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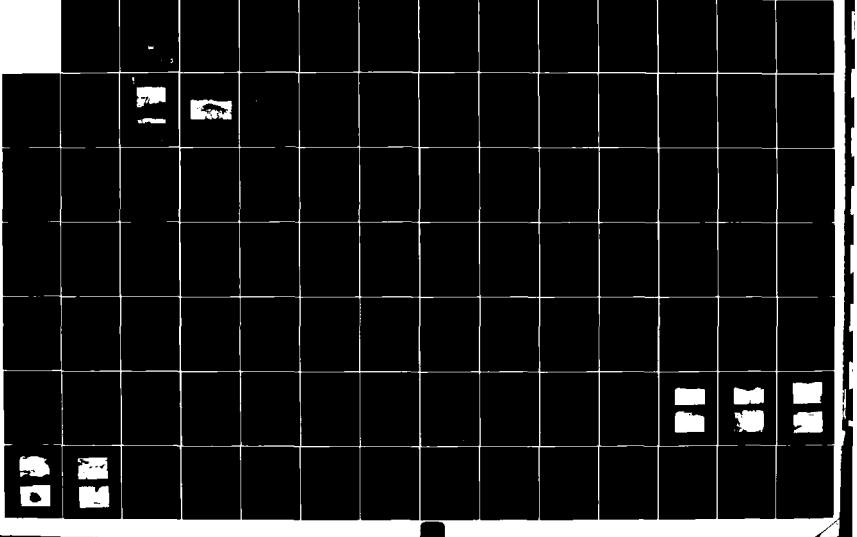

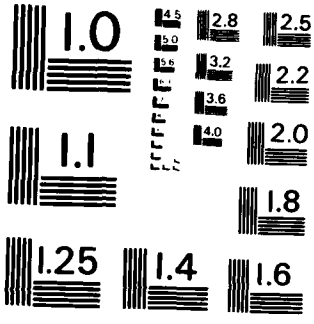

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AD-A144 547

CONNECTICUT RIVER BASIN
BLOOMFIELD, CONNECTICUT

BLUE HILLS DAM
CT 00496

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DTIC FILE COPY

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

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00496	2. GOVT ACCESSION NO. AD-A144 547	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Blue Hills Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

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

DAMS, INSPECTION, DAM SAFETY,
Connecticut River Basin
Bloomfield, Connecticut

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

Blue Hills Dam consists of an earth embankment, 4.045 ft. long with a top width of 12 ft. and a maximum height of 24.5 ft. Based on visual inspection and review of available plans and reports, Blue Hills Dam is judged to be in good condition. As per the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the Blue Hills Dam is classified as 'Intermediate' in size qith 'High' hazard potential. A test flood equal to the PMF was selected in accordance with the Corps of Engineers.

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

REPLY TO
ATTENTION OF:
NEDED

JUN 3 0 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Cold Spring Reservoir Dam (CT-00495) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve 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 vitally important part.

Copies of this report have been forwarded to the Department of Environmental Protection, and to the owner, State of Connecticut, Department of Environmental Protection. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

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BLUE HILLS DAM

CT 00496

CONNECTICUT RIVER BASIN

BLOOMFIELD, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

IDENTIFICATION NO: CT-00496

NAME OF DAM: Blue Hills Dam

TOWN: Bloomfield

COUNTY AND STATE: Hartford County, Connecticut

STREAM: Easterly branch of Beamans Brook, a tributary of North Branch of Park River

DATE OF INSPECTION: December 15, 1980

BRIEF ASSESSMENT

Blue Hills Dam consists of an earth embankment, 4,045 ft. long with a top width of 12 ft. and a maximum height of 24.5 ft. In addition, there is a 1,450 ft. long dike running parallel to Blue Hills Avenue, which is 10 ft. wide at the top and has a maximum height of 6 ft.

The two outlets for the dam are the unregulated principal spillway and emergency spillway. The principal spillway is a drop inlet structure consisting of a two stage reinforced concrete intake riser discharging through a 30" diameter, 153 ft. long reinforced concrete pipe under the dam embankment. The emergency spillway is a trapezoidal grassed channel, 210 ft. wide at the control section with its crest 6.1 ft. below the top of the dam.

Based on visual inspection and review of available plans and reports, Blue Hills Dam is judged to be in good condition. Some features found existing that could affect the stability of the dam are standing water at the seepage drain outlet nearest the emergency spillway and wheel ruts and minor erosion gullies on the crest and slopes.

The dam is a flood control project and, therefore, the reservoir is dry except during periods of heavy rainfall. With the reservoir dry, the inspection could not reveal seepage conditions. It is recommended that the owner employ a qualified registered engineer to do the following within two years of receipt of this report:

Inspect the dam during the time that water is impounded in the reservoir with particular attention to locating any possible seepage;

Determine the origin and significance of the standing water at the seepage drain outlet nearest the emergency spillway;

Design a permanent surface on the dike embankment at the utility service road crossing capable of carrying traffic without rutting or eroding.

It is recommended that the owner repair the wheel ruts and minor erosion gullies on the crest and slopes of the dam and dike embankments within two years of receipt of this report. Other remedial measures contained in Section 7 should also be carried out within a period of two years.

As per the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the Blue Hills Dam is classified as 'Intermediate' in size with 'High' hazard potential. A test flood equal to the probable maximum flood (PMF) was selected in accordance with the Corps of Engineers' Guidelines. The calculated test flood inflow of 1,800 cfs results in a routed outflow of 1,570 cfs. The maximum spillway capacity is 9,400 cfs at the top of the dam. The spillway is capable of passing 600% of the

routed test flood outflow without overtopping the dam. The storage capacity to the top of the dam is 2,200 ac-ft. and up to the test flood elevation, 1,050 ac-ft.

As the dam is a 'high' hazard potential and a potential breach may result in excessive economic loss and more than a few lives may be endangered, an emergency operation plan should be prepared and implemented if and when necessary. An operation and maintenance manual to take care of normal routine procedures should also be prepared.

GOODKIND & O'DEA, INC.
AND
SINGHAL ASSOCIATES
(J.V.)

R. P. Singhal

Ramesh P. Singhal, Ph.D., P.E.
(Singhal Associates)

STATE OF CONNECTICUT
RAMESHWAR P. SINGH
No. 9324
REGISTERED
PROFESSIONAL ENGINEER

Lawrence J. Buckley, P.E.
(Goodkind & O'Dea, Inc.)

STATE OF CONNECTICUT
LAWRENCE J. BUCKLEY
No. 4130
REGISTERED
PROFESSIONAL ENGINEER

This Phase I Inspection Report on Blue Hills Dam (CT-00496) 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.

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the

condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

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

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

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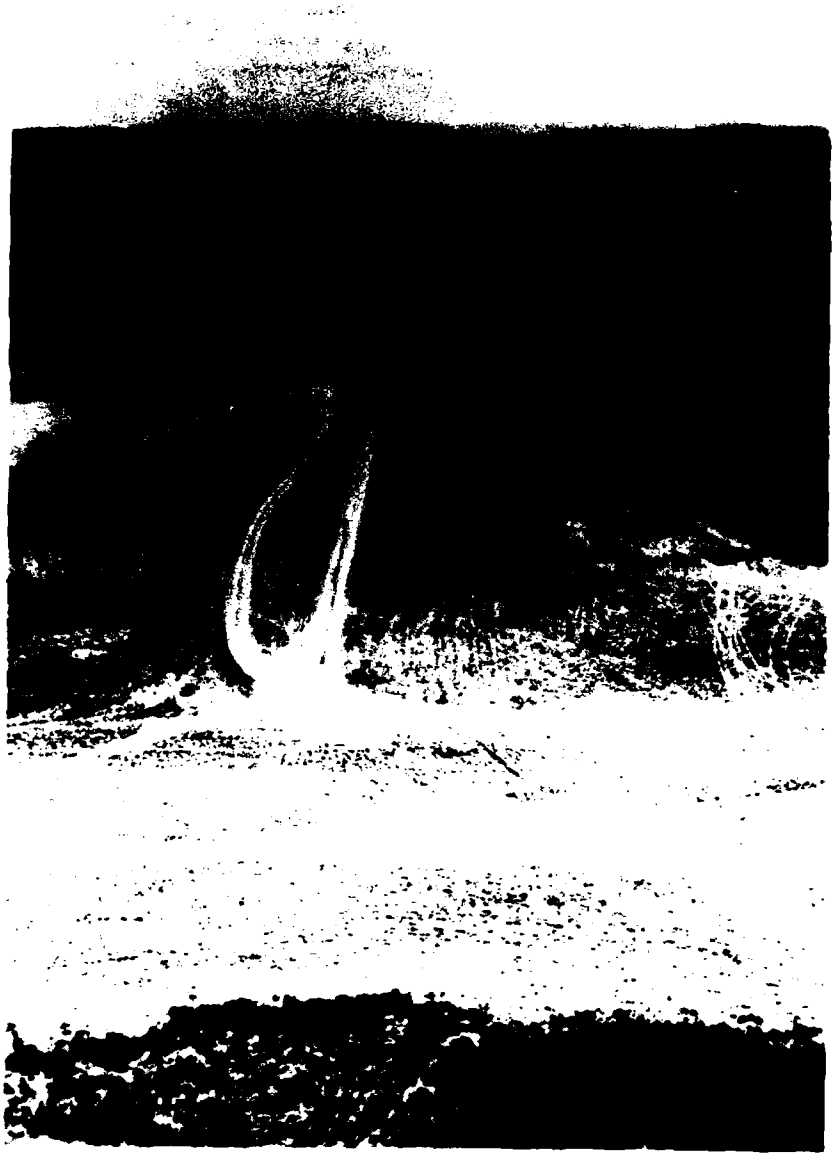
APPENDICES



NOTE:
OVERVIEW PHOTO TAKEN DECEMBER 20, 1980

GOODKIND & O'DEA INC.–SINGHAL ASSOCIATES, JV ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OVERVIEW PHOTO OF DAM

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: NONE	
E.T.K.	W.A.W.	L.A.S.	DATE: MAY, 1981	SHEET 1

NOTE:
OVERVIEW PHOTO TAKEN DECEMBER 20, 1980.

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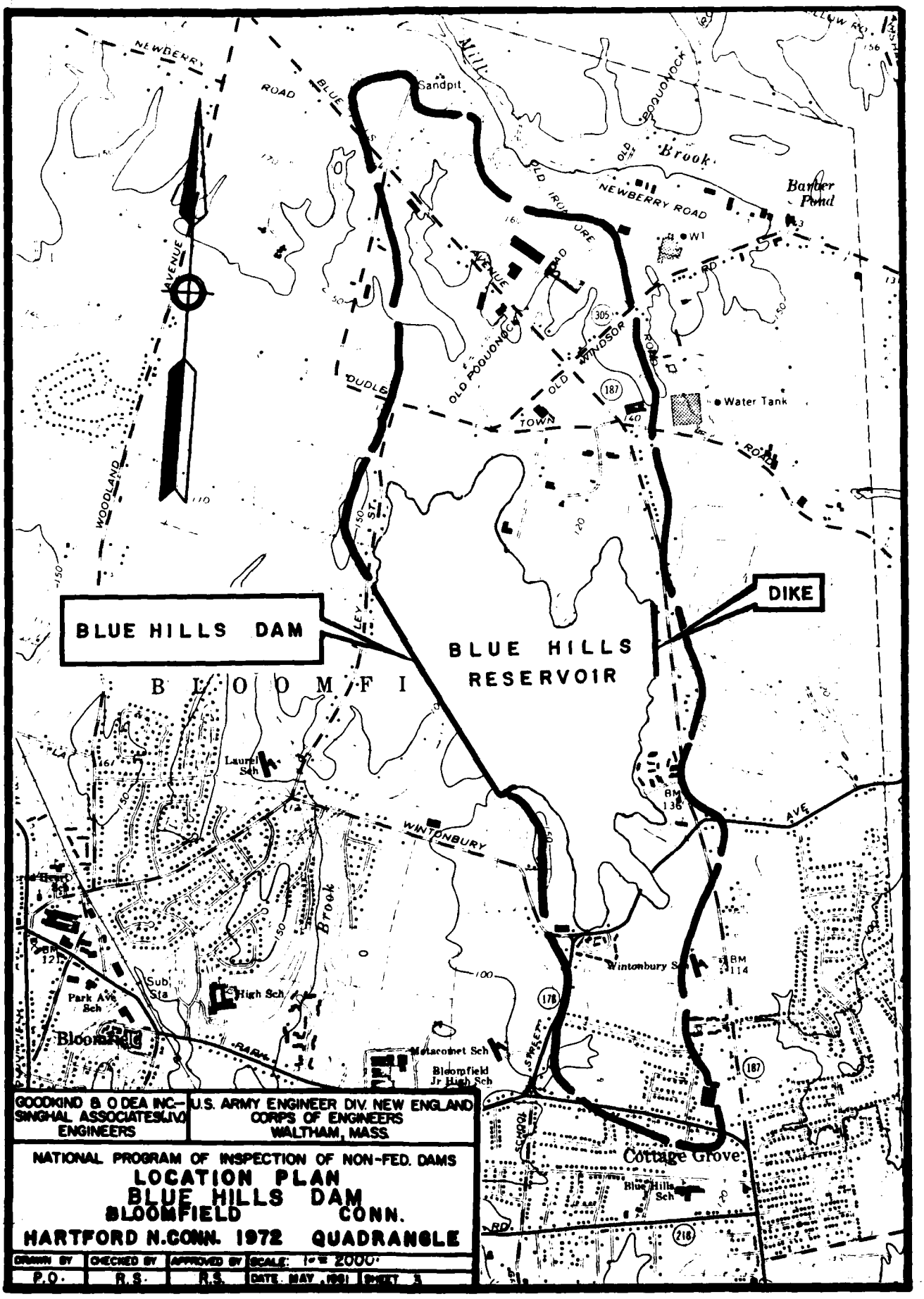
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OVERVIEW PHOTO OF DIKE

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: NONE	
E.T.K.	W.A.W.	L.J.S.	DATE: MAY , 1981	SHEET 2


BLUE HILLS DAM
DIKE
BLUE HILLS RESERVOIR
B L O O M F I
NEWBERRY ROAD
BLUE
Sandpit
Brook
Barber Pond
NEWBERRY ROAD
WOODLAND
AVENUE
DUDLEY
OLD POQUONOCK
WINDSOR
ROAD
OLD TOWN
ROAD
Water Tank
WINTONBURY
AVE
Laurel Sch
Park Ave Sch
High Sch
Sub Sta
Brook
Bloomfield
PARK
Metacomet Sch
Bloomfield Jr High Sch
Wintonbury Sch
BM 114
BM 136
SWEET
SCHOOL
Cottage Grove
Blue Hills Sch
RD
GOODKIND & O'DEA INC.—SINGHAL ASSOCIATES, J.V. ENGINEERS
U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
LOCATION PLAN
BLUE HILLS DAM
BLOOMFIELD CONN.
HARTFORD N.CONN. 1972 QUADRANGLE
DRAWN BY P.O.
CHECKED BY R.S.
APPROVED BY R.S.
SCALE: 1" = 2000'
DATE MAY 1981
SHEET 3

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

PROJECT INFORMATION
Section 1

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. Goodkind of O'Dea, Inc., Hamden, Conn. and Singhal Associates, Orange, Conn. (Joint Venture) have been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Goodkind of O'Dea, Inc. and Singhal Associates (J.V.) under a letter of December 9, 1980 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-81-C-0022 dated December 9, 1980 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

c. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Blue Hills Dam is situated on the easterly branch of Beamans Brook which flows into the North Branch of the Park River, approximately 2.3 miles downstream from the dam. The location is approximately 1.3 miles northeast of the Bloomfield Town Hall and 0.8 miles northwest of the intersection of Wintonbury and Blue Hills Avenues. The geographic location of this site may be found on the Hartford North Quadrangle Map, with coordinates of latitude N41° 50.3' and longitude W72° 42.8'.

b. Description of Dam and Appurtenant Structures

The Blue Hills Reservoir is impounded by a dam and a dike. The dam consists of a grass covered earth embankment approximately 4,045 ft. long with a top width of 12 ft. and upstream and downstream slopes of 3 horizontal to 1 vertical. The top of the dam is at an elevation of 116.1' Metropolitan District Commission Datum (MDC Datum) (2.08 ft. higher than NGVD) with a maximum height of 24.5 ft. A cutoff trench 10 ft. wide and approximately 3 ft. deep is located under the upstream slope. Underlying the downstream dam embankment, there is a 2 ft. thick gravel drainage blanket with a 6" perforated pipe underdrain system. The drainage blanket extends to the toe of the downstream slope under most of the length of the dam.

The dike running parallel to Blue Hills Avenue is a low grass covered earth embankment, 1,450 ft. long, with a top width of 10 ft. and slopes of 3 horizontal to 1 vertical.

The top of the dike is at elevation of 116.1' (MDC Datum) with a maximum height of 6 ft. A 10 ft. wide, 3 ft. deep cutoff trench is centered under the crest of the dike embankment. An 18" BCCM inlet pipe is located near the middle of the dike's run. Accumulated stormwater runoff between the dike and Blue Hills Avenue passes through the pipe which is under the dike embankment into the reservoir area. A top-hinged iron flap gate located at the downstream end of the inlet pipe prevents any impounded stormwater in the reservoir from flowing out. The principal spillway is a drop inlet structure consisting of a two stage reinforced concrete intake riser discharging through a 30" reinforced concrete pipe which runs under the dam embankment. The pipe is 153 ft. long and discharges into the downstream channel which is rip-rapped for a distance of 37 ft. beyond the outlet. The low level inlet of the intake riser is at an invert elevation of 94.0' (MDC Datum) whereas the high level weir inlets are at an elevation of 100.0' (MDC Datum). The intake riser has trash racks at both the low level inlet and the high level weir inlets.

The emergency spillway at the dam is a 210 ft. wide grass trapezoidal channel. At the control section of the spillway the crest elevation is 110.0'(MDC Datum), which is 6.1 ft. below the crest elevation of the dam.

c. Size Classification - 'Intermediate'

According to the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, a dam is classified 'Intermediate' if either the height lies between 40' and 100'

or the storage is between 1,000 ac-ft. and 50,000 ac-ft. The Blue Hills Dam has a maximum height of only 24.5', but the maximum storage to the top of the dam is 2,200 ac-ft. As such, it is classified as 'Intermediate' in size.

d. Hazard Classification - 'High'

Based on the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the hazard classification for the dam is 'high'. A dam failure analysis indicates that a breach of the Blue Hills Dam would result in an instantaneous downstream flood flow of 243,000 cfs causing a 16' high wave of water to travel down in the brook and along its overbanks on both sides. Continuation of the valley flood routing indicates that even as far down as 3,500' from the dam, the excess flow and the wave height are as high as 63,000 cfs and 16' above the bottom of the brook.

The depths of flow in the brook in the vicinity of 47 downstream houses considered (the last one being 3,500 ft. from the dam), range as below:

	Pre-Failure Depth	Post-Failure Depth
First 10 houses:	4.5 ft.	16.0 ft.
Next 21 houses:	4.5 ft.	17.0 ft.
Next 16 houses:	5.0 ft.	16.5 ft.

None of these houses are subject to potential flooding under test flow conditions. In case of dam failure, they will be flooded to depths ranging up to 4 ft. above their first floor elevation.

The dam failure would flood a large number of houses, roads

and public buildings and could result in the loss of more than a few lives, and excessive economic loss on the downstream side.

e. Ownership

The Blue Hills Dam is owned by:

The State of Connecticut
Department of Environmental Protection
State Office Building
165 Capitol Avenue
Hartford, Connecticut 06115
Telephone: (203) 566-7244/7245.

f. Operator

Mr. Victor Galgowski
Superintendent, Dam Maintenance
DEP (Water Resources Unit)
165 Capitol Avenue
Hartford, Connecticut 06115
Telephone: (203) 566-7245

g. Purpose of Dam

The purpose of the dam is for flood control.

h. Design and Construction History

The dam and appurtenant structures were designed in the year 1960 by Anderson-Nichols, Consulting Engineers, Boston/Hartford, under the direction of the U.S. Department of Agriculture, Soil Conservation Service. The construction was completed in 1964. Design report and construction plans are available at the Soil Conservation Service Office in Storrs, Connecticut.

i. Normal Operational Procedures

Blue Hills Dam is a dry dam. The normal operation and maintenance is limited to cutting the grass and brush from the slopes of the dam and dike embankments and cleaning the trash racks at the principal spillway intake riser.

1.3 Pertinent Data

a. Drainage Area

The drainage area consists of 1.90 square miles of flat terrain with an average slope under 1%. Elevations in the basin range from about 100 ft. to 170 ft. MSL. Most of the area is open and inhabited with several town roads and the State Route 187 passing through it.

b. Discharge at Damsite

Two separate discharge spillway facilities exist at the damsite. The principal spillway under the dam consists of a two stage reinforced concrete intake riser and a 153 ft. long 30" reinforced concrete pipe. The emergency spillway is a grassed trapezoidal channel 210 ft. wide at the control section, and located at the south end of the dam.

1.	Outlet works (conduits)	1-30" RCP
	Low level inlet invert elevation:	94.0
	High level weir inlet elevation:	100.0
	Discharge capacity at test flood:	90.0 cfs
	Elevation:	111.8
2.	Maximum known flood at damsite:	Unknown
3.	Ungated spillway capacity at top of dam:	9,400 cfs
	Elevation:	116.1
4.	Ungated spillway capacity at test flood elevation of 111.8:	1,570 cfs
5.	Gated spillway capacity at normal pool elevation of:	N/A
6.	Gated spillway capacity at test flood elevation:	N/A
7.	Total spillway capacity at test flood elevation of 111.8:	1,570 cfs

8.	Total project discharge at top of dam:	9,400 cfs
	Elevation:	116.1
9.	Total project discharge at test flood:	1,570 cfs
	Elevation:	111.8

c. Elevation - Feet above MDC Datum. (2.08' higher than NGVD)

1.	Stream bed at toe of dam:	91.6 (downstream channel)
2.	Bottom of cutoff:	93.0 (varies)
3.	Maximum tailwater:	N/A
4.	Normal pool:	N/A
5.	Full flood control pool:	110.0
6.	Spillway crest:	
	Emergency	110.0
	Principal (High level weir inlet)	100.0
7.	Design surcharge (original design)	112.4 (design highwater)
8.	Top of dam	116.1
9.	Test flood surcharge:	111.8

d. Reservoir - Length in feet

1.	Normal pool:	N/A
2.	Flood control pool:	5,800 ft.
3.	Spillway crest pool:	
	Emergency spillway	5,800 ft.
	Principal spillway (High level weir inlet)	1,400 ft.
4.	Top of dam:	8,200 ft.
5.	Test flood pool:	7,200 ft.

e. Storage - Acre-Feet

1. Normal pool:	N/A
2. Flood control pool:	700 ac-ft.
3. Spillway crest pool:	
Emergency spillway	700 ac-ft.
Principal spillway (high level weir inlet)	25 ac-ft.
4. Top of dam:	2,200 ac-ft.
5. Test flood pool:	1,050 ac-ft.

f. Reservoir surface - Acres

1. Normal pool:	N/A
2. Flood control pool:	175 acres
3. Spillway crest pool:	
Emergency spillway	175 acres
Principal spillway (high level weir inlet)	5 acres
4. Top of dam:	365 acres
5. Test flood pool:	220 acres

g. Dam

	Dam	Dike
1. Type:	Earth Embankment	Earth embankment
2. Length:	4,045 ft.	1,450 ft.
3. Height:	24.5 ft.	6.0 ft.
4. Top width:	12.0 ft.	10.0 ft.
5. Side slopes:	3 Hor. to 1 Ver. for both U/S and D/S slopes	Same as dam
6. Zoning	Zone A: U/S shell: compacted impervious fill. Zone B: Core and D/S shell: compacted fill (non-plastic sandy silt or silty fine sands)	Zone A: U/S shell and core: Compacted impervious fill. Zone B: Core and D/S shell: compacted fill.

		Dam	Dike
7.	Impervious core:	N/A	Compacted impervious fill
8.	Cutoff:	10 ft. wide, 3 ft. deep cutoff trench.	10 ft. wide, 3 ft. deep cutoff trench
9.	Grout curtain:	N/A	N/A
10.	Other	2' thick drainage blanket and 6" perforated pipe underdrain system	N/A

h. Diversion and Regulating Tunnel — N/A

i. Spillway

		Principal Spillway	Emergency Spillway
1.	Type:	Drop inlet structure consisting of a two stage reinforced concrete intake riser w/30" reinforced concrete pipe	Grassed trapezoidal channel
2.	Length of crest:	15 ft. (high level inlet weirs)	210 ft. (at control section)
3.	Crest elevation (MDC Datum) w/flashboards:	N/A	N/A
	wo/flashboards:	100.0 (high level weir inlets)	110.0
4.	Gates	N/A	N/A
5.	Upstream channel	Natural channel & relocated brook	N/A
6.	Downstream channel	Excavated channel w/ 37 ft. length rip-rapped at outlet	N/A
7.	General	N/A	N/A

j.	Regulating Outlets:	The only outlet is the unregulated principal spillway. (See Section 1-3-i, page 1-9)
k.	Inlet Pipe	
	1. Type:	18" BCCM inlet pipe with top-hinged flap gate on the outlet end. Located under dike embankment.
	2. Invert (MDC Datum) upstream: downstream:	 110.0 109.8
	3. Size:	18" BCCM Pipe
	4. Control Mechanism:	Iron flap gate hinged to the top of the outlet end of the pipe.

ENGINEERING DATA
Section 2

2.1 Design Data

A comprehensive design report prepared in 1960 and entitled "North Branch Park River Watershed Protection Project, Design Report, Site No. 2, Bloomfield, CT." is available. The design report includes hydrologic and hydraulic data and computations soil borings, soil laboratory test data, dam stability analysis and seepage analysis.

2.2 Construction Data

"As-Built" drawings entitled "North Branch Park River Watershed Protection Project, Floodwater Retarding Structure, Site No. 2, Blue Hills Dam" are available. These drawings have been reviewed and found to show good agreement with the visual inspection. Certain details have been copied from the "As-Built" drawings provided by the U.S. Department of Agriculture, Soil Conservation Service in Storrs, Connecticut and are included in Appendix B.

2.3 Operational Data

Normally a pool does not exist and water level readings are not taken at any specified intervals. According to the owner, water levels have never risen to the level of the emergency spillway crest. No formal operation records are known to exist.

2.4 Evaluation of Data

a. Availability

Available existing data was provided by the State of Connecticut Department of Environmental Protection who are the

owners and the U.S. Soil Conservation Service who designed and constructed the dam. Location of the available data is given in Appendix B.

b. Adequacy

The engineering data available, when coupled with visual inspection, was generally adequate to perform an assessment of the dam.

c. Validity

A comparison of record data and visual observation reveals no significant discrepancies in the record data.

VISUAL INSPECTION
Section 3

3.1 Findings

a. General

The formal field inspection took place December 15, 1980 by engineers from Goodkind & O'Dea, Inc., and Singhal Associates. Detailed checklists, which are included in Appendix A, were utilized for the inspection of the dam, dike and spillways. During the visual inspection, photographs showing the dam features and problem areas were also taken. These photographs, along with the photo location plans, are given in Appendix C.

The general condition of the project was good as assessed by the visual inspection; however, the inspection did reveal some areas requiring maintenance work and/or monitoring or needing further study.

The reservoir area was dry at the time of the inspection.

b. Dam

The dam is a grass-covered, earthfill embankment with a gravel drainage blanket underlying the downstream slope. The dam alignment was good with no sign of vertical or horizontal movement as shown in Photos 1, 2 and 3. Some moderate vehicular rutting was observed along the crest of the dam embankment, which was covered by a well developed, stable growth of grass (See Photos 2 & 3). Minor erosion associated with the rutting along

the dam crest was observed on the embankment slopes as noted on the general dam plan in Appendix B. There was also evidence of some moderate vehicular trespassing along the downstream slope and toe of the dam embankment as shown by the wheel tracks in Photo 2.

Standing water was observed in the vicinity of the seepage drain outlet nearest the emergency spillway as shown on the general dam plan in Appendix B. The ground in the area of the standing water was soft, with some cattail growth, indicating that this wet condition may be year-round (See Photo 4). The outlet of the pipe was covered with earth and/or water and could not be located and, therefore, was not inspected.

The two seepage drain outlets at the principal spillway contained between 2 and 3 inches of moist silt, whereas the other outlet at the north end of the dam was clean and dry. Minor brush growth was noted along the slopes of the ditch running along the downstream embankment toe.

c. Appurtenant Structures

Principal Spillway

The normal flow of the brook and the impounded storm-water runoff is carried through the dam embankment by the principal spillway which primarily consists of a two stage concrete intake riser and a 30" reinforced concrete pipe (Photo 6 & 7). The concrete of the intake riser was in good condition with no visible cracking or spalling. Some minor accumulation of debris was observed in front of the trash rack which was missing one bar (Photo 6). The channel and side ditch, upstream of the intake

structure, were clean with minor brush growth along the side slopes (See Photo 5).

The reinforced concrete discharge pipe was clean with some minor exterior concrete spalling at the outlet end (Photo 7). Under the concrete cradle which supports the pipe, a small scour pocket, approximately 6 inches deep was noted. The rip-rapped area downstream of the outlet appeared stable with no sign of failure.

Emergency Spillway

The grass-lined spillway just south of the dam embankment was generally in good condition (See Photo 1). Minor rutting caused by vehicular trespassing was observed along the south cut slope of the spillway and on the floor of the discharge channel as shown in Photo 9. The three drainage ditches located along the floor of the approach channel were stable with no detrimental erosion.

Dike

The grass-covered earthfill dike embankment was generally in good condition with good alignment and stable slopes. Where the utility service road crossed the dike, a depressed area lacking vegetative cover was observed as noted on the general dike plan in Appendix B. Tire ruts were observed along the entire crest of the dike with heavy rutting at the north end. Moderate brush growth along the slopes at the north end of the dike was also noted as shown in Photo 10. There was no evidence of any downstream seepage; however, since the reservoir was dry, no conclusive determination could be made.

The 18" corrugated pipe which passes through the dike embankment was clean and in good condition. The top-hinged flap gate located on the reservoir end of the pipe was also in good working condition.

d. Reservoir Area

The reservoir, which was dry at the time of the inspection, primarily consists of open grass fields and wooded areas, with a few residential homes bordering it.

e. Downstream Channel

The channel just downstream from the principal spillway was clean with some minor brush growth along the slopes (Photo 8). The downstream channel area is flat and mostly undeveloped.

3.2 Evaluation

The general condition of the dam and appurtenant structures is good, based upon the visual inspection. The following features could influence the future condition and/or stability of the structure.

1. Continued vehicular traffic along the dam and dike embankments and emergency spillway could lead to erosion problems.
2. Further erosion of the dam embankment may result in decreased structural stability, especially in the vicinity of the principal spillway.
3. The year-round wet condition in the area of the seepage drain outlet nearest the emergency spillway may lead to slope sloughing and structural instability.

4. Additional siltation of the outlet seepage drain at the principal spillway may lead to the stoppage of seepage flow through the drainage blanket.
5. The additional accumulation of debris at the trash rack on the intake riser could result in a serious decrease of flow through the principal spillway and a build-up of water in the reservoir area.
6. The absence of one trash rack bar may lead to the accumulation of debris in the intake riser and outlet pipe.
7. Increased brush growth along the slopes of the downstream channel and ditches will result in decreased channel flow capacity.
8. The depressed and raw earth area on the dike crest may lead to erosion and deterioration of the dike embankment.
9. Additional brush growth on the dike embankment slopes could result in decreased structural stability due to increased root development.
10. Increased scouring under the concrete cradle may lead to serious undermining of the 30" outlet pipe.

The dam is a flood control project and, therefore, the reservoir is dry except during periods of heavy rainfall. With the reservoir dry, the inspection could not reveal seepage conditions. Thus, this inspection cannot in any way evaluate the seepage conditions that may exist when water is impounded in the reservoir.

OPERATIONAL AND MAINTENANCE PROCEDURES
Section 4

4.1 Operational Procedures

a. General

There are no operational procedures such as dam surveillance or reservoir level readings at this time. The spillways were designed to be uncontrolled and, therefore, do not have any operational procedures.

b. Description of any Warning System in Effect

There are no warning systems in effect.

4.2 Maintenance Procedures

a. General

The Town of Bloomfield leases the Blue Hills Reservoir area from the State of Connecticut Department of Environmental Protection and is responsible for general maintenance. A copy of the lease is available from the State of Connecticut Department of Environmental Protection, or the Town of Bloomfield.

The Town mows the dam and dike embankments and the emergency spillway semi-annually, whereas the upstream and downstream channels are generally cleaned and cleared of debris and brush annually. The grass fields within the reservoir area are mowed annually by a private farmer.

The dam is inspected annually by representatives from the State of Connecticut Department of Environmental Protection, the U.S. Soil Conservation Service and the Town of Bloomfield. A copy of the latest inspection report is included in Appendix B.

b. Operating Facilities

Although the Town of Bloomfield leases the reservoir area, the State of Connecticut Department of Environmental Protection has charge of the construction, operation, and structural repair of the flood control works.

4.3 Evaluation

The operational and maintenance procedures are generally satisfactory but there are areas requiring improvement. A formal operational procedure with continuing records and a downstream emergency warning plan should be developed by the State of Connecticut Department of Environmental Protection. A formal maintenance procedure with continuing records should also be developed by the State of Connecticut Department of Environmental Protection with the Town of Bloomfield to insure the continued safety of the dam. A list of recommended procedures for the operation and maintenance of the dam is given in Section 7.

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES
Section 5

5.1 General

Blue Hills Reservoir was created along with three others in the Bloomfield, Connecticut area in 1974 to reduce potential flooding in the watershed area of the North Branch of the Park River. Detailed designs were prepared for the U.S. Department of Agriculture, Soil Conservation Service by Anderson-Nichols, Consulting Engineers.

The reservoir has a contributory watershed area of 1.90 square miles which is practically flat with an average slope under 1%. Most of this area is developed, having a good number of town and state roads, houses and other buildings spread over it.

The Blue Hills Dam is a 4,045 ft. long earth embankment with a maximum height of 24.5 Ft. It consists of a compacted core, a drainage blanket, a cutoff trench, and a seepage drain system. There is a two stage reinforced concrete intake riser with the 30" reinforced concrete pipe outlet acting as the principal spillway, and a trapezoidal grassed channel, 210 ft. wide at the control section, serving as the emergency spillway. The combined spillway capacity is 9,400 cfs before overtopping of the dam occurs. The spillway capacity at the routed test flood elevation of 111.8'MDC Datum is 1,570 cfs. The crest elevation of the dam is 116.1'MDC Datum, which is 6.1 ft. higher than the emergency spillway crest elevation of 110.0'MDC Datum.

5.2 Design Data

Detailed plans, the as-built drawings, and the original design report prepared by Anderson-Nichols, Consulting Engineers, are available at the Soil Conservation Service office in Storrs, Connecticut. These documents contain the necessary design data. It appears that some changes were made at the time of construction. Particularly noticeable were the width of the emergency spillway at the control section which was changed from 150 ft. to 210 ft., and the design high water elevation changed from 114.1' to 112.4 'MDC Datum. The original design test flood inflow for Blue Hills Dam was 7,535 cfs. and the routed outflow was 1,455 cfs. The original design high water elevation in the reservoir was set at 114.1 'MDC Datum, giving a freeboard of 2.0 ft.

5.3 Experience Data

There are no known records of reservoir levels during the times that water has been impounded at Blue Hills Dam.

5.4 Test Flood Analysis

Based on the dam failure analysis, the dam is classified as being 'High' hazard potential in accordance with Table 2, on page D-9 of the Corps of Engineers Recommended Guidelines for Safety Inspection of Dams. The test flood should be equal to the probable maximum flood (PMF) which was accordingly adopted for analysis.

An inflow flood peak of runoff was calculated for the 1.90 square miles watershed area using the guide curves for "flat and coastal" terrain, supplied by the Corps of Engineers. The peak flow of 950 cfs per square miles (csm) was read from the curve which gave the PMF as 950 x 1.90 = 1,800 cfs.

A triangular hydrograph was constructed, using the methodology given in the "Hydrology, Section 4, Soil Conservation Service National Engineering Handbook". The peak inflow rate of 1,800 cfs and a total runoff of 19.0" for the PMF were used to construct the inflow hydrograph.

The flood was then routed through the reservoir, assuming an initial water elevation of 110.0 ft MDC Datum, which was at the crest of the emergency spillway control section.

The test flood produced a maximum outflow discharge of 1,570 cfs which is far below the maximum spillway capacity of 9,400 cfs which is 600% of the former. The peak flood test pool elevation of 111.8 ft. MDC Datum results in a 4.3 ft. freeboard to the top of dam.

5.5 Dam Failure Analysis

A dam failure analysis was made using the guidelines provided by the Corps of Engineers. Failure of the dam was assumed with water level at the test flood pool elevation of 111.8 ft. MDC Datum and a prefailure routed outflow of 1,570 cfs. Assuming a dam breach size of 20 ft. high and 1,620 ft. wide (40% of dam length), the peak release rate into the downstream valley was 243,000 cfs.

The height of the flood wave came out to be approximately 16 ft. at the first cross-section (sta. 18+00). Three cross-sections were analyzed, the last one being 3,500 ft. downstream from the dam. Flood routing computations were done taking into consideration the available valley storage. The resulting flood elevations and the values of the routed flood flows are shown

in Appendix D. Although the flood flow goes down to 63,000 cfs at the last cross-section, the valley slope is very flat and the flood wave height was found to be about 16 ft. at this location. A large number of buildings and several streets will be flooded as a result of dam breach.

The depths of flow in the brook in the vicinity of 47 downstream houses considered (the last one being 3,500 ft. from the dam), range as follows:

	Pre-Failure Depth	Post Failure Depth
First 10 houses:	4.5 ft.	16.0 ft.
Next 21 houses:	4.5 ft.	17.0 ft.
Next 16 houses:	5.0 ft.	16.5 ft.

None of these houses are subject to potential flooding under the test flow condition. In case of dam failure, they will be flooded to depths which range up to 4 ft. above their first floor elevation.

The dam is classified as 'High' hazard potential. Its failure could result in loss of more than a few lives and excessive economic loss.

Dam breach computations are shown in Appendix D.

EVALUATION OF STRUCTURAL STABILITY
Section 6

6.1 Visual Observation

The visual inspection revealed no apparent structural stability problems; however, two areas of concern were noted.

Standing water at the seepage drain outlet nearest the emergency spillway poses a concern. The cattails and standing water at the outlet indicate that this wet condition may be year-round, even though the reservoir is normally dry. This outlet is located at what appears to have been the prior path of a small stream which was relocated along the upstream side of the dam embankment. A drainage channel may exist under the dam embankment from the stream in the reservoir area to the underdrain outlet. Such a drainage path could endanger the dam stability, especially during periods of heavy rainfall.

The rutting on top of the embankments has resulted in minor slope erosion. Such rutting, if allowed to continue, could cause serious erosion damage. The water in the ruts tends to accumulate at low spots and flow down the embankment slopes in concentrated gullies.

The reservoir was dry at the time of inspection; therefore, any seepage that may exist when water is impounded in the reservoir could not be observed.

6.2 Design and Construction Data

A review of the available data indicates that the dam and dike were adequately designed for structural stability.

6.3 Post Construction Changes

The available data does not indicate any post construction changes.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 1, and in accordance with Corps of Engineers' guidelines does not warrant further seismic analysis at this time.

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES
Section 7

7.1 Project Assessment

a. Condition

Based upon the visual inspection of the site, review of available data and past performance, the project appears to be in good condition. No evidence of structural instability was observed. The dam, dike and spillway are generally in good condition with areas of some concern requiring further study, or maintenance and/or monitoring.

Any structural instability that might occur due to seepage when the reservoir contains floodwater could not be evaluated due to the dry condition of the reservoir.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978, peak inflow to the lake is 1,800 cfs; peak outflow is 1,570 cfs with the water level 4.3 feet below the dam crest. Based upon our hydraulic computations, the spillway capacity with the pool level to the top of dam is 9,400 cfs , which is equivalent to approximately 600% of the routed test flood outflow.

b. Adequacy of Information

The information available is such that an assessment of the condition and stability of the project can be made.

c. Urgency

It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within two years of the owner's receipt

of this report.

7.2 Recommendations

It is recommended that the owner employ a qualified registered engineer to:

1. Inspect the dam during the time that water is impounded in the reservoir with particular attention to locating any possible seepage.
2. Determine the origin and significance of the standing water at the seepage drain outlet nearest the emergency spillway.
3. Design a permanent surface on the dike embankment at the utility service road crossing capable of carrying traffic without rutting or eroding.

The owner should implement the recommendations of the engineer.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

The following measures should be undertaken within the time period indicated in Section 7.1.c., and continued on a regular basis.

1. Surveillance should be provided by the owner during periods of unusually heavy precipitation and high discharge. The owner should develop and implement a downstream warning system to be used in case of emergencies at the dam or dike.
2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. A comprehensive program of inspection by a registered professional engineer qualified in dam inspection should be instituted on a biennial basis.
4. Remove brush from upstream and downstream ditches at dam. Remove brush from upstream and downstream channel within 30 feet of toe of slope of dam.
5. Remove brush from the crest, slopes and within 10 ft. of the toe and heel of the north portion of the dike.
6. Remove debris and replace missing rod at trash rack.
7. On the emergency spillway, fill in minor erosion gullies and vehicular scars and reestablish sod and vegetation.
8. Expose and/or clean out outlet seepage drains, where required.
9. Fill in ruts and minor erosion gullies on the dam and dike embankments and reestablish sod and vegetation.
10. Fill in the small scour pocket under the 30" outlet pipe.

7.4 Alternatives

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Blue Hills Dam

DATE 12/15/80

TIME Morning

WEATHER Sunny, 20s

W.S. ELEV. _____ U.S. _____ DN.S.

PARTY:		DISCIPLINE:
1. Ramesh Singhal	(RS)	Hydraulics
2. Ed Henderson	(EH)	Geotechnical
3. Wesley J. Wolf	(WW)	Hydraulics
4. Gerald F. Buckley	(GB)	Soils & Structures
5.		

PROJECT FEATURE	INSPECTED BY
1. Dam Embankment (Earthfill)	RS, EH, WW, GB
2. Principal Spillway - Intake Riser	RS, EH, WW, GB
3. Principal Spillway - Outlet	RS, EH, WW, GB
4. Emergency Spillway	RS, EH, WW, GB
5. Dike Embankment (Earthfill)	RS, EH, WW, GB
6.	
7.	
8.	
9.	
10.	

PERIODIC INSPECTION CHECK LIST

PROJECT Blue Hills Dam DATE 12/15/80

PROJECT FEATURE Earth Fill Dam NAME RC, EH, WW, GB

DISCIPLINE _____ NAME _____

AREA ELEVATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	116.1 ± MDC Datum
Current Pool Elevation	No Pool - Dry Dam
Maximum Impoundment to Date	Unknown
Surface Cracks	None Observed
Pavement Conditions	N/A
Movement or settlement of crest	None Observed (Vehicle Ruts)
Lateral movement	None Observed
Vertical alignment	Looks Good
Horizontal alignment	Looks Good
Conditions ~~at abutment &~~ at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Moderate
Sloughing or Erosion of Slopes ~~or Abutments~~	Minor Erosion
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	None Observed
Unusual Embankment or Downstream Seepage	Only at One Underdrain Outlet.
Piping or Boils	None Observed (Dry Dam)
Foundation Drainage Features	One Outlet Covered, Two Partially Full of Silt
Toe Drains	Same
Instrumentation System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Blue Hills Dam DATE 12/15/80

PROJECT FEATURE Intake Riser & Channel NAME RS, EH, WW, GB

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Natural & Brook Relocation
Slope Conditions	Some Brush
Bottom Conditions	Some Brush
Rock Slides or Falls	None
Log Boom	N/A
Debris	Minor at Intake Structure
Condition of concrete lining	N/A
Drains or Weep Holes	N/A
b. Intake Structure	Concrete Riser for Pipe
Condition of Concrete	Good
~~Stop Logs and~~ Slots	Minor Debris at Trash Rack One Bar from Trash Rack is Missing.

PERIODIC INSPECTION CHECK LIST

PROJECT Blue Hills Dam DATE 12/15/80

PROJECT FEATURE Outlet Channel NAME RC, EH; WW, GB

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	No Outlet Structure, Flow Discharges from Pipe onto Rip-Rap
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Dondition at Joints	
Drain Holes	
Channel	Excavated Outlet Channel
Loose Rock or Trees Overhanging Channel	Little Brush on edge
Condition of Discharge Channel	Satisfactory - Very Minor Bank Erosion

PERIODIC INSPECTION CHECK LIST

PROJECT Blue Hills Dam DATE 12/15/80

PROJECT FEATURE Emergency Spillway NAME RS, EH, WW, GB

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel (Before Crest)	
General Condition	Good - Some Vehicle Marks
Loose rock overhanging channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Good
b. Weir and trailing walls	
General Condition of Concrete	N/A
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel (After Crest)	
General Condition	Good - Minor Vehicle Marks
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Good - Minor Vehicle Marks
Other Obstructions	None

* Note: Emergency Spillway is Grass Covered Earth

PERIODIC INSPECTION CHECK LIST

PROJECT Blue Hills Dam DATE 12/15/80

PROJECT FEATURE Earthfill Dike NAME EH, EG, GB, WW

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	116.1 ± MDC Datum
Current Pool Elevation	None - Dry Dam
Maximum Impoundment to Date	Unknown
Surface Cracks	None Observed
Pavement Conditions	N/A
Movement or settlement of crest	Settlement at Utility Access Road over Road. Ruts along crest.
Lateral movement	None Observed
Vertical alignment	Depression at Utility Access Road
Horizontal alignment	Looks Good
Conditions at abutment & at Concrete Structures	N/A
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	Minor
Sloughing or Erosion of Slopes ~~or Abutments~~	Very Minor Erosion by Water from Wheel Ruts
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	None Observed
Unusual Embankment or Downstream Seepage	None Observed (Dry Dam)
Piping or Boils	None Observed (Dry Dam)
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

APPENDIX B

ENGINEERING DATA

ENGINEERING DATA CHECKLIST

ITEM	AVAILABILITY	LOCATION
LOCATION MAP	Available	Metropolitan District Commission, Hartford, CT
AS-BUILT DRAWINGS	Available	U.S. Soil Conservation Service Storrs, CT.
HYDROLOGIC & HYDRAULIC DATA	Available in Design Report	
SOIL BORINGS	Available in Design Report	
SOIL TESTING	Available in Design Report	
GEOLOGY REPORTS	Available in Design Report	
CONSTRUCTION HISTORY	Not Available	
OPERATION RECORDS	Not Available	
INSPECTION HISTORY	Available	State of Connecticut Department of Environmental Protection
DESIGN REPORT	Available	U.S. Soil Conservation Service Storrs, CT.
DESIGN COMPUTATIONS		
HYDROLOGIC & HYDRAULIC	Available in Design Report	
DAM STABILITY	Available in Design Report	
SEEPAGE ANALYSIS	Available in Design Report	

DESIGN REPORT

NORTH BRANCH PARK RIVER
WATERSHED PROTECTION PROJECT
RETARDING STRUCTURE - SITE NO. 2
BLUE HILLS DAM
BLOOMFIELD, CONNECTICUT

The site of this proposed floodwater retarding structure is located approximately 1. 3 miles northeast of Bloomfield Town Hall and 0. 8 miles northwest of the intersection of Wintonbury and Blue Hills Avenues. The dam is situated on the easterly branch of Beamans Brook, a tributary of the North Branch of Park River.

The geographic location of this site may be found on the Metropolitan District Geodetic and Topographical Survey Sheet 235, published by the Commission on Regional Planning, Hartford County, Connecticut, by scaling 4. 1 inches north (latitude 41° 50' 23. 1" north) and 6. 3 inches west (longitude 72° 42' 46. 8" west) from the lower right-hand corner of the sheet. Sheet 5 of this report is an overlay which when placed on the appropriate latitude and longitude of the Metropolitan District Geodetic and Topographical Sheet 235 will locate the proposed dam.

This dam, designed as a class "C" structure, has a watershed of 1,215 acres. It is to be constructed of compacted earthfill on a foundation of non-plastic medium dense silts and silty fine sands. The principal spillway will be a single stage drop inlet spillway with a reinforced concrete pipe 30 inches in diameter and a reinforced concrete riser with 2. 5 ft. x 7. 5 ft. inside dimensions. It will rest on a foundation of sandy silts and fine sands.

Am emergency spillway with a base width of 150 feet and crest elevation at 112. 0 feet (MDD) will also be provided. The maximum velocity at the control section of the emergency spillway will be 6. 03 feet per second for the design flood. The frequency of use will not exceed a one percent chance.

A rectangular low flow orifice, 1 ft. x 2.5 ft., will be provided in the face of the riser to pass base flow of the stream and maintain a "dry" sediment pool. The invert elevation of the low flow orifice is set at 96.0 feet (MDD) on the assumption that the accumulation of sediment will be negligible in the vicinity of the principal spillway. The crest of the riser is set at elevation 100.0 feet (MDD). The riser was used to provide a simple means of Vortex Control and to facilitate the construction of an adequate trash rack.

The drawdown time was computed to be 7.19 days from the crest of the emergency spillway to the crest of the riser.

This is to be a dry reservoir (no permanent pool) but a drainage blanket with a toe drain is provided.

The flood routing procedure used in the design is described in Engineering Handbook, Section 5, Hydraulics, U. S. Department of Agriculture, Soil Conservation Service.

The flood routing procedure was used to determine the maximum stages shown in the table on page 3.

Factor Which Determines Stage	Surface Area Acres	Runoff in Inches	Peak Inflow CFS	Elev. of Max. Stage Ft. 1/	Storage Ac. Ft.	Element of Structure Determined by Maximum Stage
	--	--	--	96.0	--	Invert of low-flow orifice
	6.	--	--	100.0	--	Crest of Riser
Project Storm (Prin. Spwy. Design)	237	12.0	3100	112.0	1098	Crest of Emergency Spillway
1.75x 6 hr. point rainfall, moisture condition III (Emer. Spwy. Design)	291	15.84	7535	114.1	1640	Design Highwater
2.5 x 6 hr. point rainfall, moisture condition II (Freeboard Design)	302 348 2/	19.6 --	9850 --	114.4 116.1 2/	1730 2180	Top of Dam

1/ Referred to Metropolitan District Datum

2/ Determined on the basis of State criteria requiring a minimum freeboard of two feet above design highwater elevation.

The reinforced concrete design procedure was based on Engineering Handbook, Section 6, Structural Design U. S. Department of Agriculture, Soil Conservation Service. The data used were for Class B concrete as described in this publication.

Hazard Classification

The dam site is located about 5 to 6 miles upstream from the business center of Hartford, Connecticut. The area to be protected from inundation by the reservoir is well developed and includes a complex of residential, commercial and industrial properties.

These conditions, under Soil Conservation Service Class definitions, place the structure as Class C.

Anderson-Nichols & Company

Subject: Design of Flood Control Dams
Pine River Structure #
Site No. 2 Elve Hill Dam

Date
Computed GEH 11-8-60
Checked

Job No. C-[illegible]

Basic Data for Hydrograph

1 Soil-Cover Complex Numbers

a For Principal Spillway Hydrograph, Moisture Condition II Curve Number 85.

b For Emergency Spillway Design Hydrograph, Soil Conservation Service Criteria point use of Moisture Condition II with Curve No 85. However, a letter from the Connecticut Water Resources Commission, dated April 30 1959 to John J Mezochi specifies that in determining this hydrograph the rate of retention or total precipitation "loss" may not exceed 0.25 inches per hour. In order to satisfy this Condition the Curve No. is raised to 88

c. For Emergency Spillway Freeboard Hydrograph, Moisture Condition II. Curve No. 67.

2 Time of Concentration

Overland Flow: distance about 1400 ft. slope 1.5 %
velocity taken = 0.6 fps

$$\text{Time} = \frac{1400}{0.6} = 2340 \text{ sec}$$

Channel Flow: distance 11 000 ft
Av. slope 0.0045, $S^{1/2} = 0.067$
$n = 0.04$
Av. hydraulic radius about 1.75 ft
$r^{2/3} = 1.45$

$$V = \frac{1.49}{.04} \times 1.45 \times .067 = 3.6 \text{ fps}$$

$$\text{Time} = \frac{11\,000}{3.6} = 3060 \text{ sec}$$

Total time 5400 sec = 1.50 hrs - Time used in hydrograph computations ✓

Anderson-Nichols & Company

Subject Design of Two Earth Park River Structures
Site No. 2 Blue Hills Dam

Date 1-27-60
Computed RJA
Checked [illegible] 2-9-60

JOB No. C-1432

Basic Data for Hydrographs Continued

3. Storm Rainfall and Duration

a. Emergency Spillway Hydrograph
Point rainfall – 14.75 in
Areal rainfall – 13.91 in.
Duration – 19 hrs.

b. Emergency Spillway Design Hydrograph
Duration 6 hr.
6 hr. point rainfall – from SCS-NEH-4, Sup. A, Fig. 3.21-I; 10.6 in.
6 hr. rainfall – for duration = 1.75 × 10.6 = 18.55 in.
Areal rainfall = 0.936 × 18.55 = 17.34 in.

c. Emergency Spillway Freeboard Hydrograph

Duration 6 hr.
6 hr. point rainfall (same as above) = 10.6 in.
6 hr. " " – for hydrograph = 2.5 × 10.6 = 26.5 in.
Areal rainfall = 0.936 × 26.5 = 24.78 in.

Sediment Storage Computation

Basis – Rate of accumulation in reservoir 0.1 ton per acre of drainage area per year.

Dr. Area = 1.90 sq mi = 1215 acres

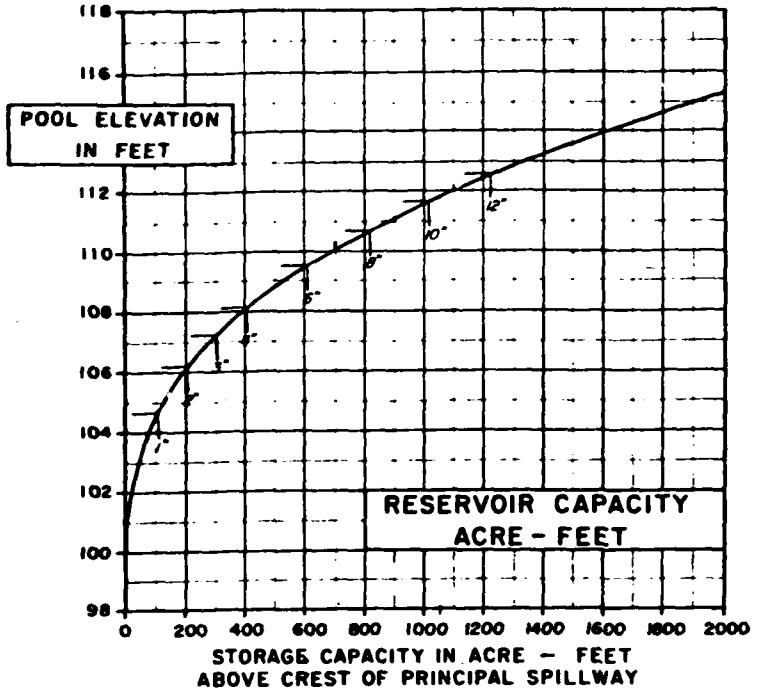
50 yr. acc. = 0.1 × 1215 × 50 = 6075 tons

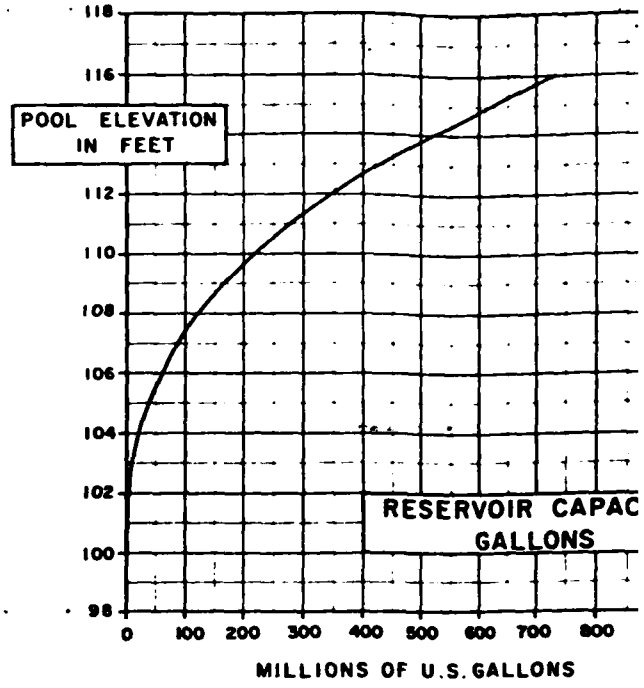
Dry unit weight = 90 lb per cu. ft

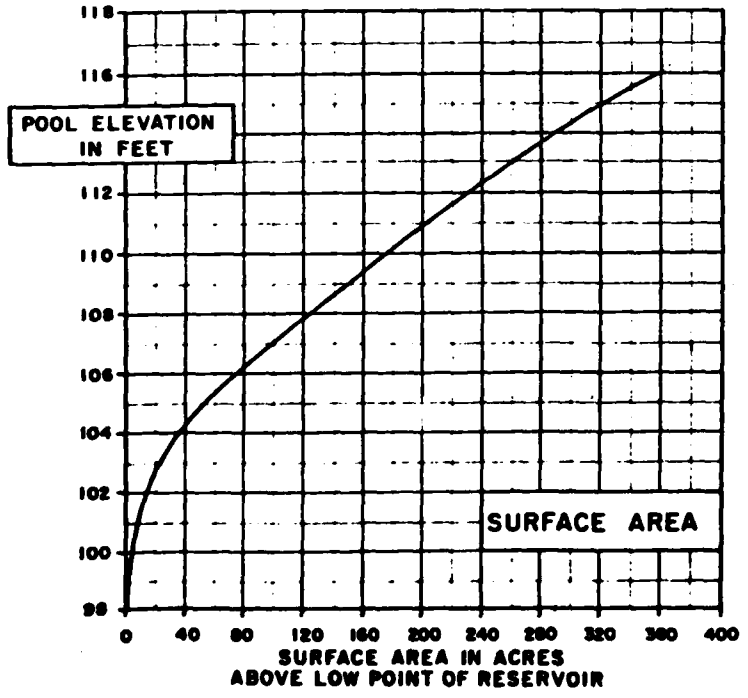
$$\text{50 yr. acc. volume} = \frac{6075 \times 2000}{90 \times 43\,560} = 3.10 \text{ ac. ft.}$$

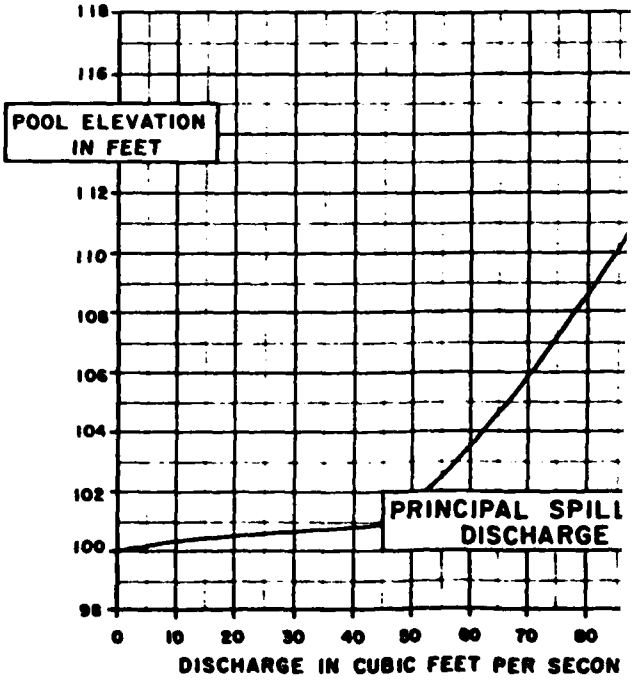
RESERVOIR OPERA

BLUE HILLS RESERVOIR - BEAMAN'S BROOK - NO



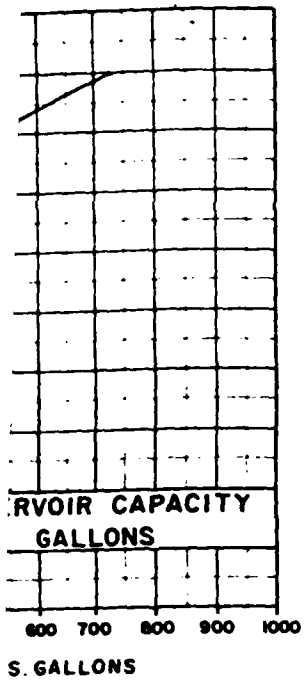


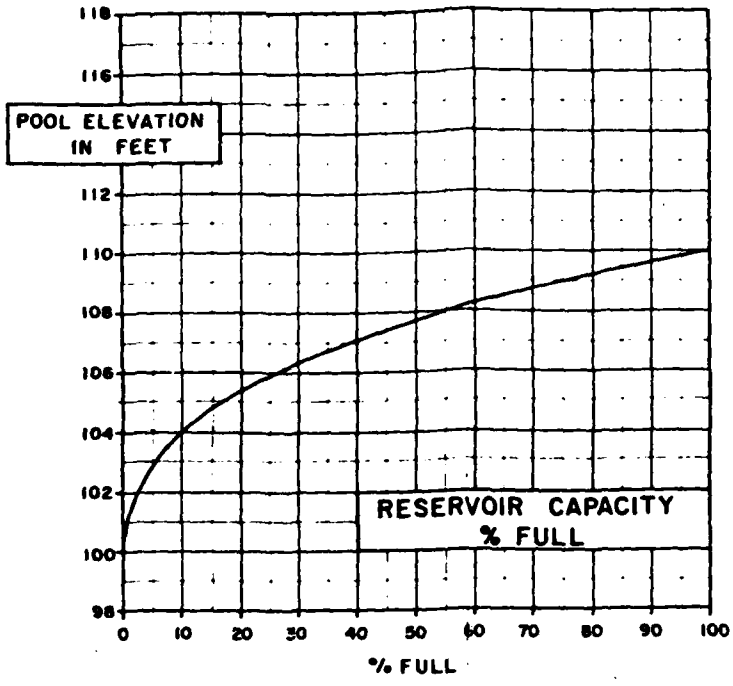


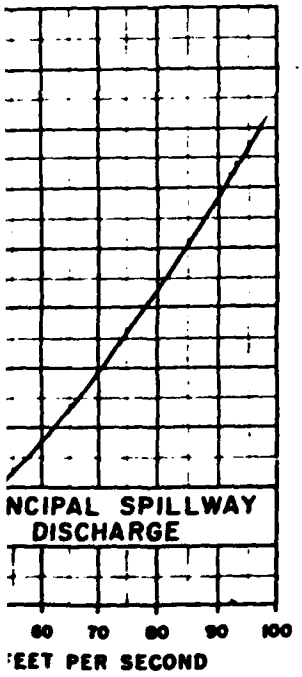


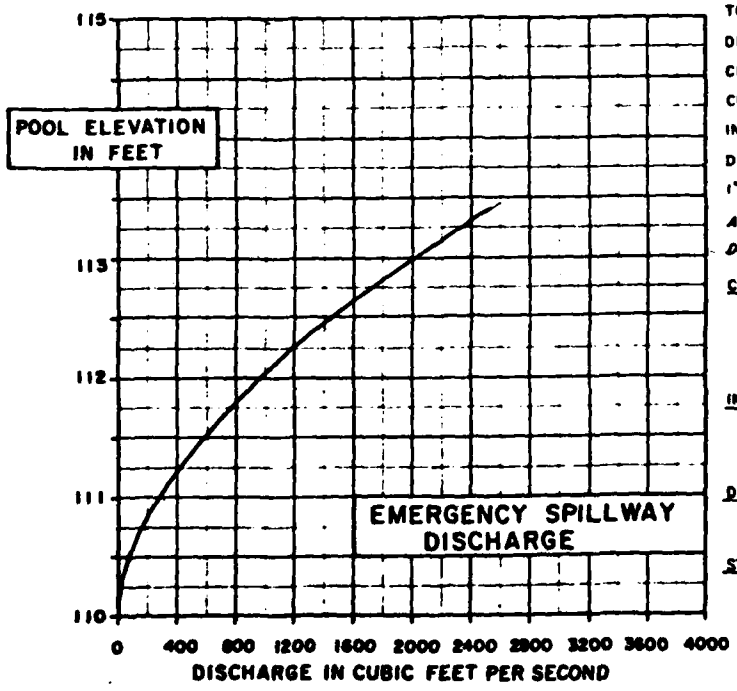
PERATION DATA

OK - NORTH BRANCH PARK RIVER WATERSHED









PERTINENT DATA

TOP OF DAM	EL. 116.0
DESIGN HIGH WATER	EL. 112.4
CREST EMERGENCY SPILLWAY	EL. 110.0
CREST PRINCIPAL SPILLWAY	EL. 100.0
INVERT LOW FLOW ORIFICE	EL. 96.0
DRAINAGE AREA CONTROLLED	1.90 SQ MI.
1" OF RUNOFF = 101.33	ACRE-FEET

ALL ELEVATIONS REFER TO METROPOLITAN DISTRICT DATUM

CONSTRUCTED BY
STATE OF CONNECTICUT
DEPARTMENT OF AGRICULTURE & NATURAL RESOURCES
JOSEPH N. GILL, COMMISSIONER

IN ASSOCIATION WITH THE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PUBLIC LAW 566 FUNDS

DESIGNED BY
ANDERSON - NICHOLS
CONSULTING ENGINEERS

STATUS
COMPLETED AUGUST 10, 1964

Anderson-Nichols Associates February 1967

WATER RESOURCES UNIT - D.E.P.

OPERATION AND MAINTENANCE INSPECTION REPORT

PROJECT: Bloomfield - Blue Hills Reservoir DATE: August 7, 1979

INSPECTION PARTY: H. Barenz, L. Warren, J. Kazmarski, Town of Bloomfield; A. Horwarth, Soil Conservation Service; and A. Roberts, V. Galgowski, Department of Environmental Protection

ITEM	CONDITION S or U*	MAINTENANCE OR REPAIRS REQUIRED	DATE COMPLETED
I. Embankments			
A. Vegetation	S		
B. Rip rap	S		
C. Drains	S		
II. Principal Spillway			
A. Trash rack	S		
B. Gates	S		
C. Stilling basin	S	Cut brush	
D. Conduit	S		
III. Emergency Spillway			
A. Vegetation	S		
B. Obstructions	S		
IV. Outlet Channels			
A. Slope protection	S		
B. Debris	S		
V. Reservoir Area			
A. Debris	S		
B. Stop logs	N/A		
VI. Miscellaneous			
A. Access road	S		
B. Fences	N/A		

Remarks: Site well maintained.

Inspected by: Victor F. Galgowski Title Supt. of Dam Maintenance

* S = Satisfactory
U = Unsatisfactory
NA = Not applicable

BIBLIOGRAPHY

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3. Soil Survey, Hartford County, Connecticut, United States Department of Agriculture, U.S. Government Printing Office, Washington 25, D.C. 1962

4. Donald M. Gray: Handbook on the Principles of Hydrology, Water Information Center, 1970.

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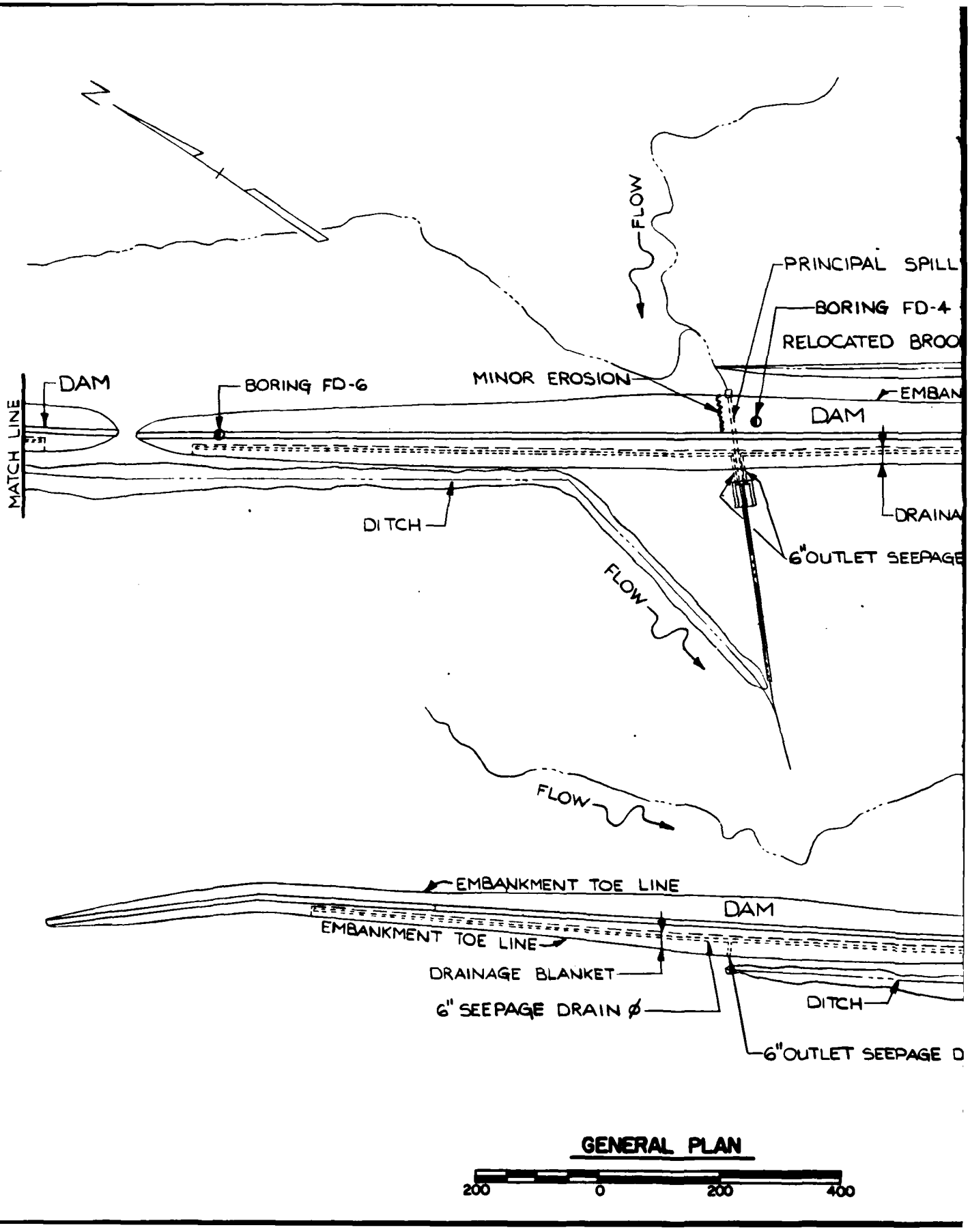
6. Victor L. Streeter: Fluid Mechanics, McGraw-Hill Book Company, Inc. 1958.

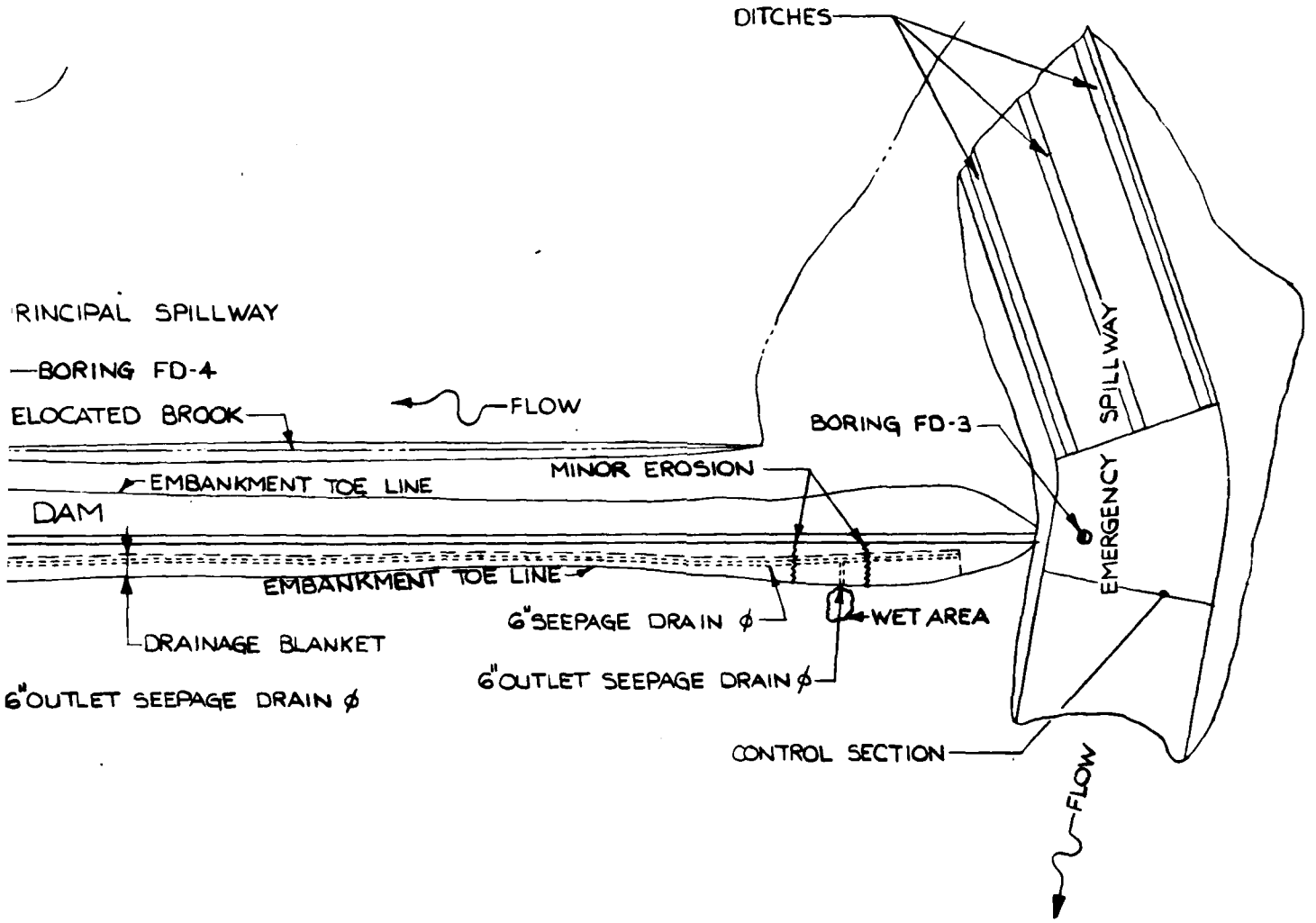
7. S.C.S. National Engineering Handbook, Hydrology Section 4, Soil Conservation Service, U.S. Department of Agriculture, 1972.

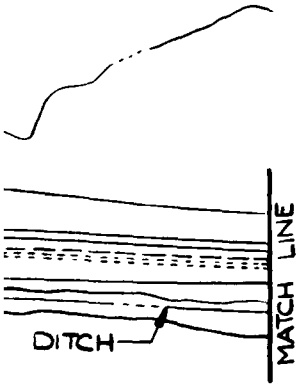
8. "North Branch Park River,Watershed Protection Project Design Report, Site No. 2 (Blue Hills Dam)" Bloomfield, Conn. Anderson-Nichols, Consulting Engineers Boston/Hartford, 1960.



GENERAL PLAN

200 0 200 400





OUTLET SEEPAGE DRAIN ϕ

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE, MANSFIELD, CONN.

GOODKIND & O'DEA INC.–SINGHAL ASSOCIATES, JV ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GENERAL PLAN

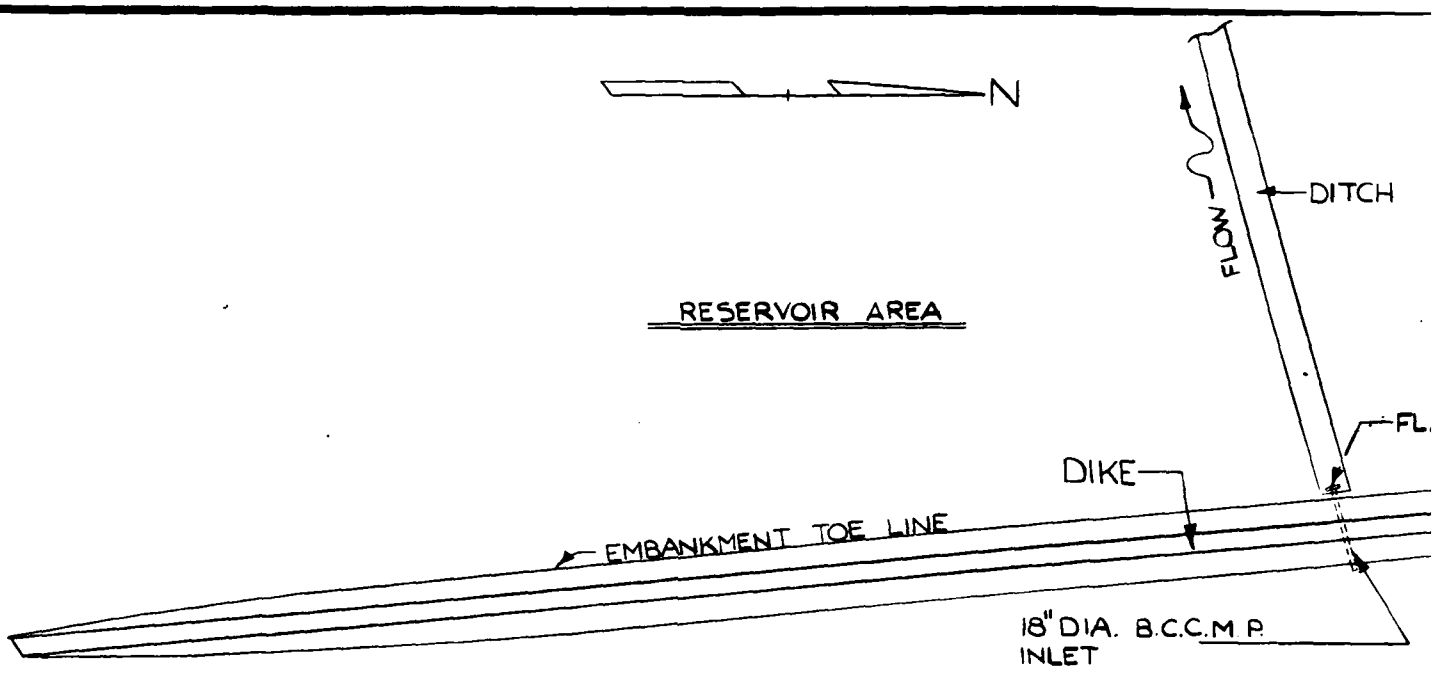
BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
E.T.R.	W.A.W.	L.A.B.	DATE: MAY, 1981 SHEET 6-1

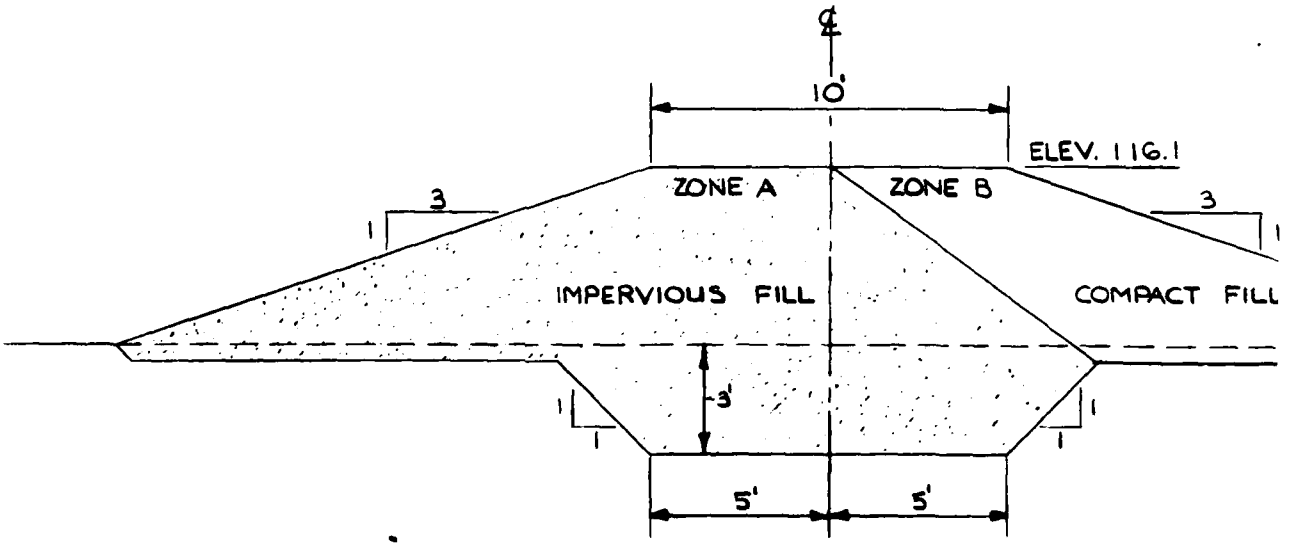
400

2



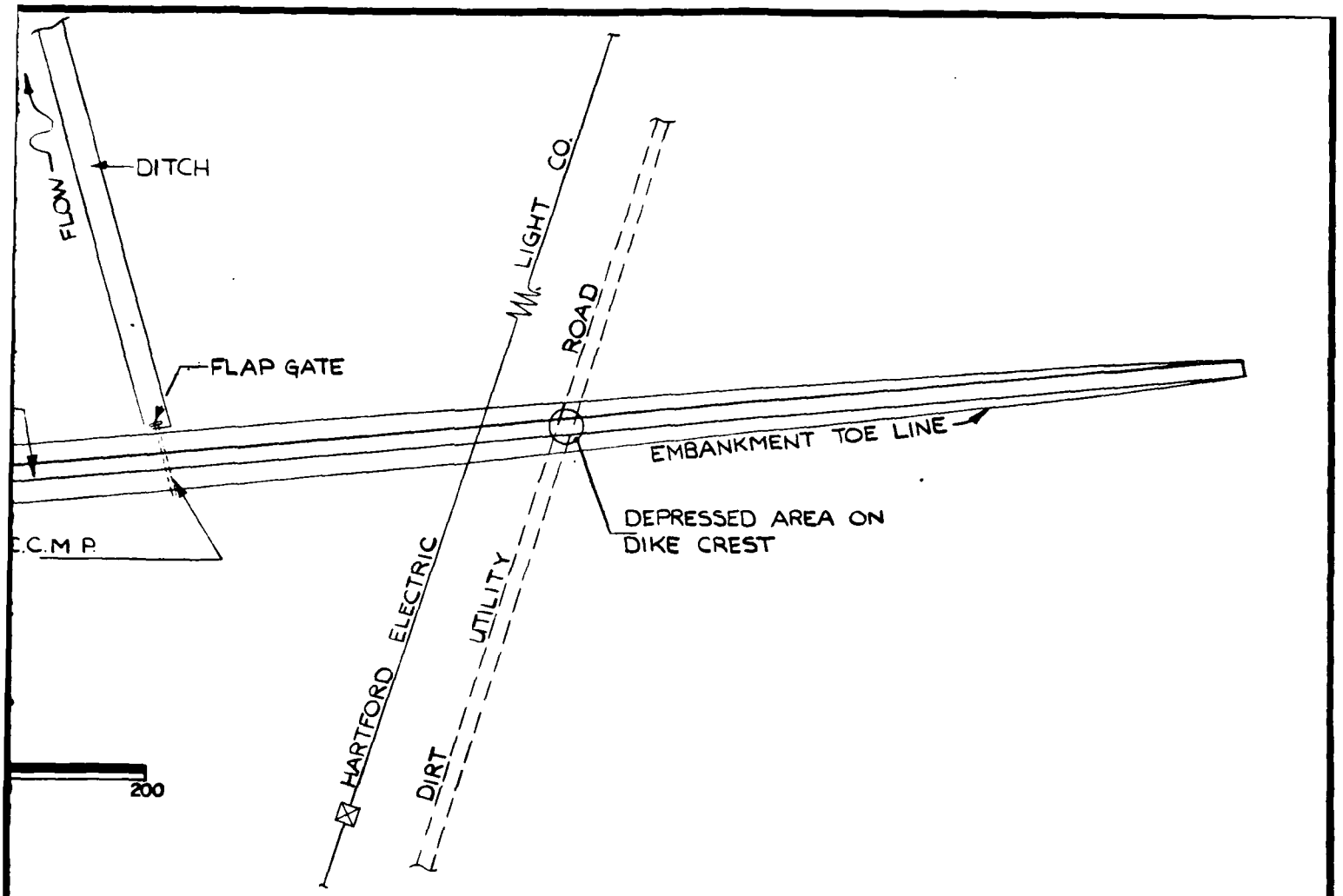
PLAN

100 0 100 200



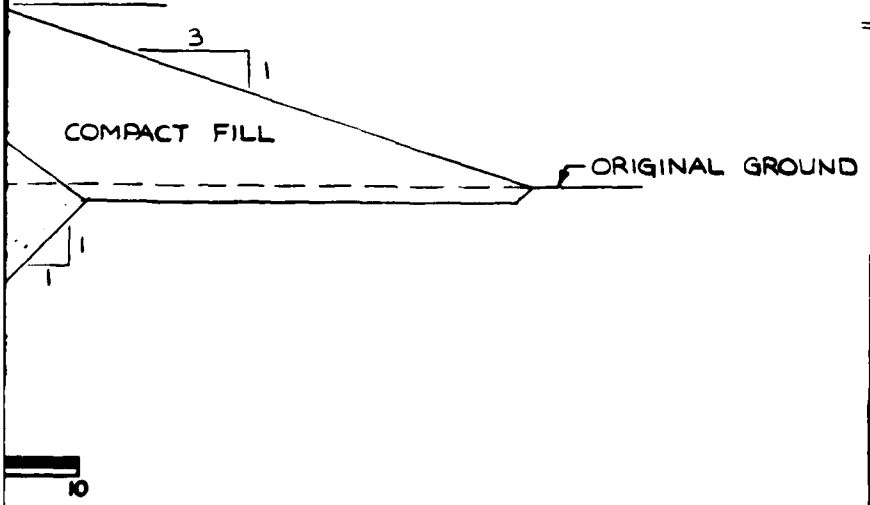
TYPICAL SECTION

5 0 5 10



NOTE:
ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.



GOODKIND & O'DEA INC.—SINGHAL ASSOCIATES, JV. ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

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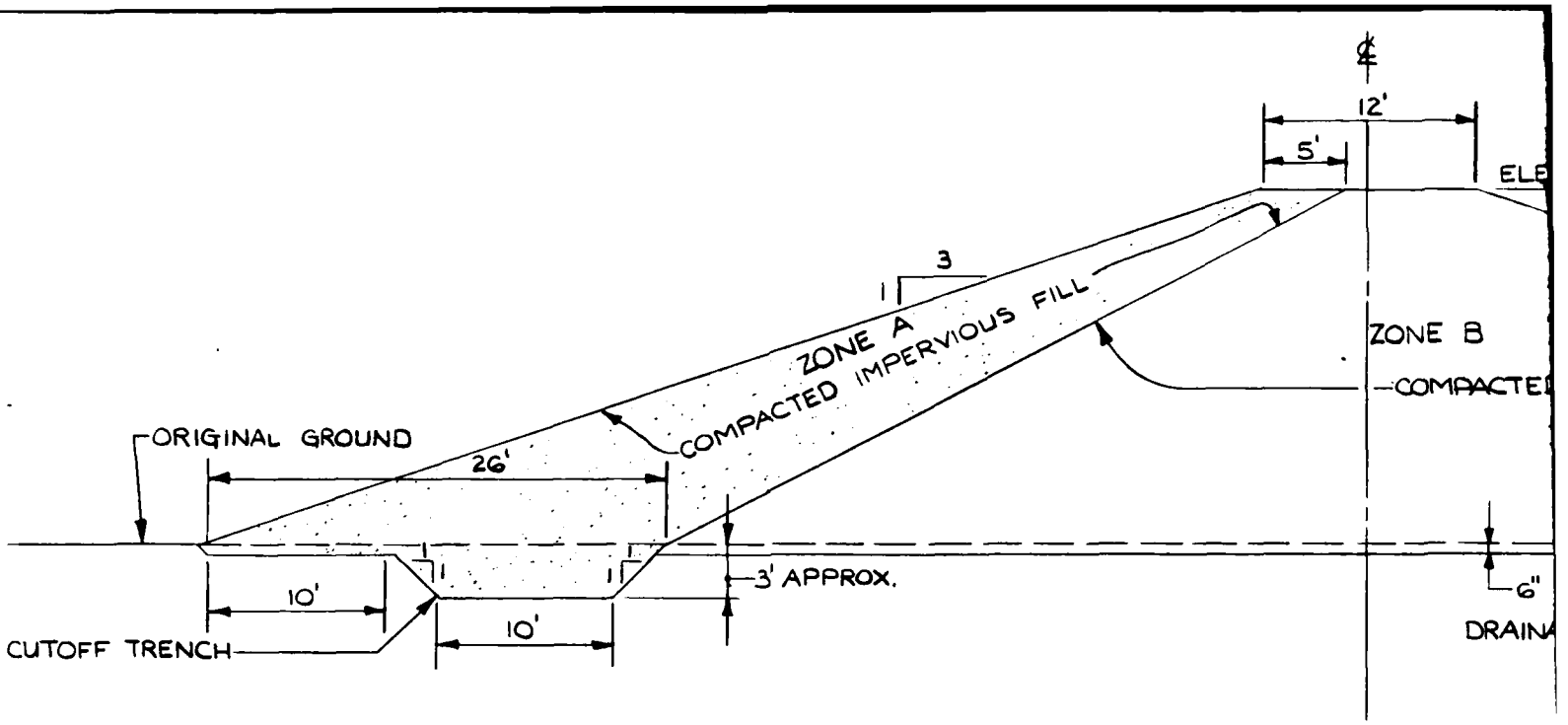
PLAN AND SECTION OF DIKE

BLUE HILLS DAM

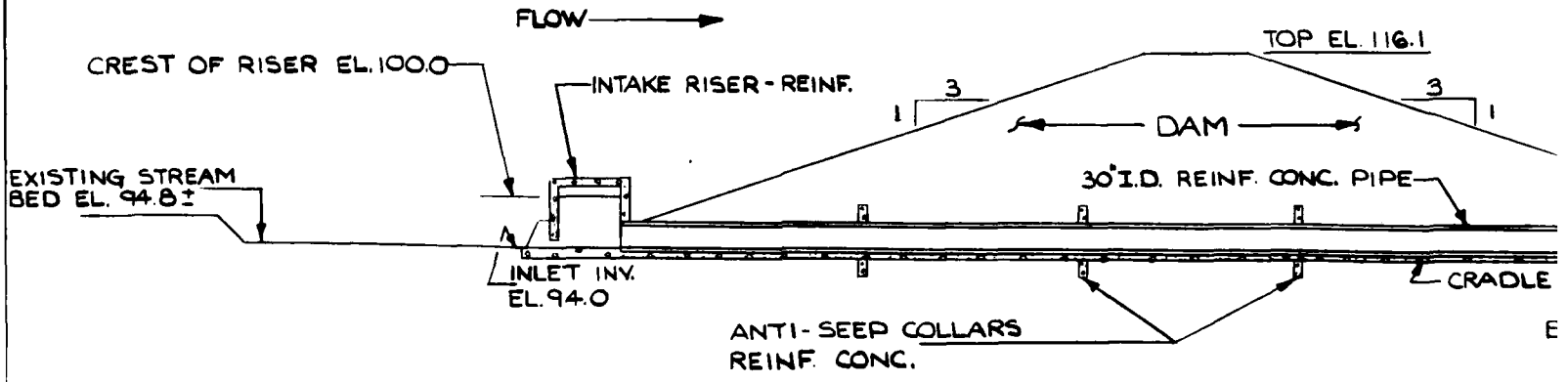
BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED	
E.T.R.	W.J.M.	L.J.S.	DATE: MAY, 1981	SHEET 8-2



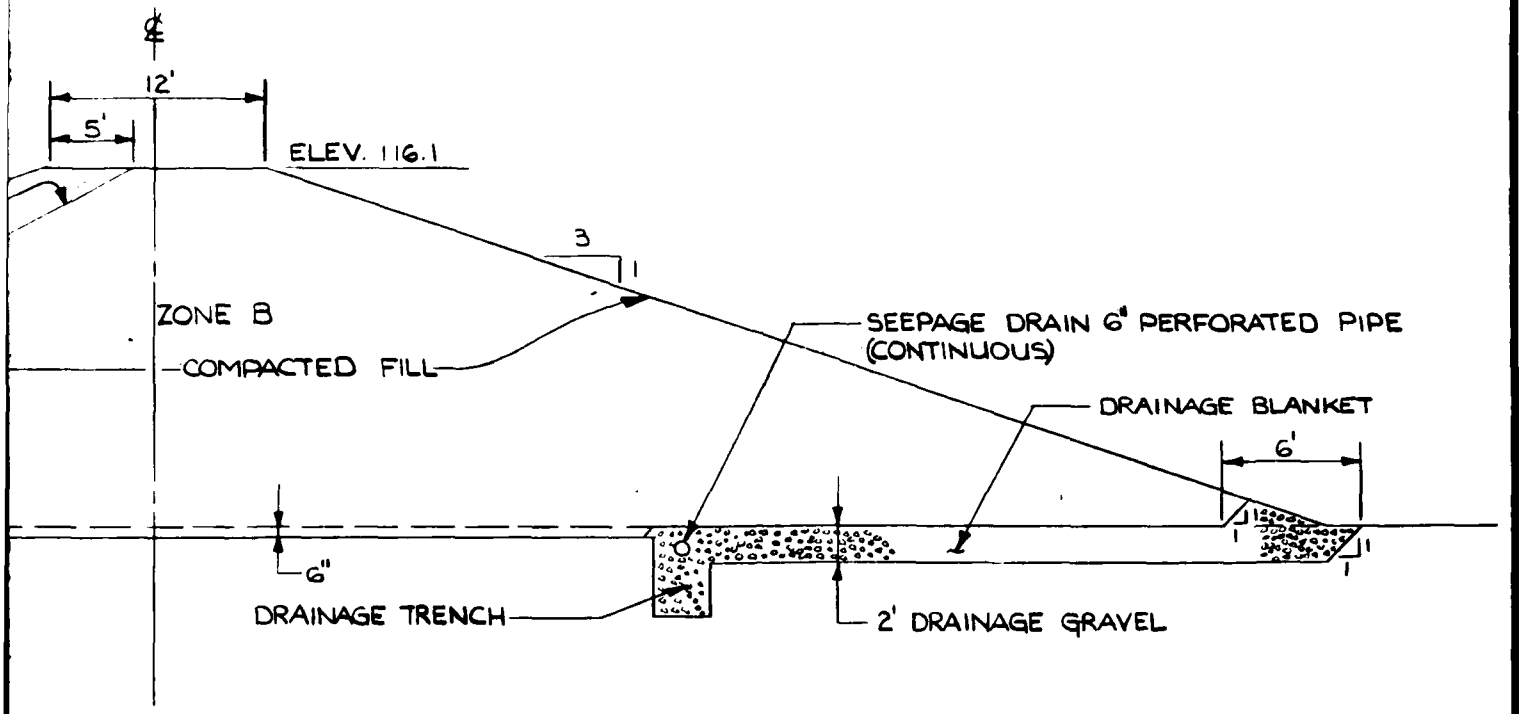
TYPICAL SECTION OF DAM

10 0 10



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

NOT TO SCALE

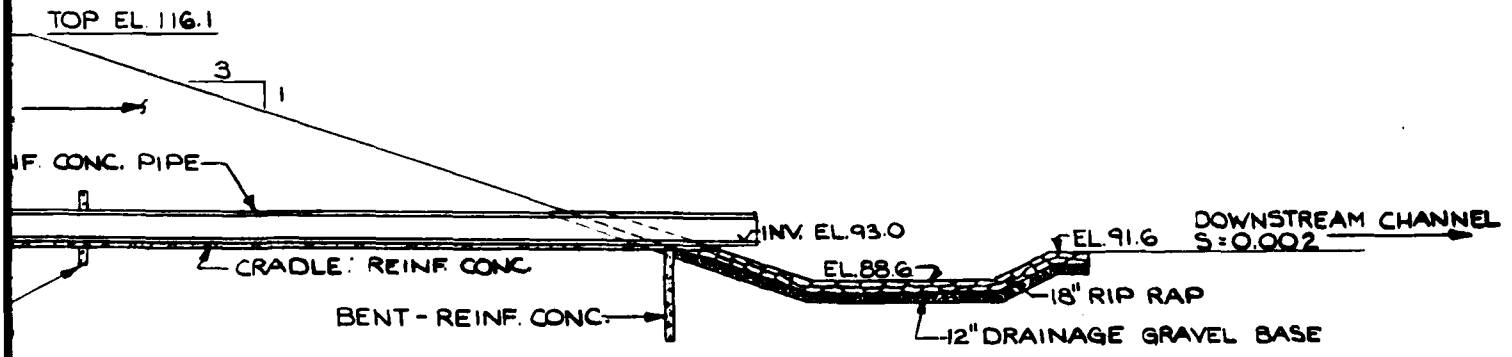


AL SECTION OF DAM

0 10 20

NOTE:
ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.



RINCIPAL SPILLWAY

ALE

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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

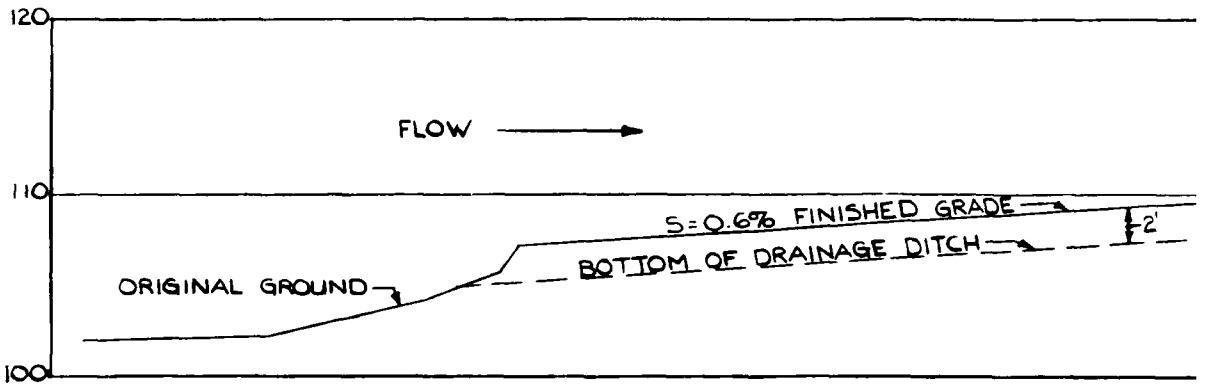
PROFILE OF PRINCIPAL SPILLWAY & TYP. DAM SECTION

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
E.T.R.	W.A.W.	L.A.S.	DATE: MAY, 1981 SHEET 3 - 3

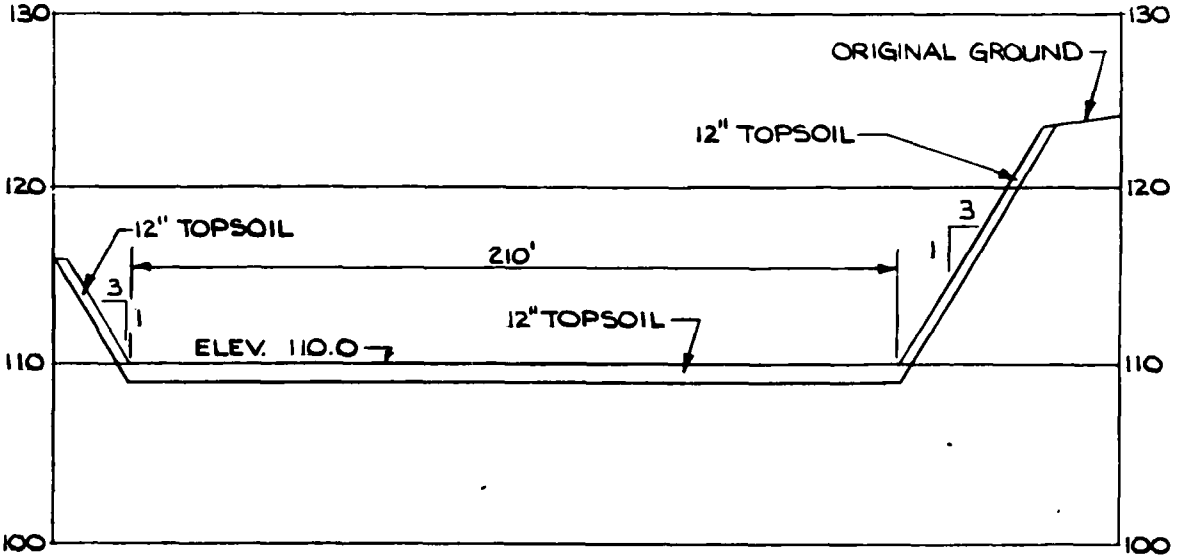
2



PROFILE ALONG ℄ OF EMEF

HORIZONTAL 100 0

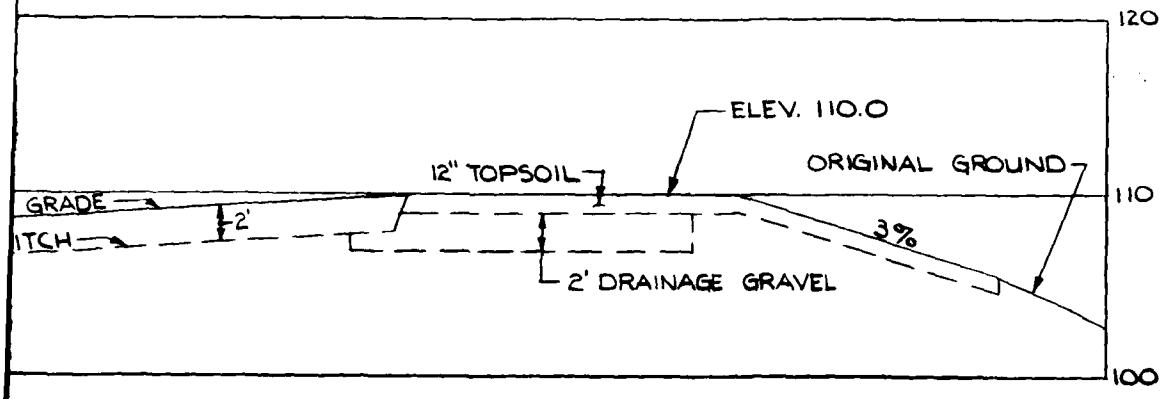
VERTICAL 10 0



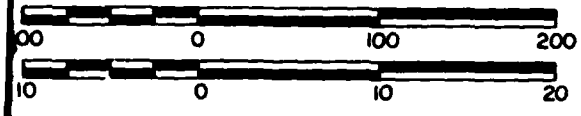
TYPICAL SECTION OF EMERGENCY SPILLWAY

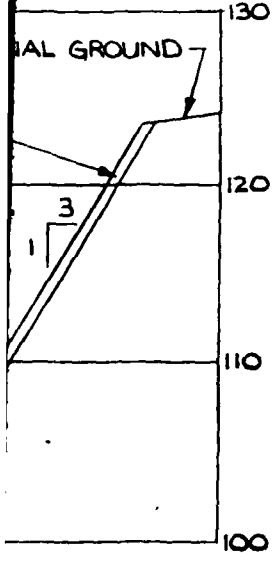
HORIZONTAL 50 0 50 100

VERTICAL 10 0 10 20



ALONG ℄ OF EMERGENCY SPILLWAY





NOTE:
ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.

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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PROFILE & TYP. SECTION OF EMERGENCY SPILLWAY

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

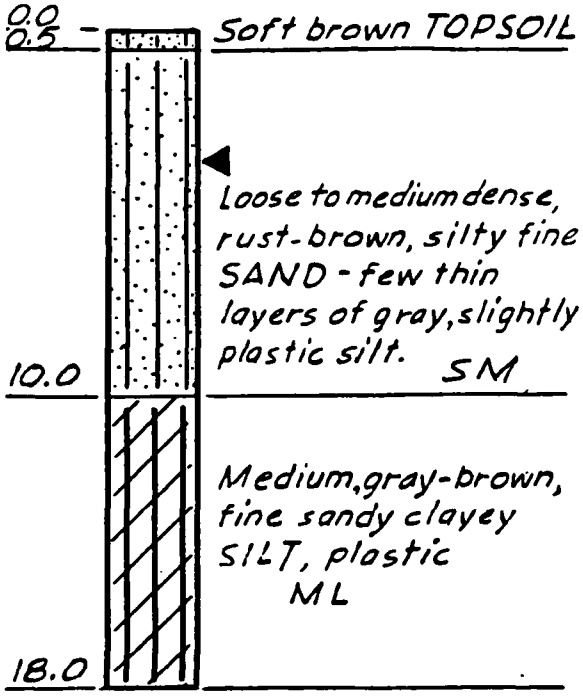
DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
E.T.K.	W.J.W.	L.J.B.	DATE: MAY, 1981 SHEET 8-4

2

FD-3

10-21-58

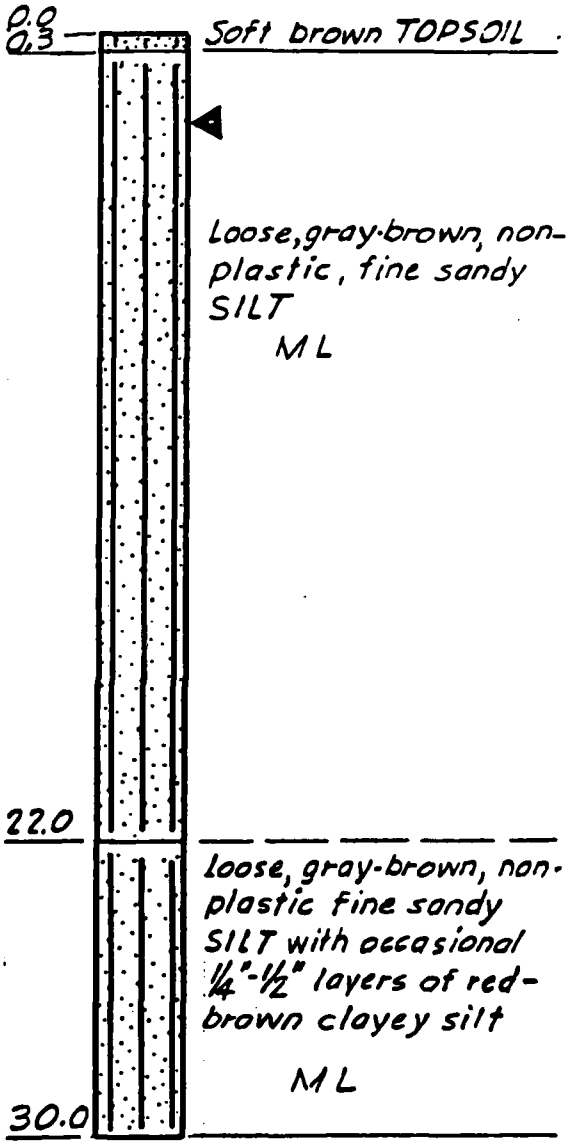
EL. 115 ±



FD-4

10-22-58

EL. 90 ±



FD-6

10-31-58

EL. 105 ±

0.0

1.0 Soft, black, peaty TOPSOIL OL

Medium dense, brown, silty fine SAND

5.0 SM

Medium gray, interbedded non-plastic SILT and slightly plastic SILT

ML

15.0

Medium dense, gray-brown, non-plastic fine sandy SILT, trace of red-brown clay.

ML

35.0

NOTES:

1) ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

2) SEE SHEETS B-1 & B-2 "GENERAL PLAN" FOR LOCATION OF BORINGS.

3) SEE DESIGN DRAWINGS FOR ADDITIONAL BORINGS.

REFERENCE:

DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.

GOODKIND & O'DEA INC.—SINGHAL ASSOCIATES, J.V. ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

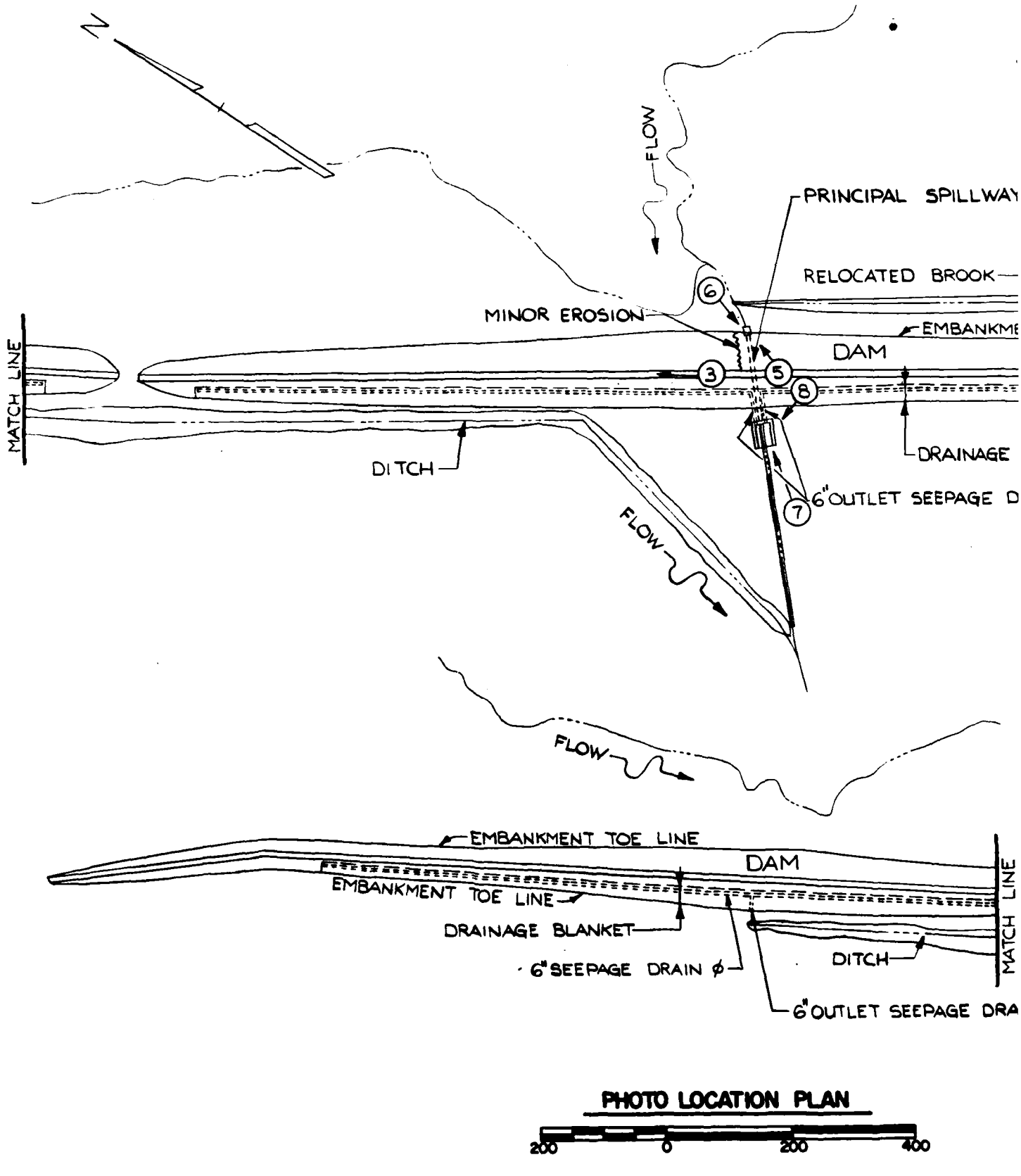
TYPICAL BORINGS

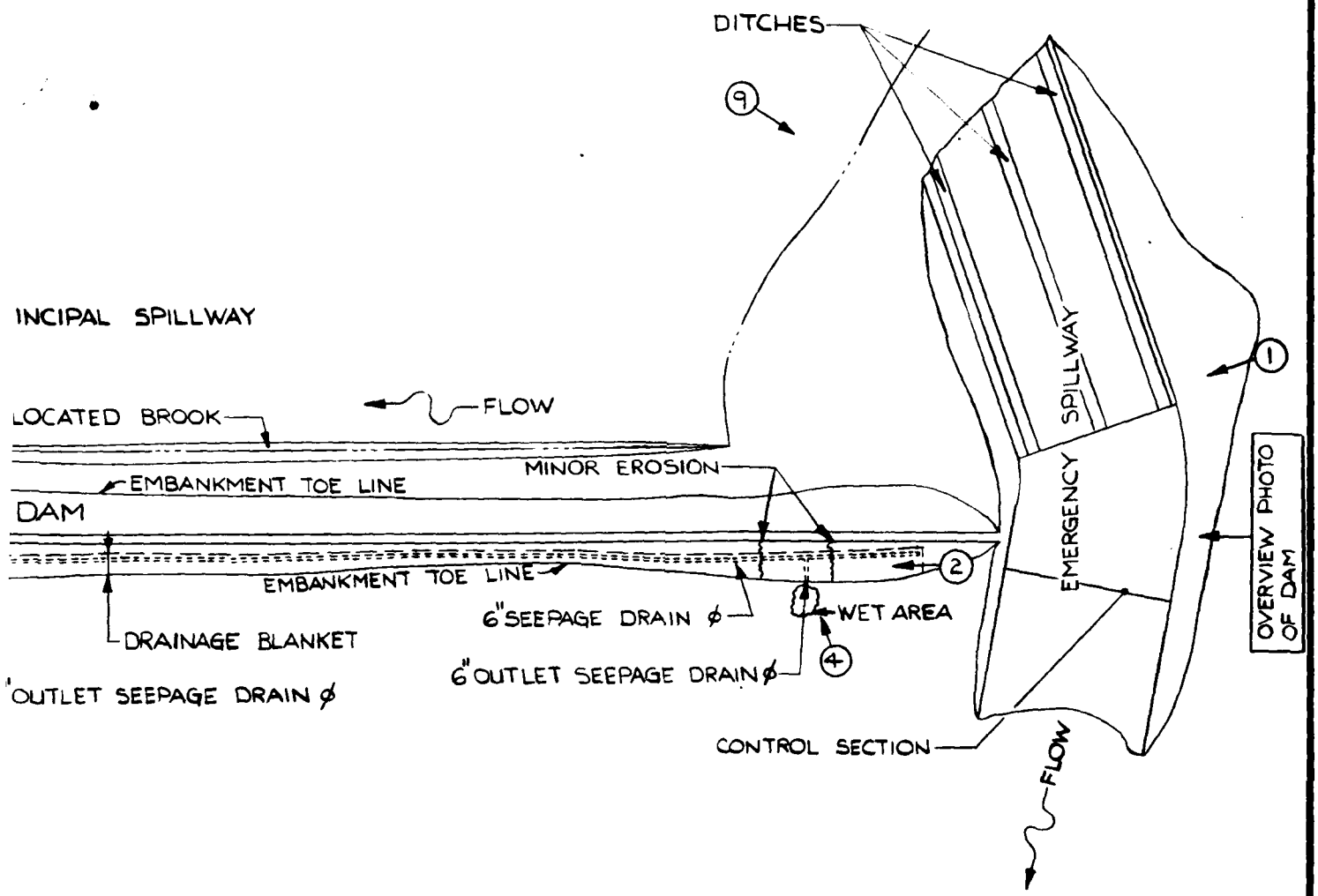
BLUE HILLS DAM

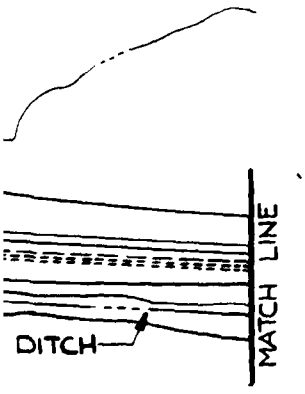
BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: NONE	
E.T.R.	W.A.W.	L.A.S.	DATE: MAY, 1961	SHEET B-3

2


N
FLOW
PRINCIPAL SPILLWAY
RELOCATED BROOK
MINOR EROSION
EMBANKME
DAM
MATCH LINE
DITCH
DRAINAGE
6"OUTLET SEEPAGE D
FLOW
FLOW
EMBANKMENT TOE LINE
DAM
EMBANKMENT TOE LINE
DRAINAGE BLANKET
6" SEEPAGE DRAIN ϕ
DITCH
MATCH LINE
6"OUTLET SEEPAGE DRA
PHOTO LOCATION PLAN
200
0
200
400





UTLET SEEPAGE DRAIN ϕ

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE, MANSFIELD, CONN.

AN

400

2

GOODKIND & O'DEA INC.–SINGHAL ASSOCIATES, (JV) ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

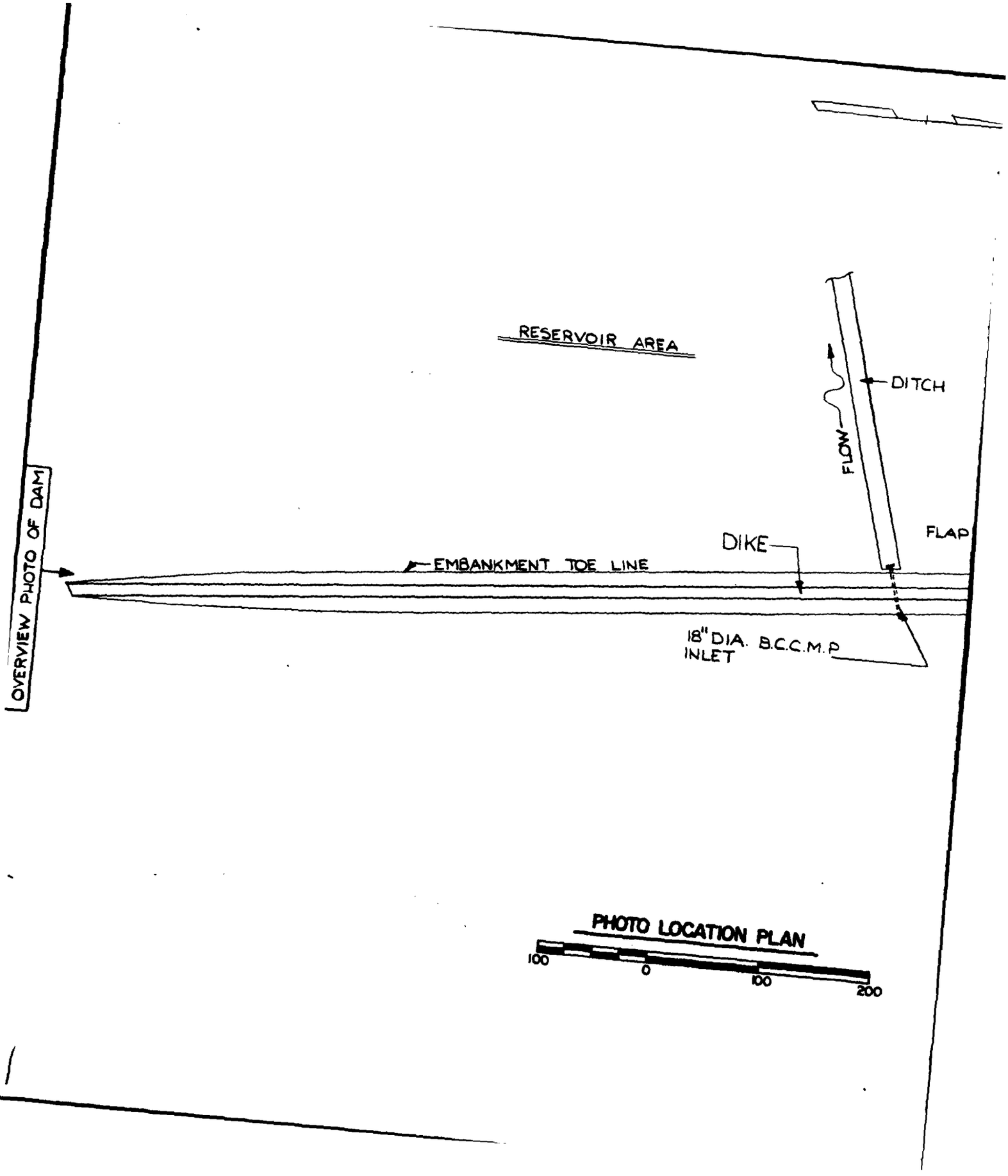
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

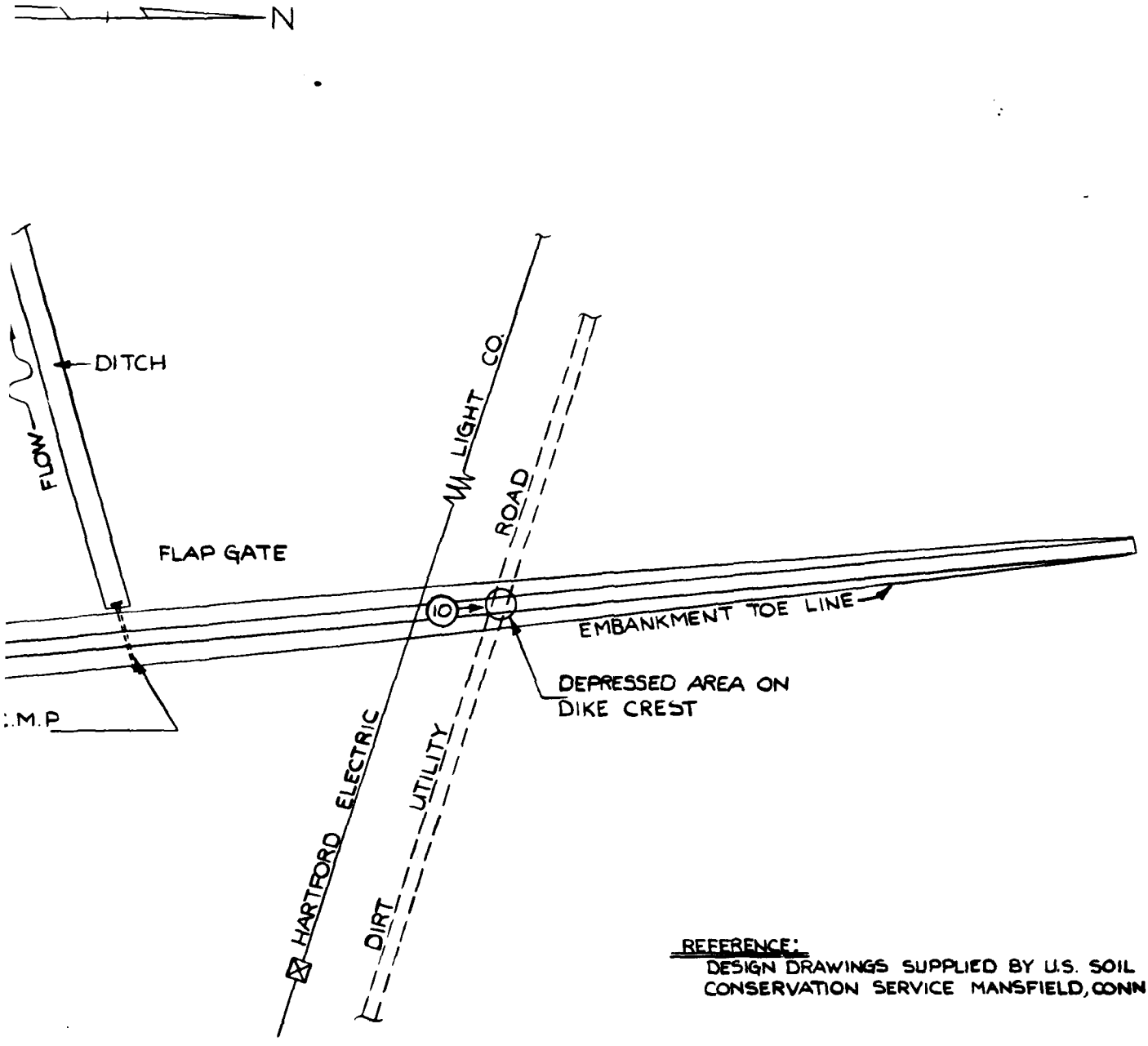
PHOTO LOCATION PLAN OF DAM

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
E.T.R.	W.J.W.	L.J.S.	DATE: MAY, 1981 SHEET C-1


RESERVOIR AREA
DITCH
FLOW
OVERVIEW PHOTO OF DAM
DIKE
FLAP
EMBANKMENT TOE LINE
18" DIA. B.C.C.M.P
INLET
PHOTO LOCATION PLAN
100
0
100
200



REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.

LAN

0 200

GOODKIND & O'DEA INC.—SINGHAL ASSOCIATES, J.V. ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHOTO LOCATION PLAN OF DIKE

BLUE HILLS DAM

BLOOMFIELD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
E.T.R.	W.J.M.	L.A.B.	DATE: MAY, 1981 SHEET C-2

2

APPENDIX C

DETAIL PHOTOGRAPHS

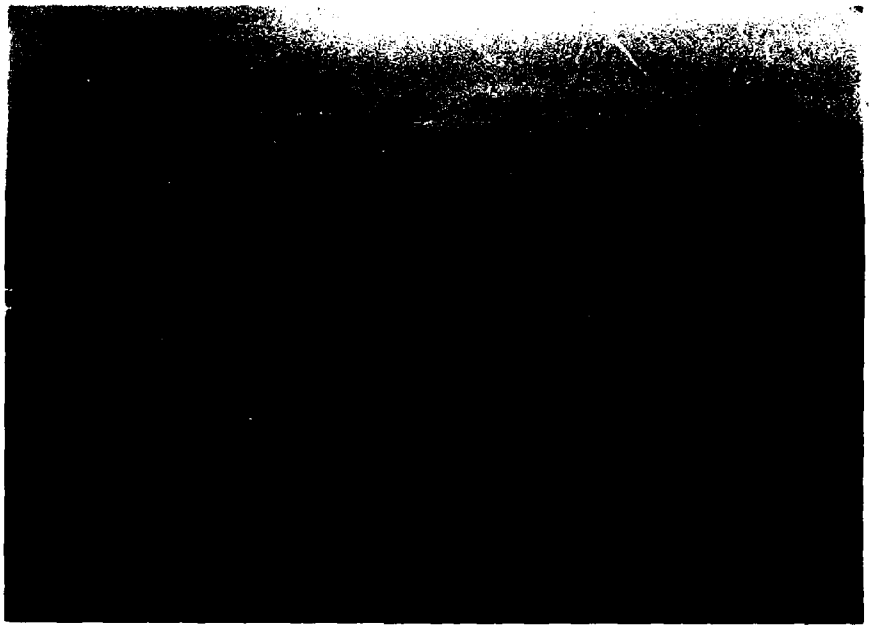


PHOTO 1 - View of dam and emergency spillway looking north. Reservoir area on right.

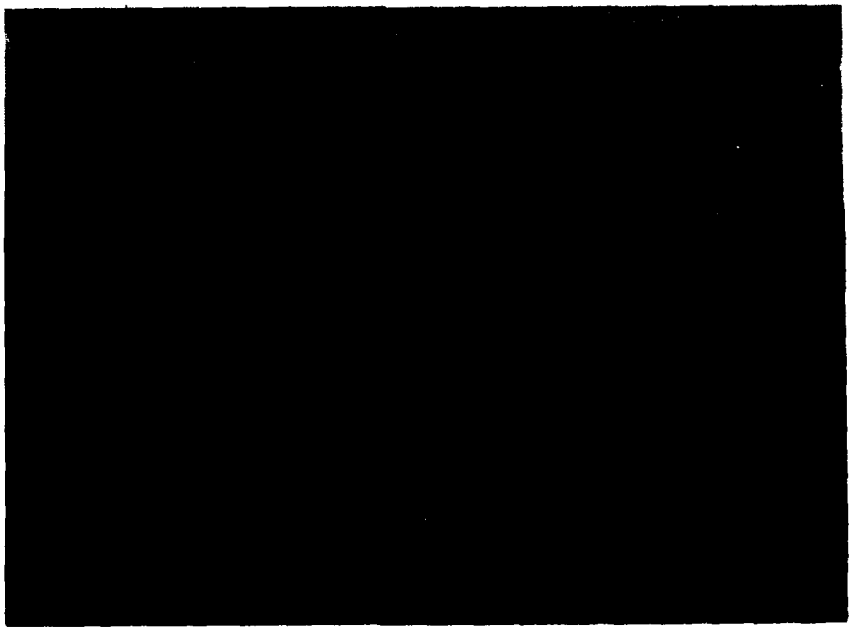


PHOTO 2 - View looking north along the downstream slope of the dam embankment. Note vehicular trespassing.

PHOTO 3 - View at principal spillway looking north along dam crest. Note vehicular ruts.

PHOTO 4 - Standing water at underdrain outlet. Drain pipe could not be located. Note cattails which indicate that area is wet year-round.

PHOTO 5 - Upstream channel. Relocated brook coming in front right. Note minor brush growth on channel slopes.

PHOTO 6 - Principal spillway - Intake riser. Note minor debris build-up on trash rack.

PHOTO 7 - Principal spillway - Outlet Pipe. Note minor spalling on concrete pipe and cradle.

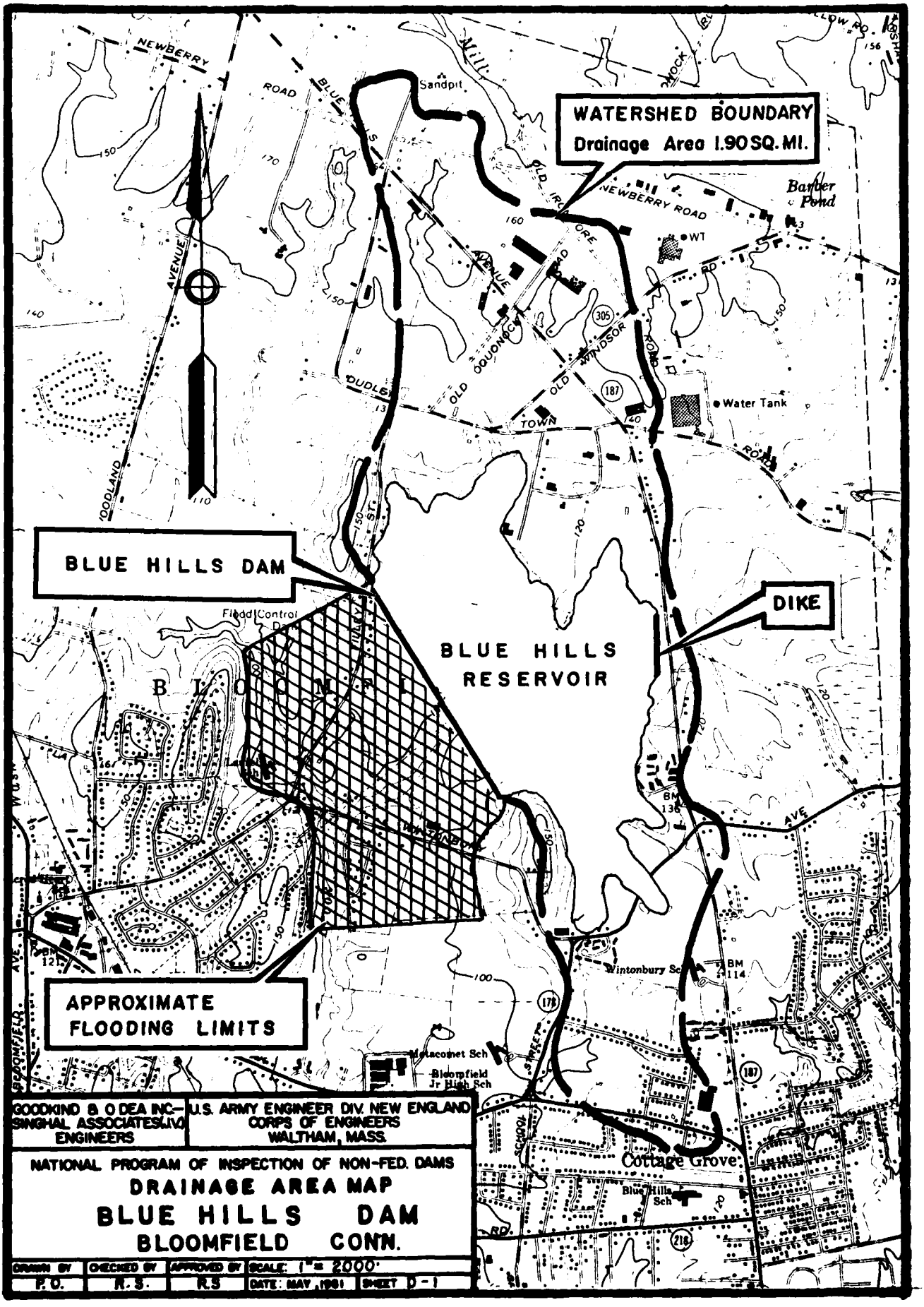
PHOTO 8 - Downstream channel.

PHOTO 9 - View of emergency spillway. Note vehicle trespass on slope.

PHOTO 10 - View of dike looking north. Note brush along slopes and depressed area at utility service road.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS


WATERSHED BOUNDARY
Drainage Area 1.90 SQ. MI.
BLUE HILLS DAM
DIKE
BLUE HILLS RESERVOIR
APPROXIMATE FLOODING LIMITS
NEWBERRY ROAD
BLUE
Sandpit
Barber Pond
WT
Water Tank
OLD WINDSOR ROAD
OLD TOWN ROAD
DUDLEY
WOODLAND AVENUE
Flood Control Dam
Wintonbury Sch
Metacomet Sch
Bloomfield Jr High Sch
Cottage Grove
Blue Hills Sch
BM 136
BM 114
GOODKIND & O'DEA INC.—SINGHAL ASSOCIATES, J.V. ENGINEERS
U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
DRAINAGE AREA MAP
BLUE HILLS DAM
BLOOMFIELD CONN.
DRAWN BY P.O.
CHECKED BY R.S.
APPROVED BY R.S
SCALE: 1" = 2000'
DATE: MAY, 1981
SHEET D - 1

SINGHAL ASSOCIATES
CONSULTING ENGINEERS
(CIVIL, HYDRAULICS, SANITARY)
827 MAPLEDALE ROAD, ORANGE, CT 06477
TEL: (203) 795-6562

Job BLUE HILLS DAM
Sheet Number D-1
Date 12-22-1980
By R.S./G.H.

TEST FLOOD

DRAINAGE AREA = 1.90 SQ. MILES

THE DRAINAGE AREA IS FLAT WITH AVERAGE SLOPE UNDER 1%.

FROM THE CORPS OF ENGINEES' CHART FOR "FLAT & COASTAL" TERRAIN, THE PROBABLE MAX. FLOOD,

PMF = 950 CFS PER SQ. MILE

= 950 x 1.90

= 1,800 CFS.

SIZE AND HAZARD CLASSIFICATION

MAXIMUM HEIGHT OF THE DAM = 24.4 FT.
MAXIMUM IMPOUNDMENT UPTO TOP OF DAM = 2,200 AC-FT

ALTHOUGH, THE HEIGHT OF THE DAM IS UNDER 40 FT., THE IMPOUNDMENT EXCEEDS 1,000 AC. FT. AS SUCH:

THE SIZE OF THE DAM = "INTERMEDIATE"

THE HAZARD POTENTIAL IS "HIGH" DUE TO THE EXISTENCE OF SEVERAL IMPORTANT ROADS AND STREETS AS WELL AS A LARGE NUMBER OF HOUSES AND OTHER STRUCTURES ON THE DOWNSTREAM SIDE WHICH WILL BE FLOODED IN CASE OF DAM FAILURE. THERE IS POTENTIAL FOR LOSS OF "MORE THAN FEW" LIVES.

AS PER TABLE 3, PAGES D-12, D-13 OF THE 'RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS', THE RECOMMENDED TEST FLOOD WILL BE THE PMF = 1800 CFS.

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Job BLUE HILLS DAM
Sheet Number D-2
Date 12-22-1980
By R.S./G.H.

SPILLWAY CAPACITIES

THE SPILLWAY CONSISTS OF THE FOLLOWING:

1-30" R.C. WATER PIPE (UPSTREAM INVERT ELEVATION: 94.0, WEIR CREST ELEV. 100.0

1- EMERGENCY SPILLWAY, 210 FT. WIDE AT CONTROL SECTION, CREST ELEV. 110.0

CAPACITIES AT VARIOUS ELEVATIONS ARE TABULATED BELOW:

ELEVATION	CAPACITY - C.F.S.		
	PRINCIPAL SPILLWAY	EMERGENCY SPILLWAY $Q = 3.0\ LH^{3/2}$	TOTAL
110.0	85.0	0.0	85.0
110.5	87.0	223.0	310.0
111.0	89.0	630.0	719.0
111.5	90.0	1157.0	1247.0
112.0	91.0	1782.0	1873.0
112.5	93.0	2490.0	2583.0
113.0	94.0	3,274.0	3368.0
113.5	95.0	4,125.0	4,220.0
114.0	96.0	5040.0	5,136.0
114.5	98.0	6014.0	6,112.0
115.0	100.0	7,044.0	7,144.0
115.5	102.0	8126.0	8,228.0
116.0	104.0	9,259.0	9,363.0

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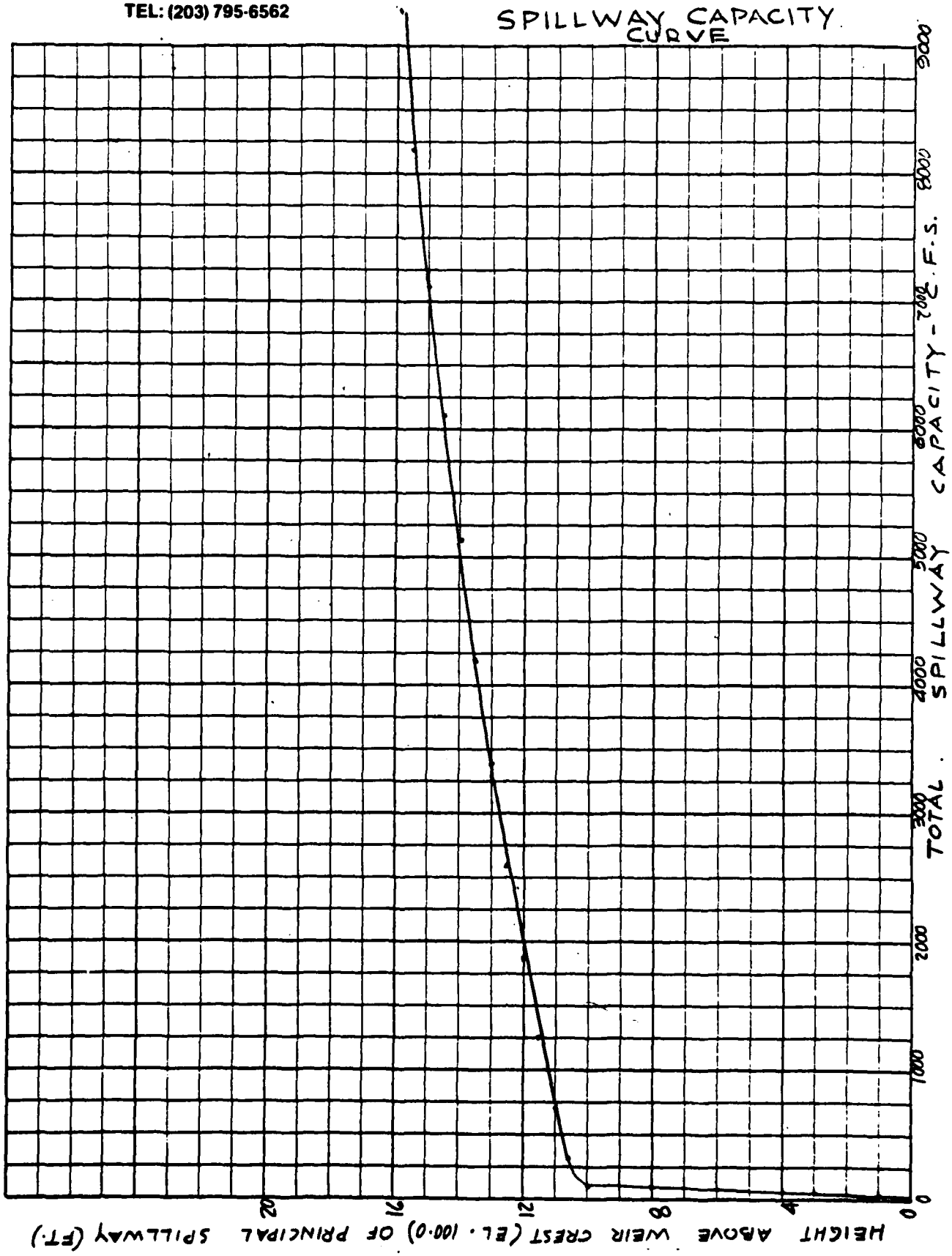
Job BLUE HILLS DAM
Sheet Number D-3
Date 12-22-1980
By RS/GH



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Job BLUE HILLS DAM
Sheet Number D-4
Date 12-22-1980
By R.S./G.H.

SURCHARGE STORAGES & WATER SURFACE AREAS

RESERVOIR WATER SURFACE ELEVATION	HEIGHT ABOVE EMERGENCY SPILLWAY CREST (FT)	WATER SURFACE AREA (ACRES)	SURCHARGE STORAGE CAPACITY (AC-FT)
110.0	0.0	175.0	0.0
110.5	0.5	187.0	90.0
111.0	1.0	200.0	195.0
111.5	1.5	215.0	300.0
112.0	2.0	230.0	400.0
112.5	2.5	245.0	500.0
113.0	3.0	260.0	600.0
113.5	3.5	275.0	750.0
114.0	4.0	290.0	900.0

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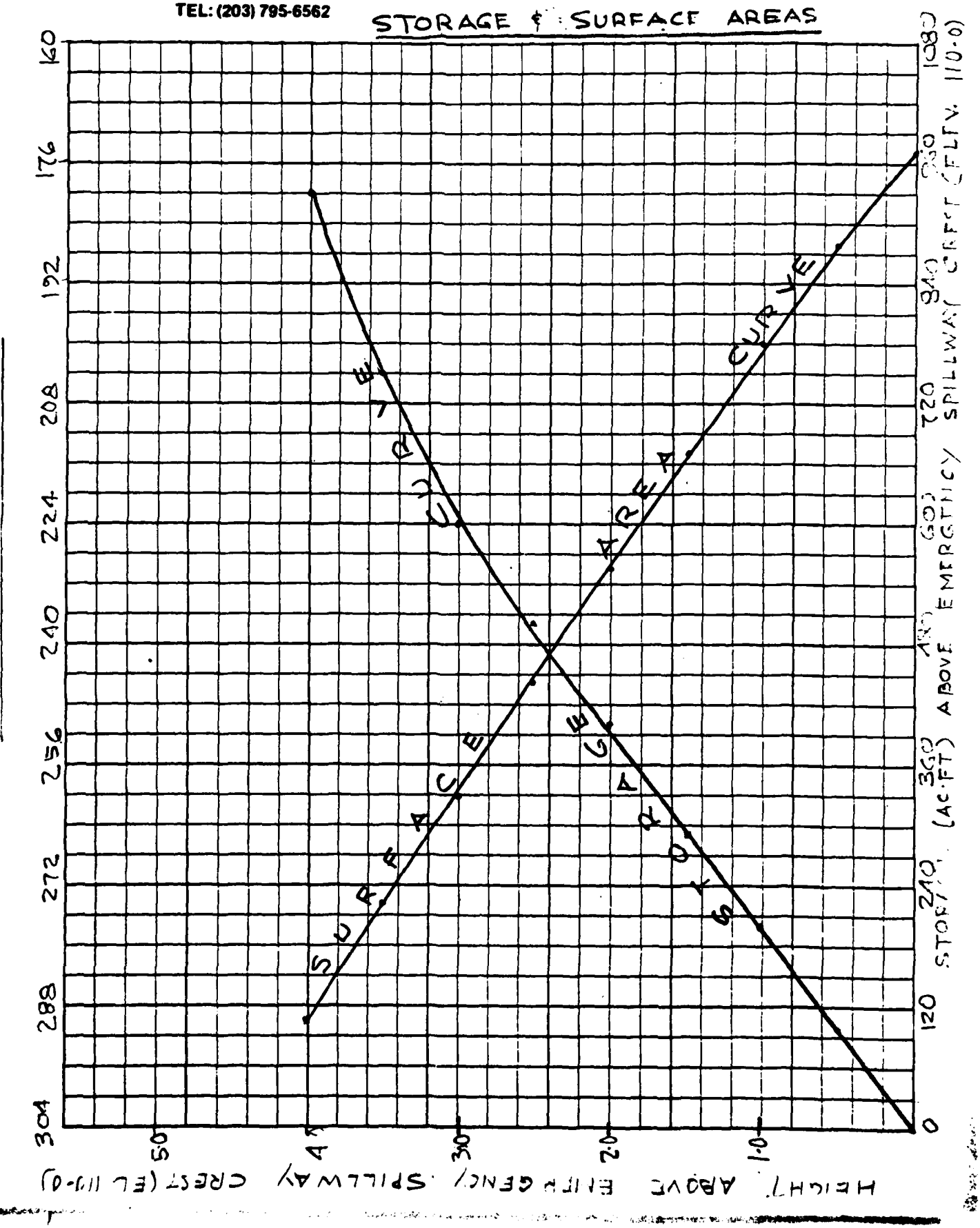
Job BLUE HILL DAM
Sheet Number D - 5
Date 12-23-1980
By R.S./G.H

STORAGE & SURFACE AREAS



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Job BLUE HILLS DAM
Sheet Number D-6
Date 12-23-1980
By R.S./G.H.

INFLOW FLOOD HYDROGRAPH

TEST FLOOD = 1,800 CFS
DRAINAGE AREA = 1.90 SQ. MILES

AS PER 'HYDROLOGY, SECTION 4, S.C.S. NATIONAL ENGINEERING HANDBOOK':

$$q_p = \frac{484 \cdot A \cdot Q}{T_p}$$

AND $T_b = 2.67\, T_p$

WHERE T_b = TIME BASE OF HYDROGRAPH IN HOURS

T_p = TIME IN HOURS FROM START OF RISE OF HYDROGRAPH TO ATTAINMENT OF PEAK.

q_p = PEAK RATE OF RUNOFF IN CFS

A = DRAINAGE AREA IN SQ. MILES

Q = TOTAL RUNOFF IN INCHES

SUBSTITUTING THE KNOWN VALUES OF A, Q AND q_p:

$$1{,}800 = \frac{484 \times 1.90 \times 19}{T_p}$$

FROM WHICH T_p = 9.7 HOURS

AND $T_b = 2.67 \times 9.7 = 25.9$ HOURS
(SAY 26.0 HOURS)

THE TRIANGULAR HYDROGRAPH HAS BEEN DRAWN ACCORDINGLY ON THE NEXT PAGE.

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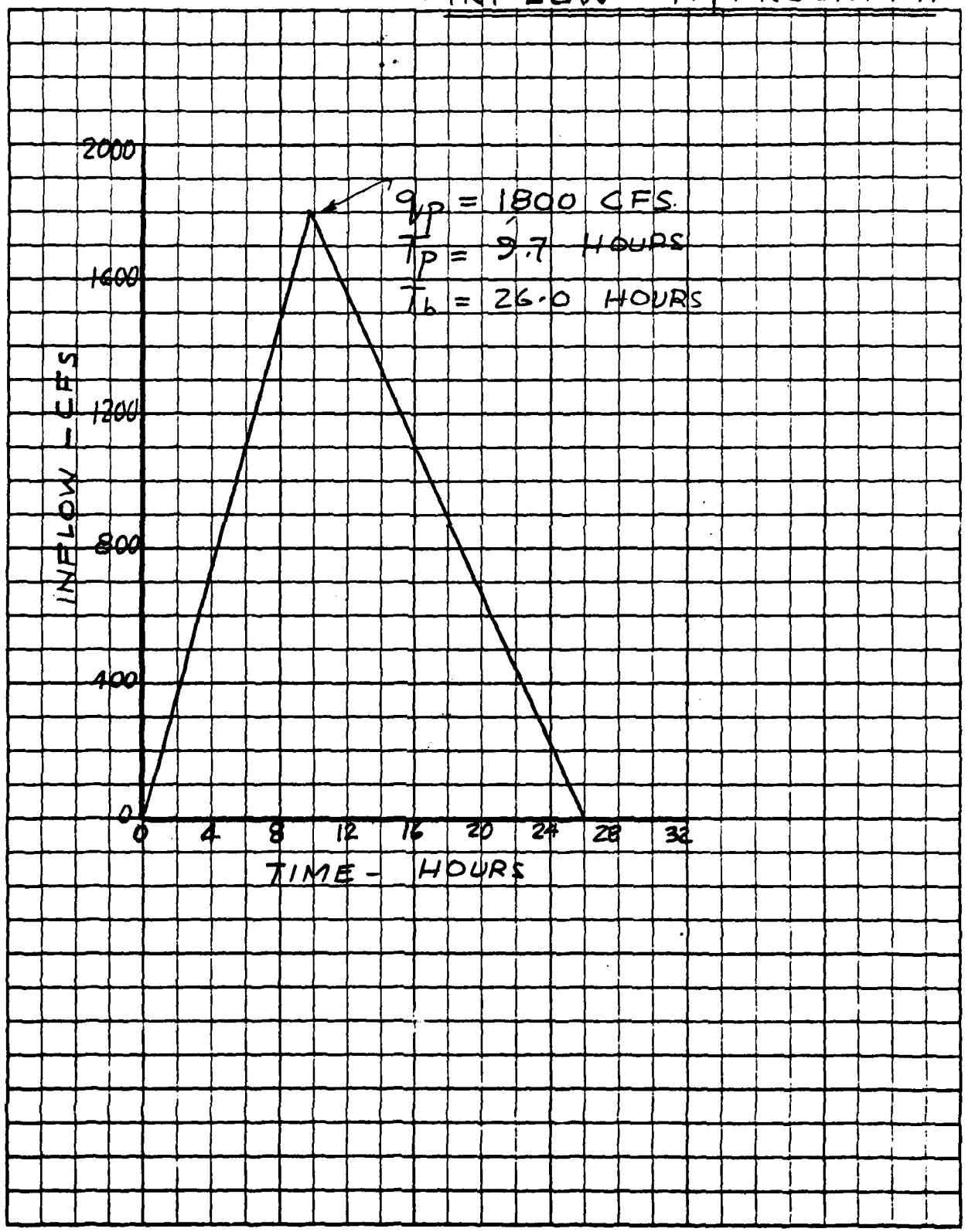
Job BLUE HILL DAM
Sheet Number D-7
Date
By R.S/G.H.

INFLOW HYDROGRAPH



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Job BLUE HILL DAM
Sheet Number D-2
Date 12-23-1980
By R.S./G.H.

TIME HRS	INTERVAL ΔT HRS	AVERAGE INFLOW RATE SEC-FT	AVERAGE INFLOW AC-FT.	TRIAL RESERVOIR ELEVATION AT END OF ΔT.	OUTFLOW RATE C.F.S. END OF ΔT	OUTFLOW RATE C.F.S. AVG FOR ΔT	AVERAGE OUTFLOW FOR ΔT. AC-FT	INCREMENTAL STORAGE ΔS AC-FT.	TOTAL STORAGE AC-FT.	RESERVOIR ELEVATION END OF ΔT.	
0											
	1	93	7.8	~~110.01~~	~~90~~	~~45~~	~~3.8~~	4.0	4.0	~~110.02~~	
1				110.02	94	47	3.9	3.9	3.9	110.02	
	1	278	23.2	110.10	130	112	9.3	13.9	17.8	110.09	
2											
	1	464	38.7	~~110.20~~	~~175~~	~~153~~	~~12.7~~	~~26.0~~	~~43.8~~	~~110.22~~	
3				110.22	184	157	13.1	25.6	43.4	110.22	
	1	650	54.2	~~110.35~~	~~243~~	~~213~~	~~17.8~~	~~36.4~~	~~79.8~~	~~110.46~~	
4				110.40	265	225	18.7	35.5	78.9	110.39	
	1	835	69.6	110.60	392	329	27.4	42.2	121.1	110.60	
5											
	1	1021	85.1	~~110.80~~	~~555~~	~~474~~	~~39.5~~	~~45.6~~	~~166.7~~	~~110.83~~	
6				110.82	572	482	40.2	44.9	166.0	110.83	
	1	1206	100.5	~~111.10~~	~~825~~	~~698~~	~~58.2~~	~~42.3~~	~~208.3~~	~~111.04~~	
7				111.05	772	672	56.0	44.5	210.5	111.05	
	1	1392	116.0	~~111.30~~	~~1036~~	~~904~~	~~75.3~~	~~40.7~~	~~251.2~~	~~111.25~~	
8				111.26	994	893	73.6	42.4	252.9	111.26	
	1	1577	131.4	111.46	1205	1099	91.6	39.8	292.7	111.46	
9											
	1	1763	146.9	111.65	1435	1320	110.0	36.9	329.6	111.65	
10											
	1	1712	142.7	~~111.83~~	~~1640~~	~~1548~~	~~129.0~~	~~13.7~~	~~343.3~~	~~111.72~~	
11				111.73	1535	1485	123.8	18.9	348.5	111.74	
	1	1601	133.4	~~111.80~~	~~1623~~	~~1579~~	~~131.6~~	~~1.8~~	~~350.3~~	~~111.75~~	
12				111.76	1573	1554	129.6	3.8	352.3	111.76	← MAX
	1	1491	124.3	~~111.75~~	~~1570~~	~~1566~~	~~130.5~~	~~-6.2~~	~~346.1~~	~~111.73~~	
13				111.74	1547	1570	130.0	-5.7	346.6	111.73	
	1	1380	115.0	~~111.70~~	~~1497~~	~~1522~~	~~126.8~~	~~-11.8~~	~~334.8~~	~~111.67~~	
				111.68	1472	1510	125.8	-10.8	335.8	111.67	

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Job BLUE HILL DAM
Sheet Number D-9
Date 12-22-198
By R.S./G.H.

TIME HRS	INTERVAL ΔT HRS	AVERAGE INFLOW RATE SEC-FT	AVERAGE INFLOW AC-FT	TOTAL RESERVOIR ELEV. AT END OF ΔT	OUTFLOW RATE CFS END OF ΔT	OUTFLOW RATE CFS AVG FOR ΔT	AVERAGE OUTFLOW FOR ΔT. AC-FT.	INCREMENTAL STORAGE ΔS AC-FT.	TOTAL STORAGE AC-FT	RESERVOIR ELEVATION END OF ΔT.
13										
	1	1380	115·0	111·68	1472	1510	125·8	-10·8	335·8	111·67
14										
	1	1270	105·8	111·60	1372	1422	118·5	-12·7	323·1	111·61
15										
	1	1160	96·7	111·54	1297	1335	111·3	-14·6	318·5	111·54
16										
	1	1049	87·4	~~111·47~~	~~1215~~	~~1256~~	~~104·7~~	~~-17·3~~	~~301·2~~	~~111·50~~
17				111·50	1247	1272	106·0	-18·6	299·9	111·50
	1	939	78·3	111·40	1141	1194	99·5	-21·2	278·7	111·39
18										
	1	828	69·0	~~111·33~~	~~1071~~	~~1106~~	~~92·2~~	~~-23·2~~	~~255·5~~	~~111·28~~
19				111·30	1036	1088	90·7	-21·7	257·0	111·29
	1	718	59·8	~~111·20~~	~~930~~	~~983~~	~~81·9~~	~~-22·3~~	~~234·8~~	~~111·17~~
20				111·18	909	972	81·0	-21·2	235·8	111·18
	1	608	50·7							
21										
	1	437	36·4							
22										
	1	387	32·3							
23										
	1	276	23·0							
24										
	1	166	13·8							
25										
	1	55	4·6							
26										

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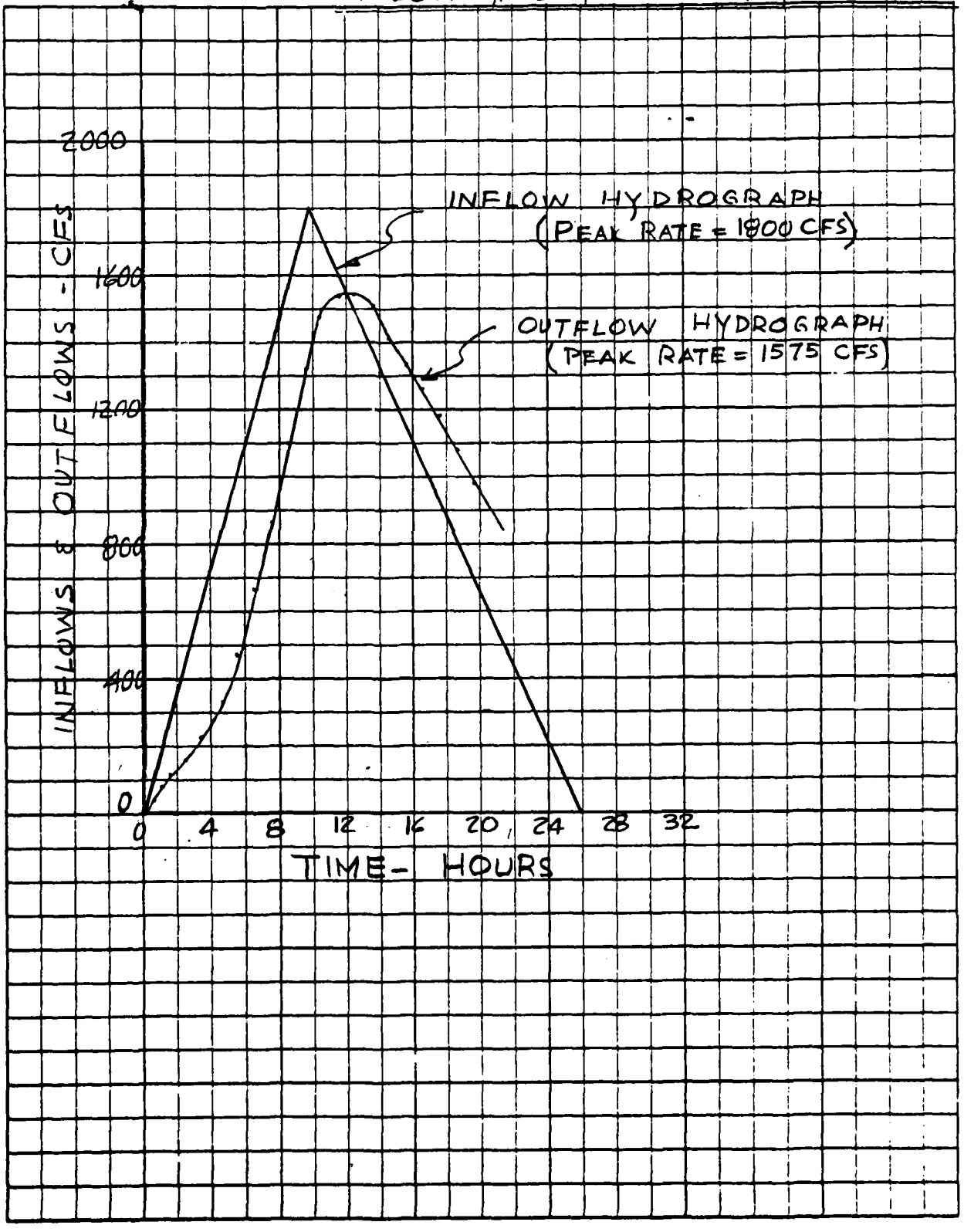
Job BLUE HILLS DAI
Sheet Number D - 10
Date
By R.S./G.H

INFLOW & OUTFLOW HYDROGRAPHS



AD-A144 547 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
BLUE HILLS DAM (CT 00..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV MAY 81

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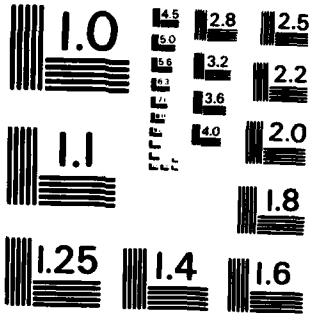

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

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Job BLUE HILLS RESERVOIR DAM
Sheet Number D-11
Date 1-21-1981
By R.S./G.H.

DAM FAILURE ANALYSIS

AS PER CORPS OF ENGINEERS' GUIDELINES,

$$Q_{P_{11}} = \frac{8}{27} \cdot W_b \cdot \sqrt{g} \cdot y_o^{3/2}$$

WHERE

$Q_{P_{11}}$ = DAM BREACH PEAK FAILURE OUTFLOW IN C.F.S.

W_b = BREACH WIDTH = 40% OF DAM LENGTH AT MID-HEIGHT.

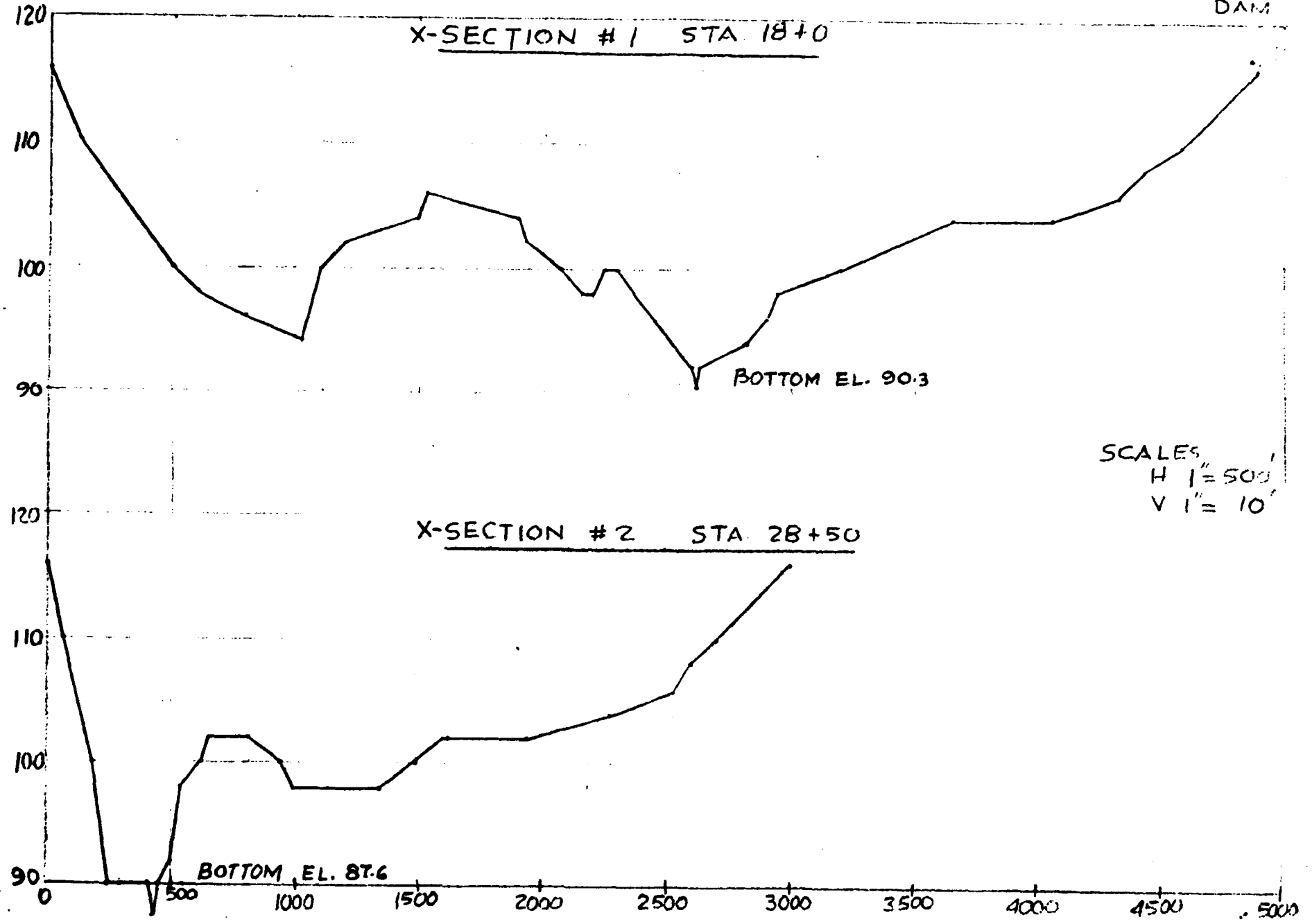
Y_o = HEIGHT OF STREAM-BED TO POOL LEVEL AT FAILURE

SUBSTITUTING THE VALUES OF Y_o AND W_b AS 24.4' AND $(0.4 \times 4045' = 1618')$ RESPECTIVELY:

$$Q_{P_{11}} = \frac{8}{27} \times (0.4 \times 4045) \times \sqrt{32.2} \times 20.0^{3/2}$$

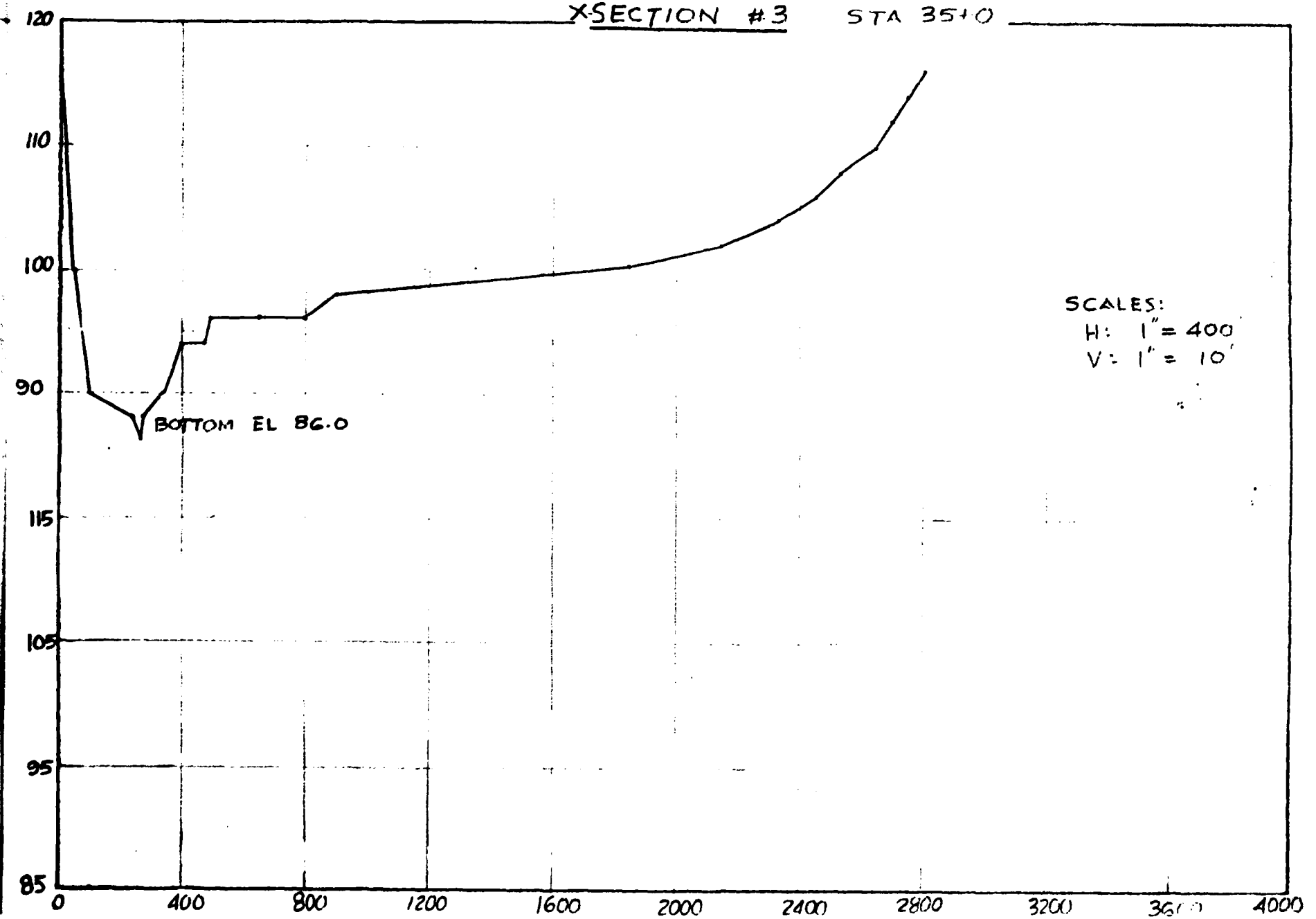
$$= 243{,}000 \text{ C.F.S.}$$

BLUE HILL RESERVOIR
DAM



SHT. # D-12

BLUE HILLS RESERVOIR
DAM



SHEET # D-13

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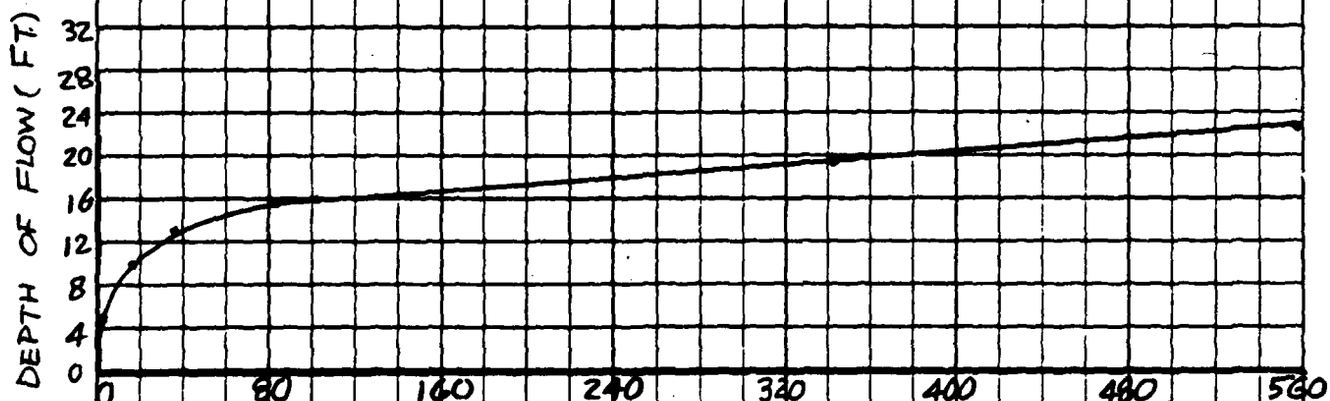
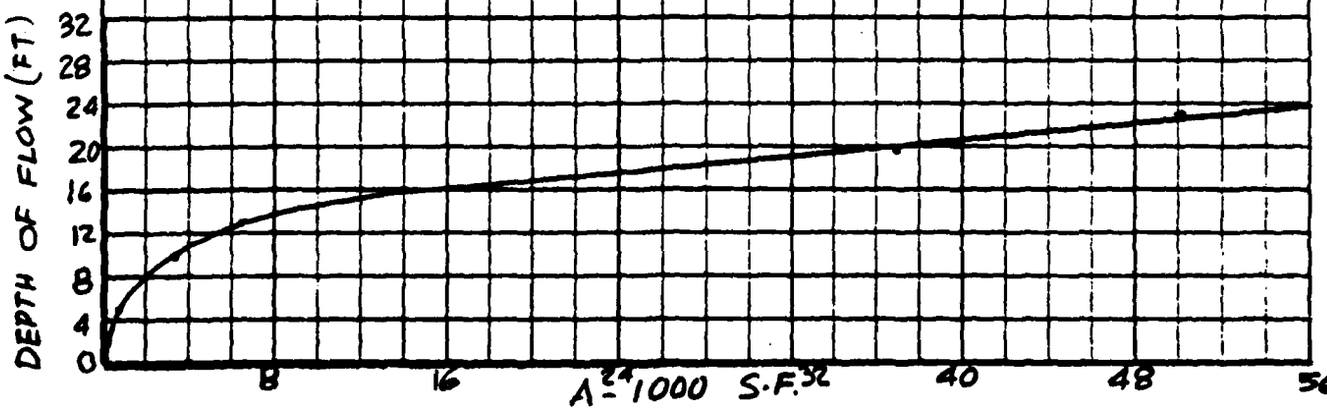
Job BLUE HILLS DAM
Sheet Number D-14
Date 1.23.1981
By R.S./G.H.

DAM FAILURE (D/S FLOOD ROUTING).

X-SECTION #1 (STA 18+0)

ELEV (FT)	D (FT.)	P_w (FT.)	A (S.F.)	R A/P_w (FT.)	S (FT/FT)	V ($1.\frac{486}{n} R^{2/3} S^{1/2}$) FT/SEC.	Q (C.F.S.)
95.0	4.7	370	600	1.62		3.10	1862
100.0	9.7	900	3350	3.72		5.40	18 097
103.0	12.7	1620	6500	4.01	.0028	5.68	36 914
106.0	15.7	2800	13 100	4.68		6.30	82 472
110.0	19.7	4430	36 900	8.33		9.25	341 195
113.0	22.7	4630	50 400	10.89		11.06	557,185
116.0	25.7	4860	64 950	13.36		12.67	822,880





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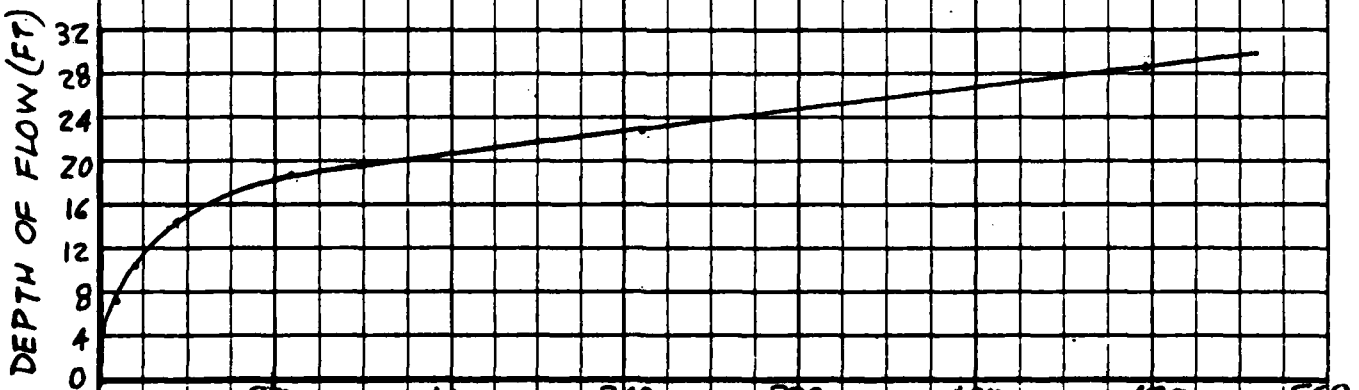
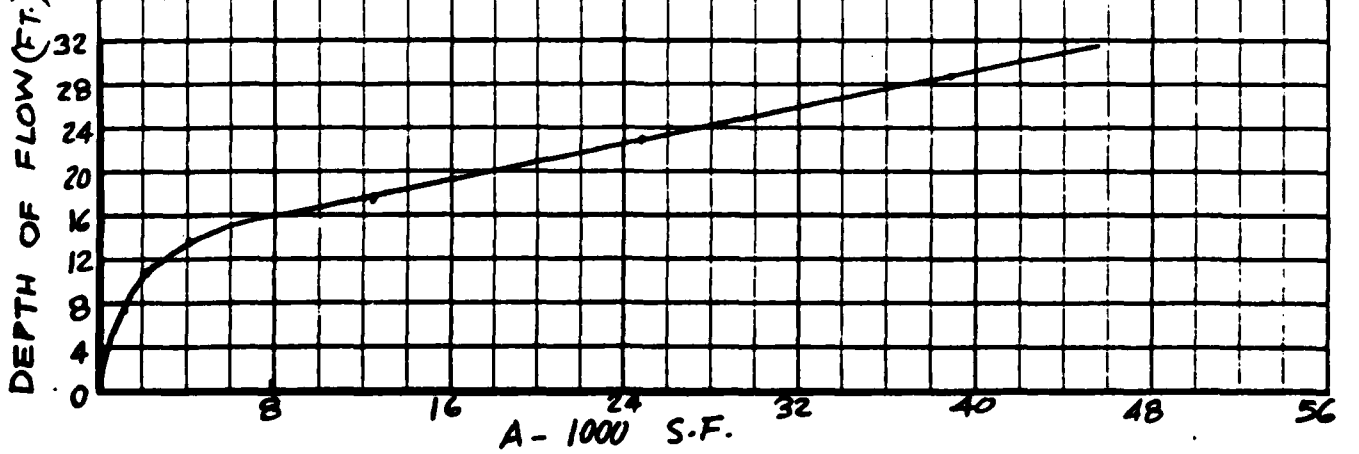
Job BLUE HILLS RESERVOIR
Sheet Number D-15 DAM
Date 1.22.1981
By R.S./G.H.

DAM FAILURE (D/S FLOOD-ROUTING)

X-SECTION #2 STA. 28+50

ELEV (FT)	D (FT)	P_W (FT)	A (S.F.)	$R = A/P_W$ (FT)	S (FT/FT.)	$V = \frac{1.49}{n} R^{2/3} S^{1/2}$ (FT/SEC)	Q (C.F.S.)
92.0	4.4	260	520	2.0		3.50	1.820
95.0	7.4	300	1250	4.17		5.73	7163
98.0	10.4	350	2225	6.36		7.59	16888
102.0	14.4	500	3925	7.85	.0027	8.73	34265
105.0	17.4	2250	12,425	5.52		6.90	85733
110.0	22.4	2600	24,925	9.59		9.98	248,752
116.0	28.4	3000	39,050	13.02		12.23	477,582





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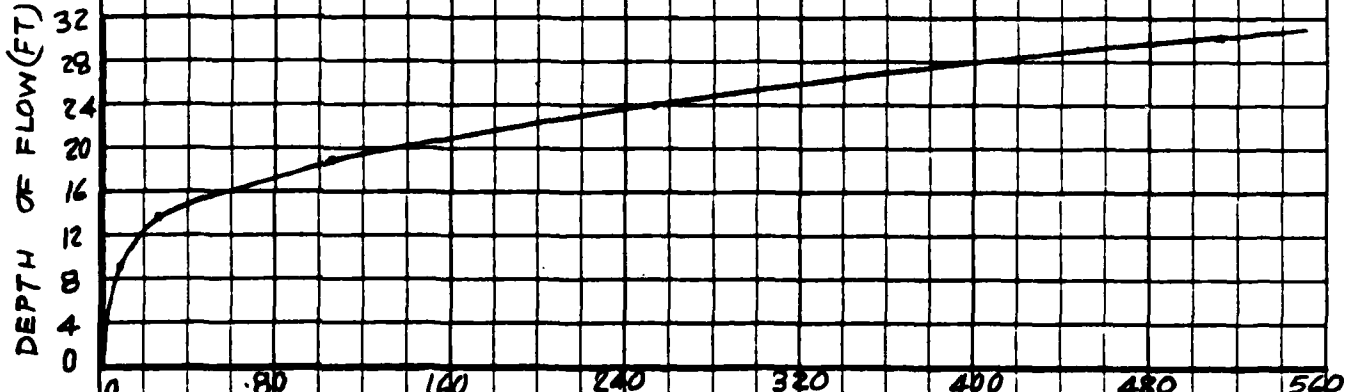
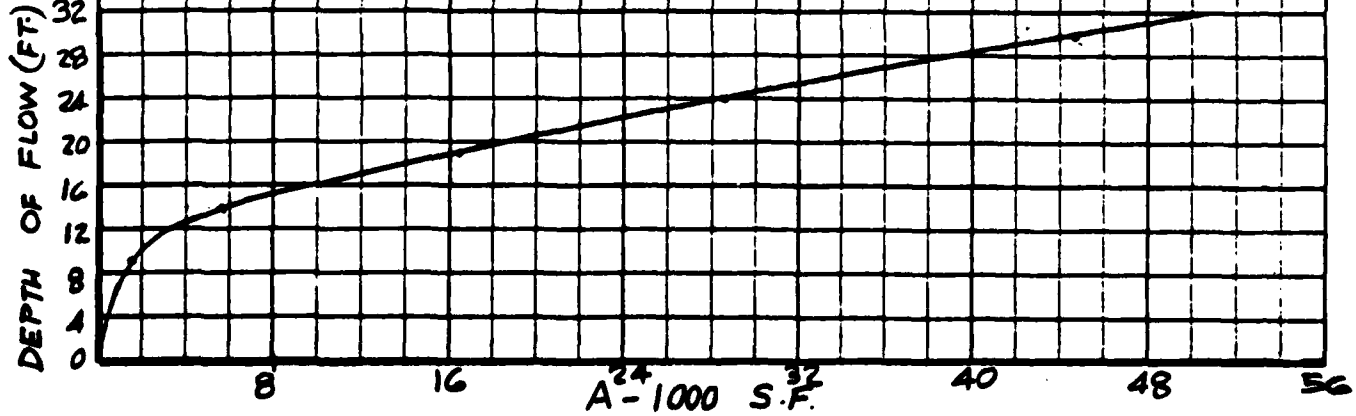
Job BLUE HILLS RESERVOIR
Sheet Number D-16
Date 1-22-1991
By R.S./G.H.

DAM FAILURE (D/S FLOOD ROUTING)

X-SECTION #3 STA 35+0

ELEV (FT)	D (FT)	P_w (FT)	A (S.F.)	$R = A/P_w$ (FT)	S (FT/FT)	$V = \frac{1.486}{n} R^{2/3} S^{1/2}$ (FT/SEC)	Q (C.F.S.)
91.0	5	260	550	2.10		3.00	1650
95.0	9	400	1800	4.50		4.91	8838
100.0	14	1800	5800	3.22	.0018	3.93	22794
105.0	19	2350	16175	6.88		6.51	105,300
110.0	24	2600	28550	10.98		8.89	253810
116.0	30	2800	44750	15.98		11.42	511,045





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Job BLUE HILLS RESERVOIR DAM
Sheet Number D-17
Date 3.7.1981
By R.S. / G.H

DAM FAILURE FLOOD ROUTING

X- SECTION #1 STA. 18+0

FOR Q_{p_1} = 243000 CFS.

H_1 = 18.2' AND A_1 = 27860 SF

REACH LENGTH = 1800'

STORAGE = 27860 × 1800/43560 = 1150 AC.FT.

ASSUME STORAGE = 800 AC.FT.

$Q_{p_2} = Q_{p_1}\left(1 - \frac{800}{1050}\right)$ = 243,000 × 0.24 = 58300 CFS

H_2 = 14.1' AND A_2 = 9600 SF.

STORAGE = 9600 × 1800/43560 = 397 AC.FT

AVG. STORAGE = ½ (397 + 800) = 600 AC.FT

$Q_{p_3} = Q_{p_1}\left(1 - \frac{600}{1050}\right)$ = 243,000 × 0.43 = 104,500 CFS.

H_3 = 16.0' AND A_3 = 15100 SF.

STORAGE = 15100 × 1800/43560 = 624 AC.FT

AVG. STORAGE = ½ (624 + 600) = 612 AC.FT.

$Q_{p_4} = Q_{p_1}\left(1 - \frac{612}{1050}\right)$ = 243,000 × 0.42 = 102,000 CFS

H_4 = 16.0'

ROUTED FLOW = 102,000

POST-FAILURE FLOOD ELEV. = 90.3 + 16.0
= 106.3 (SAY 106.0)

PRE-FAILURE FLOW = 1575 CFS

FLOW DEPTH = 4.5'

AND FLOOD ELEV. = 90.3 + 4.5
= 94.8 (SAY 95.0).

RISE IN FLOOD STAGE = 106.0 − 95.0 = 11.0'

NUMBER OF HOUSES FLOODED:

BEFORE FAILURE = 0

AFTER FAILURE = 10

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Job BLUE HILLS RESERVOIR DAM
Sheet Number D-18
Date 3.7.1981
By R.S./G.H

DAM FAILURE FLOOD ROUTING

X-SECTION #2 STA. 28+50

FOR Q_{p1} = 102,000 CFS,
H_1 = 17.9' AND A_1 = 13,675

REACH LENGTH = 1050'

STORAGE = 13675 × 1050/43560 = 330 AC.FT.

$Q_{p2} = Q_{p1}\left(1 - \frac{330}{1050}\right)$ = 102,000 × 0.69 = 70400 CFS

H_2 = 16.5' AND A_2 = 9875 S.F.

STORAGE = 9875 × 1050/43560 = 238 AC.FT.

AVG. STORAGE = ½(238 + 330) = 284 AC.FT.

$Q_{p3} = Q_{p1}\left(1 - \frac{284}{1050}\right)$ = 102,000 × 0.73 = 74,500 CFS

H_3 = 16.75'

ROUTED FLOW = 75,000 CFS ±

POST-FAILURE FLOOD ELEV. = 87.6 + 16.75
= 104.35 SAY 104.5

PRE-FAILURE FLOW = 1575 CFS
WATER-DEPTH = 4.3'
AND FLOOD ELEV. = 87.6 + 4.3
= 89.9 SAY 90.0

RISE IN FLOOD STAGE = 104.5 - 90.0
= 14.5'

NUMBER OF HOUSES & BUILDINGS FLOODED:
BEFORE FAILURE = 0
AFTER FAILURE = 31 +

SINGHAL ASSOCIATES
CONSULTING ENGINEERS
(CIVIL, HYDRAULICS, SANITARY)
827 MAPLEDALE ROAD, ORANGE, CT 06477
TEL: (203) 795-6562

Job BLUE HILLS RESERVOIR DAM
Sheet Number D-19
Date 3.7.81
By R.S. / G.H.

DAM FAILURE FLOOD ROUTING
X-SECTION #3 STA. 35+0

FOR Q_{P_1} = 75000 CFS. H_1 = 17.2′ AND A_1 = 12400 SF
REACH LENGTH = 650′
STORAGE = 650 × 12400/43560 = 185.0 AC. FT.

$Q_{P_2} = Q_{P_1}\left(1 - \frac{185}{1050}\right)$ = 75000 × 0.82 = 61500 CFS

H_2 = 16.3′ AND A_2 = 10700 SF

STORAGE = 650 × 10700/43560 = 160 AC. FT.

AVG. STORAGE = ½ (160 + 185) = 172.5 AC. FT.

$Q_{P_3} = Q_{P_1}\left(1 - \frac{172.5}{1050}\right)$ = 75000 × 0.84 = 63000 CFS

H_3 = 16.4′
ROUTED FLOW = 63000 CFS

POST-FAILURE FLOOD ELEV = 86.0 + 16.4 = 102.4
SAY 102.5

PRE-FAILURE FLOW = 1575 CFS.
WATER-DEPTH = 5.0′
AND FLOOD ELEV. = 86 + 5 = 91.0

RISE IN FLOOD STAGE = 102.5 − 91.0
= 11.5′

NUMBER OF HOUSES AND BUILDINGS FLOODED:

BEFORE FAILURE = 0
AFTER FAILURE = 47 (+)

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
CT	490	NED	CT	009	01				BLUE HILLS DAM	4150.3	7242.8	13FEB81

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	BLUE HILLS

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	08	TR-BEAMANS BROOK	BLOOMFIELD	0	18600

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RE	1964	C	27	24	2200		NED	N	N	N	B	

(28) REMARKS

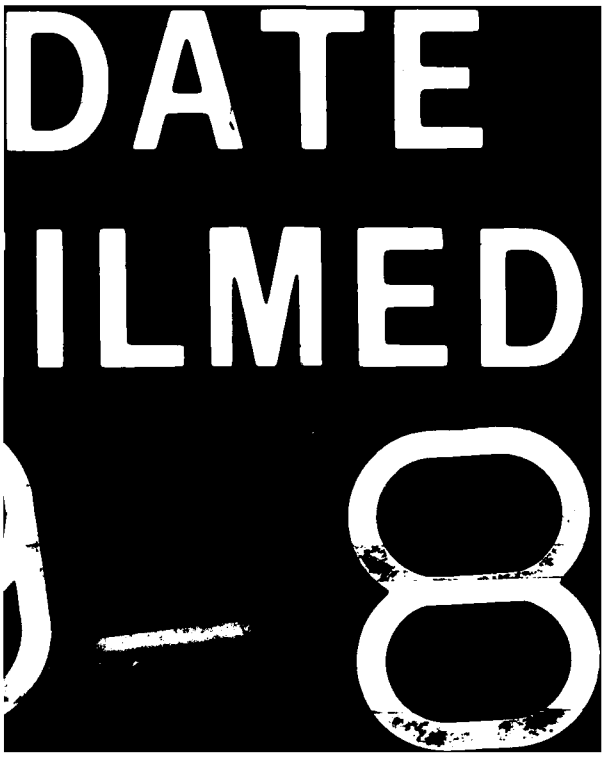
(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	4045	U	210	1554	137600											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
STATE OF CT	USDA SCS	MASKEL CONSTRUCTION

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
GOODWIN & O'DEA INC	15DEC80	PL92-367

(53) REMARKS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