1.34 1.70 4.94 1.16
 0.98 0.80

LOSS DATA

STRM 0.0 OLIMP 0.0 RTIOL 1.00 ERAIN 0.0 STAKS 0.0 RTIOK 1.00 STRTL 0.0 CNSTL 0.0 ALSMX 0.0 RTIMP 0.0

GIVEN UNIT GRAPH, NUHGE= 44

4. 20. 43. 76. 117. 163. 209. 241. 263. 271. 0.
 266. 249. 203. 179. 152. 133. 114. 100. 87. 20.
 75. 57. 49. 42. 35. 31. 27. 23. 20.
 18. 14. 12.

UNIT GRAPH TOTALS 360.5 CFS OR 1.00 INCHES OVER THE AREA

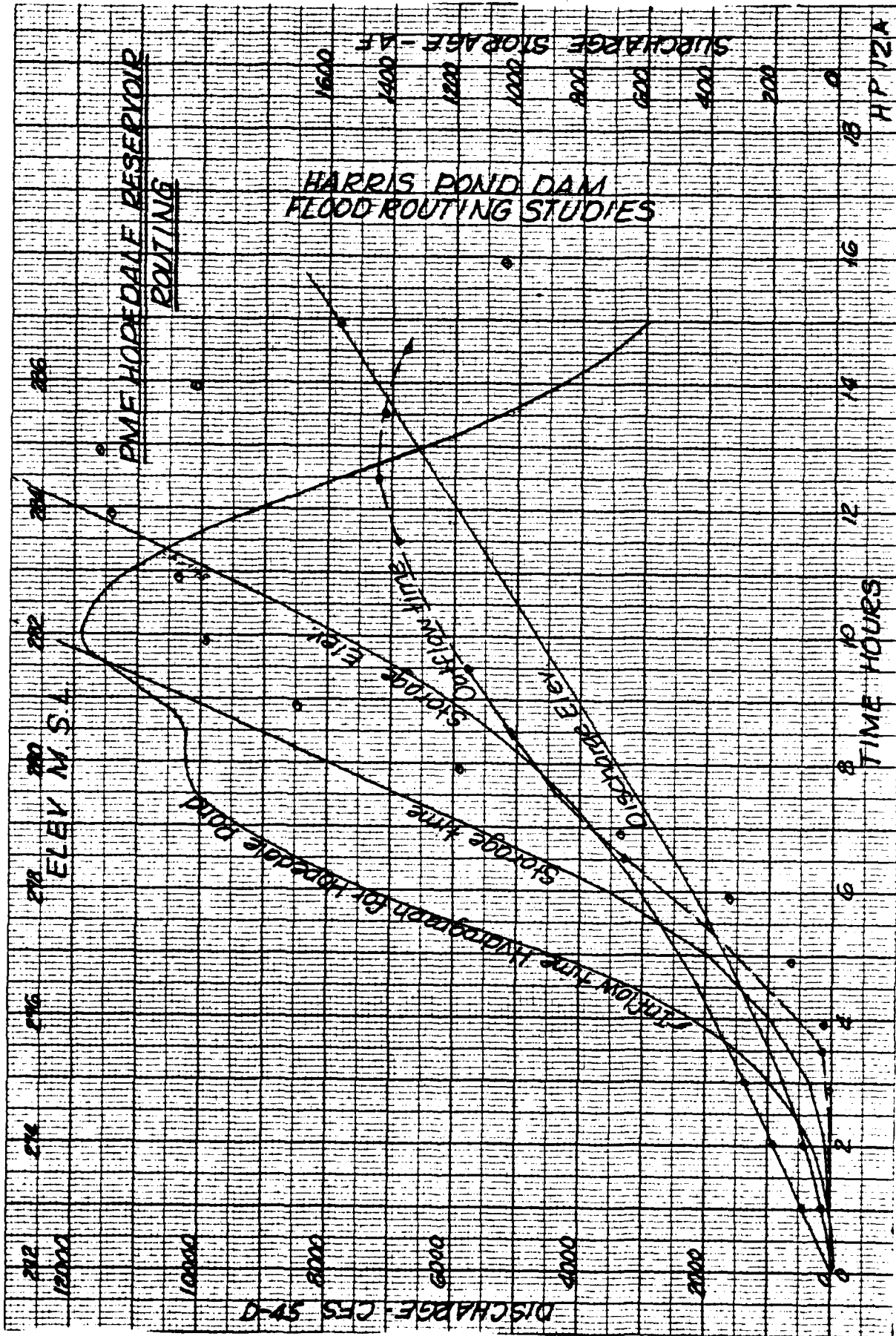
HP 11

| END-OF-PERIOD FLOW | | | |
|--------------------|------|------|--------|
| TIME | RAIN | EXCS | COMP W |
| 1 | 0.40 | 0.40 | 0. |
| 2 | 0.40 | 0.40 | 0. |
| 3 | 0.89 | 0.89 | 0. |
| 4 | 1.07 | 1.07 | 0. |
| 5 | 1.16 | 1.16 | 0. |
| 6 | 1.34 | 1.34 | 0. |
| 7 | 1.70 | 1.70 | 0. |
| 8 | 4.94 | 4.94 | 0. |
| 9 | 1.16 | 1.16 | 0. |
| 10 | 1.16 | 1.16 | 0. |
| 11 | 0.98 | 0.98 | 2. |
| 12 | 0.80 | 0.80 | 10. |
| 13 | 0.0 | 0.0 | 29. |
| 14 | 0.0 | 0.0 | 70. |
| 15 | 0.0 | 0.0 | 142. |
| 16 | 0.0 | 0.0 | 254. |
| 17 | 0.0 | 0.0 | 418. |
| 18 | 0.0 | 0.0 | 650. |
| 19 | 0.0 | 0.0 | 976. |
| 20 | 0.0 | 0.0 | 1367. |
| 21 | 0.0 | 0.0 | 1819. |
| 22 | 0.0 | 0.0 | 2304. |
| 23 | 0.0 | 0.0 | 2788. |
| 24 | 0.0 | 0.0 | 3221. |
| 25 | 0.0 | 0.0 | 3638. |
| 26 | 0.0 | 0.0 | 3738. |
| 27 | 0.0 | 0.0 | 3799. |
| 28 | 0.0 | 0.0 | 3727. |
| 29 | 0.0 | 0.0 | 3537. |
| 30 | 0.0 | 0.0 | 3280. |
| 31 | 0.0 | 0.0 | 2972. |
| 32 | 0.0 | 0.0 | 2651. |
| 33 | 0.0 | 0.0 | 2321. |
| 34 | 0.0 | 0.0 | 2033. |
| 35 | 0.0 | 0.0 | 1763. |
| 36 | 0.0 | 0.0 | 1533. |
| 37 | 0.0 | 0.0 | 1329. |
| 38 | 0.0 | 0.0 | 1153. |
| 39 | 0.0 | 0.0 | 996. |
| 40 | 0.0 | 0.0 | 865. |
| 41 | 0.0 | 0.0 | 746. |
| 42 | 0.0 | 0.0 | 643. |
| 43 | 0.0 | 0.0 | 551. |
| 44 | 0.0 | 0.0 | 480. |
| 45 | 0.0 | 0.0 | 411. |
| 46 | 0.0 | 0.0 | 351. |
| 47 | 0.0 | 0.0 | 296. |
| 48 | 0.0 | 0.0 | 250. |
| 49 | 0.0 | 0.0 | 207. |
| 50 | 0.0 | 0.0 | 167. |
| 51 | 0.0 | 0.0 | 128. |
| 52 | 0.0 | 0.0 | 60. |
| 53 | 0.0 | 0.0 | 40. |
| 54 | 0.0 | 0.0 | 23. |
| 55 | 0.0 | 0.0 | 10. |

| | | | |
|--------|-------|--------------|--------|
| SUM | 16.00 | 16.00 | 57648. |
| PEAK | 3799. | | |
| 6-HOUR | 3156. | 24-HOUR | 1201. |
| | 10.49 | | 15.96 |
| | 1566. | | 2383. |
| | | 72-HOUR | 400. |
| | | | 15.96 |
| | | | 2383. |
| | | TOTAL VOLUME | 57648. |
| | | | 15.96 |
| | | | 2383. |

CFS
INCHES
AC-FT

HP 12



SUB-AREA RUKOFF COMPUTATION

HYDROGRAPH FOR MUDDY RIVER

ISTAQ 5 IECON 0 IIAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA

IHYDG 0 IUNG -1 TAREA 6.10 TRSDA 6.10 TRSPC 0.0 RATIO 0.0 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA

NP 22 STORM 0.0 DAJ 0.0 DAK 0.0
PRECIP PATTERN

0.40 0.48 0.89 1.07 1.16 1.34 1.70 4.94 1.16 1.16

LOSS DATA

STSKR 0.0 PLTKF 0.0 RTIOL 1.00 BRAIN 0.0 STRKS 0.0 RTIOK 1.00 STRTL 0.0 CNSIL 0.0 ALSMX 0.0 RTIMP 0.0

GIVEN UNIT GRAPH, NUHQD= 44

0. 44. 579. 165. 40.
0. 9. 54. 142. 35.
0. 44. 579. 165. 40.
0. 9. 54. 142. 35.
0. 44. 579. 165. 40.

UNIT GRAPH TOTALS 7847. CFS OR 1.00 INCHES OVER THE AREA

HP 13.

HP-14

RECESSION DATA
 START= 0.0 GRCSN= 0.0 RTIO= 1.00

| END-OF-PERIOD FLOW | | | |
|--------------------|------|------|-------|
| TIME | RAIN | EXCS | COMP |
| 1 | | | |
| 2 | 0.98 | 0.98 | 4. |
| 3 | 0.80 | 0.80 | 21. |
| 4 | 0.0 | 0.0 | 63. |
| 5 | 0.0 | 0.0 | 152. |
| 6 | 0.0 | 0.0 | 309. |
| 7 | 0.0 | 0.0 | 554. |
| 8 | 0.0 | 0.0 | 911. |
| 9 | 0.0 | 0.0 | 1413. |
| 10 | 0.0 | 0.0 | 2127. |
| 11 | 0.0 | 0.0 | 2978. |
| 12 | 0.0 | 0.0 | 3958. |
| 13 | 0.0 | 0.0 | 5014. |
| 14 | 0.0 | 0.0 | 6067. |
| 15 | 0.0 | 0.0 | 7015. |
| 16 | 0.0 | 0.0 | 7710. |
| 17 | 0.0 | 0.0 | 8141. |
| 18 | 0.0 | 0.0 | 8275. |
| 19 | 0.0 | 0.0 | 8117. |
| 20 | 0.0 | 0.0 | 7708. |
| 21 | 0.0 | 0.0 | 7141. |
| 22 | 0.0 | 0.0 | 6476. |
| 23 | 0.0 | 0.0 | 5773. |
| 24 | 0.0 | 0.0 | 5054. |
| 25 | 0.0 | 0.0 | 4423. |
| 26 | 0.0 | 0.0 | 3838. |
| 27 | 0.0 | 0.0 | 3338. |
| 28 | 0.0 | 0.0 | 2890. |
| 29 | 0.0 | 0.0 | 2509. |
| 30 | 0.0 | 0.0 | 2169. |
| 31 | 0.0 | 0.0 | 1882. |
| 32 | 0.0 | 0.0 | 1623. |
| 33 | 0.0 | 0.0 | 1404. |
| 34 | 0.0 | 0.0 | 1205. |
| 35 | 0.0 | 0.0 | 1044. |
| 36 | 0.0 | 0.0 | 895. |
| 37 | 0.0 | 0.0 | 770. |
| 38 | 0.0 | 0.0 | 649. |
| 39 | 0.0 | 0.0 | 548. |
| 40 | 0.0 | 0.0 | 453. |
| 41 | 0.0 | 0.0 | 363. |
| 42 | 0.0 | 0.0 | 278. |
| 43 | 0.0 | 0.0 | 131. |
| 44 | 0.0 | 0.0 | 88. |
| 45 | 0.0 | 0.0 | 49. |
| 46 | 0.0 | 0.0 | 21. |

SUM 16.00 16.00 125553.

| | | | | | |
|--------|-------|---------|-------|--------------|---------|
| PEAK | 8275. | 72-HOUR | 872. | TOTAL VOLUME | 125551. |
| | | 24-HOUR | 2616. | | 15.96 |
| | | 6-HOUR | 6874. | | 5191. |
| | | | 10.48 | | |
| | | | 3410. | | |
| CFS | | | | | |
| INCHES | | | | | |
| AC-FT | | | | | |

D-47

SUB-AREA RUNOFF COMPUTATION

INFLOW TO FORGE POND

ISTAQ 6 ICOMP 0 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA

IHYDG 0 IUHG -1 TAREA 9.40 SNAP 0.0 TRSCA 9.40 TRSPC 0.0 KATIO 0.0 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA

AP 12 STORM 0.0 DAJ 0.0 LAK 0.0

PRECIP PATTERN

0.40 0.80 0.69 1.07 1.16 1.34 1.70 4.94 1.16 1.16

LOSS DATA

STKRS 0.0 STIRK 0.0 RTIOL 1.00 RTIOL 1.00 STIRL 0.0 CNSIL 0.0 ALSMX 0.0 RTIMP 0.0

GIVEN UNIT GRAPH, NUHGG= 34

14. 68. 146. 255. 391. 546. 701. 810. 883. 910.
892. 764. 601. 510. 446. 382. 337. 291.
255. 191. 141. 118. 104. 89. 79. 68.
61. 47. 40.

UNIT GRAPH TOTALS 12095. CFS OR 1.00 INCHES OVER THE AREA

HP15

RECESSION DATA

STPTG= 0.0 QRCN= 0.0 RTIOR= 1.00

| END-OF-PERIOD FLOW | | | | | | | |
|--------------------|------|------|--------|----|-----|-----|-------|
| TIME | RAIN | EXCS | COMP Q | | | | |
| 1 | 0.40 | 0.40 | 6. | 23 | 0.0 | 0.0 | 7789. |
| 2 | 0.40 | 0.40 | 33. | 24 | 0.0 | 0.0 | 6219. |
| 3 | 0.89 | 0.89 | 98. | 25 | 0.0 | 0.0 | 5915. |
| 4 | 1.07 | 1.07 | 236. | 26 | 0.0 | 0.0 | 5149. |
| 5 | 1.16 | 1.16 | 477. | 27 | 0.0 | 0.0 | 4454. |
| 6 | 1.34 | 1.34 | 856. | 28 | 0.0 | 0.0 | 3669. |
| 7 | 1.70 | 1.70 | 1404. | 29 | 0.0 | 0.0 | 3340. |
| 8 | 4.94 | 4.94 | 2185. | 30 | 0.0 | 0.0 | 2901. |
| 9 | 1.16 | 1.16 | 3281. | 31 | 0.0 | 0.0 | 2503. |
| 10 | 1.16 | 1.16 | 4695. | 32 | 0.0 | 0.0 | 2160. |
| 11 | 0.98 | 0.98 | 6105. | 33 | 0.0 | 0.0 | 1853. |
| 12 | 0.80 | 0.80 | 7728. | 34 | 0.0 | 0.0 | 1612. |
| 13 | 0.0 | 0.0 | 9353. | 35 | 0.0 | 0.0 | 1378. |
| 14 | 0.0 | 0.0 | 10610. | 36 | 0.0 | 0.0 | 1188. |
| 15 | 0.0 | 0.0 | 11879. | 37 | 0.0 | 0.0 | 1000. |
| 16 | 0.0 | 0.0 | 12545. | 38 | 0.0 | 0.0 | 843. |
| 17 | 0.0 | 0.0 | 12754. | 39 | 0.0 | 0.0 | 699. |
| 18 | 0.0 | 0.0 | 12507. | 40 | 0.0 | 0.0 | 563. |
| 19 | 0.0 | 0.0 | 11379. | 41 | 0.0 | 0.0 | 429. |
| 20 | 0.0 | 0.0 | 11003. | 42 | 0.0 | 0.0 | 203. |
| 21 | 0.0 | 0.0 | 9978. | 43 | 0.0 | 0.0 | 136. |
| 22 | 0.0 | 0.0 | 8897. | 44 | 0.0 | 0.0 | 77. |
| | | | | 45 | 0.0 | 0.0 | 32. |
| | | | | 46 | 0.0 | 0.0 | 0. |

SUM 16.00 16.00 193521.

| | PEAK | 8-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|--------|--------|---------|---------|--------------|
| CFS | 12754. | 10593. | 4032. | 1344. | 193519. |
| INCHES | | 10.48 | 15.96 | 15.96 | 15.96 |
| AC-FT | | 5256. | 8001. | 8001. | 8001. |

SUR-AREA RUNOFF COMPUTATION

INFLOW TO HARRIS POND

ISTAO 6 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA
 IHVPG 0 IUHG -1 TARFA 3.10 SNAP 0.0 TRSDA 3.10 TRSPC 0.0 RATIO 0.0 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA
 NP STORM DAIJ EAK
 12 0.0 0.0 0.0
 PRECIP PATTERN

0.40 0.89 1.07 1.16 1.34 1.70 4.94 1.16 1.16

LOSS DATA

STKR CLIKR RTIOL LPAIN STRKS RTIOK STRTL CNSTL ALSMX RTIMP
 0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 0.0 0.0

GIVEN UNIT GRAPH, NUHGG= 15

190. 720. 1000. 310. 510. 320. 200. 115. 75. 45.

UNIT GRAPH TOTALS 4051. CFS OK 1.01 INCHES OVER THE AREA

HP17.

HP-18

RECESSION DATA
 STRIG= 0.0 QRCNV= 0.0 RTIOR= 1.00

| END-OF-PERIOD FLOW | | | |
|--------------------|------|------|--------|
| TIME | RAIN | EXCS | COMP Q |
| 1 | 0.40 | 0.40 | 76. |
| 2 | 0.40 | 0.40 | 364. |
| 3 | 0.89 | 0.89 | 857. |
| 4 | 1.07 | 1.07 | 1568. |
| 5 | 1.16 | 1.16 | 2409. |
| 6 | 1.34 | 1.34 | 3213. |
| 7 | 1.70 | 1.70 | 3976. |
| 8 | 4.94 | 4.94 | 5399. |
| 9 | 1.16 | 1.16 | 7751. |
| 10 | 1.16 | 1.16 | 8792. |
| 11 | 0.98 | 0.98 | 7930. |
| 12 | 0.80 | 0.80 | 6561. |
| 13 | 0.0 | 0.0 | 5336. |
| 14 | 0.0 | 0.0 | 3947. |
| 15 | 0.0 | 0.0 | 2574. |
| 16 | 0.0 | 0.0 | 1612. |
| 17 | 0.0 | 0.0 | 990. |
| 18 | 0.0 | 0.0 | 613. |
| 19 | 0.0 | 0.0 | 369. |
| 20 | 0.0 | 0.0 | 225. |
| 21 | 0.0 | 0.0 | 127. |
| 22 | 0.0 | 0.0 | 70. |
| 23 | 0.0 | 0.0 | 33. |
| 24 | 0.0 | 0.0 | 16. |

SUM 16.00 16.00 64816.

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 8792. | 4958. | 1350. | 450. | 64816. |
| INCHES | | 14.88 | 16.21 | 16.21 | 16.21 |
| AC-FT | | 2460. | 2680. | 2680. | 2680. |

SUB-AREA RUNOFF COMPUTATION

INFLOW FROM HIAWATHA

ISTAG 7 ICOMP 0 IFCON 0 ITAPL 0 JPLT 0 JFRT 0 INAME 1

HYDROGRAPH DATA

IHYDG 0 IUHG -1 TAREA 1.10 SNAP 0.0 TRSCA 1.10 TRSPC 0.0 RATIO 0.0 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA

NP 15 STORM 0.0 DAK 0.0

PRECIP PATTERN

0.40 0.89 1.07 1.16 1.34 1.70 4.94 1.16 1.16
0.98 0.80

LOSS DATA

STKX 0.0 DLTKR 0.0 RTIOL 1.00 FRAIN 0.0 STRKS 0.0 RTIOK 1.00 STRIL 0.0 CNSTL 0.0 ALSMX 0.0 RTIMP 0.0

GIVEN UNIT GRAPH, NUHGG= 22

0. 0. 0. 31. 114. 224. 256. 176. 120.
85. 60. 41. 28. 20. 14. 9. 5. 3.
2. 1.

UNIT GRAPH TOTALS 1440. CFS OR 1.01 INCHES OVER THE AREA

HP 19

HP 20

RECESSION DATA
 STAGE= 0.0 GRCSN= 0.0 RTIOF= 1.00

END-OF-PERIOD FLOW

| TIME | RAIN | EXOS | COMP |
|------|------|------|-------|
| 1 | 0.40 | 0.40 | 0. |
| 2 | 0.40 | 0.40 | 0. |
| 3 | 0.89 | 0.89 | 0. |
| 4 | 1.07 | 1.07 | 12. |
| 5 | 1.16 | 1.16 | 58. |
| 6 | 1.34 | 1.34 | 163. |
| 7 | 1.70 | 1.70 | 331. |
| 8 | 4.94 | 4.94 | 557. |
| 9 | 1.16 | 1.16 | 814. |
| 10 | 1.16 | 1.16 | 1077. |
| 11 | 0.98 | 0.98 | 1445. |
| 12 | 0.80 | 0.80 | 1561. |
| 13 | 0.0 | 0.0 | 2489. |
| 14 | 0.0 | 0.0 | 2681. |
| 15 | 0.0 | 0.0 | 2839. |
| 16 | 0.0 | 0.0 | 2830. |
| 17 | 0.0 | 0.0 | 1838. |
| 18 | 0.0 | 0.0 | 1435. |
| 19 | 0.0 | 0.0 | 1052. |
| 20 | 0.0 | 0.0 | 739. |
| 21 | 0.0 | 0.0 | 512. |
| 22 | 0.0 | 0.0 | 359. |
| 23 | 0.0 | 0.0 | 249. |
| 24 | 0.0 | 0.0 | 169. |
| 25 | 0.0 | 0.0 | 119. |
| 26 | 0.0 | 0.0 | 82. |
| 27 | 0.0 | 0.0 | 53. |
| 28 | 0.0 | 0.0 | 35. |
| 29 | 0.0 | 0.0 | 21. |
| 30 | 0.0 | 0.0 | 10. |
| 31 | 0.0 | 0.0 | 6. |
| 32 | 0.0 | 0.0 | 3. |
| 33 | 0.0 | 0.0 | 1. |

SUM 16.00 16.00 23040.

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 2681. | 1692. | 480. | 160. | 23040. |
| INCHES | | 14.31 | 16.24 | 16.24 | 16.24 |
| AC-FT | | 839. | 953. | 953. | 953. |

HIAWATHA

ROUTING THROUGH RESERVOIR

ISTAG ICOMP
77 1

GLCSS
0.0

NSTPS NSTHL
1 0

HYDROGRAPH ROUTING

IELCON IIAPE JPLT JPRY INAME
0 0 0 0 1

ROUTING DATA

CLOSS AVG IRFS ISAMF
0.0 0.0 1 0

LAG AMSKK X TSK STORA
0 0.0 0.0 0.0 0.

STORAGE
OUTFLOW

| | | | | | | | |
|------|-------|-------|-------|--------|--------|----|----|
| 62. | 128. | 198. | 273. | 353. | 437. | 0. | 0. |
| 574. | 2144. | 4530. | 7587. | 11166. | 15553. | 0. | 0. |

D-54

HP21

HP 22.

| TIME | ROP | STOR | AVG IN | ROP OUT |
|------|-----|------|--------|---------|
| 1 | | 0. | 0. | 0. |
| 2 | | 0. | 0. | 0. |
| 3 | | 0. | 0. | 0. |
| 4 | | 0. | 6. | 2. |
| 5 | | 1. | 35. | 13. |
| 6 | | 5. | 110. | 44. |
| 7 | | 12. | 247. | 109. |
| 8 | | 23. | 444. | 217. |
| 9 | | 40. | 685. | 367. |
| 10 | | 60. | 945. | 553. |
| 11 | | 80. | 1261. | 997. |
| 12 | | 99. | 1703. | 1462. |
| 13 | | 120. | 2225. | 1965. |
| 14 | | 136. | 2585. | 2432. |
| 15 | | 141. | 2610. | 2579. |
| 16 | | 136. | 2385. | 2418. |
| 17 | | 127. | 2034. | 2109. |
| 18 | | 113. | 1636. | 1798. |
| 19 | | 98. | 1244. | 1432. |
| 20 | | 83. | 895. | 1079. |
| 21 | | 71. | 625. | 780. |
| 22 | | 61. | 435. | 564. |
| 23 | | 52. | 304. | 480. |
| 24 | | 42. | 209. | 393. |
| 25 | | 34. | 144. | 313. |
| 26 | | 26. | 101. | 245. |
| 27 | | 20. | 68. | 188. |
| 28 | | 15. | 44. | 142. |
| 29 | | 11. | 28. | 105. |
| 30 | | 8. | 16. | 77. |
| 31 | | 6. | 8. | 55. |
| 32 | | 4. | 4. | 38. |
| 33 | | 3. | 2. | 27. |
| 34 | | 2. | 0. | 18. |
| 35 | | 1. | 0. | 12. |
| 36 | | 1. | 0. | 8. |

| SUM | | 23240. | | | |
|--------|-------|--------|---------|---------|--------------|
| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
| CFS | 2579. | 1635. | 480. | 160. | 23240. |
| INCHES | | 13.82 | 16.24 | 16.24 | 16.24 |
| AC-FT | | 811. | 953. | 953. | 953. |

0. 01

NORTH POND
AREA 1
JAN 75

NG NHR NWIN IDAY IHR IMIN METRC IPLY IPRT INSTAN
150 0 30 0 0 0 0 0 0
JOPER 3 NWT 0
0.5 PMF

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAG ICOMP IECON ITAPE JPLT JPRT INAME
1 0 0 0 0 0 1

HYDROGRAPH DATA

IHYLG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
0 -1 2.70 0.0 2.70 0.0 0.500 0 0 0

PRECIP DATA

LP STORM DAJ DAK
40 0.0 0.0 0.0
PRECIP PATTERN
0.40 0.89 1.07 1.16 1.34 1.70 4.94 1.16
0.48 0.80

LOSS DATA

STPKR OLTKR RTIOL FRAIN STPKS RTIOL STRTL CNSTL ALSMX RTIMP
0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 0.0 0.0
GIVEN UNIT GRAPH, NUHGU= 40
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
653. 575. 431. 294. 209. 147. 100. 281.
23. 16. 12. 8. 6. 3. 1. 49.
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

UNIT GRAPH TOTALS 3534. CFS OR 1.01 INCHES OVER THE AREA

HP23

D-56

HP 25

TIME EOP STOR AVG IN EOP OUT

| | | | |
|----|------|-------|-------|
| 1 | 0. | 0. | 0. |
| 2 | 0. | 7. | 0. |
| 3 | 2. | 43. | 1. |
| 4 | 8. | 135. | 2. |
| 5 | 20. | 302. | 5. |
| 6 | 42. | 545. | 12. |
| 7 | 76. | 841. | 21. |
| 8 | 123. | 1163. | 35. |
| 9 | 185. | 1546. | 57. |
| 10 | 267. | 2089. | 113. |
| 11 | 374. | 2730. | 182. |
| 12 | 496. | 3171. | 264. |
| 13 | 610. | 3203. | 612. |
| 14 | 697. | 2925. | 1010. |
| 15 | 752. | 2493. | 1362. |
| 16 | 775. | 2007. | 1515. |
| 17 | 775. | 1525. | 1517. |
| 18 | 760. | 1096. | 1417. |
| 19 | 736. | 765. | 1262. |
| 20 | 710. | 533. | 1089. |
| 21 | 684. | 372. | 919. |
| 22 | 658. | 257. | 809. |
| 23 | 634. | 177. | 711. |
| 24 | 612. | 123. | 620. |
| 25 | 592. | 85. | 537. |
| 26 | 573. | 53. | 463. |
| 27 | 557. | 33. | 397. |
| 28 | 543. | 23. | 339. |
| 29 | 530. | 12. | 289. |
| 30 | 519. | 6. | 280. |
| 31 | 508. | 3. | 272. |
| 32 | 497. | 1. | 265. |
| 33 | 486. | 0. | 257. |
| 34 | 475. | 0. | 250. |
| 35 | 465. | 0. | 243. |
| 36 | 455. | 0. | 237. |
| 37 | 446. | 0. | 230. |
| 38 | 436. | 0. | 224. |
| 39 | 427. | 0. | 218. |
| 40 | 418. | 0. | 212. |
| 41 | 410. | 0. | 206. |
| 42 | 401. | 0. | 200. |
| 43 | 393. | 0. | 195. |
| 44 | 385. | 0. | 189. |
| 45 | 377. | 0. | 184. |
| 46 | 370. | 0. | 179. |
| 47 | 363. | 0. | 175. |
| 48 | 355. | 0. | 170. |
| 49 | 348. | 0. | 166. |

SUN

24377.

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 1517. | 1070. | 437. | 169. | 24377. |
| INCHES | | 3.09 | 6.02 | 7.00 | 7.00 |

D-59

COMBINED WITH NORTH POLE

| INCHES | AC-FT | CFS | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL | VOLUME |
|--------|-------|-------|-------|--------|---------|---------|--------|--------|
| 0. | 0. | 0. | 2509. | 1915. | 781. | 291. | 41913. | 1 |
| 0. | 0. | 0. | | 4.05 | 6.60 | 7.38 | 7.38 | |
| 0. | 0. | 1. | | 950. | 1550. | 1733. | 1733. | |
| 698. | 904. | 0. | | | | | | |
| 2369. | 2141. | 0. | | | | | | |
| 633. | 453. | 0. | | | | | | |
| 239. | 224. | 6. | | | | | | |
| 179. | 170. | 1129. | | | | | | |
| 138. | 130. | 1472. | | | | | | |
| 105. | 100. | 381. | | | | | | |
| 84. | 80. | 218. | | | | | | |
| 67. | 65. | 166. | | | | | | |
| | | 127. | | | | | | |
| | | 124. | | | | | | |
| | | 96. | | | | | | |
| | | 94. | | | | | | |
| | | 92. | | | | | | |
| | | 74. | | | | | | |
| | | 59. | | | | | | |
| | | 60. | | | | | | |
| | | 42. | | | | | | |
| | | 1503. | | | | | | |
| | | 1346. | | | | | | |
| | | 1164. | | | | | | |
| | | 306. | | | | | | |
| | | 277. | | | | | | |
| | | 189. | | | | | | |
| | | 145. | | | | | | |
| | | 111. | | | | | | |
| | | 88. | | | | | | |
| | | 70. | | | | | | |
| | | 57. | | | | | | |
| | | 232. | | | | | | |
| | | 2256. | | | | | | |
| | | 867. | | | | | | |
| | | 263. | | | | | | |
| | | 250. | | | | | | |
| | | 184. | | | | | | |
| | | 141. | | | | | | |
| | | 108. | | | | | | |
| | | 86. | | | | | | |
| | | 69. | | | | | | |
| | | 55. | | | | | | |

D-60

HP27

| | | | |
|-------|-------|-------|-------|
| 11.66 | 15.99 | 15.99 | 15.99 |
| 1057. | 1450. | 1450. | 1450. |

RUNOFF MULTIPLIED BY 0.10

[illegible]

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 1340. | 1665. | 565. | 124. | 17554. |
| 1DCHFS | | 5483 | 8400 | 8400 | 8400 |
| AC-FY | | 524. | 725. | 725. | 725. |

D-61

HP 28

INLET TO HEPATIC VESSEL

| ISTAG | ICOMP | IECCN | ITAPE | JPLY | JPRY | INAME |
|-------|-------|-------|-------|------|------|-------|
| 3 | 0 | 0 | 0 | 0 | 0 | 1 |

| IUNUC | IUNG | HYDROGRAPH DATA | | | | | RATIO | ISNO | ISAME | LOCAL |
|-------|------|-----------------|------|-------|-------|-------|-------|------|-------|-------|
| | | TAREA | SAAP | TRSDA | TRSPC | | | | | |
| 0 | -1 | 5.60 | 0.0 | 5.60 | 0.0 | 0.500 | 0 | 0 | 0 | |

```
NP      PRECIP DATA      LAK
32      STORM           CAJ      0.0
        0.0              0.0      0.0
        PRECIP PATTERN
```

| | | | | | | |
|------|------|------|------|------|------|------|
| 0.40 | 0.49 | 1.07 | 1.16 | 1.70 | 4.94 | 1.16 |
| 0.98 | 0.80 | | | | | |

LOSS DATA

| | STRENGTH | CLIQUE | KTIOL | EKAIN | STRKS | RIUOK | SIRIL | CNSTL | ALSMX | KTIIMP |
|--|----------|--------|-------|-------|-------|-------|-------|-------|-------|--------|
| | 0.0 | 0.0 | 1.00 | 6.0 | 0.0 | 1.00 | 0.0 | 0.0 | 0.0 | 0.0 |

GIVEN UNIT GRAPH, NUHG= 48

| | | | | | | | |
|-------------------|-----|-----|------|----------------------------------|-----|-----|-----|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 26 | 40 | 169 | 291 | 445 | 562 | 676 | 796 |
| 524 | 447 | 368 | 308 | 249 | 217 | 185 | 152 |
| 87 | 72 | 61 | 51 | 44 | 38 | 31 | 24 |
| UNIT GRAPH TOTALS | | | 7225 | CFS OR 1.00 INCHES OVER THE AREA | | | |

HP 29

COMBINE HYDROGRAPHS

COMBINE HOPEDALE WITH SUM OF ARCV
 ISTAG ICOPP IECON ITAPE JPLT JPRT INAME
 0 2 0 0 0 0 1

SUM OF 2 HYDROGRAPHS AT 0

D-64

| | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 4. | 20. | 55. | 138. | 275. | 479. | 759. | 1147. | 1654. | 2236. |
| 2571. | 5500. | 4021. | 4360. | 4497. | 4419. | 4186. | 3862. | 3500. | 3151. |
| 2888. | 2700. | 2580. | 2530. | 2502. | 2480. | 2438. | 2618. | 2819. | 2557. |
| 2889. | 2678. | 2391. | 2066. | 1741. | 1414. | 1206. | 1031. | 877. | 742. |
| 633. | 539. | 453. | 381. | 353. | 329. | 306. | 277. | 243. | 250. |
| 239. | 230. | 224. | 218. | 212. | 206. | 200. | 195. | 189. | 184. |
| 179. | 175. | 170. | 166. | 161. | 157. | 153. | 149. | 145. | 141. |
| 138. | 134. | 130. | 127. | 124. | 120. | 117. | 114. | 111. | 108. |
| 105. | 103. | 100. | 98. | 96. | 94. | 92. | 90. | 88. | 86. |
| 84. | 82. | 80. | 79. | 77. | 75. | 74. | 72. | 70. | 69. |
| 67. | 66. | 65. | 63. | 62. | 60. | 59. | 58. | 57. | 55. |

HP31

HYDROGRAPH ROUTING

ROUTING THROUGH HOPEDALE

ISTAD ICOMP
43 1

IFCON ITAPE JPLT JPRT INAME
0 0 0 0 1

ROUTING DATA
GROSS AVG IRLS ISAME
0.0 0.0 1 0

NSTPS NSTUL
1 0

LAG AMSKK X TSK STORA
0 0.0 0.0 0.0 0.

LAGGE = STORAGE = 0.
FLOWGE = OUTFLOW = 0.

89.
150.

180.
428.

274.
786.

374.
1210.

481.
1690.

612.
2222.

762.
2800.

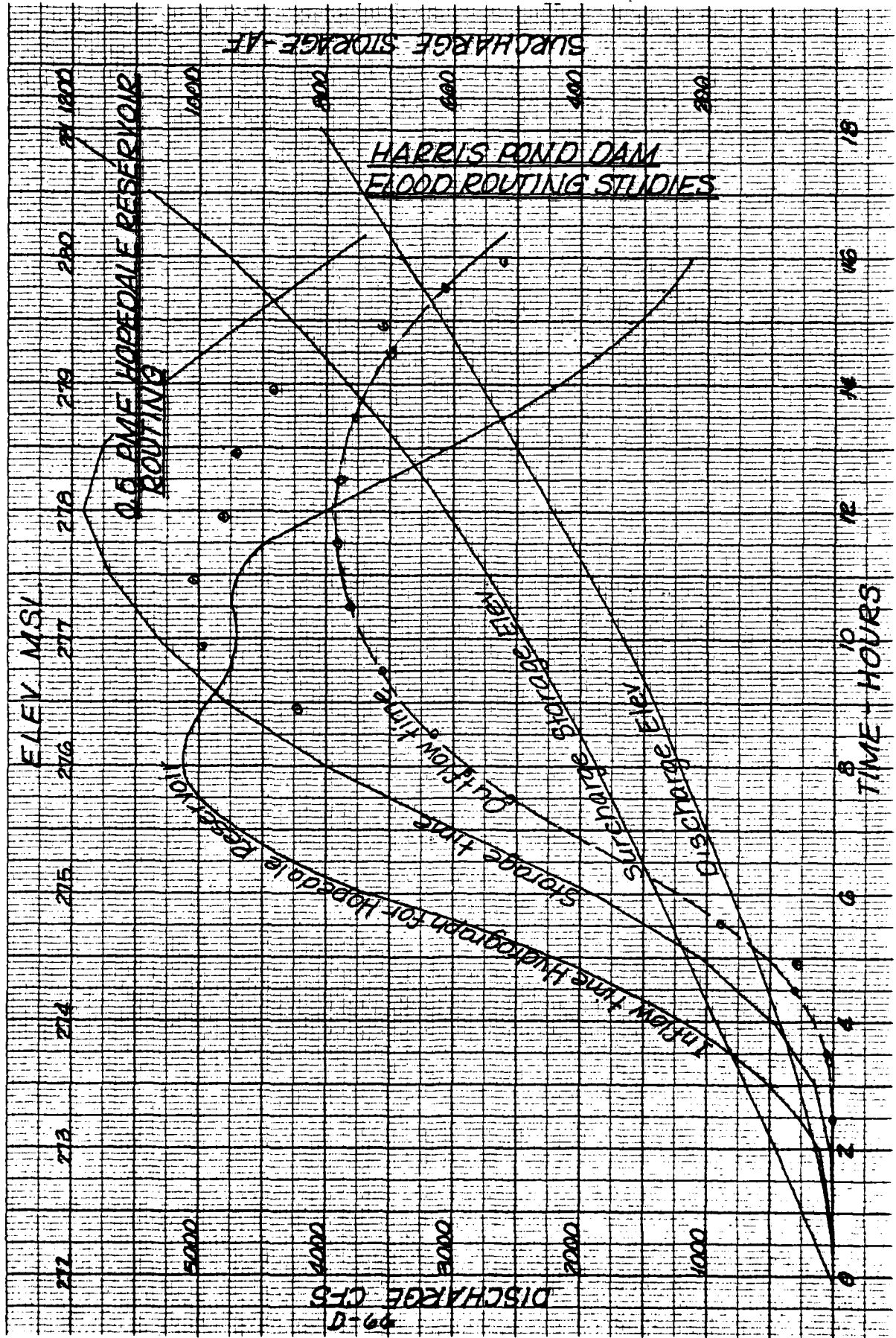
957.
3421.

1221.
4000.

D-65

HP 32

KEUFFEL & ESSER CO
MADE IN U.S.A.



SUR-AREA RUNOFF COMPUTATION

HYDROGRAPH FOR MUDDY RIVER

ISTAG 5 ICOMP 0 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA

IHYOG 0 IUHG -1 TARFA 6.10 SNAP 0.0 TRSDA 6.10 TRSPC 0.0 RATIO 0.500 ISAME 0 LOCAL 0

PRECIP DATA

NP 22 STORM 0.0 DAJ 0.0 DAK 0.0

PRECIP PATTERN

0.40
0.98

0.40
0.80

1.07

1.16

1.34

1.70

4.94

1.16

1.16

LOSS DATA

STRR DLTK RTIOL RTIOL ERAIN STRKS RTIOL STRTL CNSTL ALSMX RTIMP

GIVEN UNIT GRAPH, NUHGG= 44

0.
9.
579.
165.
40.

0.
44.
543.
142.
35.

0.
94.
496.
124.
30.

0.
165.
443.
106.
26.

0.
254.
390.
92.
26.

0.
354.
331.
77.
26.

0.
455.
282.
67.
26.

0.
526.
248.
58.
26.

0.
573.
218.
51.
26.

0.
590.
189.
44.
26.

UNIT GRAPH TOTALS 7847. CFS OR 1.00 INCHES OVER THE AREA

HP33

[illegible]

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|----------|-------|--------|---------|---------|--------------|
| CFS | 4137. | 3457. | 1308. | 436. | 62776. |
| 1-INCHES | | 5.24 | 7.98 | 7.98 | 7.98 |
| AC-FT | | 1705. | 2595. | 2595. | 2595. |

HP 34

D-68

SUP-AREA RUNOFF COMPUTATION

INFLOW TO HARRIS POND

ISTAG ICOMP IECON ITAPE JPLI JPRT INAME
 2 0 0 0 0 0 1

HYDROGRAPH DATA
 INHUG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 0 -1 3.10 0.0 3.10 0.0 0.500 0 0 0

PRECIP DATA
 AP STORM DAK
 12 0.0 0.0 0.0

PRECIP PATTERN
 1.16 1.34

0.40 0.89 1.07 1.34 1.70 4.94 1.16 1.16
 0.98

D-69

LOSS DATA

STKRP QUTKR RTIOL FRAIN STRKS RTIOK SIRTIL CNSIL ALSMX RIIMP
 0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 0.0 0.0

GIVEN UNIT GRAPH, NUHGG= 13

190. 720. 1000. 810. 510. 320. 200. 115. 75. 45.
 30. 18. 11. 5. 2.

UNIT GRAPH TOTALS 4051. CFS OR 1.91 INCHES OVER THE AREA

REFCESSION DATA
 SIRTQ= 0.0 GRCSN= 0.0 RTIOR= 1.00

HP 35

[illegible]

CFS
INCHES
AC-FT

PEAK
4396.

6-HOUR
2473.
7.44
1230.

24-HOUR
675.
8.10
1340.

72-HOUR
225.
8.10
1340.

TOTAL VOTING 32

VOLUME
32408.
8.10
1340.

HP 36

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ 4 ICOMP 0 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROGRAPH DATA

IHYDG 0 IUHG -1 TAREA 2.80 SNAP 0.0 TRSDA 2.86 TRSPC 0.0 RATIO 0.500 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA

NP 22 STORM 0.0 DAK 0.0
PRECIP PATTERN 0.0

0.40 0.40 0.89 1.07 1.16 1.34 1.70 4.94 1.16 1.16
0.98 0.80

LOSS DATA

STKRS 0.0 DLTKR 0.0 RTIOL 1.00 ERAIN 0.0 STKRS 0.0 RTIOL 1.00 SRTL 0.0 CNSTL 0.0 ALSMX 0.0 KTIMP 0.0

GIVEN UNIT GRAPH, NUHGG= 44

0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
20. 43. 228. 76. 117. 163. 209. 241. 263. 271.
266. 249. 203. 203. 179. 152. 132. 114. 100. 67.
75. 57. 49. 42. 35. 31. 27. 23. 20.
15. 14. 12. 12. 12. 12. 12. 12. 12. 12.

UNIT GRAPH TOTALS 4603. CFS OR 1.00 INCHES OVLR THE AREA

HP37

| Year | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 |
|------|
|------|

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 1500. | 1578. | 600. | 200. | 28824. |
| INCHES | | 5.24 | 7.98 | 7.98 | 7.98 |
| AC-FT | | 783. | 1152. | 1192. | 1192. |

D-72

HP 38

SUP-AREA RUNOFF COMPUTATION

INFLOW TO FORGE POND

ISIAQ 6 ICOMP 0 IECON 0 ITAPE 0 JPLI 0 JPRT 0 INAME 1

INHYDC 0 IUHG -1 TAREA 9.40 SNAP 0.0 TRSCA 9.40 TRSPC 0.0 RATIO 0.500 ISNOW 0 ISAME 0 LOCAL 0

HYDROGRAPH DATA

PRECIP DATA
NP STORM DAIJ LAK
12 0.0 0.0 0.0

PRECIP PATTERN

0.40 0.40 0.89 1.07 1.16 1.54 1.70 4.94 1.16 1.16

D-73

LOSS DATA

STPKR 0.0 DLIKR 0.0 KTIOL 1.00 LGAIN 0.0 STRKS 0.0 RTIOK 1.00 STIRL 0.0 CNSTL 0.0 ALSMX 0.0 RTIMP 0.0

GIVEN UNIT GRAPH, NUMGG= 34

14. 68. 146. 255. 351. 546. 701. 810. 883. 910.
892. 837. 764. 682. 601. 510. 446. 382. 357. 291.
255. 191. 164. 141. 118. 104. 89. 79. 68.
61. 54. 47. 40.

UNIT GRAPH TOTALS 12095. CFS OR 1.00 INCHES OVER THE AREA

HP39

[illegible]

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|--------|-------|--------|---------|---------|--------------|
| CFS | 6377. | 5251. | 2016. | 672. | 96759. |
| 1MCHFS | | 5.24 | 7.98 | 7.58 | 7.98 |
| AC-FT | | 2624. | 4000. | 4000. | 4000. |

D-74

HP40

SUR-AREA RUNOFF COMPUTATION

INFLOW FROM HIAWATHA

ISTAG 7 ICOMP 0 IECON 0 ITAPE 0 JPLT 0 JPRT 0 INAME 1

HYDROG 0 IUHG -1 IAREA 1.10 SNAP 0.0 TRSDA 1.10 TRSPC 0.0 KATIO 0.500 ISNOW 0 ISAME 0 LOCAL 0

PRECIP DATA
STORM DAK
0.0 0.0
PRECIP PATTERN
0.40 0.89
0.80

0.0 0.0 0.0 0.0 1.07 1.16 1.34 1.70
4.94 1.16 0.40 0.98 0.80

LOSS DATA
STIRK DLTKR RTIOL ERRAIN STIRKS RTIOK STRTL CNSIL ALSMX RTIMP
0.0 0.0 1.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0

GIVEN UNIT GRAPH, NUHGG= 22
0. 0. 114. 224.
60. 41. 20. 14.
1. 1. 1. 1.

120.
3.

176.
5.

234.
7.

266.
9.

UNIT GRAPH TOTALS 1440. CFS OR 1.01 INCHES OVLR THE AREA

RECESSION DATA
STIRQ= 0.0 GRCSN= 0.0 RTIOK= 1.00

HP41

[illegible]

D-76

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

| IECON | ITAPE | JPLI | JFRT | INAME |
|-------|-------|------|------|-------|
| 0 | 0 | 0 | 0 | 1 |

| ROUTING DATA | |
|--------------|-----------|
| CLOSS | CLOSS AVG |

| CROSS | AVG | IRIS | ISAME |
|-------|-----|------|-------|
| 0.0 | 0.0 | 1 | 0 |

| | | | | | | |
|-------|-------|-----|-------|-----|------|-------|
| NSIPS | NSTIL | LAG | AMSKK | X | TASK | STORA |
| 1 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0. |

| | | | | | | | |
|---------------|------|-------|-------|-------|--------|--------|----|
| 64=STORAGE 0. | 62. | 128. | 194. | 273. | 353. | 437. | 0. |
| 64=OUTFLOW 0. | 574. | 2144. | 4550. | 7587. | 11166. | 15553. | 0. |

HP 42

| TIME | EOP STOR | AVG IN | EOP OUT |
|------|----------|--------|---------|
| 1 | 0. | 0. | 0. |
| 2 | 0. | 3. | 1. |
| 3 | 1. | 18. | 6. |
| 4 | 2. | 55. | 22. |
| 5 | 6. | 123. | 55. |
| 6 | 12. | 222. | 108. |
| 7 | 20. | 343. | 184. |
| 8 | 30. | 473. | 276. |
| 9 | 42. | 630. | 390. |
| 10 | 58. | 851. | 538. |
| 11 | 75. | 1113. | 879. |
| 12 | 86. | 1293. | 1152. |
| 13 | 91. | 1305. | 1253. |
| 14 | 89. | 1192. | 1213. |
| 15 | 63. | 1017. | 1034. |
| 16 | 76. | 818. | 909. |
| 17 | 68. | 622. | 720. |
| 18 | 60. | 448. | 558. |
| 19 | 52. | 313. | 479. |
| 20 | 43. | 218. | 395. |
| 21 | 34. | 152. | 317. |
| 22 | 27. | 105. | 249. |
| 23 | 21. | 72. | 192. |
| 24 | 16. | 50. | 147. |
| 25 | 12. | 34. | 110. |
| 26 | 9. | 22. | 82. |
| 27 | 6. | 14. | 60. |
| 28 | 5. | 8. | 43. |
| 29 | 3. | 4. | 31. |
| 30 | 2. | 2. | 22. |
| 31 | 2. | 1. | 15. |
| 32 | 1. | 0. | 10. |
| 33 | 1. | 0. | 7. |
| 34 | 1. | 0. | 5. |
| 35 | 0. | 0. | 3. |
| 36 | 0. | 0. | 2. |
| 37 | 0. | 0. | 1. |

APPENDIX E
INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

77 14 14
14 14 14

INVENTORY OF DAMS IN THE UNITED STATES

| STATE | DIVISION | COUNTY | CITY | COUNTY | DIST. | NAME | REPORT DATE |
|-------|----------|--------|------|--------|-------|-----------------|-------------|
| RI | 001 | 01 | | | | HARRIS POND DAM | 01 MAR 79 |

| POPULAR NAME | NAME OF IMPONDMENT |
|--------------|--------------------|
| | HARRIS POND |

| REGION BASIN | RIVER OR STREAM | NEAREST DOWNSTREAM CITY - TOWN - VILLAGE | POPULATION |
|--------------|-----------------|--|------------|
| 01 06 | MILL RIVER | WOODSOKET | 46620 |

| TYPE OF DAM | YEAR COMPLETED | PURPOSES | STILLING BASIN HEIGHT | HYDRAULIC HEIGHT | IMPOUNDING CAPACITIES | DIST | OWN | FED | R | PRV | FED | SCS | A | VER/DATE |
|-------------|----------------|----------|-----------------------|------------------|-----------------------|------|-----|-----|---|-----|-----|-----|---|-----------|
| RECIBG | 1960 | S | 40 | 40 | 2450 | 1050 | N | N | N | N | N | N | N | 07 MAR 79 |

| REMARKS |
|--------------|
| 21 ZONE FILL |

| D/S | SPILLWAY | MAXIMUM DISCHARGE | VOLUME OF DAM | POWER CAPACITY | NAVIGATION LOCKS |
|-----|----------|-------------------|---------------|----------------|------------------|
| 1 | 1014 | 18500 | 184296 | 184296 | 184296 |

| OWNER | ENGINEERING BY | CONSTRUCTION BY |
|-------------------|---------------------|-----------------|
| CITY OF WOODSOKET | METCALF + EDDY INC. | CAMPANELLA CORP |

| DESIGN | CONSTRUCTION | OPERATION | MAINTENANCE |
|--------|--------------|-----------|-------------|
| NONE | NONE | NONE | NONE |

| INSPECTION BY | INSPECTION DATE | AUTHORITY FOR INSPECTION |
|---------------------------------|-----------------|--------------------------|
| LOUIS BERGER & ASSOCIATES, INC. | 27 SEP 78 | PL92-367 |

| REMARKS |
|---------|
| |

DATE
FILMED
— 8