Approved May 1977

HOUSATONIC RIVER BASIN MASTER MANUAL OF WATER CONTROL REGULATION

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OCTOBER 1976

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HOUSATONIC RIVER BASIN
MASTER MANUAL
OF
WATER CONTROL REGULATION

THOMASTON DAM
BLACK ROCK LAKE
HOP BROOK LAKE
HANCOCK BROOK LAKE
NORTHFIELD BROOK LAKE
EAST BRANCH DAM
HALL MEADOW BROOK DAM

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
WALTHAM, MASSACHUSETTS

June 1964
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PREFACE

The Housatonic River basin comprises an area of 1,949 square miles and is located in the western portion of Massachusetts and Connecticut and eastern New York. The coordinated flood control plan for the basin, described in this manual, includes seven dams and reservoirs and five local protection projects.

The Master Manual includes a description of the basin, statistical, climatological and flood data, project descriptions, operating procedures for reservoir regulation and also serves as a reference source for future studies. Appendix A contains the standard operating procedures (SOP) for regulation of the Naugatuck River watershed reservoirs. Appendix B contains pertinent data for the seven reservoirs, five local protection projects and hydrologic information for the Housatonic basin.

MASTER MANUAL OF WATER CONTROL REGULATION
HOUSATONIC RIVER BASIN
CONNECTICUT, MASSACHUSETTS AND NEW YORK

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CHAPTER I

INTRODUCTION

1. MASTER MANUAL

a. Authorization. This report is prepared pursuant to authority contained in ER 1110-2-240, "Reservoir Regulation," dated 22 April 1970, and EM 1110-2-3600, dated 25 May 1959 which requires that manuals of reservoir regulation for flood control, navigation or multipurpose reservoirs be prepared whenever storage allocated to one or more of the functions is the responsibility of the Corps of Engineers. Requirements and format given in the draft copy, "A Guide for Preparing Water Control Manuals for Lakes, Reservoirs, Locks and Dams, Hurricane Barriers, Reregulating Structures, Controlled Channels and Floodways, Office, Chief of Engineers," January 1973, were utilized in the preparation of this manual.

b. Purpose and Scope. This manual will serve as a guide and reference source for higher authority, reservoir regulation personnel in the New England Division Office, respective project managers and other personnel who may become concerned with, or responsible for, regulation of the reservoirs in the Housatonic River basin. Included in this manual are the following chapters:

(1) Introduction. A brief history of flood problems and studies which led to the authorization of the Housatonic River watershed flood control projects, including statistical data relative to population, industry and agriculture, and a description of the physical features of all Corps projects.

(2) Hydrometeorology. A general description of the basin and major tributaries, and a general coverage of the hydrologic and meteorologic data, i.e., temperature, precipitation, snowfall, snow cover, storms, streamflow and floods.

(3) Management. A general description of the functional responsibilities of the Corps in regard to regulation of the projects, with a listing of all interagency coordinating agreements.

(4) Reservoir Regulation. A general discussion of the regulation procedures and basin flood control plan for the existing system of flood control reservoirs. Explicit instructions and procedures are given in Appendix "A".

(5) Communications and Hydrologic Equipment. A brief description of the means of reporting from field to office, such as used by the project managers during nonflood and flood periods, including parameters to be reported, and the maintenance of the equipment which measures these parameters. Also included is a description of the river reporting network and Automatic Hydrologic Radio Reporting System.

(6) Hydrologic Forecasts. A description of forecasts used by Reservoir Control Center personnel in regulating the projects in the basin, including precipitation forecasts from the National Weather Service and river predictions from the Northeast River Forecast Center at Bloomfield, Connecticut and from the Corps.

(7) Regulation of Local Protection Projects. A general discussion of the regulation procedures for five local protection projects.

2. DESCRIPTION OF THE BASIN

a. General. The Housatonic River and its tributaries drain an area of 1,949 square miles in the western portions of Connecticut and Massachusetts and eastern New York. The basin, shown on plate 1, is roughly elliptical in shape, oriented in a north-south direction with a maximum length and width of 98 and 35 miles, respectively. It is a hilly basin with forested uplands and cleared valleys. Elevations vary from mean sea level (msl) to 2,620 feet msl along the northern divide. There are numerous lakes and ponds scattered throughout the basin which have a modifying influence on minor floods, but generally have little effect on major floods. There is considerable valley storage on the main stem between Great Barrington and Falls Village, which has a significant effect in desynchronizing floodflows from the upper watershed.

The Housatonic River rises near Washington Station, Massachusetts in the Berkshire Hills and flows in a southerly direction for 146 miles through Massachusetts and Connecticut to its mouth in Stratford on Long Island Sound. In the headwaters above Great Barrington, Massachusetts the valley is narrow and the river is steep as it emerges from the Berkshire Hills. Between Great Barrington and Falls Village, Connecticut, the river meanders through a generally broad valley varying from 1 to 3 miles in width. The river valley from Falls Village to tidewater at Shelton Dam is generally narrow and flanked by hills on either side. In the lower 12 miles from Shelton to Stratford the river is a tidal estuary and has been improved for navigation. The main stem of the Housatonic River has an overall fall of about 960 feet and an average slope of 7.3 feet per mile. A profile of the Housatonic River is shown on plate 2. The more important tributaries of the Housatonic River in downstream order are: East and West Branches, Ten Mile, Still, Shepaug, Pomperaug, and Naugatuck Rivers.

b. Tributaries

(1) Naugatuck River. The Naugatuck River is the largest and most important watershed of the Housatonic River, and is shown in Appendix A on plate A-1. The general flow is southerly through Torrington, Thomaston, Waterbury, Naugatuck, Beacon Falls, Seymour, and Ansonia to Derby where it discharges into the Housatonic River, 12 miles above its mouth. The watershed of the Naugatuck River is located primarily within the boundaries of Litchfield and New Haven Counties, with a small portion extending into Hartford County. The Naugatuck River watershed has a maximum length and width of approximately 50 and 12 miles, respectively, and a drainage area of 312 square miles. It has a rather uniform slope of about 14 feet per mile between the headwaters at Torrington and tidewater in Derby, Connecticut. The river valley is narrow with rocky hills rising on either side of the river. Elevations vary from a maximum of 1,625 feet msl on Dennis Hill in Norfolk along the northern divide to approximately 5 feet at the mouth. Its several relatively short and steep tributaries are conducive to rapid runoff. Major tributaries are the East and West Branches, Leadmine Brook, Branch Brook, Hancock Brook, Mad River, Meadow Brook, Little River, Bladdens River and Beaver Brook.

(2) East Branch - Housatonic River. The East and West Branches of the Housatonic River unite in the vicinity of Pittsfield, Massachusetts to form the main stem of the Housatonic River. The East Branch rises in Muddy Pond near Washington Station, and flows in a northerly direction through Hinsdale to Dalton, then in a general southwesterly direction to its junction with the West Branch, a total distance of approximately 17 miles. This tributary has a drainage area of 71 square miles and a total fall of about 480 feet.

(3) West Branch - Housatonic River. The West Branch has its source in Pontoosuc Lake in the northern part of Pittsfield. The river follows a southerly course for about 5 miles to its confluence with the East Branch. This branch drains an area of 59 square miles, and falls 140 feet in its 5-mile course below Pontoosuc Lake.

(4) Ten Mile River. The drainage area of Ten Mile River is 210 square miles, most of which lies in Dutchess County, New York. It joins the Housatonic River at mile 52, three-quarters of a mile below Bulls Bridge, Connecticut. The river has an average slope of about 4.3 feet per mile over its 35 mile length. The extensive valley storage coupled with the mild streambed slope, results in a moderate watershed runoff characteristic. It has been considered as a possible source of water supply for New York City, but to date its interstate character has precluded its development for this purpose. Principal tributaries are the Swamp River and Webatuck and Wassaic Creeks.

(5) Still River. The Still River has an area of 71.5 square miles and enters the Housatonic River at mile 40.6, about 2 miles downstream of New Milford, Connecticut. The headwater topography is hilly and the river has a slope of nearly 20 feet per mile for about 8 miles; however, the lower 11 miles below the Danbury-Brookfield town line has a comparatively flat gradient and narrow watershed. The river has a total length of 21.9 miles and falls 260 feet between its source in Lake Kenosia and the Housatonic River. There are numerous lakes above Danbury which are utilized for municipal water supply. Principal tributaries of the Still River are the Sympaug, Padanarum, Blind, and Lime Kiln Brooks.

(6) Shepaug River. The Shepaug River has a long, narrow drainage area of 156 square miles lying wholly within the State of Connecticut. It has an average slope of about 30 feet per mile over its 37.5 mile length. The source of the Shepaug River is west of North Goshen, from whence it flows in a southerly direction joining the Housatonic River about 10.5 miles below New Milford, Connecticut. The lower 3.5 miles are within Lake Lillinonah, formed by the Shepaug Dam on the Housatonic River at mile 30. About 25 miles above its mouth, the city of Waterbury has constructed a water supply reservoir and at times, diverts practically the entire runoff from the 38 square mile drainage area of the West Branch of the Shepaug River above the dam. The economic value of the Shepaug River lies principally in its use for water supply. The only important tributary of the Shepaug River is the Bantam River.

(7) Pomperaug River. The Pomperaug River drains an area of 88.8 square miles in Connecticut between the Shepaug and Naugatuck Rivers. The average slope over the 22.7 mile length is about 7 feet per mile. Principal tributaries of the Pomperaug River are the Weekeepeemee and Nonewaug Rivers.

c. Non-Federal Reservoirs

(1) General. There are a significant number of non-Federal reservoirs or lake systems in the basin which are used for power, water supply or recreation purposes. Although none of these reservoirs have storage set aside for flood control purposes, it is recognized that several of the power and water supply reservoirs are drawn down during the winter months and are capable of storing the runoff during the spring snowmelt periods. The power dams are generally operated for peaking purposes although during the springtime, and at other times when riverflows are considerable, some dams generate power continuously. Pertinent information on 19 selected projects are briefly summarized in table 1. The three largest reservoirs are further described in the following paragraphs.

(2) Candlewood Lake. Candlewood Lake Dam is located near the mouth of the Rocky River about two miles west of New Milford, Connecticut. The lake itself extends into Brookfield, New Fairfield and Danbury and has a drainage area of 40.4 square miles on Rocky River. This pumped storage project is operated

TABLE 1

PERTINENT DATA
SELECTED NON-FEDERAL RESERVOIRS (1)

Project	River	Drainage Area (sq. mi.)	Owner	Total Storage (ac/ft)	Purpose (2)
Pontoosuc Lake	West Br. Housatonic	24.2	Berkshire County, MA	5,000	R
Onota Lake	Onota Brook	10.3	City of Pittsfield, MA	5,130	R
Cleveland Res.	Cleveland Brook	1.4	City of Pittsfield, MA	5,680	WS
Center Pond	East Br. Housatonic	53.8	City of Dalton, MA	370	R
Shaker Mill Pond	Williams	33.0	Town of Stockbridge, MA	500	R,C
Mill Pond	Hubbard Brook	26.8	Private	605	R
Rising Paper Co. Dam	Housatonic	333.0	Rising Paper Co.	215	WS
Great Falls Dam	Housatonic	631.0	Conn. Light & Power	450	P
Bulls Bridge Dam	Housatonic	781.0	Conn. Light & Power	1,320	P
West Twin Lake	Schenob Brook	7.3	Private	9,146	R
Woodbridge Lake	Marshpaug	8.9	Private	6,630	R
Upper Shepaug Res.	West Br. Shepaug	10.5	City of Waterbury, CT	10,250	WS
Shepaug Res.	Shepaug	38.0	City of Waterbury, CT	4,090	WS
Wigwam Res.	Branch Brook	17.5	City of Waterbury, CT	4,100	WS
Candlewood Lake	(3)	40.5	Conn. Light & Power	172,000	P,R
Trapp Falls Res.	Pumpkin Ground Brook	1.1	Bridgeport Hydroelectric	7,280	P
Shepaug Dam	Housatonic	1,391.0	Conn. Light & Power	74,000	P,R
Stevenson Dam	Housatonic	1,545.0	Conn. Light & Power	26,900	P,R
Derby Dam	Housatonic	1,580.0	United Illuminating Co.	4,428	P,R

(1) Drainage area greater than 20 square miles OR storage greater than 4,000 Acre-Feet
(2) R - Recreation; WS - Water Supply; C - Conservation Storage; P - Hydroelectric Power
(3) Pump Storage facility

by the Connecticut Light & Power Company, with water pumped from the Housatonic River at the Rocky River power house during offpeak power periods. It has a total storage of 172,000 acre-feet and usable storage of 142,600 acre-feet. The Rocky River drainage basin contributes little if any to peak flows in the Housatonic River.

(3) Lake Lillinonah. Lake Lillinonah, located in Newtown, Brookfield, New Milford and Bridgewater, Connecticut is formed by the 147-foot high Shepaug Dam shown on plate 78. The dam, located 2.3 miles north of the center of Newtown at river mile 30, has a drainage area of 1,392 square miles and is used for hydroelectric power by the Connecticut Light & Power Company. The usable storage of approximately 5,400 acre-feet has no dependable beneficial effect upon floodflows in the Housatonic River (total storage is 74,000 acre-feet). In the past some of the storage evacuated in anticipation of a flood to minimize the backwater effect of the lake in the New Milford area has affected flood levels downstream. The project design discharge capacity is 132,400 cfs, of which 126,700 are passed over the spillway and the remainder through the station.

(4) Lake Zoar. Lake Zoar provides storage for hydroelectric power generation at the 124-foot high Stevenson Dam on the Housatonic River at mile 19.2, and is shown on plate 79. It has a usable pondage capacity of approximately 5,040 acre-feet, a total capacity of 26,900 acre-feet and a drainage area of 1,545 square miles. This project is an element in the Connecticut Light & Power Company system and is operated similar to the Shepaug project 10 miles upstream. Its limited storage has negligible effect upon floodflows in the lower Housatonic River. The design discharge capacity is 119,000 cfs, 113,000 over the spillway and 6,000 through the station.

3. CORPS OF ENGINEERS FLOOD CONTROL RESERVOIRS

a. General. The seven Corps flood control dams in the Naugatuck River watershed significantly reduce flooding at downstream control points. Approximately 50 percent of the drainage area at Ansonia is controlled by these projects. Three projects, namely, Thomaston Dam, Black Rock and Hop Brook Lakes have gated outlet controls and are manned, while the remaining four - East Branch and Hall Meadow Brook Dams, and Northfield Brook

and Hancock Brook Lakes have ungated outlets and are unmanned. These four projects which have comparatively small upstream drainage areas, serve as automatic floodwater detention reservoirs with limited discharge capacities. Flooding along the Naugatuck River is developed from the many small steep tributaries with rapid runoff characteristics. Therefore, the reduction and desynchronization of the contributions from these tributaries effectively reduce flood peaks on the main river.

Prior to 1955 it was considered that there should be sufficient storage capacity in a flood control reservoir to hold 6 inches of runoff from the watershed upstream of the project. Following the major floods of 1955, a reappraisal was made of storage requirements in New England flood control reservoirs. In general, the volume of runoff experienced in the 1955 floods demonstrated that it is desirable to provide at least 8 inches with up to 10 inches for smaller drainage areas whenever economically feasible.

b. Thomaston Dam

(1) Location. The dam is located in Thomaston on the Naugatuck River about 1.1 miles above Thomaston Center. The project encompasses portions of the towns of Thomaston, Harwinton and Litchfield. A photo and general plan are shown on plates 3 and 4.

(2) Purpose. Thomaston Dam, the largest and most important flood control dam in the Naugatuck River system is regulated to reduce flood stages on the Naugatuck River at all downstream communities such as Thomaston, Beacon Falls and Ansonia and also to reduce stages on the Housatonic River downstream of Ansonia.

(3) Physical Components. The important physical components of the project, shown on plates 5 and 6, consist of a rolled earth and rock-faced dam, outlet works and a side channel spillway. Pertinent data for the project is summarized on page ii of Appendix B.

The dam embankment consists of a rolled earth and rock fill dam 2,000 feet in length, with a maximum height above streambed of 142 feet. Top width of the dam is 24 feet, accommodating a paved road, and the top elevation of 517.0 feet msl provides for

18 feet of spillway surcharge and 5 feet of freeboard. The alignment of the dam is curved to position the dam along the most favorable foundation and also to accommodate the relocated railroad which crosses the downstream face of the dam on a 25.5 foot berm of varying elevation. Embankment slopes are 1 on 2 on the upstream side and 1 on 1-1/2 on the downstream side.

The spillway is an L-shaped side channel type located in rock on the left abutment. The 435-foot long ogee-shaped weir has its crest at elevation 494 feet msl, which is 9 feet above the approach channel. The discharge channel is 1,225 feet in length, varies from 70 to 65 feet in width, and discharges back into the river at an approximate elevation of 400 feet msl.

The outlet works consist of a gate chamber, control tower and operating house on the upstream side of the dam and a 455 foot long and 10-foot diameter horseshoe-shaped conduit. The gate structure contains two 5'-8" x 10' high hydraulically operated vertical slide gates for regulation purposes. The invert elevations of the intake and outlet ends of the conduit are 383 and 379 feet msl, respectively.

The authorization for the dam provides for flood control only, with a total storage capacity of 42,000 acre-feet, equivalent to 8.1 inches from the gross drainage area of 97.2 square miles, or 11.1 inches from the drainage area below East Branch and Hall Meadow Brook Reservoirs. Area capacity curves, area capacity table and a percent full curve are shown on plates 7 through 9.

Existing recreational development is limited to a picnic and overlook area near the left abutment immediately downstream of the dam, and contains picnic tables, fireplaces, parking area and a comfort station. The major limiting factor in public use development is the fact that the Naugatuck River is presently polluted by domestic and industrial wastes. Swimming is not encouraged and fishing is poor throughout most of the river. Ultimate development is contingent on pollution abatement on the Naugatuck River and future demands for increased facilities and activities.

c. Black Rock Lake

(1) Location. Black Rock Lake is located in Thomaaton and

Watertown on Branch Brook, about 2 miles upstream from the Naugatuck River. A photo and general plan of the project are shown on plates 10 and 11.

(2) Purpose. The project is regulated in conjunction with other Corps dams to reduce flood stages at downstream communities on the Naugatuck and lower Housatonic Rivers.

(3) Physical Components. The components of the project, shown on plates 12 through 14, consist of a rolled earth fill and rock-faced dam, outlet works, a chute spillway, and a small recreation pool. Pertinent data for the project is summarized on page iii of Appendix B.

The dam embankment consists of a rolled earth fill and rock-faced dam 933 feet in length, with a maximum height of 155 feet above the streambed. Top width of the dam is 25 feet with a paved roadway. Top elevation of the dam is 540 feet msl providing 15 feet of spillway surcharge and 5 feet of freeboard. The alignment is curved to position the dam where advantage was taken of the rock abutments to minimize the length of the dam.

The chute spillway is located in rock cut along the right bank. The spillway weir is a low concrete ogee section, 140 feet in length at elevation 520 feet, which is 8 feet above the approach channel.

The outlet works are located on the right bank and consist of an intake channel, a concrete weir to maintain a permanent pool, a control tower on the upstream side of the dam, a 704 foot long, 4 foot wide by 5 foot rectangular conduit, and an outlet channel. The intake channel weir is located just upstream of gate 1. The 6 stoplog openings of the control weir are 4 feet deep for flexibility in maintaining the level of the permanent pool. The lower part of the control tower contains the gate chamber with two 3 x 4 foot high slide gates at invert elevation 410 feet.

The lake contains storage for flood control and recreation. The recreation pool at elevation 437 feet (stage = 27 feet) contains 305 acre-feet, equal to 0.28 inch of runoff. The flood control storage contains 8,430 acre-feet which equals 7.75 inches of runoff from 20.4 square miles of drainage area. Area capacity curves, area capacity table and a percent full curve are shown

on plates 15, 16 and 17.

At present, the only recreation development has been the establishment of a permanent pool. The area is being managed for fish and wildlife conservation with no facility developments.

d. Hop Brook Lake

(1) Location. Hop Brook Lake is located in Waterbury, Naugatuck and Middlebury. The dam is situated on Hop Brook, about 1.3 miles above its confluence with the Naugatuck River. A photo and general plan are shown on plates 18 and 19.

(2) Purpose. The project is regulated to lower flood stages on the Naugatuck River and the lower Housatonic River.

(3) Physical Components. The physical components of the project, shown on plates 20 and 21, consist of a rolled earth fill and rock-faced dam, outlet works, a chute spillway, and a small recreation pool. Pertinent data is summarized on page iv of Appendix B.

The embankment consists of a rolled earth fill and rock-faced dam 520 feet in length and 97 feet in height above the streambed. Top width of the dam is 25 feet with a paved roadway. Top elevation of the dam is 381 feet msl, providing 12 feet of spillway surcharge and 5 feet of freeboard.

The spillway chute is located 1,200 feet northeast of the dam through a saddle. The 200- foot long concrete, broad-crested weir with crest at elevation 364.0 feet is 2 feet above the approach channel.

The outlet works are located along the left bank and consist of an intake channel, a concrete weir to maintain a permanent pool, a control tower, a 425 foot long and 3 x 4 foot high rectangular conduit, a stilling basin and an outlet channel. The intake channel weir is located just upstream of gate 1. The 6 stoplog openings of the control weir are 4 feet deep for flexibility in maintaining the level of the permanent pool. The control tower contains the gate chamber with two 3 x 4 foot high slide gates.

The lake contains storage for flood control and recreation.

The 18 foot deep recreation pool (elevation 310 feet) contains 120 acre-feet, equal to 0.14 inch of runoff. The flood control storage contains 6,850 acre-feet which equals 7.86 inches of runoff from the 16.4 square miles of drainage area. The permanent pool provides for swimming, fishing and small nonpower boating use. The area capacity curves, area capacity table and percent full curve are shown on plates 22, 23 and 24.

e. Hancock Brook Lake

(1) Location. Hancock Brook Lake is located within the town of Plymouth, Connecticut. The dam is situated on Hancock Brook, about 3.2 miles upstream of its confluence with the Naugatuck River. Photo, reservoir map and a general plan are shown on plates 25 through 27.

(2) Purpose. The project acts automatically and temporarily stores excessive Hancock Brook floodwaters to reduce flood stages on the Naugatuck River and the lower Housatonic.

(3) Physical Components. The components of the project, shown on plates 28 and 29, consist of a rolled earth fill and rock-faced dam, ungated outlet works, a chute spillway and a small conservation pool. Pertinent data is tabulated on page v of Appendix B.

The embankment consists of a rolled earth fill dam with rock slope protection that is 630 feet in length and 57 feet above the streambed. Top width of the dam is 20 feet and the top elevation of 505.0 feet msl provides 15.7 feet of surcharge and 5.3 feet of freeboard.

The spillway is an uncontrolled chute type adjacent to the right abutment of the dam. The 100 foot long concrete crest is at elevation 484.0 feet and the discharge channel is 850 feet in length. A spillway rating curve is shown on plate 30.

The outlet works are located on the right bank and consist of an inlet channel, a small U-shaped concrete weir to control the level of the permanent pool, a 3'-0" x 4'-6" high rectangular conduit 250 feet in length. An outlet rating curve is shown on plate 31. A 2 x 3 foot sluice gate in the weir dewaters the permanent pool.

The lake contains storage for flood control and conservation. The 6-foot deep permanent pool contains 130 acre-feet of storage, equal to 0.20 inch of runoff. The flood control storage at spillway crest elevation 484.0 feet msl contains 3,900 acre-feet, which is equivalent to 6.13 inches of runoff from the 12.0 square mile drainage area. The area capacity curves, area capacity table, percent full curve and inflow computation curves are shown on plates 32 through 35.

At the present time the only recreation development has been the establishment of a permanent pool. This pool provides opportunities for fishing and hunting.

f. Northfield Brook Lake

(1) Location. Northfield Brook Lake is within the towns of Thomaston and Litchfield, with the dam located on Northfield Brook about 1.3 miles above its confluence with the Naugatuck River. A photo, reservoir map and general plan are shown on plates 36 through 38.

(2) Purpose. The project acts automatically and temporarily stores excessive Northfield Brook floodwaters and helps to lower flood stages at downstream locations.

(3) Physical Components. The important components of the project, shown on plates 39 and 40, consist of a rolled earth fill and rock faced dam, ungated outlet works, a chute spillway and a small recreation pool. Pertinent data is presented on page vi of Appendix B.

The embankment is composed of rock slope protection and rolled earth fill that is 810 feet in length, with a maximum height of 118 feet above the streambed. Top width of the dam is 20 feet and the top elevation is 591.0 feet msl, with 10.1 feet of surcharge and 4.9 feet of freeboard.

The spillway is an uncontrolled, fixed crest, ogee weir with a crest length of 72 feet at elevation 576.0 feet msl. Its rating curve is shown on plate 41.

The outlet works are located on the right abutment and

consist of an inlet channel, a concrete weir with stoplogs to control the recreation pool level and a 36-inch diameter conduit 544 feet in length. An outlet rating curve is shown on plate 42. A 2 x 3 foot manually operated gate is provided in the concrete weir to dewater the recreation pool.

The lake contains storage for flood control and recreation. The 20-foot deep, 8-acre permanent pool at elevation 500 feet msl contains 82 acre-feet, equal to 0.30 inch of runoff. The flood control storage contains 2,310 acre-feet, equivalent to 7.70 inches of runoff from the 5.7 square miles of drainage area. The area capacity curves, area capacity table, percent full curve and inflow computation curves are shown on plates 43 through 46.

g. East Branch Dam

(1) Location. The East Branch project is located in Torrington, Connecticut. The dam is situated on the East Branch Naugatuck River about 3 miles above its confluence with the West Branch Naugatuck River. A photo, reservoir map and general plan are shown on plates 47, 48 and 49.

(2) Purpose. The project acts automatically and temporarily stores excessive East Branch floodwaters, thereby providing protection to the downstream community of Torrington. The reservoir provides protection to only one downstream community, and is therefore considered to be a local protection project.

(3) Physical Components. The physical components of this project, shown on plates 50 and 51, consist of a rolled earth filled dam with rock slope protection, ungated outlet works and a chute spillway. Pertinent data for the project is summarized on page vii of Appendix B.

The embankment consists of rolled earth fill with rock slope protection and the dam, 700 feet in length, has a maximum height of 92 feet above the streambed. The 20-foot wide top of dam is at elevation 881 feet msl providing an 11-foot surcharge and 5 feet of freeboard.

The spillway is a chute channel type located in the west abutment and the 100-foot long concrete ogee weir has a crest

elevation of 865 feet msl. A rating curve is shown on plate 52.

The outlet works, located on the west bank, consist of an inlet structure, a conduit and a stilling basin. The inlet structure is a drop inlet with a trash rack but without a gate. The 450-foot long, 36-inch diameter conduit discharges into the downstream stilling basin. An outlet rating curve is shown on plate 53.

The authorization provides for flood control only and the reservoir capacity totals 4,350 acre-feet, equivalent to 8.8 inches from its upstream 9.3-square mile drainage area. An area capacity curve, area capacity table, percent full curve and inflow computation curve are shown on plates 54 through 57.

Recreation at the project is suited primarily to day usage and organized overnight group-type activities. Existing uses include fishing, hunting, swimming and picnicking. A small pool has been created upstream of the dam and recreation facilities include a parking area, beach and comfort station.

h. Hall Meadow Brook Dam

(1) Location. The Hall Meadow Brook project (view shown on plate 58) is located in the city of Torrington and town of Goshen, Connecticut. The dam is situated on Hall Meadow Brook about 0.4 mile above its confluence with Hart Brook which forms the West Branch Naugatuck River. A reservoir map and general plan are shown on plates 59 and 60.

(2) Purpose. The project acts automatically and temporarily stores floodwaters from Hall Meadow Brook and those diverted from Rueben Hart Reservoir to reduce flood stages at Torrington on the West Branch Naugatuck and Naugatuck Rivers. The reservoir provides protection to only one downstream community, and is therefore considered to be a local protection project.

(3) Physical Components. The project components, shown on plates 61 and 62, consist of a rolled earth fill dam with rock slope protection, outlet works, a chute spillway, and a diversion channel from Reuben Hart Reservoir. Pertinent data for the project is summarized on page viii of Appendix B.

The embankment comprised of rolled earth fill with rock slope protection is 1,200 feet in length, has a top width of 20 feet and a maximum height of 73 feet above the streambed. Top of the dam is at elevation 917 msl and 19 feet above the spillway crest, providing a 14.1 foot spillway surcharge and 4.9 foot freeboard.

The spillway is an uncontrolled ogee weir type, located adjacent to the right abutment. The weir is a concrete ogee section with a length of 100 feet and an elevation of 898 feet msl. A spillway rating curve is shown on plate 63.

The outlet works (see plate 64 for rating curve) are located on the right bank of the dam and consist of an inlet channel, inlet structure, a conduit and an outlet channel. The inlet structure contains a small concrete weir with stoplog openings and weir, stoplog structure, and a 3 x 4 foot manually operated sluice gate. This structure was built to establish and maintain a permanent pool at a future date. The conduit, a 48-inch diameter concrete pipe constructed on rock under the dam, is approximately 315 feet in length.

The authorization provides for flood control storage which totals 8,620 acre-feet, equivalent to 9.4 inches from the contributing 17.2-square mile drainage area. An area capacity curve, area capacity table, percent full curve and inflow computation curve are shown on plates 65 through 68.

Recreation facilities at the project consist of a 600 x 400 foot swimming pool located 5,000 feet upstream of the dam, and two picnic areas with sanitary facilities.

Reuben Hart Reservoir, constructed in 1932, is owned and operated by the Torrington Water Company, with the dam located on Hart Brook adjacent to the Hall Meadow Brook project. Floodflows from the Reuben Hart drainage area are diverted to the Hall Meadow Brook Reservoir by means of a diversion canal and a spillway shown on plate 69. The arrangement provides for the control of floodwaters from 17.2 square miles of drainage area, consisting of 12.2 square miles from Hall Meadow Brook and 5.0 square miles from Hart Brook.

4. HISTORY OF RESERVOIR PROJECTS

a. Authorization

(1) Thomaston Dam. The project was authorized by the Flood Control Act approved 22 December 1944, Public Law 534, 78th Congress, 2d Session substantially in accordance with the recommendations of the Chief of Engineers in House Document 338, 77th Congress, 1st Session. This authorization provides for flood control only.

(2) Black Rock Lake. The project was authorized by the Flood Control Act approved 14 July 1960, Public Law 86-645, 86th Congress, 2d Session substantially in accordance with the recommendations of the Chief of Engineers in House Document 372. This lake has been authorized as a flood control project which includes a permanent conservation pool. Authorization for development and use of the lake area for public recreation and other purposes is contained in section 4 of the Flood Control Act approved 22 December 1944, as amended.

(3) Hop Brook Lake. The project was authorized by the Flood Control Act approved 14 July 1960, Public Law 86-645, 86th Congress, 2d Session substantially in accordance with the recommendation of the Chief of Engineers in House Document 372. The lake has been authorized as a flood control project which includes a permanent conservation pool. Authorization for use and development of the lake area for public recreation and other purposes is contained in section 4 of the Flood Control Act approved 22 December 1944, as amended.

(4) Hancock Brook Lake. The project was authorized by the Flood Control Act approved 14 July 1960, Public Law 86-645, 86th Congress, 2d Session substantially in accordance with the recommendation of the Chief of Engineers in House Document 372. The lake has been authorized as a flood control project which includes a permanent conservation pool.

(5) Northfield Brook Lake. The project was authorized by the Flood Control Act approved 14 July 1960, Public Law 86-645 substantially in accordance with the recommendations of the Chief of Engineers in House Document 372. The lake has been authorized as a flood control project which includes a conservation pool.

(6) East Branch Dam. The project was authorized by the Flood Control Act approved 3 July 1958, Public Law 85-500 substantially in accordance with recommendations of the Chief of Engineers in House Document 81. The dam has been authorized as a flood control project only.

(7) Hall Meadow Brook Dam. The project was authorized by the Flood Control Act approved 3 July 1958, Public Law 85-500 substantially in accordance with recommendations of the Chief of Engineers in House Document 81. The dam was authorized as a flood control project only.

b. Construction Periods

Project	Initiated	Completed
Thomaston Dam	May 1958	Nov 1960
Black Rock Lake	Nov 1967	Jul 1971
Hop Brook Lake	Dec 1965	Dec 1968
Hancock Brook Lake	Jul 1963	Aug 1966
Northfield Brook Lake	May 1963	Oct 1965
East Branch Dam	Jul 1962	Jun 1964
Hall Meadow Brook Dam	Mar 1961	Jun 1962

c. Modifications to Authorization. There have been no modifications to the authorized projects at any of the seven flood control dams within the Naugatuck River watershed.

d. Principal Project Problems. There have been no significant problems affecting the regulation of the seven flood control dams and reservoirs.

5. CORPS OF ENGINEERS LOCAL PROTECTION PROJECTS

a. Ansonia Local Protection Project. This complex project is located on the Naugatuck River and Beaver Brook in Ansonia, Connecticut. A plan of the project is shown on plate 70. The flood protection project extends 2 miles along the Naugatuck River, beginning 1,300 feet below the Division Street bridge and terminating near the American Brass Company hydroelectric plant. A line of protection has also been constructed along Beaver Brook from 400 feet above Central Street to its confluence with the Naugatuck River. The project includes relocation and realignment of

the river channel and construction of dikes, floodwalls, railroad and highway gate structures and interior drainage facilities, including pumping stations. The project provides flood protection to properties on both sides of the Naugatuck River up to the standard project flood (75,000 cfs) and up to a flow of 2,500 cfs along the lower reaches of Beaver Brook. Following is a description of the important physical components of the protective works.

(1) Four pumping stations can place a total of 10 pumps on line to discharge interior runoff during periods of high river stage. Each station is provided with sufficient pumping capacity so that with one pump inoperable, two-thirds of the design runoff can be discharged, based on existing developments.

(2) A total of 6,420 feet of concrete walls is provided in areas where space for earth dikes is insufficient, with heights of walls varying from 10 to 30 feet.

(3) There are about 10,400 feet of dikes along both banks of the Naugatuck River and along one bank of Beaver Brook. The dikes are rolled earth filled with rock slope protection along river and brook sides, with topsoil, seeded land slopes and gravel top surfaces. Height of the dikes varies from 10 to 30 feet.

(4) Channel improvement includes the widening, deepening and straightening of the Naugatuck River channel for 1,500 feet (with a 120-foot bottom width) from upstream of the ABC bridge to downstream of Maple Street bridge, and for 4,600 feet (with a 220-foot width) between the railroad bridge and mouth of Beaver Brook. In addition, the channel of Beaver Brook has been improved and consists of widening, deepening and straightening for a distance of 1,300 feet with a bottom width of 10 feet.

(5) A total of 4 railroad gates and 4 street gates (swing-type) are provided to permit vehicular passage through the protective system during nonflood times. The gates are fastened to the concrete abutments when not in use.

(6) The Beaver Brook portion of the protective works consists of 1,700 feet of earth dikes, 190 feet of concrete floodwalls, about 1,300 feet of channel improvements and the construction of about 1,050 feet of concrete conduit.

b. Derby Local Protection Project. The project is located within the city of Derby, New Haven County, Connecticut on the north bank of the Housatonic River and west bank of the Naugatuck River as shown on plate 71. Protection along the Housatonic River starts in the vicinity of Bridge Street with a 370-foot long floodwall joining an earth dike and continuing about 1,650 feet downstream to tie into the Route 8 highway embankment near the bridge. The Connecticut Route 8 embankment serves as the dike, linking the downstream end of the Housatonic protective works with the Naugatuck dike system. Protection along the Naugatuck River consists of an earth dike starting at Route 34, extending upstream about 3,300 feet and tieing into the downstream end of the Ansonia local protection project. A pumping station has also been constructed near the Derby sewage treatment plant. Four swing-type railroad gates are provided to permit passage through the protective works during nonflood periods. The project provides protection from a standard project flood with a combined peak discharge from the Housatonic and Naugatuck Rivers of 220,000 cfs.

c. Waterbury-Watertown Local Protection Project. The project shown on plate 72 extends 4,150 feet along the east bank of the Naugatuck River from the NYNH&H Railroad southerly towards Huntington Avenue bridge, and for 365 feet downstream on the west side of state highway Route 8. The project consists of 1,450 feet of stone-faced earth dike, a stop log structure at the NYNH&H railroad track, and about 2,700 feet of concrete wall. The river face of the existing rubble wall has been grouted from the railroad to a point 110 feet downstream of the Chase Brass bridge. The flood control works provide protection from a project design flood of 30,000 cfs.

d. Torrington Local Protection Project. The East Branch project, shown on plate 73, consists of channel straightening, deepening and widening, thus providing for a greater flow of water through the city. New bridges with greater span were provided by the city of Torrington and the State of Connecticut as replacements for inadequate, obsolete or flood-damaged structures. Local dikes were required at some locations, principally to provide necessary freeboard for the design flow of 3,700 cfs.

The West Branch project, shown on plate 74, consists of a concrete floodwall on the right bank between the Prospect Street

and Main Street bridges, minor channel excavation with side slopes of 2 horizontal to 1 vertical, and deepening and widening the channel downstream of the Main Street bridge. The channel adjacent to Fuessenich Park was deepened and widened, with floodwalls added to retain the design streamflow of 12,600 cfs.

e. Danbury Local Protection Project. The project, currently under construction and scheduled for completion in January 1977 (shown on plate 75) consists of channel improvements, realignment, excavation and backfilling providing protection for a standard project flood of 6,900 cfs.

The project originates 50 feet upstream of the completed Still River Channel Urban Renewal Project and extends 6,350 feet downstream below the Triangle Street bridge where it ties into the State of Connecticut Still River Channel Improvement Project. Demolition and construction of 4 railroad crossings, removal of a privately-owned highway bridge, construction of 2 highway crossings, and the filling of the old river channel were required. The project contains two separate reaches, a 3,625 foot long rectangular reinforced concrete channel with 3 box culverts of 170, 210 and 140 foot lengths and a 2,695 foot riprapped trapezoidal channel.

f. Construction Periods

Project	Initiated	Completed
Ansonia	Sep 1968	Jan 1973
Derby	May 1970	Jun 1973
Waterbury-Watertown	Jan 1961	Nov 1961
Torrington		
East Branch	Jul 1957	Sep 1958
West Branch	Jul 1959	May 1960
Danbury	Jul 1974	Jan 1977 (sched)

6. SOIL CONSERVATION SERVICE PROJECTS

a. Washington Mountain Brook. The Soil Conservation Service is responsible for the administration of a Watershed Work Plan Agreement on the Washington Mountain Brook drainage area. The plan, presently under construction (shown on plate 76) is located in the towns of Washington and Lee, Berkshire

County, Massachusetts, and will consist of 3 multipurpose reservoirs, streambank protection, channel improvement, and land treatment measures. The 3 reservoirs will control 6.1 of the 9.0 square mile drainage area of Washington Mountain Brook for a total of 1,251 acre-feet of flood control storage, equivalent to 3.8 inches of runoff from the contributing drainage area. However, due to the location and size of the watershed, it will not affect regulation of any Corps of Engineers reservoirs. Pertinent data on all SCS projects is listed in table 2.

b. Blackberry River Watershed. The Blackberry River watershed, shown on plate 77, is a tributary of the Housatonic River and has a total drainage area of 46.2 square miles. It is located primarily in Litchfield County, Connecticut, with a small portion in Berkshire County, Massachusetts. The Whiting River with a 19.7 square mile drainage area is the major tributary.

The Soil Conservation Service's improvements, completed in 1974, consist of 3 floodwater retarding structures on tributaries upstream of the village of Norfolk, Connecticut and 2 floodwater retarding structures on Whiting River. These 5 structures control 22.6 square miles or 49 percent of the total drainage area. Total flood control storage is 7,342 acre-feet, equivalent to 6.1 inches from the contributing drainage areas. These SCS projects have no effect on Corps of Engineers flood control activities.

7. REPORTS

a. Previous Reports. Published documents and reports on flood control projects in the Housatonic River basin that have been authorized, recommended or studied are summarized in the following paragraphs.

(1) House Document 308, 69th Congress, which was enacted into law, with modifications, in Section I of the River and Harbor Act of 21 January 1927 authorized a preliminary report covering navigation, flood control, power development and irrigation for the Housatonic River basin. Pursuant to this act, an unfavorable report was submitted 25 June 1931 by the District Engineer in House Document 246, 72d Congress.

(2) A review report of House Document 246 with recommendations for a flood control survey of the Housatonic River

TABLE 2

HOUSATONIC RIVER BASIN
SOIL CONSERVATION SERVICE
WATER IMPOUNDING STRUCTURES

Washington Mt. Brook, Massachusetts

Reservoir	Drainage Area (sq mi)	Flood Control Storage (acre/feet)	Flood Control Storage (inches)	Principal Spillway Max. Discharge Cap. (cfs)	Principal Spillway Max. Discharge Cap. (csm)	Emergency Spillway Design Capacity (cfs)	Emergency Spillway Design Capacity (csm)	Storage* Purpose
3	1.60	325	3.8	62	39	112	70	S,F,R
4	0.71	126	3.3	31	44	310	435	S,F,R
5 + 6	3.83	800	3.9	148	39	160	42	S,F,WS,R
TOTAL	6.14	1,251	3.8					

Blackberry River Watershed

1	4.75	1,585	6.3	145	31	1,300	275	S,F
5	3.03	1,027	6.4	139	46	950	315	S,F
6	1.09	353	6.1	57	52	800	735	S,F
9	4.09	1,052	4.8	142	35	3,170	775	S,F
15	9.65	3,325	6.5	238	25	7,200	745	S,F
TOTAL	22.61	7,342	6.1					

*S - Sediment; F - Flood Water; WS - Water Supply; R - Recreation

basin was submitted 1 October 1936 in compliance with a resolution approved and adopted by the Committee on Flood Control of the House of Representatives on 2 April 1936. This report received favorable recommendations by the Board of Engineers for Rivers and Harbors on 29 March 1937.

In letter dated 30 July 1937, the Chief of Engineers directed a report for flood control be made for the Housatonic River basin as recommended by the Board of Engineers for Rivers and Harbors.

(3) The first Federal flood control project for the Housatonic River basin was Thomaston Dam and Reservoir. This project was recommended in the report on survey for flood control dated 20 June 1940, contained in House Document 338, 77th Congress.

(4) Pursuant to authority contained in the Resolution by the Committee on Public Works of the United States Senate adopted 14 September 1955, the Chief of Engineers directed that a review of previous reports be made.

(a) The first interim report on review of survey for the Housatonic River basin covered the Upper Naugatuck River and was contained in House Document 81, 85th Congress, which recommended Hall Meadow Brook Dam and Reservoir and East Branch Dam and Reservoir.

(b) The second interim report on review of survey, Housatonic River basin, covered the Naugatuck River and is contained in House Document 372, 86th Congress, which recommended the following projects: Northfield Brook, Hancock Brook, Black Rock and Hop Brook Dams and Reservoirs.

(c) The third interim report on review of survey, Ansonia-Derby, Connecticut, Naugatuck River is contained in House Document 437, 87th Congress. The Flood Control Act of 1962 authorized the Ansonia Local Protection Project.

(d) The final report on review of survey for flood control, Housatonic River basin, submitted to OCE on 13 September 1963, recommended local protection projects at Danbury, Connecticut on the Still River and at Derby, Connecticut on the

Housatonic and Naugatuck Rivers. These two projects were authorized in 1965.

(5) Pursuant to authority contained in section 205 of the Flood Control Act of 1948, as amended by section 212 of the Flood Control Act of 1950 and Public Law 685, 84th Congress, approved 11 July 1956, the Division Engineer recommended construction of three local protection projects.

(a) Authorization for two of these is contained in letter dated 2 August 1956, from OCE in reply to letter dated 17 July 1956 from the New England Division, subject: "Local Protection Project - East Branch and Naugatuck Rivers, Torrington, Connecticut" and "Local Protection Project - West Branch of Naugatuck River, Torrington, Connecticut."

(b) Authorization for the third is contained in letter, dated 17 October 1956 from OCE in reply to letter of 27 September 1956 from the New England Division, subject: "Local Protection Project - Naugatuck River, Waterbury, Connecticut."

(6) Flood control and allied water users were considered in The Resources of the New England-New York Region, part 2, chapter XXII, "Housatonic River Basin." This comprehensive report inventoried the resources of the New England-New York area and recommended a master plan to be used as a guide for regional planning, development, conservation, and use of land, water and related resources of the region. Also included were proposals to reduce flood losses. Prepared by the New England-New York Inter-Agency Committee, the report was submitted to the President of the United States by the Secretary of the Army on 27 April 1956. Part 1 and chapter 1 of Part 2 are printed as Senate Document 14, 85th Congress, 1st Session.

b. Flood Plain Information Reports

(1) A Flood Plain Information Report, Naugatuck River, Ansonia, Seymour, Beacon Falls, Naugatuck, Waterbury, Watertown and Thomaston, Connecticut, authorized under section 206, Public Law 86-645, was requested by the State of Connecticut. This report, dated June 1973, was prepared by the New England Division, Corps of Engineers.

(2) A Flood Plain Information Report, Upper Housatonic River, Dalton, Hinsdale, Lanesborough and Pittsfield, Massachusetts, authorized under section 6, Public Law 83-566, was requested by the Commonwealth of Massachusetts. The report, dated March 1974, was prepared by the U.S. Department of Agriculture, Soil Conservation Service.

(3) A Flood Plain Information Report, Housatonic River, Sheffield, Massachusetts, authorized under section 206, Public Law 86-645 requested by the Commonwealth of Massachusetts was prepared by the New England Division, Corps of Engineers and published in May 1976.

c. Current Studies. The Housatonic River Basin Study, Massachusetts and Connecticut, is scheduled to begin in FY 1978. Primary focus of the study will be the development of alternative urban water resource plans which are compatible with the comprehensive urban development goals of the study area.

Initial work on the study will include reassessment of the Plan of Study prepared in June 1974, coordination with both states, public participation activities, and preliminary engineering work. Tentative completion is planned for FY 1981.

8. ECONOMY OF THE BASIN

a. General. The first settlement in the Housatonic River basin was at Stratford, Connecticut in 1639 with shipbuilding and shellfishing constituting the main activities of the early settlers. Other settlements began to appear along the river and its lower tributaries during the 17th century. Waterbury, now the center of the brass industry, was established in 1674, Seymour in 1680, Danbury (the "Hat Town") in 1684, and Shelton in 1697. These towns became important manufacturing centers. Until the middle of the 18th century, the Massachusetts area of the watershed was only sparsely settled by a few Dutch prospectors and traders. Stockbridge was originally established as an Indian mission in 1734. Eleven years later a grist mill was constructed, followed shortly by mills producing hats and wrought nails. The principal city and industrial center of the Massachusetts portion of the basin is Pittsfield which became a thriving agricultural and trading center soon after its settlement in 1752. However, during the post-Revolution depression, it turned to manufacturing

and during the past century and a half has experienced a rapid industrial growth. Many of the towns in the central and northern portions of the basin were established as agricultural centers.

b. Population. The population of the basin, based on the 1970 census, is estimated to be 560,000, an increase of 85,000 or nearly 18 percent over the 1960 census. All but 8,000 of the increase occurred in Connecticut, especially in the southern portion of the basin. Of the total 1970 basin population, 444,000 were estimated in Connecticut, 98,000 in Massachusetts and 18,000 in New York.

Major urban centers in the basin, with the exception of Pittsfield, Massachusetts and Danbury, Connecticut are located in the Naugatuck and lower Housatonic Valleys. While the population of the central cities remained relatively static between 1960 and 1970, the surrounding areas experienced rapid growth. For example, Waterbury increased by only 0.8 percent while the surrounding area grew 30.3 percent. The most dramatic growth during the 1960-1970 decade occurred in the Danbury area where the population increased 59 percent.

More than 40 percent of the labor force in the Naugatuck and lower Housatonic Valleys is employed in manufacturing industries, while the percent employed in these industries in the more rural areas of the basin ranges from less than 20 to 30 percent. Median family income tends to be less in manufacturing centers such as Waterbury, where this income ranges between $10,000 and $11,000 per year. On the other hand, the relatively affluent Danbury area had a 1970 median family income of $12,600. Socio-economic characteristics of selected communities within the basin are listed in table 3.

c. Economic Development. Manufacturing is the most important element in the economy of the basin. The rapidly flowing Naugatuck River in particular has attracted water-using manufacturing concerns to its banks, especially industries that specialize in the production of nonferrous metal and rubber products. Although much of the industrial activity is still located along the Naugatuck and lower Housatonic Rivers, to the detriment of water quality, new industrial parks on major transportation routes have attracted new or relocated industries. Likewise, the construction of suburban shopping centers has stimulated

TABLE 3

SOCIO-ECONOMIC CHARACTERISTICS

	1960 Pop.	1970 Pop.	Median Income (1970)	Employed in Mfg. (1970)
Waterbury	107,130	108,033	$10,459	43.3%
Milford	41,662	50,858	$12,414	39.8%
Danbury	39,382	50,781	$11,394	37.3%
Stratford	45,012	49,775	$12,268	46.6%
Torrington	30,045	31,952	$10,484	44.4%
Shelton	18,190	27,165	$12,099	49.1%
Naugatuck	19,551	23,034	$11,522	55.4%
Ansonia	19,819	21,160	$10,571	50.2%

and dispersed economic activity, thereby reducing the relative importance of the central cities as centers of commerce and industry.

Other than the Naugatuck River basin in Connecticut and the Ten Mile River basin in New York, agriculture is one of the principal industries of the Housatonic River basin and of great importance to its economy. Most of the tillable farmland is utilized by dairy interests, with a large percentage of all farm activity devoted to this purpose. Livestock and their byproducts account for about 90 percent of the farm income in the Housatonic River basin.

Tourism is an important element in the economy in the sparsely populated upper and middle portions of the basin. Principal summer resort centers are Lenox, Lee, Stockbridge and Great Barrington, Massachusetts and Lakeville and New Milford, Connecticut. The economy of these areas is bolstered by a heavy influx of

summer residents clustered around the numerous lakes and ponds.

d. Land Use. Land use in the Naugatuck and lower Housatonic Valleys is reflective of the region's dense population and heavy industry. Major highway and railroad networks serve the many riverfront industries and downtown and suburban shopping centers. Most of the housing is concentrated in high density (less than one-half acre per dwelling unit) areas, although an increasing percentage of the population lives in suburban tract developments with densities ranging from one-half to one acre per dwelling unit.

Except for the regions mentioned above, most of the existing land use in the basin is woodland and agricultural, with low density residential areas scattered throughout. Small concentrations of middle and high density residential uses occur in some of the town centers.

CHAPTER II

HYDROMETEOROLOGY

9. CLIMATE AND RUNOFF

a. General. The Housatonic basin has a variable climate and frequently experiences periods of heavy precipitation produced by local thunderstorms and larger weather systems of tropical and extra-tropical origin. The basin lies in the path of the prevailing "westerlies" which generally travel across the country in an easterly or northeasterly direction producing frequent weather changes. Due to its proximity to the Atlantic Ocean and Long Island Sound, the southern portion of the basin escapes the severe cold and heavy snowfall experienced in the higher elevations in the northern part of the watershed.

b. Precipitation. The mean annual precipitation over the Housatonic River basin is about 46 inches. The average annual precipitation varies over the basin due to orographic influences, from less than 42 inches in an area east of Candlewood Lake to more than 56 inches at higher elevations along the eastern boundary.

Distribution of the mean precipitation is approximately uniform throughout the year; however, the monthly extremes range from a high of more than 23 inches in August 1955 to less than 0.20 inch on several occasions. Table 4 summarizes the monthly precipitation at Pittsfield, Massachusetts, and Norfolk, Cream Hill, Danbury, Ansonia and Bridgeport, Connecticut; while plate 80 indicates the annual precipitation for the same stations.

c. Temperature. The average annual temperature of the Housatonic River basin is about 47° Fahrenheit. Within the basin, average annual temperatures range from about 50° near the coast to about 44° Fahrenheit in the higher elevations of northern portions. Average monthly temperatures vary widely throughout the year, ranging between 65° and 73° over the basin in July and August, and between 20° and 30° in January and February. Extremes in temperature range from occasional highs just over

TABLE 4

MONTHLY PRECIPITATION RECORD
(In Inches)

Month	Bridgeport, Connecticut Elevation 7 feet msl 82 Years of Record Through 1975			Danbury, Connecticut Elevation 510 feet msl 33 Years of Record Through 1975			Ansonia, Connecticut Elevation 20 feet msl 32 Years of Record Through 1975		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	3.59	7.88	0.40	3.12	7.68	0.20	3.45	7.50	0.37
February	3.48	6.65	0.85	3.19	8.44	1.02	3.45	5.59	1.15
March	4.09	9.64	0.29	3.69	8.68	1.74	4.51	12.81	1.59
April	3.84	9.41	0.69	3.83	8.17	1.34	3.92	7.31	0.89
May	3.77	10.18	0.49	4.02	8.58	1.39	4.02	7.75	0.78
June	3.34	17.70	0.06	3.61	11.65	0.53	3.22	14.00	0.20
July	4.03	18.77	0.45	4.31	11.30	0.92	3.71	7.94	0.32
August	4.14	13.29	0.20	4.40	16.34	1.19	3.87	12.36	1.33
September	3.65	14.15	0.09	4.04	13.56	0.26	4.14	11.39	0.27
October	3.47	10.72	0.30	3.54	17.64	0.24	3.45	14.37	0.77
November	3.86	10.22	0.81	4.63	8.56	1.28	4.54	7.82	1.59
December	3.92	9.85	0.33	4.27	10.21	0.72	4.53	9.22	0.63

Month	Cream Hill, Connecticut Elevation 1300 feet msl 74 Years of Record Through 1972			Norfolk, Connecticut Elevation 1380 feet msl 43 Years of Record Through 1975			Pittsfield, Massachusetts Elevation 1153 feet msl 72 Years of Record Through 1970		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	3.28	7.64	0.51	3.98	8.32	0.93	2.88	6.25	1.13
February	3.12	6.57	0.81	3.75	5.90	1.47	2.62	6.80	0.78
March	3.55	8.01	0.29	4.44	10.37	1.82	3.27	6.63	0.25
April	3.58	7.65	0.84	4.28	7.19	1.15	3.22	6.30	0.63
May	3.83	7.06	0.95	4.15	8.14	1.33	3.25	6.91	0.66
June	4.24	10.05	0.89	4.72	8.73	1.11	3.70	11.38	1.06
July	4.44	9.71	1.15	4.15	9.33	1.29	4.20	12.19	0.48
August	4.15	18.54	0.87	4.36	23.67	0.65	3.82	9.26	0.60
September	4.11	13.03	0.63	4.63	13.40	0.92	3.86	10.50	0.50
October	3.35	11.75	0.22	3.77	17.49	0.63	2.93	8.04	0.06
November	3.76	9.25	0.75	4.95	10.03	1.51	3.42	10.44	0.45
December	3.51	9.52	0.98	4.69	9.56	0.82	3.19	8.88	0.49

TABLE 5

MONTHLY TEMPERATURES
(Degrees Fahrenheit)

	Bridgeport, Connecticut Elevation 7 feet msl 80 Years of Record Through 1975			Danbury, Connecticut Elevation 510 feet msl 33 Years of Record Through 1975			Waterbury, Connecticut Elevation 340 feet msl 73 Years of Record Through 1966		
Month	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	30.1	68	-44	28.9	71	-16	27.7	73	-19
February	30.4	70	-20	30.5	70	-16	28.1	70	-25
March	38.4	85	1	38.4	80	- 9	37.1	87	- 7
April	48.7	97	9	50.1	91	15	48.2	92	11
May	57.7	95	26	60.1	94	25	59.4	96	24
June	68.1	99	34	68.9	97	35	67.9	101	33
July	73.8	103	44	73.8	101	40	72.7	105	41
August	72.2	101	38	72.1	100	33	70.6	104	35
September	65.9	98	32	64.8	93	23	64.0	103	25
October	55.4	90	20	55.4	91	19	53.4	94	17
November	44.4	80	8	43.2	82	0	42.3	84	2
December	33.1	67	-12	32.0	68	-11	30.9	70	-12
Annual	51.5	103	-20	51.5	101	-16	50.2	105	-25

	Cream Hill, Connecticut Elevation 1300 feet msl 76 Years of Record Through 1972			Norfolk, Connecticut Elevation 1380 feet msl 36 Years of Record Through 1975			Pittsfield, Massachusetts Elevation 1153 feet msl 52 Years of Record Through 1970		
Month	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	23.9	58	-19	22.0	62	-22	21.8	65	-22
February	24.4	70	-23	22.3	66	-17	22.3	63	-26
March	33.3	72	-10	31.1	77	-11	31.6	80	-11
April	44.7	85	11	43.7	86	6	43.3	91	5
May	56.2	87	23	55.6	87	25	55.0	95	24
June	65.0	92	32	64.4	91	32	63.7	100	33
July	69.8	98	41	69.2	92	41	66.5	101	39
August	67.7	98	37	67.3	93	35	66.2	100	31
September	61.5	94	26	59.8	93	26	57.6	95	23
October	51.3	89	15	49.2	79	17	47.3	89	14
November	38.9	77	- 5	37.6	73	5	36.8	76	- 1
December	26.9	67	-22	25.5	63	-14	25.0	67	-23
Annual	47.0	98	-23	45.6	93	-22	47.7	101	-26

TABLE 6

MEAN MONTHLY SNOWFALL
(Average Depth in Inches)

Pittsfield, Massachusetts
Elevation 1153 feet msl
49 Years of Record
Through 1970

Month	Snowfall
January	17.4
February	17.9
March	11.9
April	3.7
May	0.1
June	0
July	0
August	0
September	0
October	0.2
November	5.6
December	12.0
Annual	68.5

Norfolk, Connecticut
Elevation 1380 feet msl
37 Years of Record
Through 1975

Month	Snowfall
January	21.2
February	22.5
March	21.0
April	7.6
May	0.3
June	0
July	0
August	0
September	0
October	0.5
November	7.6
December	18.3
Annual	99.0

Cream Hill, Connecticut
Elevation 1300 feet msl
74 Years of Record
Through 1972

Month	Snowfall
January	16.7
February	17.5
March	13.8
April	5.0
May	0
June	0
July	0
August	0
September	0
October	0.2
November	5.6
December	13.4
Annual	72.8

Bridgeport, Connecticut
Elevation 7 feet msl
76 Years of Record
Through 1975

Month	Snowfall
January	8.7
February	10.0
March	6.5
April	1.1
May	0
June	0
July	0
August	0
September	0
October	0
November	1.4
December	6.5
Annual	34.2

100° Fahrenheit to lows in the minus teens in the southern part of the basin and minus twenties in the northern areas. Freezing temperatures may be expected from the latter part of October until late in April. The mean, maximum, and minimum monthly and annual temperatures at selected stations are shown in table 5.

d. Snowfall. The average annual snowfall over the Housatonic River basin varies from about 35 inches near the coast to over 80 inches in the higher elevations of Massachusetts and northern Connecticut. The mean monthly and annual snowfall at Pittsfield, Massachusetts and Norfolk, Cream Hill and Bridgeport, Connecticut are shown in table 6. Locations of these stations are shown on plate 1.

e. Snow Cover. In recent years, surveys of snow cover have been taken in the upper Naugatuck River basin by the Corps. The location of these snow courses are shown on plate 1, and indicated in table 7. The surveys indicate that water content of the snow reaches a maximum during early March. A flood threat due to a combination of heavy rain and snowmelt runoff is a possibility nearly every year. Monthly water equivalents in the snow cover are listed in the hydrologic pertinent data sheet on page i of Appendix B.

TABLE 7

SNOW COURSES IN CONNECTICUT
(1957 - 1976)

Course	Elevation (msl)	Latitude	Longitude
Norfolk	1,360	41°59'	73°12'
West Torrington	640	41°48'	73°08'
Campville	490	41°44'	73°06'
Thomaston Dam	450	41°42'	73°04'

f. Storms. The three general types of storms occurring in the Housatonic River basin are continental, coastal, and those associated with thunderstorms which may be of local origin or the result of a stationary front. Continental storms originate over the western or central part of the United States and move in a general easterly and northeasterly direction. These storms may be rapidly moving intense cyclones or of the stationary type. They are not limited to any season or month, but follow one another at more or less regular intervals with varying intensities throughout the year.

Tropical hurricanes are the most important of the coastal storms. They originate either in the South Atlantic or in the Western Caribbean Sea and generally move in a westerly or northwesterly direction, recurving to the north as they near the mainland, and then to the northeast approaching New England. In general, hurricanes are likely to occur during the months of August and September.

Coastal storms of an extratropical nature differ from the hurricanes principally as they originate along the eastern seaboard and have less energy associated with them. These storms travel northward along the coast, occurring most frequently during the autumn, winter, and spring months. Thunderstorms may be of a local origin or the frontal type associated with the summer months.

g. Runoff

(1) Discharge Records. The U.S. Geological Survey has published records for 23 gaging stations in the Housatonic River basin for varying periods of time since 1900. Pertinent data for 18 current stations are summarized in table 8.

(2) Streamflow Data. The average annual runoff on the Housatonic River at Stevenson, Connecticut, which encompasses 1,545 of the total area of 1,949 square miles of the Housatonic River basin, is 22.4 inches. This compares with the average annual runoff of 25.9 inches for the Naugatuck River at Beacon Falls, Connecticut. These values represent approximately 50 percent of the average annual precipitation. Mean, maximum, and minimum monthly runoff in cubic feet per second and inches are shown for selected locations in table 9. These values are

TABLE 8

HOUSATONIC RIVER BASIN
CURRENT STREAMFLOW RECORDS THROUGH WATER YEAR 1974

Location of Gaging Station	Drainage Area (sq. mi.)	Period of Record	Discharge (cfs) Mean	Maximum	Minimum
East Br. Housatonic R. at Coltsville, Mass.	57.1	1936-1974	112	6,400 9/21/38	4.4 8/15/36
Housatonic R. near Great Barrington, Mass.	280	1913-1974	518	12,200 1/1/49	1.0 10/18/14
Housatonic R. at Falls Village, Conn.	634	1912-1974	1,066	23,900 1/1/49	*
Tenmile R. near Gaylordsville, Conn.	203	1929-1974	295	17,400 8/19/55	5.0 9/8/57
Pomperaug R. at Southbury, Conn.	75	1932-1974	124	29,400 8/19/55	2.5 8/30/66
Copper Mill Brook near Monroe, Conn.	2.5	1958-1974	473	255 2/2/73	0.04 9/9/64
Housatonic R. at Stevenson, Conn.	1,545	1928-1974	2,548	75,800 10/16/55	*
West Br. Naugatuck R. at Torrington, Conn.	33.7	1956-1974	53.7	4,630 12/21/73	0.3 8/21/68
East Br. Naugatuck R. at Torrington, Conn.	13.7	1956-1974	23.5	1,500 8/5/69	0.3 8/24/64
Naugatuck R. at Thomaston, Conn.	99.2	1959-1974	186	5,140 3/31/60	8.4 8/14/64
Housatonic R. at Gaylordsville, Conn.	993	1940-1974	1,632	51,800 8/19/55	60.0 8/31/44
Naugatuck R. at Beacon Falls, Conn.	261	1918-1974	480	106,000 8/19/55	24 10/21/35
Salmon Creek at Limerock, Conn.	29.4	1961-1974	44.6	1,300 12/21/73	0.7 9/25/64
Guinea Brook at Ellsworth, Conn.	3.5	1960-1974	6.29	319 12/22/73	0
Marshepaug R. near Milton, Conn.	9.24	1967-1974	20.8	474 12/22/73	0.5 5/13/70
Nonewaug R. at Minortown, Conn.	17.7	1962-1974	27.7	2,300 9/29/74	0.23 10/10/70
Branch Brook near Thomaston, Conn.	20.6	1971-1974	-	585 2/6/73	0.7 6/22/73
Hop Brook near Naugatuck, Conn.	16.3	1969-1974	35.9	535 12/22/73	0.06 8/20/70

*No flow at times (result of regulation)

TABLE 9

MONTHLY RUNOFF
HOUSATONIC RIVER BASIN

Housatonic River at Stevenson, Connecticut (DA = 1545 square miles) 1928-1974

Month	Average CFS	Average Inches	Maximum CFS	Maximum Inches	Minimum CFS	Minimum Inches
January	2776	2.09	9550	7.19	797	.60
February	2867	1.95	7455	5.07	1191	.81
March	4861	3.66	13202	9.94	2085	1.57
April	5462	3.98	10994	8.01	2169	1.58
May	3174	2.39	6428	4.84	1222	.92
June	2059	1.50	7055	5.14	523	.38
July	1262	.95	5007	3.77	292	.22
August	1023	.77	8275	6.23	239	.18
September	1139	.83	8605	6.27	151	.11
October	1116	.84	9444	7.11	239	.18
November	2072	1.51	8756	6.38	288	.21
December	2577	1.94	7531	5.67	770	.58

Naugatuck River at Beacon Falls, Connecticut (DA = 261 square miles) 1918-1974

Month	Average CFS	Average Inches	Maximum CFS	Maximum Inches	Minimum CFS	Minimum Inches
January	559	2.49	1517	6.76	128	.57
February	564	2.27	1466	5.90	211	.85
March	1023	4.56	2266	10.10	478	2.13
April	958	4.13	2017	8.70	318	1.37
May	586	2.61	1131	5.04	220	.98
June	357	1.54	1584	6.83	95	.41
July	222	.99	1001	4.46	43	.19
August	218	.97	3078	13.72	38	.17
September	213	.92	1366	5.89	53	.23
October	245	1.09	2475	11.03	45	.20
November	429	1.85	1869	8.06	58	.25
December	554	2.47	1642	7.32	114	.51

Housatonic River near Great Barrington, Massachusetts (DA = 280 square miles) 1913-1974

Month	Average CFS	Average Inches	Maximum CFS	Maximum Inches	Minimum CFS	Minimum Inches
January	484	2.01	1728	7.18	82	.34
February	464	1.74	1061	3.98	128	.48
March	888	3.69	2506	10.41	289	1.20
April	1278	5.14	2624	10.55	455	1.83
May	674	2.80	1353	5.62	279	1.16
June	403	1.62	1301	5.23	132	.53
July	277	1.15	1129	4.69	91	.38
August	224	.93	929	3.86	87	.36
September	259	1.04	1587	6.38	75	.30
October	250	1.04	1066	4.43	79	.33
November	443	1.78	2022	8.13	85	.34
December	510	2.12	1574	6.54	111	.46

Still River near Lanesville, Connecticut (DA = 68.5 square miles) 1932-1971

Month	Average CFS	Average Inches	Maximum CFS	Maximum Inches	Minimum CFS	Minimum Inches
January	133	2.26	296	5.03	33	.56
February	149	2.29	334	5.12	49	.75
March	219	3.72	463	7.86	110	1.86
April	191	3.14	349	5.74	68	1.12
May	125	2.12	213	3.61	45	.76
June	85	1.39	318	5.22	33	.55
July	58	.98	201	3.41	25	.42
August	63	1.07	435	7.39	21	.36
September	61	1.01	377	6.19	16	.26
October	68	1.15	636	10.80	18	.31
November	107	1.76	480	7.89	24	.39
December	121	2.05	256	4.35	32	.54

average discharges which have been adjusted for upstream storage and diversion; annual runoff for the same locations is shown on plate 81.

h. Frequency Analysis

(1) Natural Peak Discharge Frequency. The frequency or percent chance of occurrence of discharges in the Housatonic River basin were determined for U.S. Geological Survey gaging stations which had periods of record in excess of 15 years. Frequency analyses were made in accordance with procedures described in ER 1110-2-1450, "Hydrologic Frequency Estimates," dated 10 October 1962. A regional skew coefficient of 1.0 was adopted for all stations in the basin. Natural peak discharge-frequency data through 1967 for the selected locations are shown on table 10.

(2) Frequency of Reservoir Filling. A tabulation of significant storages at the seven Corps reservoirs is listed on table 11.

10. CHANNEL AND FLOODWAY

a. General. Industrial and commercial development has been confined to the lower portion of the basin in Connecticut, particularly in the Naugatuck River Valley. Some of the commercial centers and many of the factories and mills in these areas are located on banks of the rivers. The river channels in many reaches are restricted by buildings, walls and bridges. Concentration of runoff and steep hydraulic gradients throughout the flood-prone areas also produce damaging velocities. Roads, bridges, railroads, buildings and lands along the streams are all susceptible to damage from flooding.

Except for concentrations in the Pittsfield and Derby-Shelton areas, flood damage along the main stem of the Housatonic River is widely scattered. Due to the lengthy travel time and great amount of valley storage near the central portion of the watershed, flood peaks in the lower basin are produced by the tributaries just upstream of the damage centers. The most important Housatonic River index station is the USGS gage at Stevenson.

Most of the flood plain along the Naugatuck River has been

TABLE 10

HOUSATONIC RIVER BASIN
NATURAL FREQUENCY DATA
(Peak Discharge in Cubic Feet Per Second)

DA (Square Miles)		East Branch Housatonic R. at Coltsville, Mass.	Housatonic R. near Great Barrington, Mass.	Housatonic R. at Falls Village, Conn.	Housatonic R. at Gaylordsville, Conn.	Tenmile River near Gaylordsville, Conn.	Still River at Lanesville, Conn.
		57.1	280	632	994	204	68.5
Percent Chance	Years						
.50	200	9,850	16,500	30,500	56,000	26,500	8,000
1.00	100	7,900	13,600	24,600	45,000	19,500	6,100
1.25	80	7,450	12,800	23,000	44,000	18,000	5,600
2.0	50	6,290	11,100	19,900	36,000	14,500	4,600
4.0	25	5,050	9,150	15,900	28,200	10,600	3,500
5.0	20	4,660	8,530	14,800	26,100	9,550	3,180
10.0	10	3,670	6,900	11,600	20,100	6,800	2,360
20.0	5	2,840	5,500	9,000	15,300	4,800	1,790
50.0	2	1,970	4,050	5,850	10,800	3,260	1,250
99.9	1	1,450	2,560	4,000	8,300	2,120	920

DA (Square Miles)		Shepaug River at Woodville, Conn.	Shepaug River near Roxbury Conn.	Pomperaug R. at Southbury, Conn.	Housatonic R. at Stevenson, Conn.	Naugatuck R. at Beacon Falls, Conn.
		38	133	75.3	1,545	261
Percent Chance	Years					
.50	200	16,400	37,000	24,900	164,000	82,500
1.00	100	11,800	26,400	18,500	122,000	60,000
1.25	80	10,500	23,700	16,800	112,000	56,000
2.0	50	8,400	18,800	13,600	91,000	45,000
4.0	25	6,000	13,200	10,000	67.500	34,000
5.0	20	5,400	11,900	9,100	60,500	29,500
10.0	10	3,740	8,300	6,590	44,000	21,500
20.0	5	2,540	5,600	4,650	32,200	15,000
50.0	2	1,500	3,750	2,970	22,000	10,300
99.9	1	900	2,820	2,260	13,200	6,400

TABLE 11

TABULATION OF SIGNIFICANT STORAGES*

Date	Maximum Stage	Storage Utilized Inches	Storage Utilized Acre-Feet	Storage Utilized Percent
THOMASTON DAM				
1961 Feb	52.7	1.1	5,600	13
1967 Dec	46.0	0.8	3,950	9
1968 Mar	59.2	1.4	7,400	18
1968 May	45.0	0.7	3,775	9
1969 Mar	51.0	1.0	5,200	12
1969 Apr	60.0	1.5	7,850	18.5
1969 Aug	57.0	1.3	6,900	16
1970 Feb	48.1	0.9	4,450	10
1970 Apr	59.0	1.5	7,600	18
1972 Mar	45.0	0.7	3,775	9
1972 Jul	45.6	0.8	4,100	9.5
1973 Feb	60.0	1.5	7,850	18.5
1973 Jul	46.1	0.8	4,000	9.5
1973 Dec	68.9	2.2	11,300	27
1975 Sep	68.7	2.2	11,190	27
1976 Jan	65.0	1.9	9,980	23
HOP BROOK LAKE				
1969 Mar	36.6	0.9	820	12
1969 Apr	37.8	1.0	920	14
1970 Feb	40.2	1.4	1,150	16
1970 Apr	40.6	1.4	1,200	17
1971 Aug	33.8	0.7	620	10
1972 Feb	32.0	0.6	500	8
1972 Mar	38.0	1.1	930	14
1972 Jun	32.1	0.6	500	8
1972 Nov	32.5	0.6	530	8
1973 Feb	42.3	1.6	1,360	19
1973 Jul	47.0	2.2	1,950	28
1973 Dec	45.8	2.0	1,780	25.5
1975 Sep	44.1	1.9	1,690	22
1976 Jan	47.3	2.3	2,000	29
HALL MEADOW BROOK DAM				
1967 Dec	11.0	0.3	305	6
1968 Mar	12.2	0.5	425	7
1968 May	11.0	0.3	305	6
1969 Apr	14.0	0.7	655	9
1969 Aug	16.0	0.9	840	11
1970 Feb	11.0	0.3	305	6
1970 Apr	12.5	0.5	465	7
1972 Mar	11.0	0.3	305	6
1972 Jun	11.0	0.3	305	6
1972 Jul	11.0	0.3	305	6
1973 Feb	14.5	0.8	700	9
1973 Dec	17.2	1.1	1,010	13
1975 Mar	13.5	0.7	595	8
1975 Apr	11.5	0.4	355	6
1975 Sep	16.1	0.9	855	11
1976 Jan	13.0	0.6	560	8
HANCOCK BROOK LAKE				
1968 Mar	11.6	0.6	355	10
1968 May	11.8	0.6	365	10
1969 Mar	10.5	0.5	300	7
1970 Feb	13.6	0.8	520	15
1972 Mar	11.4	0.6	350	9
1973 Feb	11.8	0.6	365	10
1973 Jun	10.2	0.5	285	6
1973 Dec	16.1	1.5	955	24
1975 Sep	No Record			
1976 Jan	14.0	1.0	655	17
BLACK ROCK LAKE				
1972 Mar	52.0	1.0	1,050	13
1972 Jun	42.0	0.5	510	6
1972 Jul	43.2	0.5	565	7
1973 Feb	65.6	1.9	2,100	25
1973 Apr	44.0	0.6	600	8
1973 Jun	51.7	1.0	1,030	13
1973 Dec	78.5	3.1	3,500	42
1974 Sep	40.9	0.4	450	6
1975 Mar	50.5	1.2	1,260	12
1975 Jul	55.2	1.4	1,555	16
1975 Sep	71.0	2.7	2,970	32
1976 Jan	61.9	1.6	1,790	22
NORTHFIELD BROOK LAKE				
1968 Mar	39.0	0.8	240	10
1969 Mar	40.0	0.8	255	11
1969 Apr	40.5	0.9	260	11
1969 Jul	37.0	0.7	210	8
1970 Feb	36.4	0.6	195	7
1970 Apr	39.0	0.8	240	10
1973 Feb	45.2	1.2	350	14
1973 Dec	56.4	2.0	610	26
1975 Jul	36.0	1.1	285	8
1975 Sep	57.4	2.4	725	27
1976 Jan	51.6	1.5	470	20
EAST BRANCH DAM				
1967 Dec	18.0	0.4	200	5
1969 Mar	21.0	0.6	295	7
1969 Apr	21.0	0.6	295	7
1970 Apr	23.0	0.8	380	9
1972 Mar	20.8	0.6	285	7
1972 Dec	19.0	0.5	225	5
1973 Feb	27.4	1.1	565	14
1973 Dec	32.2	1.7	830	19
1975 Mar	23.4	0.8	395	9
1975 Apr	20.2	0.5	260	6
1975 Sep	38.1	2.4	1,205	27
1976 Jan	24.9	1.0	475	11
1976 Apr	18.8	0.5	245	5

* *Minimum Storages Listed*

Thomaston	- 9%	Hall Meadow Brook	- 6%
Black Rock	- 5%	Northfield Brook	- 7%
Hop Brook	- 8%	Hancock Brook	- 5%
East Branch	- 5%		

utilized by industrial, commercial and residential developments. In some areas the river channel is restricted by buildings, dams and bridges which permit the formation of debris dams with resulting increase in flood levels. Lack of valley storage and short time of concentration characterized by steep tributaries in the watershed produce very high rates of runoff. The USGS gage at Beacon Falls is the primary index station on the Naugatuck. Maintaining flows at Beacon Falls below 8,250 cfs, stage of 10 feet, will normally result in the passage of nondamaging floodflows along the entire length of the Naugatuck River. Flood levels in the Ansonia-Derby area are also affected by abnormally high tide conditions associated with hurricanes or severe coastal storms.

b. Downstream Channel Capacities. A tabulation of the maximum nondamaging channel capacities immediately downstream of the three manned projects follows:

	Channel Capacity	
	CFS	CSM
Thomaston Dam	3,500+	36
Black Rock Lake	800+	39
Hop Brook Lake	550+	34

A tabulation of the regulated peak discharges from the three manned reservoirs is listed in table 12.

c. Stream Encroachment Lines. The State of Connecticut, Department of Environmental Protection is responsible for establishing stream encroachment lines along flood-prone areas within the following framework:

> "The Commissioner shall establish, along any tidal or inland waterway or flood-prone area considered for stream clearance, channel improvement of any form of flood control or flood alleviation measure, lines beyond which, in the direction of the waterway or flood-prone area, no obstruction of encroachment shall be placed by any person, firm or corporation,

TABLE 12

REGULATED PEAK DISCHARGES AT MANNED RESERVOIRS

Naugatuck River at Thomaston** (DA = 101 square miles)

Date	Gage Height (ft)	Discharge (cfs)
31 Mar 1960	6.25	5,140
28 Feb 1961	5.23	3,090
3 Apr 1962	4.37	1,780
29 Mar 1963	4.46	1,900
27 Jan 1964	4.29	1,680
9 Feb 1965	4.09	1,430
3 Mar 1966	3.43	764
20 Apr 1967	3.92	1,230
22 Mar 1968	4.58	2,060
8 Aug 1969	4.53	1,990
8 Apr 1970	4.49	1,950
16 Sep 1971	4.04	1,370
24 Mar 1972	4.46	1,900
8 Dec 1972	4.82	2,410
6 Feb 1973	4.75	2,300
31 Oct 1973	4.51	1,960
23 Dec 1973	5.30	3,220
22 Mar 1974	4.27	1,650
29 Sep 1975	5.61	3,810

Branch Brook near Thomaston** (DA = 20.6 square miles)

Date	Gage Height (ft)	Discharge (cfs)
14 Sep 1971	3.11	494
19 Mar 1972	2.98	411
7 Dec 1972	3.87	684
6 Feb 1973	3.68	580
22 Dec 1973	3.45	468
22 Mar 1974	3.30	440
28 Sep 1975*	4.05	795

Hop Brook near Naugatuck** (DA = 16.4 square miles)

Date	Gage Height (ft)	Discharge (cfs)
5 Feb 1970	3.88	482
11 Feb 1971	3.48	334
13 Sep 1971	3.22	256
14 Mar 1972	3.35	295
7 Dec 1972	3.62	378
6 Feb 1973	3.76	440
1 Jul 1973	3.80	460
22 Dec 1973	3.95	535
22 Mar 1974	3.68	403
28 Sep 1975	3.92	520

* Gage relocated downstream to Route 6 bridge (DA = 21.3 square miles)

** Tailwater gages immediately downstream of Thomaston Dam, Black Rock Lake and Hop Brook Lake, respectively

public or private, unless authorized by said Commissioner. The Commissioner shall issue or deny permits upon applications for establishing such encroachments based upon his findings of the effect of such proposed encroachments upon the flood carrying and water storage capacity of the waterways and flood plains, flood heights, hazards to life and property, and the protection and preservation of the natural resources and ecosystems of the state, including but not limited to ground and surface water, animal, plant, and aquatic life, nutrient exchange, and energy flow, with due consideration given to the results of similar encroachment constructed along the reach of waterway."

Following is a tabulation of the 16 communities within the Housatonic River basin for which stream encroachment lines have been established:

Ansonia	Naugatuck	Thomaston
Beacon Falls	New Milford	Torrington
Danbury	North Canaan	Washington
Derby	Norfolk	Waterbury
Harwinton	Plymouth	Watertown
	Seymour	

11. FLOODS OF RECORD

a. General. The Housatonic River basin is susceptible to destructive floods caused by ice, heavy rainfall, melting snow or some combination thereof. Floods may occur at any time of the year, and runoff is rapid, particularly on tributaries where the topography is hilly. The floods of August and October 1955 were caused by intense rainfall, while the March 1936 event was the result of heavy rainfall and considerable snowmelt.

b. Historic Floods. The flood history of the Housatonic River basin extends back to the first settlers, about 300 years ago. Information pertaining to flooding in this area was obtained through field investigations and research of published U.S. Geological Survey data and newspaper accounts.

Records of floods in the Housatonic River basin prior to the turn of the century are meager. From available information, the largest known flood prior to 1900 occurred in October 1869, with other noteworthy events of the period occurring in 1886, 1888 and 1897.

In the Naugatuck River watershed, the earliest flood of significance occurred in February 1691, with two other events of the same magnitude taking place in November 1853 and April 1854. A damaging flood occurred in January 1891, while the October 1869 flood was the largest event prior to 1900. The order of magnitude of these floods is not known; however, they were all smaller than the August and October 1955 events.

c. Recent Floods. Since 1900, more than 10 events of varying severity have been experienced in the Housatonic River basin. The floods of August 1955 and October 1955 surpassed all other recorded discharges in the Naugatuck watershed and most of the Housatonic River basin. A tabulation of discharges for the largest recorded floods at selected gaging stations is presented in table 13. Descriptions of the most destructive floods during the last 50 years follow:

(1) November 1927. A tropical storm formed over the Carribean late in October 1927, commenced northward 1 November and was at the lower end of Chesapeake Bay by 3 November. The storm followed a path over western Connecticut, Massachusetts and Vermont, causing the greatest flooding on the Vermont tributaries of the Connecticut River and flooding in New Hampshire, western Massachusetts and Connecticut. Storm rainfall on 2-4 November at Waterbury and Cream Hill, Connecticut and Pittsfield, Massachusetts was 5.1, 5.4 and 5.7 inches, respectively.

(2) March 1936. During the second week of March 1936, temperatures in New England became unseasonably warm and continued for the remainder of the month. Snow cover in the upper portions of the Housatonic River basin was above average since little thawing had occurred in January and February. During the period 9-22 March, three storm centers passed over New England, with heavy rainfall on 11-12 and 17-18 March. The total storm rainfall for the month at Bridgeport, Waterbury and Cream

TABLE 13

MAJOR FLOODS
HOUSATONIC RIVER BASIN
(Through 1974)

Location	Drainage Area (sq. mi.)			Peak Discharge CFS	Peak Discharge CSM
Housatonic River near Great Barrington	280	January	1949	12,200	44
		September	1938	11,520	41
		March	1936	8,990	32
		November	1927	7,910	28
		August	1955	6,060	22
Housatonic River at Stevenson	1,545	October	1955	75,800	49
		March	1936	69,500	45
		August	1955	69,400*	45
		September	1938	59,500	38
		December	1948	51,800	34
Naugatuck River at Beacon Falls	261	August	1955	106,000	406
		October	1955	30,400	116
		December	1948	28,500	109
		November	1927	26,000	100
		September	1938	25,300	97
Still River near Lanesville	68.5	October	1955	7,980	117
		September	1938	4,410	64
		March	1936	3,930	57
		August	1955	3,920	57
		February	1941	3,800	55

*Without benefit of storage at Lake Lillinonah, it is estimated that the peak discharge would have been over 100,000 cfs (56 csm).

Hill, Connecticut and Pittsfield, Massachusetts was 6.5, 8.9, 6.9, and 5.9 inches, respectively. Total runoff for the month at the Stevenson gage was 9.7 inches. The rainfall pattern for this event is shown on plate 82.

(3) September 1938. A stationary cold front along the Atlantic coast was overrun by a rapidly moving tropical hurricane, producing record breaking rainfall over large areas of Connecticut, Massachusetts and New Hampshire. The storm which started with light rain, gradually increased in intensity over the 4-day period and produced heavy downpour associated with the hurricane. The total storm rainfall averaged about 9 inches for the period 17-21 September. Precipitation at Bridgeport, Waterbury, Cream Hill and Pittsfield was 11.2, 9.1, 10.1 and 7.3 inches, respectively. Total runoff for the period 20-28 September at Stevenson was 5.4 inches. In the lower reaches of the Housatonic River, the flood occurred almost simultaneously with the abnormally high hurricane tide, causing significant flooding in the tidal reach. Plate 82 indicates the rainfall pattern for this event.

(4) December 1948 - January 1949. The "New Year's" storm of 1949, typical of winter cyclonic events of continental origin, was characterized by a low pressure area which deepened and intensified as it moved northward from the Middle Atlantic coast. Upon approaching the New England area, the northward movement of the low pressure area became blocked by an area of high pressure over the North Atlantic Ocean and the circulating warm moist air became fixed with the cold air, resulting in intense rainfall over eastern New York State and western New England. Rain fell on partially frozen ground, ranging up to 10 inches over portions of the Housatonic River basin. Total precipitation for 29 December through 2 January for Waterbury, Cream Hill and Pittsfield was 7.7, 8.6 and 8.1 inches, respectively. Total runoff for the period 30 December through 12 January at Stevenson was 5.9 inches. Snowmelt was a minor factor early in the flood, and in general, had little effect on the magnitude of the peak discharges. An isohyetal map together with mass rainfall curve is shown on plate 83.

(5) August 1955 Storm. The hurricane "Diane" storm of August 1955 produced record-breaking floods throughout much of

southern New England. The accompanying rains fell on ground previously saturated by rainfall from hurricane "Connie" which occurred one week earlier. Rainfall amounts, for the period from the 17th to 20th, ranged about 5 to 13 inches over the Housatonic River basin. Recorded 24-hour totals were in excess of 8 inches at several stations within the lower portion of the basin. Total precipitation for the period 17-20 August for Cream Hill and Torrington was 9.6 and 13.3 inches, respectively. Total runoff at Stevenson for the period 19-26 August was 4.8 inches, while total runoff on the Naugatuck River at Naugatuck for the period 18-23 August was 11.9 inches from the contributing 246 square mile drainage area. An isohyetal map for the storm of 17-20 August 1955 together with mass rainfall curves at selected locations in the basin is shown on plate 83, while hydrograph analysis for the event on the main stem Housatonic and Upper and Lower Naugatuck are shown on plates 84, 85 and 86.

Following this event the Corps of Engineers constructed small dikes, repaired existing dikes, placed riprap around bridges and cleared channels throughout the entire Housatonic basin. Significant emergency operations were performed in Thomaston, Waterbury, Ansonia, Litchfield, Bethlehem and Winchester, Connecticut.

(6) October 1955. The storm of 14-17 October originated as an extratropical low pressure area off the Florida coast. The northward moving low pressure system became stalled south of the New England coastline. The warm, moist tropical air circulating about the low pressure area overran cooler air over New England and intense rainfall resulted over most of southern New England. The heaviest rainfalls occurred over western Massachusetts and Connecticut, including portions of the Housatonic River basin where amounts of approximately 12 inches were recorded during the 72-hour storm period. Total precipitation between 14-17 October at Ansonia, Bridgeport, Cream Hill and Torrington was 9.5, 7.2, 5.9 and 10.4 inches, respectively. Total runoff at Stevenson for the 1,545 square mile drainage area between 15-22 October was 5.0 inches, while the Naugatuck River at Naugatuck experienced 8.1 inches of runoff between 15-25 October. An isohyetal map of the storm together with mass rainfall curves at selected locations in the basin are shown on plate 83.

d. Flood Profiles. High water profiles on the Housatonic, Naugatuck, Shepaug and Still Rivers were determined from field surveys after the floods of September 1938, December 1948, and August and October 1955. Flood profiles of these rivers and flood events are shown on plates 87 through 91.

12. ANALYSIS OF FLOODS

a. Housatonic River. Floodflows and precipitation records were analyzed to determine the runoff characteristics of the Housatonic River basin such as: (1) time of year when floods may occur, (2) effect of topography, and (3) relative timing and flood peak contributions at downstream damage centers. The analysis resulted in the following conclusions:

The basin responds quickly to periods of intense rainfall which may occur in any month and as a result, there is no flood-free season of the year. The spring snowmelt is not of damaging magnitude unless augmented by rainfall. Although there are a number of moderate to steep tributary slopes throughout the basin, the lakes, ponds, swampy areas and natural valley storage upstream of Falls Village result in moderate main stem runoff characteristics.

Rapid runoff from the headwaters of the East and West Branches of the Housatonic River, combined with artificial and natural restrictions, cause flooding in the city of Pittsfield, Massachusetts. Several tributaries with characteristics conducive to high rates of runoff discharge into the reach between Pittsfield and Great Barrington, Massachusetts where the river falls about 280 feet in 30 miles. However, the vast amount of storage in the main river valley, falling about 45 feet in 24 miles, retards and modifies these discharges so that their peak contributions occur on the recession side of the flood hydrographs at downstream locations. Flood peaks on the Housatonic River from Falls Village to Derby are largely produced by the drainage area below the Connecticut-Massachusetts state line. Flood stages in the tidal reach downstream of Derby and Shelton may be produced by a combination of concurrent flows in the Housatonic and Naugatuck Rivers and abnormal high tides from severe coastal storms or hurricanes.

b. Naugatuck River. The Naugatuck River can also

experience flooding in any season of the year; however, the majority of significant events experienced in the watershed have been associated with tropical storms. With a uniform slope of about 14 feet per mile on the main stem and steep tributaries, the watershed is quite sensitive to periods of intense rainfall, and floodflows develop rapidly.

The only appreciable amounts of storage are located in man-made flood control projects. These seven Corps of Engineers projects control approximately 50 percent of the watershed's drainage area at its confluence with the main stem. The four ungated projects desynchronize flows that contribute to downstream flooding. There is no significant river storage in the 39 mile river length that in any way contributes to flood control, peak reduction, or desynchronization. In the future, flooding in the lower reaches of the Naugatuck will be a direct result of runoff from the uncontrolled drainage areas downstream of Corps' projects.

c. Still River. Floods in the Still River may occur during any season of the year as a result of either intense rainfall over the watershed or from rainfall in conjunction with melting snow such as the flood of March 1936. However, the largest floods have developed from rainfall associated with tropical storms such as the August and October 1955 events.

The lower reach of the Still River downstream of Danbury has a comparatively flat gradient and contains a large amount of natural valley storage and for this reason peaks tend to be smaller but of longer duration than Danbury.

d. Ice Jam Flooding. During the spring runoff period consideration should be given to possible ice jam flooding in the Housatonic River basin at the following locations:

(1) Housatonic River at Route 20 in Pittsfield

(2) Housatonic River at the West Cornwall covered bridge

(3) Housatonic River at Kent just upstream of the Bulls bridge hydroelectric station

(4) Housatonic River at New Milford at Lovers Leap Gorge immediately downstream of the Still River confluence

(5) West Branch Naugatuck River just downstream of its confluence with Hall Meadow Brook

These locations have not experienced significant flooding due to ice jams in recent years.

e. Tidal Flooding. The lower 12-mile reach of the Housatonic River from its mouth to Shelton Dam and 2.5 miles along the Naugatuck River above the confluence, is a tidal estuary. Flood stages in this area are produced by freshwater flood discharges, abnormally high tides, or a combination of both. Table 14 shows a tabulation of floodflows, water levels and tide conditions during recent major floods at selected locations. Plate 92 shows discharge rating curves for the Housatonic River at Shelton, Connecticut below the confluence of the Naugatuck River for normal and abnormal tide conditions. The Corps reservoirs will lower Housatonic River levels by 1 to 3 feet during flood periods depending on concurrent tidal conditions.

13. DESIGN FLOODS

a. Standard Project Floods. Standard project floods were developed for the lower Housatonic River basin below the Massachusetts-Connecticut State line, the upper Naugatuck River basin above Torrington, Connecticut, the lower Naugatuck River basin below Thomaston Dam and on the Still River above Danbury. These standard project floods were used as criteria in selecting design floods for the local protection projects at Torrington, Watertown-Waterbury, Ansonia, Derby and Danbury, Connecticut.

(1) Housatonic River Basin. A standard project flood was developed for the lower Housatonic River basin at Derby-Shelton, Connecticut. The standard project storm was centered below the Massachusetts-Connecticut State line as shown on plate 93. The effective drainage area is located below Falls Village to the confluence of the Naugatuck River and its drainage area below the authorized flood control dams. The SPF peak at the confluence of the Housatonic and Naugatuck Rivers was 220,000 cfs. The desynchronized flood peaks of the Housatonic and Naugatuck Rivers were 198,500 and 70,000 cfs, respectively.

TABLE 14

MAJOR FLOODS AND CONCURRENT TIDE CONDITIONS

Date of Flood	Contribution to Maximum Discharge in Housatonic River (cfs)			Water Surface Elevations		Concurrent Tide Condition at Derby, Conn.	Concurrent Elevation at Stratford Point (ft, msl)
	Naugatuck River	Housatonic River	Total	Ansonia Division St. Br. (ft, msl)	Shelton Treatment Plant (ft, msl)		
Mar 1936	27,000	60,000	87,000	21±	18.0	-	-
Sept 1938	30,000	60,000	90,000	21.3	19.6	Abnormal*	9.2
Dec 1948	32,000	50,000	82,000	18.8	17.2	Near normal high	-
Aug 1955	112,000	40,000	152,000	27.9	21.0	Normal high	5.3***
Oct 1955	40,000	75,000	115,000	23.8	21.0	Abnormal**	7.9

* Abnormal high tide due to hurricane occurring 21 September 1938 at 8 p.m. Maximum discharge occurred 22 September at 1 a.m. Maximum stage recorded concurrently with abnormal high tide.

** Stages of Housatonic River at Devon, Connecticut near the mouth remained 2 to 3 feet above predicted tides throughout the flood

*** High spring tide of 5.3 feet msl at Stratford, Connecticut

(2) Upper Naugatuck River Watershed. A standard project flood was developed for the upper Naugatuck River basin above Torrington, Connecticut. The SPF peak was 35,000 cfs for the 47.6 square miles at the confluence of the branches. Of the total standard project flood, 24,700 and 10,300 cfs are contributed from the West and East Branches, respectively. On the West Branch the SPF is reduced to 12,400 cfs by Hall Meadow Brook Reservoir, and the SPF on the East Branch is reduced to 3,700 cfs by the East Branch Reservoir. The SPF developed for Torrington, and the effect of the Hall Meadow Brook and East Branch reservoir projects are shown on plate 94.

(3) Lower Naugatuck River Watershed. A standard project flood was developed at selected downstream points for the lower Naugatuck River basin below Thomaston Reservoir by centering the standard project storm over the Naugatuck River basin and routing the flood hydrographs downstream. The resulting natural SPF at the Watertown-Waterbury local protection site was 97,000 cfs.

The natural peak of the SPF at Ansonia-Derby is 148,000 cfs and is reduced by the upstream reservoir system to 75,000 cfs. The SPF developed for Ansonia-Derby and the effect of upstream reservoirs is shown on plate 95.

(4) Still River Watershed. A standard project flood was developed for the Still River at Cross and Triangle Streets in Danbury and also for Sympaug Brook with a 7.3 square mile drainage area. The SPF for the 38.3 square mile drainage area above Cross Street has a peak flow of 7,800 cfs. The SPF hydrograph for Sympaug Brook was subtracted from the Cross Street hydrograph, resulting in a peak discharge on the Still River above Sympaug Brook of 6,900 cfs. The derived SPF hydrographs for the Still River at Cross Street, Sympaug Brook and the Still River upstream of Sympaug Brook are shown on plate 96.

b. Spillway Design Floods. Spillway design flood (SDF) hydrographs for the seven flood control reservoirs were computed by applying probable maximum storm excess rainfall to unit hydrographs derived from analysis of recorded floods, and are shown on plate 97.

The precipitation used to develop the SDF hydrograph for all

reservoirs was determined directly from criteria contained in Hydrometeorological Report 33, "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian," dated April 1956. Losses from infiltration, surface detention, transpiration and other intangible factors were assumed at a rate of 0.15 inch for 3 hours which is consistent with minimum losses determined in previous studies for the New England area.

In the spillway analysis for each project the reservoirs were assumed filled either to spillway crest or to 6 inches of flood control storage at the beginning of the excess rainfall. A summary of spillway design flood criteria for the 7 projects is presented in table 15.

c. Review of Adequacy of Spillway Discharge Capacities and Freeboard Allowances. Pursuant to the authority contained in Engineer Circular 1110-2-34, "Review of Design Features of Existing Dams," dated 1 November 1966, a review was made of the spillway design and real estate acquisitions at the 35 existing dams and lakes in the New England Division to determine whether they conformed adequately with current policies and criteria with respect to safety and functional reliability. Included in this report, which was completed in August 1967, was a determination of the adequacy of spillway discharge capacities and freeboard allowances for all 7 Corps reservoirs in the Naugatuck River watershed. The study indicated that all projects in the basin were adequately designed and further studies were considered unnecessary.

14. FLOOD DAMAGES

a. General. Flood damage areas in the Housatonic River basin are separated into two groups, namely, those occurring in the Naugatuck River watershed, and the damages occurring in the remaining portion of the Housatonic River basin. Estimates of losses sustained in the floods that occurred in the Housatonic River basin prior to the March 1936 flood are not available.

b. Housatonic River Basin (Excluding Naugatuck River Watershed). Damages experienced in the flood of March 1936 are estimated to have been $1.8 million, the flood of September 1938 caused losses amounting to over $2 million, and losses from the December 1949 flood amounted to over $2.5 million. Damages

TABLE 15

SPILLWAY DESIGN CRITERIA
NED FLOOD CONTROL RESERVOIRS

Item	Hall Meadow Brook	East Branch	Thomaston	Northfield Brook	Black Rock	Hancock Brook	Hop Brook
Drainage Area (sq.mi.)	17.2	9.25	97.2 (gross) 70.75 (net)	5.7	20.4	12.0	16.4
Spillway Design Storm							
Basis of Design	HR #33	HR #33	HR #33	HR #33	HR #33	HR #33	HR #33
Volume of Rainfall (in./24 hr)	24.0	24.0	24.5***	24.4	22.2	24.0	25.0
Total Losses (inches)	1.2	1.2	2.1	1.2	1.6	1.2	1.2
Unit Hydrograph							
Unit Rainfall Duration (hrs)	2	2	3	2	3	2	2
Peak Flow (cfs)	1,730**	1,310	10,300	810	2,600	1,730	2,270
Spillway Design Flood							
Peak Inflow to Reserv. (cfs)	26,600	15,500	158,000	9,000	35,000	20,800	26,400
Volume of Runoff (ac/ft)	20,930	11,200	116,000	7,050	22,400	14,600	20,800
Peak Outflow (cfs)	19,200	14,300	132,200	8,800	33,500	16,600	23,000
SDF Reservoir Reg. Plan							
Initial Pool Elev. (ft,msl)*	889.0	865.0	494.0	576.0	520.0	484.0	357.0
Outlet Facil. During Flood	Not Used	Not Used	Operable	Not Used	Not Used	Not Used	Operable
Max. Surcharge Elev. (ft,msl)	912.1	876.0	512.0	586.1	535.0	499.7	376.0
FRL (Max. Surcharge Elev.)	912.1	876.0	512.0	586.1	535.0	499.7	376.0
Freeboard Characteristics							
Design Wind Velocity (mph)	78	80	80	80	80	80	80
Effective Fetch (miles)	0.64	0.40	0.87	0.29	0.40	0.39	0.5
Average Depth (feet)	-	-	-	-	-	-	-
Wave Runup (feet)	2.9	2.35	4.0	2.0	2.9	2.3	2.6
Wind Tide (feet)	Negli.	Negli.	.15	Negli.	Negli.	Negli.	Negli.
Adopted Freeboard (feet)	4.9	5.0	5.0	4.9	5.0	5.3	5.0
Top Elevation of Dam (ft,msl)	917.0	881.0	517.0	591.0	540.0	505.0	381.0

* All reservoirs initially full to spillway crest elevation except Hop Brook and Hall Meadow Brook which were full to 6 inches of storage

** From net drainage area of 12.2 square miles

*** Duration of storm - 48 hours

from the flood of August 1955 exceeded by far those of all previous floods in the Housatonic River basin. This event took five lives and caused damage in excess of $25 million. Over 90 percent of the damages were suffered in the State of Connecticut with New Milford, Derby and Shelton on the main river, Danbury on the Still River and Washington Depot on the Shepaug River being the most severely hit. Damages caused by the August 1955 flood were as follows:

Type	Losses
Urban	$ 7,020,000
Industrial	8,410,000
Highway	7,800,000
Railroad	1,720,000
Utility	160,000
	$25,110,000

The October 1955 flood produced record losses in the southwestern portion of the basin, particularly in Danbury where one life was lost and damages were estimated at about $6.5 million. Damages in the remaining portion of the basin were in excess of $3 million. If the August storm had not occurred as closely, losses would have been much greater.

c. Naugatuck River Watershed. Damages experienced in the March 1936 flood amounted to approximately $240,000, the flood of September 1938 caused losses amounting to about $570,000, and losses from the December 1948 flood amounted to $1.8 million. The August 1955 event in the Naugatuck River basin caused destruction unparalleled by any other flood in the history of New England as is evident in photos on plates 98 and 99. Damage extended from Torrington to tidewater in Derby, reaching a total of over $217 million in addition to the loss of 40 human lives.

The flood of October 1955 threatened many areas which were still staggering from the effects of the August event. This flood was generally much less destructive than the August event in terms of damage. If the August storm had not produced such catastrophic damage and eliminated damageable property in the Naugatuck River Valley, the October losses in this area would have been much greater.

d. Recurring Losses. A recurrence of the October 1955 event, the maximum of record at Danbury, Connecticut and the August 1955 flood of record in the Naugatuck River basin under 1975 economic conditions without flood control would cause damages as follows:

Danbury, Connecticut	$ 8,100,000
Naugatuck River basin	$455,800,000

Stage-damage curves were developed for the principal damage areas on the Naugatuck and lower Housatonic Rivers. Flood damage information was obtained during the period 1955 through 1961 and was adjusted to the price level. Additional detailed surveys will supplement this data as required in the future.

e. Benefit Analysis. Following each flood event, RCC personnel will determine the modifying effect of Corps reservoirs. Natural flows and stages will be computed for damage zones along the Naugatuck and lower Housatonic Rivers. The natural and observed data will be reported on the form shown on plate 100. The Economic and Social Analysis Branch of Planning Division will complete the form by determining benefits at each zone associated with reservoirs and local protection projects.

15. DROUGHTS

a. General. The Housatonic River basin lies within the general zone classified as humid, where average annual precipitation is distributed reasonably throughout the year. In National Weather Service terminology, a drought is considered to be a period of 14 or more days in which less than 0.1 inch of precipitation falls in a 48-hour period. To the agriculturist, a drought is a lack of soil moisture during the growing season. Hydrologically, a drought is defined as a prolonged period of precipitation deficiency which seriously affects riverflow as well as surface and ground water supplies. Periods of deficient precipitation and runoff have occurred in the watershed.

b. History. The drought history in the basin extends back more than 100 years. Since the establishment of stream gaging stations within the watershed in the early part of this century, two rather extensive periods have occurred when recorded amounts of runoff in the watershed were far below normal. The

first occurred during water years 1930 through 1932, inclusive and the second, and most severe, began in the latter part of water year 1961 and extended through the middle of water year 1966.

c. Drought of 1961-1966. The greatest and most severe drought in the history of the Housatonic River basin occurred in water years 1961 through 1966. During this period, the cumulative precipitation deficiencies at Bridgeport and Cream Hill, Connecticut and Pittsfield, Massachusetts were 92.0, 79.6 and 51.7 inches, respectively, which are 200, 172 and 126 percent of the average annual precipitation. The cumulative runoff deficiencies for water years 1961-1966 for the Housatonic River at Falls Village and Stevenson, Connecticut and on the Naugatuck River at Beacon Falls were 42.6, 44.5 and 37.4 inches, respectively, which are 187, 200 and 153 percent of the average annual runoff. Rarely is a deficiency of ground water carried over from one growing season to the next in New England, since it is replenished during each spring runoff. However, this condition occurred in the winter of 1964-1965 and resulted in a record low flow runoff in water year 1965 at Falls Village, Stevenson and Beacon Falls of 8.7, 8.5 and 11.7 inches, respectively, which are 38, 38 and 48 percent of the average annual runoff.

CHAPTER III

MANAGEMENT

16. GENERAL

a. Project Owners. Five of the seven flood control reservoirs, namely, Thomaston Dam, Black Rock, Hop Brook, Hancock Brook and Northfield Brook Lakes, are owned by the Department of the Army, Corps of Engineers. The remaining projects, namely, East Branch and Hall Meadow Brook Dams are owned by the State of Connecticut.

b. Operating Agencies. The New England Division is responsible for the operation and maintenance of Thomaston, Black Rock and Hop Brook which are gated reservoirs. Staffing on a normal work week, Monday through Friday, is 0800 to 1630 hours and from 0800 to 0900 on Saturday and Sunday, with the project managers living at or near the dams. During flood emergency conditions, the projects will be staffed on a 24-hour basis or as instructed by RCC for the duration of the emergency.

Hancock Brook and Northfield Brook are both ungated; however, because they help to provide protection to all downstream communities they are maintained by the New England Division. The reservoir area at Hancock Brook is managed by the State of Connecticut, Park and Forest Commission under a long term lease.

Hall Meadow Brook and East Branch, both ungated, are maintained by the State of Connecticut, Department of Environmental Protection, Water and Related Resources Unit, with the reservoir areas including Hall Meadow Brook and Sunny Brook State Parks managed by the State Park and Forest Commission.

c. Operation and Maintenance Manuals. Routine maintenance activities at 5 of the 7 flood control reservoirs, namely, Thomaston, Black Rock, Hop Brook, Hall Meadow Brook and Northfield Brook are performed by the three project managers under the supervision of the Reservoir Branch of the Operations Division. Hall Meadow Brook and East Branch Dams are

maintained and operated by the State of Connecticut, Department of Environmental Protection, Water and Related Resources Unit. The following manuals, dated June 1972, present the essential instructions to operating personnel for the operation, repair and maintenance of project facilities:

Operation and Maintenance Manuals

Thomaston Dam
Black Rock Lake
Hop Brook Lake
Hancock Brook Lake
Northfield Brook Lake
East Branch Dam
Hall Meadow Brook Dam

17. FUNCTIONAL RESPONSIBILITIES

a. Corps of Engineers. The reservoir regulation activities are performed by the Reservoir Control Center (RCC), whose responsibilities are spelled out in a publication entitled: "Guidance Memorandum, Reservoir Control Center," dated September 1971. RCC is an element of the Water Control Branch within the Engineering Division. Administrative and maintenance activities at the five Corps-owned projects are performed by project managers under supervision of the Reservoir Branch of the Operations Division. During regulation periods the managers are responsible to the Reservoir Control Center and report directly to the Center for instructions and information.

The Water Control Branch is comprised of three sections, namely, Reservoir Control Center, Hydrologic Engineering, and Hydraulics and Water Quality. RCC consists of a staff of highly trained hydraulic engineers and hydrologists who devote full time to the operation of reservoirs in New England. Members of the other sections assist the RCC during routine and flood operations, and also provide technical assistance as needed. An organization chart for reservoir regulation in the New England Division is shown on plate 101.

RCC is divided into basin units, each responsible for receiving routine hydrologic and meteorologic reports and directing reservoir regulation within an assigned river basin. Personnel from

RCC and other sections of the Water Control Branch are assigned to these units. Each unit consists of a regulator in charge of the overall operation in the basin, and project regulators who receive reports and issue instructions to individual dams either from NED headquarters during working hours or from their homes during nonworking hours. Whenever severe emergency conditions exist, RCC staffs NED headquarters and regulation units are organized to assure 24-hour operations as long as necessary.

b. Other Agencies. Since Hall Meadow Brook and East Branch reservoirs provide flood protection to only one downstream community, Torrington, Connecticut, they are considered local protection projects and are maintained by the State of Connecticut, Department of Environmental Protection.

18. INTERAGENCY COORDINATION

a. Interagency Agreements. The Corps of Engineers has cooperative working programs with the U.S. Geological Survey, the National Weather Service and its River Forecast Center at Bloomfield, Connecticut, and the Connecticut Department of Environmental Protection. The Corps uses the hydrologic and forecasting information from these agencies in operating the Naugatuck flood control reservoirs in a manner that provides efficient protection for downstream communities.

b. News Releases. It is the policy of the Corps of Engineers to cooperate with the local press and all other news media. This cooperation provides the local community with information regarding the regulation of the Naugatuck River projects.

The primary source of information regarding the regulation of the projects is the Public Affairs Officer who has the responsibility of issuing all releases to the press and news media.

Whenever project managers receive requests for information from local news media and private citizens, the operator can release information pertinent to his project; however, he will not make any flood forecasts. Referrals should be made to RCC for additional information.

18-1. WATER QUALITY ACTIVITIES

There is no storage of water at any of the Naugatuck River watershed reservoirs specifically for water quality control or management. Although water quality control is not an authorized project purpose, compliance with Executive Order 11752 requires that all Federal facilities shall be managed so as to protect and enhance the quality of the water resources through compliance with applicable standards for the prevention, control and abatement of environmental pollution in full cooperation with State and local governments.

As spelled out in ER 1130-2-334 and ER 1130-2-415, monitoring of reservoir inflows, impoundments and discharges is accomplished on a scheduled basis. Data is collected for many physicochemical parameters and a limited number of bacteriological and biological parameters. The monitoring and analysis are under the administrative and management control of Operations Division. Summaries of their water quality analyses and activities are included in an annual report to OCE, as required under the provisions of ER 1130-2-334. Sampling and analysis of water quality is also being performed in the interest of public health associated with water supply and recreation activities at the projects in accordance with ER 1130-2-407 and other existing guidance.

Revised
16 August 1977

CHAPTER IV

RESERVOIR REGULATION

19. GENERAL OBJECTIVES

The general objective of the regulation procedures for the Housatonic River basin is to provide a comprehensive tool for guiding those responsible for regulating Thomaston Dam, and Black Rock and Hop Brook Lakes in the Naugatuck River watershed in accomplishing the missions for which these projects were authorized. These procedures, in conjunction with the four ungated (unmanned) reservoirs, allow for the most efficient flood protection of downstream communities on the Naugatuck and lower Housatonic Rivers. The Naugatuck River watershed map is shown on plate A-1.

20. RESERVOIR REGULATION PROCEDURES

Detailed reservoir regulation procedures are contained in Appendix A.

21. MISCELLANEOUS CONSIDERATIONS

a. Extraordinary Flood Conditions. It is conceivable that extraordinary circumstances or unpredictable flood conditions may arise such as drownings, dam or bridge failures, highway or railroad washouts, ice jams or debris deposits. Since the purpose of the reservoirs is to save lives and prevent or reduce damage, regulation during such unusual conditions may not follow previously described rules but will be governed by the urgency of the circumstances. During such conditions the project manager has full authority to act immediately in the public interest. RCC will be notified as soon as possible of any unusual incident so that additional action may be taken to provide maximum protection. If the closure of gates is required, they will not be reopened until RCC has been contacted.

b. Regulation with Failure of Communication. Should the Thomaston, Black Rock and Hop Brook project managers be unable to contact RCC when a flood is developing, the Naugatuck River

Basin Manager has full authority to act promptly in accordance with instructions contained in the SOP and will direct the regulation of all reservoirs until communications can be re-established. Should the basin manager be unavailable for duty, then either the Thomaston, Black Rock, and Hop Brook project manager, in that order of priority, will direct the regulation of all projects in accordance with instructions in Appendix A. Releases for emptying the reservoirs will not be made until contact has been established with RCC. Possession of the instructions contained in this manual does not relieve the project manager of his responsibility for continued efforts to communicate with RCC.

c. Emergency Operating Procedures. When unable to contact RCC personnel and flood conditions develop, the project managers have full authority to regulate their gate openings in accordance with instructions contained in Appendix A. Emptying the reservoirs will not be initiated until contact has been re-established with RCC.

d. Emergency Power Supply. All three manned projects in the Naugatuck River watershed have been provided with manually operated standby diesel generators. These generators have sufficient capacity to operate all flood control apparatus and appurtenant equipment in the event that commercial power is interrupted.

e. Cooperation with Downstream Communities or Water Users. It is the policy of the Corps of Engineers to cooperate with downstream water users and other interested parties or agencies. The project manager may be requested by downstream users to deviate from normal regulation for short periods of time. Whenever a request for such modification is received, the manager shall ascertain the validity of the request and require the user to obtain assurance from others downstream that they are in agreement with the proposed operation. The manager will then relay the information to RCC for consideration. A minimum release from all projects for downstream fish life shall be maintained during periods of regulation.

f. Maintaining Existing Nondamaging Channel Capacities. Since the inception of the Reservoir Control Center in 1970, emphasis has been continually placed on trying to prevent, limit or reduce downstream encroachments which would adversely affect regulation procedures. This is accomplished in a joint effort by

the Reservoir Control Center and the project manager. RCC makes a determined effort to release stored floodwaters up to a maximum "nondamaging" downstream channel capacity as often as hydrologically possible, consistent with regulation procedures. The project managers continually monitor downstream developments and immediately notify RCC whenever the developments might affect existing reservoir release rates. RCC personnel immediately visit the area, contact the owner, and if necessary follow through with correspondence that the Corps will not reduce the existing maximum nondamaging release rate to prevent flooding of the site area. Correspondence is also forwarded to the appropriate local and State agencies, commissions and officials.

g. Absence from the Dam. RCC and the basin manager are notified whenever the project manager expects to be away from the dam either overnight or for an extended period.

h. Sedimentation. Sedimentation ranges and monuments have not been installed in the reservoir areas. Experience from other reservoir projects in New England has shown that only minimal amounts of sedimentation can be expected.

i. Future Studies. Post-flood studies will be made of each flood operation by RCC to determine efficiency of communication and reporting networks, the applicability of regulation guides, including stage-discharge relationships, discharge correlations and flood reductions at damage centers. In addition, procedures will be reviewed to make sure that precedents are not set that could adversely affect flood regulation procedures in future years.

CHAPTER V

COMMUNICATIONS AND HYDROLOGIC EQUIPMENT

22. GENERAL

All communications between the project managers and RCC are made via the NED radio network during normal working hours or when NED headquarters are otherwise manned. Whenever the radio network is inoperative, communications are made by telephone. During nonwork hours, reports and regulation instructions are issued via telephone to or from the homes of RCC personnel. The order of contact within the Reservoir Control Center is updated annually. In the event of failure of the NED radio network and telephone service, emergency communications will be attempted through the State Police or Civil Defense radio facilities. In addition, voice radio facilities located in the Automatic Hydrologic Radio Reporting Network, described in paragraph 23, are tied directly to the RCC computer room, and serve as an additional backup system for communication.

23. PRECIPITATION REPORTING NETWORK

Reports of precipitation data from the Housatonic River basin are used primarily for the purpose of alerting regulation personnel and providing a basis for appraising the severity of the storm. Collection and reporting of precipitation data from Thomaston Dam and Black Rock and Hop Brook Lakes are the responsibility of the project managers who also receive calls from observers in the basin.

The Reservoir Control Center periodically reviews network arrangements to insure that an adequate reporting network is maintained. The River Forecast Center in Bloomfield, Connecticut receives precipitation reports from observers in and near the Housatonic River basin, which are available to RCC upon request. In addition, cooperative reporting procedures from all Corps dams have been established with the River Forecast Center and have been detailed in separate memos to each project manager. Locations of the NED and National Weather Service precipitation stations are shown on plate 1.

24. RIVER REPORTING NETWORK

a. General. A network of river stage stations for Corps flood control activities has been established within the Housatonic River basin. This network assists in the execution of the reservoir regulation plan by permitting personnel in RCC or at the dams to obtain river stages at selected index stations. This information is used for regulation procedures during floods or post-analysis studies for determining benefits or analyzing procedures.

b. River Reporting System. The river reporting system in the basin consists principally of USGS recording or staff gages at the following locations:

Housatonic River at Stevenson
Naugatuck River at Thomaston
Naugatuck River at Beacon Falls
Branch Brook near Thomaston
Hop Brook near Naugatuck
East Branch Naugatuck River at Torrington
West Branch Naugatuck at Torrington
Staff gage at Ansonia LPP
Staff gage at Derby LPP
Staff gage at Danbury LPP

The Beacon Falls gage is also equipped with Telemark (telephone) equipment which serves as a backup for the AHRRN. Locations of these stations are shown on plate 1.

25. AUTOMATIC HYDROLOGIC RADIO REPORTING NETWORK (AHRRN)

NED's automatic hydrologic data collection system, shown on plate 102, is comprised of the following:

41 Remote Reporting Stations
12 Repeater Stations
5 Remote Recording Dams
4 Relay Stations
1 Control Station at RCC

The remote reporting stations are situated at key index stations and report information on river and reservoir stages and

precipitation data. Two tidal stations report tide elevation, wind speed and direction, and barometric pressure. Table 16 lists the stations and reporting parameters, while plate 103 shows an AHRRN printout. It should be emphasized that all 7 reservoirs are included in this reporting network. The system reports via radio and uses batteries as its primary source of power, thus eliminating many problems that arise during major floods and hurricanes when power and telephone lines are knocked down and normal means of communications fail. The batteries are charged either by thermoelectric generators or AC power where available. When the outside source of power is out, the batteries have sufficient energy to operate for about 3 weeks without recharging.

There are four relay stations which transmit the signal from different locations in New England to the Control Center. These same relays are used in the voice radio communication network for NED. In order to bring radio signals from the remote reporting stations to the relays, 12 repeater stations were built to provide a strong reliable signal.

The Control Station at RCC consists of an interface between radio equipment and a computer. Under computer programmed control, remote stations can be interrogated singly or as a group at selected time intervals. Response time is about 3 seconds for a single interrogation which is considered "real time" for regulation purposes. Data received at the Control Center is stored in the computer for further analysis. River stage data are converted to flow and plotted by basins. Data for ungated (unmanned) dams are analyzed and reservoir inflow and outflow are computed automatically and also plotted. Other information at gated dams received from the voice radio network are key punched and stored in the computer for further analysis and computation of inflow.

The system also includes 5 remote recording stations located at strategic dams. All information received at RCC from the system is retransmitted and received at the recording stations. This allows one dam in each river basin to have access to all available information. A typical Thomaston Dam teletype printout is shown on plate 104. During emergency conditions such as communication failure with RCC, each recording station can interrogate certain stations in its own area without going through the Control Center. The system is capable of handling up to 100 remote stations, and

TABLE 16

PERTINENT DATA
AUTOMATIC REPORTING NETWORK

GAGING STATION		LOCATION		REPORTING PARAMETERS		
NO.	NAME	RIVER	STATE	WATER LEVEL	RAIN	WEATHER DATA*
33	WOODSTOCK	Pemigewasset	N.H.	X	X	
39	CAMPTON	Mad	N.H.	X	X	
34	RUMNEY	Baker	N.H.	X	X	
32	PLYMOUTH	Pemigewasset	N.H.	X		
10	PENACOOK	Contoocook	N.H.	X		
3	SOUCOOK	Soucook	N.H.	X		
11	CONCORD	Merrimack	N.H.	X		
8	GOFFSTOWN	Piscataquoag	N.H.	X		
9	GOFFS FALLS	Merrimack	N.H.	X		
14	LOWELL	Merrimack	Mass.	X		
38	WELLS RIVER	Connecticut	Vt.	X		
36	WEST HARTFORD	White	Vt.	X		
35	WHITE RIVER JUNCTION	Connecticut	Vt.	X		
37	NORTH WALPOLE	Connecticut	N.H.	X		
15	KEENE	Ashuelot	N.H.	X		
7	WEST DEERFIELD	Deerfield	Mass.	X		
6	MONTAGUE CITY	Connecticut	Mass.	X		
17	INDIAN ORCHARD	Chicopee	Mass.	X		
18	WESTFIELD	Westfield	Mass.	X		
16	SPRINGFIELD	Connecticut	Mass.	X		
24	COLLINSVILLE	Farmington	Conn.	X		
27	MAD RIVER DAM	Mad	Conn.	X		
20	RAINBOW	Farmington	Conn.	X		
19	HARTFORD	Connecticut	Conn.	X		
28	HALL MEADOW DAM	Hall Meadow	Conn.	X		
30	EAST BRANCH DAM	Naugatuck	Conn.	X	X	
26	THOMASTON DAM	Naugatuck	Conn.	X		
31	NORTHFIELD BRK. LK.	Northfield Brk.	Conn.	X		
25	BLACK ROCK LAKE	Branch Brook	Conn.	X		
23	HANCOCK BROOK LAKE	Hancock Brook	Conn.	X		
29	HOP BROOK LAKE	Hop Brook	Conn.	X		
22	BEACON FALLS	Naugatuck	Conn.	X		
21	STEVENSON	Housatonic	Conn.	X		
2	WEBSTER	French	Mass.	X		
4	JEWETT CITY	Quinebaug	Conn.	X		
1	WILLIMANTIC	Shetucket	Conn.	X		
5	NATCHAUG FOREST		Conn.		X	
13	NORTHBRIDGE	Blackstone	Mass.	X		
12	WOONSOCKET	Blackstone	R.I.	X		
40	BLOCK ISLAND		R.I.			X
41	OLD SAYBROOK LIGHT		Conn.	X		X
			Total	39	5	2

* Barometric Pressure, Wind Velocity and Direction

studies continue to improve the functions of the data collection system. The network is fully described in an RCC publication entitled: "Flood Control - Automatic Hydrologic Radio Reporting Network," dated August 1976.

26. LANDSAT EXPERIMENT

In June 1972, NED entered into a contract with NASA for an experiment to study the feasibility of using the Earth Resources Technology Satellite ("ERTS" or "LANDSAT") for collecting hydrologic data from Data Collection Platforms which are installed at 27 locations throughout New England. Many are situated at existing U.S. Geological Survey gaging stations. A major objective of this experimental program has been to compare the cost, reliability, and operational effectiveness of the LANDSAT Data Collection System with the existing NED (AHRRN) radio network. The results and recommendations of this will be summarized in a final report to NASA, which is scheduled for completion in June 1977.

27. REPORTS

a. Weekly Reports. The project managers make routine reports by radio or telephone to RCC each Friday morning. These reports insure continuous contact between the operating personnel and RCC and also serve as a check on the communications network. The reports include the preceding 24-hour precipitation, current weather conditions, reservoir pool stage, regulation data, river conditions at index stations, and other miscellaneous data. Information on weekly reports, as well as the following types, are spelled out in detail in Appendix A.

b. Alerting Reports. An alerting report is promptly made and includes pertinent data that is readily available together with a general appraisal of local conditions, although data from all the precipitation or flood index stations may not be available.

c. Supplemental Reports. Supplemental radio or telephone reports are made to RCC by the manager either following instructions from RCC or if it appears that flood conditions might develop in the watershed as the result of melting snow, ice jams, dam failures or heavy localized rainfall. The time and frequency of these reports are dependent upon the severity of conditions and specific instructions from RCC.

d. Special Reports. A special report is submitted by the manager to RCC whenever unusual circumstances occur during a flood or if requested by RCC. This report may be written in longhand and should describe observations at the dam or selected control points.

e. Snow Survey Reports. Snow courses have been established at selected locations within the watershed. Weekly surveys are made by the managers during the winter and early spring to determine the depth of snow and its equivalent water content. Dates for surveys are established each year by RCC so as to correspond with monthly bulletins of the U.S. Geological Survey and supplemental data from power companies.

f. Northeast River Forecast Center Report. The project managers at many Corps reservoirs in New England telephone hydrologic data and climatologic conditions at their projects to the National Weather Service on a daily basis. The NWS uses this data in preparing flood and rainfall-runoff forecasts into Corps reservoirs. Detailed information is presented in Appendix A.

28. SPECIAL ADVISORIES

In accordance with regulations set forth in EM 500-1-1, "Domestic Emergency Operations" and the "Guidance Memorandum, Reservoir Control Center," special advisories from RCC on flood potential and progress of all threatening storms are submitted to the Division Engineer and the Engineering and Operations Divisions. Flood reports are also prepared for OCE by the Reservoir Control Center.

29. MAINTENANCE OF LOG

All reports, instructions, records of unusual circumstances at the dam, and information pertinent to regulation of the reservoir are entered in the logs, which are maintained by both the project manager and Reservoir Control Center.

30. RECORD OF RESERVOIR REGULATION

All gate operations are carefully noted on NED Form 90 and submitted semimonthly to RCC. All operations are noted regardless of the duration of the change in gate position. The report

includes data on time of day, reservoir stage, outflow, precipitation, gate opening, tailwater gage reading and remarks. RCC personnel utilize the form 90's in the preparation of monthly reservoir regulation charts, which serve as permanent records of reservoir operation when the projects become operational. These forms are also utilized in the preparation of yearly reservoir regulation exhibits for the RCC Annual Report, which is forwarded to OCE and disseminated to the public upon request.

31. PRECIPITATION GAGES

A standard weighing and recording NWS precipitation gage has been installed at Thomaston Dam. The Black Rock and Hop Brook project managers each have nonrecording precipitation gages at their projects. In addition, a standard weighing but nonrecording gage is located at the unmanned East Branch Dam. This gage functions in conjunction with the automatic hydrologic reporting network. All four gages serve as a supplement to other NWS rainfall stations within the Housatonic River basin.

32. RESERVOIR STAGE RECORDERS

The automatic float-operated water level recorders at the 3-gated reservoirs and the manometer gas-operated recorders at the 4-ungated projects indicate the water level in the reservoirs at all times. The recording instruments at the 3 manned dams should be checked each morning to assure that the clock is keeping correct time and the pen is tracing the water levels properly. Any discrepancies, as evidenced by the pen time or gage height, should be reset. During periods of reservoir storage, the outside tile or staff gage should be periodically read to check the accuracy of the chart record. Should the recorder become inoperable, RCC should be notified and arrangements will be made for immediate repair.

The chart should be changed the first working day of each month at the 3 projects except during periods of significant impoundments, and the following information should be noted in ink at the beginning and end of each chart:

Outside tile gage reading
Pen gage height reading
Watch time
Pen time
Date and name of dam

Maintenance of the recorders at the 4 unmanned projects is included in the cooperative stream gaging program and is the responsibility of the U.S. Geological Survey in Hartford, Connecticut. The pool charts are mailed to RCC on a monthly basis.

33. TAILWATER GAGING STATIONS

It is necessary for the Corps to have a continuous discharge record from all gated reservoirs. As a result, gaging stations are located downstream about 1.5 miles from Thomaston Dam, 0.8 mile from Hop Brook Lake, and 0.5 mile from Black Rock Lake. These stations provide a continuous official record of releases from the dams, are equipped with digital-type water stage recorders, and also operated and maintained under the cooperative program with the USGS. It is essential that the gages be checked frequently to assure proper operation. If inspection indicates a need for repair, RCC should be notified immediately. The project manager is responsible for making arrangements with the USGS to have the equipment repaired.

34. TELEPHONE TRANSMITTER (TELEMARK)

A telephone transmitter is also in operation on the Naugatuck River at the Beacon Falls gage to obtain river stages in the regulation of Thomaston, Black Rock and Hop Brook. The project manager at Hop Brook calls the gage as part of the normal weekly report. The other project managers should also call the gage at least once each month to remain familiar with its code. Should the telemark become inoperable, the Hop Brook project manager should visit the gage, and if the trouble cannot be determined the telephone company should be requested to check their circuits in the presence of the project manager. If the telemark still does not function, the USGS should be notified. Batteries for the ADR-BDT equipment at the Beacon Falls gage will be furnished and installed by the USGS.

35. SNOW SAMPLING SET

A snow sampling set has been assigned to the project manager at Thomaston. Snow surveys will be carried out by the project managers and their assistants from the 3 manned projects. Procedures for obtaining snow survey data should follow instructions set forth in "Snow Sampling Guide, Department of Agriculture,

Handbook 1960." If given proper care, the only maintenance required would be occasional replacement of worn out cutterheads.

CHAPTER VI

HYDROLOGIC FORECASTS

36. NATIONAL WEATHER SERVICE (NWS)

a. Weather Forecasts. The National Weather Service in Boston, Massachusetts is responsible for issuing daily weather forecasts for public dissemination through the news media. These reports are received at RCC approximately four times each day on the Weather Service teletype loop.

b. Precipitation Forecasts. In addition to the normal weather forecasts, quantitative precipitation forecasts are received daily by RCC. Supplemental weather information and forecasts prior to or during floods are made available via telephone upon request.

c. River Forecasts. The NWS Northeast River Forecast Center at Bloomfield, Connecticut (NERFC) is responsible for preparing and disseminating flood forecasts for the Housatonic River at Great Barrington, Gaylordsville and Stevenson, and on the Naugatuck River at Beacon Falls. However, due to its flashy nature and the short time required for a flood to develop on the Naugatuck River, advance accurate forecasting is difficult. For this reason a flash flood guidance is utilized instead of the usual stage-discharge forecasts which are developed for the communities along the Housatonic River. The flash flood guidance is based primarily on precipitation and observed Beacon Falls discharges. NERFC also prepares and transmits headwater rainfall forecasts twice a week to RCC via teletype, indicating the amount of 6-hour rainfall necessary to produce runoff varying from .25 to 5 inches into Corps reservoirs and also the amount of rainfall required to produce flood conditions at Beacon Falls and Gaylordsville.

37. CORPS OF ENGINEERS

a. Housatonic River Forecasts. Since the 7 Corps flood control dams are located within the Naugatuck River watershed, it has not been necessary to establish river reporting stations or develop flood forecasts for the Housatonic River upstream of the Stevenson gage.

b. Naugatuck River Forecasts. The major damage zones along the Naugatuck River are Torrington, Thomaston, Waterbury and Ansonia. Hall Meadow Brook and East Branch Dams control approximately 55 percent of the drainage area above Torrington; Thomaston Dam controls about 98 percent of the drainage area at Thomaston; Black Rock, Northfield Brook, Thomaston and Hancock Brook control 76 percent at Waterbury; and finally, the entire seven project system, including Hop Brook, controls 58 percent of the area above Beacon Falls and 50 percent of the drainage area above Ansonia. The amount of flood control storage in the reservoirs is sufficient to adequately handle all floodflow volumes up to the record August 1955 event and the standard project flood. The gated reservoirs have storage capacities ranging from 7.8 to 8.1 inches of runoff from their upstream watersheds, while the ungated reservoirs have storages ranging from 6.1 to 9.4 inches of runoff.

RCC continually receives data from the automatic hydrologic radio reporting system, all 28 manned reservoirs, and continual NWS weather, precipitation and flood forecasts. Operating experience at Thomaston Dam for the past 15 years has indicated that reservoir regulation for specific river conditions at Beacon Falls provides protection to all other downstream Naugatuck River communities. The high flow travel times from Thomaston, Black Rock and Hop Brook to Beacon Falls are only 4, 3-1/2 and 1 hours, respectively, and to the mouth of the Naugatuck at Derby only 6, 5-1/2 and 3 hours, respectively.

Based on all the aforementioned, it was not considered necessary to develop an exact rainfall-flood forecasting procedure in the Naugatuck River basin for regulation purposes. Regulation procedures were developed that are conservative in nature; gate openings are throttled under normal streamflow conditions to insure that reservoir discharges will not exceed downstream channel capacities if pool levels unexpectedly rise due to heavy rainfall. Gate closures are initiated with specific amounts of rainfall, or predetermined downstream river levels.

CHAPTER VII

REGULATION OF LOCAL PROTECTION PROJECTS

38. GENERAL

In addition to the seven flood control reservoirs built by the Corps to reduce flooding, local protective works at five industrialized communities within the basin were also constructed. These projects, described in detail in paragraph 5, are operated and maintained by the respective communities in which they are located. Specific regulation and maintenance procedures at each project are detailed in the following Operation and Maintenance Manuals:

Torrington, Connecticut, East and West Branches, Naugatuck River, June 1960

Waterbury-Watertown, Connecticut, Naugatuck River, January 1962

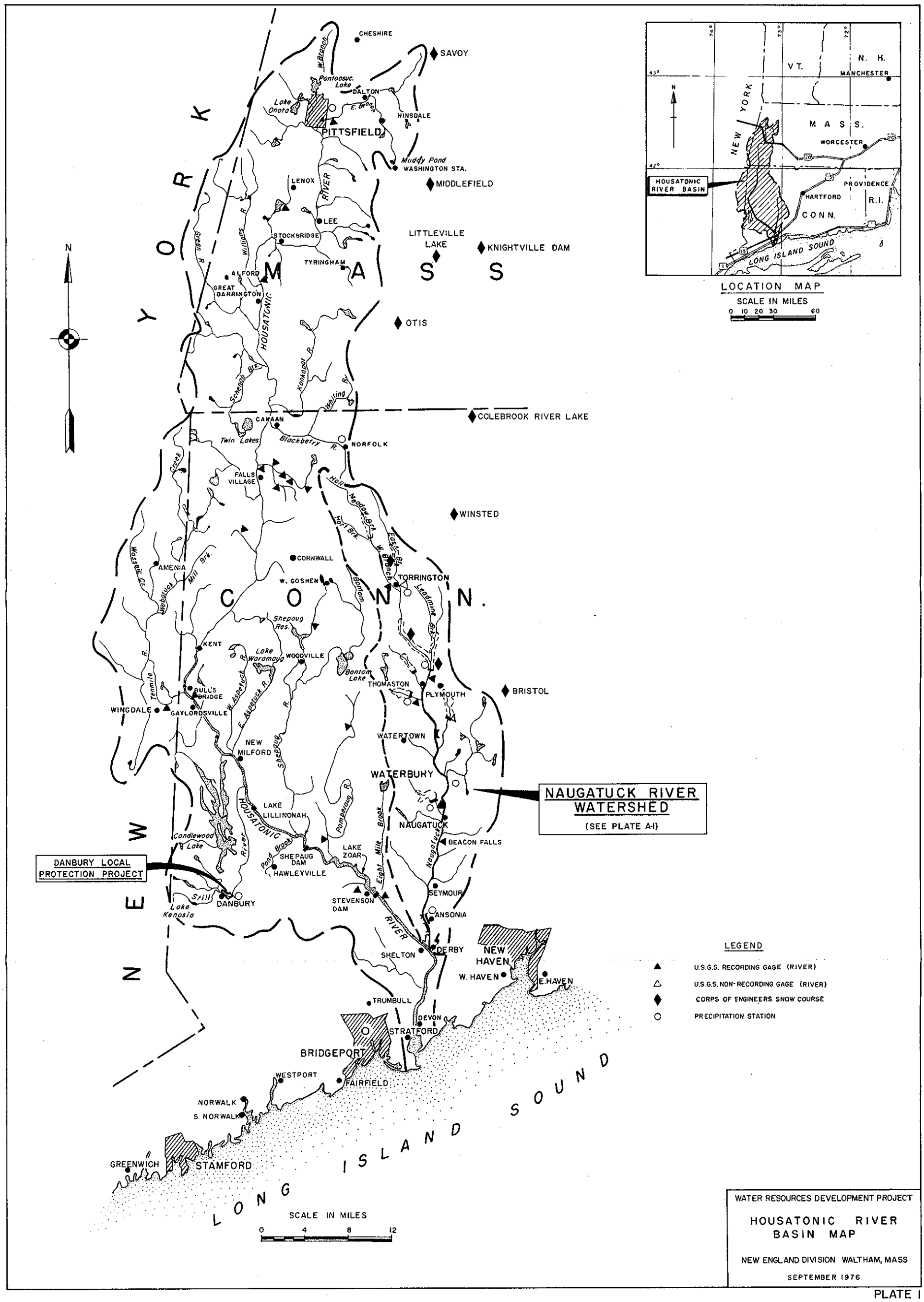
Ansonia, Connecticut, Naugatuck River, May 1973

Derby, Connecticut, Naugatuck and Housatonic Rivers, September 1973

Danbury, Connecticut, Still River, 1977

39. POST-OPERATION STUDIES

Following each flood control operation, a reporting log of activities is forwarded by the local community to the Reservoir Control Center and used to compute benefits, determine adequacy of regulation procedures and efficiency of communications.



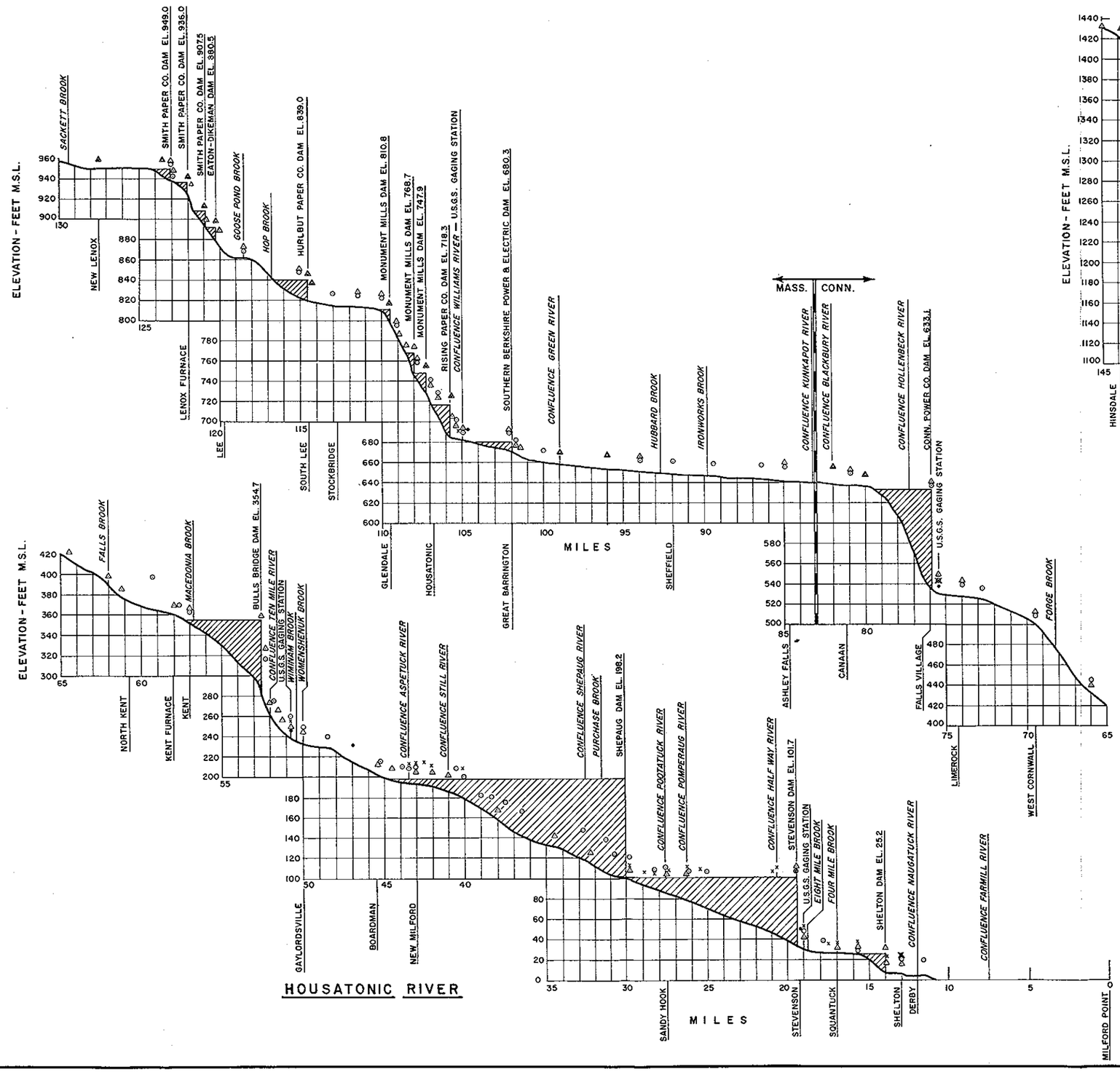
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN MAP

NEW ENGLAND DIVISION WALTHAM, MASS

SEPTEMBER 1976

PLATE I



LEGEND

- DAMS
- ● OCTOBER 1955 FLOOD
- X AUGUST 1955 FLOOD HIGH WATER MARKS
- △ DECEMBER 1948 FLOOD HIGH WATER MARKS
- ⊙ SEPTEMBER 1938 FLOOD HIGH WATER MARKS
- LOW FLOW PROFILE

NOTE:
Distances are in river miles from Milford Point.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY MWB | CK. BY P.H.

PROJECT ENGINEER

CHIEF, HYD. & HYD. SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS. BRANCH

HOUSATONIC RIVER FLOOD CONTROL

PROFILES

HOUSATONIC RIVER, MASS. & CONN.

DATE SEPT. 1963

APPROVED

CHIEF ENGINEERING DIV.

TO ACCOMPANY REPORT
DATED: 13, SEPT. 1963

SCALE

DRAWING NUMBER

SHEET

PLATE 2

View of Thomaston Dam

PLATE 3

CORPS OF ENGINEERS

U.S. ARMY

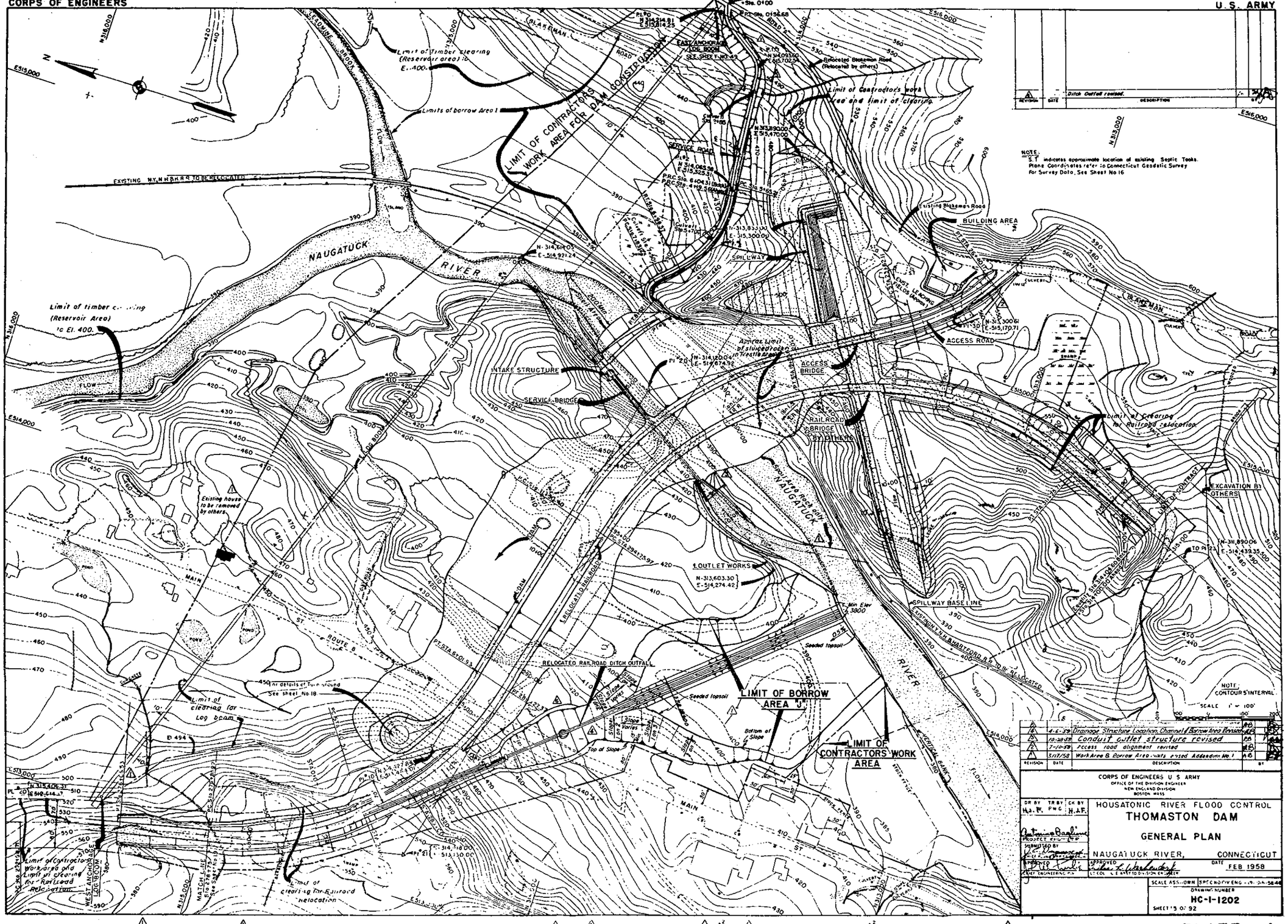
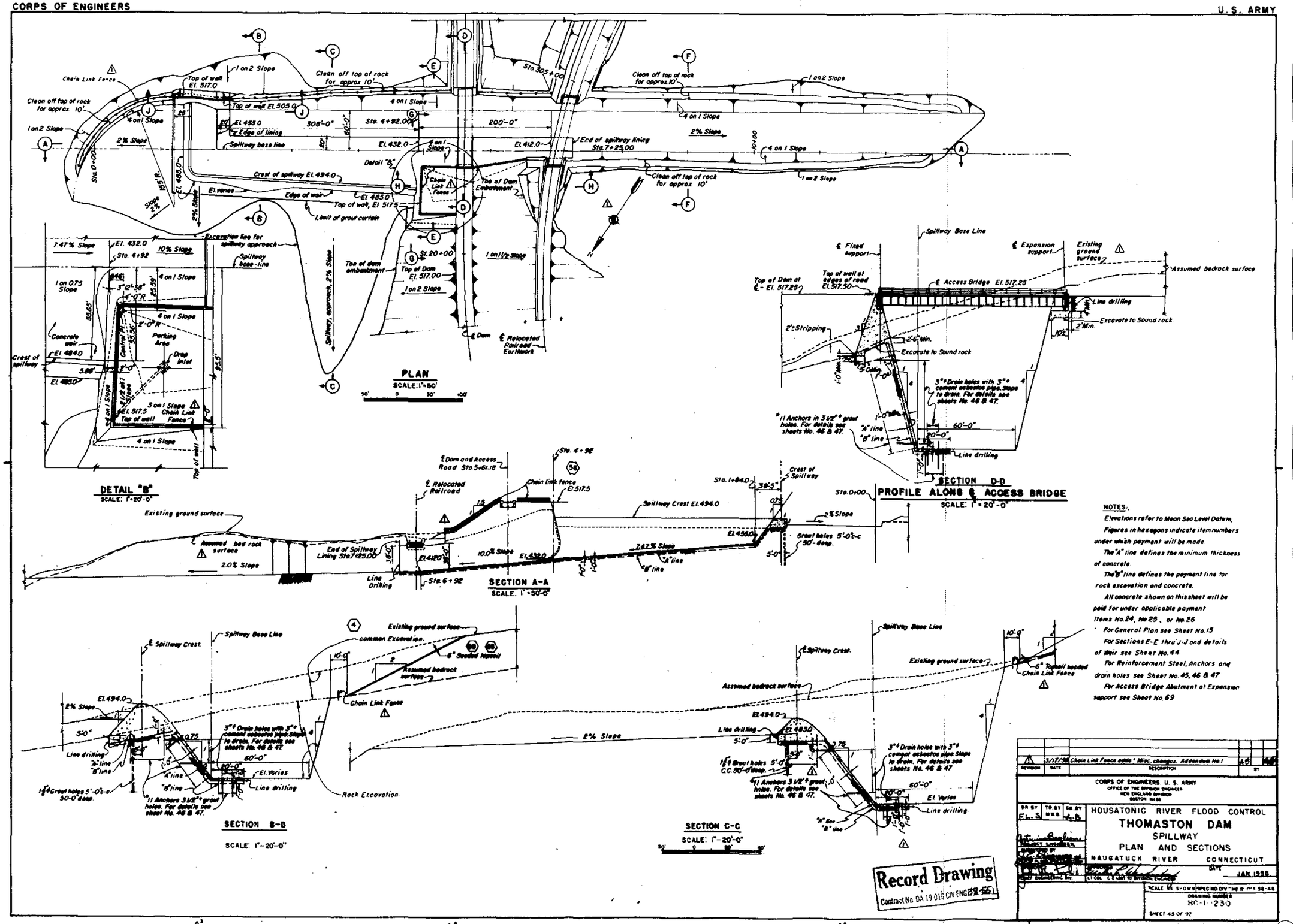


PLATE 4

CORPS OF ENGINEERS

U. S. ARMY



NOTES:-

Elevations refer to Mean Sea Level Datum.

Figures in hexagons indicate item numbers under which payment will be made.

The "A" line defines the minimum thickness of concrete.

The "B" line defines the payment line for rock excavation and concrete.

All concrete shown on this sheet will be paid for under applicable payment Items No. 24, No. 25, or No. 26.

For General Plan see Sheet No. 15.

For Sections E-E thru J-J and details of Weir see Sheet No. 44.

For Reinforcement Steel, Anchors and drain holes see Sheet No. 45, 46 & 47.

For Access Bridge Abutment at Expansion support see Sheet No. 69.

REVISION	DATE	DESCRIPTION	BY
1	3/17/58	Chain Link Fence adds & Misc. changes. Addendum No. 1	A.B.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY F.L.S. TR. BY M.W.B. CK. BY A.B.

HOUSATONIC RIVER FLOOD CONTROL
THOMASTON DAM
SPILLWAY
PLAN AND SECTIONS
NAUGATUCK RIVER CONNECTICUT

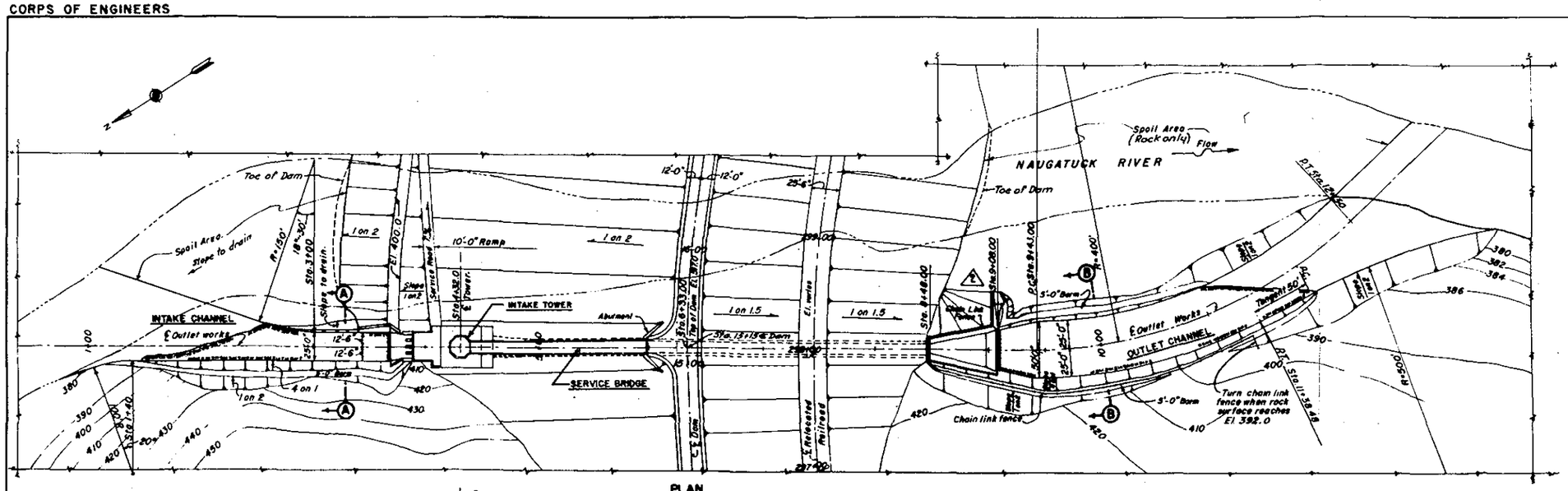
DATE JAN 1958

SCALE AS SHOWN SPEC. NO. CIV ENG 58-46

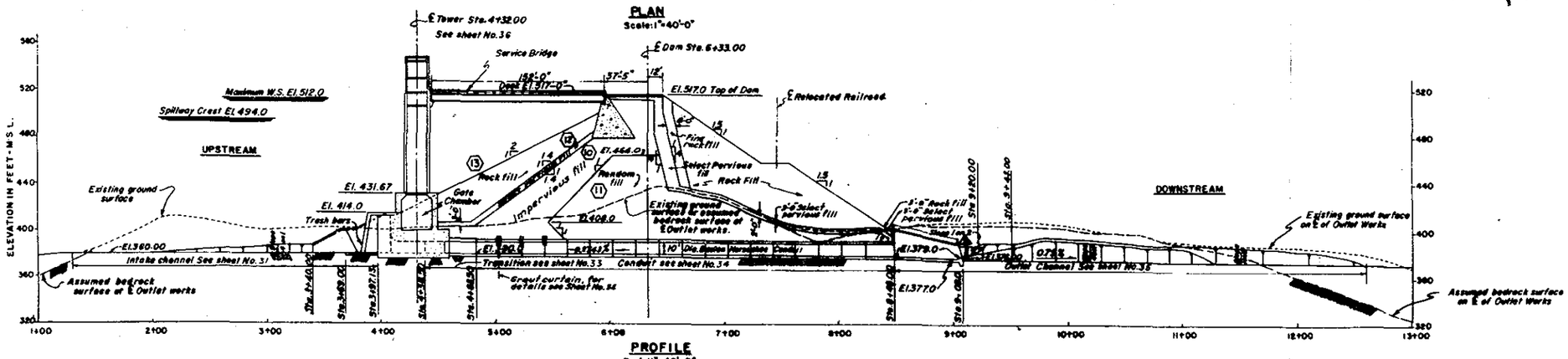
DRAWING NUMBER HC-1-230

SHEET 43 OF 92

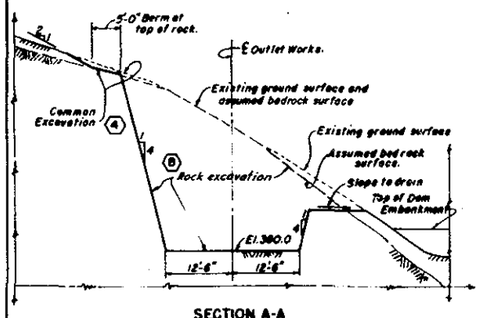
PLATE 5



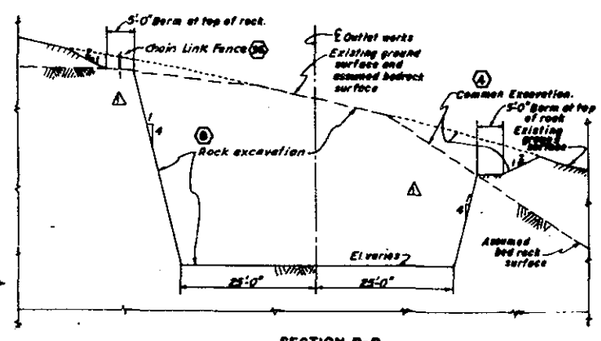
PLAN
Scale: 1" = 40'-0"



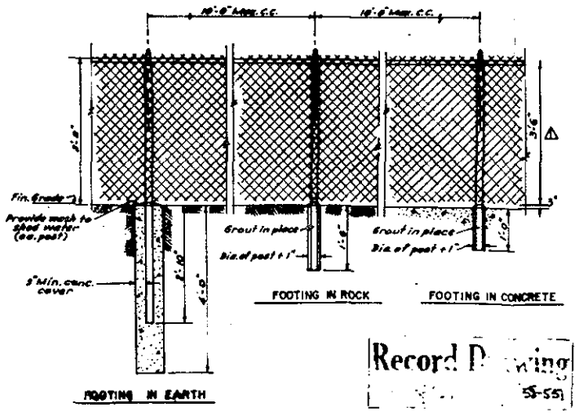
PROFILE
Scale: 1" = 40'-0"



SECTION A-A
Scale: 1" = 10'-0"



SECTION B-B
Scale 1" = 10'-0"



DETAIL-CHAIN LINK FENCE (56)
SCALE: 3/4" = 1'-0"

NOTES:
Elevations refer to Mean Sea Level Datum.
Figures in hexagons indicate item number under which payment will be made.

REVISION	DATE	DESCRIPTION	BY
4		Conduit outlet structure revised	BG
3	3-26-58	Minor revisions. Addn. No. 2	AG

CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY P.B.S. | TR. BY R.W.G. | CK. BY H.J.F.

HOUSATONIC RIVER FLOOD CONTROL
THOMASTON DAM
OUTLET WORKS
PLAN, PROFILE & SECTIONS
NAUGATUCK RIVER, CONNECTICUT

Lt. Col. C.E. Chief Construction Engineer
DATE JAN. 1958

SCALE AS SHOWN | SPEC NO. DIV ENG-10-06-58-40
DRAWING NUMBER HC-1-1217
SHEET 40 OF 92

ADD. V PRINT N

Record Drawing 55-55

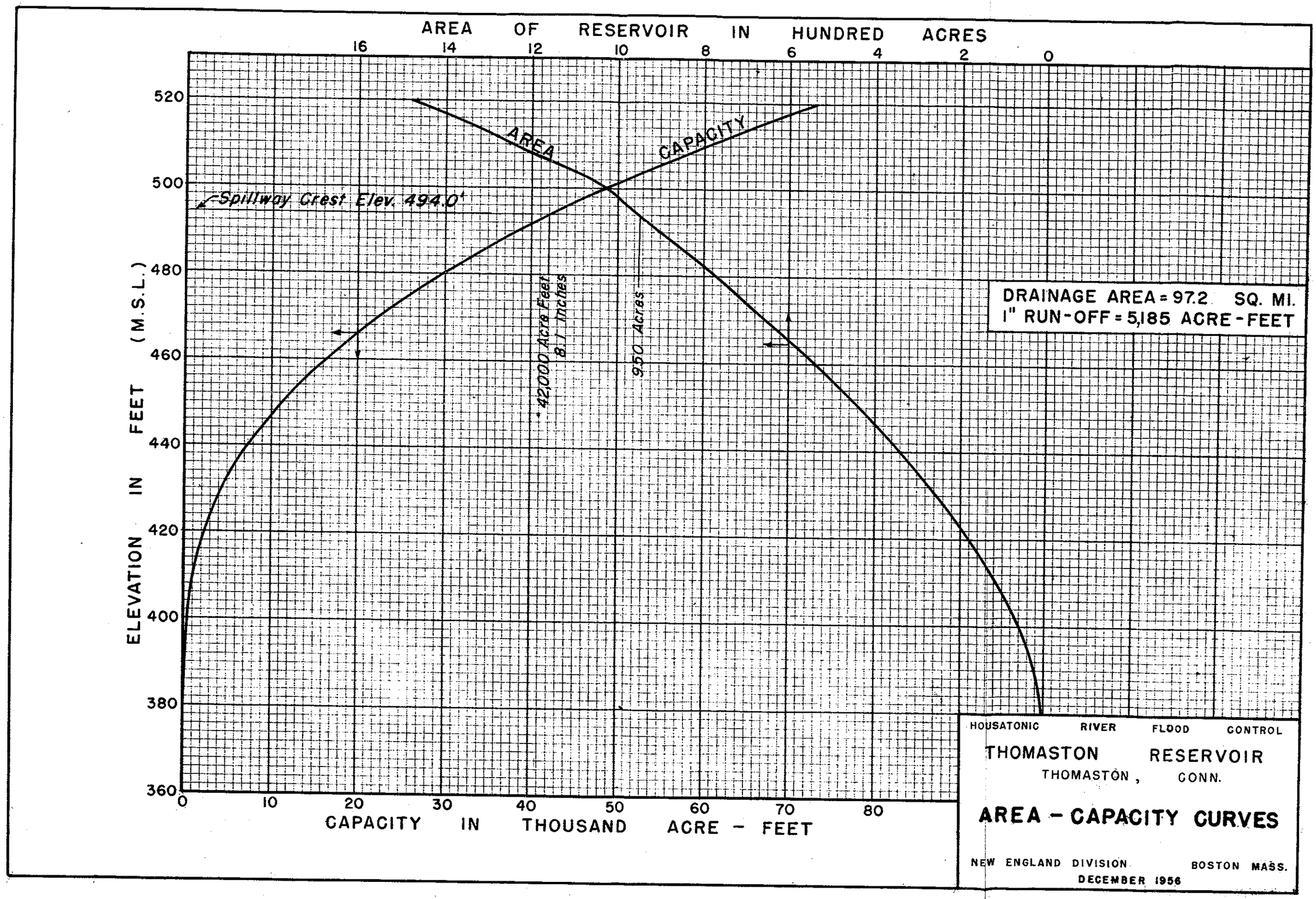
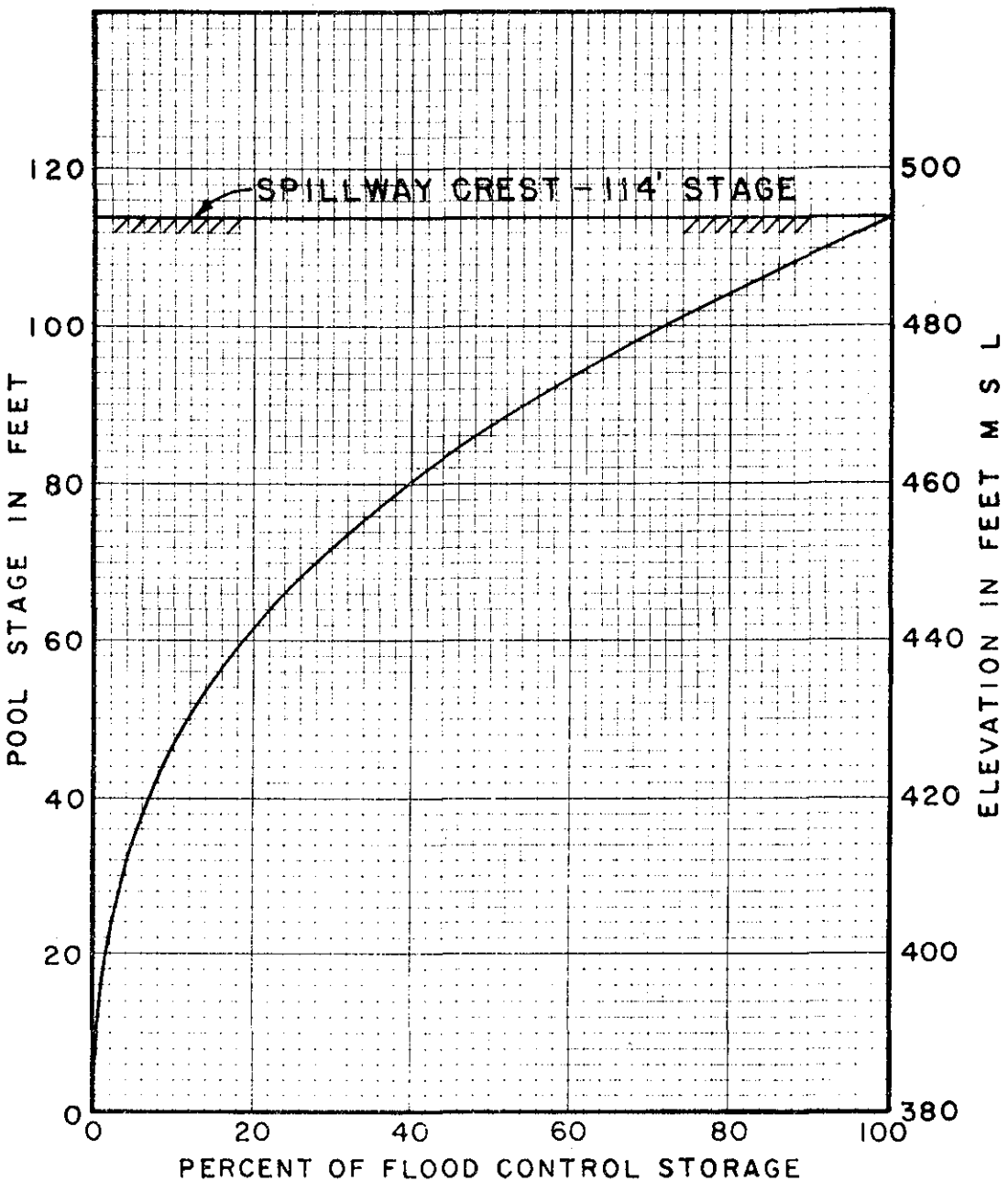

AREA OF RESERVOIR IN HUNDRED ACRES
16
14
12
10
8
6
4
2
0
520
500
480
460
440
420
400
380
360
ELEVATION IN FEET (M.S.L.)
AREA
CAPACITY
Spillway Crest Elev. 494.0'
42,000 Acre Feet
8.1 Inches
950 Acres
DRAINAGE AREA = 97.2 SQ. MI.
1" RUN-OFF = 5,185 ACRE-FEET
0
10
20
30
40
50
60
70
80
CAPACITY IN THOUSAND ACRE - FEET
HOUSATONIC RIVER FLOOD CONTROL
THOMASTON RESERVOIR
THOMASTON, CONN.
AREA - CAPACITY CURVES
NEW ENGLAND DIVISION BOSTON MASS.
DECEMBER 1956

PLATE NO. 7

THOMASTON LAKE
AREA-CAPACITY TABLE
DRAINAGE AREA = 97.2 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
0	380	0	0	0	60	440	339	7,746	1.49
2	382	1	4	0	62	442	363	8,448	1.63
4	384	2	7	0	64	444	383	9,194	1.77
6	386	5	14	0	66	446	401	9,978	1.92
8	388	8	27	0.01	68	448	422	10,801	2.08
10	390	12	47	0.01	70	450	443	11,666	2.25
12	392	16	75	0.01	72	452	463	12,572	2.43
14	394	25	116	0.02	74	454	484	13,519	2.61
16	396	35	176	0.03	76	456	502	14,505	2.80
18	398	50	261	0.05	78	458	523	15,530	3.00
20	400	62	373	0.07	80	460	545	16,598	3.20
22	402	73	508	0.10	82	462	567	17,710	3.42
24	404	85	666	0.13	84	464	588	18,865	3.64
26	406	96	847	0.16	86	466	611	20,064	3.87
28	408	107	1,050	0.20	88	468	635	21,310	4.11
30	410	119	1,276	0.25	90	470	661	22,606	4.36
32	412	130	1,525	0.29	92	472	688	23,955	4.62
34	414	140	1,795	0.35	94	474	710	25,353	4.89
36	416	152	2,087	0.40	96	476	735	26,798	5.17
38	418	163	2,402	0.46	98	478	760	28,293	5.46
40	420	174	2,739	0.53	100	480	784	29,837	5.75
42	422	187	3,100	0.60	102	482	806	31,427	6.06
44	424	199	3,486	0.67	104	484	829	33,062	6.70
46	426	214	3,899	0.75	106	486	852	34,743	6.70
48	428	229	4,342	0.84	108	488	874	36,469	7.03
50	430	247	4,818	0.93	110	490	897	38,240	7.38
52	432	265	5,330	1.03	112	492	923	40,060	7.23
54	434	283	5,878	1.13	114	494	960	42,000	8.10
56	436	302	6,463	1.25					
58	438	321	7,086	1.37			(Spillway Crest)		



NOTES:

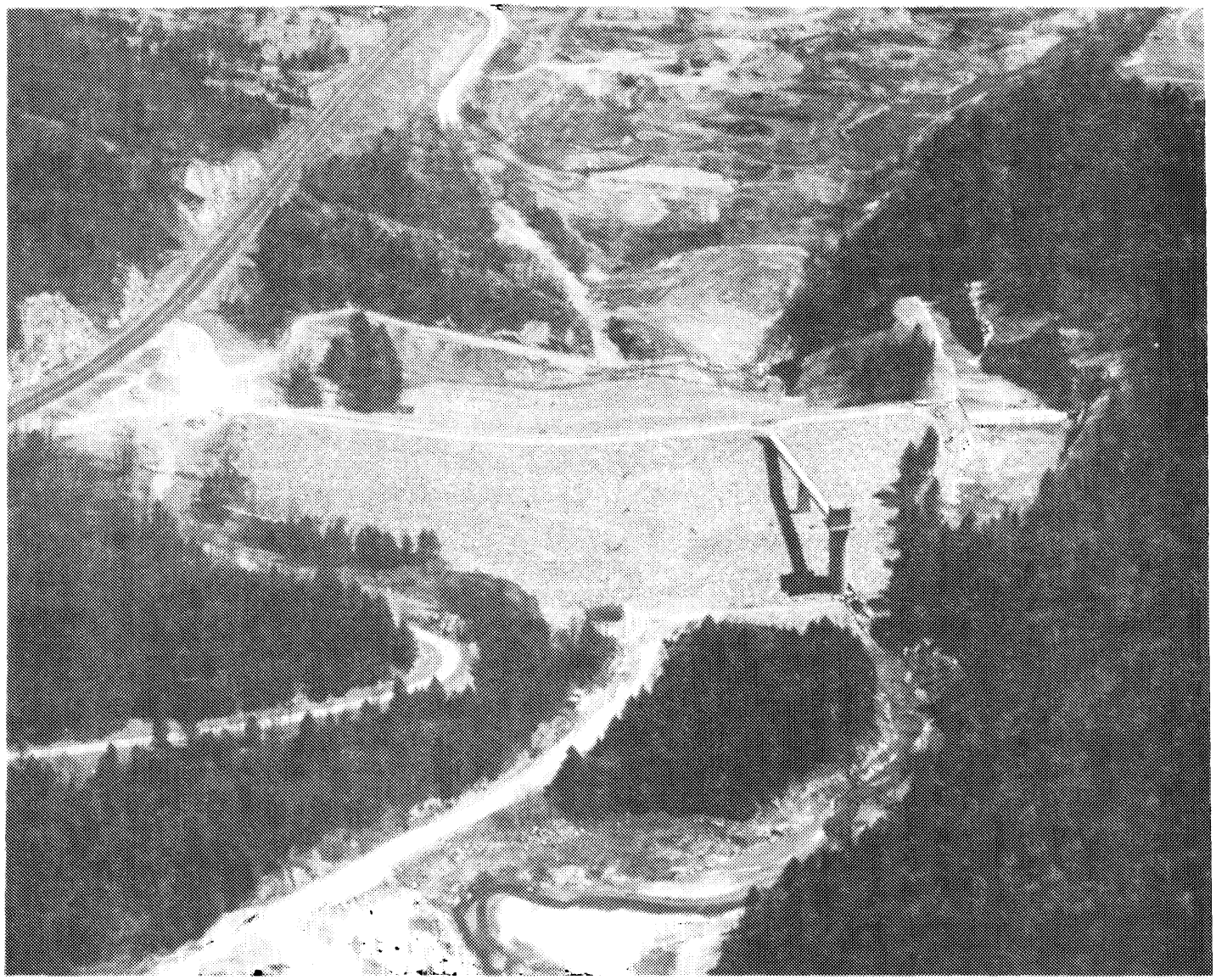
1. DRAINAGE AREA - 97.2 SQ. MI.
2. FLOOD CONTROL STORAGE - 42,000 ACRE FEET - 8.1 INCHES.
3. 1" RUNOFF = 5185 ACRE FEET.

WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
THOMASTON DAM

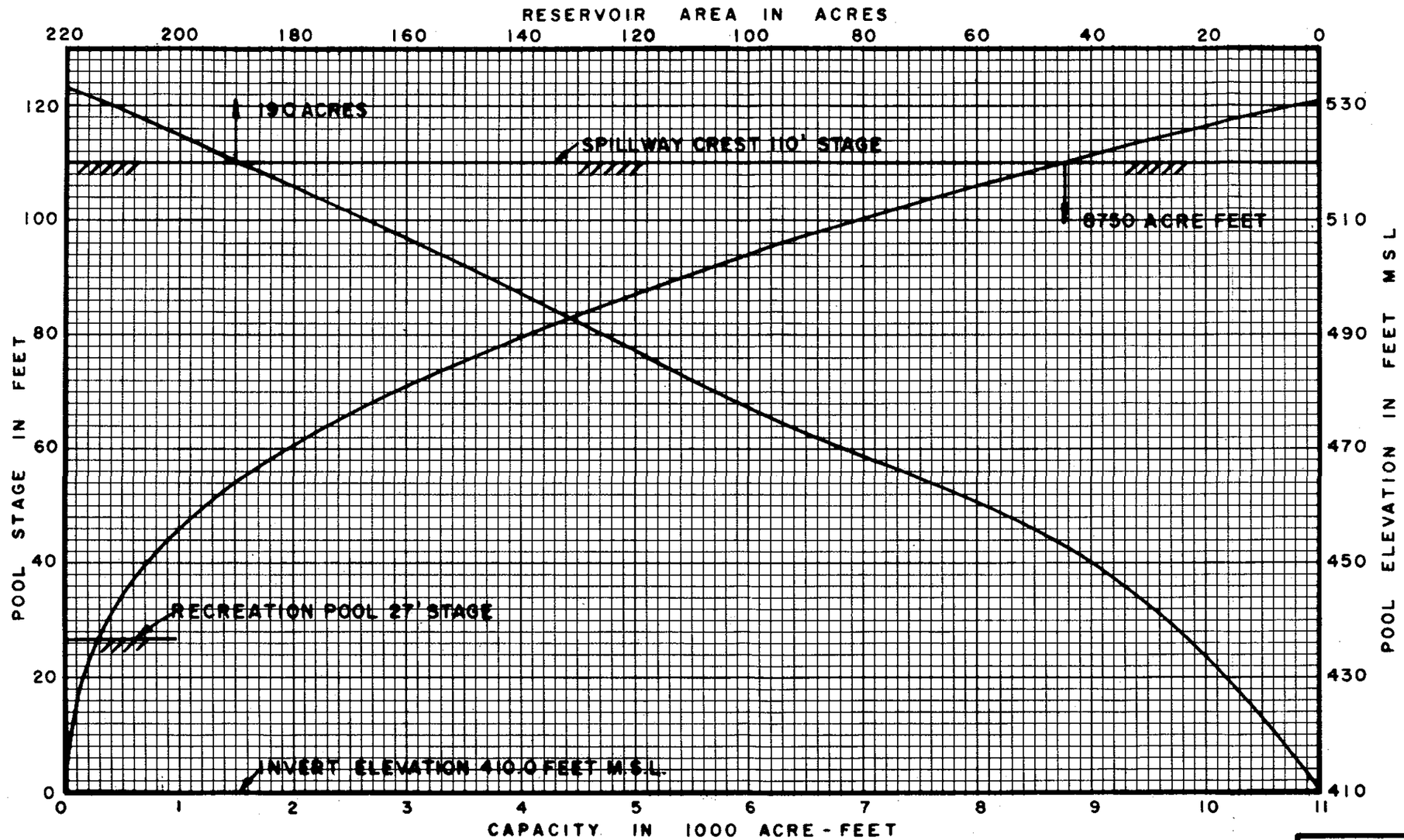
PERCENT FULL CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.



View of Black Rock Lake

PLATE 10



NOTES:
1. DRAINAGE AREA = 20.4 SQ. MI.
2. 1" RUNOFF = 1,090 ACRE FEET.

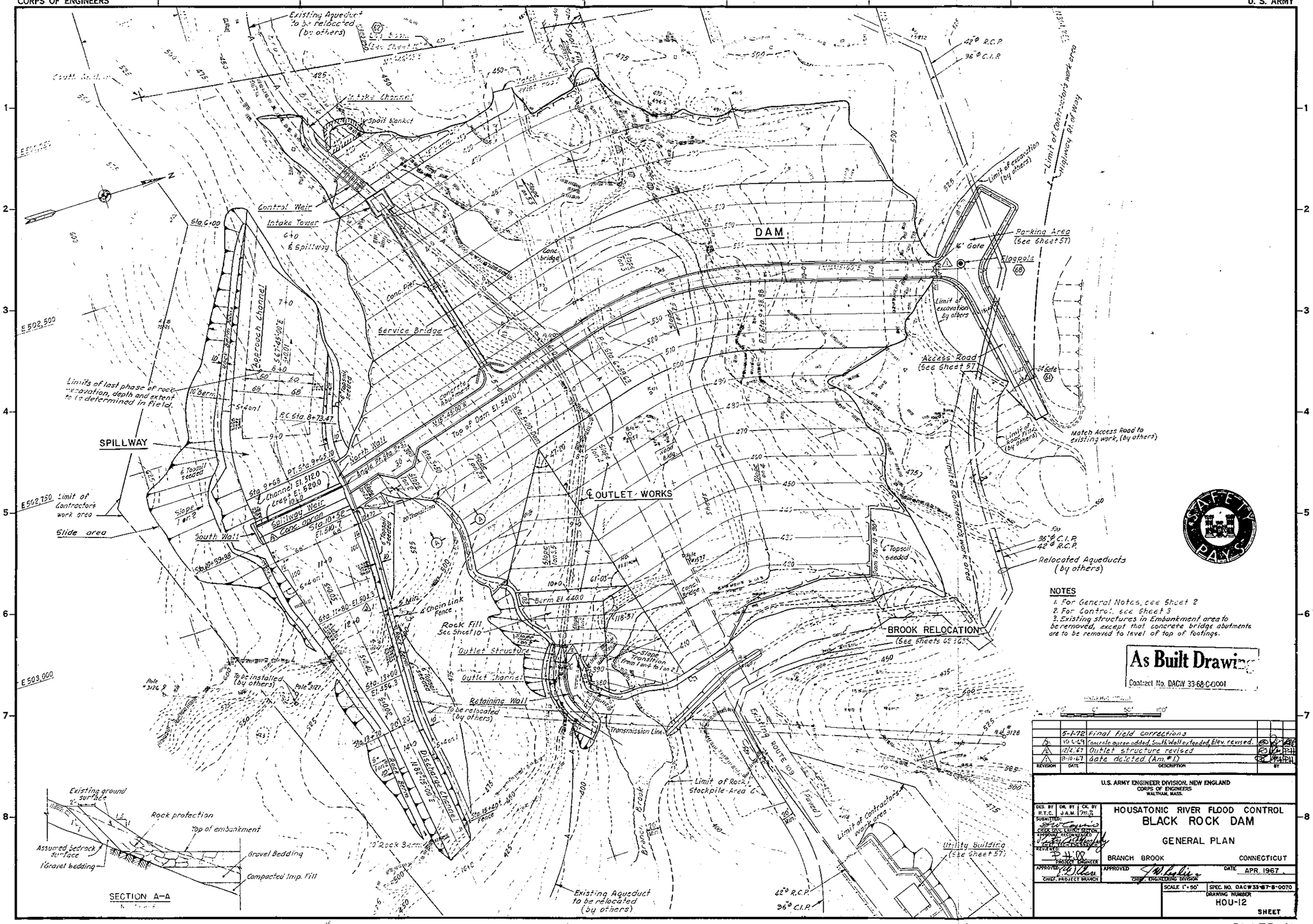
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
BLACK ROCK LAKE

AREA CAPACITY CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPT. 1976

CORPS OF ENGINEERS — U. S. ARMY



NOTES

1. For General Notes, see Sheet 2
2. For Control, see Sheet 3
3. Existing structures in Embankment area to be removed, except that concrete bridge abutments are to be removed to level of top of footings.

As Built Drawing

Contract No. DACW 33-68-C-0001

REVISION	DATE	DESCRIPTION	BY
	5-1-72	Final field corrections	
3	10-6-69	Concrete apron added, South Wall extended, Elev. revised.	
2	12-4-67	Outlet structure revised	
1	8-10-67	Gate deleted (Am. #1)	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY R.T.C. | DR. BY J.A.M. | CK. BY

SUBMITTED: CHIEF, DIV. LIAISON SECTION
APPROVE: RECOMMENDED: CHIEF, DESIGN BRANCH
REVIEWED: PROJECT ENGINEER
APPROVED: CHIEF, PROJECT BRANCH
APPROVED: CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
BLACK ROCK DAM
GENERAL PLAN

BRANCH BROOK — CONNECTICUT

DATE APR. 1967

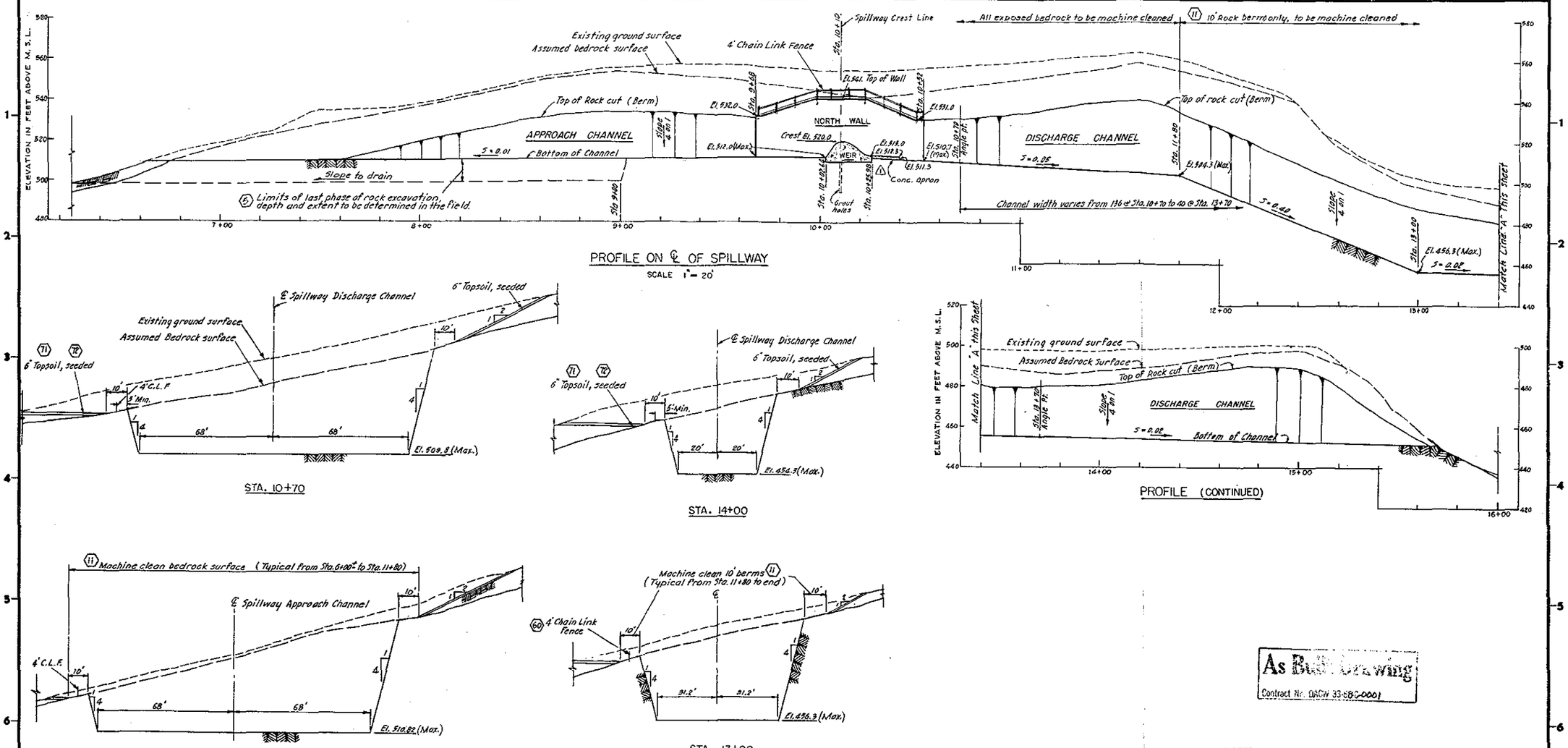
SCALE 1" = 50' | SPEC. NO. DACW33-67-B-0070

DRAWING NUMBER HOU-12

SHEET

PLATE 11

CORPS OF ENGINEERS U. S. ARMY



PROFILE ON ℄ OF SPILLWAY

SCALE 1" = 20'

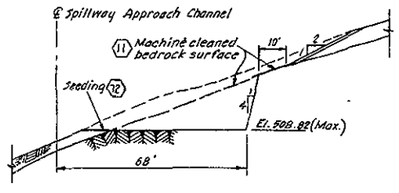
STA. 10+70

STA. 14+00

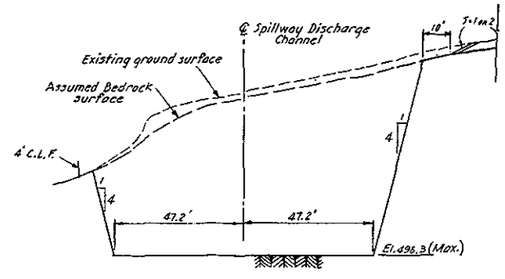
PROFILE (CONTINUED)

STA. 8+50

STA. 13+00



STA. 6+50



STA. 12+00

TYPICAL SPILLWAY SECTIONS

SCALE 1" = 20'

As Built Drawing
Contract No. DACW 33-88-0001

NOTES

1. For General notes see Sheet 2.
2. All open cut rock excavation shall be paid for under Item No. 8.
3. All unclassified excavation shall be paid for under Item No. 3.

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY
1	5-1-72	Final Field corrections	
	10-4-69	Concrete apron added.	

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

DES. BY K.E. | DR. BY J.A.M. | CK. BY R.T.C.

SUBMITTED: CHIEF, CIV. LAYOUT SECTION
APPROVAL RECOMMENDED: CHIEF, DESIGN BRANCH
REVIEWED: PROJECT ENGINEER
APPROVAL RECOMMENDED: CHIEF, PROJECT BRANCH

HOUSATONIC RIVER FLOOD CONTROL
BLACK ROCK DAM
SPILLWAY
PROFILE AND SECTIONS
BRANCH BROOK CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION
DATE APR. 1967

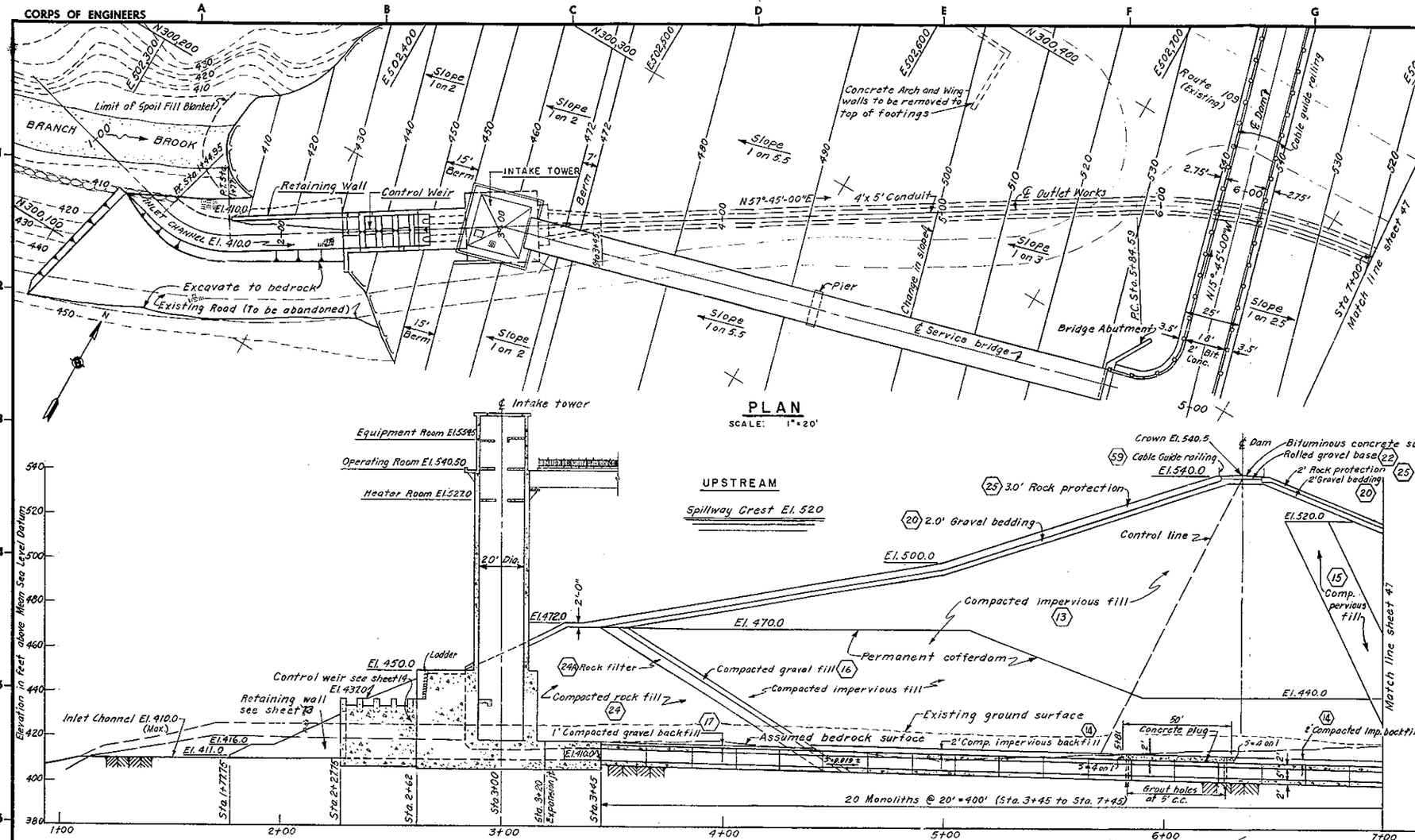
SCALE: 1" = 20' | SPEC. NO. DACW33-67-B-0070
DRAWING NUMBER HOU-12
SHEET 54

GRAPHIC SCALE 1" = 20'-0" 20' 0 20' 40'

PLATE 12

CORPS OF ENGINEERS

U. S. ARMY



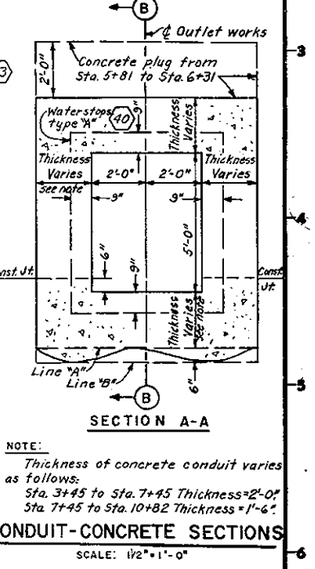
PLAN

SCALE: 1" = 20'

SECTION B-B

PROFILE ON ℄ OF OUTLET WORKS

SCALE: 1" = 20'



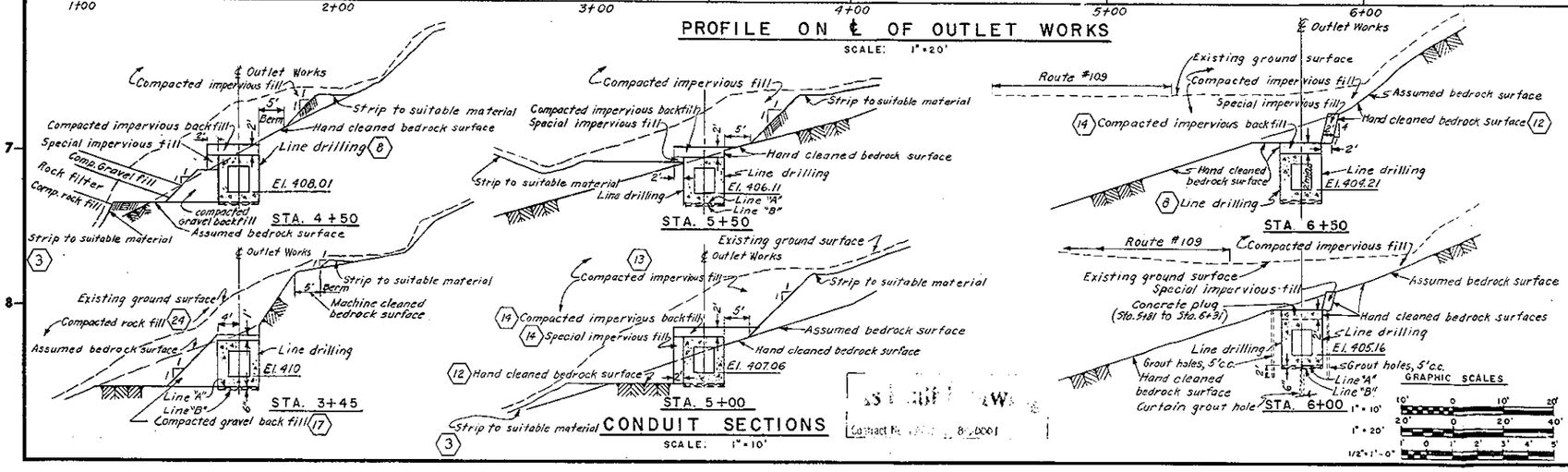
SECTION A-A

NOTE:

Thickness of concrete conduit varies as follows:
Sta. 3+45 to Sta. 7+45 Thickness = 2'-0".
Sta. 7+45 to Sta. 10+82 Thickness = 1'-6".

CONDUIT-CONCRETE SECTIONS

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



CONDUIT SECTIONS

SCALE: 1" = 10'

NOTES:

For General Notes see Sheet 2.
For Control see Sheet 3.
All concrete for concrete conduit from Sta. 3+45 to Sta. 10+82 to be paid under Payment Item 32.
For steel reinforcement in concrete conduit see Sheet 35.

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

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

DES. BY R.T.C. | DR. BY E.J.K. | CK. BY R.E.

SUBMITTED: CHIEF, DESIGN BRANCH
CHIEF, STORAGE DESIGN SECTION
REVIEWED: PROJECT ENGINEER
APPROVED RECOMMENDED: CHIEF, PROJECT BRANCH

HOUSATONIC RIVER FLOOD CONTROL
BLACK ROCK DAM
OUTLET WORKS - CONDUIT
PLAN, PROFILE & SECTIONS NO. 1

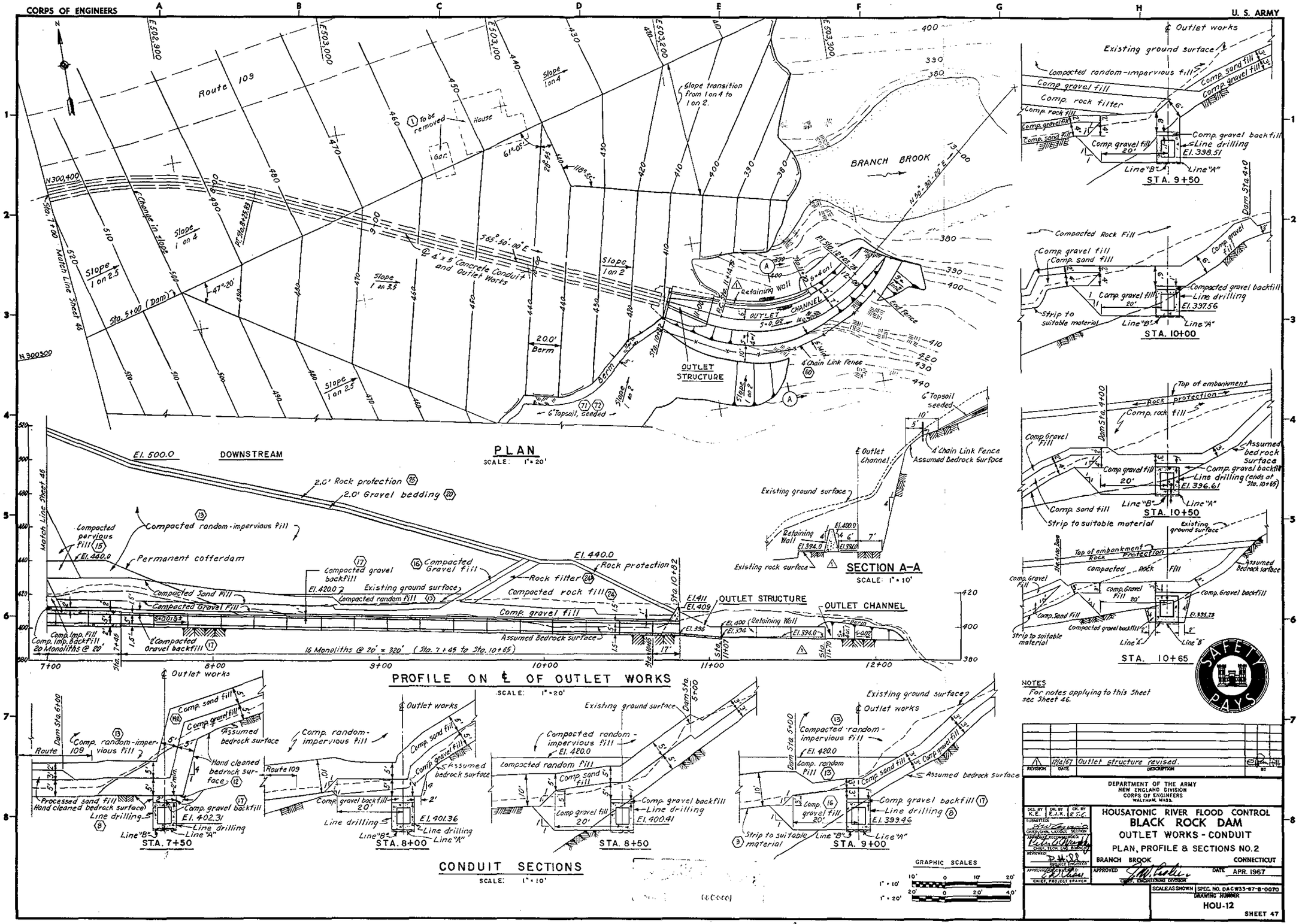
BRANCH BROOK — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION — DATE APR. 1967

SCALE AS SHOWN | SPEC. NO. DACW 33-67-B-0070
DRAWING NUMBER HOU-12
SHEET 46

PLATE 13

CORPS OF ENGINEERS — U. S. ARMY



NOTES

For notes applying to this Sheet see Sheet 46.

REVISION	DATE	DESCRIPTION	BY
1	12/2/67	Outlet structure revised.	

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

DES. BY K.E. | DR. BY E.J.K. | CK. BY R.T.C.

SUBMITTED: CHIEF, CIVIL LAYOUT SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. CON. BRANCH

REVIEWED: PROJECT ENGINEER

APPROVAL RECOMMENDED: CHIEF, PROJECT BRANCH

HOUSATONIC RIVER FLOOD CONTROL
BLACK ROCK DAM
OUTLET WORKS - CONDUIT
PLAN, PROFILE & SECTIONS NO. 2

BRANCH BROOK — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION — DATE: APR. 1967

SCALE: AS SHOWN | SPEC. NO. DACW33-67-B-0070

DRAWING NUMBER: HOU-12

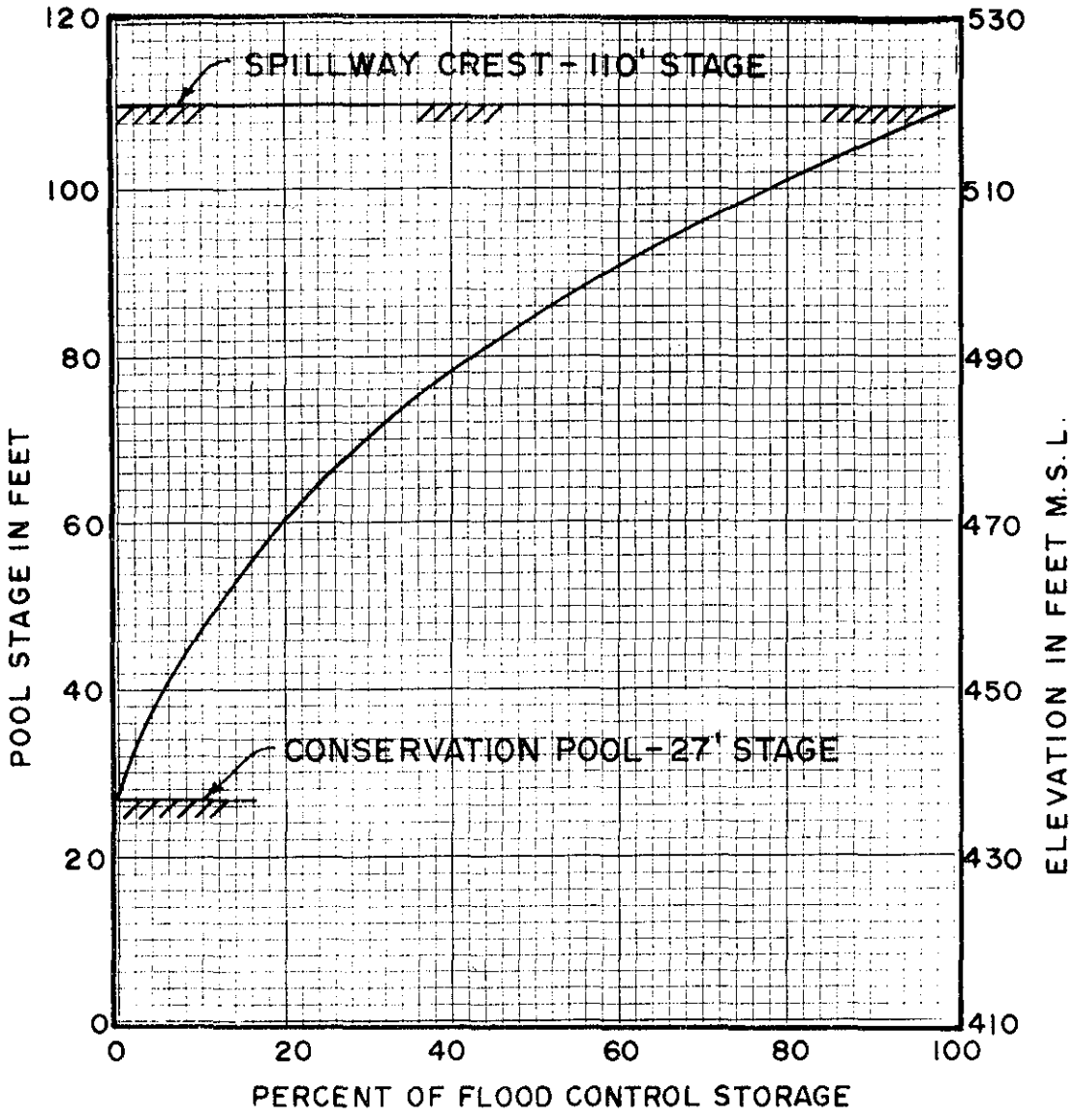
SHEET 47

PLATE 14

BLACK ROCK LAKE
AREA-CAPACITY TABLE
DRAINAGE AREA = 20.4 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
0	410	0	0	0	56	466	74	1,311	1.20
2	412	2	2	0	58	468	78	1,463	1.34
4	414	4	8	0.01	60	470	83	1,624	1.49
6	416	6	18	0.02	62	472	87	1,794	1.65
8	418	7	31	0.03	64	474	92	1,973	1.81
10	420	8	46	0.04	66	476	97	2,162	1.99
12	422	10	64	0.06	68	478	101	2,360	2.17
14	424	12	86	0.08	70	480	106	2,567	2.36
16	426	14	112	0.10	72	482	110	2,783	3.56
18	428	16	142	0.13	74	484	114	2,007	2.76
20	230	17	175	0.16	76	486	118	3,239	2.98
22	432	18	211	0.19	78	488	122	3,479	3.20
24	434	19	250	0.23	80	490	126	3,727	3.43
26	436	20	292	0.27	82	492	130	3,983	3.66
27*	437	21	305	0.29	84	494	134	4,247	3.90
27	437	21	0	0	86	496	138	4,519	4.15
28	438	25	24	0.02	88	498	143	4,800	4.41
30	440	28	77	0.07	90	500	147	5,090	4.68
32	442	30	135	0.13	92	502	151	5,388	4.95
34	444	32	197	0.18	94	504	156	5,695	5.23
36	446	35	264	0.24	96	506	160	6,011	5.52
38	448	37	336	0.31	98	508	163	6,334	5.82
40	450	40	413	0.38	100	510	168	6,665	6.13
42	452	44	497	0.46	102	512	172	7,005	6.44
44	454	47	588	0.54	104	514	176	7,353	6.76
46	456	52	687	0.63	106	516	180	7,709	7.09
48	458	56	795	0.73	108	518	185	8,074	7.42
50	460	60	911	0.84	110	520	190	8,450	7.80
52	462	64	1,035	0.95					
54	464	69	1,168	1.07			(Spillway Crest)		

*Recreation Pool



NOTES:

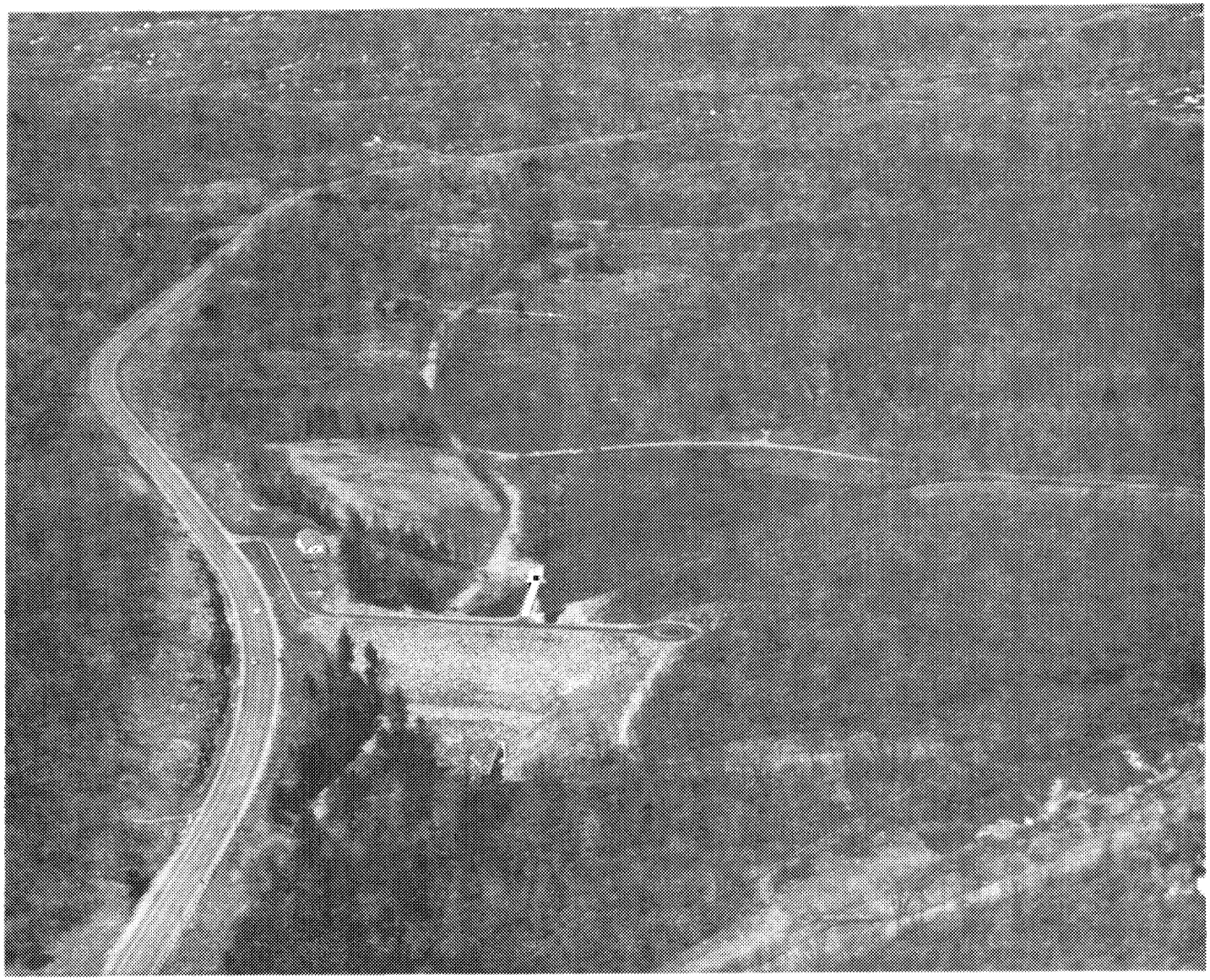
1. DRAINAGE AREA = 20.4 SQ. MI.
2. FLOOD CONTROL STORAGE - 8450 ACRE FEET - 7.8 INCHES.
3. CONSERVATION STORAGE - 305 Ac. Ft. - 0.3 INCHES.
4. 1 INCH RUNOFF = 1090 Ac. Ft.

WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
BLACK ROCK LAKE

PERCENT FULL CURVE

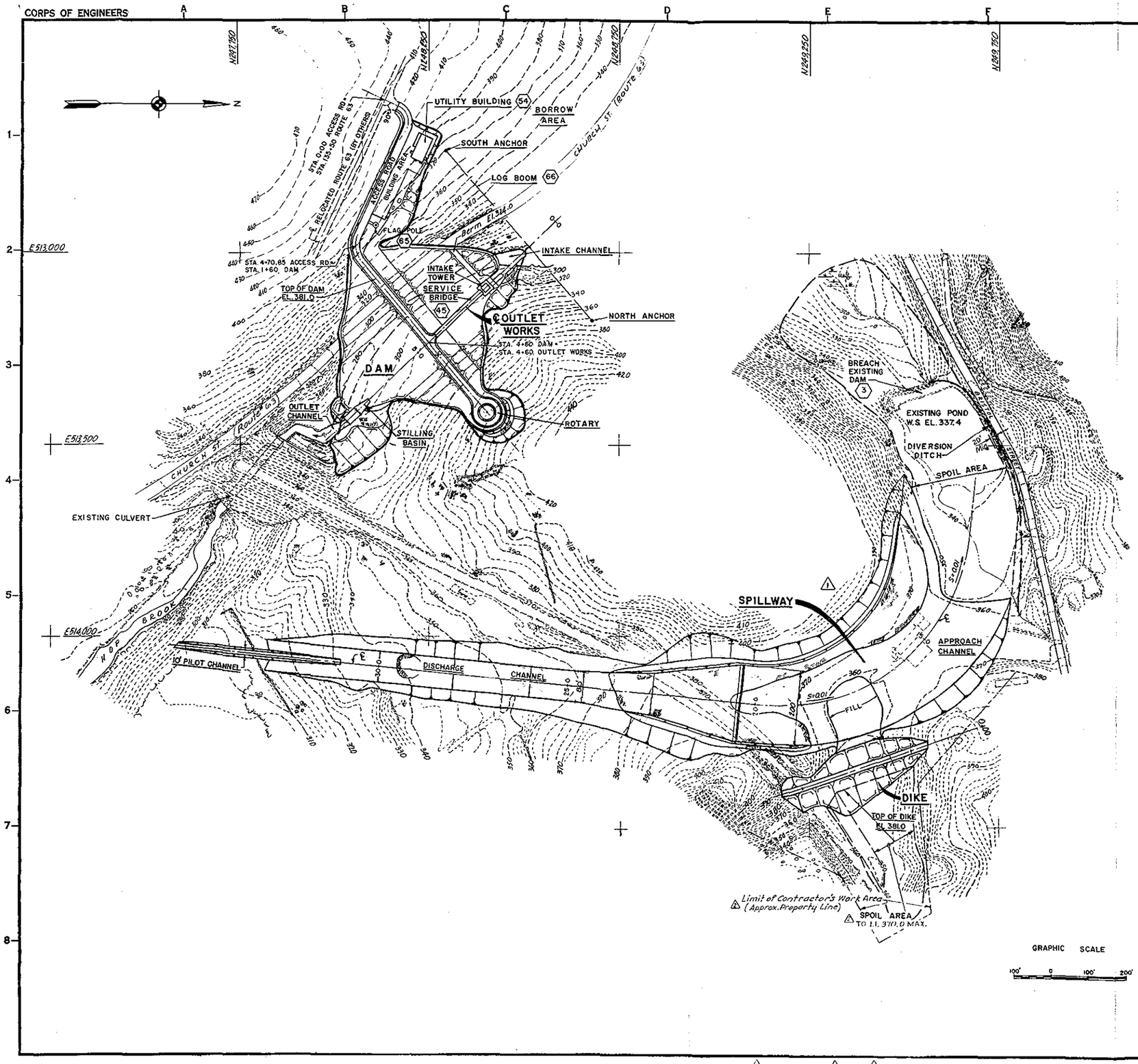
NEW ENGLAND DIVISION, WALTHAM, MA.
SEPTEMBER 1976



View of Hop Brook Lake

PLATE 18

CORPS OF ENGINEERS — U. S. ARMY



LEGEND - EXTERIOR FEATURES		
NEW	EXISTING	DESCRIPTION
400	400	CONTOURS
×314.0	314.0	ELEVATIONS
F		FENCE
		TREE LINE
		DITCH - GRADE TO DRAIN
		ROCK OR LEDGE OUTCROP
		LIMIT OF WORK
		EARTH CUT AND ROCK CUT
		EARTH FILL
		EARTH SURFACE (SECTION)
		ASSUMED BED ROCK SURFACE OR ROCK CUT (SECTION)
		EARTH CUT WITH ROCK SLOPE PROTECTION
		EARTH FILL WITH ROCK SLOPE PROTECTION
GR		CABLE GUIDE RAIL

GENERAL NOTES

1. Elevations refer to Mean Sea Level Datum.
2. Plane Coordinates refer to Connecticut Lambert Grid System.
3. Figures in hexagons indicate Item No. under which payment will be made.
4. For limits of Contractor's Work Area, see Sheet 2.

Record Drawing
Contract No. DA-19-016-CIV ENG 66-38

REVISION	DATE	DESCRIPTION	BY
		Final field corrections	
2	5-2-66	Dike and adjacent spoil Area revised.	
1	10-27-65	West bank of Spillway revised. (Am #2)	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY M.Z. | DR. BY C.T.M. | CK. BY M.Z.
SUBMITTED: CHIEF, LAYOUT SECTION
REVIEWED: PROJECT ENGINEER
CHIEF, DESIGN BRANCH

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
GENERAL PLAN

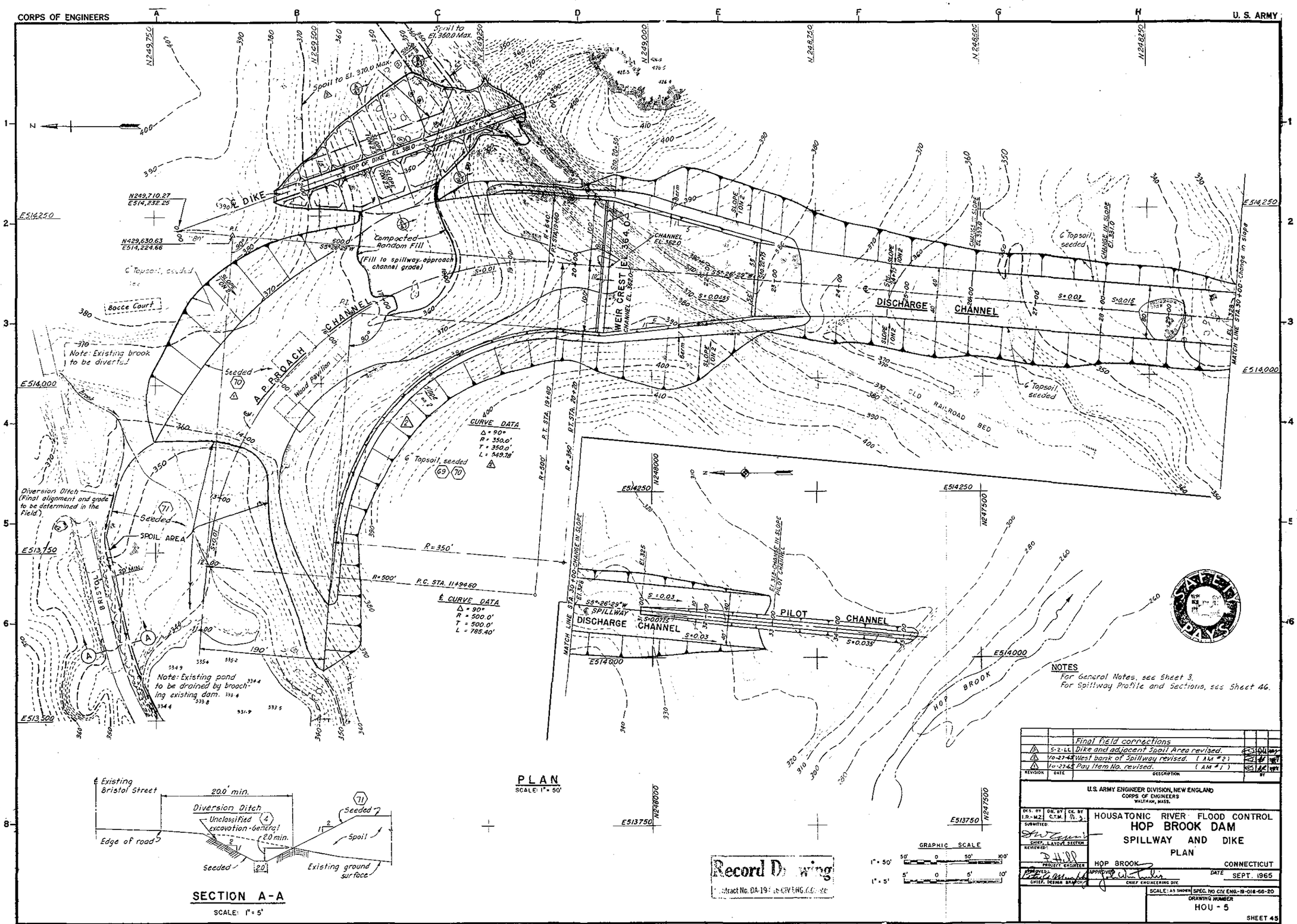
HOP BROOK — CONNECTICUT

APPROVED: CHIEF, ENGINEERING DIVISION — DATE SEPT. 1965

SCALE: 1" = 100' | SPEC. NO. CIV. ENG. 19-016-66-20
DRAWING NUMBER HOU - 5
SHEET 3

PLATE 19

CORPS OF ENGINEERS — U. S. ARMY



PLAN
SCALE: 1" = 50'

SECTION A-A
SCALE: 1" = 5'

REVISION	DATE	DESCRIPTION	BY
		Final field corrections	
3	5-2-66	Dike and adjacent Spoil Area revised.	
2	10-27-65	West bank of Spillway revised. (AM #2)	
1	10-27-65	Pay Item No. revised. (AM #1)	

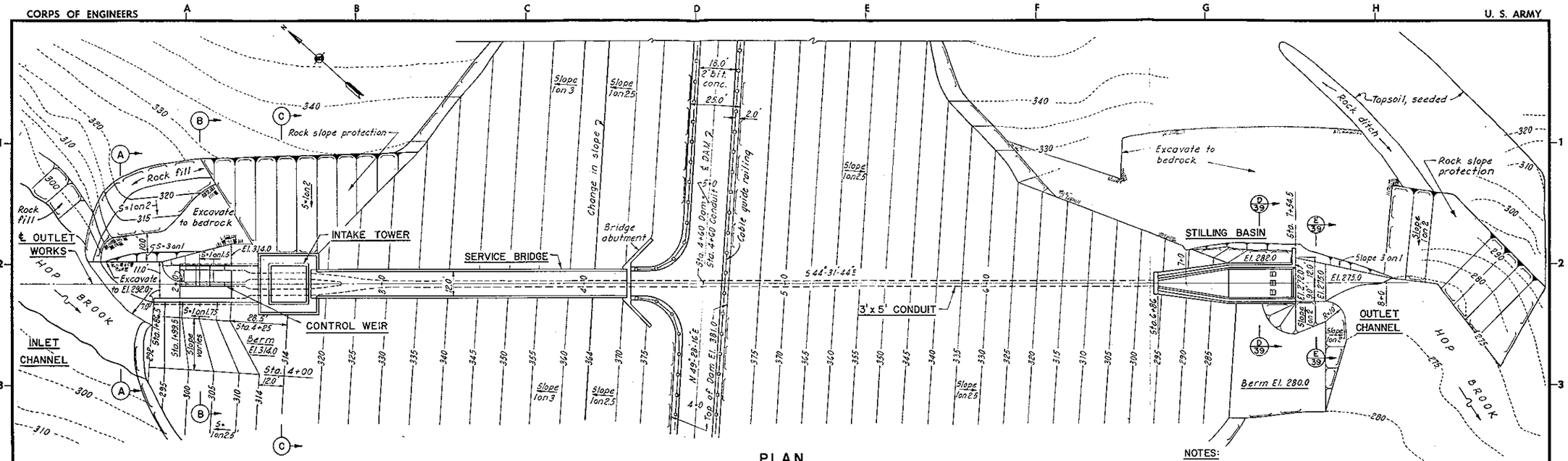
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY I.R.-M.Z. | DR. BY C.T.M. | CK. BY R.J.
SUBMITTED: CHIEF, LAYOUT SECTION
REVIEWED: PROJECT ENGINEER
APPROVED: CHIEF, DESIGN BRANCH
APPROVED: CHIEF ENGINEERING DIV.

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
SPILLWAY AND DIKE
PLAN
HOP BROOK CONNECTICUT
DATE SEPT. 1965
SCALE: AS SHOWN | SPEC. NO CIV ENG.-19-016-66-20
DRAWING NUMBER HOU - 5
SHEET 45

PLATE 20

CORPS OF ENGINEERS — U. S. ARMY



PLAN

SCALE: 1" = 20'

NOTES:

For General Notes applying to this sheet see Sheet 3.

All concrete in Inlet Structure and Stilling Basin will be paid for under Item No. 27.

All concrete in Intake Tower to El. 320.0 (Sta. 2+21 to Sta. 2+72.5) will be paid for under Item No. 29.

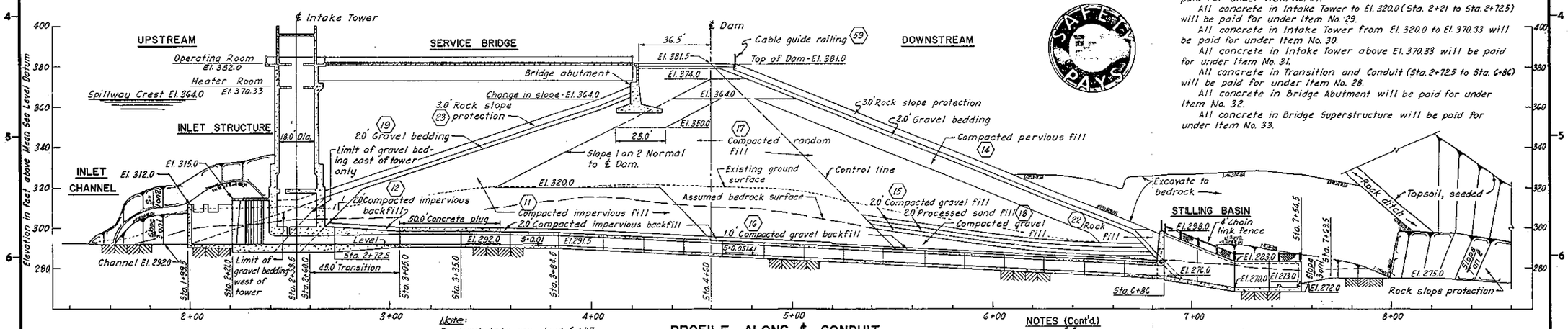
All concrete in Intake Tower from El. 320.0 to El. 370.33 will be paid for under Item No. 30.

All concrete in Intake Tower above El. 370.33 will be paid for under Item No. 31.

All concrete in Transition and Conduit (Sta. 2+72.5 to Sta. 6+86) will be paid for under Item No. 28.

All concrete in Bridge Abutment will be paid for under Item No. 32.

All concrete in Bridge Superstructure will be paid for under Item No. 33.



Note: For grout holes, see sheets 6 & 37

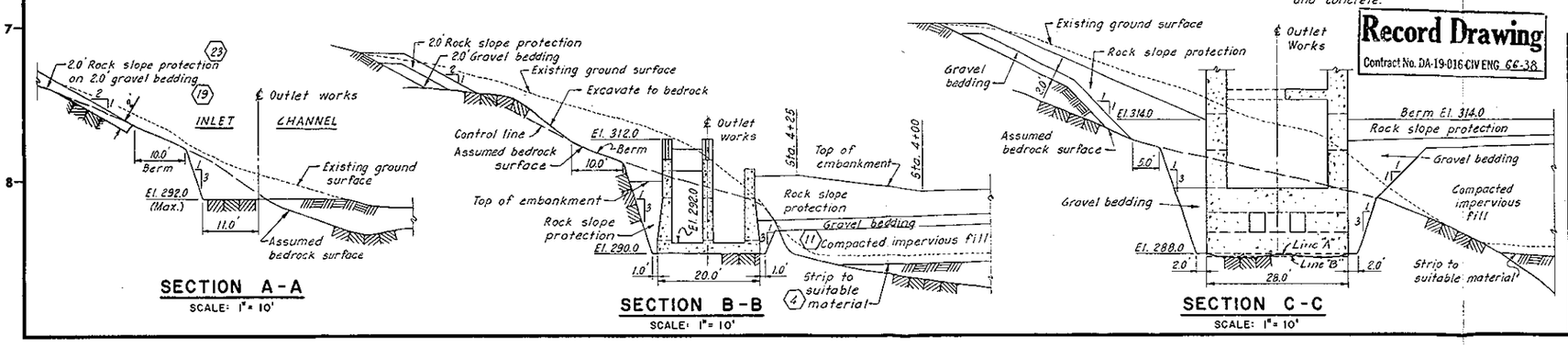
PROFILE ALONG ℄ CONDUIT

SCALE: 1" = 20'

NOTES (Cont'd.)

Line 'A' indicates minimum thickness of concrete.
Line 'B' indicates payment line for rock excavation and concrete.

GRAPHIC SCALES: 1" = 10' (10' 0 10' 20'); 1" = 20' (20' 0 20' 40')



SECTION A-A — SCALE: 1" = 10'

SECTION B-B — SCALE: 1" = 10'

SECTION C-C — SCALE: 1" = 10'

Record Drawing
Contract No. DA-19-016-CIV ENG 66-38

REVISION	DATE	DESCRIPTION	BY
		Final field corrections	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

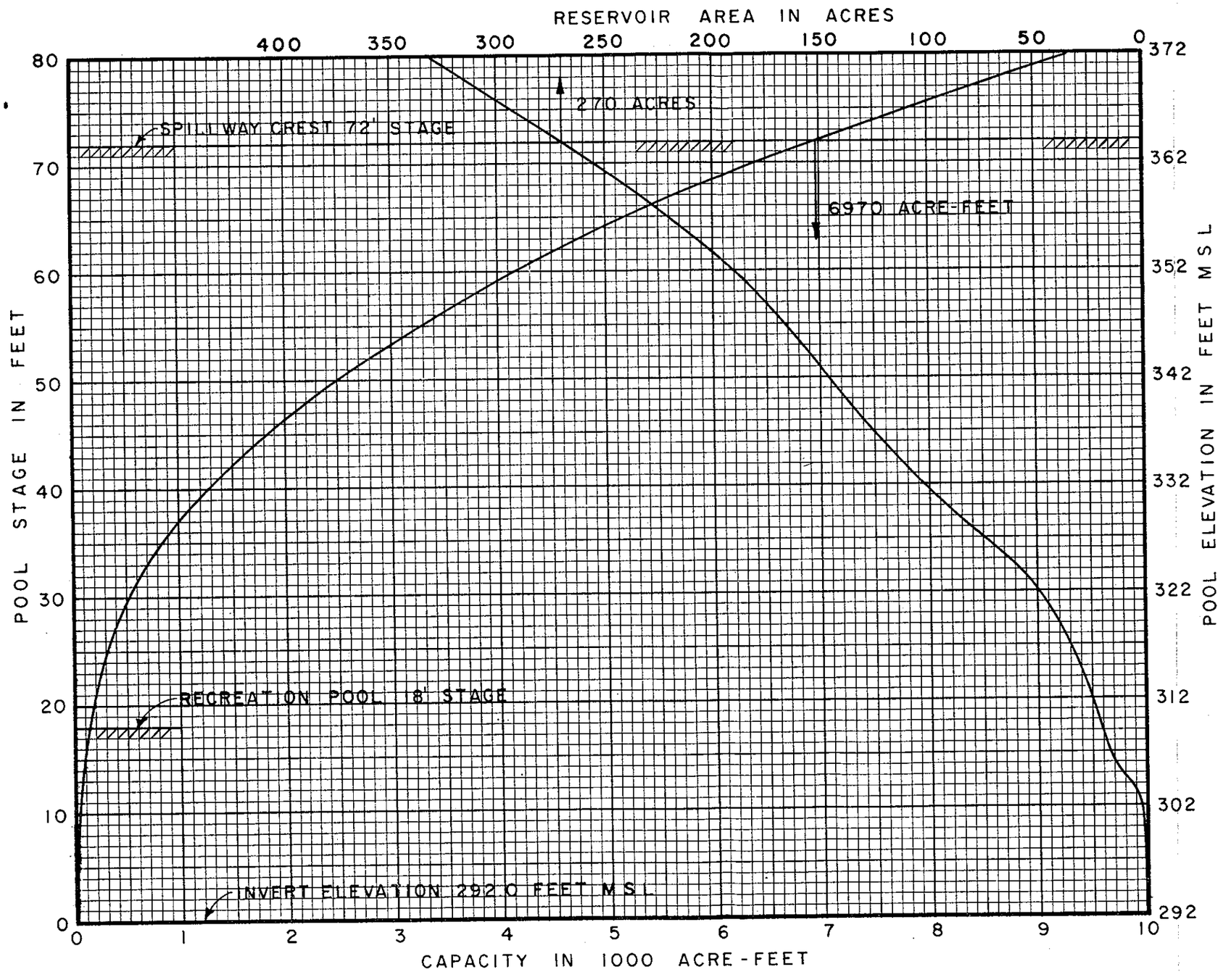
DES. BY I.R. | DR. BY A.G. | CK. BY

SUBMITTED: CHIEF, LAYOUT SECTION
REVIEWED: PROJECT ENGINEER
APPROVED: CHIEF, DESIGN BRANCH
APPROVED: CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
OUTLET WORKS
PLAN, PROFILE AND SECTIONS
HOP BROOK — CONNECTICUT
DATE SEPT. 1965

SCALE AS SHOWN | SPEC. NO. CIV. ENG. 19-016-66-20
DRAWING NUMBER: HOU-5
SHEET 8

PLATE 21



NOTES:

1. DRAINAGE AREA 16.4 SQ. MI.
2. 1" RUNOFF = 875 ACRE FEET.

WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
HOP BROOK LAKE

AREA CAPACITY CURVES

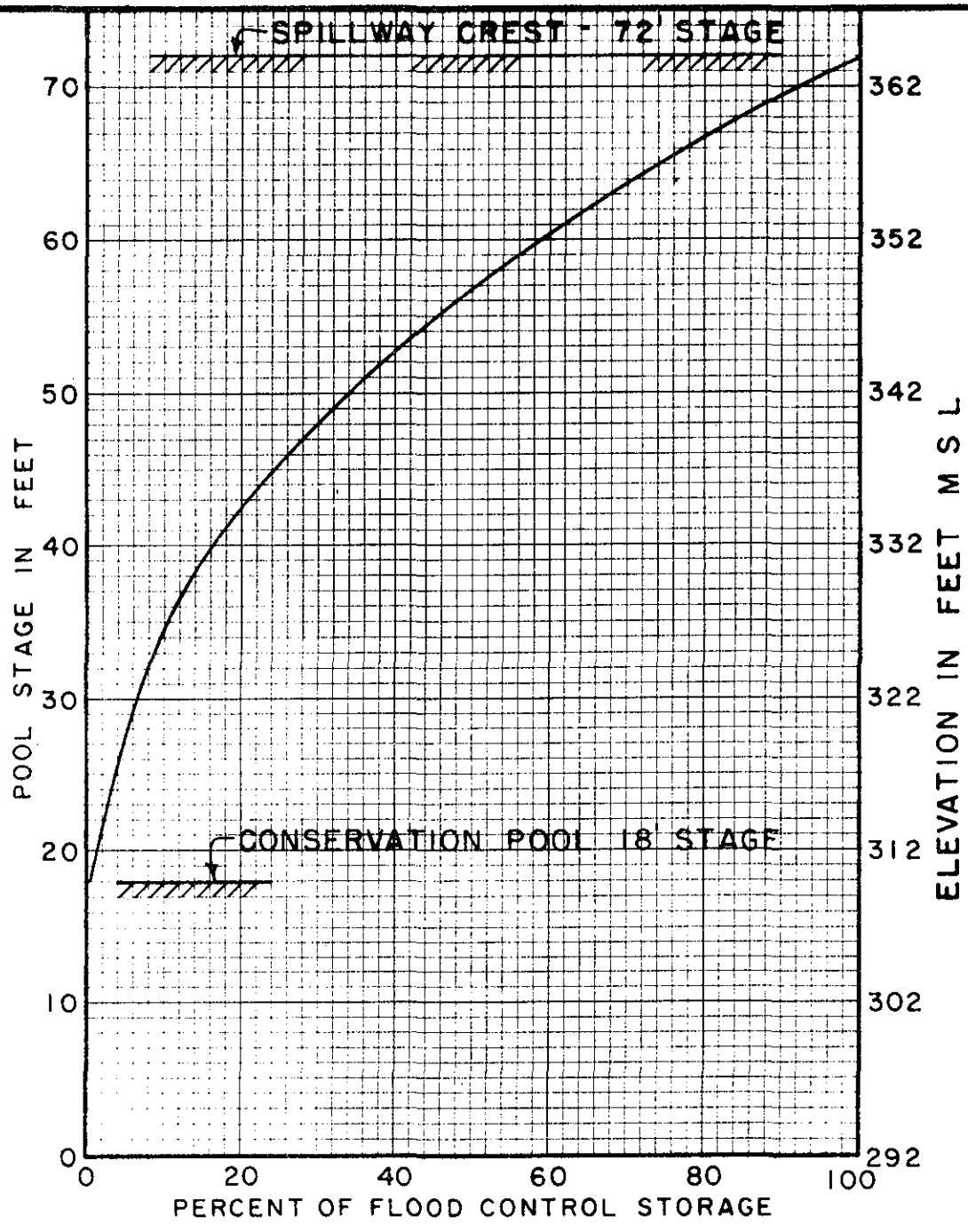
NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPT. 1976

HOP BROOK LAKE
AREA-CAPACITY TABLE
DRAINAGE AREA = 16.4 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
0	292	0	0	0	38	330	90	933	1.07
2	294	0	0	0	40	332	102	1,125	1.29
4	296	1	1	0	42	334	112	1,339	1.54
6	298	1	2	0	44	336	121	1,572	1.81
8	300	1	4	0.01	46	338	130	1,823	2.10
10	302	2	7	0.01	48	340	139	2,092	2.40
12	304	6	15	0.02	50	342	147	2,377	2.73
14	306	14	35	0.04	52	344	154	2,678	3.08
16	308	18	67	0.08	54	346	162	2,994	3.44
18*	310	21	120	0.12	56	348	169	3,324	3.82
18	310	21	0	0	58	350	180	3,672	4.22
20	312	25	46	0.06	60	352	190	4,042	4.64
22	314	28	99	0.12	62	354	205	4,437	5.10
24	316	31	158	0.18	64	356	220	4,862	5.58
26	318	35	224	0.26	66	358	232	5,314	6.10
28	320	39	298	0.34	68	360	244	5,790	6.65
30	322	48	385	0.44	70	362	257	6,291	7.22
32	324	58	491	0.57	72	364	270	6,850	7.80
34	326	68	617	0.71					
36	328	79	764	0.88			(Spillway Crest)		

*Recreation Pool



NOTES:

1. DRAINAGE AREA - 16.4 SQ. MI.
2. FLOOD CONTROL STORAGE - 6850 ACRE FEET - 7.8 INCHES.
3. CONSERVATION STORAGE - 120 ACRE FEET - 0.1 INCH.
4. 1 INCH RUNOFF = 875 ACRE FEET.

WATER RESOURCES DEVELOPMENT PROJECT

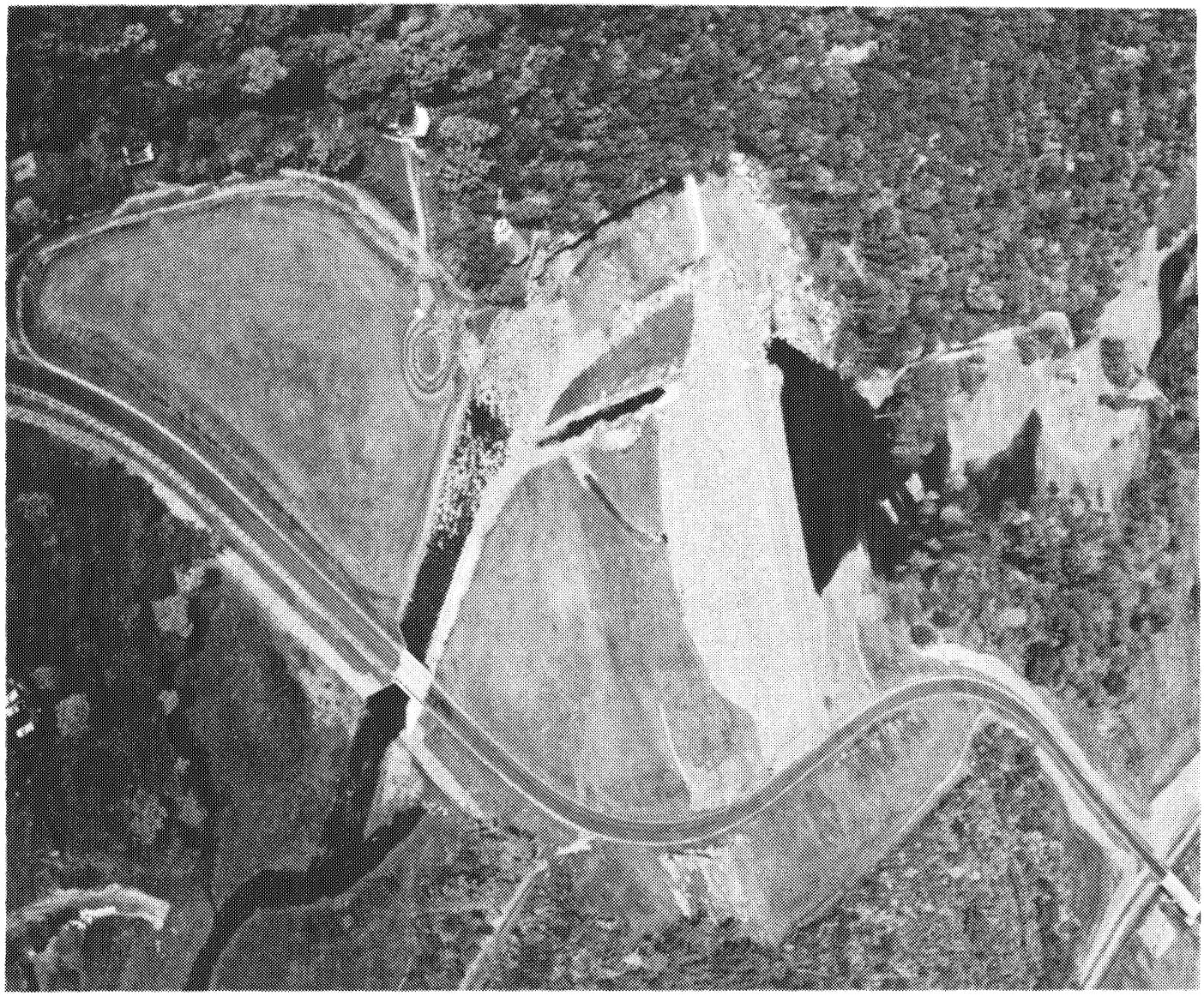
HOUSATONIC RIVER BASIN

HOP BROOK LAKE

PERCENT FULL CURVE

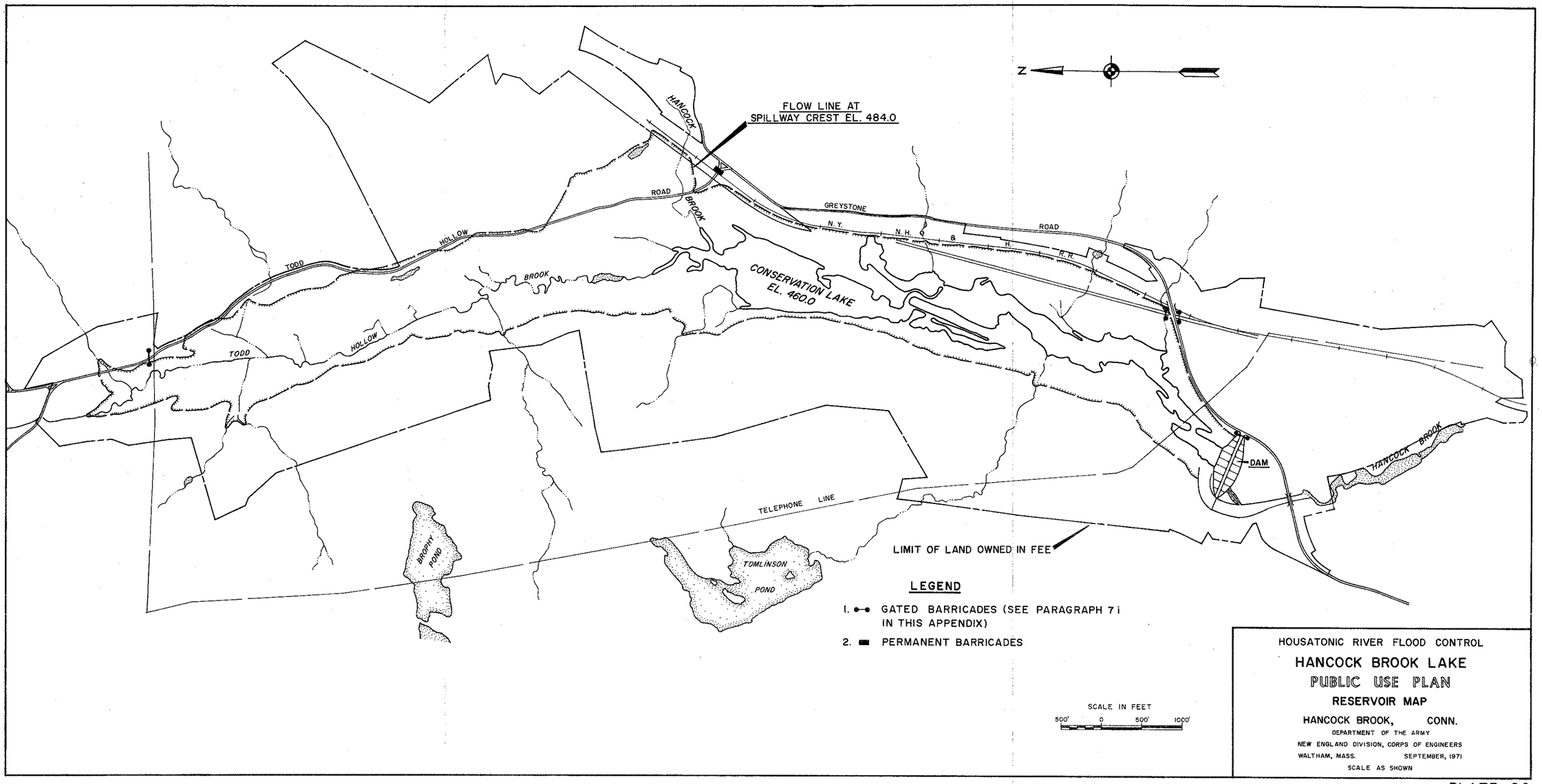
NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



View of Hancock Brook

PLATE 25


N
FLOW LINE AT
SPILLWAY CREST EL. 484.0
HANCOCK
BROOK
ROAD
GREYSTONE
ROAD
N. Y.
N. H.
&
H.
R. R.
TODD
HOLLOW
BROOK
CONSERVATION LAKE
EL. 460.0
TODD
HOLLOW
DAM
HANCOCK BROOK
TELEPHONE LINE
BROPHY POND
TOMLINSON POND
LIMIT OF LAND OWNED IN FEE
LEGEND
1. GATED BARRICADES (SEE PARAGRAPH 7 i IN THIS APPENDIX)
2. PERMANENT BARRICADES
SCALE IN FEET
500' 0 500' 1000'
HOUSATONIC RIVER FLOOD CONTROL
HANCOCK BROOK LAKE
PUBLIC USE PLAN
RESERVOIR MAP
HANCOCK BROOK, CONN.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. SEPTEMBER, 1971
SCALE AS SHOWN

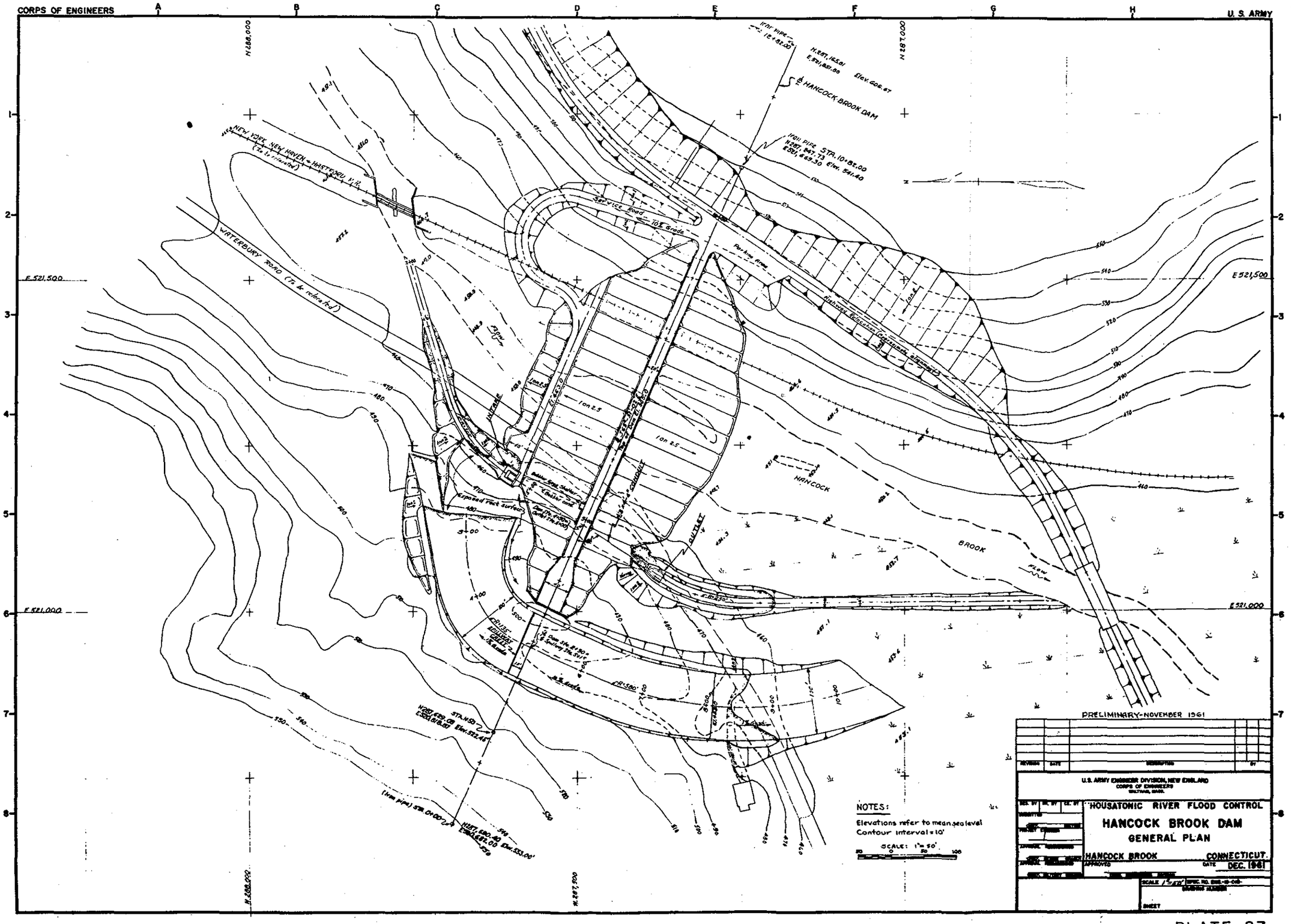
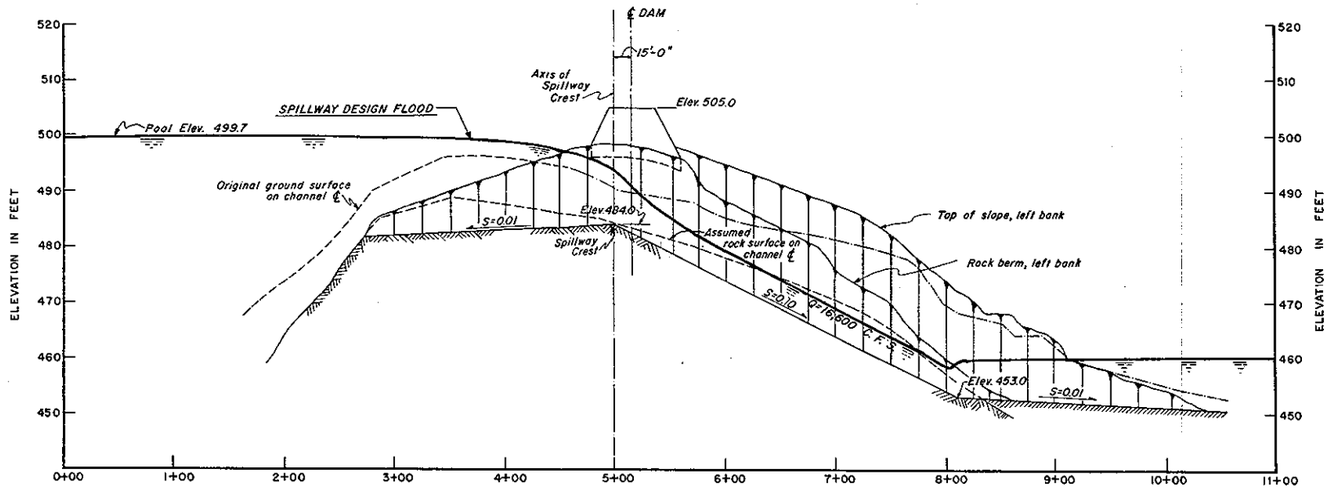
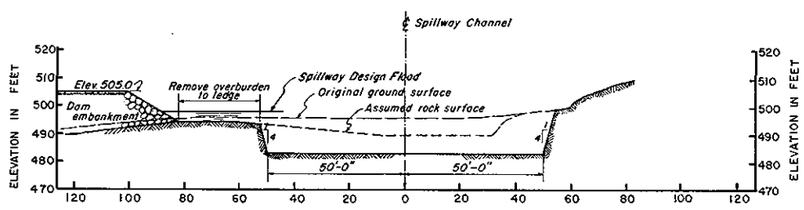

CORPS OF ENGINEERS
U. S. ARMY
HANCOCK BROOK DAM
NEW YORK, NEW HAVEN & HARTFORD R.R.
WATERBURY ROAD
Service Road
Parking Area
Relocated Transmission Line
HANCOCK
BROOK
FLOW
INLET
OUTLET
Spillway
Dam
Stop Log Slots
Expand Rock Surface
Existing Bridge
Iron Pipe
Elev. 606.67
Elev. 541.40
Elev. 522.45'
Elev. 533.00'
PRELIMINARY-NOVEMBER 1961
NOTES:
Elevations refer to mean sea level
Contour interval = 10'
SCALE: 1" = 50'
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HOUSATONIC RIVER FLOOD CONTROL
HANCOCK BROOK DAM
GENERAL PLAN
HANCOCK BROOK
CONNECTICUT
DATE DEC. 1961

PLATE 27



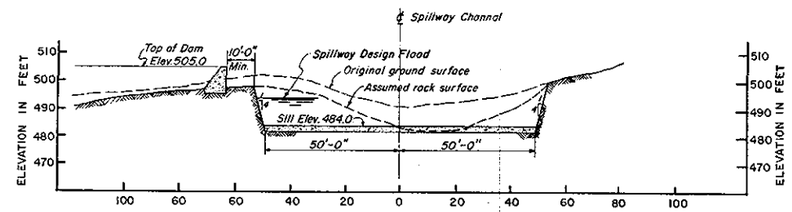
PROFILE ALONG ℄ OF SPILLWAY CHANNEL

SCALE: HOR. 1" = 50' VER. 1" = 10'



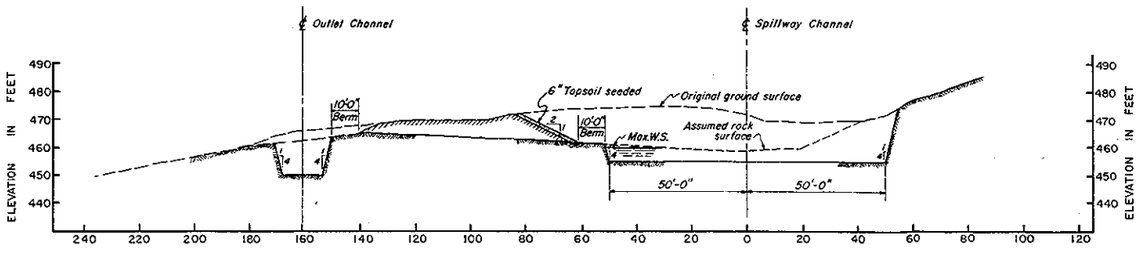
SECTION AT STA. 4+00

SCALE: 1" = 20"



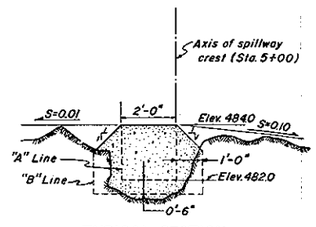
SECTION AT STA. 5+00

SCALE: 1" = 20'



SECTION AT STA. 7+90

SCALE: 1" = 20



TYPICAL SECTION SPILLWAY CREST

SCALE: 1" = 2'-0"

SCALE: 1" = 50'

SCALE: 1" = 20'

SCALE: 1" = 2'

NOTES:

Elevations refer to Mean Sea Level Datum

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY H.B.F. | TR. BY N.W.B. | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS. BRANCH

HOUSATONIC RIVER FLOOD CONTROL

HANCOCK BROOK DAM

SPILLWAY PROFILE & SECTIONS

HANCOCK BROOK CONNECTICUT

APPROVED

CHIEF ENGINEERING DIV.

DATE FEB. 1962

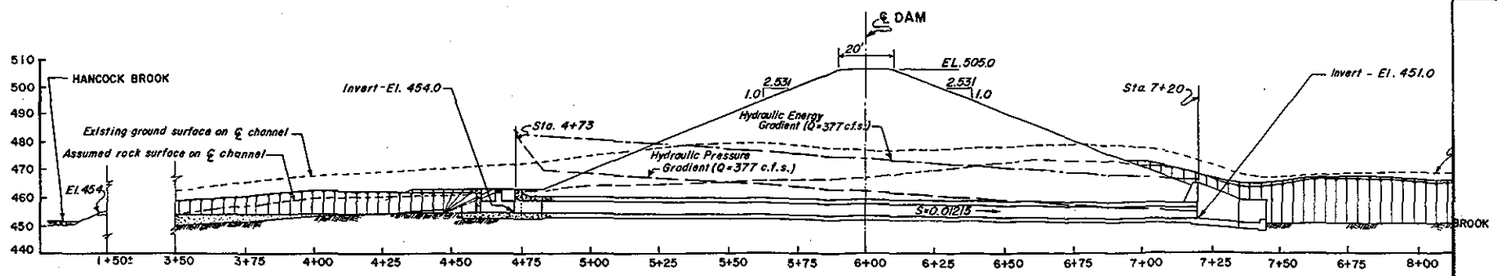
SCALE: AS SHOWN | SPEC. NO. CIV. ENG.-19-016-

DRAWING NUMBER

SHEET

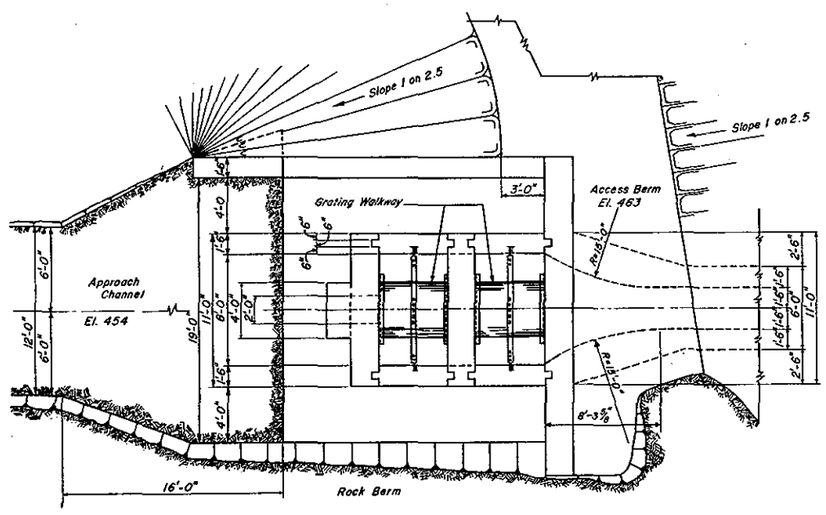
CORPS OF ENGINEERS

S. ARMY



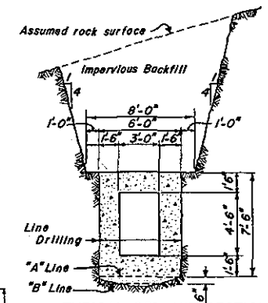
PROFILE ALONG ℄ OF OUTLET WORKS

SCALE: 1" = 20'



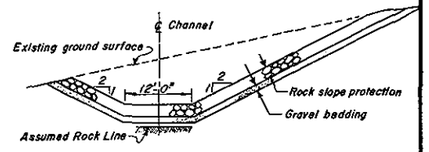
INTAKE STRUCTURE PLAN

SCALE: 1" = 4'-0"



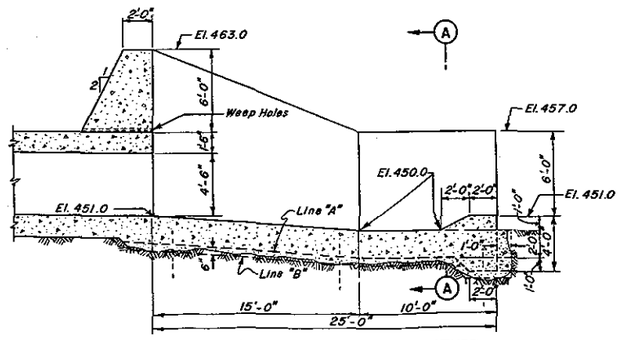
TYPICAL CONDUIT SECTION

SCALE: 1" = 4'-0"



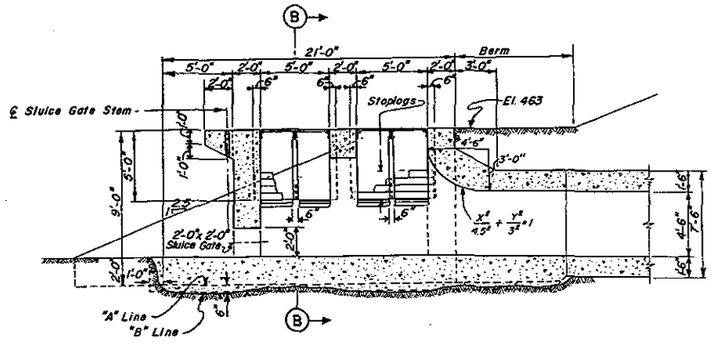
TYPICAL SECTION, INTAKE CHANNEL

SCALE: 1" = 10'



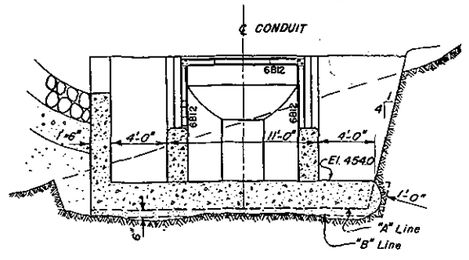
PROFILE ALONG ℄ OF OUTLET STRUCTURE

SCALE: 1" = 4'-0"



PROFILE ALONG ℄ INTAKE STRUCTURE

SCALE: 1" = 4'-0"



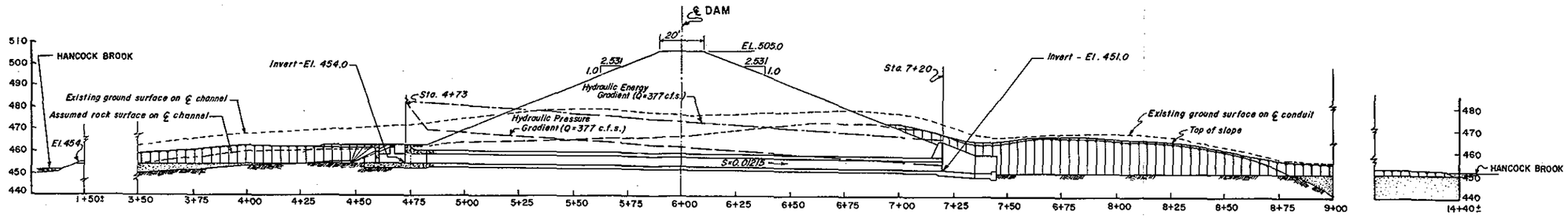
SECTION B-B

SCALE: 1" = 4'-0"

SCALE: 1" = 20'

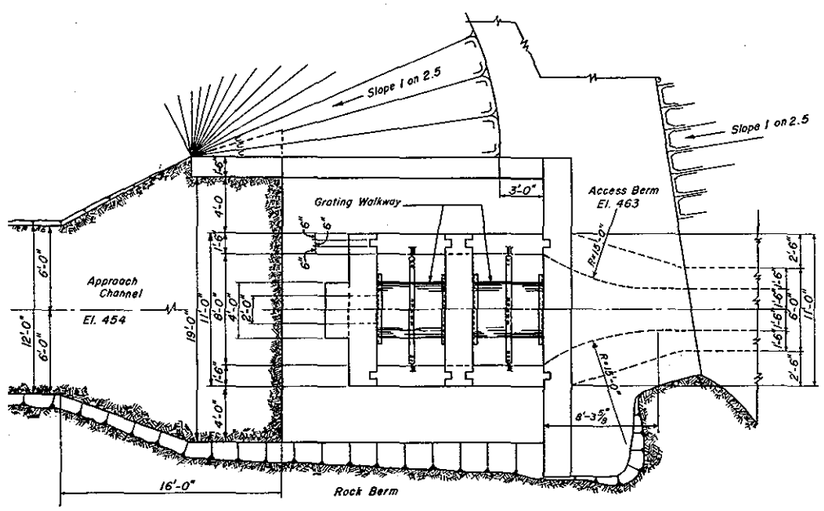
SCALE: 1" = 10'

SCALE: 1" = 4'



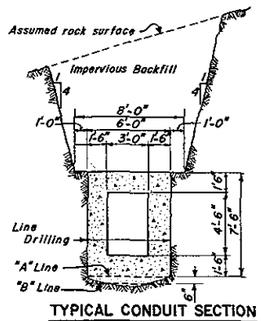
PROFILE ALONG ℄ OF OUTLET WORKS

SCALE: 1" = 20'



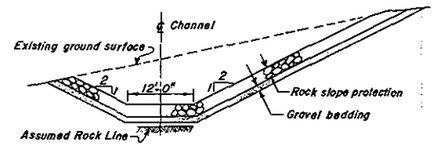
INTAKE STRUCTURE PLAN

SCALE: 1" = 4'-0"



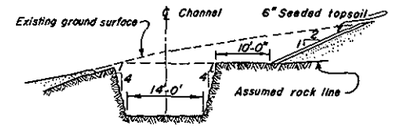
TYPICAL CONDUIT SECTION

SCALE: 1" = 4'-0"



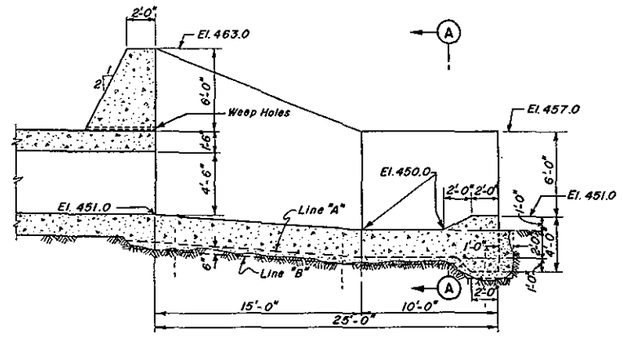
TYPICAL SECTION, INTAKE CHANNEL

SCALE: 1" = 10'



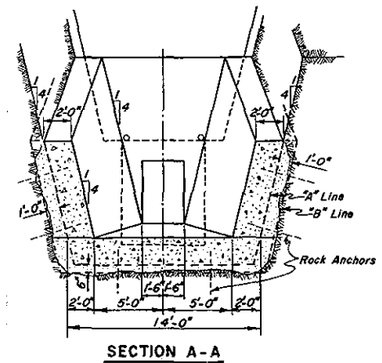
TYPICAL SECTION, OUTLET CHANNEL

SCALE: 1" = 10'



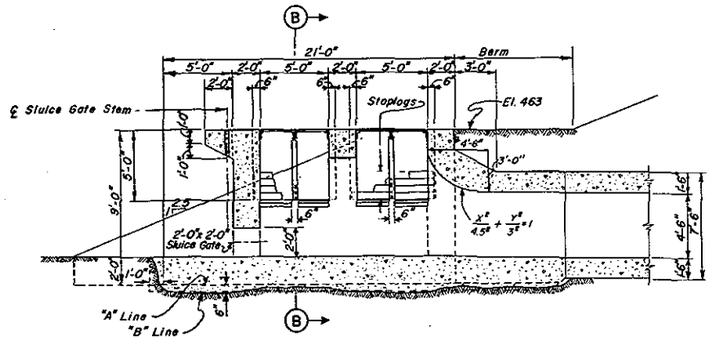
PROFILE ALONG ℄ OF OUTLET STRUCTURE

SCALE: 1" = 4'-0"



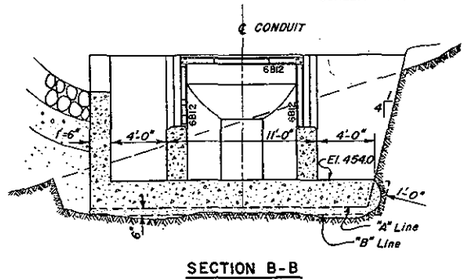
SECTION A-A

SCALE 1" = 4'-0"



PROFILE ALONG ℄ INTAKE STRUCTURE

SCALE: 1" = 4'-0"



SECTION B-B

SCALE: 1" = 4'-0"

NOTES:
Elevations refer to Mean Sea Level Datum.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY E.B.M. | TR. BY G.H.D | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS BRANCH

HOUSATONIC RIVER FLOOD CONTROL

HANCOCK BROOK DAM

OUTLET WORKS DETAILS

HANCOCK BROOK CONNECTICUT

APPROVED

CHIEF ENGINEERING DIV.

DATE FEB. 1962

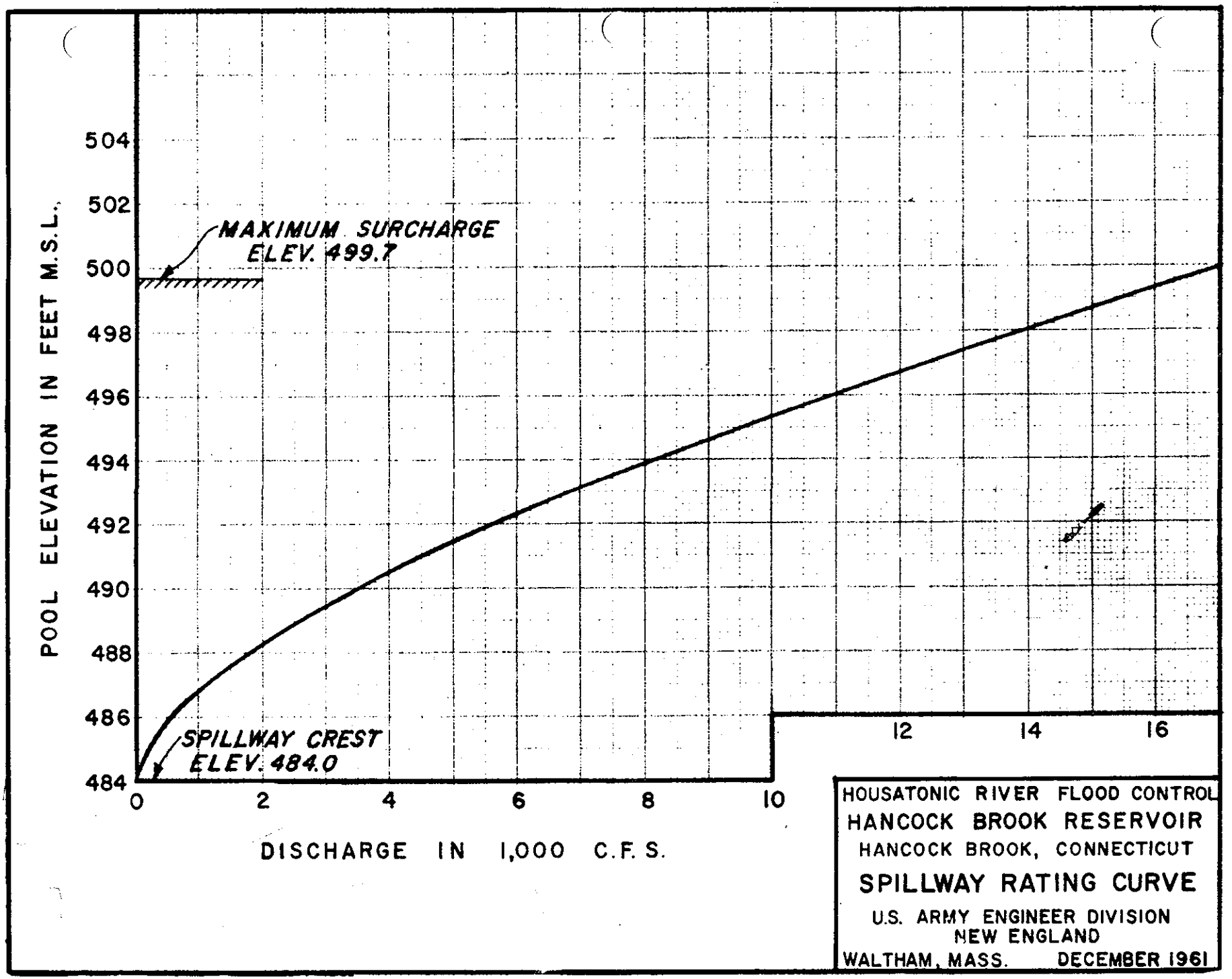
SCALE AS SHOWN | SPEC. NO. CIV ENG-19-016-

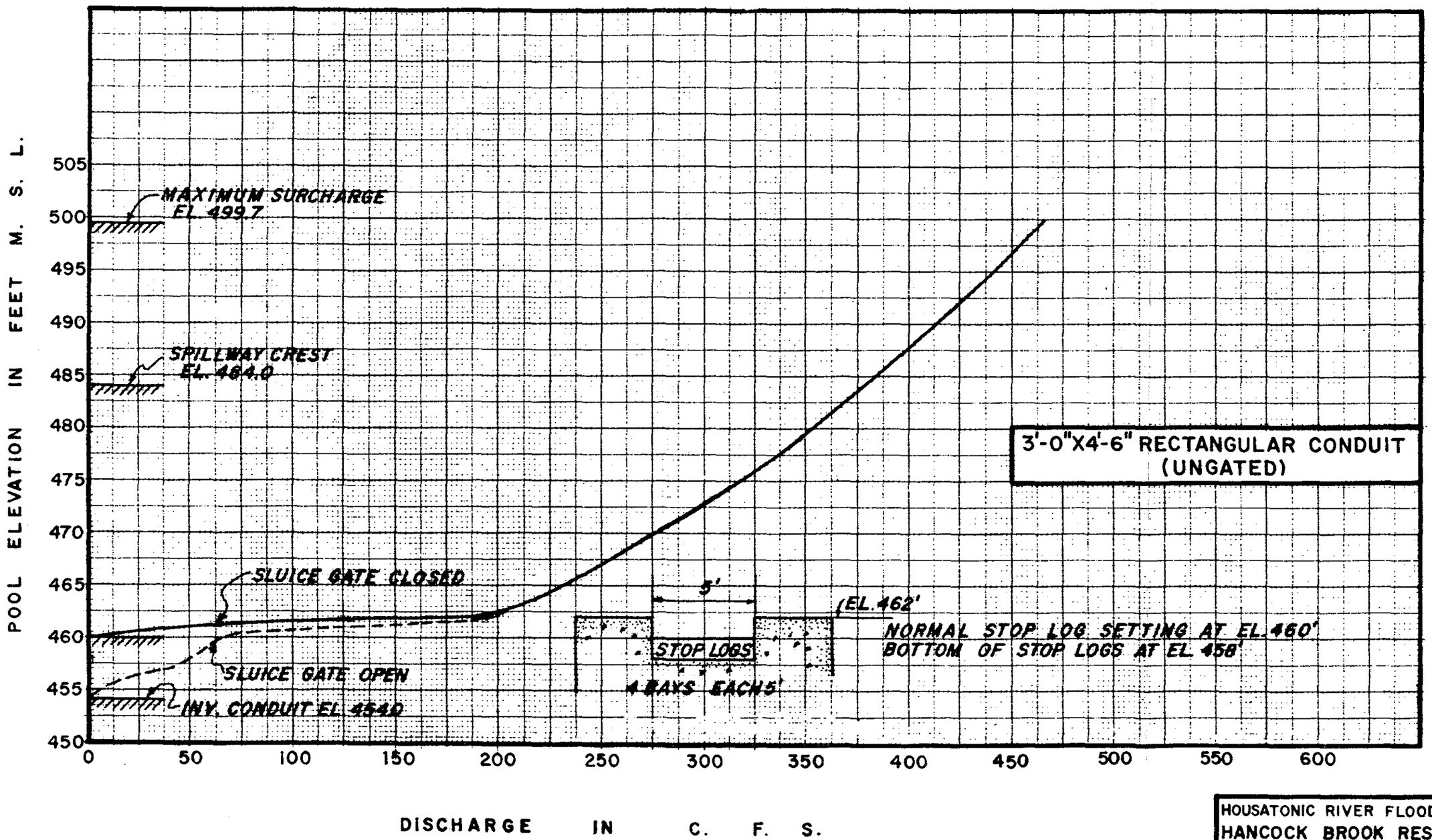
DRAWING NUMBER

SCALE: 1" = 20'

SCALE: 1" = 10'

SCALE: 1" = 4'

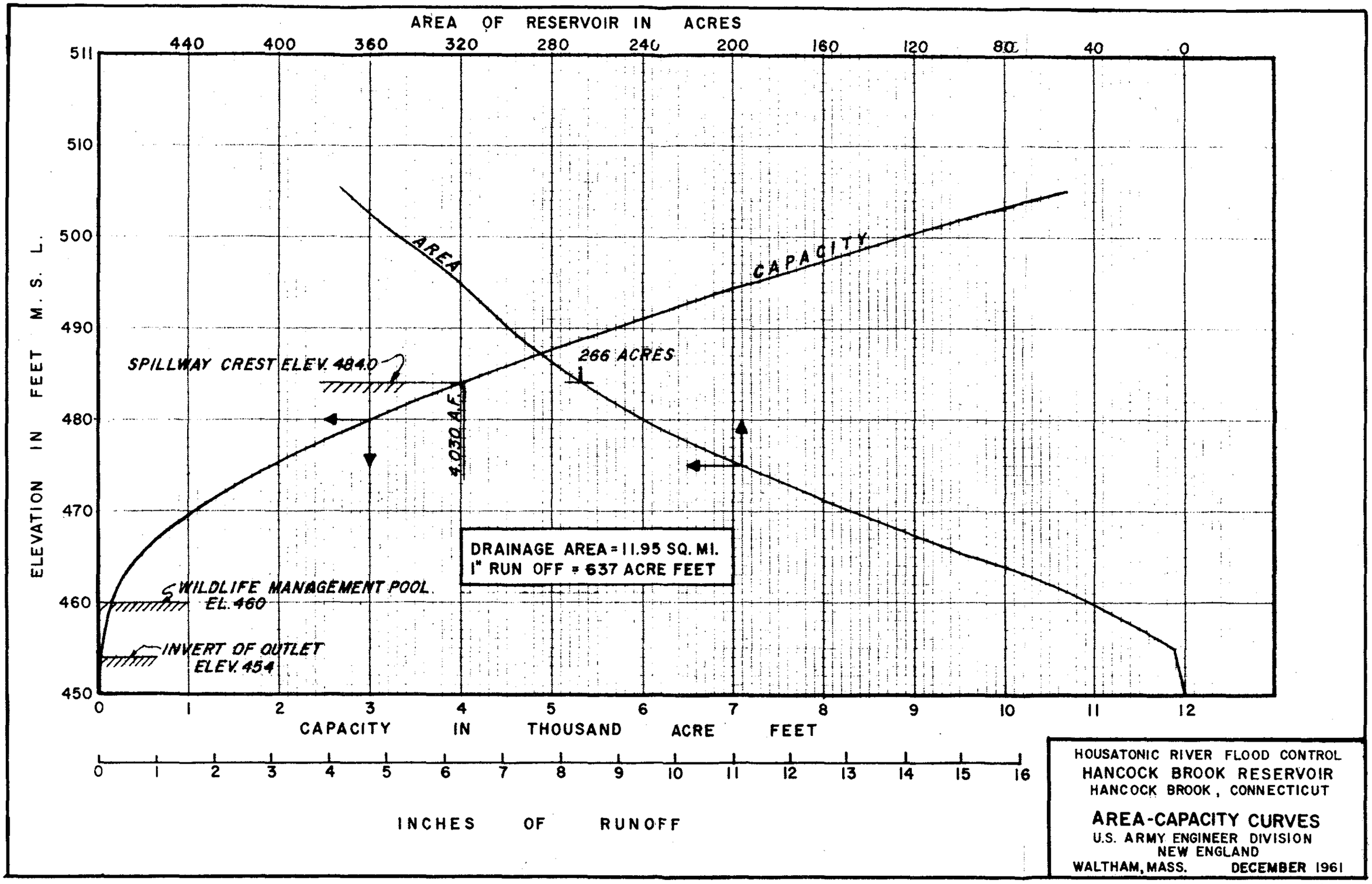

POOL ELEVATION IN FEET M.S.L.
504
502
500
498
496
494
492
490
488
486
484
MAXIMUM SURCHARGE
ELEV. 499.7
SPILLWAY CREST
ELEV. 484.0
0
2
4
6
8
10
12
14
16
DISCHARGE IN 1,000 C.F.S.
HOUSATONIC RIVER FLOOD CONTROL
HANCOCK BROOK RESERVOIR
HANCOCK BROOK, CONNECTICUT
SPILLWAY RATING CURVE
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. DECEMBER 1961



HOUSATONIC RIVER FLOOD CONTROL
HANCOCK BROOK RESERVOIR
HANCOCK BROOK, CONNECTICUT

OUTLET RATING CURVE

U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS DECEMBER 1961



HOUSATONIC RIVER FLOOD CONTROL
HANCOCK BROOK RESERVOIR
HANCOCK BROOK, CONNECTICUT

AREA-CAPACITY CURVES

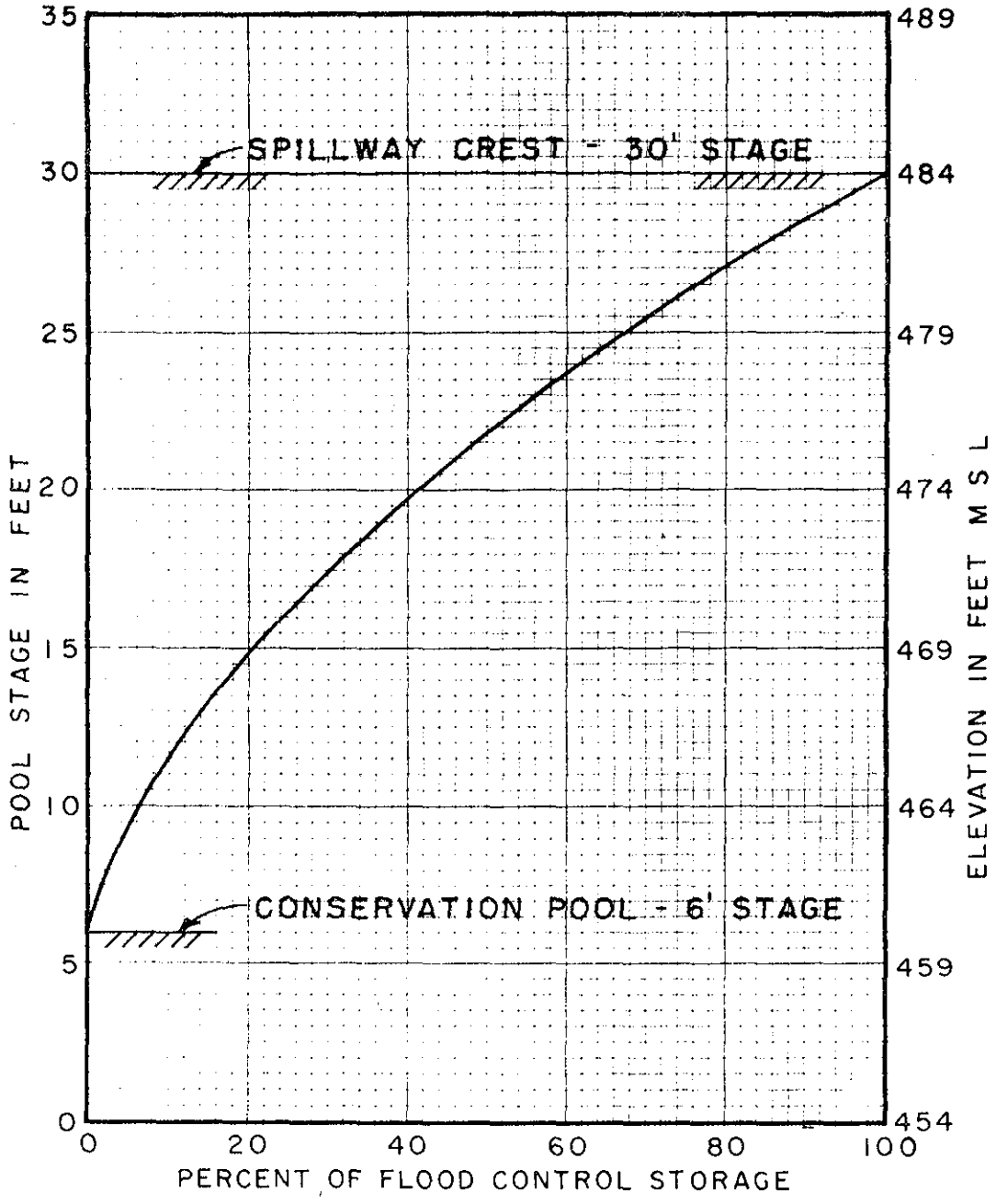
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. DECEMBER 1961

HANCOCK BROOK LAKE
AREA-CAPACITY TABLE
DRAINAGE AREA = 12.0 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
0	454	0	0	0
1	455	7	6	0.01
2	456	10	14	0.02
3	457	18	28	0.04
4	458	26	50	0.08
5	459	34	80	0.13
6*	460	40	130	0.19
6	460	40	0	0
7	461	51	47	0.07
8	462	60	102	0.16
9	463	70	167	0.26
10	464	80	242	0.38
11	465	92	328	0.51
12	466	104	426	0.66
13	467	115	536	0.84
14	468	126	656	1.03
15	469	137	788	1.23
16	470	148	930	1.46
17	471	158	1,083	1.70
18	472	168	1,246	1.95
19	473	177	1,419	2.22
20	474	186	1,600	2.51
21	475	195	1,791	2.81
22	476	204	1,990	3.12
23	477	213	2,199	3.45
24	478	222	2,416	3.79
25	479	231	2,643	4.14
26	480	240	2,878	4.51
27	481	247	3,122	4.90
28	482	253	3,371	5.29
29	483	259	3,627	5.69
30	481	266	2,900	6.10

(Spillway Crest)

*Conservation Pool



NOTES:

1. DRAINAGE AREA - 12.0 SQ. MI.
2. FLOOD CONTROL STORAGE - 3900 ACRE FEET - 6.1 INCHES.
3. CONSERVATION STORAGE - 130 Ac. Ft. - 0.2 INCHES.
4. 1 INCH RUNOFF = 640 Ac. Ft.

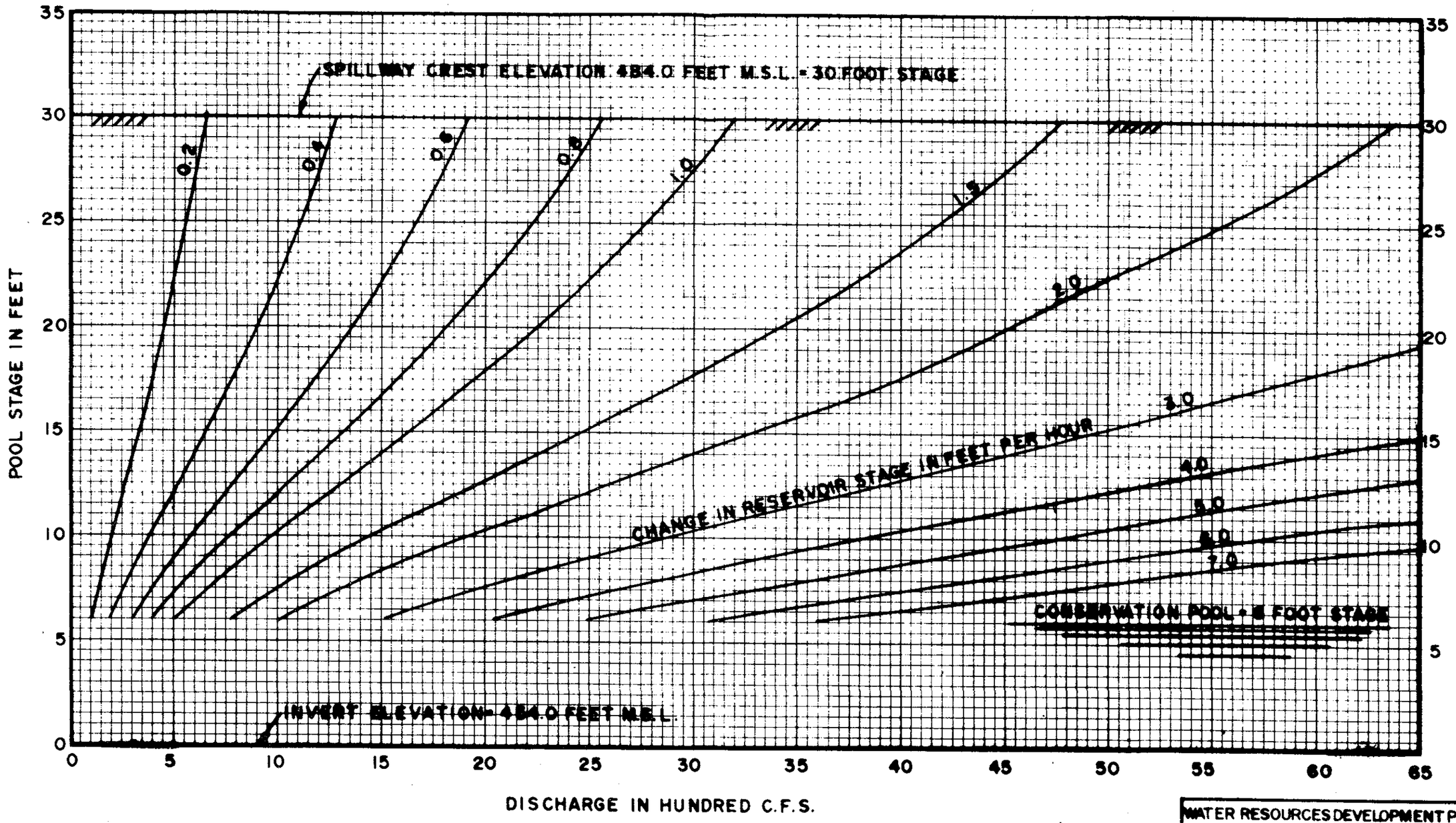
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
HANCOCK BROOK LAKE

PERCENT FULL CURVE

NEW ENGLAND DIVISION, WALTHAM, MA.

SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

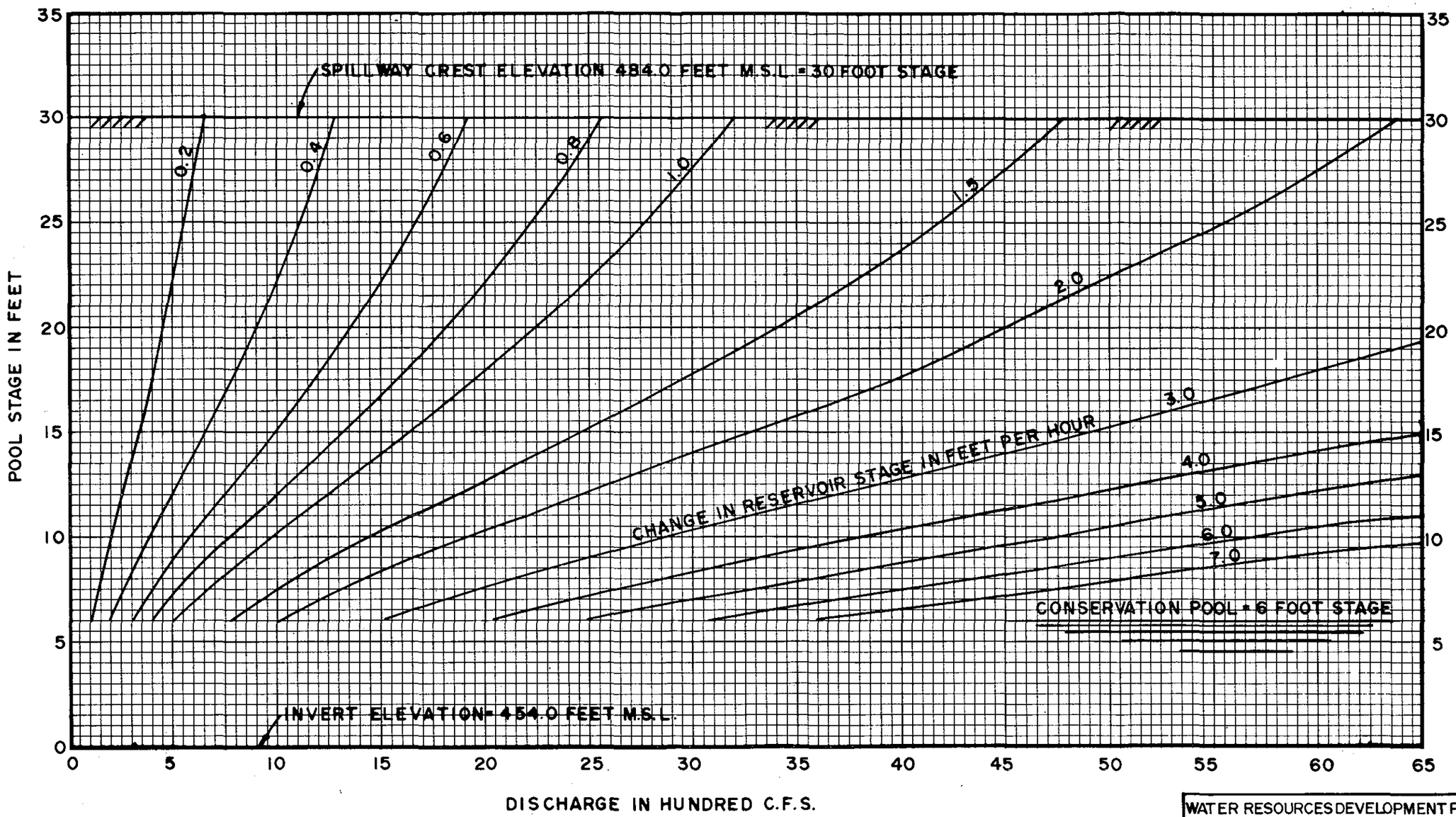
HOUSATONIC RIVER BASIN

HANCOCK BROOK LAKE

INFLOW CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

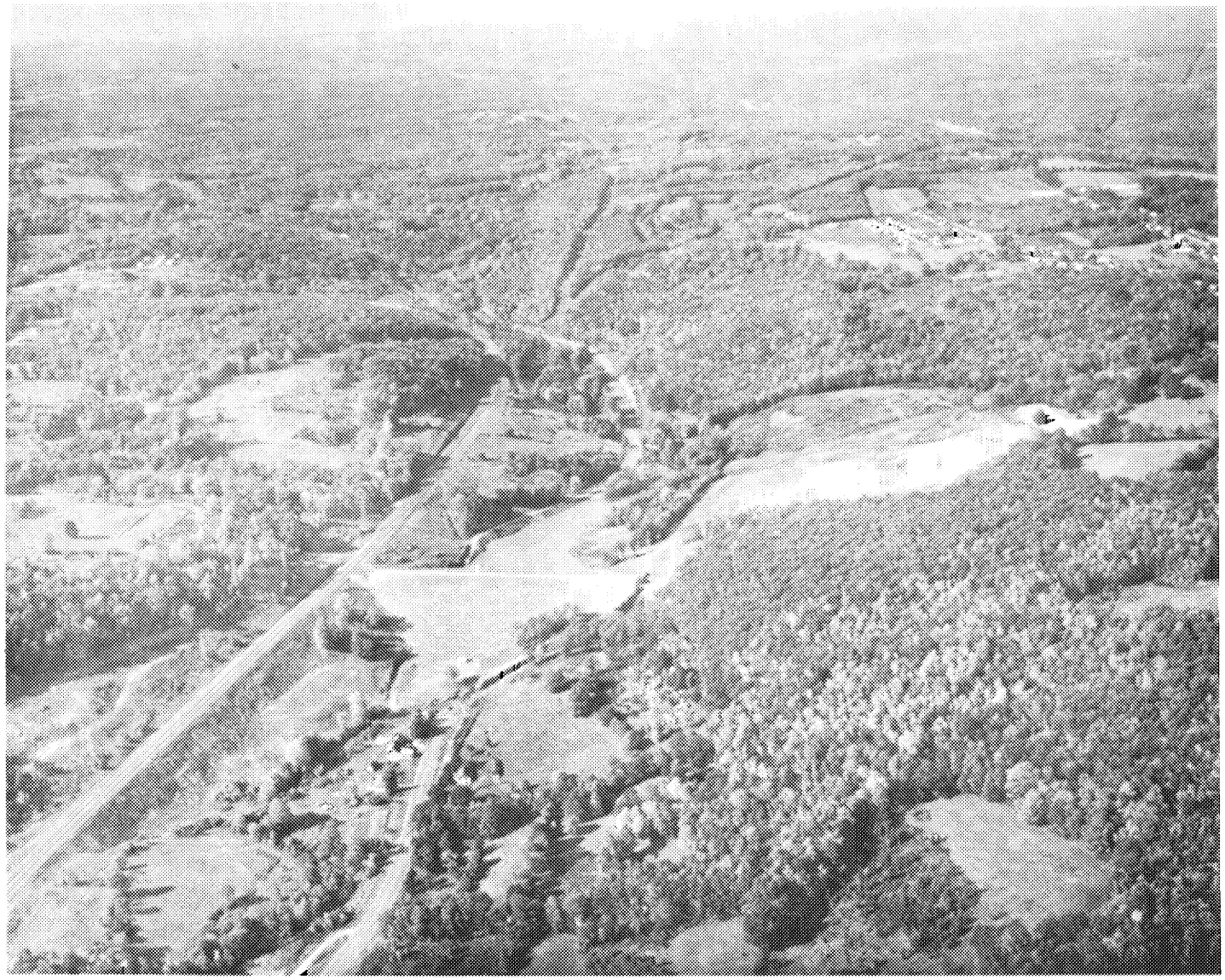
HOUSATONIC RIVER BASIN

HANCOCK BROOK LAKE

INFLOW CURVES

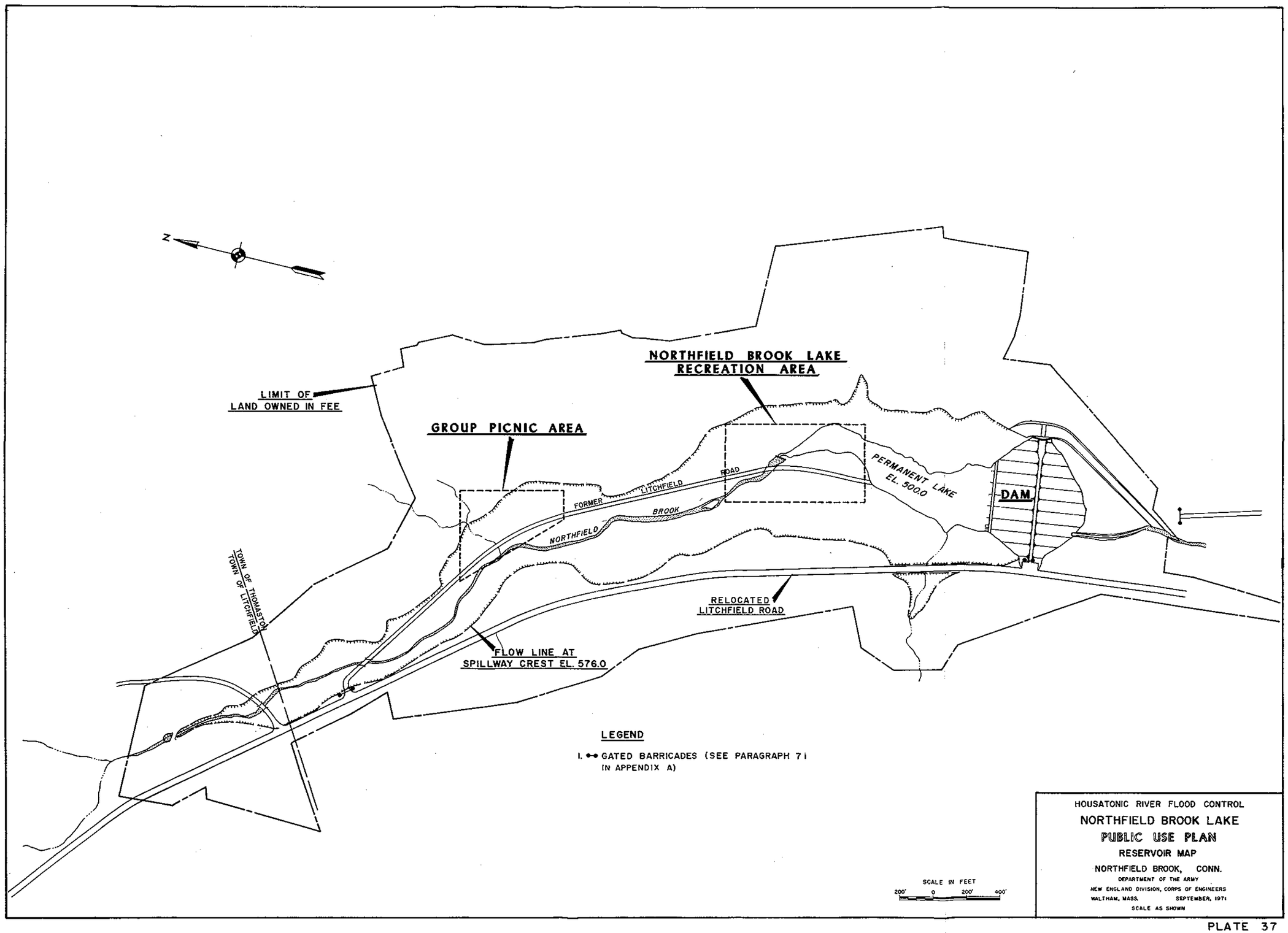
NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



View of Northfield Brook Lake

PLATE 36


N
NORTHFIELD BROOK LAKE RECREATION AREA
LIMIT OF LAND OWNED IN FEE
GROUP PICNIC AREA
PERMANENT LAKE EL. 500.0
DAM
FORMER LITCHFIELD ROAD
NORTHFIELD BROOK
TOWN OF THOMASTON
TOWN OF LITCHFIELD
RELOCATED LITCHFIELD ROAD
FLOW LINE AT SPILLWAY CREST EL. 576.0
LEGEND
1. GATED BARRICADES (SEE PARAGRAPH 7 i IN APPENDIX A)
SCALE IN FEET
200' 0 200' 400'
HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK LAKE
PUBLIC USE PLAN
RESERVOIR MAP
NORTHFIELD BROOK, CONN.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. SEPTEMBER, 1971
SCALE AS SHOWN

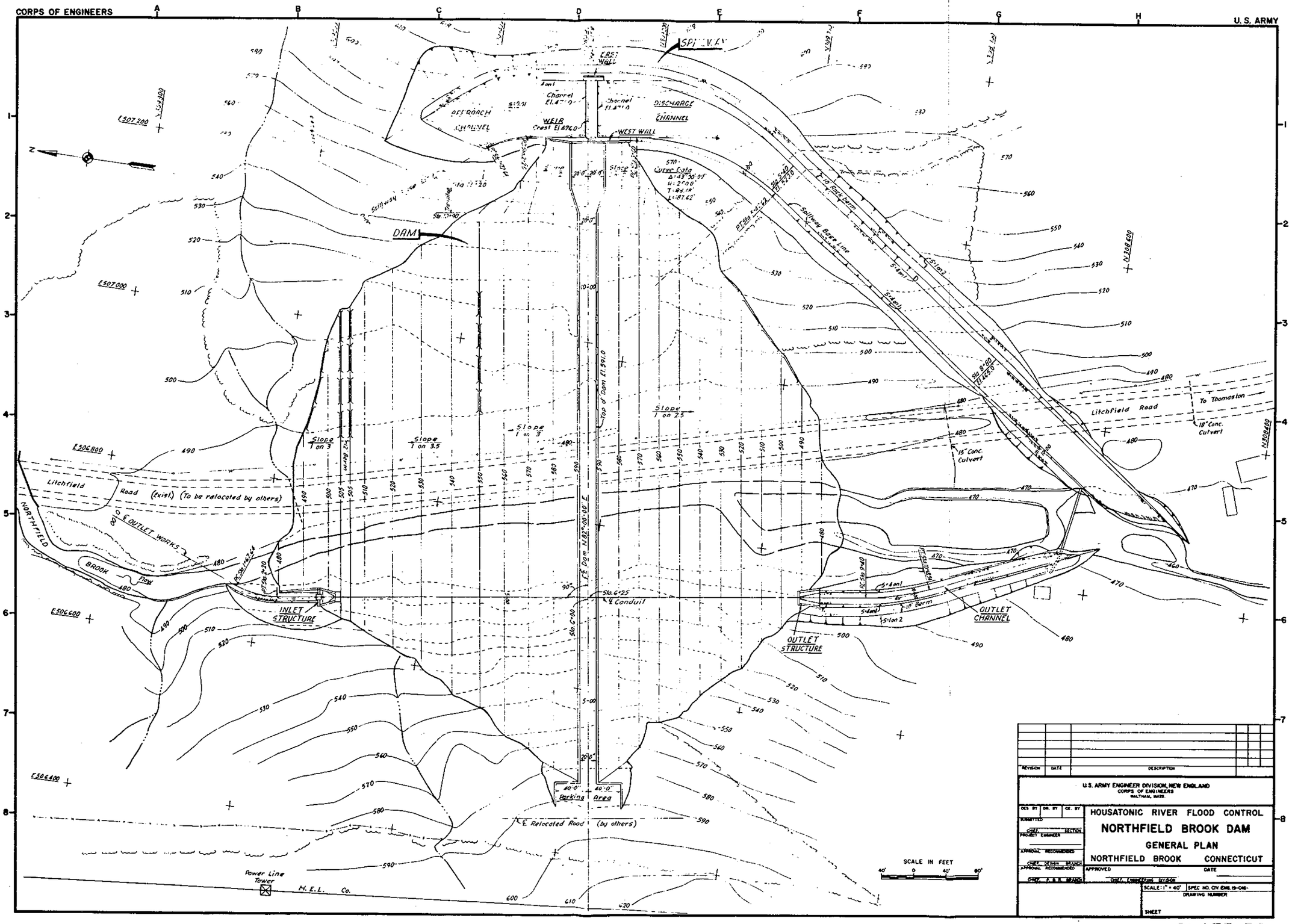
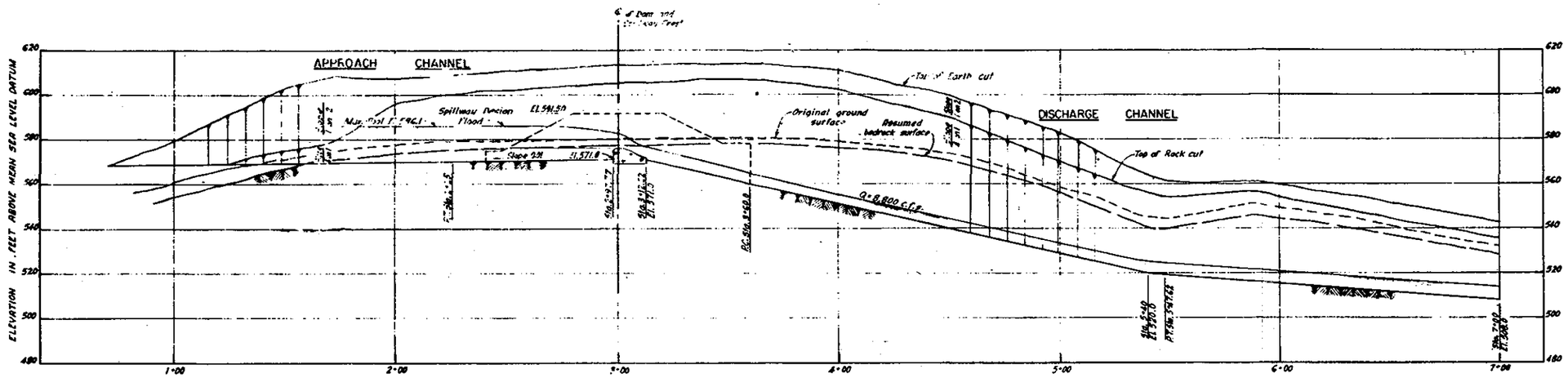
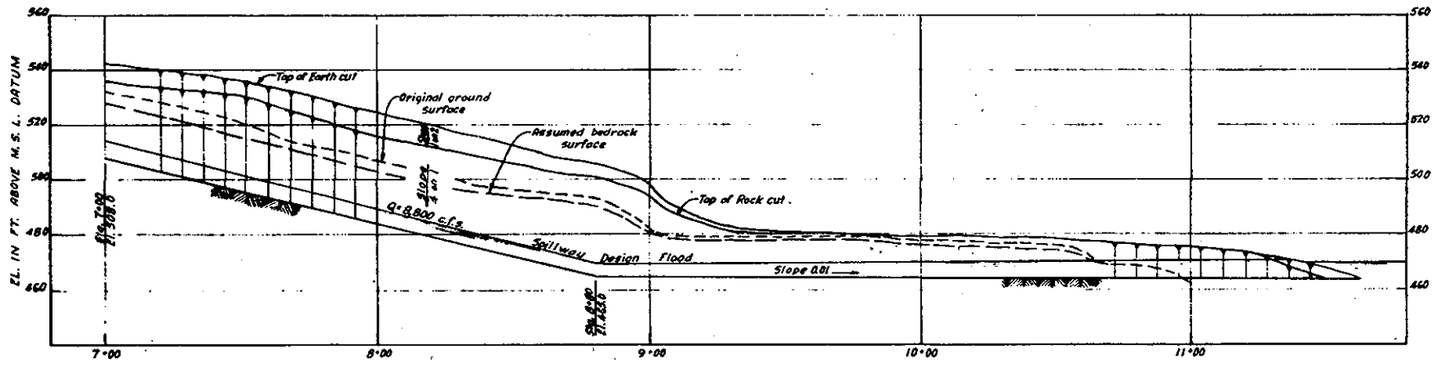

CORPS OF ENGINEERS
U. S. ARMY
SPILLWAY
DAM
WEIR
Crest El 470.0
WEST WALL
DISCHARGE CHANNEL
APPROACH CHANNEL
Slope 1 on 2.5
Slope 1 on 3.5
Slope 1 on 3
Top of Dam El 591.0
Spillway Base Line
Litchfield Road (exist) (To be relocated by others)
NORTHFIELD BROOK
Flow
℄ OUTLET WORKS
INLET STRUCTURE
OUTLET STRUCTURE
OUTLET CHANNEL
℄ Conduit
Parking Area
℄ Relocated Road (by others)
Power Line Tower
H. E. L. Co.
To Thomaston
Litchfield Road
18" Conc. Culvert
15" Conc. Culvert
SCALE IN FEET
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
GENERAL PLAN
NORTHFIELD BROOK CONNECTICUT
SCALE: 1" = 40'
SHEET

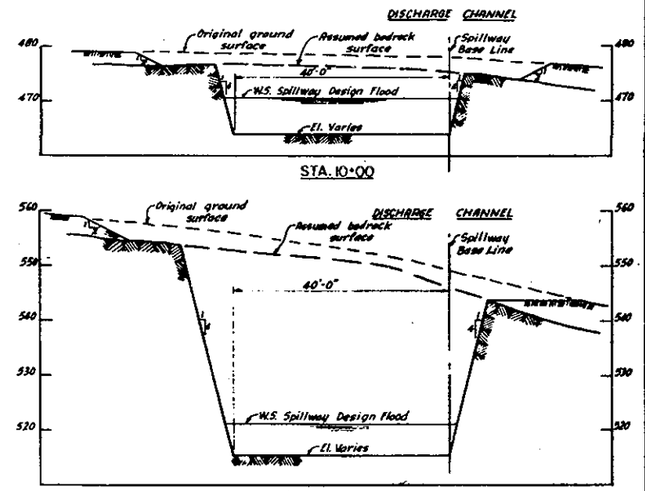
PLATE 38

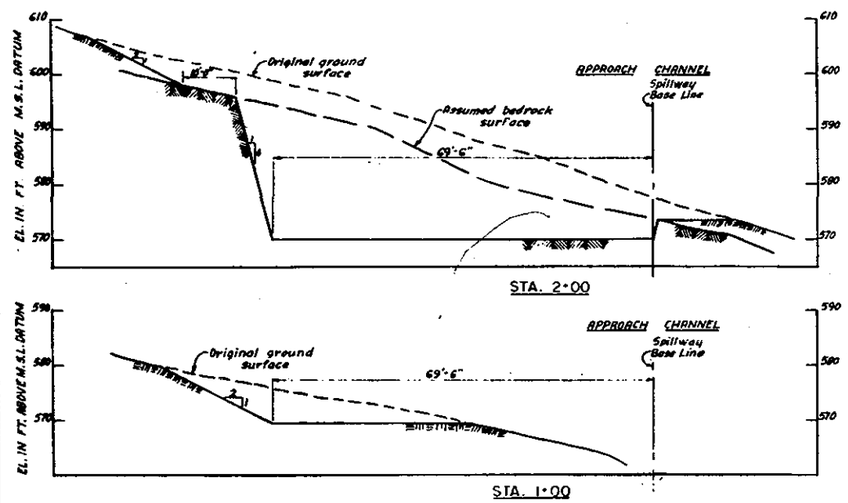
CORPS OF ENGINEERS U. S. ARMY

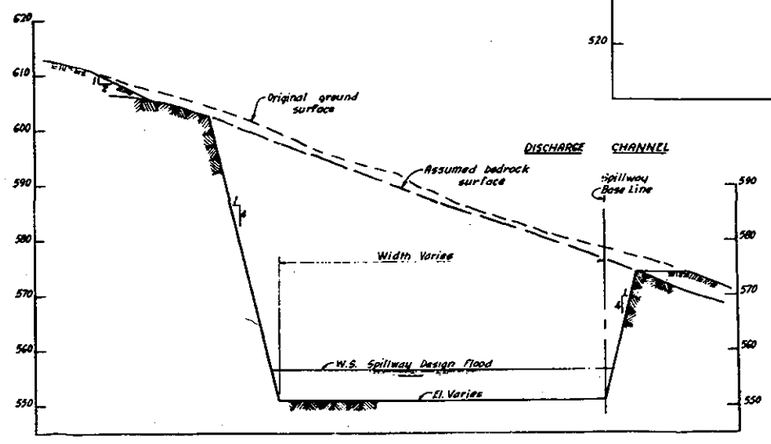




PROFILE ALONG ℄ OF SPILLWAY CHANNEL
SCALE 1" = 20'







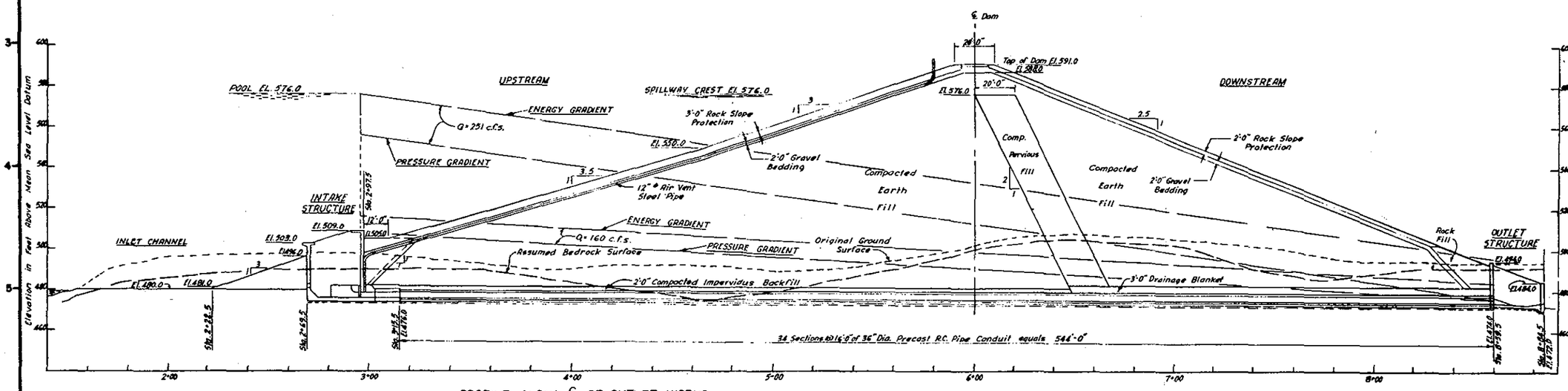
TYPICAL SECTIONS
SCALE 1" = 10'

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
SPILLWAY
PROFILE AND SECTIONS
NORTHFIELD BROOK CONNECTICUT

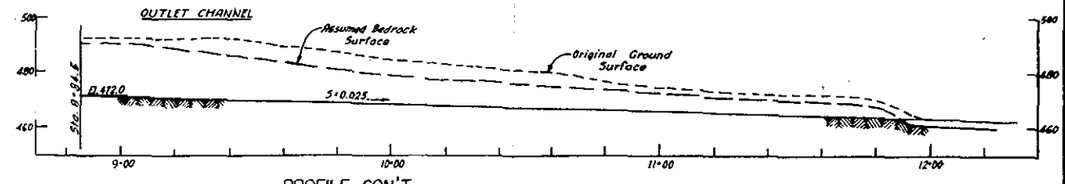
PLATE 39

CORPS OF ENGINEERS U. S. ARMY

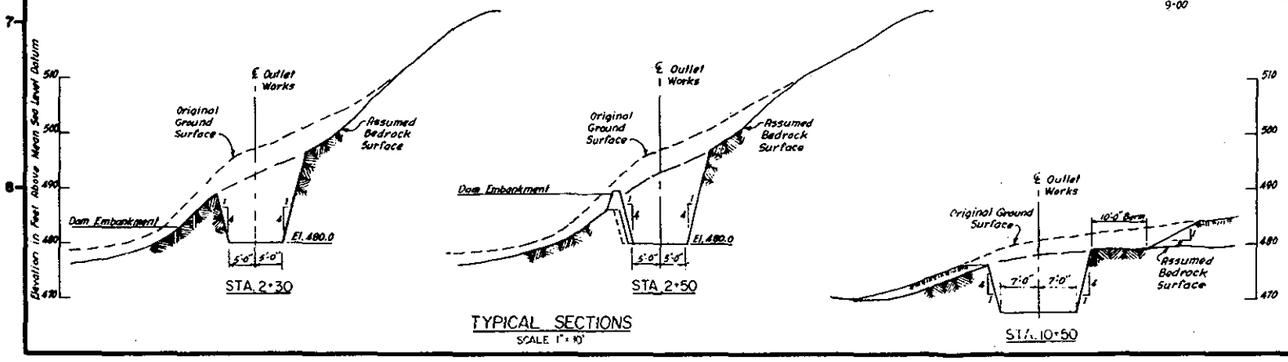


PROFILE ALONG ℄ OF OUTLET WORKS

SCALE 1" = 20'



PROFILE CON'T.



TYPICAL SECTIONS

SCALE 1" = 10'

Revision	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
OUTLET WORKS
PROFILE AND SECTIONS
NORTHFIELD BROOK CONNECTICUT

APPROVED DATE

SCALE SPEC. NO. CIV. ENG. 19-016-
DRAWING NUMBER
SHEET

PLATE 40

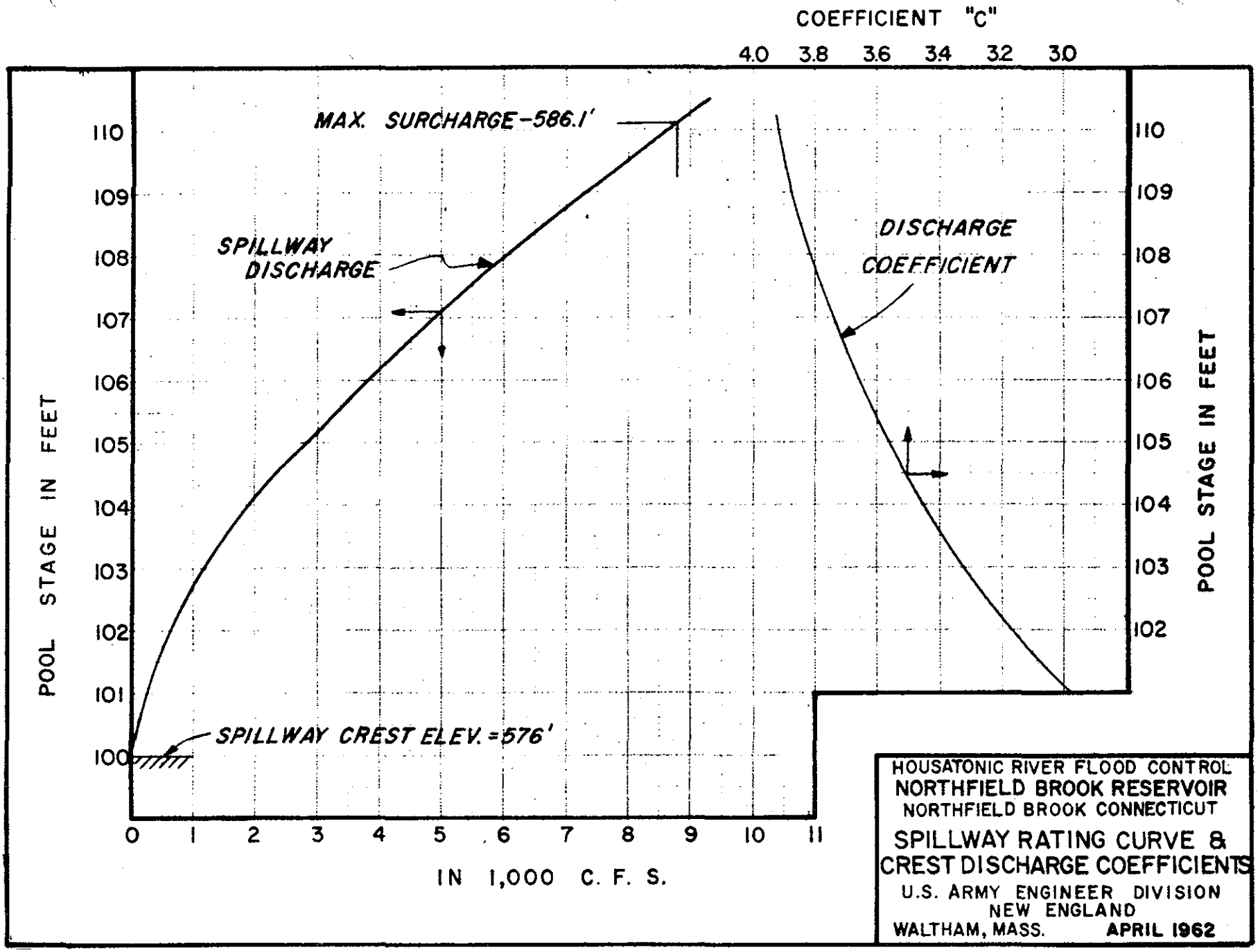
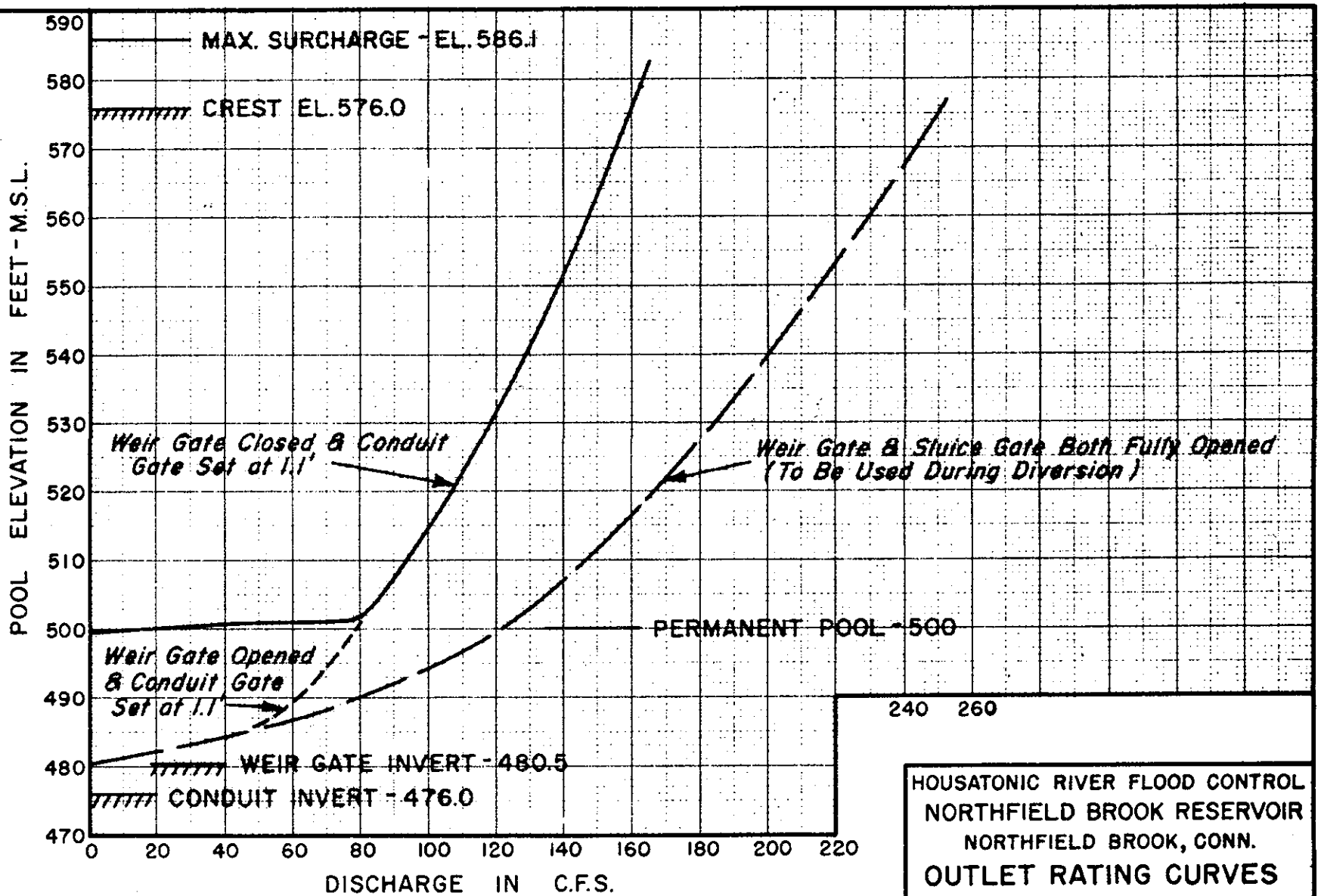

COEFFICIENT "C"
4.0 3.8 3.6 3.4 3.2 3.0
MAX. SURCHARGE-586.1'
SPILLWAY DISCHARGE
DISCHARGE COEFFICIENT
SPILLWAY CREST ELEV.=576'
POOL STAGE IN FEET
110 109 108 107 106 105 104 103 102 101 100
0 1 2 3 4 5 6 7 8 9 10 11
IN 1,000 C. F. S.
HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK RESERVOIR
NORTHFIELD BROOK CONNECTICUT
SPILLWAY RATING CURVE &
CREST DISCHARGE COEFFICIENTS
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. APRIL 1962

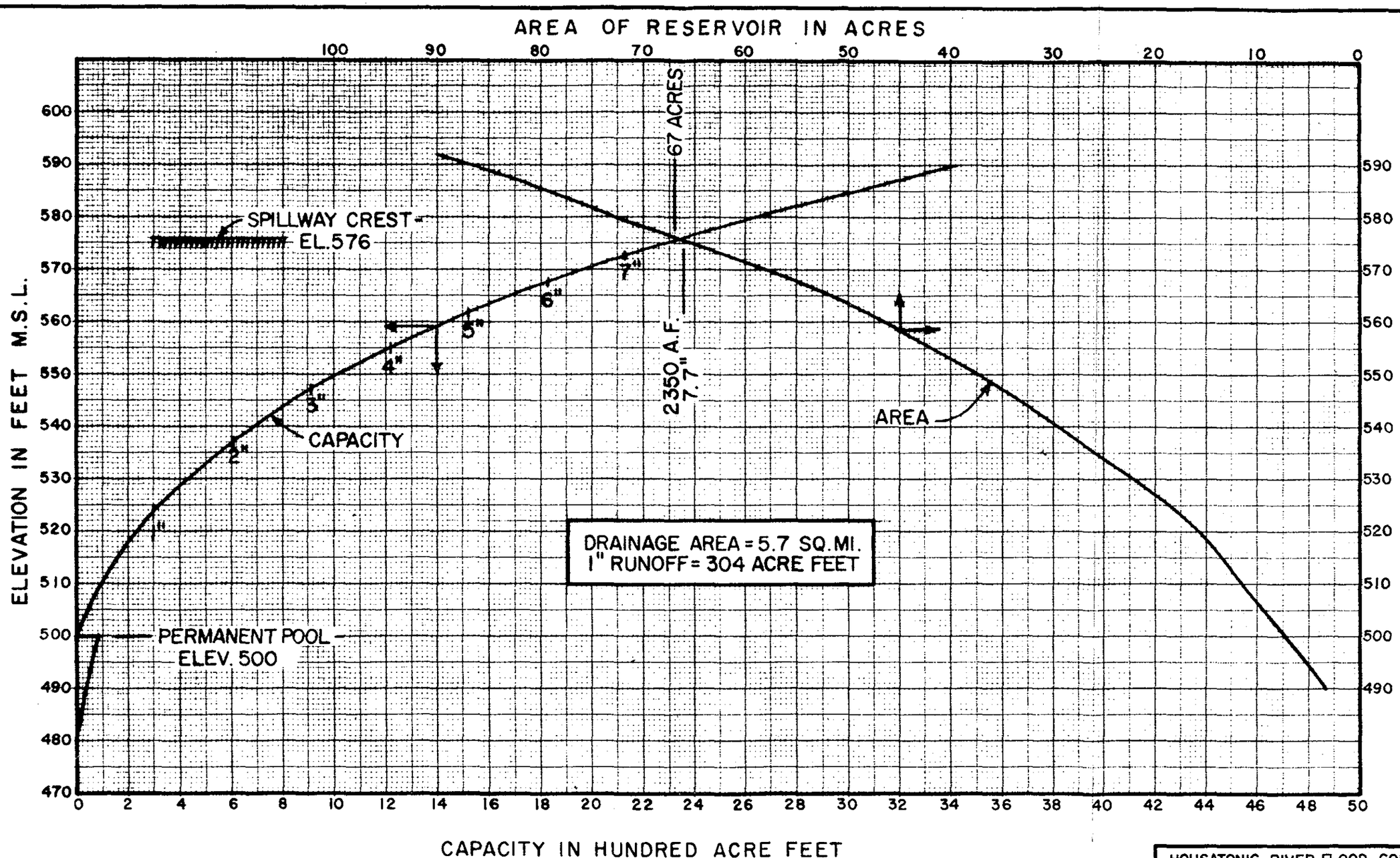
PLATE 41



HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK RESERVOIR
NORTHFIELD BROOK, CONN.

OUTLET RATING CURVES

U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. APRIL 1962



HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK RESERVOIR
NORTHFIELD BROOK CONNECTICUT

AREA-CAPACITY CURVES

U.S. ARMY ENGINEER DIVISION
NEW ENGLAND

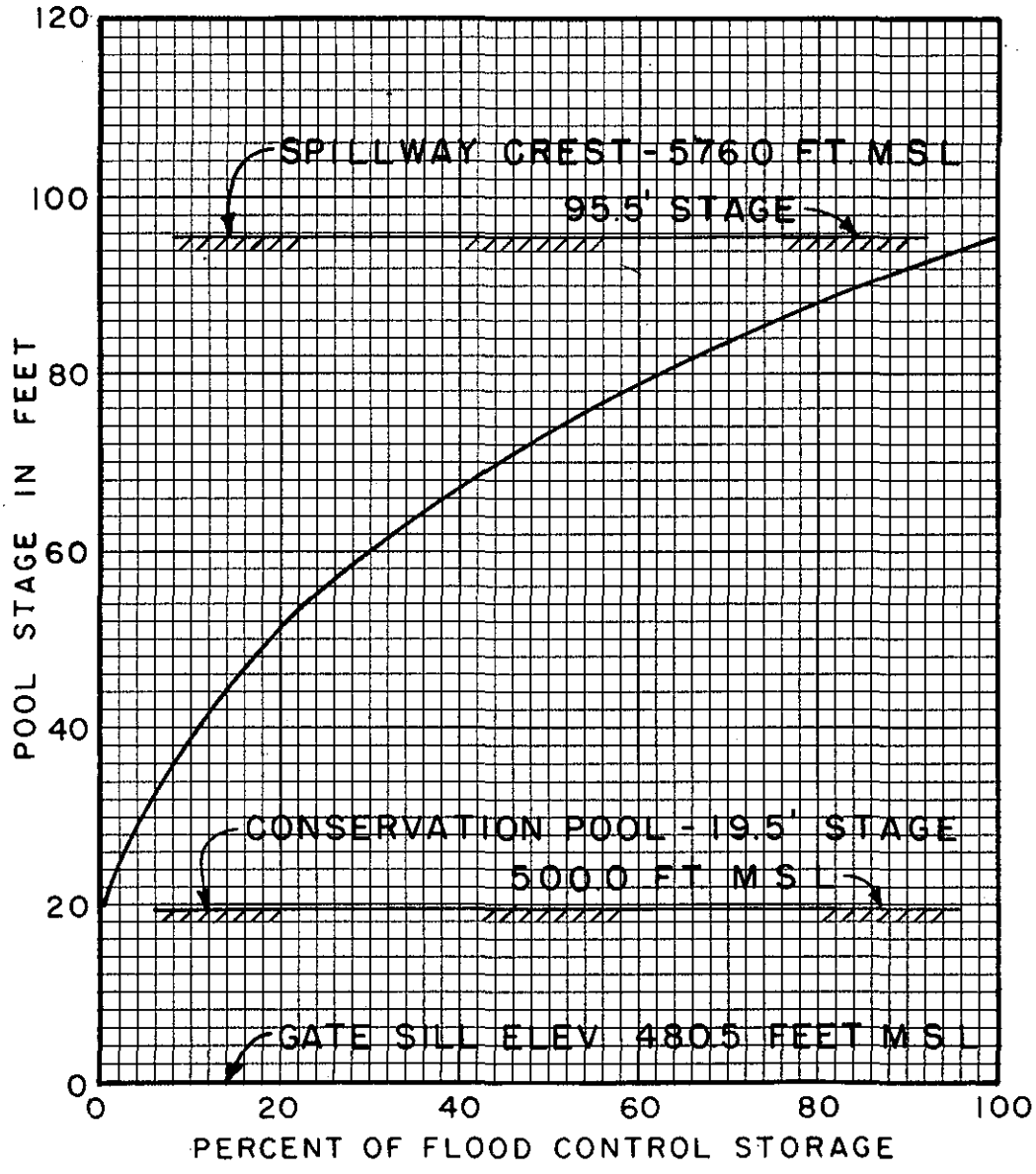
WALTHAM, MASS. APRIL 1962

NORTHFIELD BROOK LAKE
AREA-CAPACITY TABLE
DRAINAGE AREA = 5.7 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
-	476*	-	-	-	44	524.5	18	309	1.02
0	480.5	0	0	0	46	526.5	20	346	1.14
2	482.5	1	0	0	48	528.5	21	387	1.27
4	484.5	1	10	0.03	50	530.5	23	430	1.42
6	486.5	2	20	0.07	52	532.5	24	477	1.57
8	488.5	3	25	0.08	54	534.5	26	526	1.73
10	490.5	4	35	0.12	56	536.5	27	578	1.90
12	492.5	5	45	0.15	58	538.5	29	634	2.09
14	494.5	5	55	0.18	60	540.5	30	692	2.28
16	496.5	6	65	0.21	62	542.5	32	754	2.48
18	498.5	6	75	0.25	64	544.5	33	818	2.69
**19.5	500	7	80	0.26	66	546.5	35	886	2.90
					68	548.5	36	957	3.15
19.5	500	7	0	0	70	550.5	38	1,031	3.39
22	502.5	8	23	0.08	72	552.5	40	1,109	3.65
24	504.5	9	40	0.13	74	554.5	42	1,190	3.91
26	506.5	10	59	0.20	76	556.5	43	1,275	4.19
28	508.5	11	80	0.26	78	558.5	45	1,363	4.48
30	510.5	12	103	0.34	80	560.5	47	1,455	4.79
32	512.5	13	127	0.42	82	562.5	49	1,551	5.10
34	514.5	13	153	0.50	84	564.5	51	1,651	5.43
36	516.5	14	180	0.59	86	566.5	54	1,756	5.78
38	518.5	15	209	0.69	88	568.5	56	1,866	6.14
40	520.5	16	240	0.79	90	570.5	59	1,981	6.52
42	522.5	17	273	0.90	92	572.5	62	2,102	6.91
					94	574.5	65	2,223	7.33
					95.5	576	67	2,350	7.70
							(Spillway Crest)		

*Invert Elevation

**Recreation Pool



NOTES:

1. DRAINAGE AREA - 5.7 SQ. MI.
2. FLOOD CONTROL STORAGE - 2350 ACRE FEET - 7.7 INCHES.
3. CONSERVATION STORAGE - 80 ACRE FEET - 0.3 INCHES.
4. 1" RUNOFF = 305 ACRE FEET.
5. INVERT = 476.0' M S L.

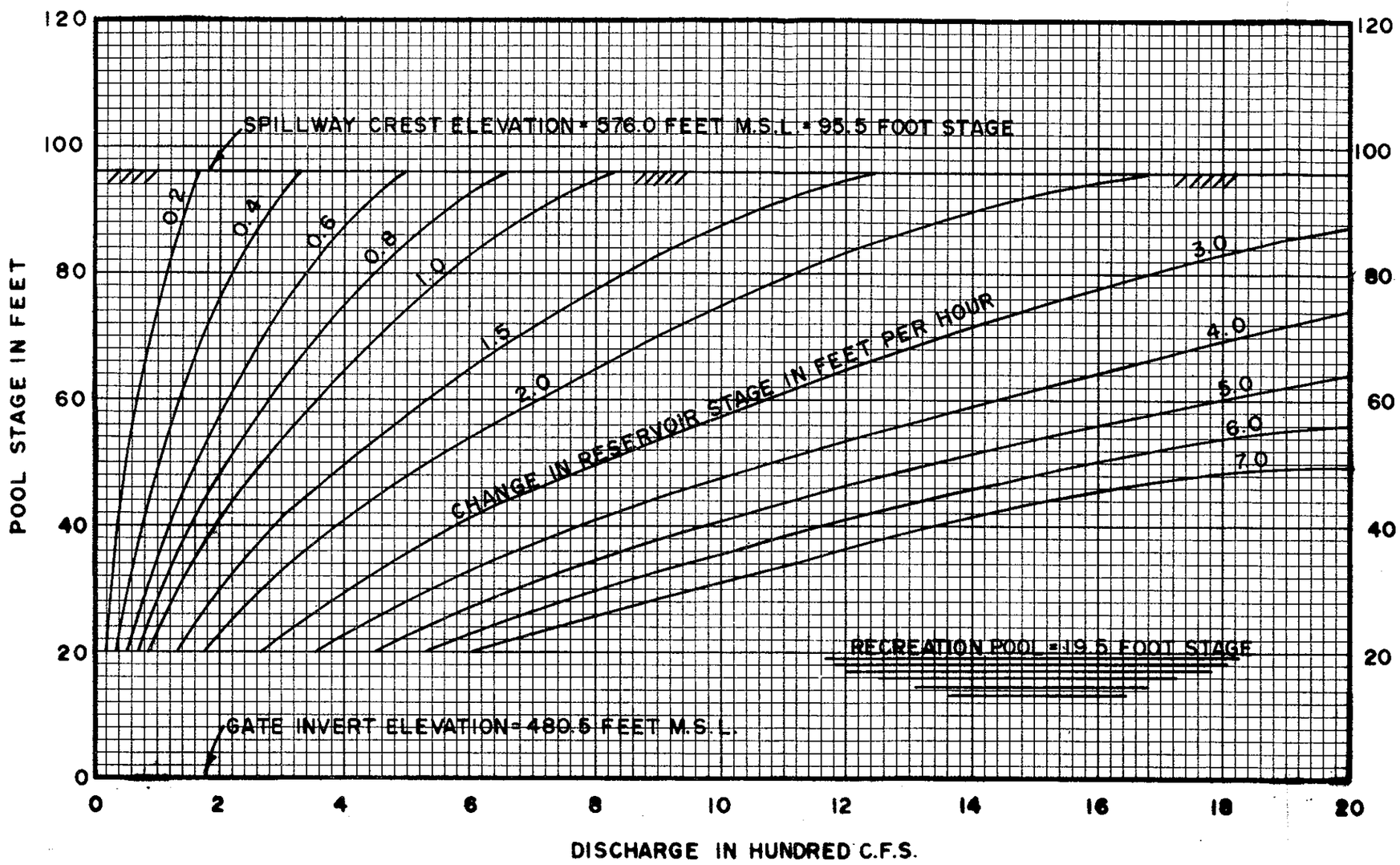
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
NORTHFIELD BROOK LAKE

PERCENT FULL CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

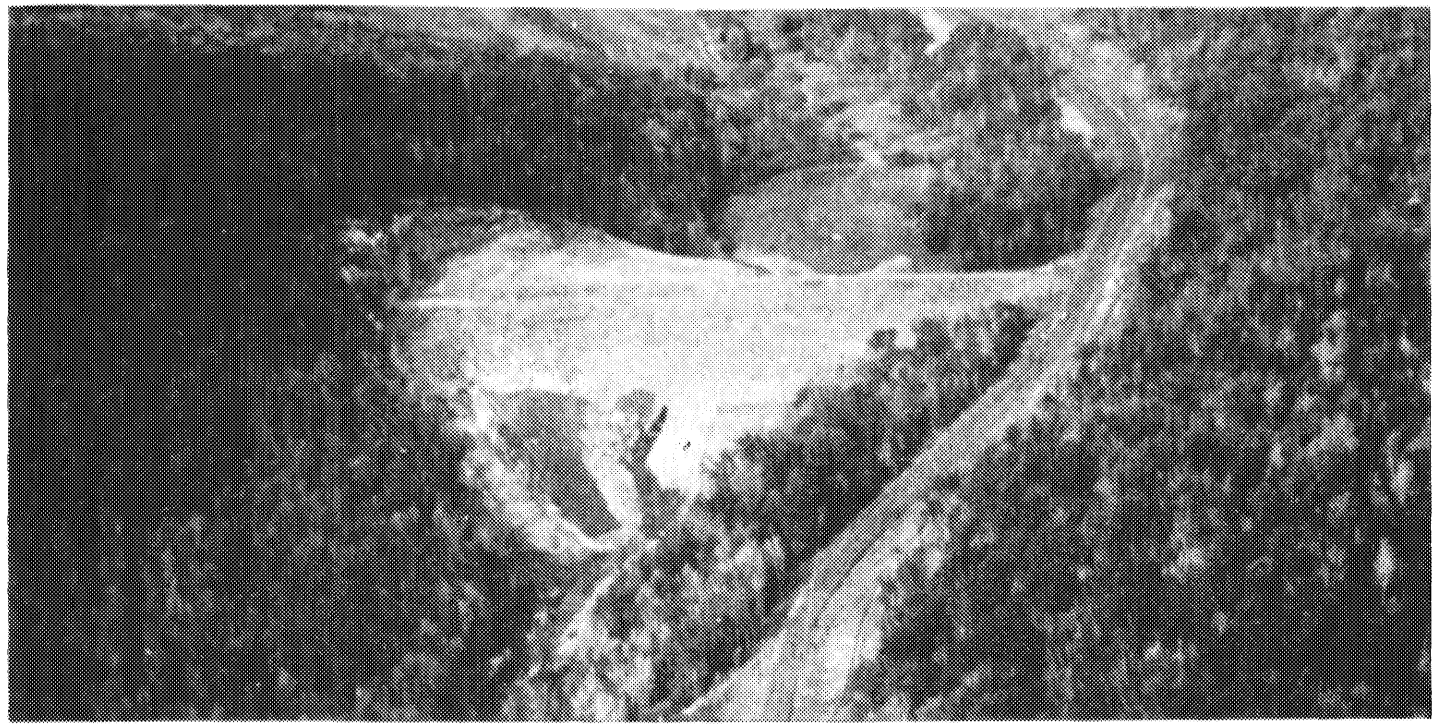
HOUSATONIC RIVER BASIN

NORTHFIELD BROOK LAKE

INFLOW CURVES

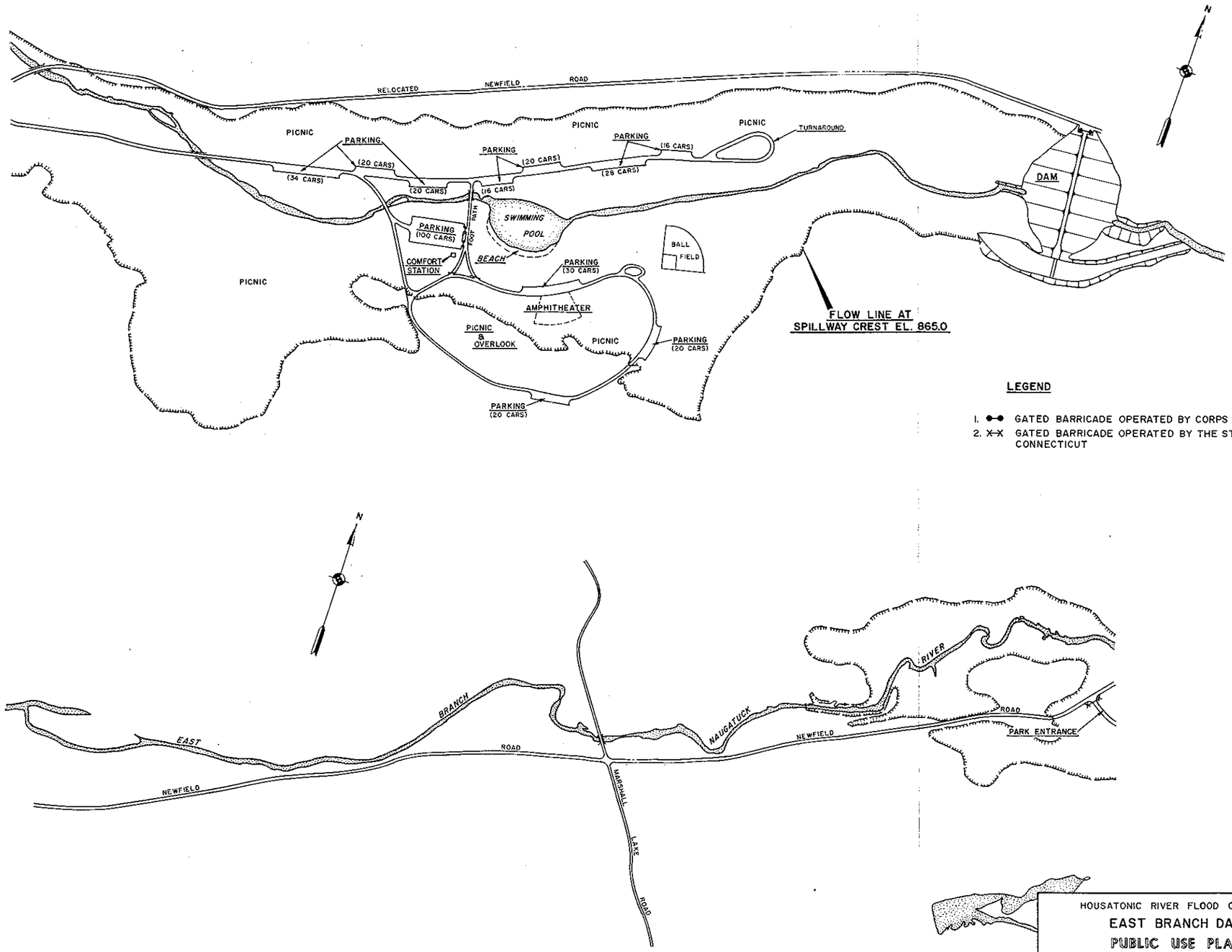
NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



View of East Branch Dam

PLATE 47



HOUSATONIC RIVER FLOOD CONTROL

EAST BRANCH DAM

PUBLIC USE PLAN

DEVELOPMENT PLAN

EAST BRANCH NAUGATUCK RIVER, CONN.

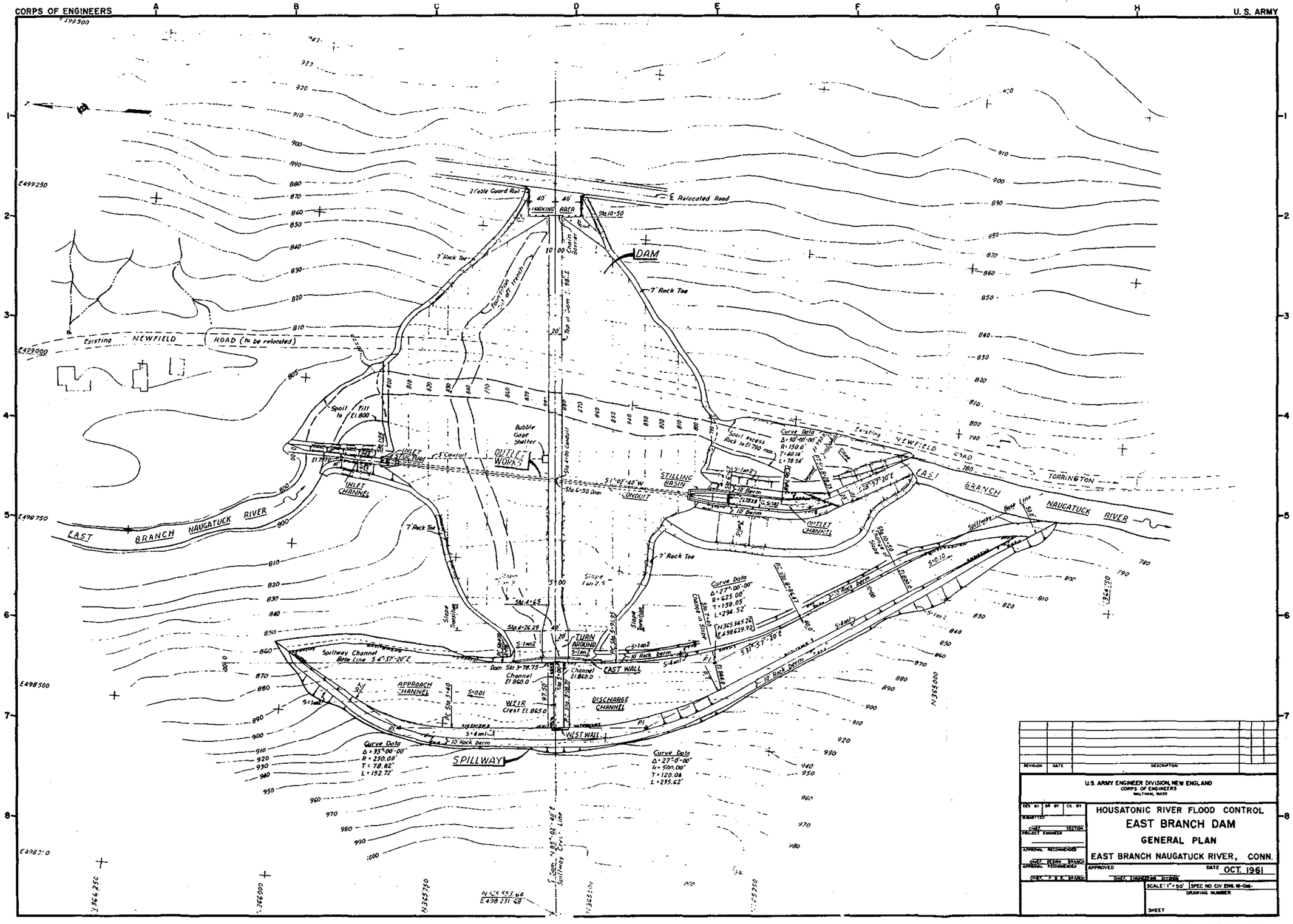
DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. SEPTEMBER, 1971

SCALE AS SHOWN

CORPS OF ENGINEERS U. S. ARMY



REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY | DR. BY | CK. BY

SUBMITTED
CHIEF, SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, E. & D. BRANCH

HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH DAM
GENERAL PLAN
EAST BRANCH NAUGATUCK RIVER, CONN.

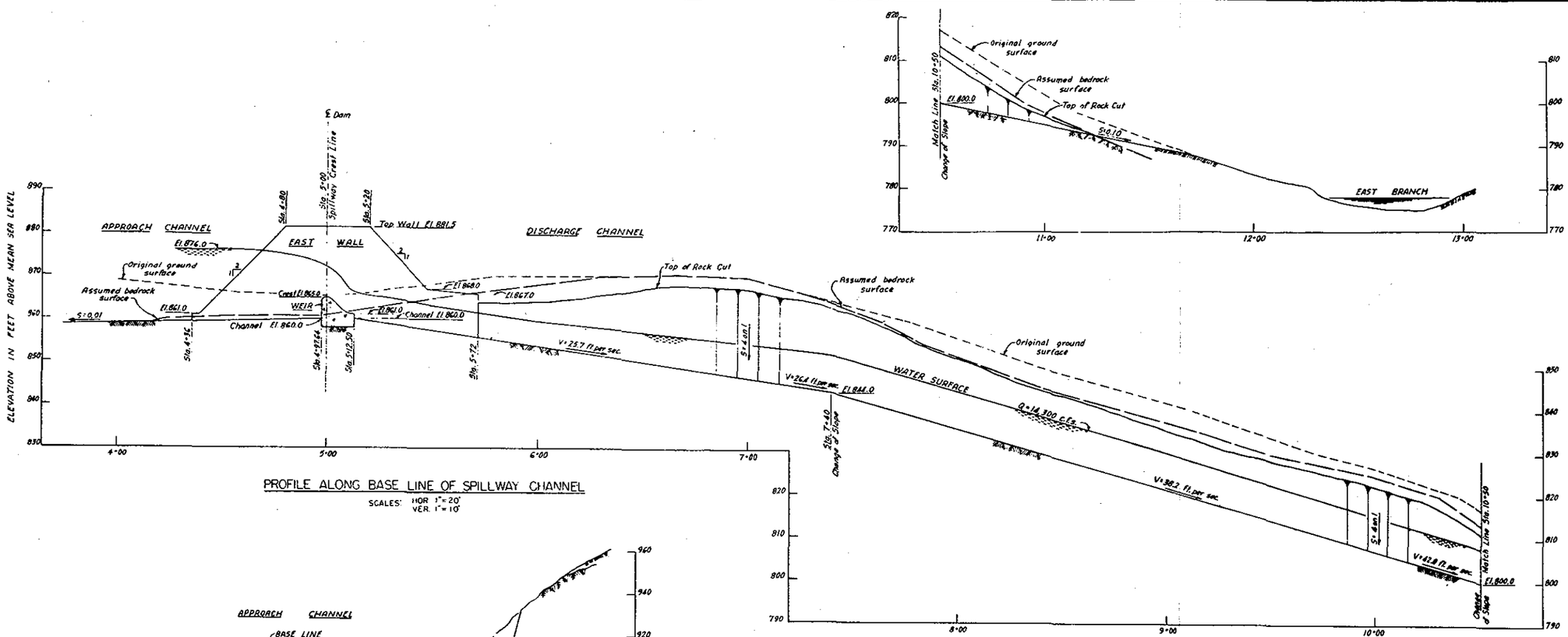
APPROVED
CHIEF, ENGINEERING DIVISION

DATE OCT. 1961

SCALE: 1" = 80'
SPEC. NO. CIV ENG. 19-068-
DRAWING NUMBER
SHEET

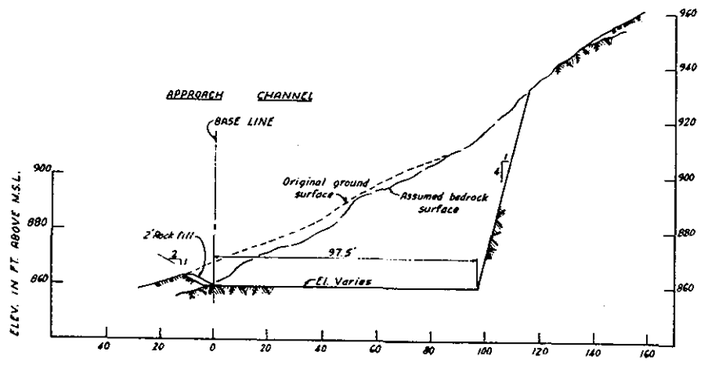
PLATE 49

CORPS OF ENGINEERS U.S. ARMY



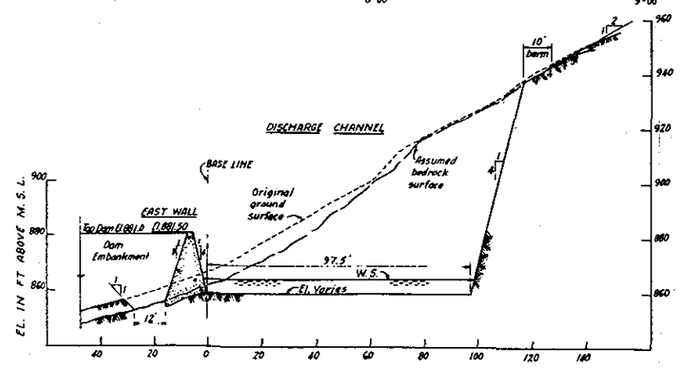
PROFILE ALONG BASE LINE OF SPILLWAY CHANNEL

SCALES: HOR 1"=20' VER. 1"=10'



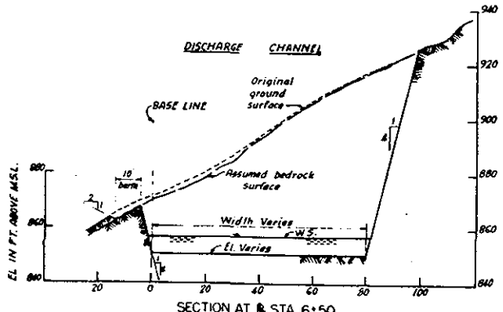
SECTION AT ℄ STA. 4+20

SCALES HOR. & VER. 1"=20'



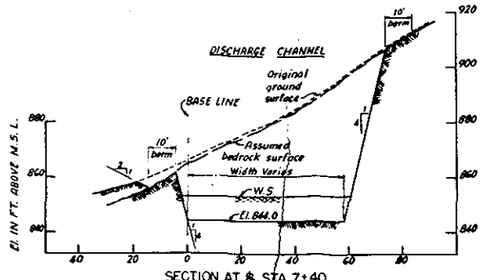
SECTION AT ℄ STA. 5+20

SCALES HOR. & VER. 1"=20'



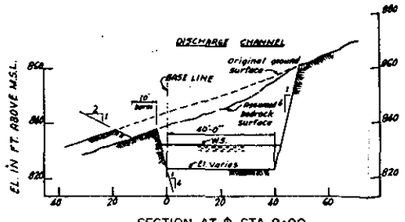
SECTION AT ℄ STA. 6+50

SCALES HOR. & VER. 1"=20'



SECTION AT ℄ STA. 7+40

SCALES HOR. & VER. 1"=20'



SECTION AT ℄ STA. 8+90

SCALES HOR. & VER. 1"=20'

REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED
CHIEF, SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P.E.D. DIVISION

HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH DAM
SPILLWAY
PROFILE AND SECTIONS
EAST BRANCH NAUGATUCK RIVER, CONN.

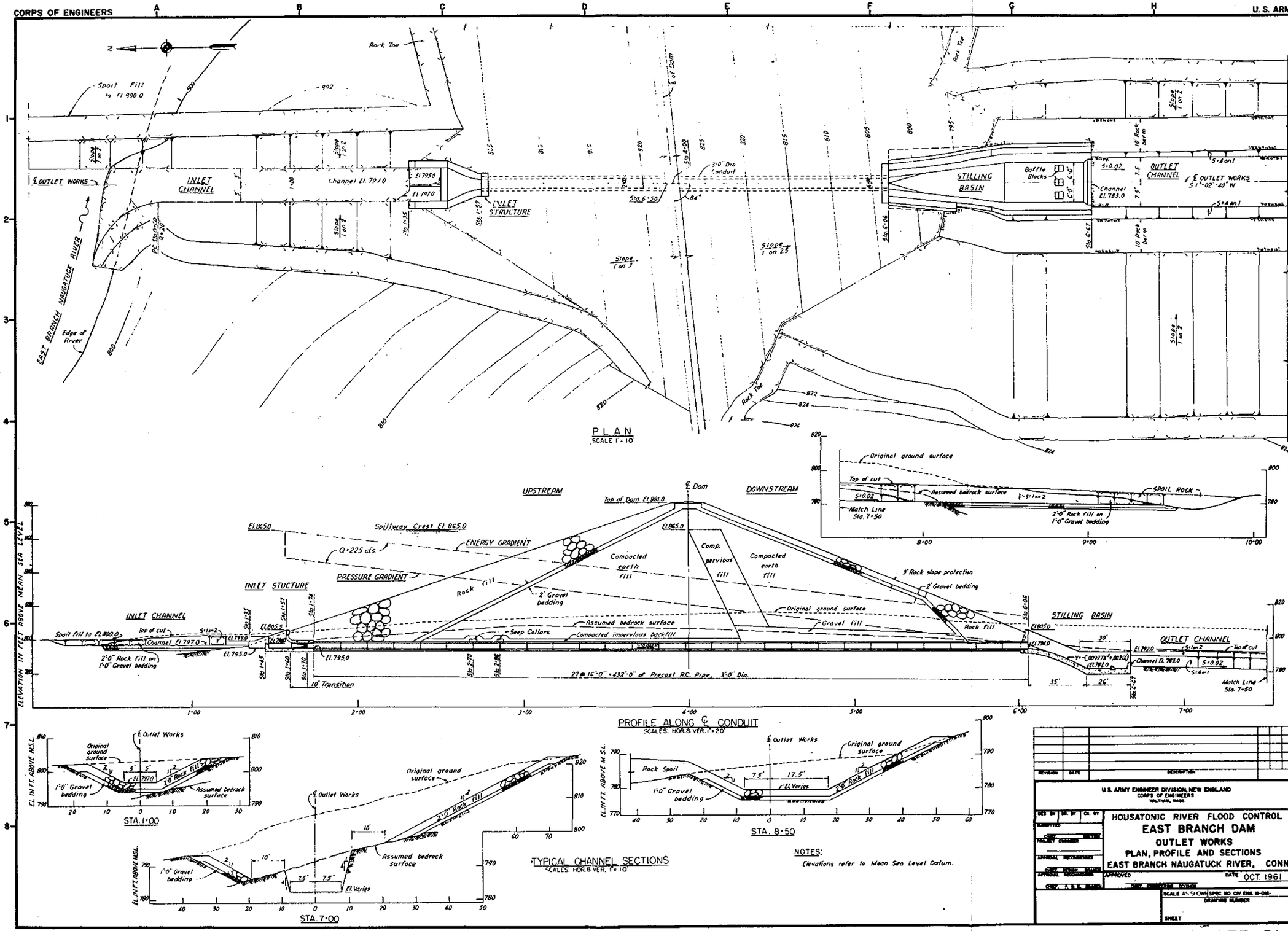
APPROVED
DATE OCT. 1961
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN
SPEC. NO. CIV. ERR. 19-018-
DRAWING NUMBER
SHEET

PLATE 50

CORPS OF ENGINEERS

U. S. ARMY



NOTES:

Elevations refer to Mean Sea Level Datum.

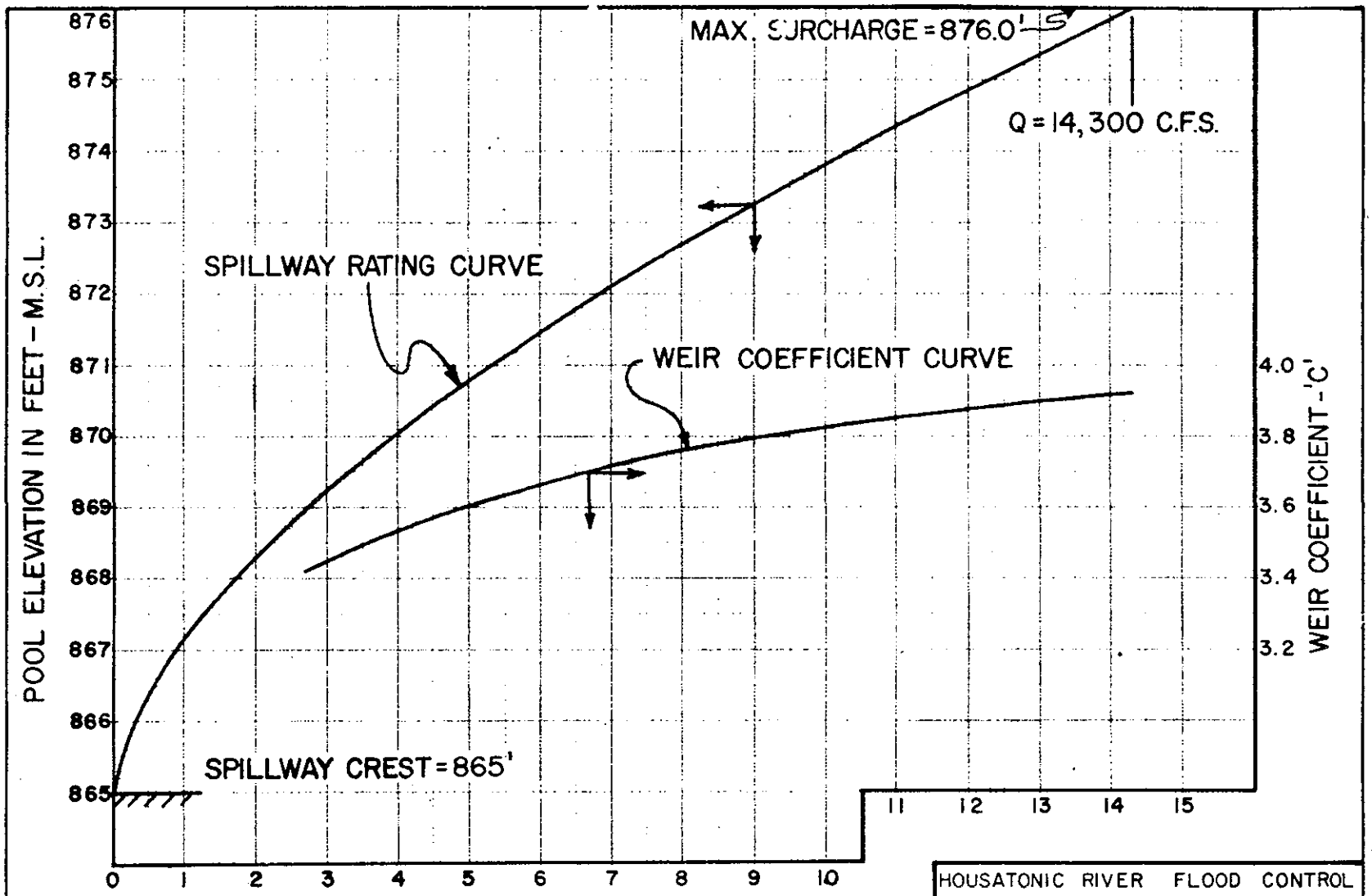
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH DAM
OUTLET WORKS
PLAN, PROFILE AND SECTIONS
EAST BRANCH NAUGATUCK RIVER, CONN.

DATE OCT. 1961

SCALE AS SHOWN

PLATE 51



HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH RESERVOIR
SPILLWAY RATING CURVE & CREST DISCHARGE COEFFICIENTS
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. OCTOBER. 1961

PLATE 52

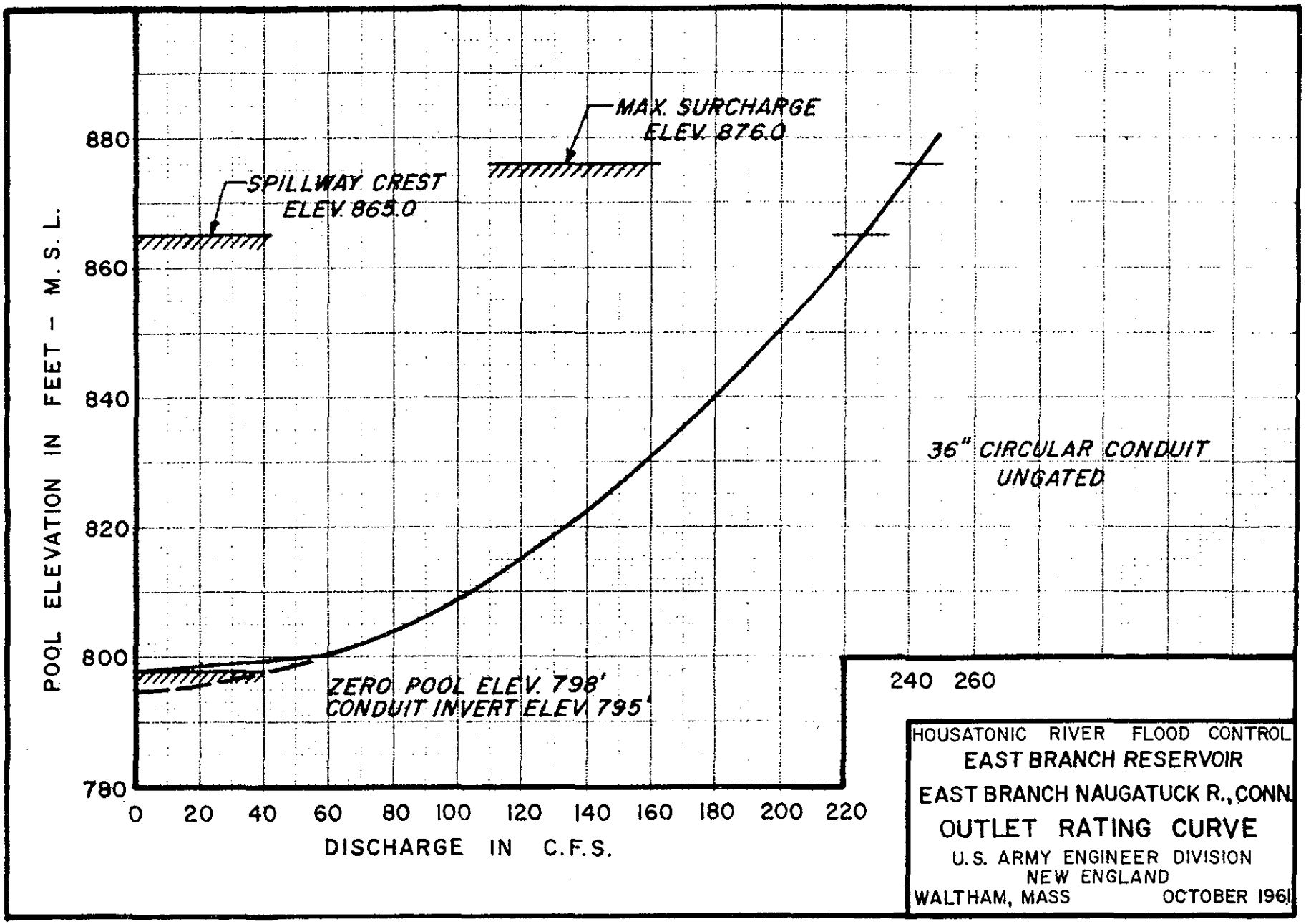
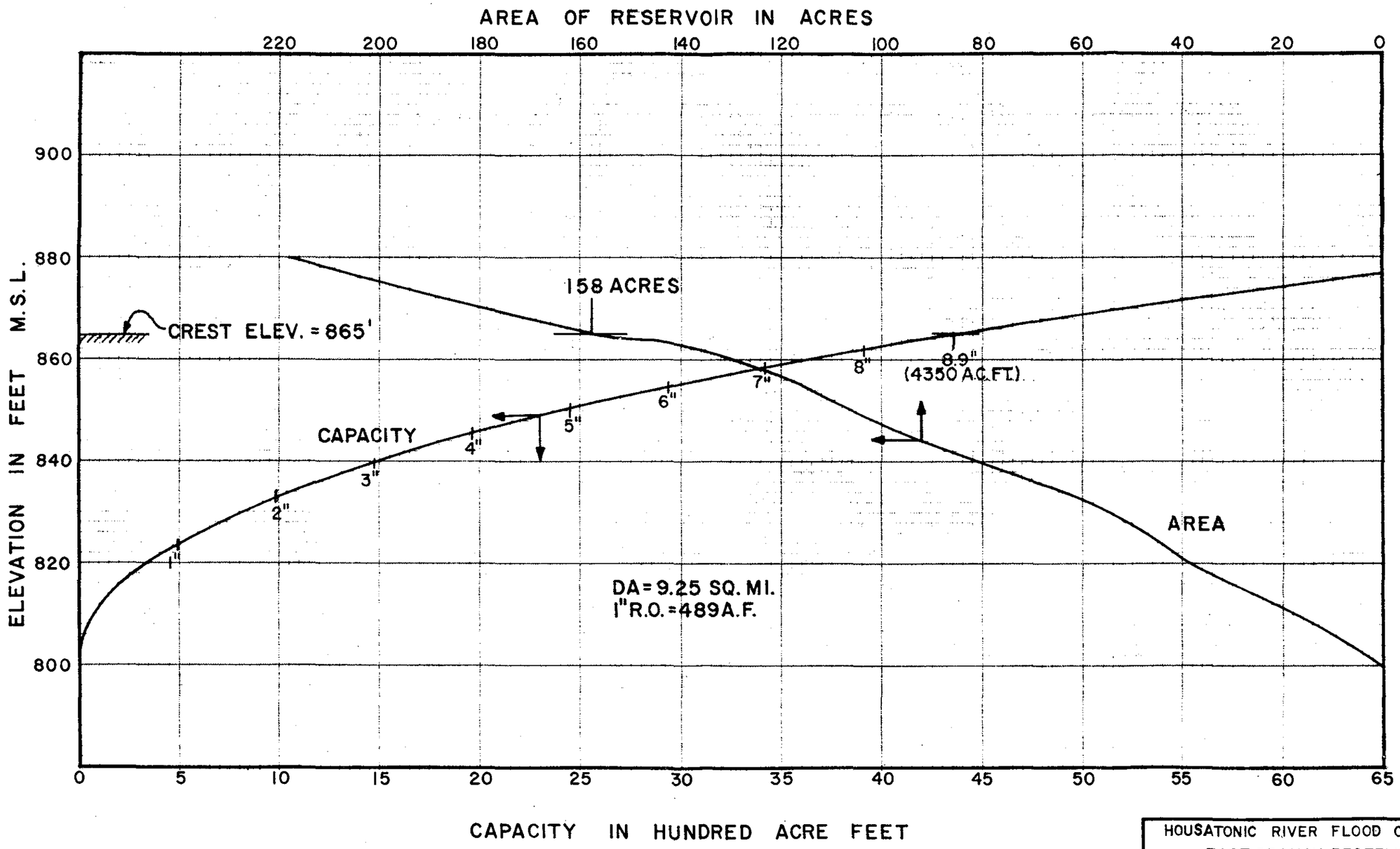

MAX. SURCHARGE
ELEV. 876.0
SPILLWAY CREST
ELEV. 865.0
36" CIRCULAR CONDUIT
UNGATED
ZERO POOL ELEV. 798'
CONDUIT INVERT ELEV. 795'
POOL ELEVATION IN FEET - M.S.L.
880
860
840
820
800
780
0 20 40 60 80 100 120 140 160 180 200 220
240 260
DISCHARGE IN C.F.S.
HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH RESERVOIR
EAST BRANCH NAUGATUCK R., CONN.
OUTLET RATING CURVE
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS
OCTOBER 1961

PLATE 53



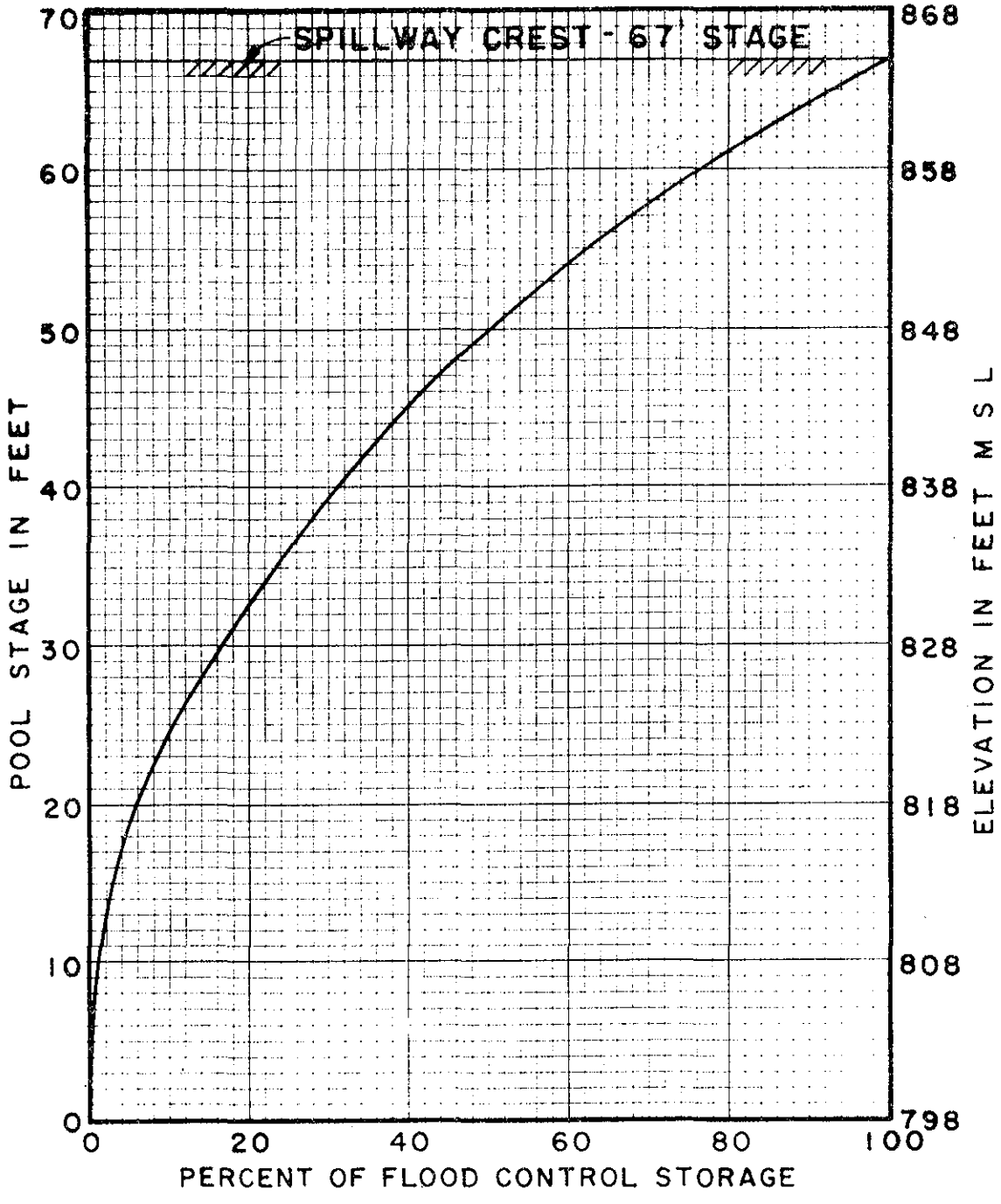
HOUSATONIC RIVER FLOOD CONTROL
EAST BRANCH RESERVOIR
EAST BRANCH-NAUGATUCK RIVER CONN.
AREA-CAPACITY CURVES
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. OCTOBER 1961

EAST BRANCH DAM
AREA-CAPACITY TABLE
DRAINAGE AREA = 9.3 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
-	795*	-	-	-	34	832	59	931	1.90
0	798	0	0	0	35	833	62	991	2.03
1	799	0	0	0	36	834	64	1,054	2.16
2	800	1	1	0	37	835	67	1,119	2.29
3	801	2	2	0.01	38	836	70	1,188	2.43
4	802	2	4	0.01	39	837	72	1,258	2.57
5	803	4	7	0.01	40	838	75	1,332	2.72
6	804	6	12	0.03	41	839	78	1,409	2.88
7	805	8	19	0.04	42	840	81	1,488	3.04
8	806	10	28	0.06	43	841	84	1,571	3.21
9	807	12	39	0.08	44	842	87	1,656	3.39
10	808	13	51	0.10	45	843	90	1,744	3.57
11	809	15	65	0.13	46	844	92	1,853	3.75
12	810	17	81	0.17	47	845	95	1,928	3.94
13	811	19	99	0.20	48	846	97	2,024	4.14
14	812	21	119	0.24	49	847	100	2,122	4.34
15	813	23	141	0.29	50	848	102	2,223	4.55
16	814	25	165	0.34	51	849	105	2,326	4.76
17	815	28	191	0.39	52	850	107	2,432	4.97
18	816	30	220	0.45	53	851	109	2,540	5.19
19	817	32	251	0.51	54	852	111	2,650	5.42
20	818	34	284	0.58	55	853	112	2,761	5.65
21	819	36	319	0.65	56	854	114	2,874	5.88
22	820	38	356	0.73	57	855	117	2,989	6.11
23	821	40	395	0.81	58	856	120	3,108	6.36
24	822	42	436	0.89	59	857	122	3,228	6.60
25	823	44	479	0.98	60	858	125	3,352	6.86
26	824	45	523	1.07	61	859	128	3,478	7.11
27	825	46	569	1.16	62	860	131	3,608	7.38
28	826	47	615	1.26	63	861	133	3,739	7.65
29	827	49	663	1.36	64	862	136	3,874	7.92
30	828	51	713	1.46	65	863	142	4,013	8.21
31	829	53	765	1.56	66	864	148	4,158	8.50
32	830	54	818	1.67	67	865	158	4,350	8.80
33	831	57	873	1.79					

(Spillway Crest)

*Invert Elevation



NOTES:

1. DRAINAGE AREA - 9.3 SQ. MI.
2. FLOOD CONTROL STORAGE - 4350 ACRE FEET - 8.8 INCHES.
3. 1" RUNOFF = 495 ACRE FEET.
4. INVERT = 795 FEET M S L.

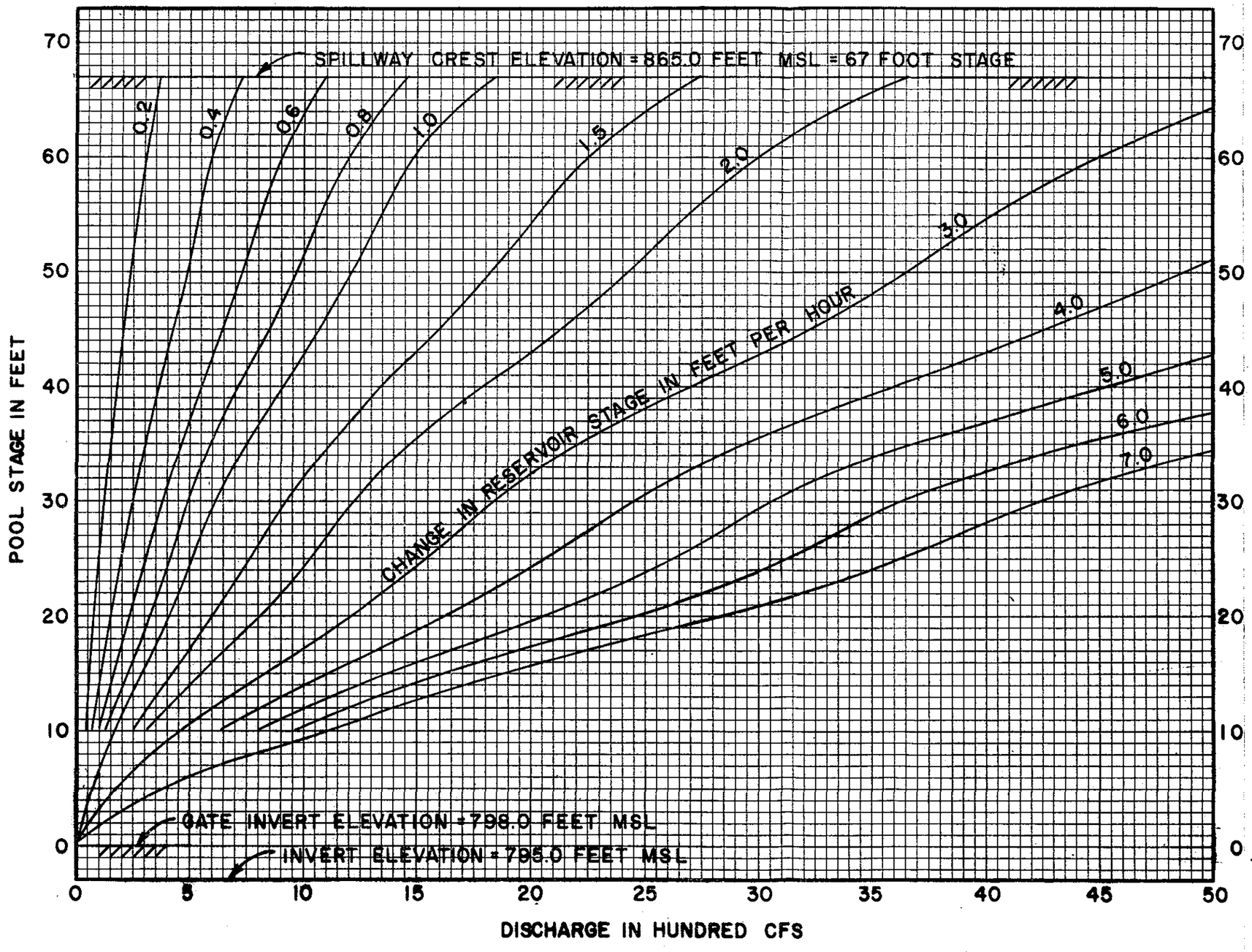
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
EAST BRANCH DAM

PERCENT FULL CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN

EAST BRANCH DAM

INFLOW CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976

View of Hall Meadow Brook Dam

PLATE 58

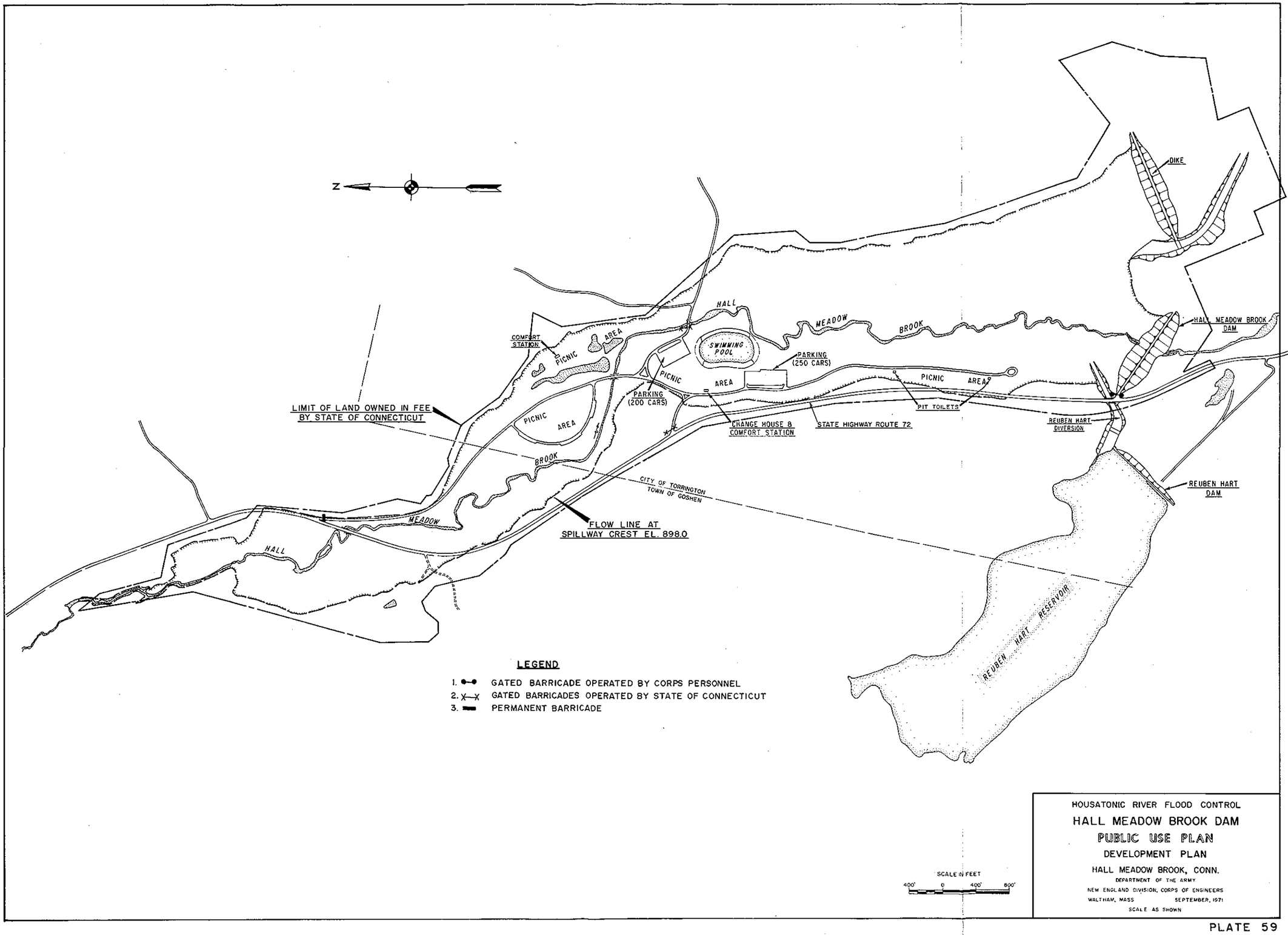

N
DIKE
HALL MEADOW BROOK DAM
HALL
MEADOW
BROOK
SWIMMING POOL
PARKING (250 CARS)
PICNIC AREA
PICNIC AREA
COMFORT STATION
PICNIC AREA
PARKING (200 CARS)
PICNIC AREA
PIT TOILETS
CHANGE HOUSE & COMFORT STATION
STATE HIGHWAY ROUTE 72
REUBEN HART DIVERSION
LIMIT OF LAND OWNED IN FEE BY STATE OF CONNECTICUT
BROOK
CITY OF TORRINGTON
TOWN OF GOSHEN
REUBEN HART DAM
MEADOW
FLOW LINE AT SPILLWAY CREST EL. 898.0
HALL
REUBEN HART RESERVOIR
LEGEND
1. GATED BARRICADE OPERATED BY CORPS PERSONNEL
2. GATED BARRICADES OPERATED BY STATE OF CONNECTICUT
3. PERMANENT BARRICADE
SCALE IN FEET
400' 0 400' 800'
HOUSATONIC RIVER FLOOD CONTROL
HALL MEADOW BROOK DAM
PUBLIC USE PLAN
DEVELOPMENT PLAN
HALL MEADOW BROOK, CONN.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS SEPTEMBER, 1971
SCALE AS SHOWN

PLATE 59

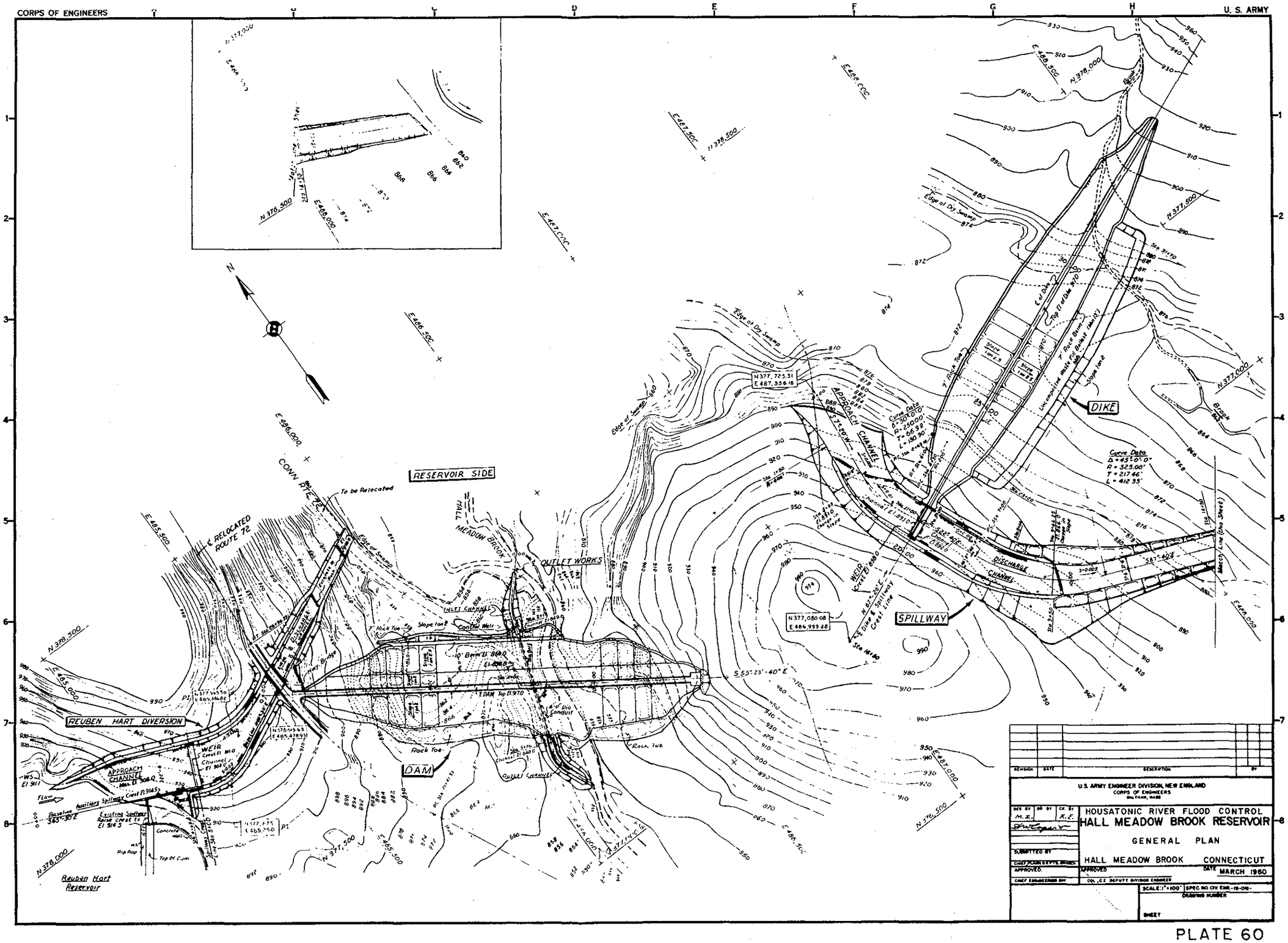
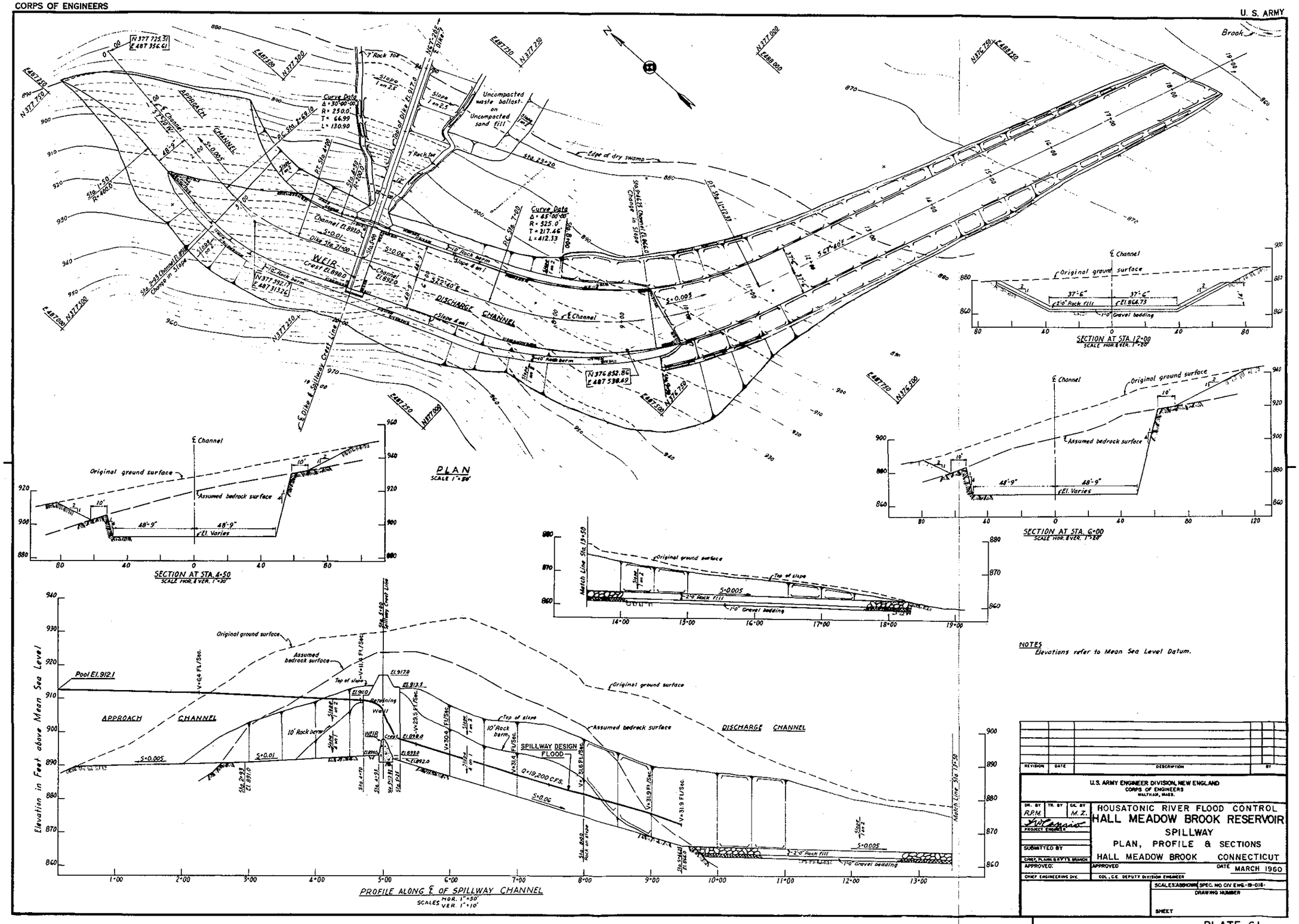

CORPS OF ENGINEERS
U. S. ARMY
RESERVOIR SIDE
DIKE
SPILLWAY
DAM
OUTLET WORKS
REUBEN HART DIVERSION
Reuben Hart Reservoir
HALL MEADOW BROOK
CONN RTE 72
℄ RELOCATED ROUTE 72
To be Relocated
APPROACH CHANNEL
DISCHARGE CHANNEL
INLET CHANNEL
OUTLET CHANNEL
Edge of Dry Swamp
Edge of Swamp
Rock Toe
Slope Ions
Curve Data
Δ = 45°0'0"
R = 325.00'
T = 217.46'
L = 412.33'
N 377,725.31
E 487,356.16
N 377,080.08
E 486,993.28
S 55°23'-40" E
Revision
DATE
DESCRIPTION
BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
DES BY
M.E.
DR BY
CK BY
K.C.
SUBMITTED BY
CHIEF, PLANN. & REPTS. BRANCH
APPROVED
CHIEF, ENGINEERING DIV.
APPROVED
COL., C.E. DEPUTY DIVISION ENGINEER
HOUSATONIC RIVER FLOOD CONTROL
HALL MEADOW BROOK RESERVOIR
GENERAL PLAN
HALL MEADOW BROOK CONNECTICUT
DATE MARCH 1960
SCALE: 1" = 100'
SPEC. NO. CIV. ENG.-19-010-
DRAWING NUMBER
SHEET

PLATE 60

CORPS OF ENGINEERS

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY R.P.M. | TR. BY | CK. BY M.Z.

PROJECT ENGINEER

SUBMITTED BY

CHIEF, PLANN. & RPT'S BRANCH

APPROVED:

CHIEF ENGINEERING DIV.

HOUSATONIC RIVER FLOOD CONTROL
HALL MEADOW BROOK RESERVOIR
SPILLWAY
PLAN, PROFILE & SECTIONS
HALL MEADOW BROOK CONNECTICUT

APPROVED

DATE MARCH 1960

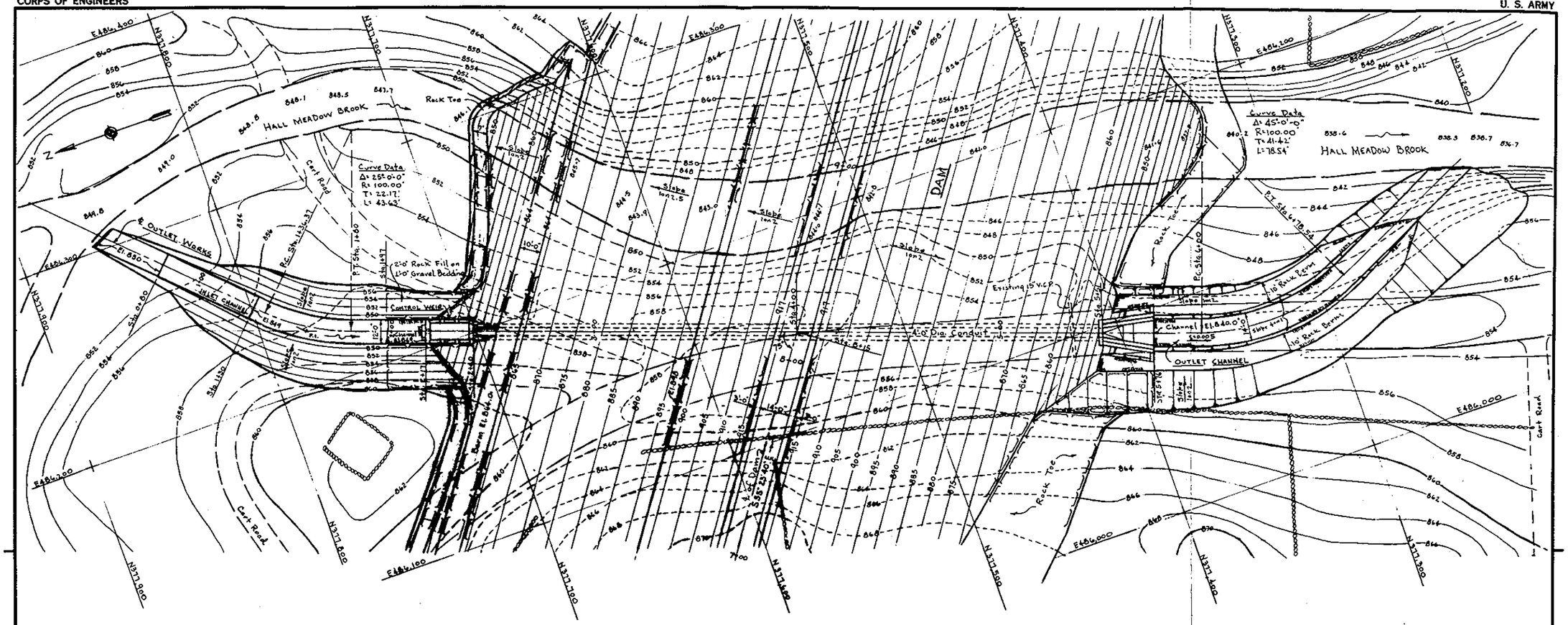
COL., C.E. DEPUTY DIVISION ENGINEER

SCALES AS SHOWN | SPEC. NO CIV ENG.-19-018-

DRAWING NUMBER

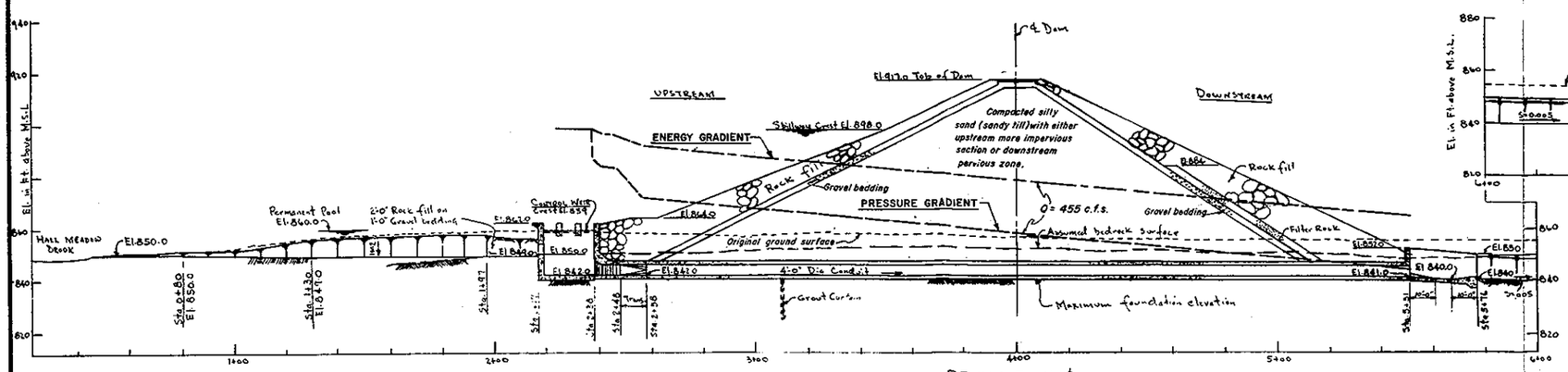
SHEET

PLATE 61



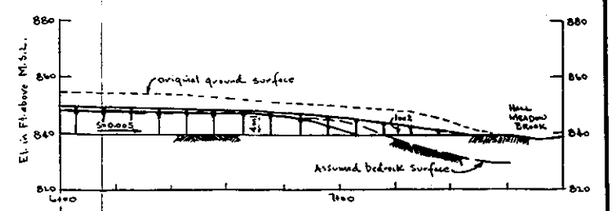
PLAN

SCALE 1" = 20'



PROFILE ON ℄

SCALE 1" = 20'



Notes

Elevations refer to Mean Sea Level Datum

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY M.E. | TR. BY | CK. BY K.E.

PROJECT ENGINEER

SUBMITTED BY

CHIEF, PLANN. & RPT'S. BRANCH

APPROVED:

CHIEF ENGINEERING DIV.

HOUSATONIC RIVER FLOOD CONTROL
HALL MEADOW BROOK RESERVOIR
OUTLET WORKS
PLAN AND PROFILE
HALL MEADOW BROOK CONNECTICUT

APPROVED

COL., C.E. DEPUTY DIVISION ENGINEER

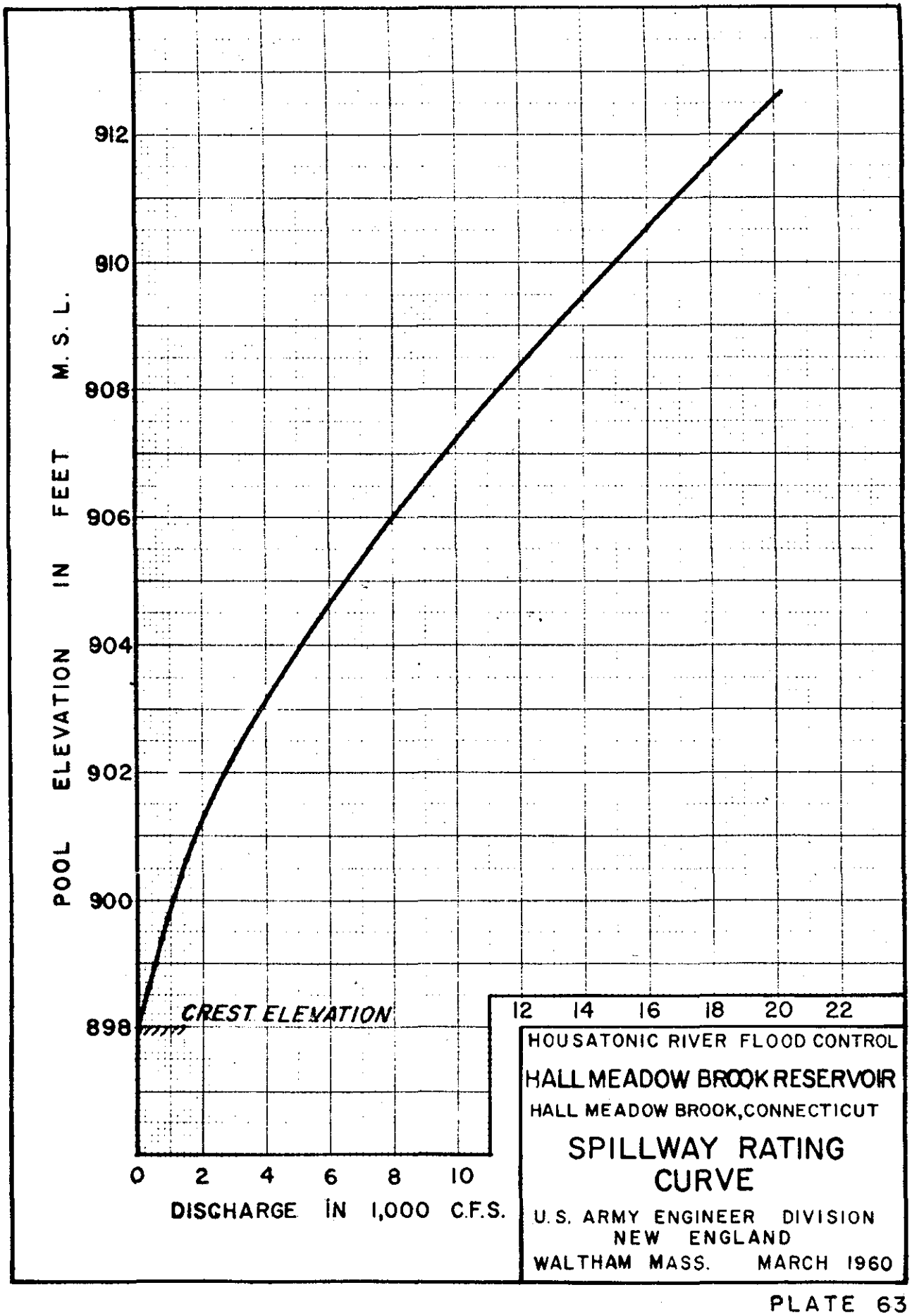
DATE MARCH 1960

SCALE: 1" = 20'

SPEC. NO. CIV. ENG.-19-016-

DRAWING NUMBER

SHEET



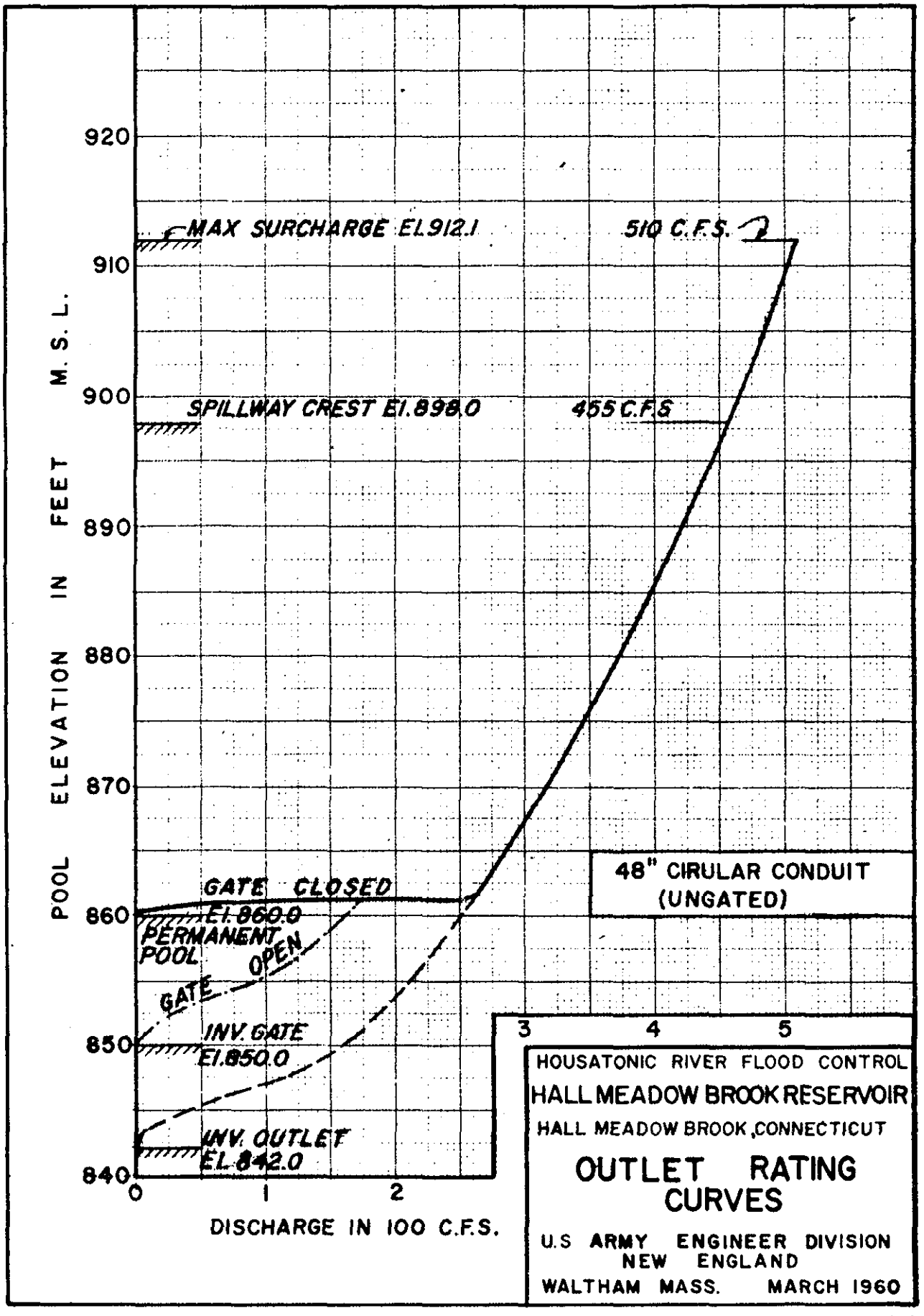
HOUSATONIC RIVER FLOOD CONTROL

HALL MEADOW BROOK RESERVOIR

HALL MEADOW BROOK, CONNECTICUT

SPILLWAY RATING CURVE

U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM MASS. MARCH 1960



HOUSATONIC RIVER FLOOD CONTROL

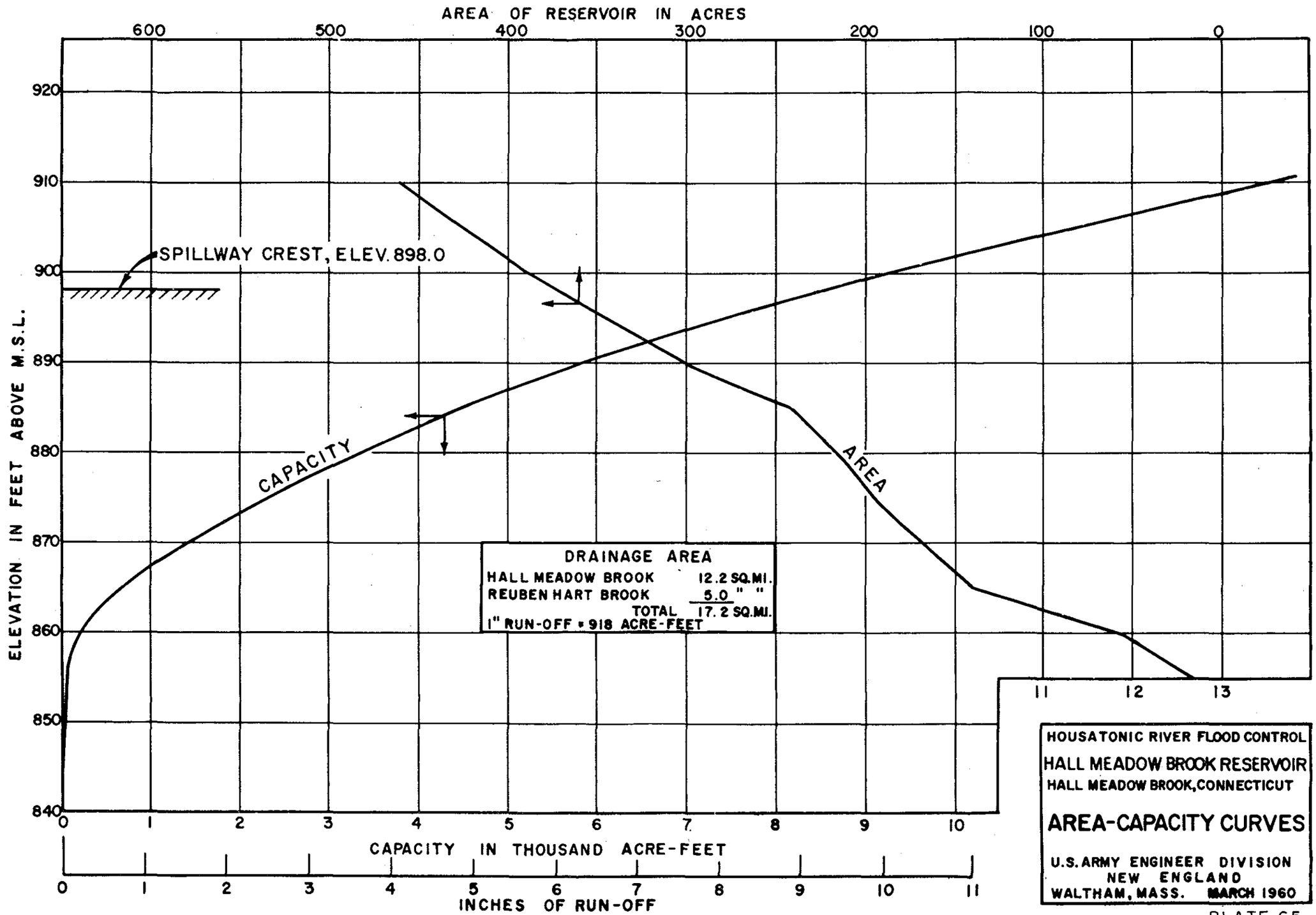
HALL MEADOW BROOK RESERVOIR

HALL MEADOW BROOK, CONNECTICUT

OUTLET RATING CURVES

U.S ARMY ENGINEER DIVISION
NEW ENGLAND

WALTHAM MASS. MARCH 1960



HOUSATONIC RIVER FLOOD CONTROL

HALL MEADOW BROOK RESERVOIR

HALL MEADOW BROOK, CONNECTICUT

AREA-CAPACITY CURVES

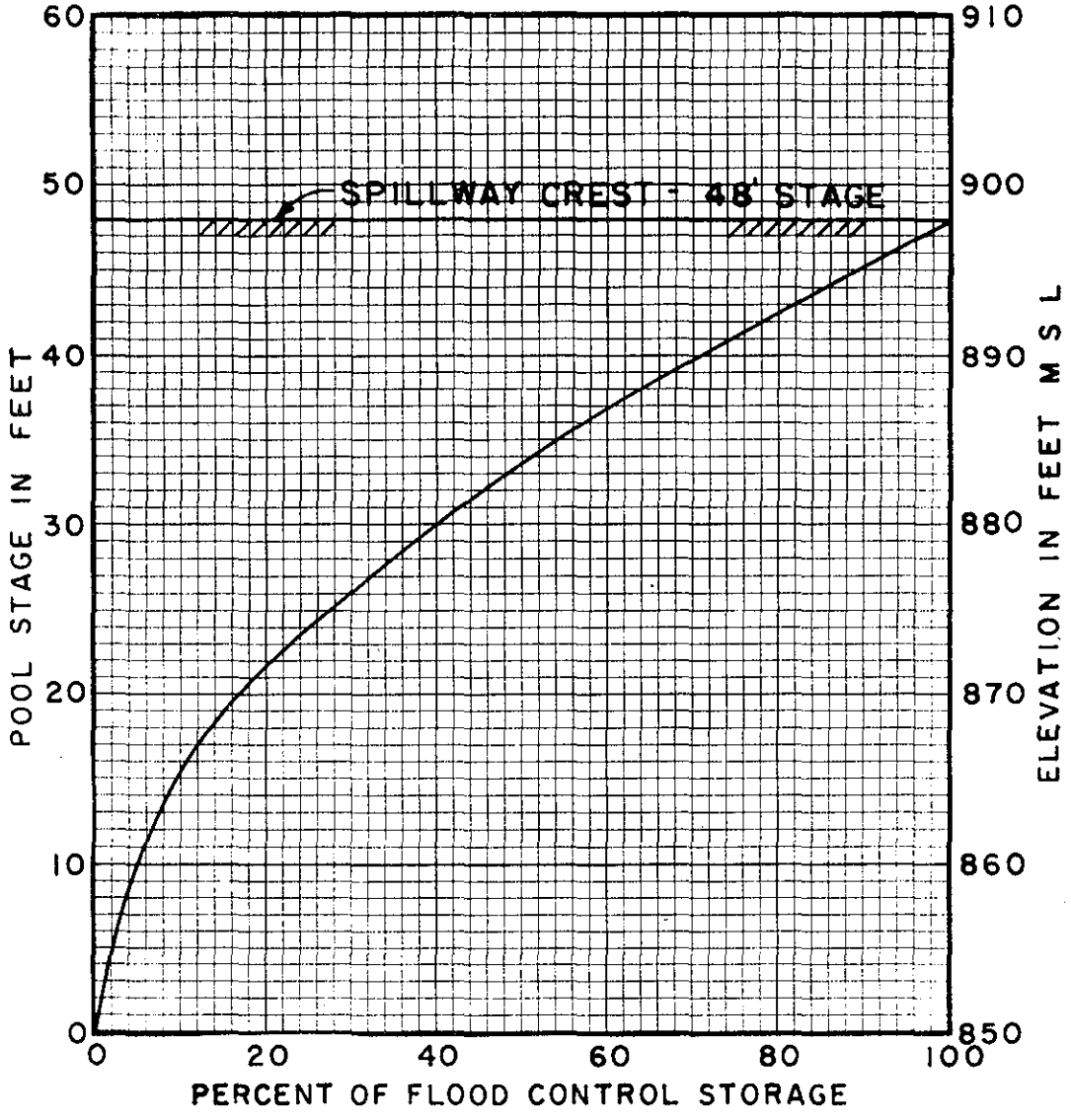
U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. MARCH 1960

HALL MEADOW BROOK DAM
AREA-CAPACITY TABLE
DRAINAGE AREA = 17.2 SQUARE MILES

Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)	Stage (ft)	Elev. (msl)	Area (acres)	Capacity (ac/ft)	Capacity (inches)
-	842*	-	-	-	24	874	190	2,287	2.49
0	850	0	0	0	25	875	195	2,479	2.70
1	851	12	6	0.01	26	876	199	2,676	2.92
2	852	23	23	0.03	27	877	204	2,877	3.13
3	853	26	48	0.05	28	878	208	3,083	3.36
4	854	29	75	0.08	29	879	213	3,293	3.59
5	855	33	106	0.12	30	880	218	3,509	3.82
6	856	36	140	0.15	31	881	222	3,728	4.06
7	857	39	178	0.19	32	882	227	3,953	4.31
8	858	42	218	0.24	33	883	234	4,183	4.56
9	859	50	264	0.29	34	884	241	4,421	4.82
10	860	58	318	0.35	35	885	247	4,664	5.08
11	861	73	383	0.42	36	886	254	4,915	5.35
12	862	87	463	0.50	37	887	266	5,175	5.64
13	863	105	559	0.61	38	888	277	5,446	5.93
14	864	123	673	0.73	39	889	289	5,729	6.24
15	865	134	802	0.87	40	890	300	6,023	6.56
16	866	145	941	1.03	41	891	309	6,327	6.89
17	867	151	1,089	1.19	42	892	318	6,641	7.23
18	868	157	1,243	1.35	43	893	326	6,962	7.58
19	869	163	1,403	1.53	44	894	335	7,293	7.94
20	870	169	1,569	1.71	45	895	344	7,633	8.31
21	871	174	1,741	1.90	46	896	354	7,982	8.69
22	872	180	1,918	2.09	47	897	363	8,340	9.09
23	873	185	2.100	2.29	48	898	372	8,620	9.40

(Spillway Crest)

*Invert Elevation



NOTES:

1. DRAINAGE AREA - 17.2 SQ.MI.
2. FLOOD CONTROL STORAGE - 8620 ACRE FEET - 9.4 INCHES.
3. 1" RUNOFF = 915 ACRE FEET.
4. INVERT = 842 FEET M S L.

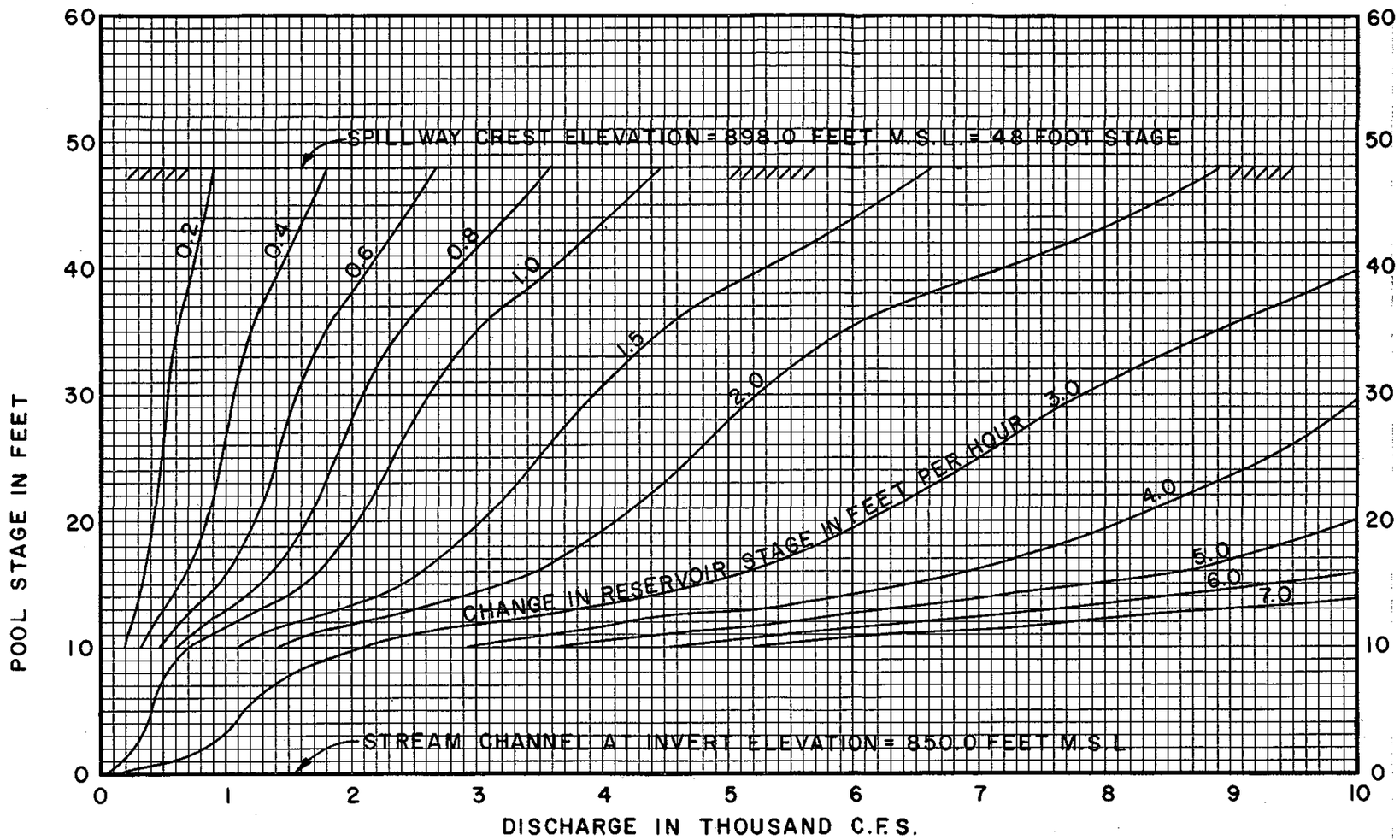
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
HALL MEADOW BROOK DAM

PERCENT FULL CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN

HALL MEADOW BROOK DAM

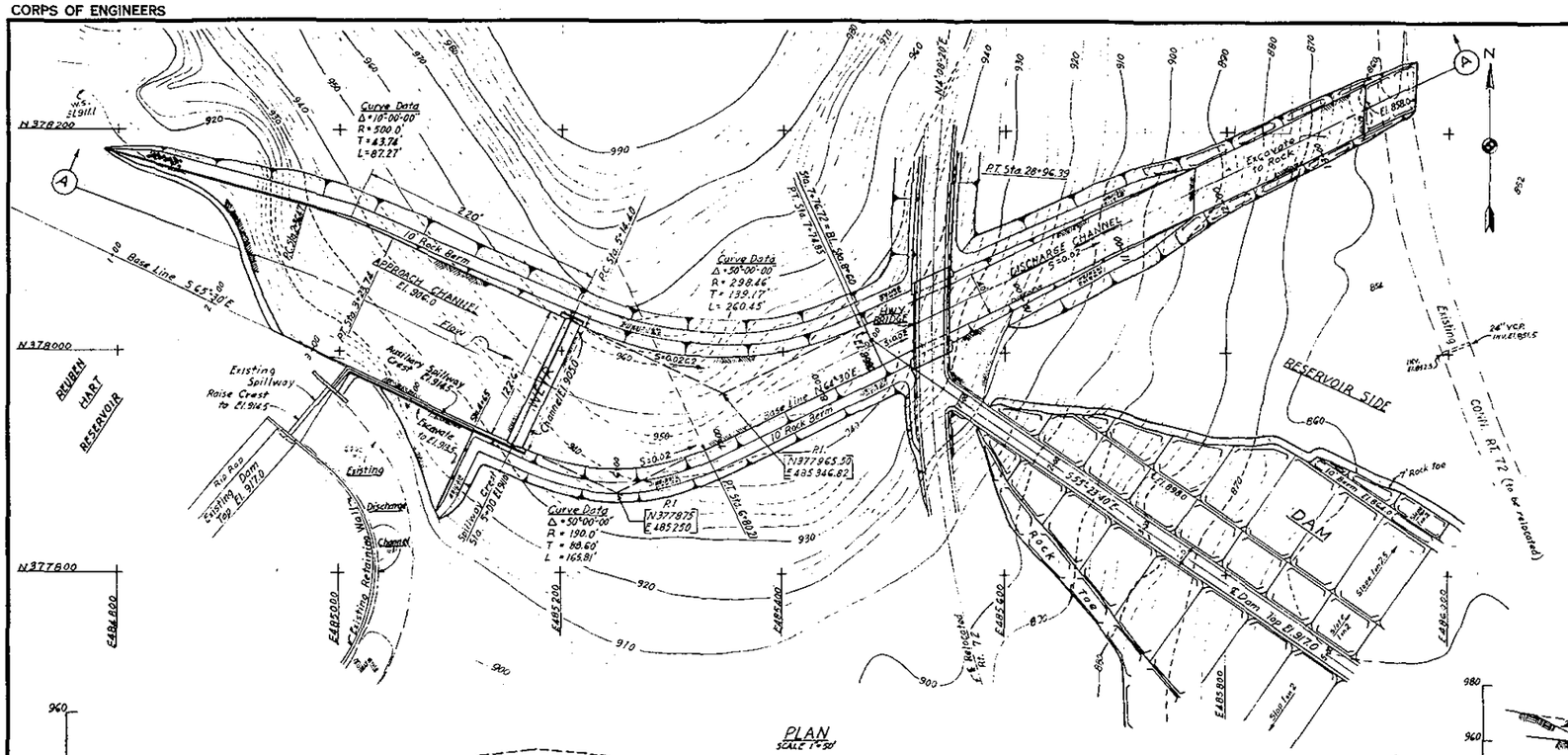
INFLOW CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.

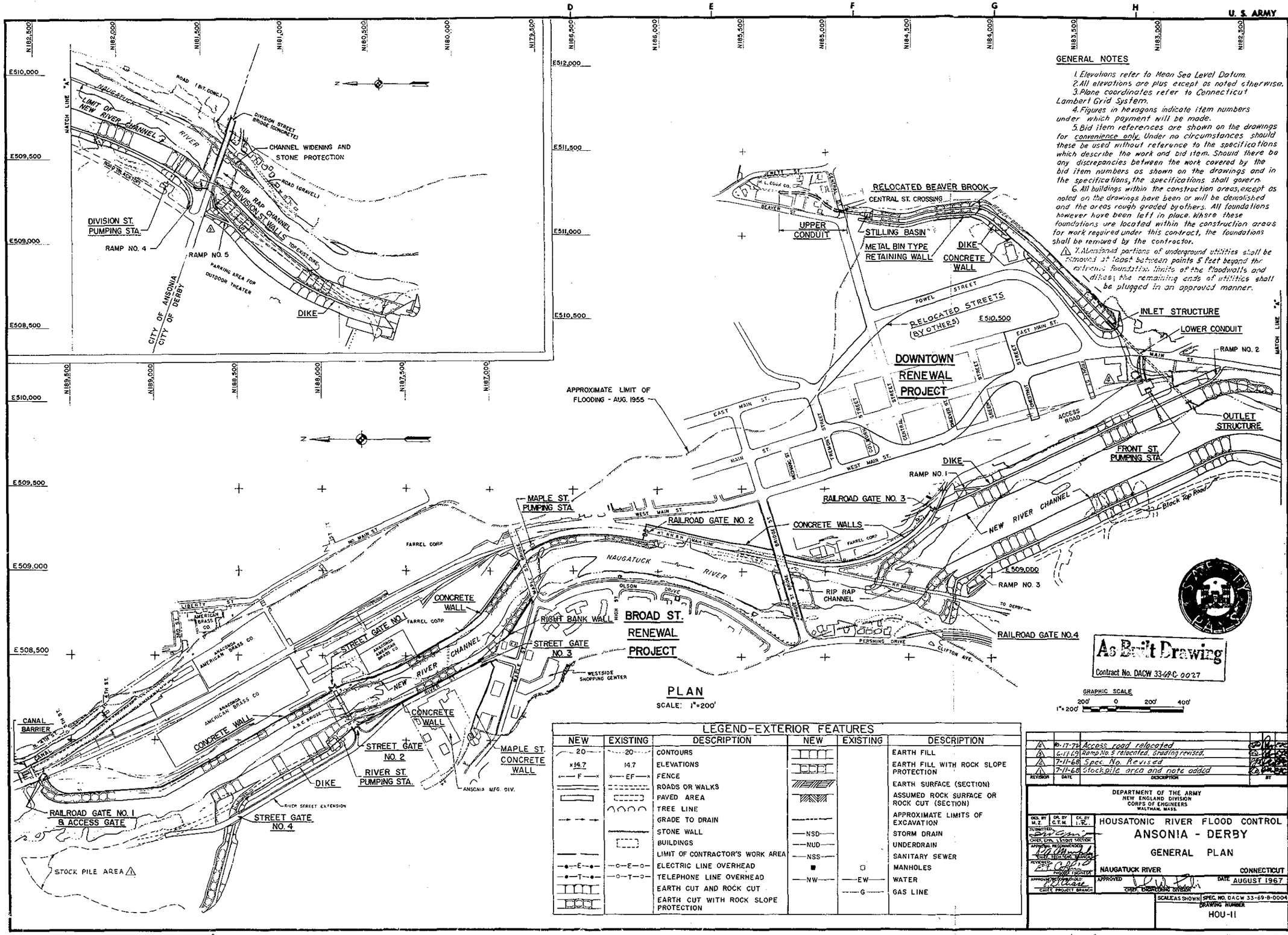
SEPTEMBER 1976

CORPS OF ENGINEERS

U. S. ARMY


PLAN
SCALE 1"=50'
REUBEN HART RESERVOIR
APPROACH CHANNEL
DISCHARGE CHANNEL
RESERVOIR SIDE
DAM
ROCK TOE
Existing Spillway
Raise Crest to El. 914.5
Existing Dam Top El. 917.0
Existing Discharge Channel
Existing Highway Relocation
Base Line S 65°30' E
10' Rock Berm
Curve Data
Δ = 10°00'00"
R = 500.0'
T = 43.74'
L = 87.27'
Curve Data
Δ = 50°00'00"
R = 298.46'
T = 139.17'
L = 260.45'
Curve Data
Δ = 50°00'00"
R = 190.0'
T = 88.60'
L = 165.81'
Excavate to Rock
Excavate to El. 913.5
Auxiliary Spillway Crest El. 914.5
Spillway Crest Sta. 4+00 El. 913.5
Existing Channel El. 920
Existing Highway Relocated Rt. 72
Existing Highway Rt. 72 (to be relocated)
24" VCP Inv. El. 851.5
Inv. El. 853.5
Slope 1 on 2.5
Slope 1 on 2
Dam Top El. 870
E. Dam Toe El. 870
7' Rock Toe
N 378200
N 378000
N 377800
E 484800
E 485000
E 485200
E 485400
E 485600
E 485800
E 486000
E 486200
N 377875
E 485250
N 377965.50
E 485346.82
PT Sta 28+96.39
PC Sta 5+46.40
PT Sta 7+43.85
PC Sta 3+27.74
Sta 7+72 = BL Sta 8+60
Sta 5+00.25
Sta 5+00.02
Sta 8+00.25
Sta 8+00.0
Sta 8+00.02
Sta 8+00.0
Sta 8+00.0
Sta 8+00.0

U. S. ARMY



GENERAL NOTES

1. Elevations refer to Mean Sea Level Datum.
2. All elevations are plus except as noted otherwise.
3. Plane coordinates refer to Connecticut Lambert Grid System.
4. Figures in hexagons indicate item numbers under which payment will be made.
5. Bid item references are shown on the drawings for convenience only. Under no circumstances should these be used without reference to the specifications which describe the work and bid item. Should there be any discrepancies between the work covered by the bid item numbers as shown on the drawings and in the specifications, the specifications shall govern.
6. All buildings within the construction areas, except as noted on the drawings have been or will be demolished and the areas rough graded by others. All foundations however have been left in place. Where these foundations are located within the construction areas for work required under this contract, the foundations shall be removed by the contractor.
7. △1 Abandoned portions of underground utilities shall be removed at least between points 5 feet beyond the extreme foundation limits of the floodwalls and dikes; the remaining ends of utilities shall be plugged in an approved manner.

PLAN

SCALE: 1" = 200'

As Built Drawing
Contract No. DACW 33-69-C-0027

LEGEND-EXTERIOR FEATURES

NEW	EXISTING	DESCRIPTION	NEW	EXISTING	DESCRIPTION
20	20	CONTOURS			EARTH FILL
x14.7	14.7	ELEVATIONS			EARTH FILL WITH ROCK SLOPE PROTECTION
F	EF	FENCE			EARTH SURFACE (SECTION)
		ROADS OR WALKS			ASSUMED ROCK SURFACE OR ROCK CUT (SECTION)
		PAVED AREA			APPROXIMATE LIMITS OF EXCAVATION
		TREE LINE	NSD		STORM DRAIN
		GRADE TO DRAIN	NUD		UNDERDRAIN
		STONE WALL	NSS		SANITARY SEWER
		BUILDINGS			MANHOLES
		LIMIT OF CONTRACTOR'S WORK AREA	NW	EW	WATER
E	E	ELECTRIC LINE OVERHEAD		G	GAS LINE
T	T	TELEPHONE LINE OVERHEAD			
		EARTH CUT AND ROCK CUT			
		EARTH CUT WITH ROCK SLOPE PROTECTION			

REVISION	DATE	DESCRIPTION	BY
△4	10-17-72	Access road relocated	
△3	6-11-69	Ramp No. 5 relocated. Grading revised.	
△2	7-11-68	Spec. No. Revised	
△1	7-11-68	Stockpile area and note added	

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

DES. BY M.Z. | DR. BY C.T.M. | CK. BY I.R.

SUBMITTED: CHIEF, ENG. LIAISON SECTION
APPROVAL RECOMMENDED: CHIEF, TECHNICAL BRANCH
REVIEWED: CHIEF, HYDROLOGY
APPROVED RECOMMENDED: CHIEF, PROJECT BRANCH
APPROVED: CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
GENERAL PLAN

NAUGATUCK RIVER — CONNECTICUT

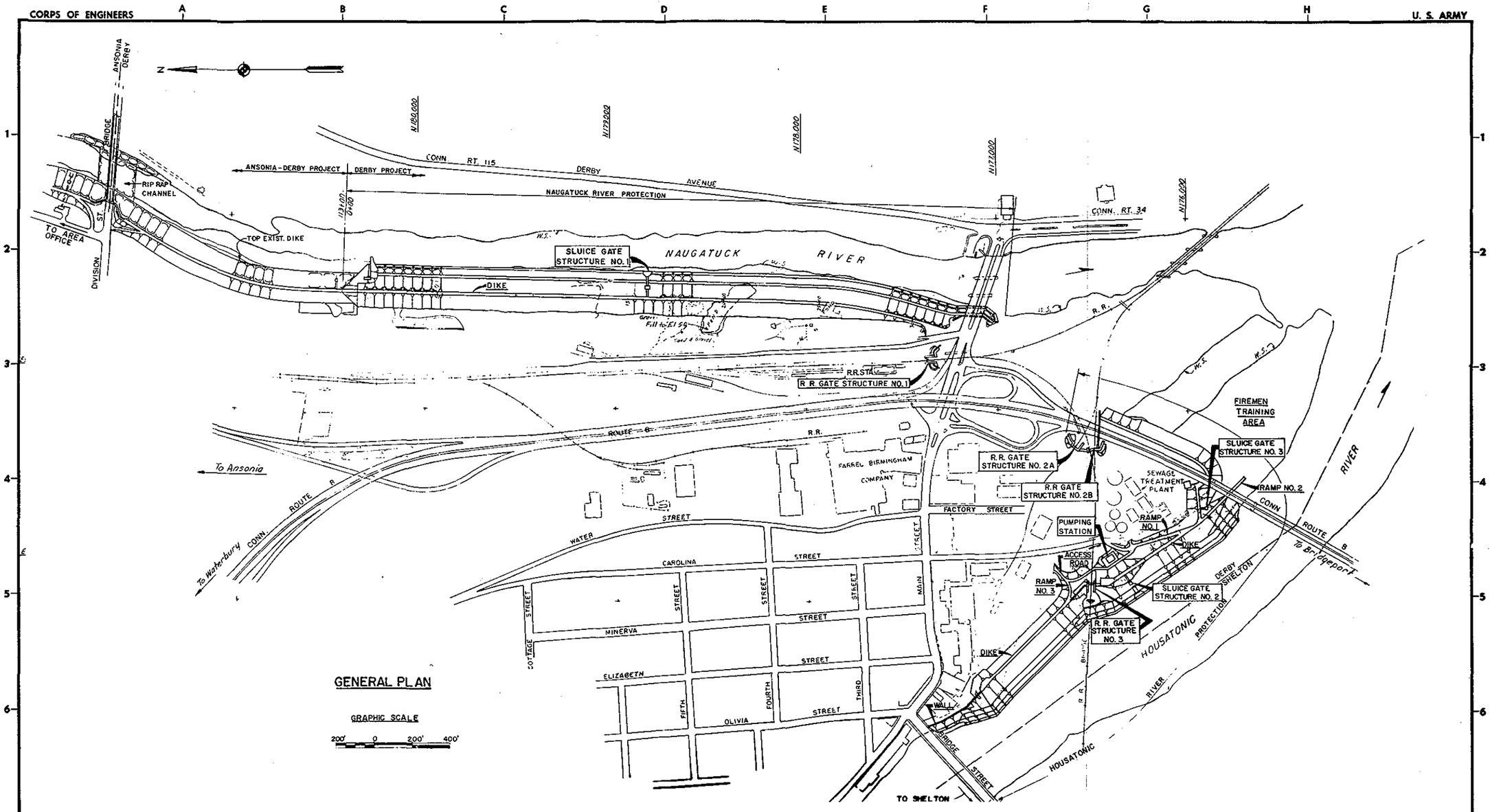
DATE: AUGUST 1967

SCALE: AS SHOWN | SPEC. NO. DACW 33-69-B-0004 △3

DRAWING NUMBER
HOU-11

PLATE 70 △2

CORPS OF ENGINEERS U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

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

DWG. BY J.C. | DEL. BY C.T.M. | CK. BY M.Z.

SUBMITTED: CHIEF, LAYOUT SECTION

APPROVAL RECOMMENDED: CHIEF, ECON. DEV. BRANCH

REVIEWED: PROJECT ENGINEER

HOUSATONIC RIVER FLOOD CONTROL
DERBY
GENERAL PLAN
HOUSATONIC AND NAUGATUCK RIVERS CONNECTICUT

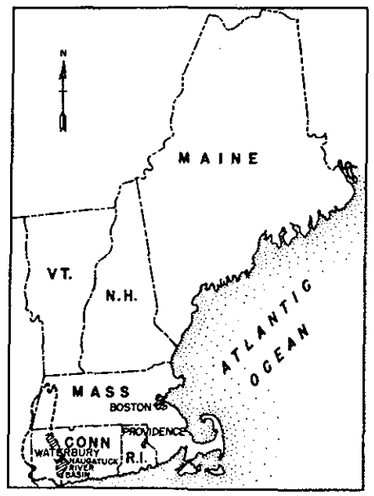
APPROVED: CHIEF, ENGINEERING DIVISION DATE

SCALE 1" = 200' SPEC. NO.
DRAWING NUMBER

PLATE 71.

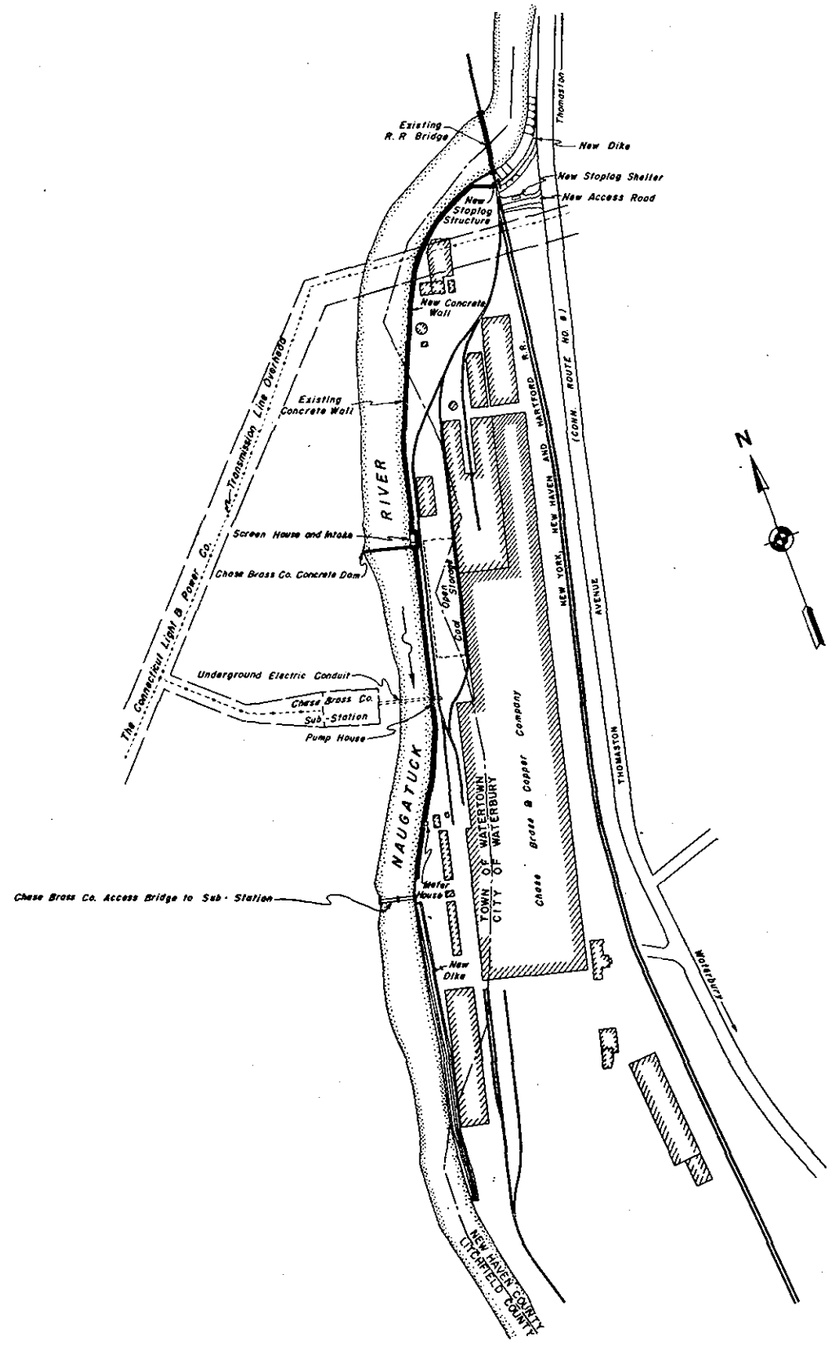
CORPS OF ENGINEERS

U. S. ARMY



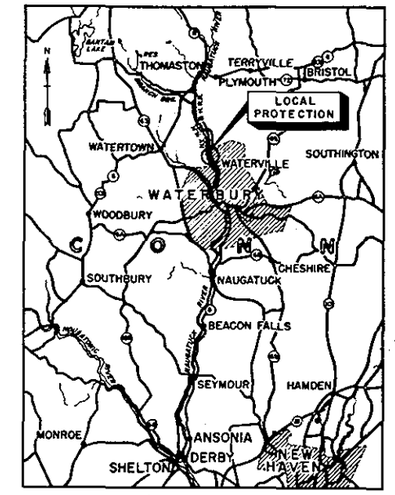
LOCATION MAP

SCALE IN MILES
50 0 50 100



PROJECT PLAN

SCALE IN FEET
200' 0 200' 400'



VICINITY MAP

SCALE IN MILES
1 0 1 2 4 6 8 10

INDEX TO DRAWINGS

SHEET NO.	TITLE	DRAWING NO.
1	PROJECT PLAN AND INDEX	HC-1-1300
2	GENERAL PLAN AND PROFILE NO. 1	HC-1-1301
3	GENERAL PLAN AND PROFILE NO. 2	HC-1-1302
4	GENERAL PLAN AND PROFILE NO. 3	HC-1-1303
5	DETAIL PLAN, DIKE AND ACCESS ROAD	HC-1-1304
6	DETAIL PLAN, SECTIONS AND EXPLORATIONS	HC-1-1305
7	STOPLOG STRUCTURE	HC-1-1306
8	STRUCTURAL DETAILS NO. 1	HC-1-1307
9	STRUCTURAL DETAILS NO. 2	HC-1-1308
10	STRUCTURAL DETAILS NO. 3	HC-1-1309
11	SCREEN HOUSE AND STOPLOG SHELTER	HC-1-1385
12	MISCELLANEOUS DETAILS	HC-1-1386
1	ALUM. COVERS & PIPE DRAIN	SKETCH

Record Drawing
Contract No. DA-19-016-CIV ENG 61-55

REVISION	DATE	DESCRIPTION	BY
	1-18-62	Final Field Correction	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY C.N.C. | DR. BY C.T.M. | CK. BY

PROJECT ENGINEER

SUBMITTED BY

CHIEF, PLANN. AND REPORTS BRANCH

RECOMMENDED

CHIEF, DESIGN BRANCH

APPROVED

CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
WATERBURY & WATERTOWN, CONN.
LOCAL PROTECTION PROJECT
PROJECT PLAN AND INDEX
NAUGATUCK RIVER CONNECTICUT
DATE SEPT. 1960

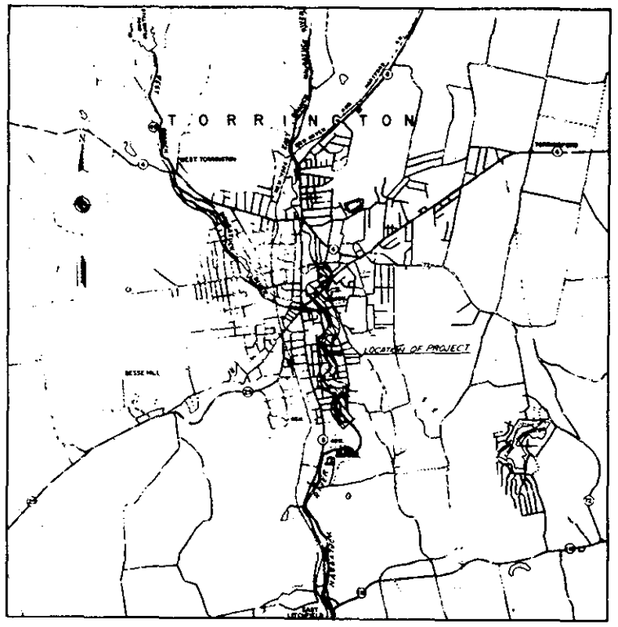
SCALE AS SHOWN | SPEC. NO. CIV ENG.-19-016-61-9

DRAWING NUMBER
HC-1-1300
SHEET 1 OF 12

PLATE 72

CORPS OF ENGINEERS

U. S. ARMY

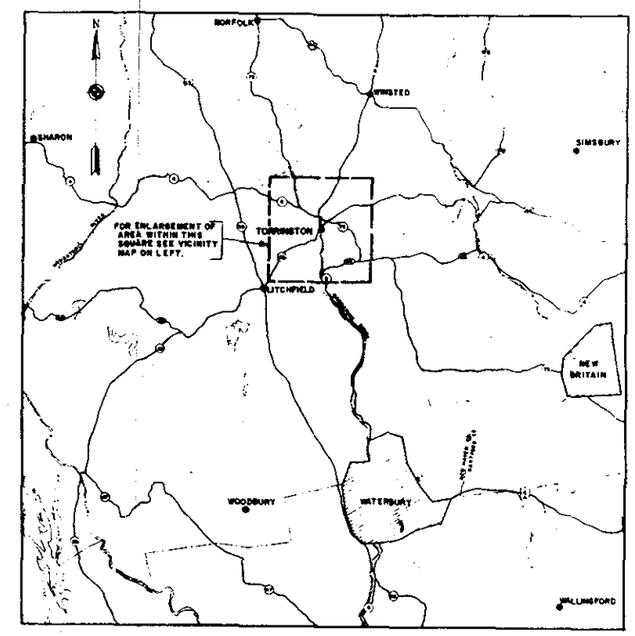


VICINITY MAP

SCALE IN MILES

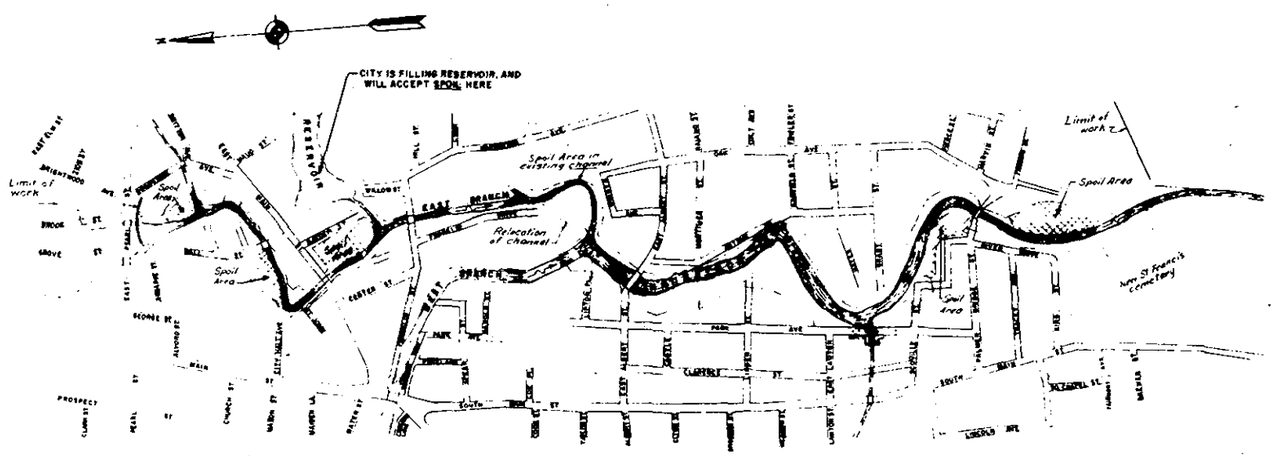
INDEX TO DRAWINGS

SHEET NO.	TITLE	FILE NO.
1	LOCATION PLAN	HC-1-1056
2	RECORD OF EXPLORATIONS	HC-1-1057
3	TYPICAL CROSS SECTIONS	HC-1-1058
4	TYPICAL CROSS SECTIONS	HC-1-1059
5	TYPICAL CROSS SECTIONS	HC-1-1060
6	PLAN AND PROFILE NO. 1	HC-1-1061
7	PLAN AND PROFILE NO.2	HC-1-1062
8	PLAN AND PROFILE NO.3	HC-1-1063
9	PLAN AND PROFILE NO.4	HC-1-1064
10	RIGHT OF WAY PLAN	HC-1-1065
11	DRAINAGE DETAILS	HC-1-1066
12	UNDERPINNING & RETAINING WALL DETAILS	HC-1-1067
13	RETAINING WALLS DETAILS	HC-1-1068



LOCATION MAP

SCALE IN MILES



WORK AND SPOIL AREAS

SCALE IN FEET

SPOIL AREAS

WORK AREA

Record Drawing

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS U S ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR BY | TR BY | CK BY

GREEN ENGINEERING AFFILIATES, INC BOSTON, MASS

SUBMITTED BY: VICE PRESIDENT

APPROVED: CHIEF ENGINEERING BR

HOUSATONIC RIVER FLOOD CONTROL
TORRINGTON, CONNECTICUT
LOCAL PROTECTION
LOCATION PLAN
EAST BR. AND NAUGATUCK R. CONNECTICUT

APPROVED: LT. COL. C.E. ASST. DIVISION ENGINEER

DATE MAY, 1957

SCALE AS SHOWN

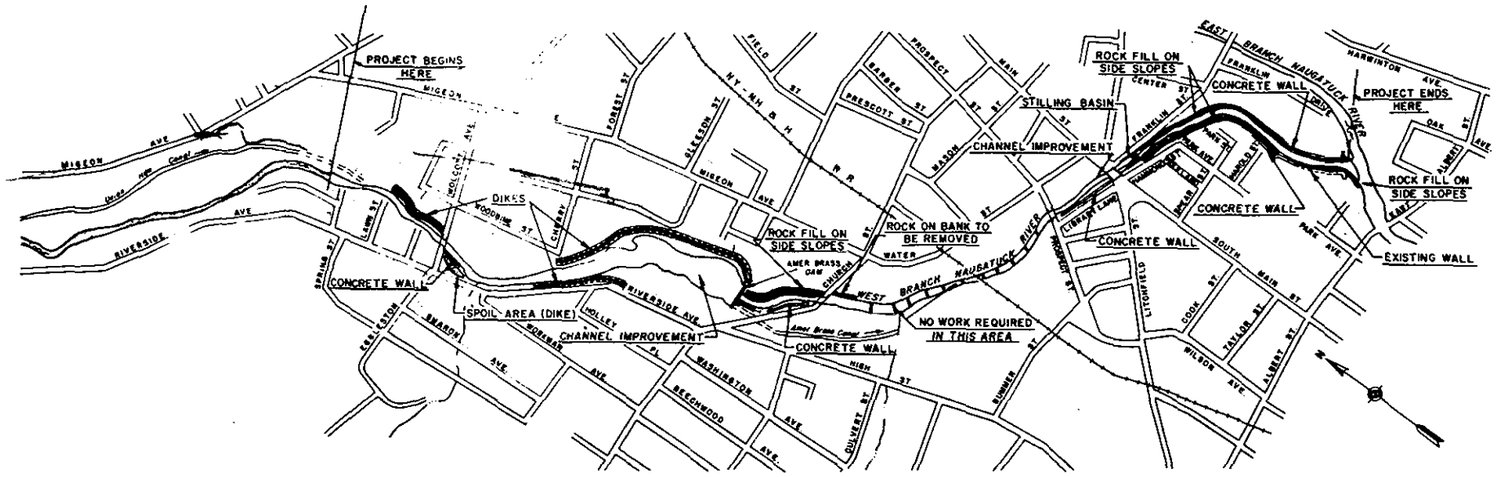
DRAWING NUMBER HC-1-1056

SHEET 1 OF 13

PLATE 73

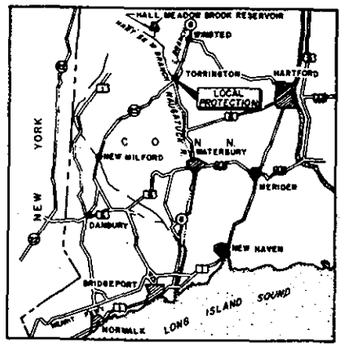
CORPS OF ENGINEERS

U.S. ARMY



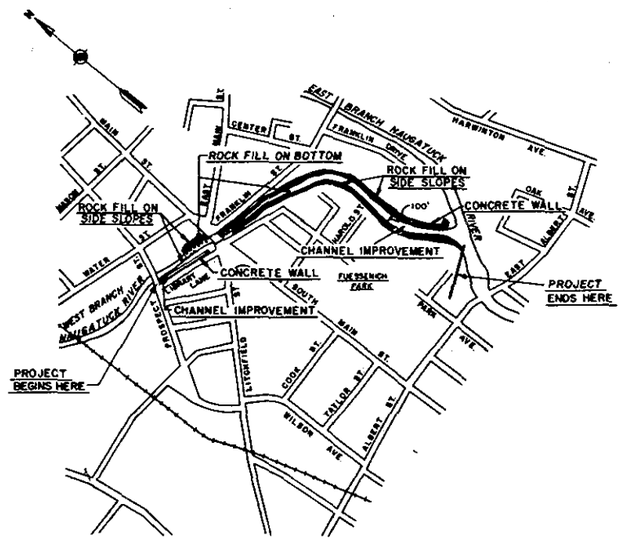
GENERAL PLAN-PROJECT (DALE ST. TO CONFLUENCE)

SCALE 1" = 400'



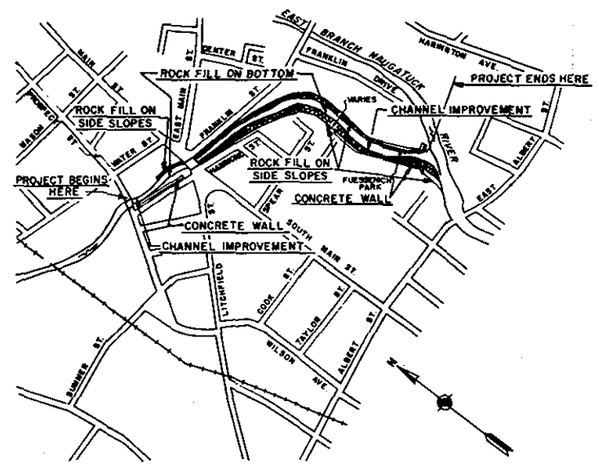
VICINITY MAP

SCALE IN MILES



GENERAL PLAN-NO. VII (PROSPECT ST. TO CONFLUENCE)

SCALE: 1" = 400'



GENERAL PLAN-NO. IX (PROSPECT ST. TO CONFLUENCE)

SCALE: 1" = 400'

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON MASS.

DR. BY | TR. BY F.L.C. | CK. BY

PROJECT ENGINEER

APPROVED BY

CHIEF ENGINEERING DIV.

HOUSATONIC RIVER BASIN
TORRINGTON, CONNECTICUT

LOCAL PROTECTION
GENERAL PLANS

WEST BR. NAUGATUCK RIVER CONN.

APPROVED

LT. COL. C.E. EXECUTIVE OFFICER

DATE JULY 1958

SCALE AS SHOWN

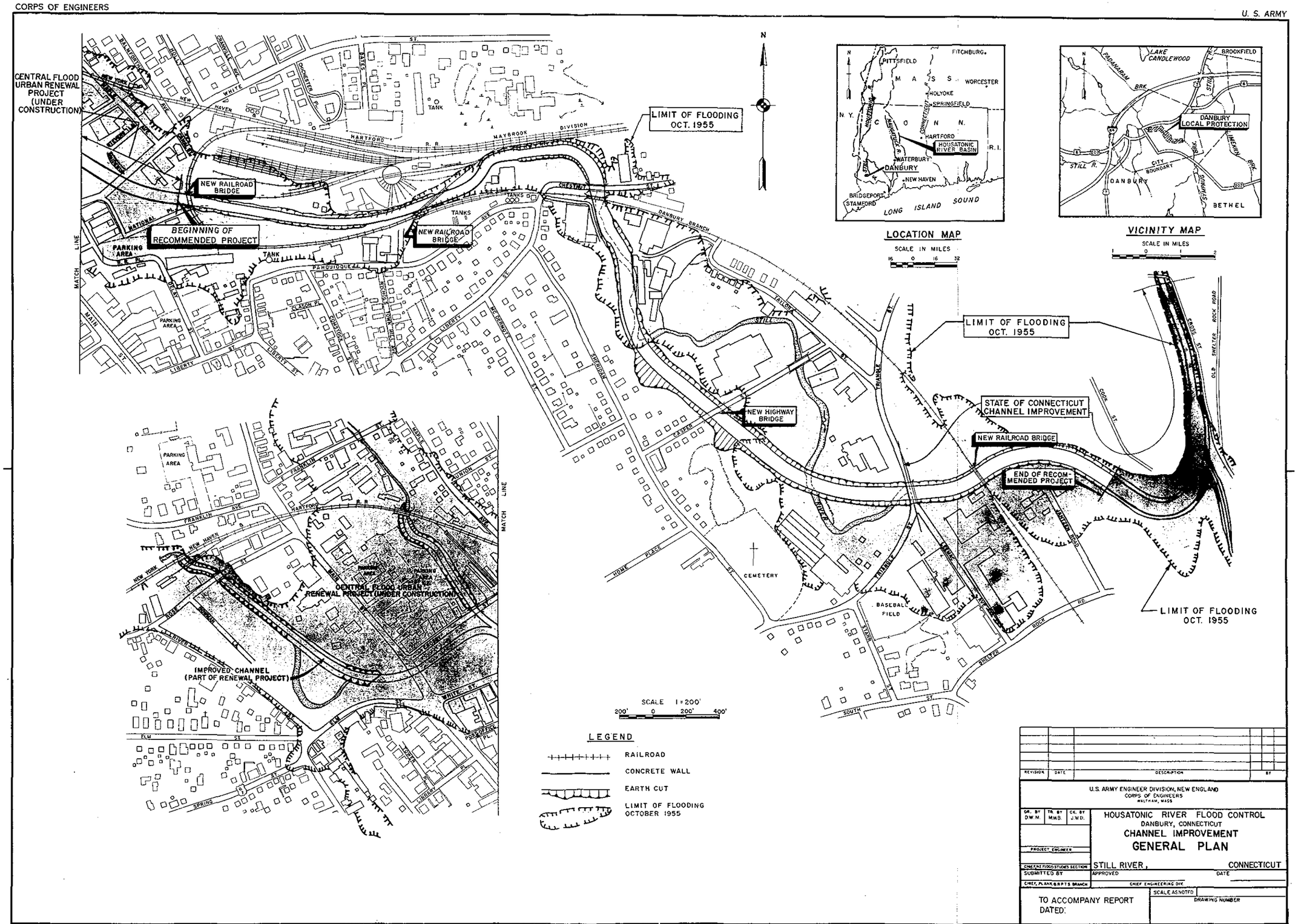
DRAWING NUMBER
HC-1-1343

SHEET 1 OF 1

PLATE 74

CORPS OF ENGINEERS

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

GR. BY	TR. BY	CK. BY
DW.M.	MWB	J.W.D.

PROJECT ENGINEER

CHIEF, NE FLOOD STUDIES SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS BRANCH

HOUSATONIC RIVER FLOOD CONTROL
DANBURY, CONNECTICUT
CHANNEL IMPROVEMENT
GENERAL PLAN

STILL RIVER, CONNECTICUT

APPROVED DATE

CHIEF ENGINEERING DIV.

TO ACCOMPANY REPORT DATED:

SCALE AS NOTED

DRAWING NUMBER

PLATE 75

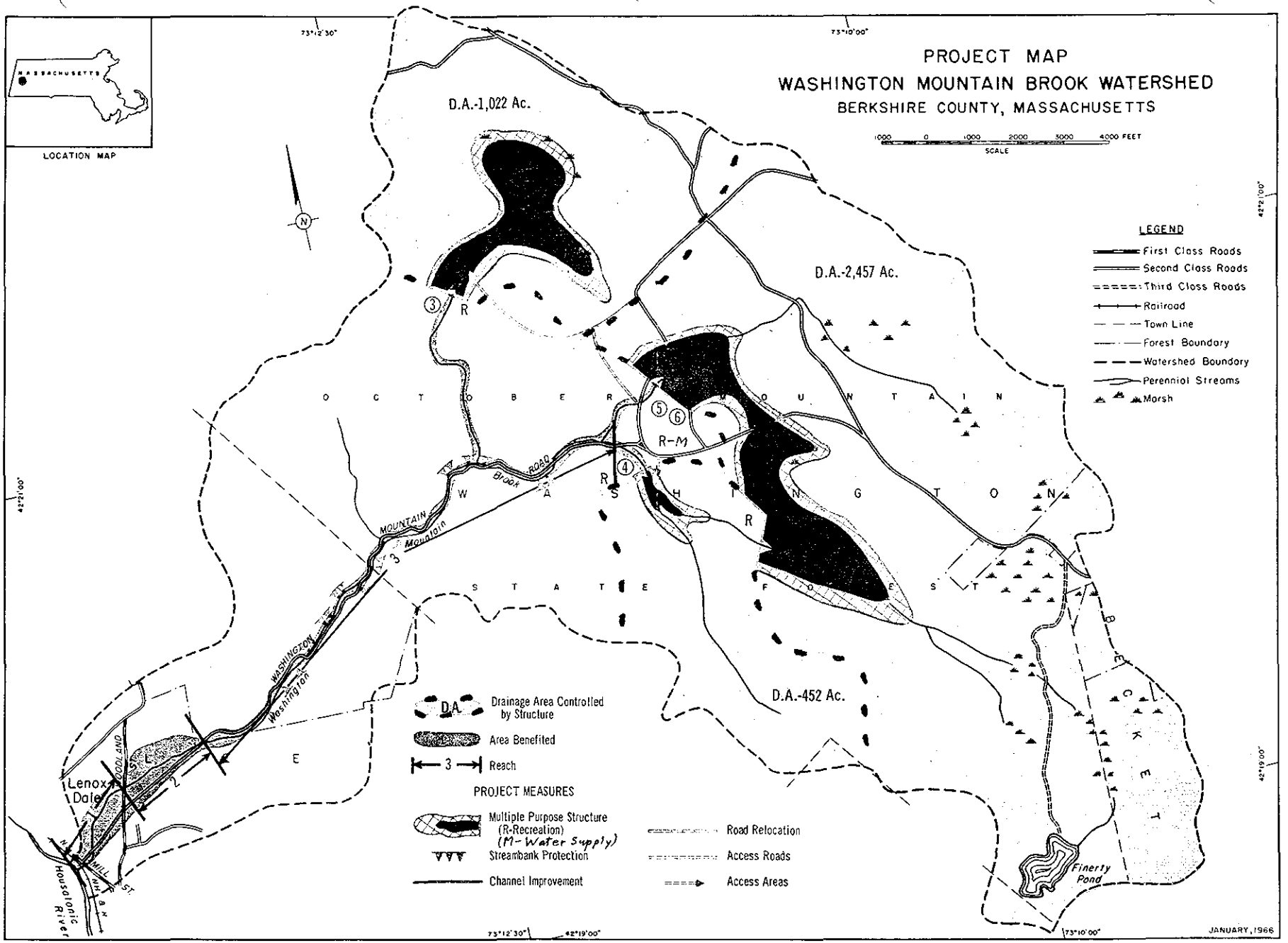
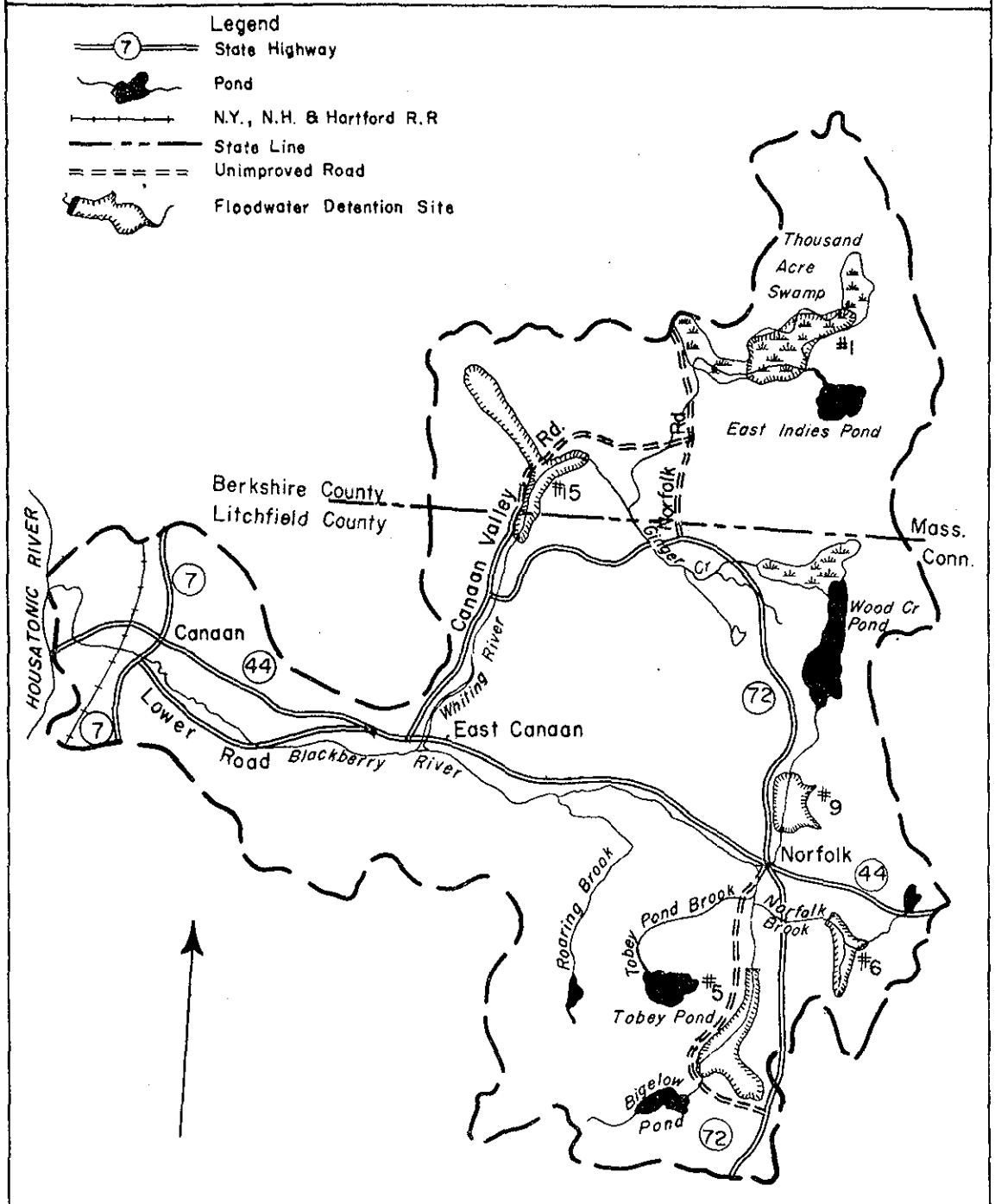

PROJECT MAP
WASHINGTON MOUNTAIN BROOK WATERSHED
BERKSHIRE COUNTY, MASSACHUSETTS
SCALE
1000 0 1000 2000 3000 4000 FEET
LOCATION MAP
MASSACHUSETTS
D.A.-1,022 Ac.
D.A.-2,457 Ac.
D.A.-452 Ac.
OCTOBER MOUNTAIN
WASHINGTON
STATE FOREST
R
R-M
Brook
ROAD
MOUNTAIN
Mountain
WASHINGTON
Washington
Lenox Dale
MILL ST.
Housatonic River
Finerty Pond
LEGEND
First Class Roads
Second Class Roads
Third Class Roads
Railroad
Town Line
Forest Boundary
Watershed Boundary
Perennial Streams
Marsh
Drainage Area Controlled by Structure
Area Benefited
Reach
PROJECT MEASURES
Multiple Purpose Structure (R-Recreation) (M-Water Supply)
Streambank Protection
Channel Improvement
Road Relocation
Access Roads
Access Areas
JANUARY, 1966

PLATE 76

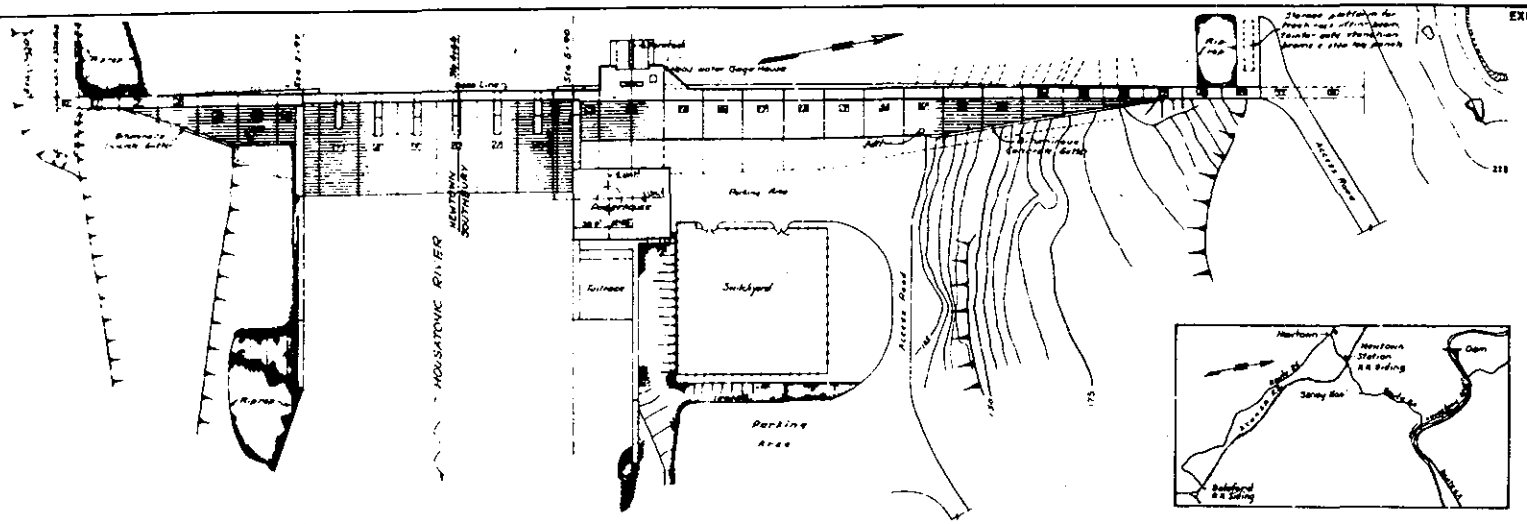
STRUCTURE LOCATION MAP
BLACKBERRY RIVER WATERSHED



SCALE 1" = 1.5 MI.

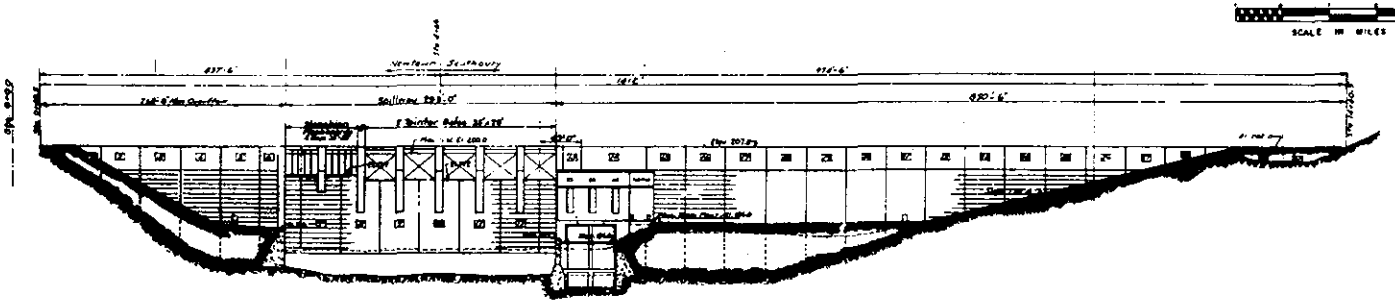
REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE	FIGURE NO. 2
USGS QUAD. MAPS	SOIL CONSERVATION SERVICE	WATERSHED CN.3
	D.A.WILLIAMS - ADMINISTRATOR	DATE: 10-15-58

EXHIBIT L

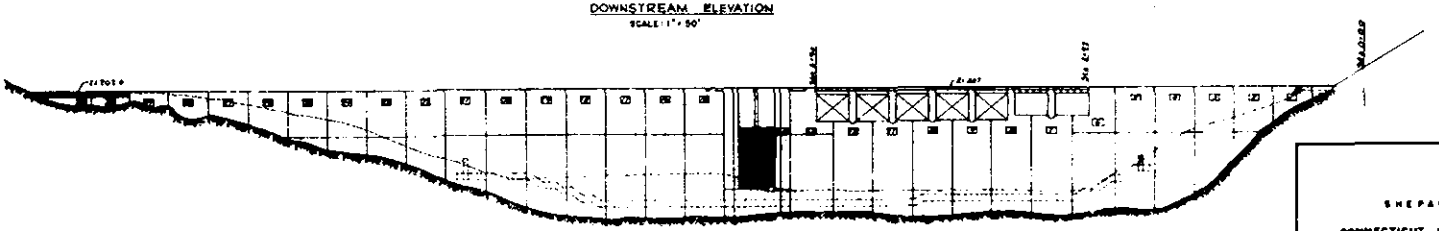


PLAN
SCALE: 1" = 50'

KEY PLAN
Scale 1" = 1 Mile
SCALE IN MILES



DOWNSTREAM ELEVATION
SCALE: 1" = 50'



UPSTREAM ELEVATION
Scale 1" = 50'
SCALE IN FEET

EXHIBIT L SHEET 3
THIS DRAWING IS PART OF THE APPLICATION FOR LICENSE MADE BY THE UNDERSIGNED THIS ____ DAY OF _____ 1964
CONNECTICUT LIGHT & POWER CO
BY: [signature]

SHEPAUG PROJECT
CONNECTICUT LIGHT & POWER CO
CHAS T MAIN, INC ENGINEERS

PLATE 78

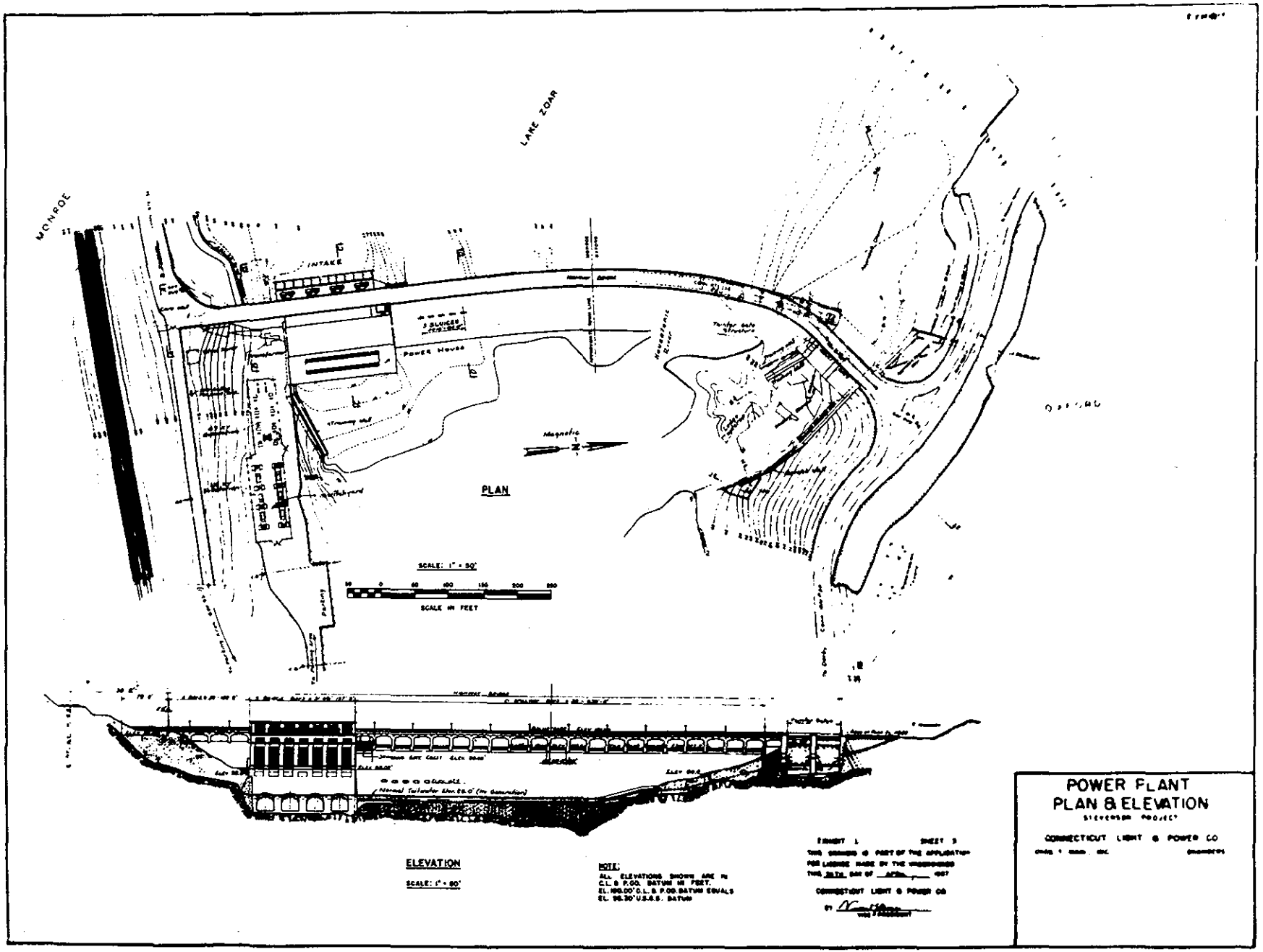

LAKE ZOAR
MONROE
INTAKE
SLUICES
POWER HOUSE
Housatonic River
Magnetic
N
PLAN
SCALE: 1" = 50'
SCALE IN FEET
ELEVATION
SCALE: 1" = 50'
NOTE:
ALL ELEVATIONS SHOWN ARE IN C.L. & P.CO. DATUM IN FEET.
EL. 100.00' C.L. & P.CO. DATUM EQUALS EL. 98.30' U.S.G.S. DATUM
EXHIBIT 1
SHEET 3
CONNECTICUT LIGHT & POWER CO
POWER PLANT
PLAN & ELEVATION
STEVENSON PROJECT
CONNECTICUT LIGHT & POWER CO

PLATE 79

ANNUAL PRECIPITATION
HOUSATONIC RIVER BASIN
(Depth in Inches)

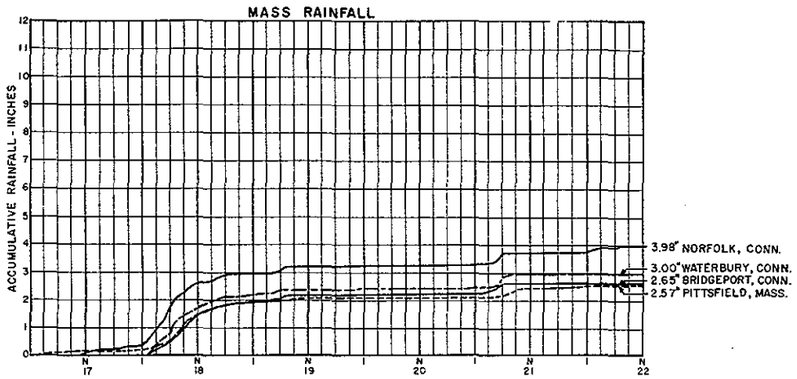
CALENDAR YEAR	PITTSFIELD, MASS. (Elevation 1,037 ft msl) 73 Years of Record Through 1970	DANBURY, CONN. (Elevation 510 ft msl) 33 Years of Record Through 1975	ANSONIA, CONN. (Elevation 20 ft msl) 32 Years of Record Through 1975	CREAM HILL, CONN. (Elevation 1,300 ft msl) 76 Years of Record Through 1972	NORFOLK, CONN. (Elevation 1,380 ft msl) 43 Years of REcord Through 1975
1895	35.11	-	-	-	-
1896	40.41	-	-	-	-
1897	53 93	-	-	49.32	-
1898	58.13(3)	-	-	48.24	-
1899	41.39	-	-	37.54	-
1900	41.08	-	-	45.17	-
1901	48.26	-	-	56.94	-
1902	46.04	-	-	61.43	-
1903	46.97	-	-	56.88	-
1904	36.66	-	-	48.20	-
1905	39.55	-	-	45.75	-
1906	40.27	-	-	46.31	-
1907	42.36	-	-	55.80	-
1908	30.89	-	-	40.26	-
1909	38.62	-	-	44.75	-
1910	37.54	-	-	45.65	-
1911	37.29	-	-	44.41	-
1912	43.17	-	-	44.87	-
1913	37.13	-	-	43.09	-
1914	33.16	-	-	36.04	-
1915	43.22	-	-	53.91	-
1916	41.02	-	-	42.49	-
1917	34.73	-	-	39.02	-
1918	40.11	-	-	42.61	-
1919	45.0	-	-	47.07	-
1920	44.20	-	-	56.00	-
1921	42.92	-	-	45.56	-
1922	48.67	-	-	44.30	-
1923	43.14	-	-	43.63	-
1924	34.34	-	-	40.86	-
1925	40.42	-	-	43.10	-
1926	42.92	-	-	43.40	-
1927	48.67	-	-	53.18	-
1928	43.14	-	-	49.45	-
1929	34.34	-	-	42.69	-
1930	30.46	-	-	37.86	-
1931	42.48	-	-	42.56	-
1932	40.84	-	-	50.88	57.96
1933	41.72	-	-	44.24	42.33
1934	42.40	-	-	47.64	58.31
1935	35.26	-	-	35.65	38.06
1936	44.48	-	-	51.36	55.09
1937	45.65	-	-	57.88	60.17
1938	46.47	66.39	-	60.45	64.02
1939	34.59	45.47	-	40.18	42.11
1940	35.02	44.22	-	45.54	51.89
1941	32.52	-	-	37.29	46.16
1942	44.49	-	54.41	51.45	53.18
1943	40.53	-	41.85	39.77	42.27
1944	42.82	-	47.40	42.00	45.38
1945	46.25	-	52.92	64.26(3)	69.21
1946	38.72	39.40	38.48	34.50	39.68
1947	42.50	50.96	-	40.91	-
1948	-	47.75	49.30	47.07	48.40
1949	(1)	37.46	40.09	-	43.99
1950	-	45.17	45.84	43.75	53.21
1951	47.18	53.40	56.48	-	60.74
1952	43.88	61.39	52.81	44.64	56.37
1953	44.37	50.14	47.41	55.31	58.78
1954	47.50	49.21	49.17	50.14	55.39
1955	44.75	67.15(3)	58.90	63.98	76.00(3)
1956	41.71	45.47	43.89	40.16	51.16
1957	34.59	44.05	39.60	34.69	40.61
1958	40.28	49.17	52.37	42.37	53.79
1959	40.51	49.14	46.71	50.17	59.10
1960	42.77	46.35	48.74	50.03	59.87
1961	33.48	43.40	46.18	38.70	48.53
1962	29.59	41.72	39.72	30.79	40.92
1963	44.00	48.80	-	46.60	42.50
1964	28.58(4)	35.90	35.62	28.38	39.62
1965	33.13	31.85(4)	29.94(4)	28.11(4)	33.89(4)
1966	38.35	33.85	36.80	33.37	45.63
1967	40.04	44.89	40.51	44.52	49.47
1968	-	45.23	46.50	36.82	48.58
1969	-	44.49	45.19	53.40	59.71
1970	-	38.55	36.74	30.53	43.39
1971	(2)	46.30	47.12	38.29	48.48
1972	-	63.46	60.90(3)	53.06	66.81
1973	-	58.33	56.12	(2)	60.00
1974	-	51.00	50.36	-	52.55
1975	-	59.63	55.37	-	63.76
MEAN ANNUAL	40.77	47.86	46.67	45.23	51.79

(1) Station moved to Airport
(2) Station discontinued
(3) Maximum annual
(4) Minimum annual

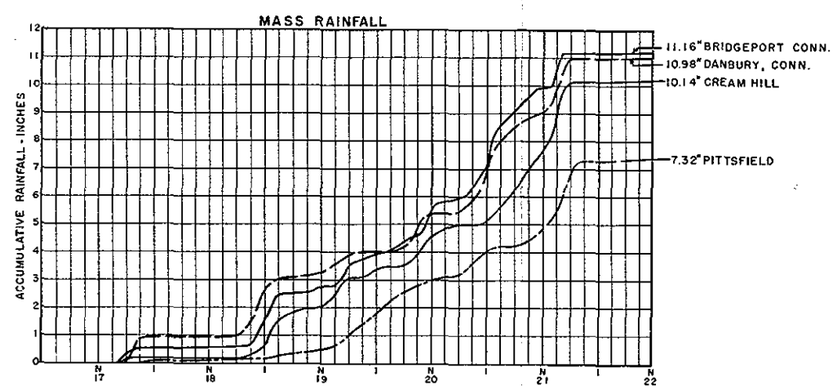
ANNUAL RUNOFF
HOUSATONIC RIVER BASIN

Water Year	NAUGATUCK RIVER AT BEACON FALLS, CT (D.A. = 261 SQ. MI.) 1918-1974		HOUSATONIC RIVER AT STEVENSON, CT (D.A. = 1,545 SQ. MI.) 1928-1974		HOUSATONIC RIVER NEAR GREAT BARRINGTON, MA (D.A. = 280 SQ. MI.) 1913-1974		STILL RIVER NEAR LANESVILLE, CT (D.A. = 68.5 SQ. MI.) 1932-1971	
	CFS	Inches	CFS	Inches	CFS	Inches	CFS	Inches
1914	-	-	-	-	549	26.64	-	-
1915	-	-	-	-	382	18.48	-	-
1916	-	-	-	-	604	29.36	-	-
1917	-	-	-	-	459	22.22	-	-
1918	-	-	-	-	389	18.85	-	-
1919	379	20.98	-	-	517	25.07	-	-
1920	592	32.86	-	-	695	33.82	-	-
1921	517	28.41	-	-	560	27.13	-	-
1922	364	20.20	-	-	593	28.77	-	-
1923	398	21.76	-	-	471	22.86	-	-
1924	471	26.17	-	-	585	28.44	-	-
1925	-	-	-	-	435	21.08	-	-
1926	-	-	-	-	479	23.21	-	-
1927	-	-	-	-	520	25.22	-	-
1928	-	-	-	-	962	46.80(2)	-	-
1929	379	21.75	2260	20.31	575	27.88	-	-
1930	280	15.42	1620	14.28	355	17.25	-	-
1931	305	16.87	1990	17.56	391	18.96	-	-
1932	245	13.62	1700	14.90	404	19.65	61	12.18
1933	496	27.41	2950	25.96	588	28.48	124	24.67
1934	452	24.92	2600	22.97	523	25.35	112	22.15
1935	474	26.10	2521	21.89	533	25.85	100	19.91
1936	412	22.66	2433	21.47	510	24.79	99	19.73
1937	519	28.69	2960	26.05	589	28.55	138	27.23
1938	686	37.81	3956	34.93(2)	744	36.10	180	35.61
1939	536	29.45	3010	26.21	553	26.82	146	28.88
1940	505	27.77	2651	23.36	508	24.67	119	23.63
1941	324	17.52	1718	15.11	293	14.20	87	17.18
1942	383	20.97	1958	17.46	416	20.18	92	18.22
1943	514	28.25	3017	26.43	649	31.46	127	25.08
1944	339	18.52	1908	17.02	408	19.84	91	17.99
1945	605	33.27	3459	30.40	731	35.43	141	27.86
1946	495	26.98	2495	21.74	489	23.73	114	22.49
1947	411	22.08	2136	18.89	488	23.67	104	20.51
1948	496	27.01	2683	23.76	551	26.78	138	27.50
1949	511	27.77	2442	21.55	493	23.92	105	20.84
1950	382	20.69	1983	17.35	408	19.77	76	15.01
1951	577	31.47	2979	26.33	574	27.86	136	26.87
1952	720	39.64	3876	34.21	664	32.28	197	39.07(2)
1953	656	35.54	3363	29.41	566	27.47	165	32.68
1954	434	23.14	2178	19.62	466	22.61	89	17.69
1955	763	41.67(1)	3399	29.99	590	28.62	157	31.15
1956	774	39.98	3698	33.15	683	33.21	194	38.46
1957	307	15.07	1657	14.51	354	17.13	89	17.58
1958	543	27.99	2542	22.69	463	22.44	138	27.46
1959	454	23.13	2308	20.34	441	21.38	101	20.02
1960	625	32.35	3248	28.61	703	34.20	132	26.12
1961	539	28.03	2641	23.21	481	23.32	129	25.74
1962	369	19.23	1664	14.63	325	15.73	92	18.51
1963	356	18.47	1702	14.96	334	16.21	90	18.10
1964	378	20.04	1838	16.21	389	18.92	92	18.44
1965	224	11.66(3)	970	8.52(3)	211	10.21(3)	62	12.49
1966	234	12.20	1272	11.17	328	15.90	55	10.99(3)
1967	462	24.06	2375	20.87	471	22.84	95	18.37
1968	524	27.43	2476	21.82	480	23.34	129	25.07
1969	516	26.88	2755	24.16	565	27.41	109	21.23
1970	522	27.09	2673	23.51	505	24.50	121	23.49
1971	423	21.99	2174	19.21	439	21.30	112	21.81
1972	795	41.74	3768	33.35	737	35.86	-	-
1973	803	42.10(2)	3826	33.67	728	35.31	- (4)	-
1974	594	31.15	3078	27.10	673	32.65	-	-
MEAN ANNUAL	482	25.92	2542	22.42	518	25.11	116	22.95

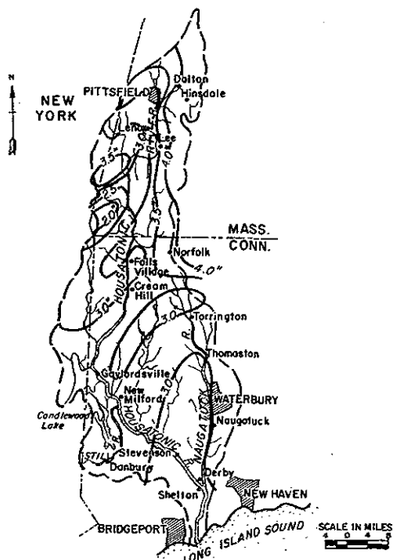
(1) Gage relocated downstream prior to 1 October 1955, D.A. = 246 Sq. Mi.
(2) Maximum Annual Runoff for period of record.
(3) Minimum Annual Runoff for period of record.
(4) Station discontinued.



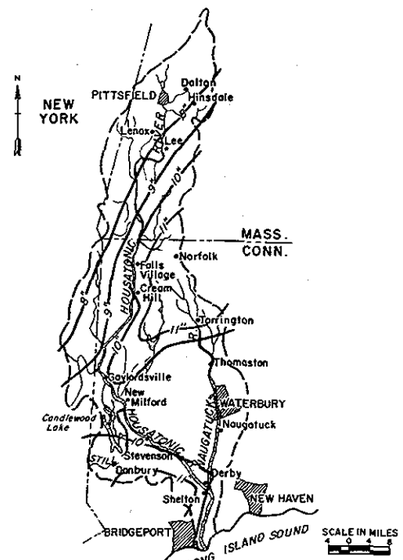
MARCH 1936



SEPTEMBER 1938



ISOHYETAL MAP
STORM OF MARCH 16-22, 1936



ISOHYETAL MAP
STORM OF SEPTEMBER 17-21, 1938

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANS & RPTS. BRANCH

HOUSATONIC RIVER RESERVOIR REGULATION MANUAL

STORMS OF
MARCH 1936 & SEPTEMBER 1938

HOUSATONIC RIVER, MASS. & CONN.

APPROVED

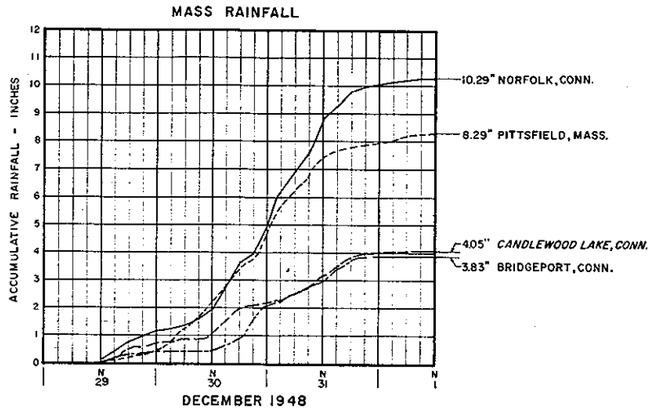
CHIEF ENGINEERING DIV.

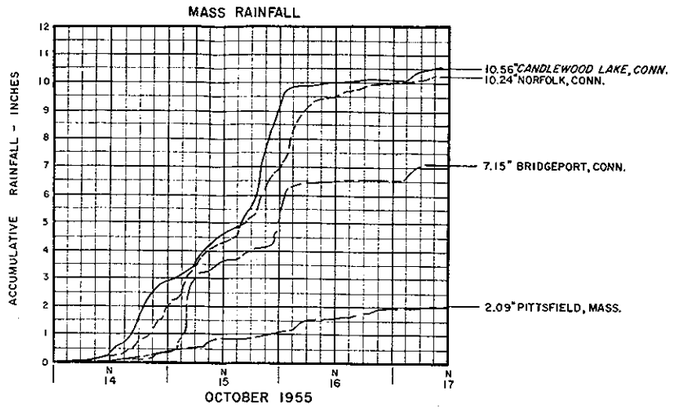
DATE JUNE 1964

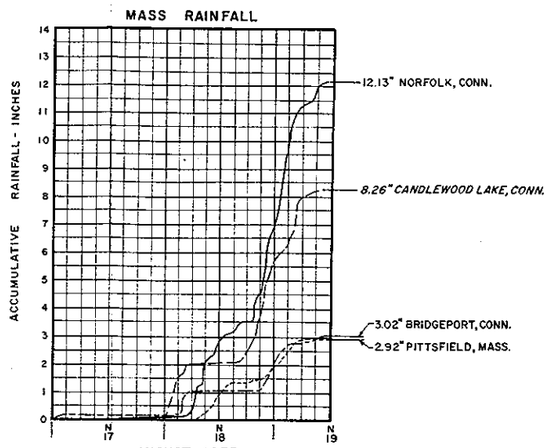
SCALE

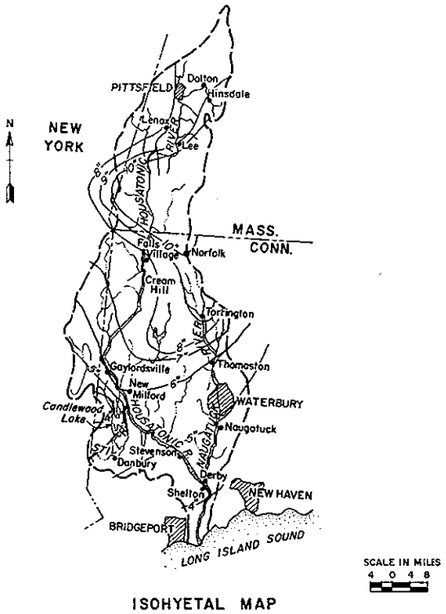
SPEC. NO CIV ENG.-19-016-

DRAWING NUMBER

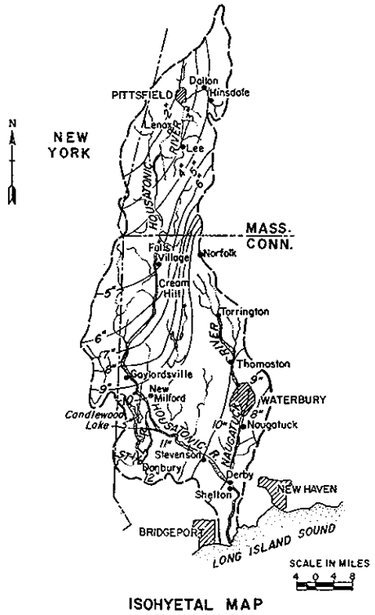




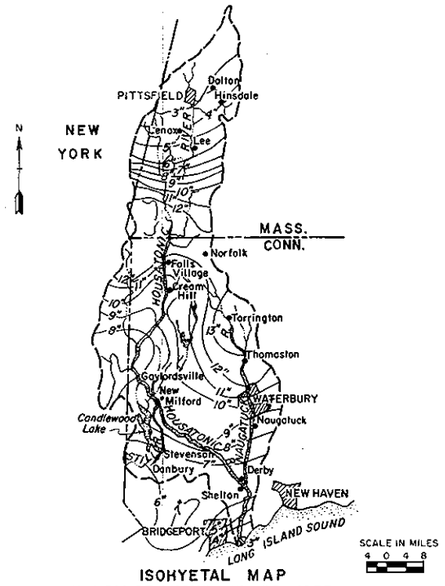




ISOHYETAL MAP
STORM OF
DECEMBER 1948



ISOHYETAL MAP
STORM OF
OCTOBER 14-17, 1955



ISOHYETAL MAP
STORM OF AUGUST 17-20, 1955
(HURRICANE "DIANE")

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS. BRANCH

HOUSATONIC RIVER RESERVOIR REGULATION MANUAL

STORM OF DECEMBER 1948, AUGUST & OCTOBER 1955

HOUSATONIC, RIVER — MASS. & CONN.

APPROVED

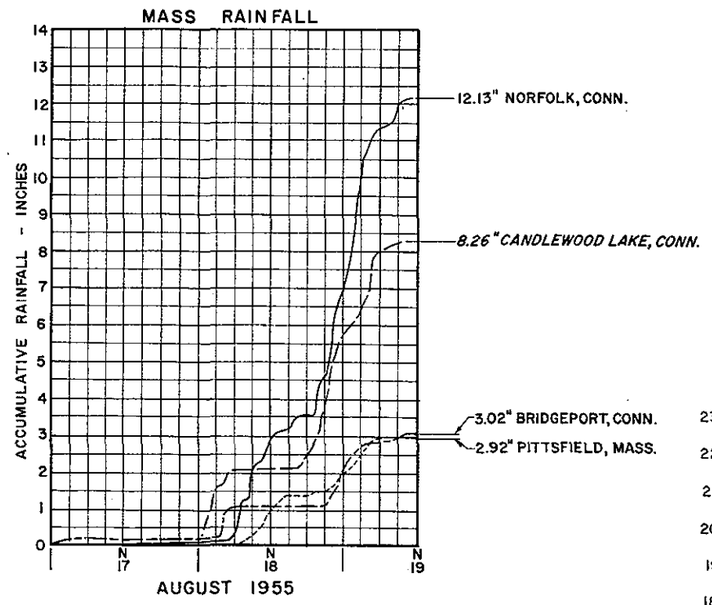
CHIEF ENGINEERING DIV.

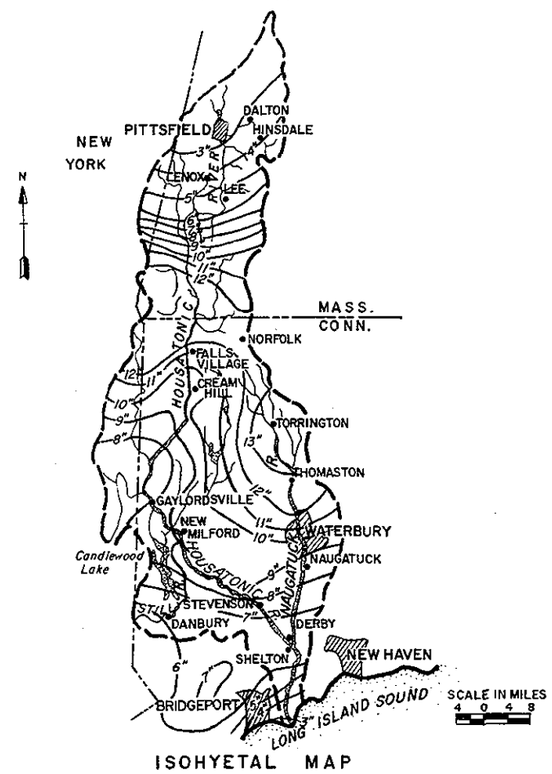
DATE JUNE 1964

SCALE

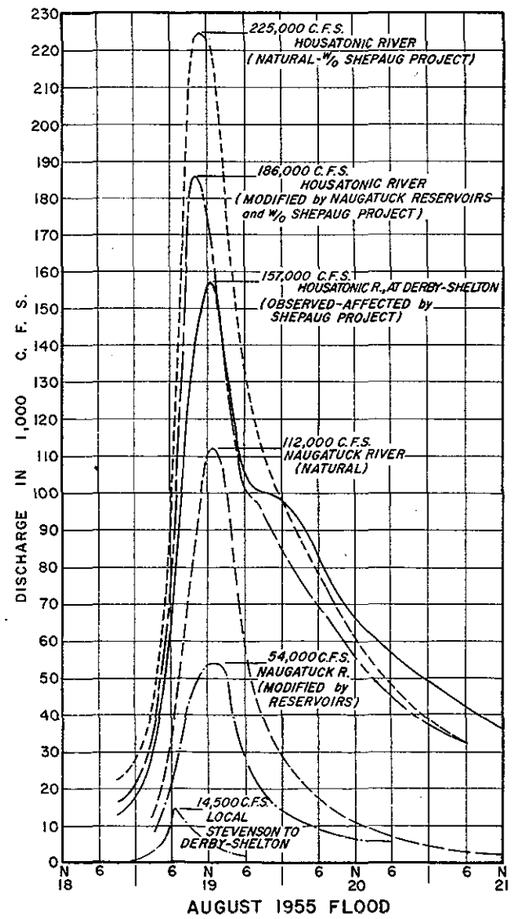
SPEC. NO. CIV ENG.-19-016-

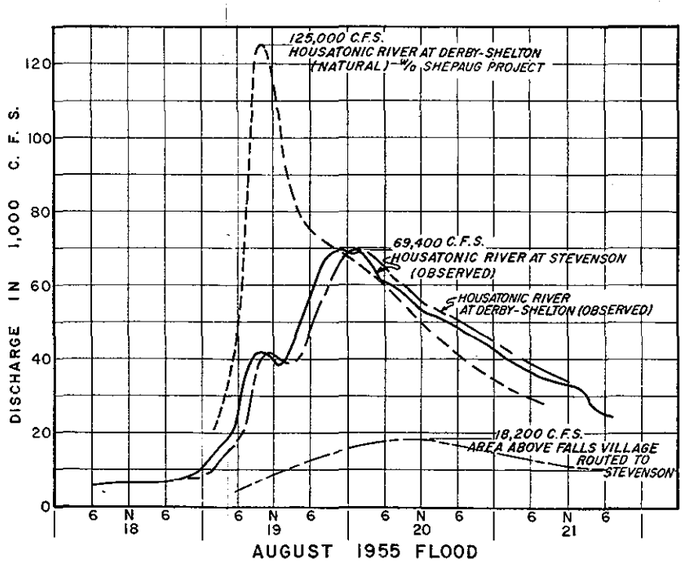
DRAWING NUMBER





ISOHYETAL MAP
STORM OF AUGUST 17 - 20, 1955
(HURRICANE "DIANE")



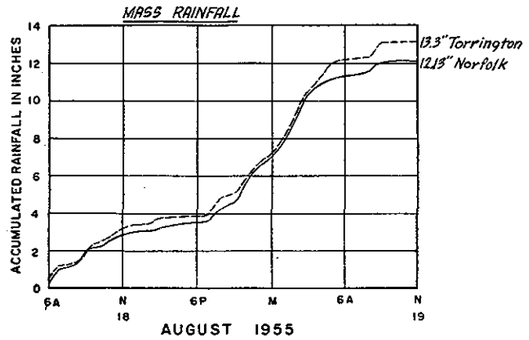


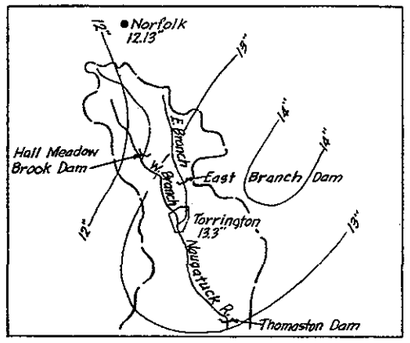
HOUSATONIC RIVER FLOOD CONTROL

FLOOD OF
AUGUST 17 - 20, 1955
(HURRICANE "DIANE")

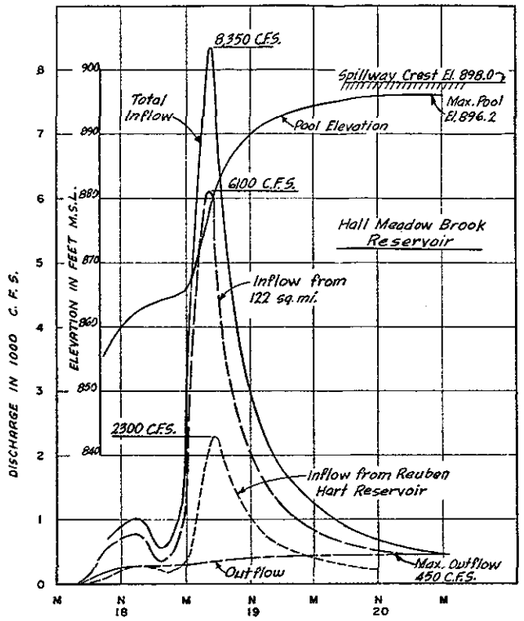
HOUSATONIC RIVER

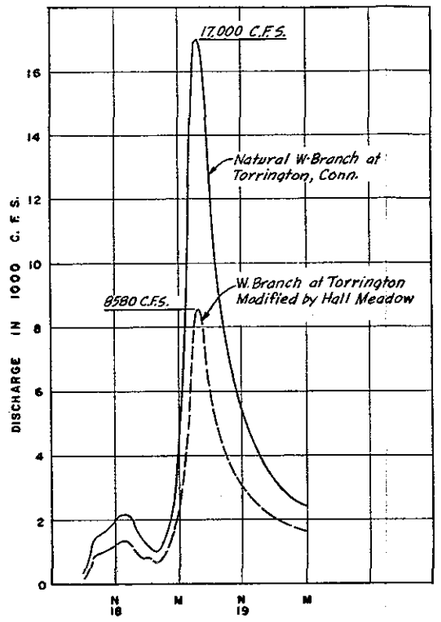
U.S. ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

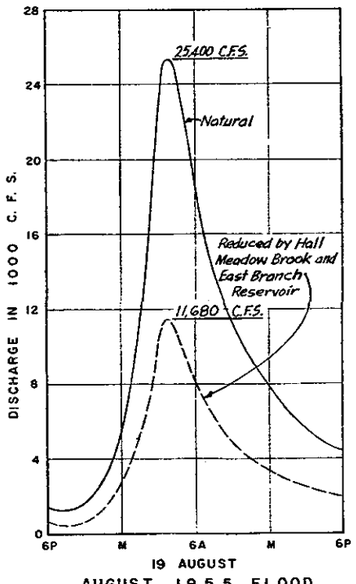


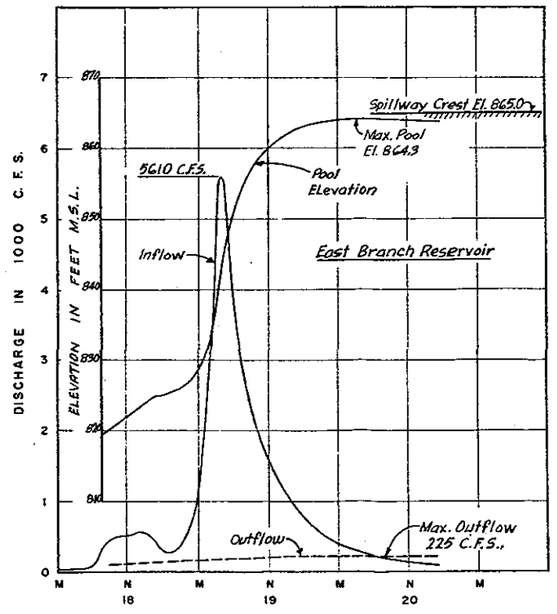


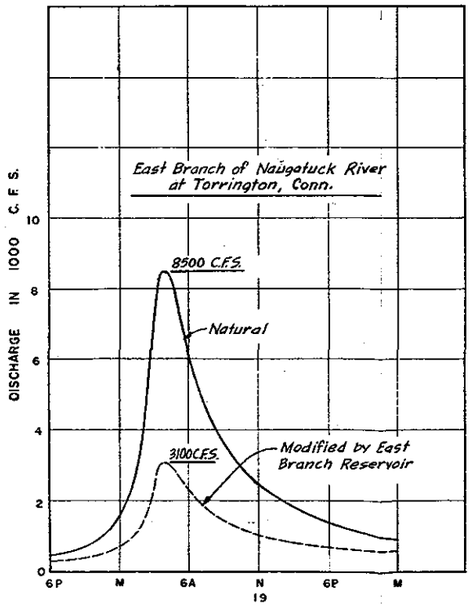
ISOHYETAL MAP
STORM OF 17-20, AUGUST, 1955
HURRICANE "DIANE"
SCALE 1" = 4 miles











HOUSATONIC R. RESERVOIR REGULATION MANUAL

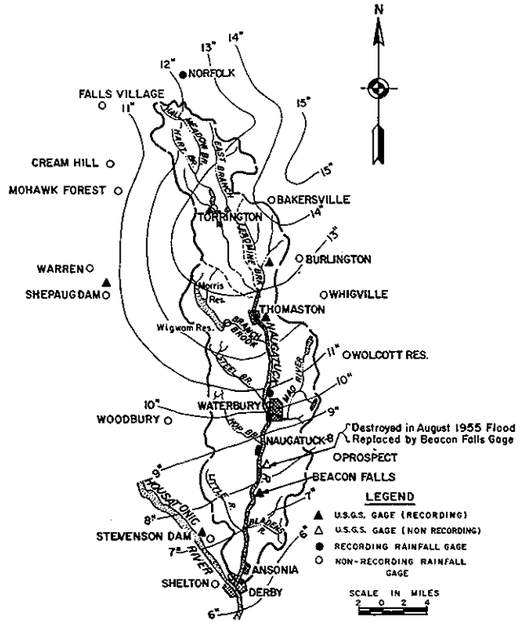
FLOOD OF
AUGUST 17-20, 1955
HURRICANE "DIANE"

UPPER NAUGATUCK RIVER BASIN

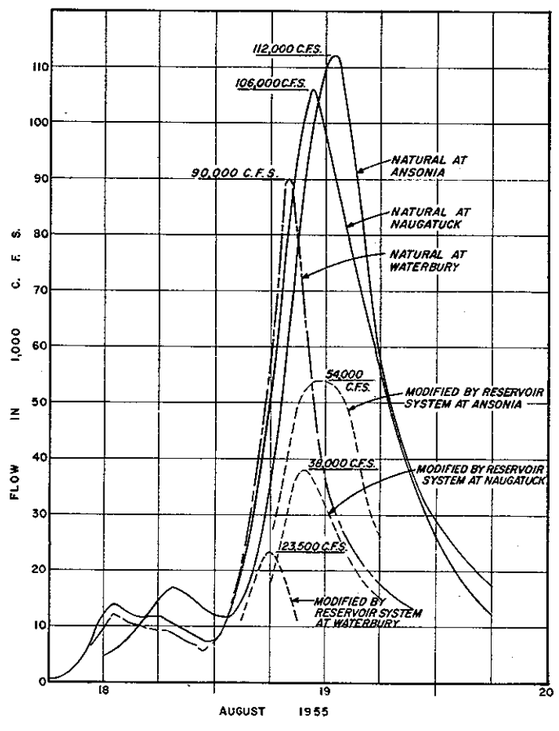
JUNE 1964

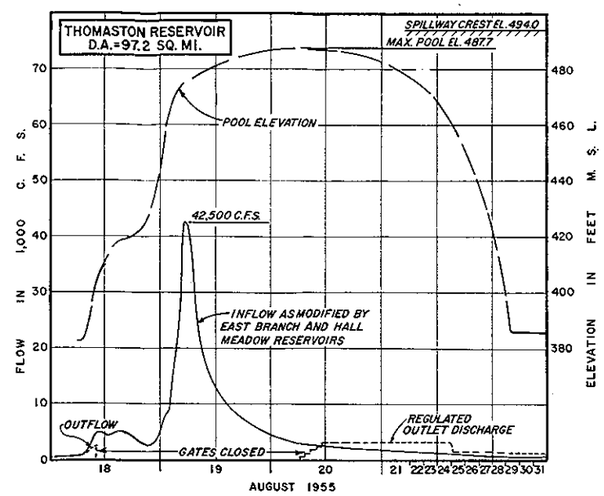
U S ARMY ENGR DIVISION
CORPS OF ENGINEERS

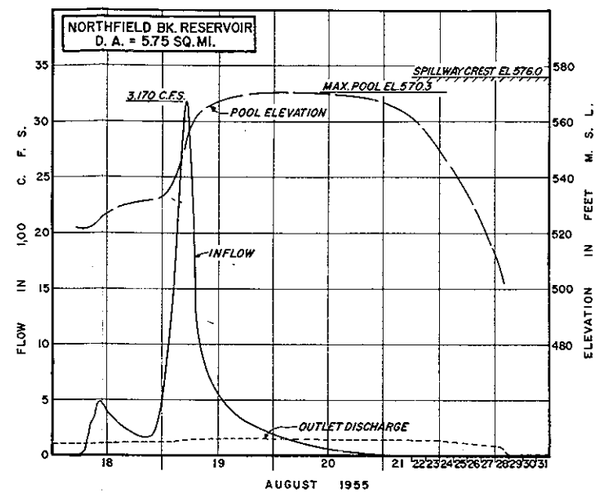
NEW ENGLAND
WALTHAM, MASS

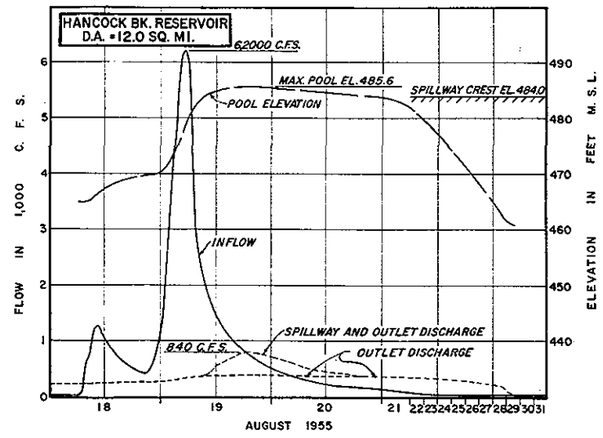


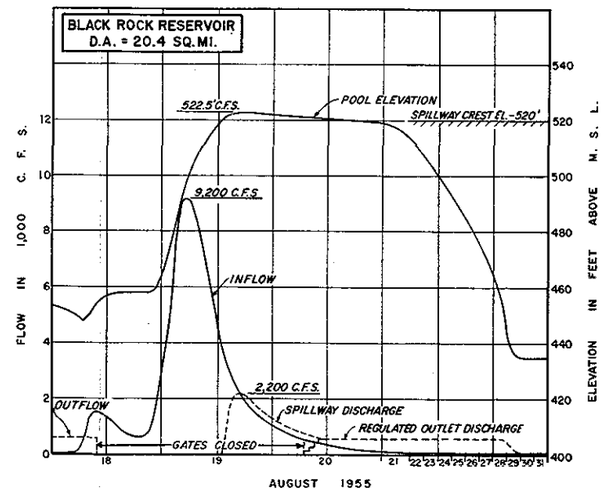
ISOHYETAL MAP
STORM OF AUGUST 17-19, 1955
NAUGATUCK RIVER BASIN

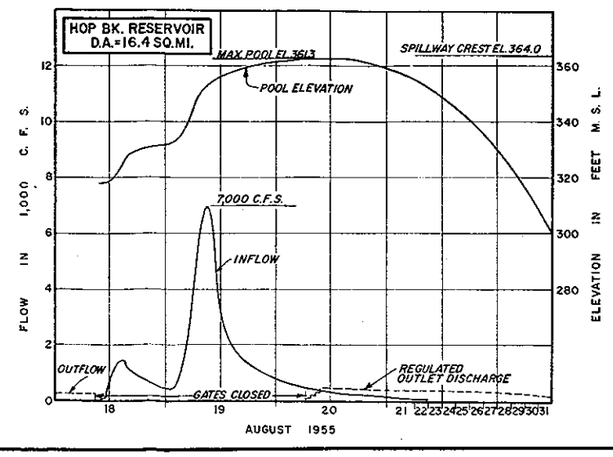












REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

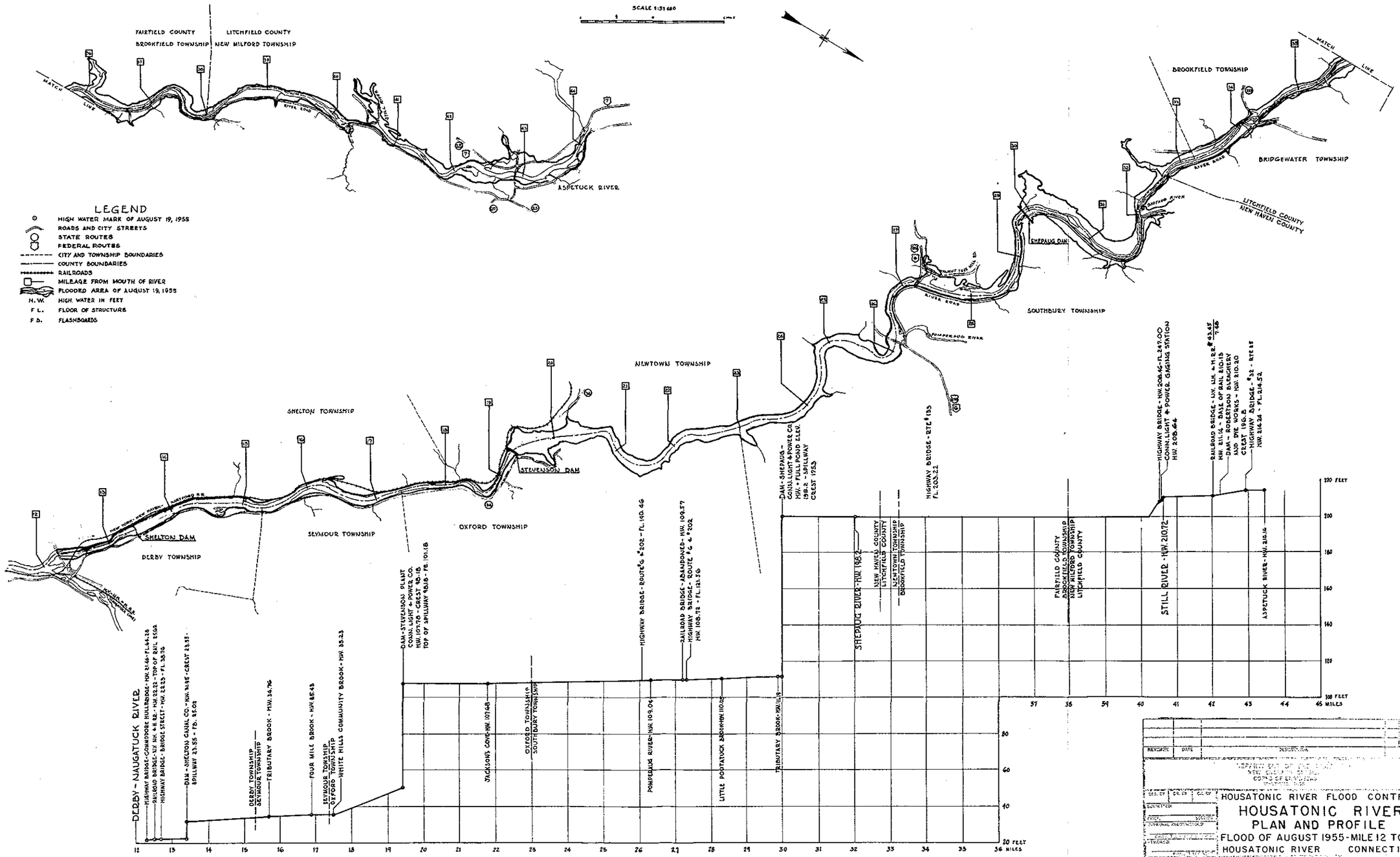
DR. BY | TR. BY M.W.B. | CK. BY

HOUSATONIC RIVER FLOOD CONTROL
LOWER NAUGATUCK RIVER
FLOOD OF AUGUST 1955
NAUGATUCK RIVER WATERSHED, CONNECTICUT

PROJECT ENGINEER
CHIEF, SECTION
SUBMITTED BY
APPROVED
DATE JAN. 1964
CHIEF, PLANN. & RPTS. BRANCH
CHIEF ENGINEERING DIV.
SCALE
SPEC. NO. CIV. ENG.-19-016-
DRAWING NUMBER
SHEET

PLAN

SCALE 1:31 680



LEGEND

- HIGH WATER MARK OF AUGUST 19, 1955
- ROADS AND CITY STREETS
- STATE ROUTES
- FEDERAL ROUTES
- CITY AND TOWNSHIP BOUNDARIES
- COUNTY BOUNDARIES
- RAILROADS
- MILEAGE FROM MOUTH OF RIVER
- FLOODED AREA OF AUGUST 19, 1955
- H.W. HIGH WATER IN FEET
- F.L. FLOOR OF STRUCTURE
- F.B. FLASHBOARDS

NOTES:
Elevations in feet above Mean Sea Level Datum.
Distances in miles from R.R. Bridge below Shelton.

REVISION	DATE	DESCRIPTION

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS

U.S. CIV. | U.S. MIL. | U.S. NAV.

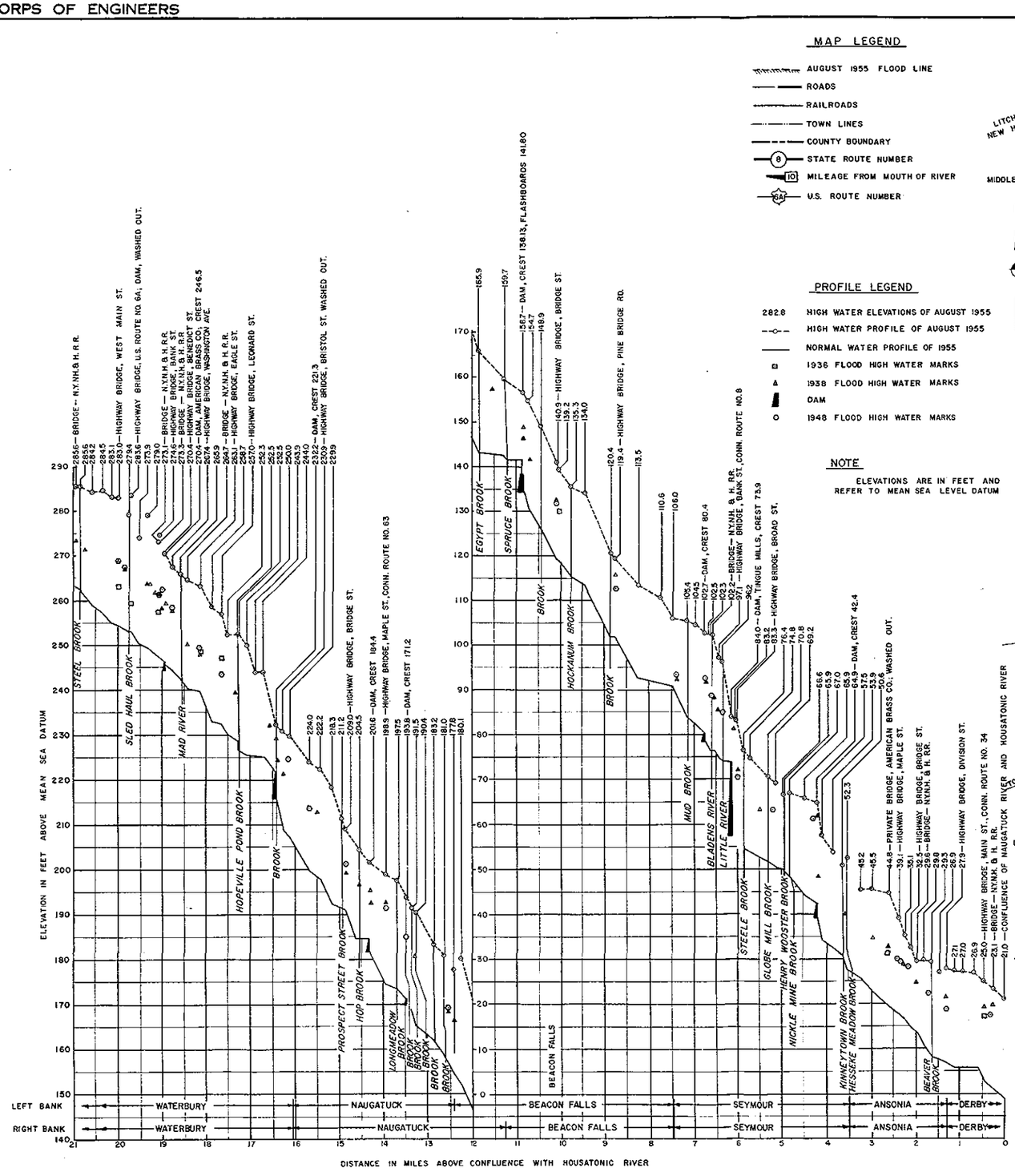
SURVEYED BY
DRAWN BY
PERSONNEL RESPONSIBLE
CHECKED BY
TRACED BY
REVIEWED BY
APPROVED FOR CONSTRUCTION BY
DATE

HOUSATONIC RIVER FLOOD CONTROL

HOUSATONIC RIVER
PLAN AND PROFILE
FLOOD OF AUGUST 1955 - MILE 12 TO 45
HOUSATONIC RIVER CONNECTICUT

SCALE AS SHOWN

PREPARED BY
FRED S. DUBIN & MORTON S. FINE
ASSOCIATES CIVIL ENGINEER
HARTFORD, CONN.



MAP LEGEND

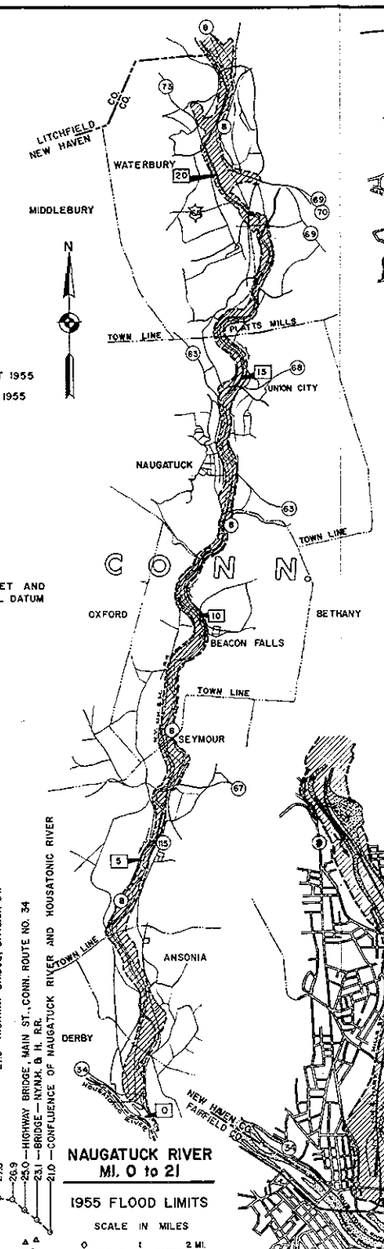
- AUGUST 1955 FLOOD LINE
- ROADS
- RAILROADS
- TOWN LINES
- COUNTY BOUNDARY
- STATE ROUTE NUMBER
- MILEAGE FROM MOUTH OF RIVER
- U.S. ROUTE NUMBER

PROFILE LEGEND

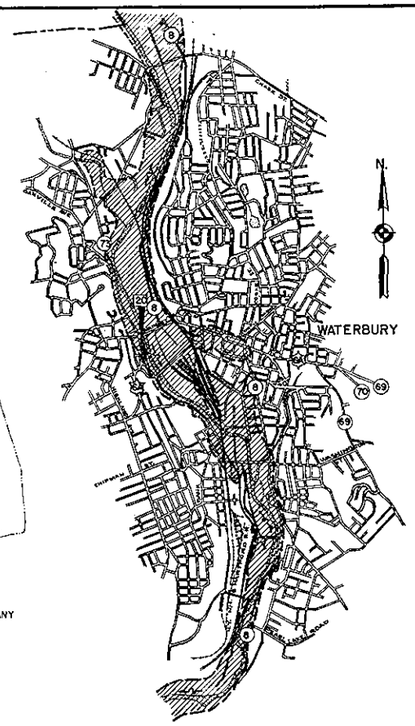
- 282.8 HIGH WATER ELEVATIONS OF AUGUST 1955
- HIGH WATER PROFILE OF AUGUST 1955
- NORMAL WATER PROFILE OF 1955
- 1936 FLOOD HIGH WATER MARKS
- 1938 FLOOD HIGH WATER MARKS
- DAM
- 1948 FLOOD HIGH WATER MARKS

NOTE

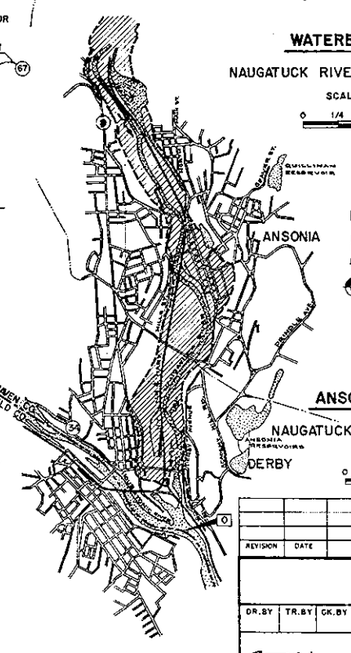
ELEVATIONS ARE IN FEET AND REFER TO MEAN SEA LEVEL DATUM



NAUGATUCK RIVER
MI. 0 to 21
1955 FLOOD LIMITS
SCALE IN MILES
0 1 2 MI.



WATERBURY, CONN.
NAUGATUCK RIVER – 1955 FLOOD LIMITS
SCALE IN MILES
0 1/4 1/2 3/4 1 MI.



ANSONIA & DERBY, CONN.
NAUGATUCK RIVER – 1955 FLOOD LIMITS
SCALE IN MILES
0 1/4 1/2 3/4 1 MI.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY | TR. BY | CK. BY

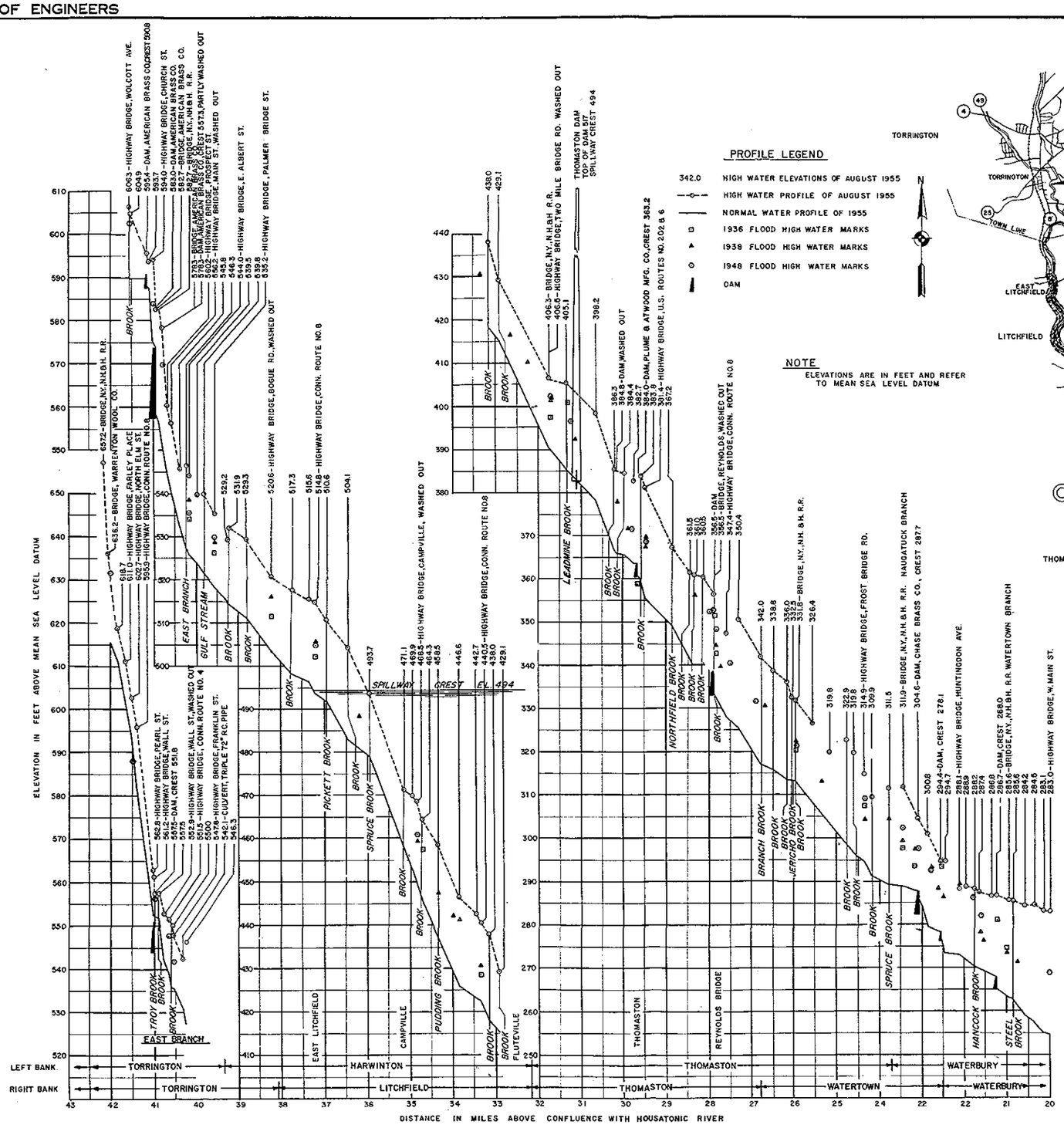
HOUSATONIC RIVER FLOOD CONTROL

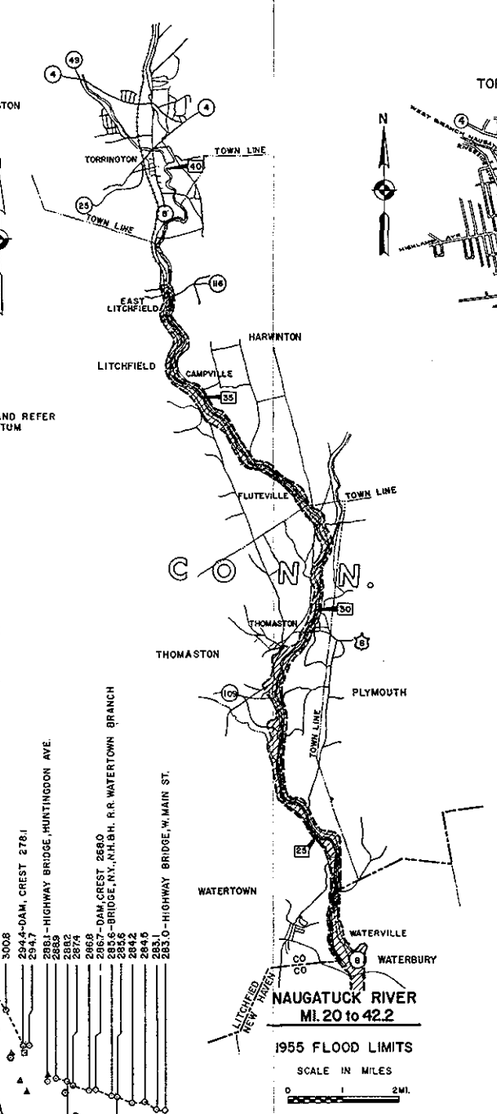
NAUGATUCK RIVER
PLAN AND PROFILE
FLOOD OF AUGUST 1955-MILE 0 to 21
HOUSATONIC RIVER WATERSHED, CONN., N.Y. & MASS.

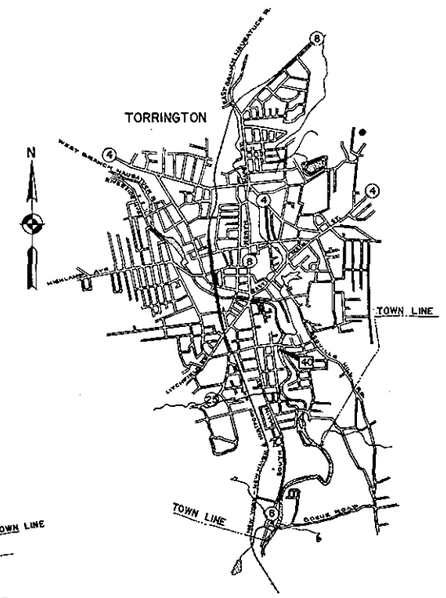
SUBMITTED BY: E. F. Childs, CHIEF, H. & H. SECTION
APPROVED: CHIEF, PLAN. & REP'TS BRANCH
APPROVED: CHIEF ENGINEERING DIV.
APPROVED: Lawrence A. Seibert, LT. COL., C.E. EXECUTIVE OFFICER
DATE JUNE 1958.

TO ACCOMPANY REPORT DATED 30 JUNE 1958

SCALE: AS SHOWN
DRAWING NUMBER HC-1-1321
SHEET 1 OF 2







MAP LEGEND

- AUGUST 1955 FLOOD LINE
- ROADS
- RAILROADS
- TOWN LINES
- COUNTY BOUNDARY
- STATE ROUTE NUMBER
- MILEAGE FROM MOUTH OF RIVER
- U.S. ROUTE NUMBER

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY | TR. BY | CK. BY

HOUSATONIC RIVER FLOOD CONTROL

NAUGATUCK RIVER
PLAN AND PROFILE
FLOOD OF AUGUST 1955 - MILE 20 to 42.2

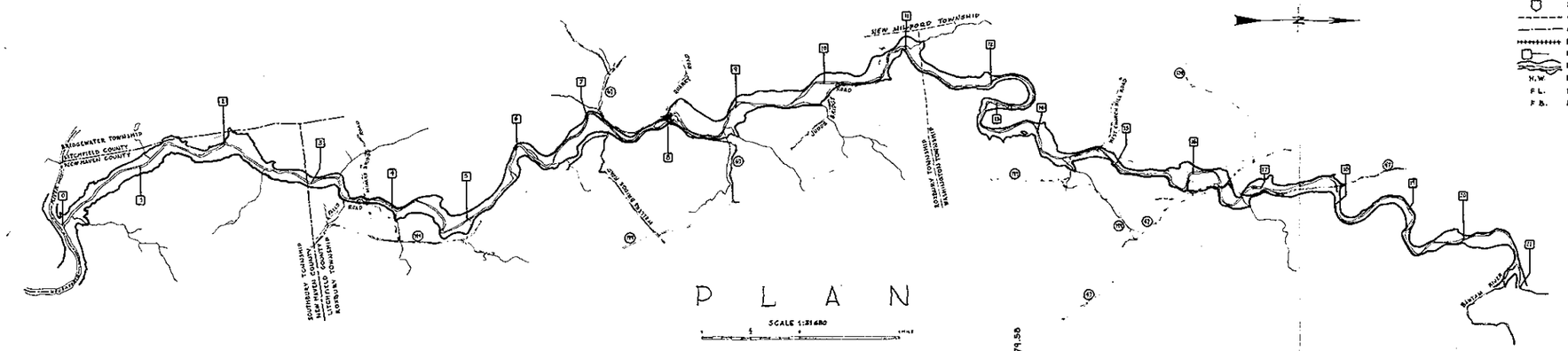
HOUSATONIC RIVER WATERSHED, CONN. N.Y. & MASS.

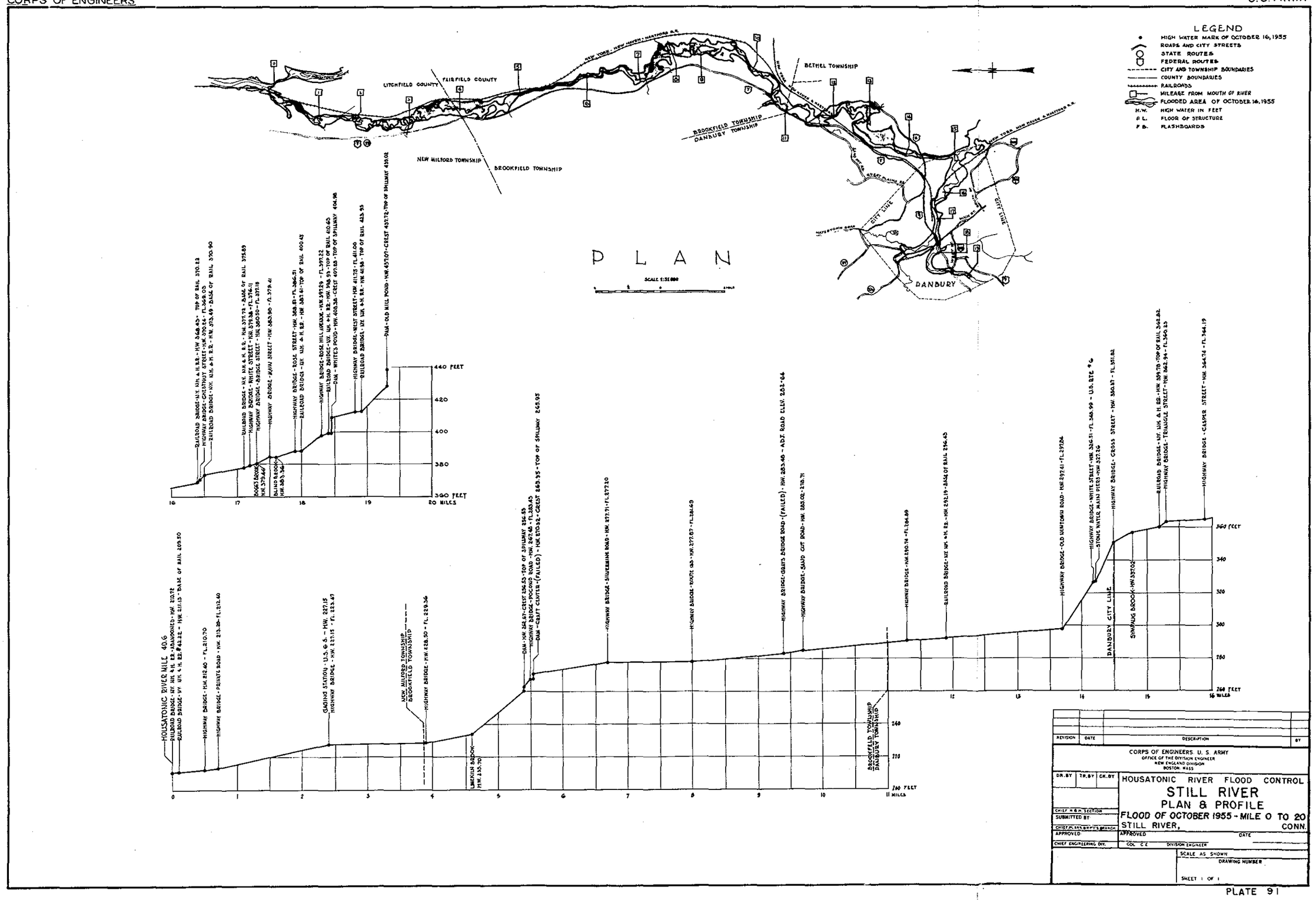
CHIEF, H. & H. SECTION
SUBMITTED BY:
CHIEF, PLAN & RPT'S BRANCH
APPROVED:
CHIEF ENGINEERING DIV.
APPROVED:
LT. COL. C.E. EXECUTIVE OFFICER
DATE JUNE 1958

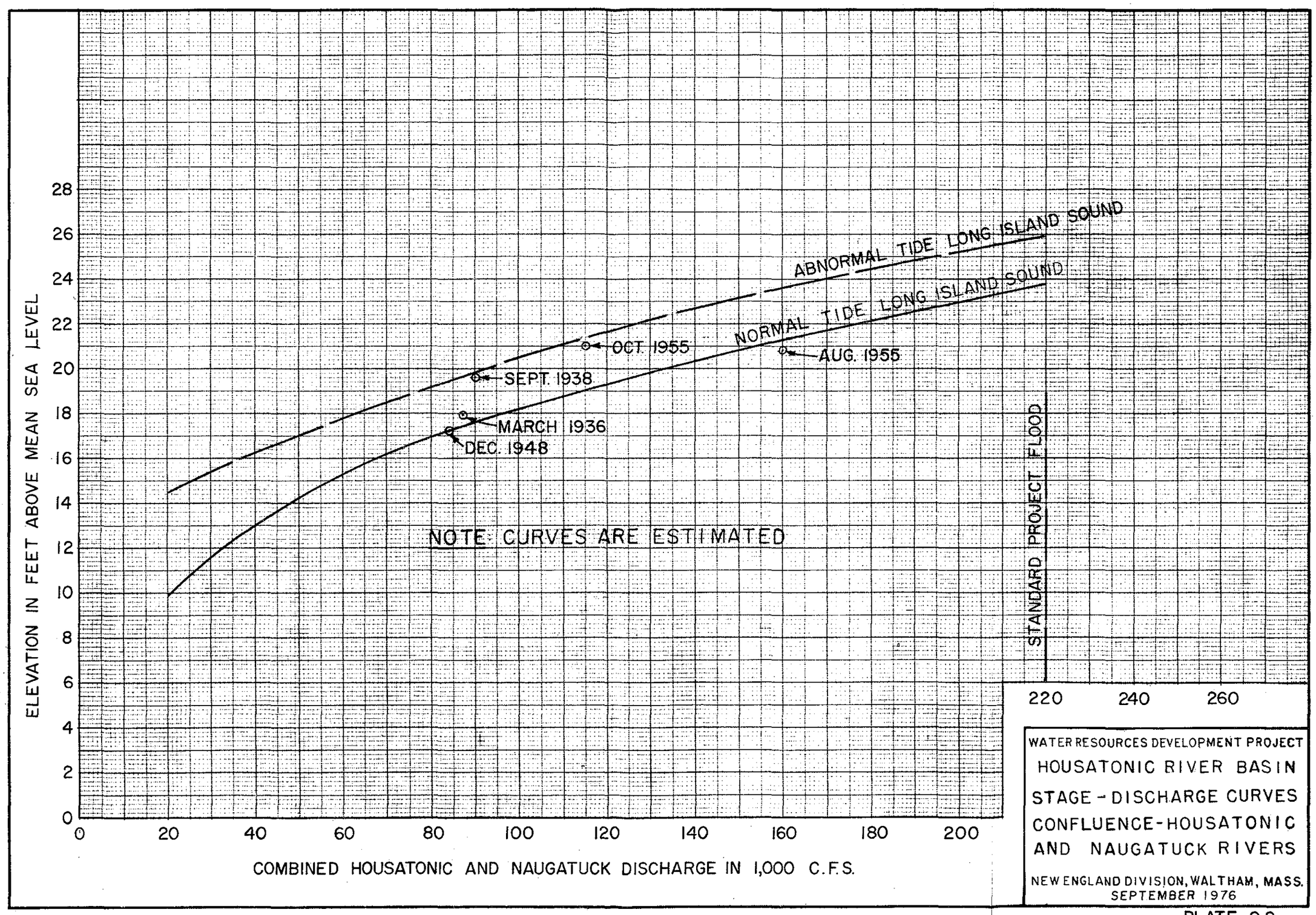
TO ACCOMPANY REPORT DATED: 30 JUNE 1958

SCALE: AS SHOWN
DRAWING NUMBER HC-1-1322
SHEET 2 OF 2

CORPS OF ENGINEERS


BRIDGEWATER TOWNSHIP
LITCHFIELD COUNTY
NEW HAVEN COUNTY
NEW MILFORD TOWNSHIP
BRIDGEWATER TOWNSHIP
NEW MILFORD TOWNSHIP
SOUTHBURY TOWNSHIP
NEW HAVEN COUNTY
LITCHFIELD COUNTY
ROXBURY TOWNSHIP
BRIDGEWATER TOWNSHIP
NEW MILFORD


LEGEND
HIGH WATER MARK OF OCTOBER 16, 1955
ROADS AND CITY STREETS
STATE ROUTES
FEDERAL ROUTES
CITY AND TOWNSHIP BOUNDARIES
COUNTY BOUNDARIES
RAILROADS
MILEAGE FROM MOUTH OF RIVER
FLOODED AREA OF OCTOBER 16, 1955
H.W. HIGH WATER IN FEET
F.L. FLOOR OF STRUCTURE
F.B. FLASHBOARDS
PLAN
SCALE 1:31 000
LITCHFIELD COUNTY
FAIRFIELD COUNTY
NEW MILFORD TOWNSHIP
BROOKFIELD TOWNSHIP
BETHEL TOWNSHIP
DANBURY TOWNSHIP
DANBURY
CITY LINE
NEW YORK - NEW HAVEN - HARTFORD R.R.
HOUSATONIC RIVER MILE 40.6
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 368.43 - TOP OF RAIL 370.23
HIGHWAY BRIDGE - CHESTNUT STREET - H.W. 370.54 - FL. 368.03
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 373.49 - BASE OF RAIL 370.90
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 377.73 - BASE OF RAIL 375.69
HIGHWAY BRIDGE - WHITE STREET - H.W. 379.38 - FL. 376.11
HIGHWAY BRIDGE - BRIDGE STREET - H.W. 380.50 - FL. 377.18
HIGHWAY BRIDGE - MAIN STREET - H.W. 383.90 - FL. 379.41
HIGHWAY BRIDGE - ROSE STREET - H.W. 388.81 - FL. 386.51
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 387.41 - TOP OF RAIL 400.45
HIGHWAY BRIDGE - ROSE HILL (HOUSE) - H.W. 397.29 - FL. 397.22
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 398.95 - TOP OF RAIL 410.45
DAM - WHITES POND - H.W. 408.38 - CREST 407.88 - TOP OF SPILLWAY 404.98
HIGHWAY BRIDGE - WEST STREET - H.W. 411.75 - FL. 411.00
RAILROAD BRIDGE - N.Y. N.H. & H.R.R. - H.W. 411.98 - TOP OF RAIL 423.95
DAM - OLD MILL POND - H.W. 457.07 - CREST 457.72 - TOP OF SPILLWAY 455.02
DOGES BROOK H.W. 379.46
BLIND BROOK H.W. 383.36
440 FEET
420
400
380
360 FEET
16
17
18
19
20 MILES
HOUSATONIC RIVER MILE 40.6
RAILROAD BRIDGE - N.Y. N.H. & H.R. - ABANDONED - H.W. 210.72
RAILROAD BRIDGE - N.Y. N.H. & H.R. #42.22 - H.W. 211.15 - BASE OF RAIL 209.50
HIGHWAY BRIDGE - H.W. 212.40 - FL. 210.70
HIGHWAY BRIDGE - PRIVATE ROAD - H.W. 213.28 - FL. 212.40
GAGING STATION - 13.5 & 5 - H.W. 227.15
HIGHWAY BRIDGE - H.W. 227.15 - FL. 223.47
NEW MILFORD TOWNSHIP
BROOKFIELD TOWNSHIP
HIGHWAY BRIDGE - H.W. 228.50 - FL. 229.36
LIMEKILN BROOK H.W. 235.70
DAM - H.W. 245.67 - CREST 256.53 - TOP OF SPILLWAY 256.53
HIGHWAY BRIDGE - POCONO ROAD - H.W. 267.45 - FL. 283.43
DAM - GRAFT CENTER (FAILED) - H.W. 270.32 - CREST 265.35 - TOP OF SPILLWAY 263.95
HIGHWAY BRIDGE - SILVERMINE ROAD - H.W. 277.71 - FL. 277.20
HIGHWAY BRIDGE - ROUTE 133 - H.W. 277.67 - FL. 281.69
HIGHWAY BRIDGE - GRAYS BRIDGE ROAD - (FAILED) - H.W. 283.45 - ADJ. ROAD ELEV. 283.64
HIGHWAY BRIDGE - SAND CUT ROAD - H.W. 283.02 - 278.71
HIGHWAY BRIDGE - H.W. 290.74 - FL. 286.89
RAILROAD BRIDGE - N.Y. N.H. & H.R. - H.W. 292.19 - BASE OF RAIL 296.43
HIGHWAY BRIDGE - OLD DANBURY ROAD - H.W. 297.41 - FL. 297.84
HIGHWAY BRIDGE - WHITE STREET - H.W. 326.51 - FL. 328.99 - U.S. RTE #6
STONE WATER, MAIN PIERS - H.W. 327.36
HIGHWAY BRIDGE - CROSS STREET - H.W. 330.37 - FL. 331.82
DANBURY CITY LINE
SWAMPUG BROOK - H.W. 337.02
RAILROAD BRIDGE - N.Y. N.H. & H.R. BD. - H.W. 339.78 - TOP OF RAIL 342.82
HIGHWAY BRIDGE - TRIANGLE STREET - H.W. 342.94 - FL. 340.33
HIGHWAY BRIDGE - CASPER STREET - H.W. 344.74 - FL. 344.19
BROOKFIELD TOWNSHIP
DANBURY TOWNSHIP
360 FEET
340
320
300
280
260 FEET
240
220
200 FEET
0
1
2
3
4
5
6
7
8
9
10
11 MILES
12
13
14
15
16 MILES
REVISION
DATE
DESCRIPTION
BY
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS
DR. BY
TR. BY
CK. BY
CHIEF H & H SECTION
SUBMITTED BY
CHIEF, PLANNING & REPORTS BRANCH
APPROVED
CHIEF ENGINEERING DIV.
HOUSATONIC RIVER FLOOD CONTROL
STILL RIVER
PLAN & PROFILE
FLOOD OF OCTOBER 1955 - MILE 0 TO 20
STILL RIVER, CONN.
APPROVED
DATE
COL. C.E. DIVISION ENGINEER
SCALE AS SHOWN
DRAWING NUMBER
SHEET 1 OF 1



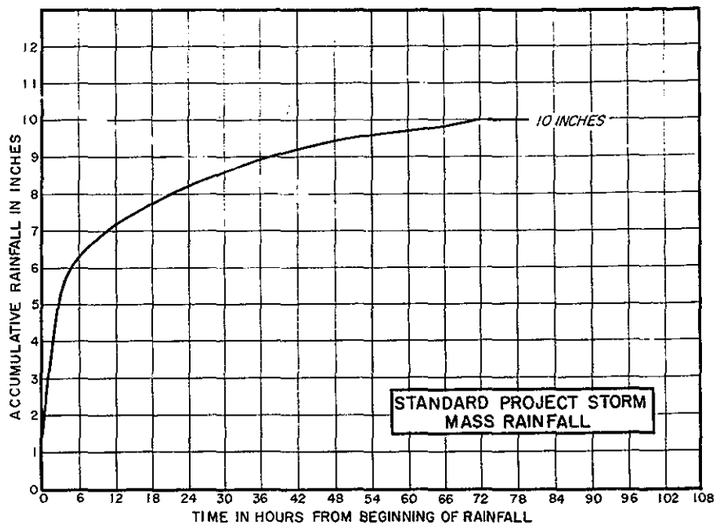
WATER RESOURCES DEVELOPMENT PROJECT

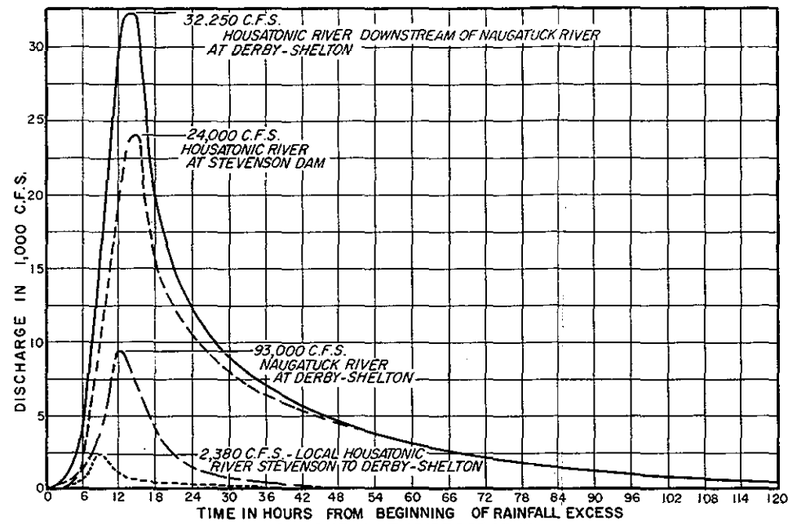
HOUSATONIC RIVER BASIN

STAGE - DISCHARGE CURVES

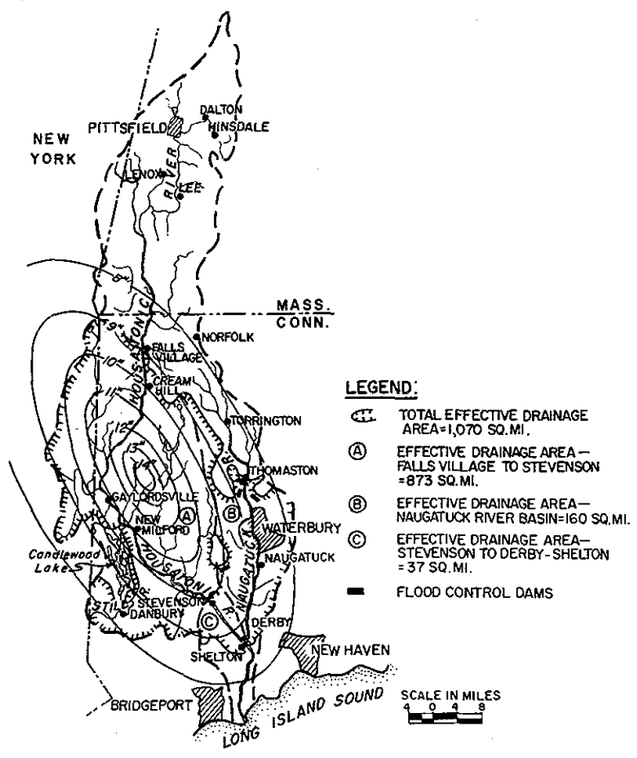
CONFLUENCE-HOUSATONIC AND NAUGATUCK RIVERS

NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPTEMBER 1976

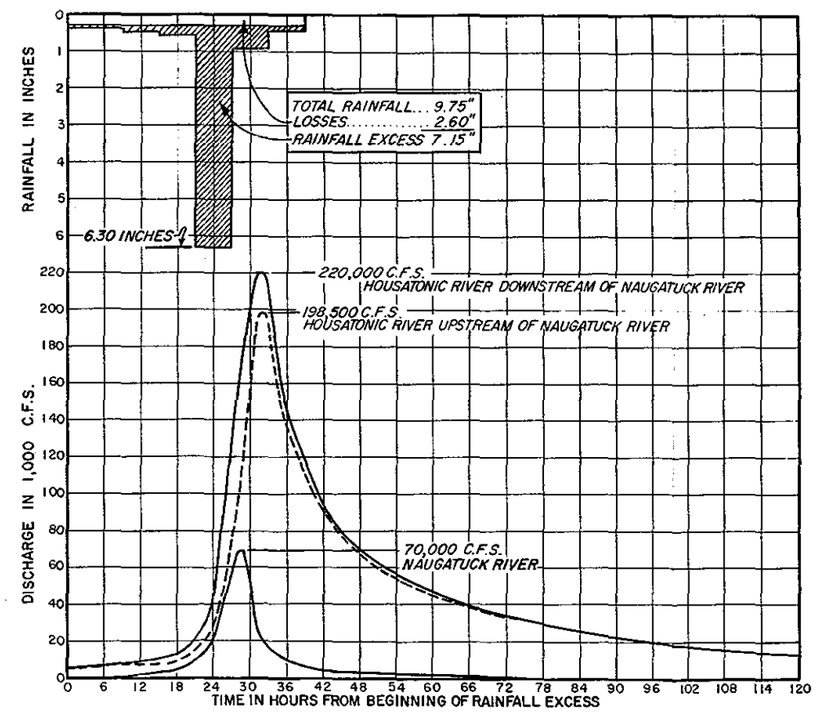




6-HOUR UNIT HYDROGRAPHS



STANDARD PROJECT STORM
ISOHYETAL PATTERN



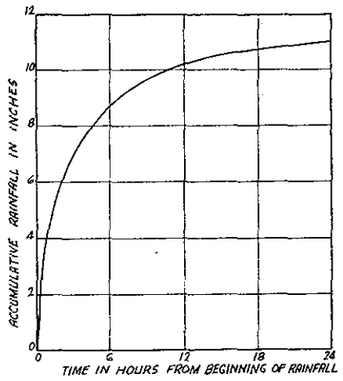
STANDARD PROJECT FLOOD

HOUSATONIC RIVER FLOOD CONTROL

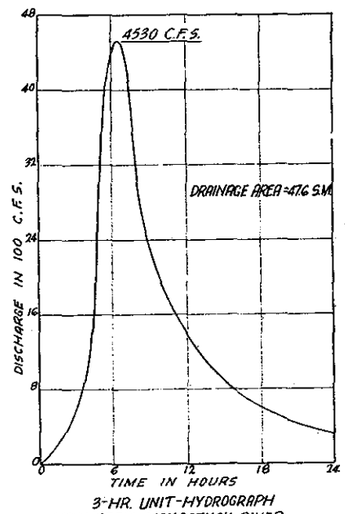
DEVELOPMENT OF
STANDARD PROJECT FLOOD
DERBY-SHELTON, CONN.

HOUSATONIC RIVER

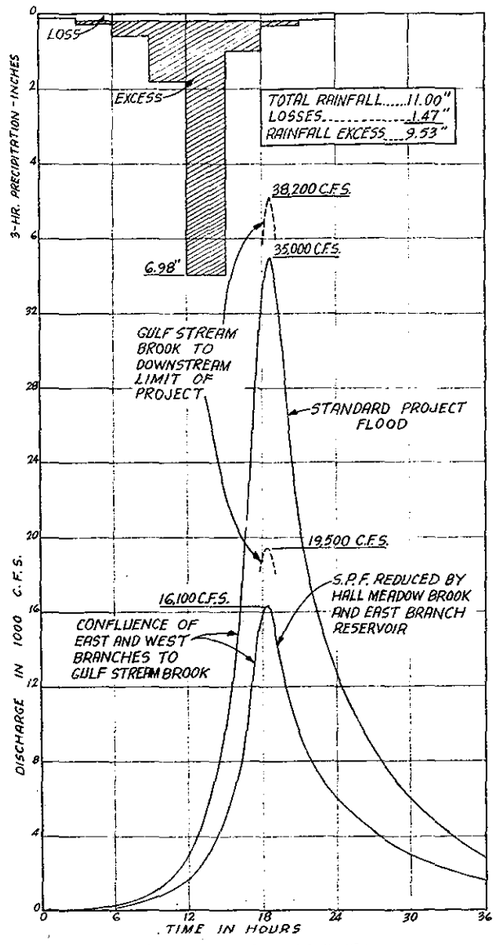
U.S. ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.



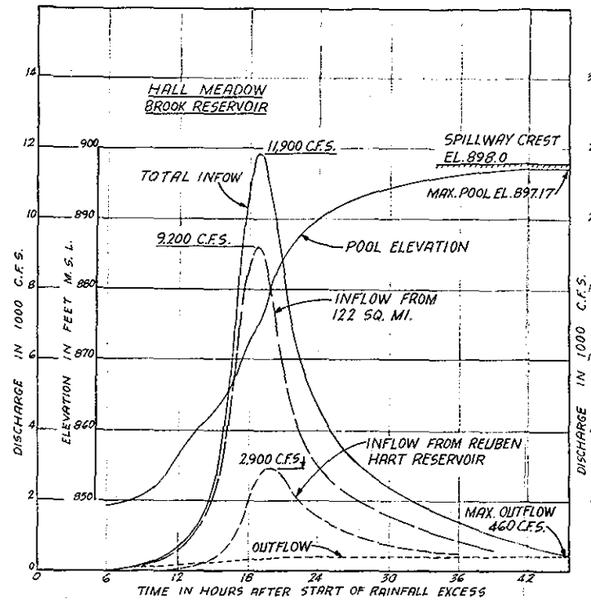
STANDARD PROJECT STORM - MASS RAINFALL

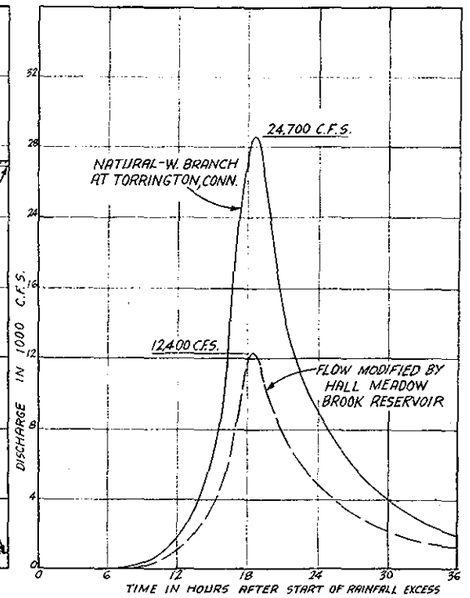


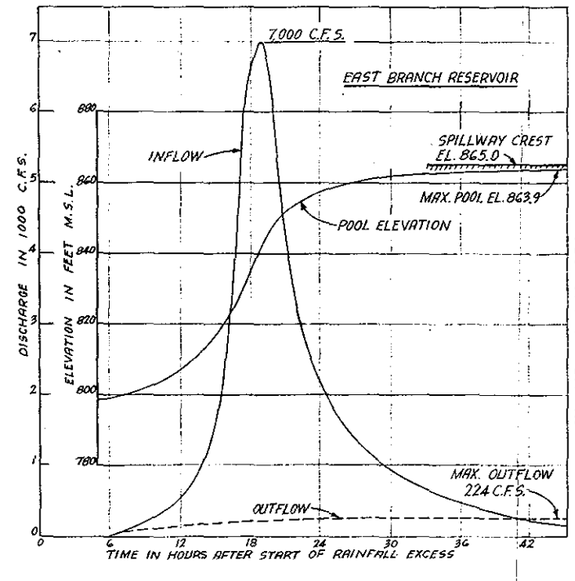
3-HR. UNIT-HYDROGRAPH
MAIN STEM NAUGATUCK RIVER

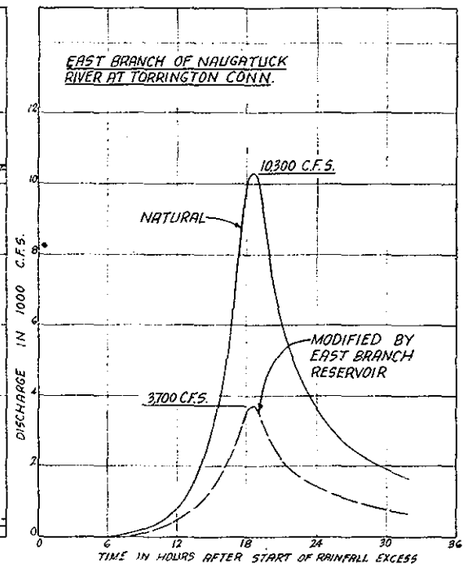


MAIN STEM NAUGATUCK RIVER









HOUSATONIC RIVER RESERVOIR REGULATION MANUAL

DEVELOPMENT OF

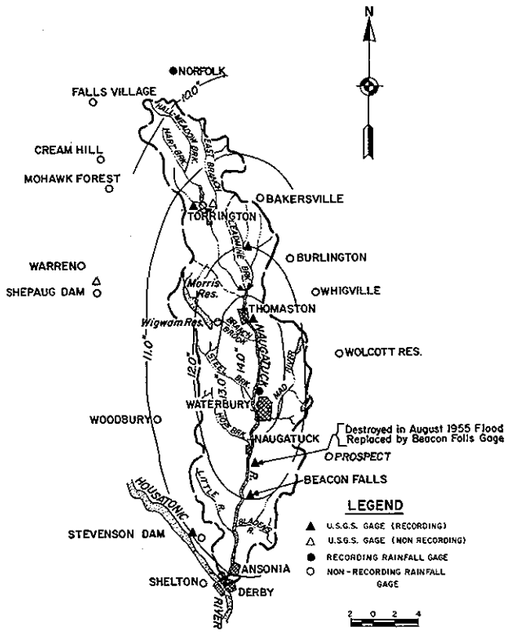
STANDARD PROJECT FLOOD

UPPER NAUGATUCK RIVER BASIN

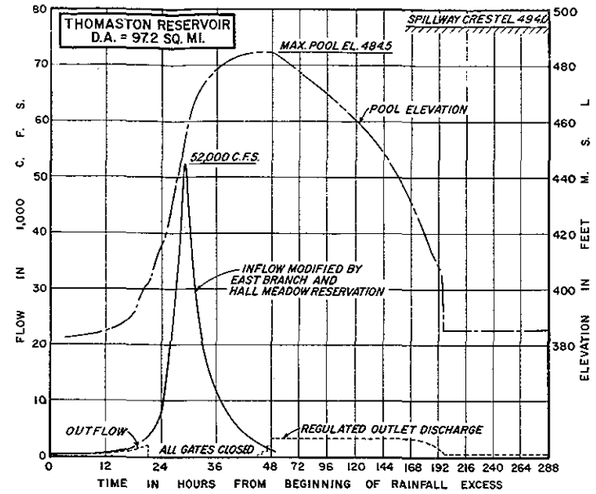
JUNE 1964

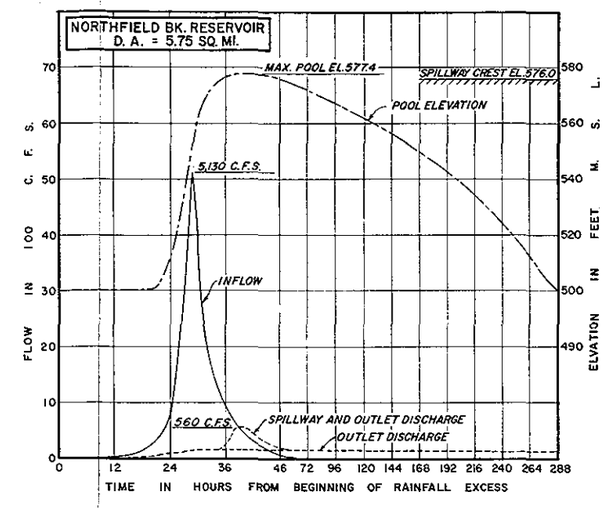
U. S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS

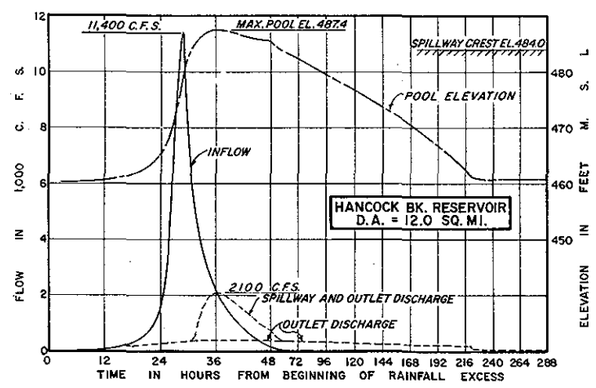
NEW ENGLAND
WALTHAM, MASS.

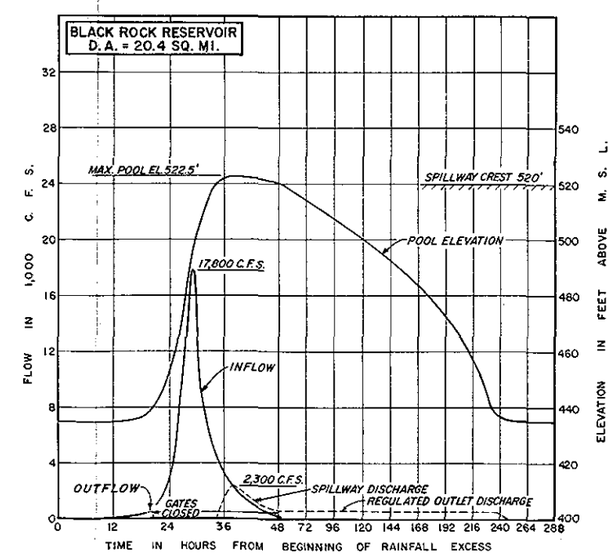


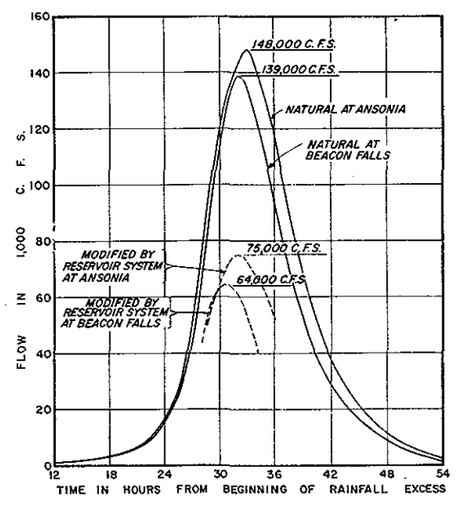
ISOHYETAL MAP
STANDARD PROJECT STORM
NAUGATUCK RIVER BASIN
96 HOUR DURATION

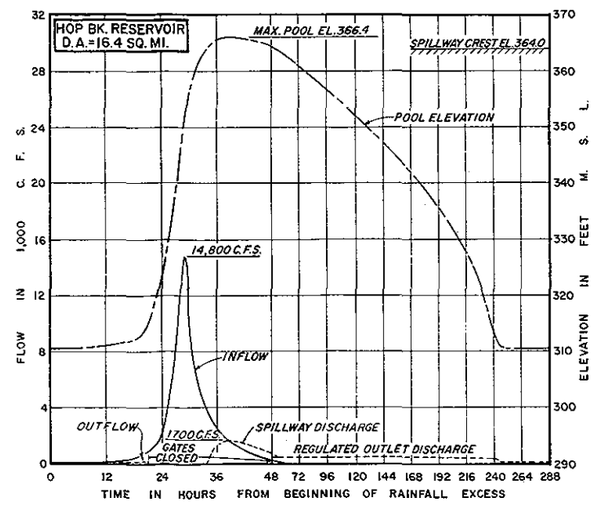












REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY M.W.B. | CK. BY

PROJECT ENGINEER

CHIEF, SECTION

SUBMITTED BY

CHIEF, PLANN. & RPTS. BRANCH

HOUSATONIC RIVER FLOOD CONTROL
LOWER NAUGATUCK RIVER
STANDARD PROJECT FLOOD
NAUGATUCK RIVER WATERSHED, CONNECTICUT

APPROVED

CHIEF ENGINEERING DIV.

DATE JAN. 1964

SCALE

SPEC. NO. CIV. ENG.-19-016-

DRAWING NUMBER

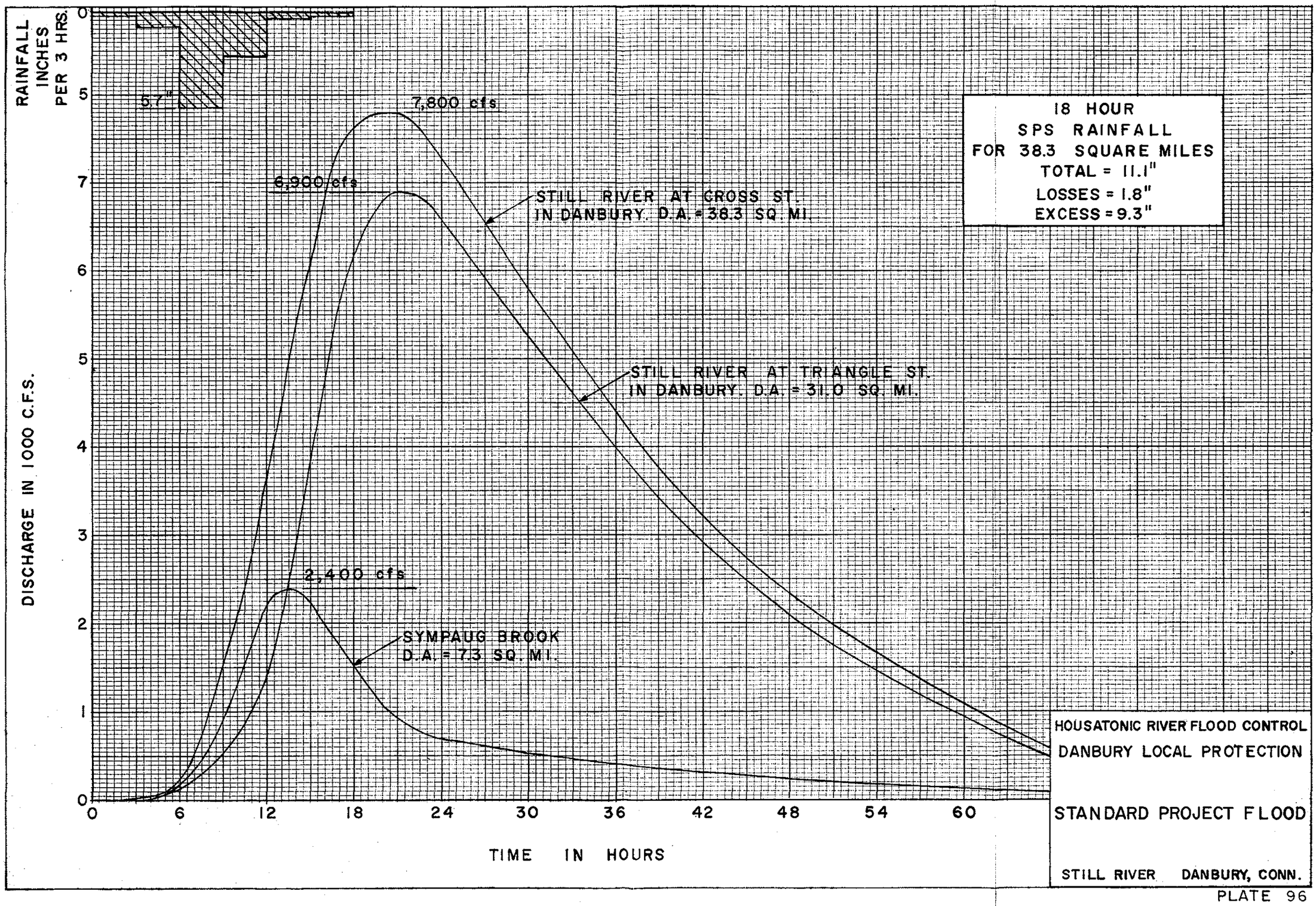
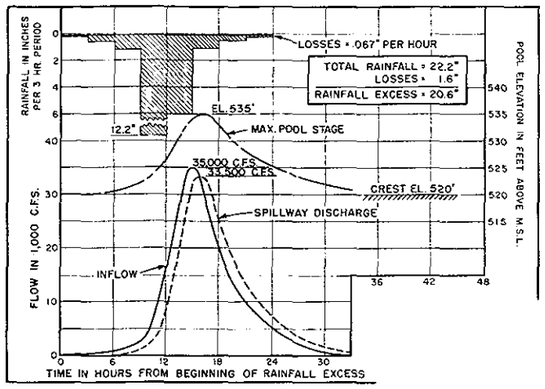
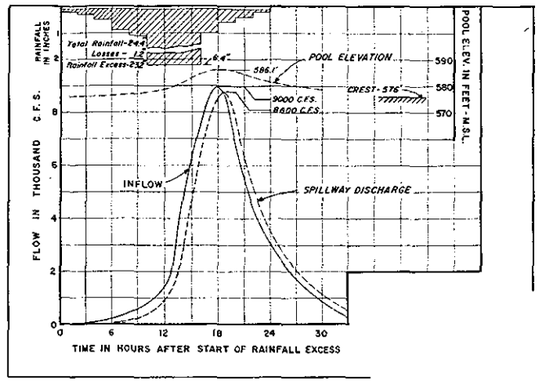

RAINFALL INCHES PER 3 HRS.
0
5
7
5.7"
7,800 cfs
6,900 cfs
STILL RIVER AT CROSS ST.
IN DANBURY. D.A. = 38.3 SQ. MI.
18 HOUR
SPS RAINFALL
FOR 38.3 SQUARE MILES
TOTAL = 11.1"
LOSSES = 1.8"
EXCESS = 9.3"
DISCHARGE IN 1000 C.F.S.
6
5
4
3
2
1
0
STILL RIVER AT TRIANGLE ST.
IN DANBURY. D.A. = 31.0 SQ. MI.
2,400 cfs
SYMPAUG BROOK
D.A. = 7.3 SQ. MI.
0
6
12
18
24
30
36
42
48
54
60
TIME IN HOURS
HOUSATONIC RIVER FLOOD CONTROL
DANBURY LOCAL PROTECTION
STANDARD PROJECT FLOOD
STILL RIVER DANBURY, CONN.

PLATE 96

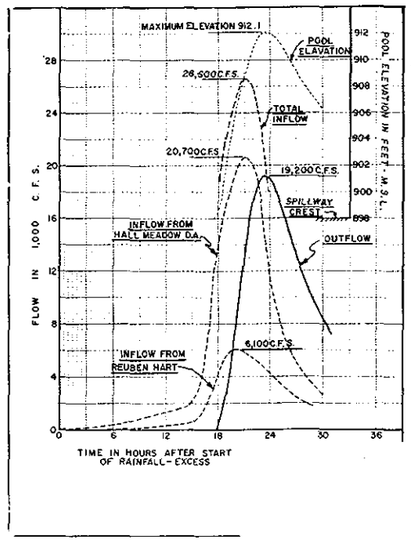
CORPS OF ENGINEERS U. S. ARMY



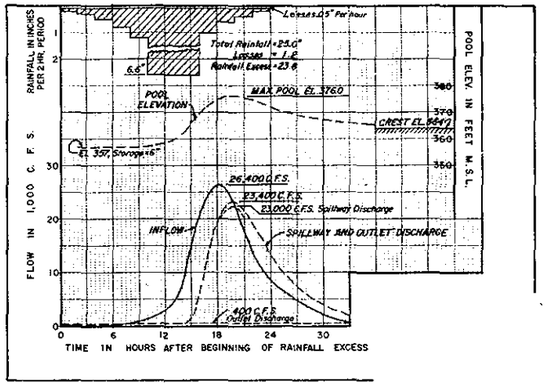
BLACK ROCK LAKE



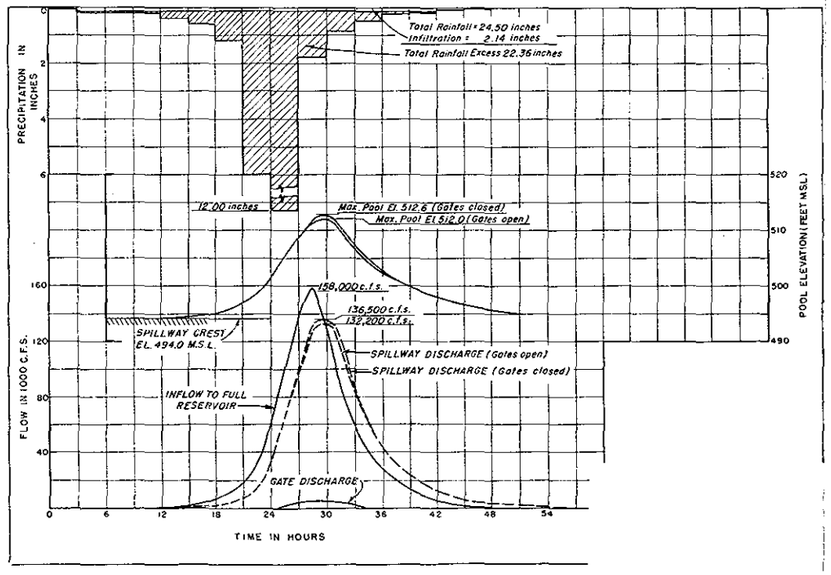
NORTHFIELD BROOK LAKE



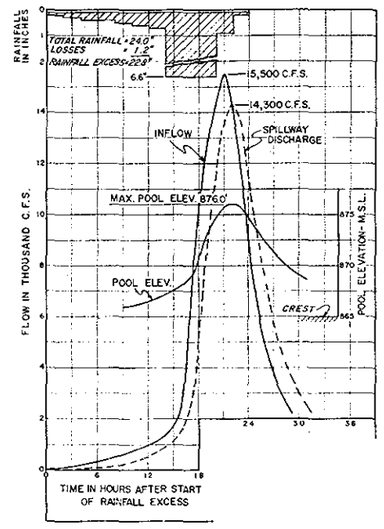
HALL MEADOW BROOK DAM



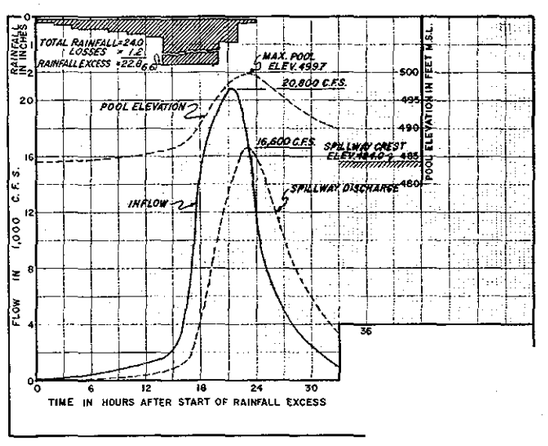
HOP BROOK LAKE



THOMASTON DAM



EAST BRANCH DAM



HANCOCK BROOK LAKE

Note:

Spillway design floods taken from design memorandum, reference table 15 for more detailed design criteria

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

DES. BY | DR. BY | CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, TECH. ENG. BRANCH
REVIEWED:
PROJECT ENGINEER
APPROVAL RECOMMENDED:
CHIEF BRANCH

WATER RESOURCES DEVELOPMENT PROJECT
HOUSATONIC RIVER BASIN

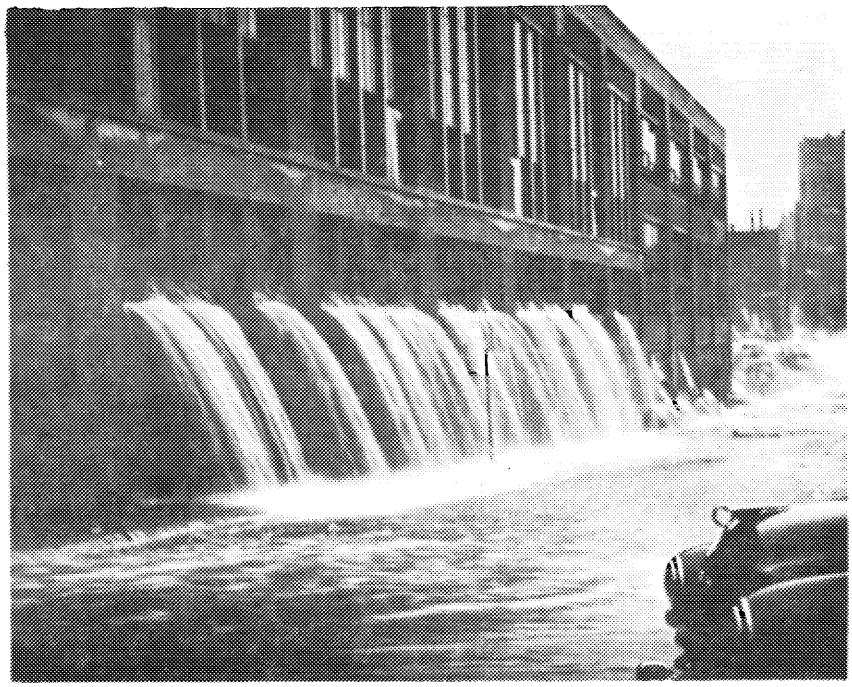
NAUGATUCK RIVER WATERSHED
SPILLWAY DESIGN FLOODS

APPROVED
CHIEF, ENGINEERING DIVISION

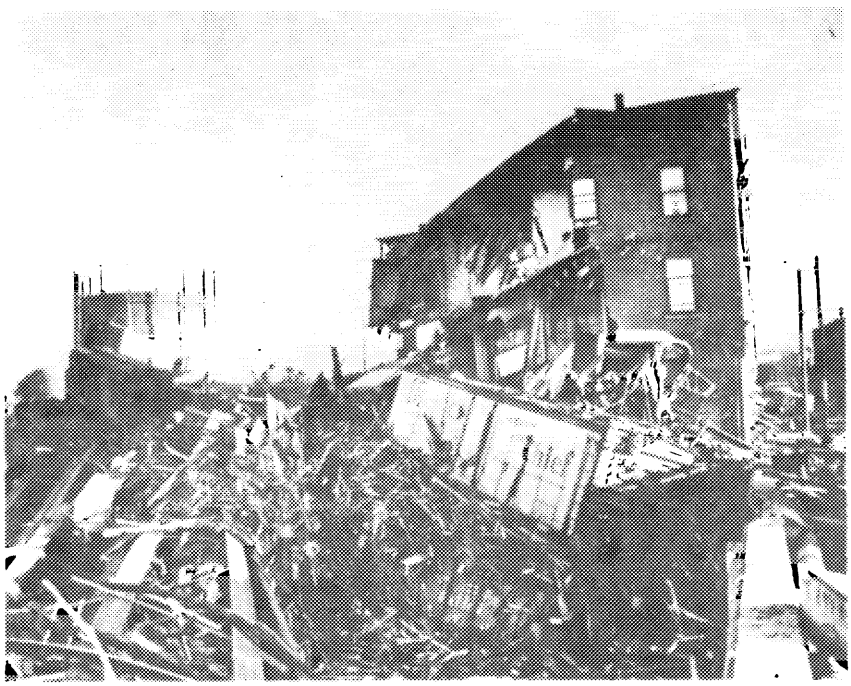
DATE SEPT. 1976

SCALE | SPEC. NO.
DRAWING NUMBER

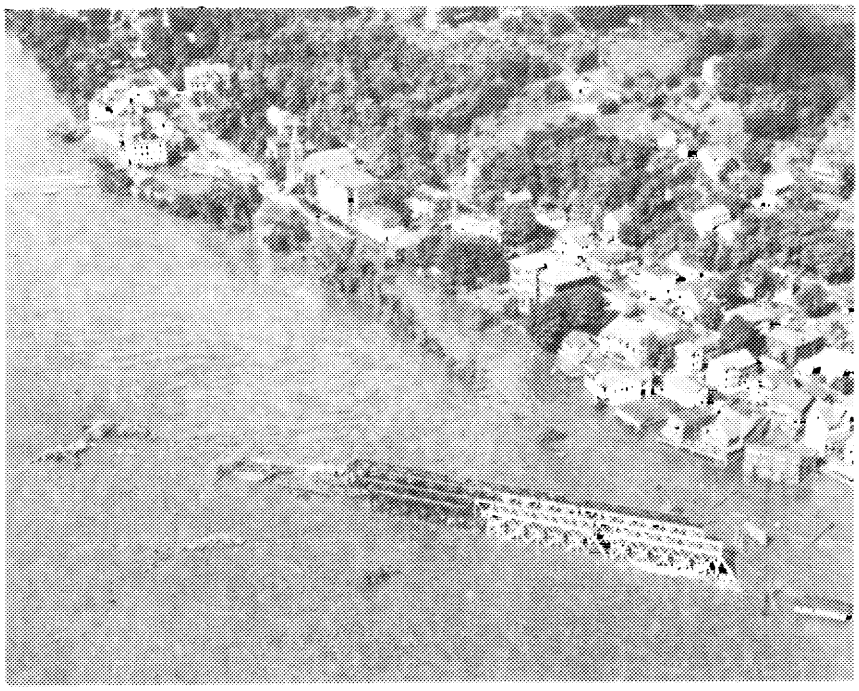
PLATE 97



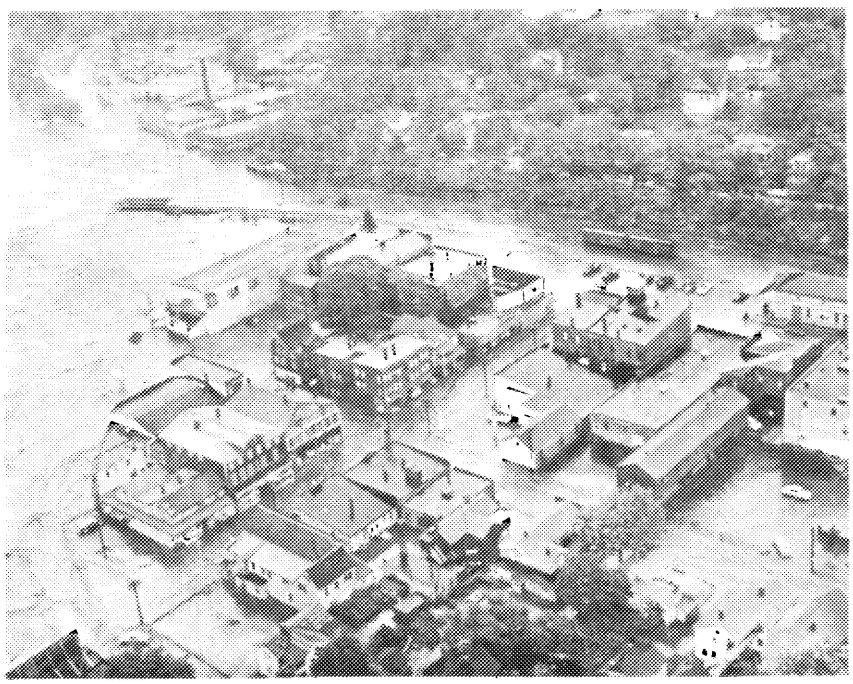
Torrington, Conn.
August 1955



Waterbury, Conn.
August 1955



Naugatuck, Conn.
August 1955



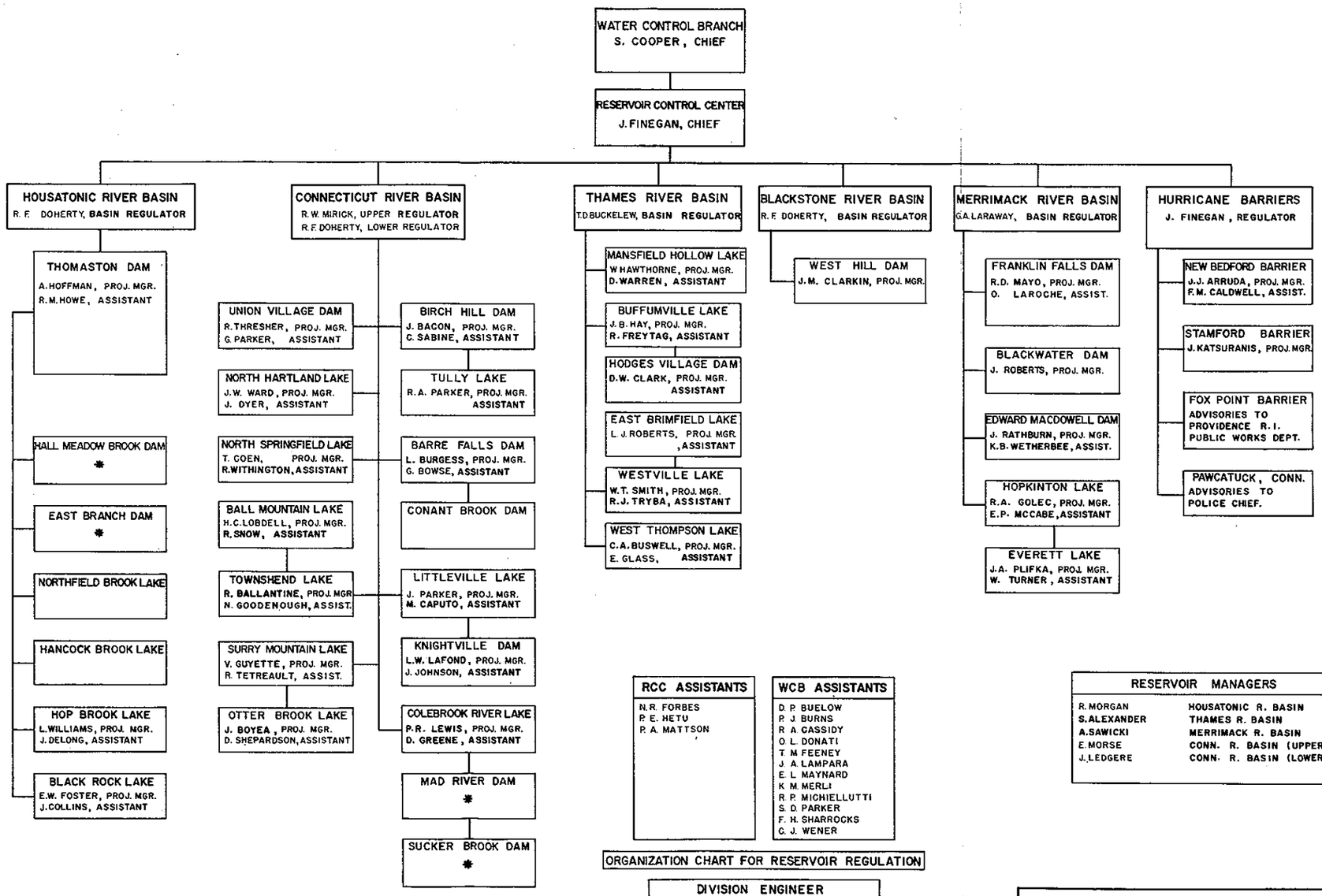
Seymour, Conn.
August 1955

PLATE 99

HOUSATONIC RIVER BASIN
DAMAGES PREVENTED FLOOD OF _____

DAMAGE ZONE			INDEX STATION		START DAMAGE[1]		EXPERIENCED CONDITIONS			COMPUTED NATURAL DATA			DAMAGES PREVENTED[2]	
NO.	RIVER	REACH	LOCATION	DRAINAGE AREA	C F S	STAGE(FT)[3]	C F S	STAGE(FT)[3]	$ DAMAGES[1]	C F S	STAGE(FT)[3]	$ DAMAGES	$ DAMS	$ LPP'S
				(SQ. MI.)	(Col. 6)	(Col. 7)	(Col. 8)	(Col. 9)	(Col. 10)	(Col. 11)	(Col. 12)	(Col. 13)	(Col. 14)	(Col. 15)
14 A	EAST BRANCH NAUGATUCK	N.Y. N.H. & H. RAILROAD BRIDGE TO EAST MAIN ST. BRIDGE	FITZGERALD MFG. CO. DAM	12.5	1,300	- 6.5								
14 B	WEST BRANCH NAUGATUCK	WEST TORRINGTON TO CONFLUENCE WITH EAST BRANCH	AMERICAN BRASS CO. DAM	32.8	3,200	- 9.0								
14 C	NAUGATUCK	CONFLUENCE EAST AND WEST BRANCHES TO THOMASTON DAM	ALBERT ST. BRIDGE	47.6	4,200	- 9.0								
14 D_1	NAUGATUCK	THOMASTON DAM TO ORIS BAKELIGHT DAM	ORIS BAKELIGHT CO. DAM	108	4,500	- 12.0								
14 D_2	NAUGATUCK	ORIS BAKELIGHT CO. DAM TO SPRUCE BROOK	PENN-CENTRAL RR. BRIDGE	138	5,200	- 12.0								
15 A	NAUGATUCK	SPRUCE BROOK TO AMERICAN BRASS CO. DAM	CHASE BRASS CO. DAM	154	5,200	- 15.0								
15 B	NAUGATUCK	AMERICAN BRASS CO. DAM TO BANK STREET BRIDGE	WEST MAIN ST. BRIDGE	180	6,000	- 17.0								
15 C	NAUGATUCK	BANK STREET BRIDGE TO PLATT BROS. DAM	EAGLE STREET BRIDGE	210	14,200	- 17.0								
15 D	NAUGATUCK	PLATT BROS. DAM TO BEACON FALLS RUBBER CO. DAM	OLD USGS GAGE AT NAUGATUCK	246	21,600	- 10.3								
15 E	NAUGATUCK	BEACON FALLS RUBBER CO. DAM TO SEYMOUR MFG. CO. DAM	PINE ROAD BRIDGE	275	23,700	- 12.0								
15 F	NAUGATUCK	SEYMOUR MFG. CO. DAM TO AMERICAN BRASS CO. DAM	AMERICAN BRASS CO. DAM	300	10,000	- 12.8								
15 G	NAUGATUCK	AMERICAN BRASS CO. DAM TO DIVISION ST. BRIDGE	MAPLE ST. BRIDGE	306	30,000	28.0 Ft. MSL								
16	NAUGATUCK & HOUSATONIC	BELOW DIVISION STREET BELOW SHELTON DAM	———	———	TIDAL	9.5 Ft. MSL 11.0 Ft. MSL								

1. NATURAL CONDITIONS PRIOR TO CONSTRUCTION OF LOCAL PROTECTION PROJECTS.
2. ALL ZONES, Col. 14 = Col. 13 - Col. 10; ZONES INCLUDING LPP'S, Col. 15 = Col. 10.
3. STAGE IS REFERENCED TO FLOOD OF RECORD AT EACH INDEX STATION.



RCC ASSISTANTS
N.R. FORBES
P.E. HETU
P.A. MATTSON

WCB ASSISTANTS
D.P. BUELOW
P.J. BURNS
R.A. CASSIDY
O.L. DONATI
T.M. FEENEY
J.A. LAMPARA
E.L. MAYNARD
K.M. MERLI
R.P. MICHIELLUTTI
S.D. PARKER
F.H. SHARROCKS
C.J. WENER

RESERVOIR MANAGERS	
R. MORGAN	HOUSATONIC R. BASIN
S. ALEXANDER	THAMES R. BASIN
A. SAWICKI	MERRIMACK R. BASIN
E. MORSE	CONN. R. BASIN (UPPER)
J. LEDGERE	CONN. R. BASIN (LOWER)

ORGANIZATION CHART FOR RESERVOIR REGULATION

DIVISION ENGINEER
↓
ENGINEERING DIVISION
↓
WATER CONTROL BRANCH
↓
RESERVOIR CONTROL CENTER

* Maintained By State Of Connecticut, Department of Environmental Protection, Water and Related Resources Unit.

ORGANIZATION CHART

RESERVOIR REGULATION

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

SEPTEMBER 1976

PLATE 101

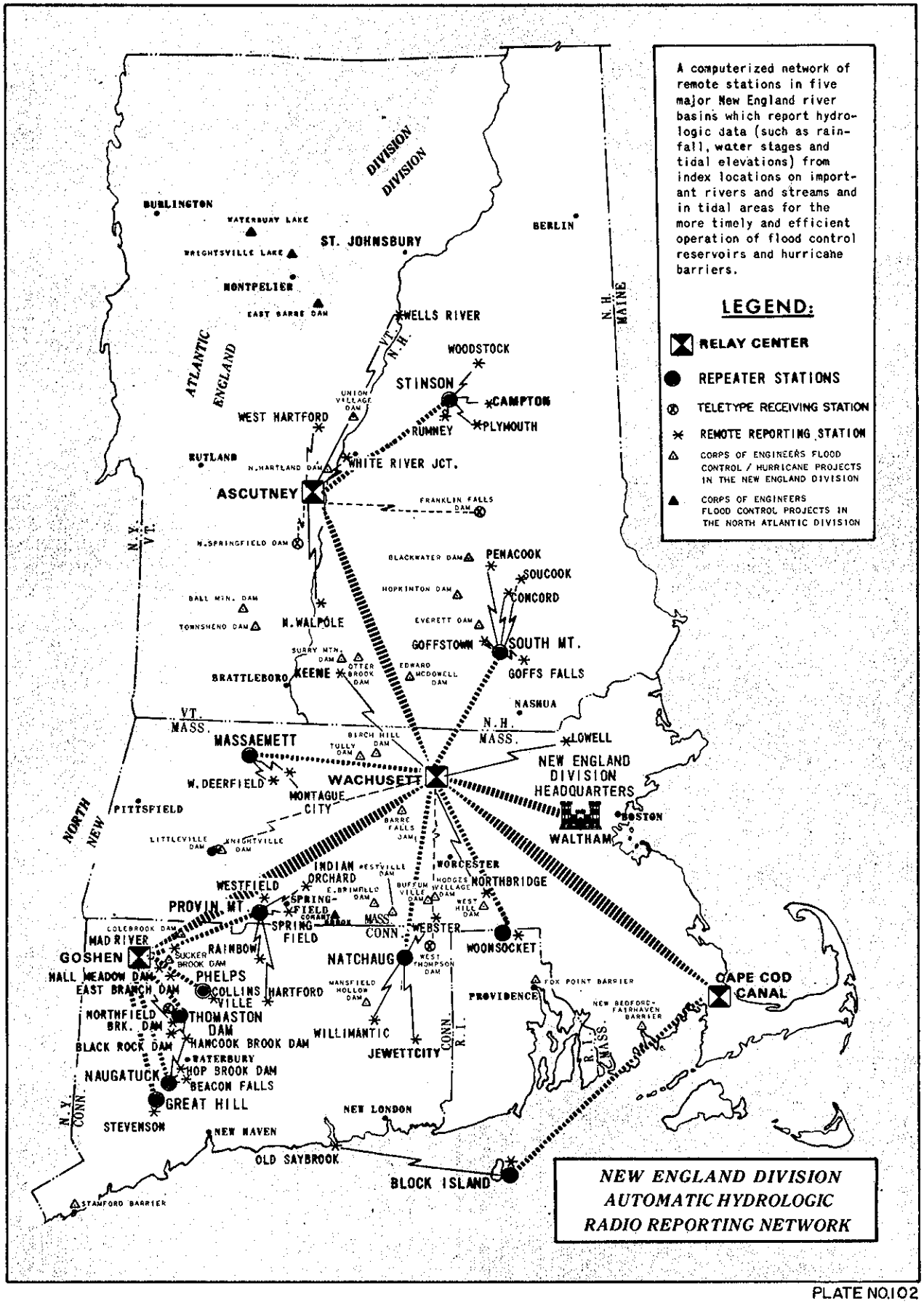

A computerized network of remote stations in five major New England river basins which report hydrologic data (such as rainfall, water stages and tidal elevations) from index locations on important rivers and streams and in tidal areas for the more timely and efficient operation of flood control reservoirs and hurricane barriers.
LEGEND:
RELAY CENTER
REPEATER STATIONS
TELETYPE RECEIVING STATION
REMOTE REPORTING STATION
CORPS OF ENGINEERS FLOOD CONTROL / HURRICANE PROJECTS IN THE NEW ENGLAND DIVISION
CORPS OF ENGINEERS FLOOD CONTROL PROJECTS IN THE NORTH ATLANTIC DIVISION
NORTH ATLANTIC DIVISION
NEW ENGLAND DIVISION
BURLINGTON
WATERBURY LAKE
WRIGHTSVILLE LAKE
ST. JOHNSBURY
BERLIN
MONTPELIER
EAST BARRE DAM
WELLS RIVER
WOODSTOCK
STINSON
CAMPTON
PLYMOUTH
RUMNEY
UNION VILLAGE DAM
WEST HARTFORD
RUTLAND
N.HARTLAND DAM
WHITE RIVER JCT.
ASCUTNEY
FRANKLIN FALLS DAM
N.SPRINGFIELD DAM
BLACKWATER DAM
PENACOOK
SOUCOOK
CONCORD
HOPKINTON DAM
BALL MTN. DAM
TOWNSHEND DAM
N.WALPOLE
EVERETT DAM
GOFFSTOWN
SOUTH MT.
GOFFS FALLS
SURRY MTN. DAM
OTTER BROOK DAM
EDWARD MCDOWELL DAM
BRATTLEBORO
KEENE
NASHUA
VT.
MASS.
N.H.
LOWELL
BIRCH HILL DAM
TULLY DAM
MASSAEMETT
W.DEERFIELD
WACHUSETT
MONTAGUE CITY
NEW ENGLAND DIVISION HEADQUARTERS
BOSTON
WALTHAM
PITTSFIELD
BARRE FALLS DAM
LITTLEVILLE DAM
KNIGHTVILLE DAM
WESTVILLE DAM
WORCESTER
INDIAN ORCHARD
WESTFIELD
E.BRIMFIELD DAM
BUFFUMVILLE DAM
HODGES VILLAGE DAM
NORTHBRIDGE
WEST HILL DAM
PROVIN. MT.
SPRING-FIELD
CORAMPTON
MASS.
CONN.
WEBSTER
COLEBROOK DAM
MAD RIVER
RAINBOW
WOONSOCKET
GOSHEN
SUCKER BROOK DAM
NATCHAUG
WEST THOMPSON DAM
HALL MEADOW DAM
PHELPS
EAST BRANCH DAM
COLLINS VILLE
HARTFORD
MANSFIELD HOLLOW DAM
PROVIDENCE
FOX POINT BARRIER
CAPE COD CANAL
NORTHFIELD BRK. DAM
THOMASTON DAM
WILLIMANTIC
NEW BEDFORD-FAIRHAVEN BARRIER
BLACK ROCK DAM
HANCOOK BROOK DAM
JEWETTCITY
CONN.
R.I.
MASS.
WATERBURY
NAUGATUCK
HOP BROOK DAM
BEACON FALLS
GREAT HILL
N.Y.
CONN.
STEVENSON
NEW LONDON
NEW HAVEN
OLD SAYBROOK
BLOCK ISLAND
STAMFORD BARRIER
NEW ENGLAND DIVISION
AUTOMATIC HYDROLOGIC
RADIO REPORTING NETWORK

PLATE NO.102

ALL STATION SCAN 2 FEB. 1973

COASTAL STATION	FILE NO.	DAY HR.MIN.	TIDE	BAROMETER	WIND VELOCITY	WIND DIRECTION
40 BLOCK ISLAND	54	33 2055	2.80 FT.	29.03 IN. WARN	49 MPH	225 DEGR
COASTAL STATION	FILE NO.	DAY HR.MIN.	TIDE	BAROMETER	WIND VELOCITY	WIND DIRECTION
41 OLD SAYBROOK	52	33 2055	2.50 FT.	29.12 IN. WARN	39 MPH	149 DEGR

98

STA. NO. AND NAME	FILE NO.	DAY HR.MIN.	DISCH.	CFS/SM	STAGE	CHNGSTG	RAIN	INCR.
38 WELLS RIVER	72	33 2055	7024.	2.7	4.60 FT.	0.0		
36 WEST HARTFORD	72	33 2056	840.	1.2	4.30 FT.	-0.1		
35 WHITE RIVER JUNCTION	69	33 2056	11590.	2.8	8.70 FT.	-0.1		
37 N WALPOLE	72	33 2056	14850.	2.7	10.90 FT.	0.0		
15 KEENE	72	33 2056	0.	0.0	69.50 FT.	0.4		
7 WEST DEERFIELD	73	33 2056	3234.	5.8	4.30 FT.	0.2		
6 MONTAGUE CITY	73	33 2056	21340.	2.7	14.10 FT.	0.8		
17 INDIAN ORCHARD	72	33 2056	1500.	2.2	6.10 FT.	0.0		
18 WESTFIELD	72	33 2056	1824.	3.7	6.10 FT.	-1.4		
16 SPRINGFIELD	72	33 2056	19600.	2.0	5.60 FT.	0.2		
27 MAD RIVER DAM	63	33 2057			NO REPORT			
24 COLLINSVILLE	72	33 2057	9000.	25.4	12.20 FT. FSTG	5.7		
20 RAINBOW	72	33 2057	2210.	3.7	3.40 FT.	0.0		
19 HARTFORD	70	33 2057	20600.	2.0	7.20 FT.	0.4		
34 RUMNEY	71	33 2057	387.	2.7	3.50 FT.	0.1	15.67 IN.	0.36 WARN
33 WOODSTOCK	72	33 2057	3946.	20.4	6.70 FT. WARN	1.4	4.03 IN.	0.37 WARN
39 CAMPTON	70	33 2057	422.	7.3	10.80 FT.	0.3	2.65 IN.	0.17
32 PLYMOUTH	72	33 2057	3450.	5.5	3.00 FT. CHRG	0.1		
10 PENACOOK	73	33 2057	3520.	4.6	4.00 FT.	0.0		
3 SOUCOOK	69	33 2057	214.	2.8	6.80 FT.	0.1		
11 CONCORD	73	33 2058	6190.	2.6	5.30 FT.	0.1		
8 GOFFSTOWN	72	33 2058	782.	7.5	5.70 FT.	1.1		
9 GOFFS FALLS	73	33 2058	6832.	2.2	5.60 FT.	-0.1		
14 LOWELL	73	33 2058	27499.	5.9	48.20 FT.	0.1		
96								
28 HALL MEADOW DAM	72	33 2058	132.	7.7	7.40 FT.	2.0		
30 EAST BRANCH DAM	71	33 2058	119.	13.0	17.30 FT.	6.7	5.80 IN.	0.22
26 THOMASTON DAM	72	33 2058	996.	10.2	26.80 FT.	11.9		
31 NORTHFIELD BRK. LAKE	72	33 2058	89.	15.7	28.60 FT.	9.7		
25 BLACK ROCK LAKE	72	33 2058	345.	15.2	39.10 FT.	9.1		
23 HANCOCK BROOK LAKE	72	33 2058	190.	15.9	8.60 FT.	0.8		
29 HOP BROOK LAKE	72	33 2059	288.	17.6	27.80 FT.	4.9		
22 BEACON FALLS	73	33 2059	6832.	26.2	9.20 FT. FSTG	0.8		
21 STEVENSON	72	33 2059	15400.	10.0	11.60 FT. WARN	2.5		
99								
13 NORTHBRIDGE	73	33 2059	-0.	0.0	-10.00 FT. NVLD1			
12 WOONSOCKET	73	33 2059	2658.	6.4	5.30 FT.	0.9		
2 WEBSTER	73	33 2059	574.	6.7	6.60 FT. WARN	0.2		
4 JEWETT CITY	73	33 2059	4290.	6.0	10.20 FT.	0.2		
1 WILLIMANTIC NATCH.P.	73	33 2059	3602.	9.0	7.10 FT. WARN	1.2	14.06 IN.	0.55 WARN

PLATE 103

SAMPLE TELETYPE TO THOMASTON DAM

STATION NAME	NOTE	STA.	DAY	TIME	DISCH.	STAGE	RAIN
**********		30	287	0809	3	13.0	0.24
HALLMEADOW BRK DAM	* *	28	287	0803	38	2.8	
EAST BRANCH DAM	*RAIN *	30	287	0803	25	1.0	6.26
THOMASTON DAM	* *	26	287	0803	60	2.9	
NORTHFIELD BRK LAKE	*CHRG *	31	287	0803	21	22.8	
HOP BROOK LAKE	* *	29	287	0803	50	18.6	
BLACK ROCK LAKE	*NRPT *	25	287	0803	15	27.0	
HANCOCK BROOK LAKE	*NVLD *	23	287	0803	0	6.7	
BEACON FALLS	* *	22	287	0803	381	2.9	
STEVENSON	*WARN*	21	287	0803	13700	11.0	

HOUSATONIC RIVER BASIN
MASTER MANUAL
OF
WATER CONTROL REGULATION

APPENDIX A
NAUGATUCK RIVER WATERSHED

THOMASTON DAM
BLACK ROCK LAKE
HOP BROOK LAKE

June 1964
Revised October 1976

MASTER MANUAL OF WATER CONTROL REGULATION
HOUSATONIC RIVER BASIN
CONNECTICUT, MASSACHUSETTS AND NEW YORK
(NAUGATUCK RIVER WATERSHED)

APPENDIX A

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APPENDIX A

WATER CONTROL REGULATION PROCEDURES FOR THOMASTON DAM, BLACK ROCK AND HOP BROOK LAKES

1. PLAN - GENERAL OBJECTIVES

The general objective of the regulation procedures for the Housatonic River basin is to provide a comprehensive tool for guiding those responsible for regulating Thomaston Dam, and Black Rock and Hop Brook Lakes in the Naugatuck River watershed in accomplishing the missions for which these projects were authorized. These procedures, in conjunction with the automatic operation of the four ungated (unmanned) reservoirs, allow for the most efficient flood protection of downstream communities on the Naugatuck River and lower Housatonic River. The Naugatuck River watershed map is shown on plate A-1.

2. REPORTS

a. Weekly Reports. The project managers make routine reports via radio (or telephone) to RCC each Friday morning. These reports insure continuous contact between the operating personnel and the RCC and also serve as a check on the communications network and river gages. The reports include the preceding 24-hour precipitation, current weather conditions, reservoir pool stage, river conditions at index stations, and other miscellaneous data. A sample of the completed form (NED 477B) is shown on plate A-2.

b. Alerting Reports. An alerting report to RCC is promptly made and includes pertinent data that is readily available together with a general appraisal of local conditions, although data from all precipitation or flood index stations may not be available.

During normal working hours each project manager will report to RCC directly. The Hop Brook project manager will obtain the stage reading of the USGS gage at Stevenson by calling the Connecticut Light and Power Company at Stevenson Dam, which is staffed 24 hours a day and remotely reads the USGS gage. During nonduty hours, the Thomaston project manager will coordinate all data from the three projects and the AHRRN readings and make a call to the basin regulator. Whenever any of the following conditions occur, the manager will immediately notify Reservoir Control Center personnel.

(1) Precipitation. Occurrence of 1 inch of rainfall, or other increment as prescribed by RCC, during any 24-hour period at either Thomaston Dam, Black Rock or Hop Brook Lakes or other precipitation stations within the basin.

(2) Reservoir Stages

Project	Rising Reservoir Stage (feet)
Thomaston	20
Black Rock	30
Hop Brook	20

(3) River Stage

Location	Rising River Stage (feet)
Naugatuck River at Beacon Falls	6.0

(4) Unusual Conditions. Unusual local conditions such as difficulty with the gates, ice jams, excessive debris, bridge failures, etc. will be reported.

c. Supplemental Reports. Supplemental radio reports are made by the project manager following additional instructions from RCC or if it appears that flood conditions could develop in the watershed as the result of melting snow, ice jams, dam failures or heavy localized rainfall. Should the reports be made during nonduty hours the Thomaston project manager will coordinate

the reports from Black Rock and Hop Brook and place a call to the basin regulator. The time and frequency of these reports are dependent upon the severity of conditions and specific instructions from RCC. Plate A-3 shows a typical reporting log (NED Form 503) which indicates the data to be included in reports by the project manager during flood periods. Insofar as practical the following information is included in the report to RCC:

(1) Precipitation at Dam. Total amount of precipitation which has fallen up to the time of reporting and several intermediate readings as requested.

(2) Reservoir Stage. The present pool stage and several previous readings at 2-hour increments to determine the rate of rise and define the inflow hydrograph. Accurate readings of stage and time are essential to determine reservoir inflows (see plates A-4 through A-7, inclusive).

(3) Gate Positions. Gate openings and discharges at time of reporting. Any gate changes since preceding report should be included with corresponding stage and discharge.

(4) Precipitation Reports from Observers. Rainfall data received from observers such as the Torrington Police Department or Anaconda Brass Company in Naugatuck. Telephone numbers for observers are listed in the RCC telephone directory.

(5) River Stages. Naugatuck and Housatonic River stages with times of observations from the Beacon Falls and Stevenson gages.

(6) Snow Cover. General snow cover which may affect runoff conditions.

(7) Temperature. Current temperature at the project, which may affect runoff conditions.

(8) Miscellaneous Data. Any other information which might be pertinent such as dam failure, bridge failure, highway or railroad washouts, ice jams or debris deposit.

d. Special Reports. A special report is submitted by the

manager to RCC whenever unusual circumstances occur during a flood or as requested by RCC. The report may be written in longhand and should describe the subjects outlined below if appropriate; photographs should be included if at all possible.

(1) Observations at Dam. The manager makes general observations of conditions occurring at the intake structure and outlet works. Observations are entered in a log book at the dam and should note the date, time, reservoir stage and position of the gates, with particular emphasis on the following:

(a) Extent and action of eddies and waves in the vicinity of the conduit intakes and portals.

(b) Extent and action of turbulence or eddies downstream of the spillway and outlet works.

(c) Effect on the flow through the gates due to an accumulation of ice or debris at the intake.

(d) The pool elevation and position of the gates at which vibrations may develop, or creation of whirlpools in the reservoir.

(e) Any seepage from vicinity of downstream toe, noting color of discharge, pool stage, location of seepage and rising or falling pool conditions.

(f) Any other unusual hydraulic phenomena that may occur.

(2) Observations at Downstream Control Points. During periods of reservoir regulation, particularly while emptying the reservoir, reconnaissance of downstream conditions is made by the managers as requested by RCC to obtain further data on channel conditions at any of the downstream damage areas or control points.

e. Snow Survey Reports. Snow courses have been established by RCC at selected locations within the watershed and are described in paragraph 9 of the Master Manual. Weekly surveys are made by the managers during the winter and early spring to determine the snow depth and its equivalent water content. Dates for surveys are

established each year to correspond with monthly bulletins of the U.S. Geological Survey and supplemental data from power companies. RCC issues a weekly snow bulletin which indicates snow conditions of the five major river basins in which the Corps provides flood protection.

f. Northeast River Forecast Center Report. The Thomaston project manager will make a daily telephone call at approximately 0815 hours to the Northeast River Forecast Center in Bloomfield, Connecticut to report climatologic conditions at his reservoir; however, if he or his assistant is not available the Black Rock or Hop Brook project manager will make the call. This data is used to develop a National Weather Service Housatonic River headwater statement. This is transmitted by computer accessed telephone lines to RCC twice weekly, and estimates the amount of 6-hour rainfall required to produce runoff varying from .25 to 5 inches into the Corps reservoirs. The following parameters will be reported daily:

Dam
Date
Time of observation
Precipitation (24 hours)
Form of precipitation
Present weather
Depth of new snow
Total depth of snow
Temperature - maximum preceding 24 hours
Temperature - minimum preceding 24 hours
Temperature - current

In addition to this daily report, the Thomaston project manager will also phone the Northeast River Forecast Center whenever he contacts RCC with a 1-inch alerting report.

3. FLOOD CONTROL

a. Objective. Thomaston Dam and Black Rock and Hop Brook Lakes are regulated to provide flood protection to all downstream communities on the Naugatuck and lower Housatonic Rivers.

b. Operating Constraints

(1) Minimum Releases. A minimum release of 10 to 20 cfs should be maintained at each of the three projects during periods of regulation in order to sustain downstream fish life.

(2) Flowage Easements. The authorization for Thomaston Dam allowed for flowage easements to elevation 499 feet msl which is 5 feet above spillway crest. However, the authorizations for Black Rock and Hop Brook Lakes called for the obtaining of land in fee to spillway crest plus a 300-foot horizontal strip.

(3) Downstream Locations. There are no serious or important regulation constraints downstream of the seven reservoirs.

(4) Reservoir Areas

(a) Thomaston Dam. There are no conditions that result in regulation constraints in the reservoir area.

(b) Black Rock Lake. There are no conditions that result in regulation constraints in the reservoir area.

(c) Hop Brook Lake. A 21-acre permanent recreation pool, 18 feet deep, offers day use water-related recreation facilities, which include a beach, picnic and parking areas, and sanitary facilities (at a stage of about 40 feet). Consideration should be given to minimize the impact of inundation on the recreational facilities during flood control activities, consistent with regulation procedures.

4. NONFREEZING SEASON

a. Thomaston Dam. This project was authorized for flood control only and is considered to be a "dry-bed" reservoir. The normal gate opening during the nonfreezing season is 3'-3'. This gate setting automatically restricts discharges so that the downstream channel capacity will not be exceeded if the pool rises during unexpected flood conditions.

b. Black Rock Lake. A small permanent pool approximately 27 feet deep is maintained by a concrete weir and stoplog structure, located upstream of gate 1. This gate is set at a 4-foot opening while gate 2 is set at 0.1 foot. This setting also restricts discharges during unexpected flood conditions, and prevents the

loss of fish population while maintaining flow from the top and bottom of the pool. Drawing from top and bottom constantly mixes the outflow, improving the quality of both the pool and discharge. The pool stage can be maintained between 23 and 27 feet with the use of stoplogs.

c. Hop Brook Lake. A small 21-acre permanent pool approximately 18 feet deep is maintained by a concrete weir and stoplog structure, located upstream of gate 1. Gate settings will be the same as Black Rock Lake. If either pool should drop below the weir crest elevation during the summer low flow period then gate 2 will be closed. The pool stage can vary between 16 and 20 feet with the use of stoplogs.

5. FREEZING SEASON

a. Thomaston Dam. A winter pool will not be maintained; however, the flood control gates will be operated daily by the project manager to prevent them from freezing. The normal gate setting during the freezing season is 3'-3'.

b. Black Rock Lake. The conservation pool will be maintained at an approximate stage of 27 feet. The exposed flood control gate will be operated daily to prevent freezing with the normal setting at 4'-0'.

c. Hop Brook Lake. The recreation pool will be maintained at an approximate stage of 18 feet. The exposed flood control gate will be operated daily to prevent freezing with the normal setting at 4'-0'.

6. EXTRAORDINARY FLOOD CONDITIONS

It is conceivable that extraordinary circumstances or unpredictable flood conditions may arise such as a drowning, bridge or private dam failures, highway or railroad washouts, ice jams or debris deposits. Since the purpose of the reservoirs is to save lives and prevent or reduce damage, regulation during such unusual conditions may not be governed by the rules described in the following paragraphs but will be determined by the urgency of the circumstances. During such conditions, the project manager has authority to act immediately in the public interest.

RCC and Operations Division will be notified as soon as possible of any unusual incident so that additional action may be taken to provide maximum protection. If the closure of gates is required, they will be opened only after RCC has been contacted.

7. FLOOD PERIOD

a. General. Regulation of flows from Thomaston, Black Rock and Hop Brook are initiated primarily for heavy rainfall occurring over the Naugatuck River watershed and, secondly, for specific river stages at key river index stations. Rainfall amounts are of prime importance due to the quickness of rapid runoff. Regulation may be considered in three phases during the course of a flood: Phase I - the appraisal of storm and river conditions during the development of the flood, Phase II - regulation of projects while the Naugatuck River and Housatonic River floodflows crest and move downstream, and Phase III - emptying the reservoirs following the downstream recession of the flood. The standard operating procedures (SOP) for regulating the reservoirs are shown on plate A-8.

b. Phase I - Appraisal - Alert. During this phase it is important to collect rainfall, river stage and pool stage data in order to appraise the development and magnitude of a flood in the basin. Consideration should be given to flow on the Naugatuck River at Beacon Falls where stages of 6 and 7 feet correspond to appraisal alerts 1 and 2 indicated in the SOP. It may also be necessary during this phase to reduce gate openings at the manned projects, based entirely on forecasted precipitation or snowmelt temperatures. This decision will be made by RCC personnel and will not actually retard normal flows but will prohibit damaging discharges from occurring downstream if the pool should rise.

c. Phase II - Regulation. An important regulation activity during this period is the collection of hydrologic data such as (1) precipitation amounts throughout the entire basin and surrounding areas, (2) snow cover and water content in case of spring floods, (3) stage and discharge values at downstream control points, and (4) other pertinent data which would assist in regulation. During this phase reservoir discharges are throttled to prevent or reduce downstream flooding on the Naugatuck and Housatonic Rivers.

Consideration will be given to complete closure of the gates at

all three projects (Thomaston 0.1'-0', Black Rock 0.1'-0', Hop Brook 0.1'-0') for any of the following conditions:

(1) Whenever rainfall of 2 inches on snow covered, wet or frozen ground or 3 inches on dry ground occurs within a 24-hour period at any dam or reporting station.

(2) Whenever the Naugatuck River at Beacon Falls rises to 8 feet. A rating table is shown on plate A-9.

(3) Whenever the Housatonic River at Stevenson rises to 15 feet. A rating table is shown on plates A-10 and A-11. Stevenson and Beacon Falls stages will also be monitored by the Hop Brook project manager by telephone and included in his reports to RCC to insure agreement with data being reported by the AHRRN.

(4) Whenever the Housatonic River at the Derby pumping station rises to 12 feet. This is indicative of possible flooding in the tidal estuary which extends from Derby Dam downstream to Long Island. The Hop Brook project manager will contact Derby LPP personnel to obtain gage readings whenever abnormal tides or heavy rainfall are occurring or forecasted by the National Weather Service.

As a flood develops, considerable judgment and experience are necessary to vary reservoir discharges in accordance with weather conditions, the amount of residual reservoir storages, downstream river stages, and water content of the snow in the watershed. In general, initial regulation will be governed principally by precipitation amounts, reservoir pool stages and river stages at Beacon Falls and Stevenson.

Secondary river rises from additional rainfall or snowmelt will be considered applicable to Phase II. With rising stages at Beacon Falls or Stevenson, consideration will be given to the travel times from the dams to downstream control points in order to anticipate river stages.

	Peak Travel Time (Hours)	
Project	Beacon Falls	Ansonia
Thomaston Dam	4	6
Black Rock Lake	3-1/2	5-1/2
Hop Brook Lake	1	3

Naugatuck River conditions will usually govern the continuation of regulation in Phase II, but in some events, flood conditions on the lower Housatonic River, below the confluence of the Naugatuck and Housatonic Rivers, will be the controlling factor. Conditions might be as such that stages on the Housatonic River are continuing to rise, while Naugatuck River levels recede below flood levels. Regulation in Phase II will continue until the flood peak has passed Ansonia on the Naugatuck River and Derby on the Housatonic River.

d. Phase III - Emptying the Reservoirs. Following the recession of the flood peaks at downstream communities along the Naugatuck and Housatonic Rivers, RCC will direct the emptying of the reservoirs as rapidly as possible, consistent with downstream channel capacities, weather conditions, utilized reservoir storage, remaining snow cover, and weather forecasts. The following river stages will be utilized during Phase III operations:

(1) Beacon Falls. USGS gage at the Bridge Street bridge. The maximum nondamaging channel capacity is approximately a stage of 10 feet, equivalent to a flow of 8,250 cfs from its 261 square mile drainage area, of which 152 square miles or 58 percent is controlled by Corps-built reservoirs.

(2) Nondamaging Downstream Channel Capacities. The maximum nondamaging channel capacities immediately downstream of the gated projects are as follows:

Thomaston Dam	3,500+ cfs
Hop Brook Lake	550+ cfs
Black Rock Lake	800+ cfs

During Phase III, releases from the reservoirs should approach these maximum capacities if hydrologically possible. Care should be taken at all times not to make releases greater than the peak inflow for that particular flood event.

The increase in reservoir discharge from Thomaston Dam should not exceed 500 cfs per hour up to a release of 3,000 cfs, and should not exceed 200 cfs per hour up to 3,500 cfs. At Black Rock the increase in discharge should not exceed 200 cfs per hour up to 600 cfs and 100 cfs per hour up to 800 cfs. At Hop Brook the increase in discharge should not exceed 100 cfs per hour up to 400 cfs and 50 cfs per hour up to 550 cfs.

In order to minimize the possible sloughing of reservoir lands during the emptying phase, the following rates of drawdown per a 24-hour period shall not be exceeded except as directed by RCC.

Thomaston Dam	10 feet
Black Rock Lake	10 feet
Hop Brook Lake	5 feet

Outlet rating curves for the three gated projects, and rating tables for the respective tailwater gaging stations are shown on plates A-12 through A-17. Following the emptying of the reservoirs, the gates will be set at their normal openings.

Discharge of water stored at the 3 gated reservoirs will be made in a manner that will allow Naugatuck and lower Housatonic River water levels to recede below nondamaging channel capacities. Secondary river rises during Phase III, due to either additional rainfall or snowmelt, may result in the regulation procedures reverting to Phase II.

With the reservoirs full to spillway crest and an inflow of 3 cubic feet per second per square mile (csm), it would require 7, 6 and 7 days to empty the Thomaston, Black Rock and Hop Brook pools.

e. Regulation for Snowmelt. Moderately high springtime discharges can occur as a result of melting snow, but runoff from snowmelt alone has not caused significant flood damage. The snow cover in the lower elevations, closer to Long Island Sound, usually diminishes before melting takes place in northern higher elevations near the Massachusetts border. However, snowmelt flooding has been experienced in the basin as early as November and as late as March but generally occurs in mid-February.

Active snowmelt begins when the density of the snowpack rises above 30 percent, i.e., a 10-inch depth of snow having 3 inches of water equivalent. RCC has not developed precise correlations regarding high temperatures, snow density and peak runoff relationships for the Housatonic River basin. However, operating experience has indicated that after the snowpack becomes "ripe", i.e., with a density in excess of 30 percent, several days of warm temperatures in the high 50 and 60 degrees result in flows up to

20 csm in the main stem of the Naugatuck River and discharges up to 30 csm from the smaller, steeper tributaries in the watershed. Runoff from snowmelt is generally diurnal, orderly and gradual, and regulation by RCC personnel will not necessarily follow the release guides established for runoff associated with rainfall. Regulation during periods of snowmelt alone generally will be based on maintaining releases consistent with full downstream channel capacities.

f. Regulation for Tidal Flooding. The lower 12-mile reach of the Housatonic River through the communities of Stratford, Milford, Orange and Shelton is tidal. Past experience has indicated that damages begin when stages in that reach exceed 10 to 12 feet msl. This can be a result of high river discharge or abnormally high tides or a combination of both. In the event that stages in the tidal reach are expected to exceed 10 feet msl, Corps personnel should consider visiting the area to determine the river levels at which damage begins. During major flood events in the tidal reach it is estimated that Corps projects lower stages in the range of 1 to 3 feet depending upon concurrent tide conditions.

g. Spillway Discharge. Ordinarily, during a major flood, gates in the 3 reservoirs will not be operated just to avoid spillway discharge. Surcharge storage above the spillway crest will be utilized if the downstream channel capacity continues to be exceeded by the runoff from uncontrolled areas. However, if the pool levels continue to rise above spillway crest with the possibility of exceeding maximum design surcharge, then RCC will initiate releases through the flood control gates. This will be done in increments, as listed below, whereby the gates will be fully open when the pool has reached about two-thirds design surcharge.

Thomaston Dam		Black Rock Lake		Hop Brook Lake	
Stage (ft)	Openings	Stage (ft)	Openings	Stage (ft)	Openings
119	0'-0.1'	115	0'-0.1'	75	0'-0.1'
120	2'-2'	116	1'-1'	76	1'-1'
121	4'-4'	117	2'-2'	77	2'-2'
122	6'-6'	118	3'-3'	78	3'-3'
123	8'-8'	119	4'-4'	79	4'-4'
124	10'-10'				

It should be emphasized that this would result from an extremely rare event, occurring after more than 20 inches of rainfall in 24 hours, with the reservoirs full or nearly full at the beginning of the storm event. Spillway rating curves are shown on plates A-18 through A-20.

h. Alerting of Flood Affected Populace. Whenver it is anticipated by RCC that any of the reservoirs in the Naugatuck River system will rise above spillway crest elevation during an extreme flood, causing uncontrolled releases, the following notifications will be made:

Project Spilling	Notifying Authority Proj. Mgr.	Town-Police Chief	State-Police Barracks
Hall Meadow Brook Dam*	Thomaston	Torrington	Litchfield
East Branch Dam*	Thomaston	Torrington	Litchfield
Thomaston Dam	Thomaston	Thomaston	Litchfield
Northfield Brook Lake*	Thomaston	Thomaston	Bethany
Black Rock Lake	Black Rock	Thomaston	Bethany
Hancock Brook Lake*	Thomaston	Waterville	Bethany
Hop Brook Lake	Hop Brook	Naugatuck	Bethany

* The Thomaston project manager will periodically monitor the Automatic Radio Reporting Network teletype so that he will be aware of reservoir conditions in the Naugatuck watershed. If communications with RCC fail, then the basin manager will coordinate the notifying of downstream officials if spillway discharge is anticipated.

i. Effect of Regulation on Roads Within the Reservoirs. There are several roads that pass into or through the Corps-operated reservoir areas that are subject to inundation during the storage of floodwaters. Because public safety is involved in the use of these roads, the three project managers are responsible for barricading or notifying local authorities to barricade these roads whenever necessary. Reservoir maps indicating the location of these barricades are shown on plates A-21 through A-23. Reservoir levels at which the gates should be closed are listed in the following tabulation:

ROAD BARRICADES
NAUGATUCK RIVER WATERSHED
CORPS-OPERATED PROJECTS

Project	Road	Stage Barricaded
Thomaston Dam	Entrance to Lead Mine Brook area	40'
	Old Route 8 in Harwinton	59'
	Old Route 8 near Campville	90'
	Entrance off new Rte. 8, Litchfield	90'
Black Rock Lake	Old Northfield Road	37'
	Old Route 109	37'
Hop Brook Lake	Bristol Street	34'
	Old Route 63	34'
Northfield Brk. Lake	Entrance to recreation area	34' or 2" rainfall
Hancock Brk. Lake	---	Barricade locked

8. EMERGENCY OPERATING PROCEDURES (EOP) - REGULATION WITH FAILURE OF COMMUNICATION WITH RCC

Should the Thomaston, Black Rock and Hop Brook project managers be unable to contact RCC when a flood is developing, the Naugatuck River basin manager has authority to act promptly in accordance with instructions contained in the EOP (plate A-8) and will direct the regulation of all reservoirs until communications can be re-established. Should the basin manager be unavailable for duty, then the Thomaston, Black Rock and Hop Brook project manager in that order of priority, will direct the regulation of all projects according to the EOP. It should be emphasized that whenever communications fail, or due to lack of adequate reports, it is difficult to fully appraise the runoff from an intense storm, then it is preferable for the manager to restrict the reservoir discharge at his project rather than delay regulation and actually contribute to downstream flood conditions.

The Naugatuck basin manager will regulate the discharge from all reservoirs during Phase II. The gates will be completely closed whenever the severity of the storm and/or lack of information concerning downstream conditions warrant such action, or for any of the following:

(1) Rainfall during any 24-hour period	
Snow covered, wet or frozen ground	1.5"
Dry ground	2.5"
(2) Rising stage, Naugatuck River at Beacon Falls	7.0'
(3) Rising stage, Housatonic River at Stevenson	13.0'

Complete gate closure for Thomaston (0'-0.1'), Black Rock (0'-0.1'), and Hop Brook (0'-0.1'). Emptying the reservoirs shall not be initiated until contact has been re-established with RCC.

In the event that either the Black Rock or Hop Brook project

manager is unable to contact either RCC or the Thomaston Dam via radio or telephone, then he or his assistant will drive to Thomaston Dam to report on flood conditions. However, the dams will not be left unattended during communication failure. Should conditions be such that immediate reduction of either Black Rock or Hop Brook outflows are required, the project manager has authority to initiate the gate change before reporting to Thomaston Dam. Releases for emptying the reservoirs will not be made until contact has been established with RCC. Possession of instructions contained in this manual does not relieve the project manager of his responsibility for continued efforts to communicate with RCC.

In cases of extreme emergency, the manager shall attempt to communicate with RCC through the Connecticut State Police and the Office of Civil Preparedness Mobilization Radio Networks. In addition, the hydrologic radio reporting stations at the 7 Corps reservoirs, Beacon Falls and Stevenson have radios that transmit directly to RCC.

9. MAINTENANCE OF LOG

All reports, instructions, records of unusual circumstances at the dam, and information pertinent to regulation of the reservoir are entered in the log, maintained by both the project manager and Reservoir Control Center.

10. GATE OPERATION RECORD

All gate operations are carefully noted on NED Form 90 and submitted semi-monthly to RCC (a sample is shown on plate A-24). All operations are noted regardless of the duration of the change in gate position. Also at 0800 hours each day pool stage, outflow, and 24-hour rainfall are noted on form 90. The reports include data and time of day, reservoir stage, outflow, precipitation, gate opening, tailwater reading and remarks column. RCC personnel use this form to prepare the monthly charts and annual report summary of reservoir regulation.

11. COOPERATION WITH DOWNSTREAM WATER USERS

It is the policy of the Corps of Engineers to cooperate with downstream water users and other interested parties or agencies.

The manager may be requested by downstream users to deviate from normal regulation for short periods of time. Whenever a request for such modification is received, the manager shall ascertain the validity of the request and obtain assurance from downstream water users that they are agreeable to the proposed operation. The manager will relay the information to RCC and request instructions. A minimum release from all projects for downstream fish life shall be maintained during periods of regulation.

12. ABSENCE FROM DAM

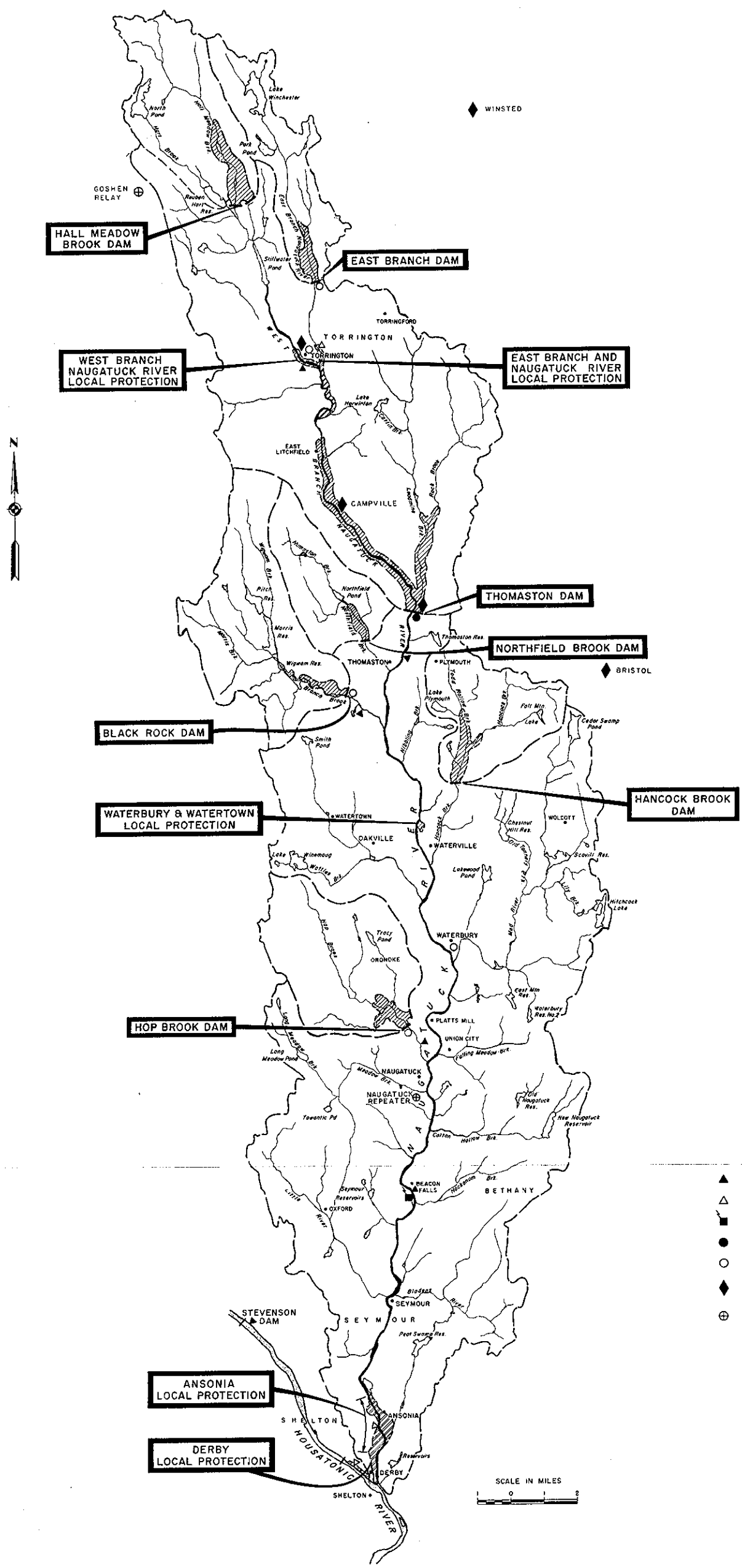
RCC and the basin manager are notified whenever the project manager expects to be away from the dam either overnight or for an extended period.

13. SEDIMENTATION

Sedimentation ranges and monuments have not been installed in the reservoir areas. Experience from other reservoir projects in New England has shown that only minimal amounts of sedimentation can be expected to take place.

14. FUTURE STUDIES

Post flood studies will be made of each reservoir regulation period to determine efficiency of communications and reporting networks, the applicability of regulation guides, including stage-discharge relationships, discharge correlations and flood reductions at damage centers.



WATER RESOURCES DEVELOPMENT PROJECT
HOUSATONIC RIVER BASIN

NAUGATUCK RIVER WATERSHED MAP

NEW ENGLAND DIVISION WALTHAM, MASS

SEPTEMBER 1976

LOG OF RADIO REPORTS – FLOOD CONTROL DAMS

29 JANUARY 76

Line	ITEM	GOSHEN RELAY 70 THOMASTON	72 BLACK ROCK	73 HOP BROOK	74 STAMFORD		ASCUTNEY RELAY 44 MAC DOWELL	40 FRANKLIN FALLS	41 BLACK WATER	42 HOPKINTON	43 EVERETT	35 SURRY MT	36 OTTER BROOK	34 TOWNSHEND	33 BALL MT	30 NORTH SPRINGFIELD	32 NORTH HARTLAND	31 UNION VILLAGE	Line
1	Time of Observation	0815	0815	0815															1
2	Precipitation (last 24 hrs.)	0	0	0															2
3	Form of Precipitation	-	-	-															3
4	Present Weather	CLDY	CLDY	CLDY															4
5	Pool Stage	64.70	61.80	47.23															5
6	Tendency	R	R	R															6
7	Gate Openings	.1-.1	.1-0	0-.1															7
8	Tailwater Gage	2.10	1.30	1.75															8
	Outflow	90	25	20															9
	INDEX POINTS																		
10	BEACON FALLS	4.8		4.8															10
11		1510		1510															11
12																			12
13	TEMPERATURE	25°	24°	30°															13
14																			14
15																			15
	REMARKS	GO TO	GO TO	GO TO															
		1-1	1-0	0-1															
		CALL @	CALL @	CALL @															
		1100	1100	1100															

NED FORM OCT 75 477(B)

NED FORM APR 65 503

REGULATION OF AND RESERVOIRS

RCS NEDED-3

LOG OF REPORTS AND INSTRUCTIONS

WUA 73

DATE AND TIME OF REPORT 1976	Hop Brook Lake RES. RES POOL HOUR	RES POOL STAGE	GATE OPENING 1	2	3	4	5	6	7	8	OUTFLOW T.W.	OUTFLOW C.F.S	RES. RES POOL HOUR	RES POOL STAGE	GATE OPENING 1	2	3	OUTFLOW T.W.	OUTFLOW C.F.S.	PRECIPITATION LOCATION	HOUR	INCHES INC	INCHES ACC.	Naugatuck RIVER AT Beacon Falls HOUR	STAGE	C.F.S	Housatonic RIVER AT Stevenson HOUR	STAGE	C.F.S	RIVER AT HOUR	STAGE	C.F.S	Temperature HOUR	STAGE	C.F.S
27 Jan	0730	21.35	0	4							3.55	365										1.20	1.20		6.5	3110		8.10	6800					50°	
		Goto	0	.5									CALL @	0800																					
	0800	22.59	0	.5							2.30	68										.40	1.60		7.1	3810		8.15	6900					50°	
													CALL @	1000																					
	1000	27.20	0	.5							2.24	60										.25	1.85		8.6	5870		8.20	7000					52°	
		Goto	0	.1									CALL @	1300																					
	1300	33.16	0	.1							1.79	21										.15	2.00		8.2	5270		8.30	7200					54°	
		Goto	0	1									CALL @	1500																					
	1500	34.71	0	2							2.51	98										.10	2.10		7.8	4570		8.50	7600					48°	
		Goto	0	2									Check @	2100	if	Additional				3/4"		Call Regulator													
	2130	30.52	0	2							2.90	170										.75	2.85		8.6	5870		9.05	8825					44°	
		Goto	0	.1									CALL @	0800																					
28 Jan	0800	43.96	0	.1							1.75	20										.70	3.55		7.4	4180		10.20	11700					36°	
		Goto	0	2									CALL @	1500																					

NED FORM 102
15 Nov. 1951

RESERVOIR REGULATION
COMPUTATION OF INFLOW

Flood of SEPTEMBER 1975

Reservoir THOMASTON DAM By R.F. D. Date 28 SEPTEMBER

TIME 1975	RES. STAGE Feet	CHANGE IN RES. STAGE Feet per hour Observed	Adjusted	FLOW into/from STORAGE c.f.s.	OUTFLOW c.f.s.	TOTAL INFLOW (5) + (6) c.f.s.	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SEPT.							
26-1200	25.2				2800		
		0.4	.2	210		330	
1400	25.6				120		
		0.6	.3	340		460	
1600	26.2				120		
		4.2	2.1	2620		2740	
1800	30.4				120		
		10.9	5.5	10000		10120	
2000	41.3				120		
		7.0	3.5	8800		8920	
2200	48.3				120		
		3.4	1.7	5250		5370	
27-0000	51.7				120		
		2.5	1.3	4400		4520	
0200	54.2				120		
		2.1	1.1	4050		4170	
0400	56.3				120		
		2.0	1.0	3900		4020	
0600	58.0				120		
		1.9	0.9	3700		3820	
0800	59.9				120		

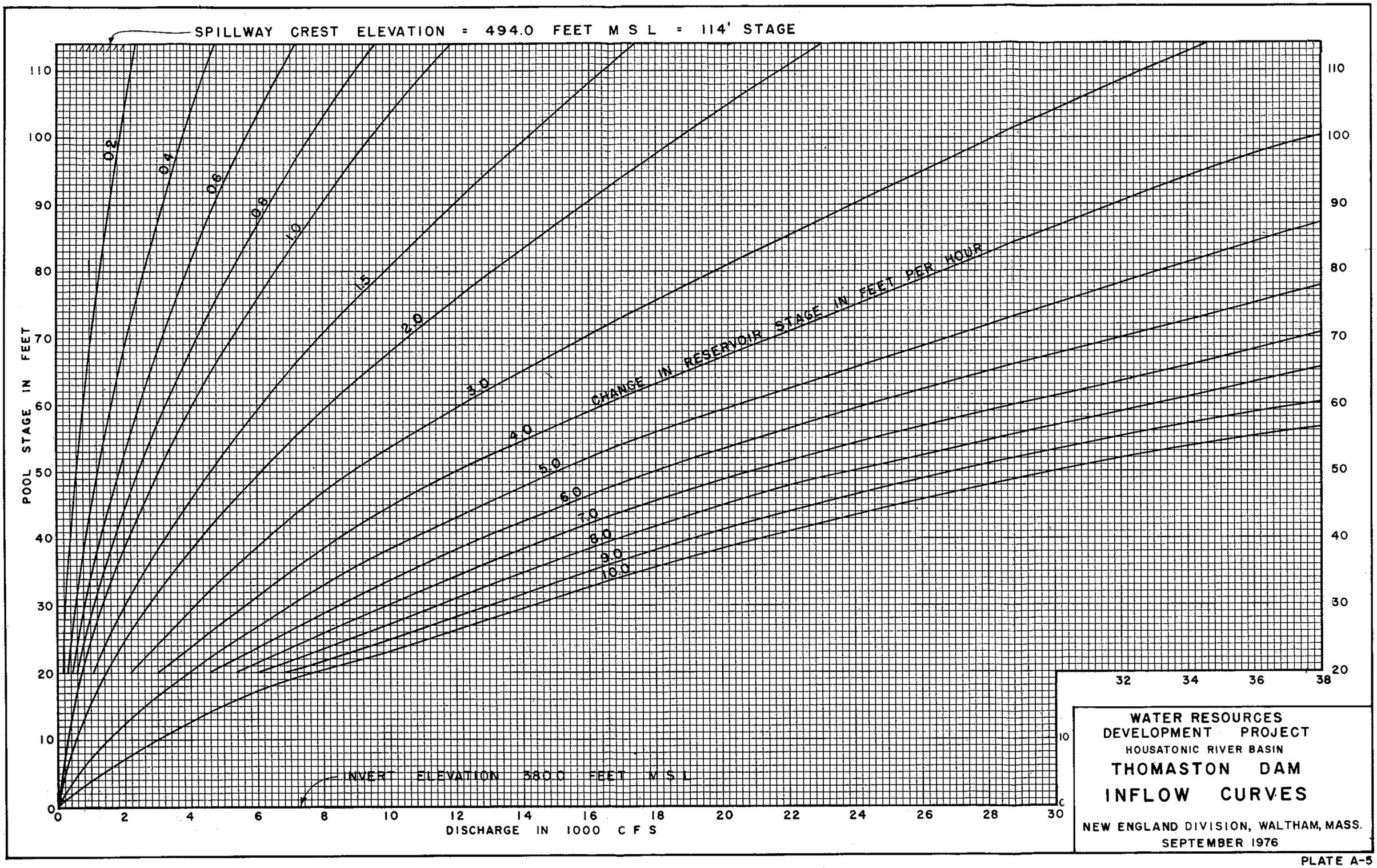
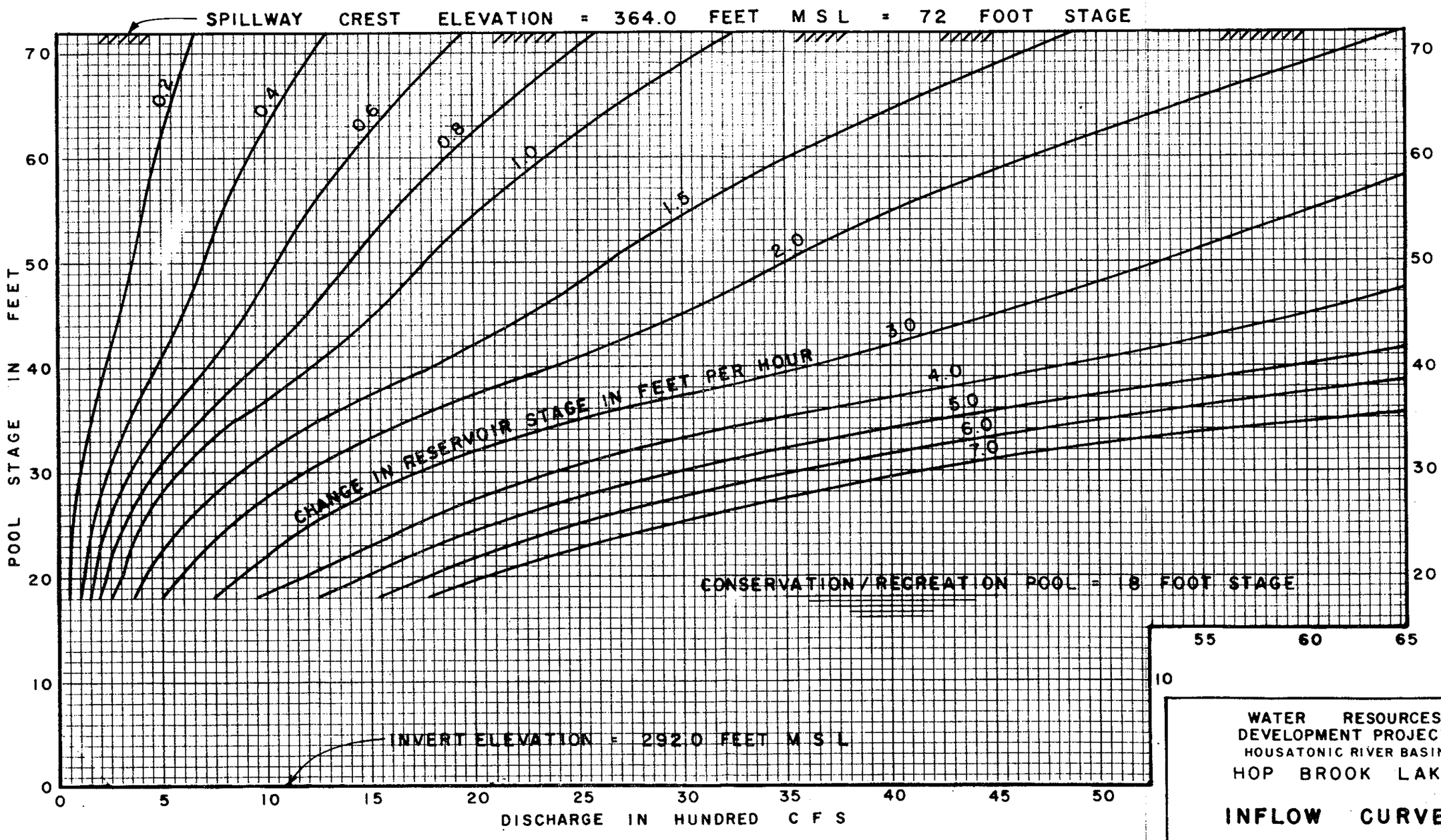

SPILLWAY CREST ELEVATION = 494.0 FEET M S L = 114' STAGE
INVERT ELEVATION 380.0 FEET M S L
CHANGE IN RESERVOIR STAGE IN FEET PER HOUR
0.2
0.4
0.6
0.8
1.0
1.5
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
POOL STAGE IN FEET
DISCHARGE IN 1000 C F S
0
10
20
30
40
50
60
70
80
90
100
110
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
WATER RESOURCES
DEVELOPMENT PROJECT
HOUSATONIC RIVER BASIN
THOMASTON DAM
INFLOW CURVES
NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPTEMBER 1976

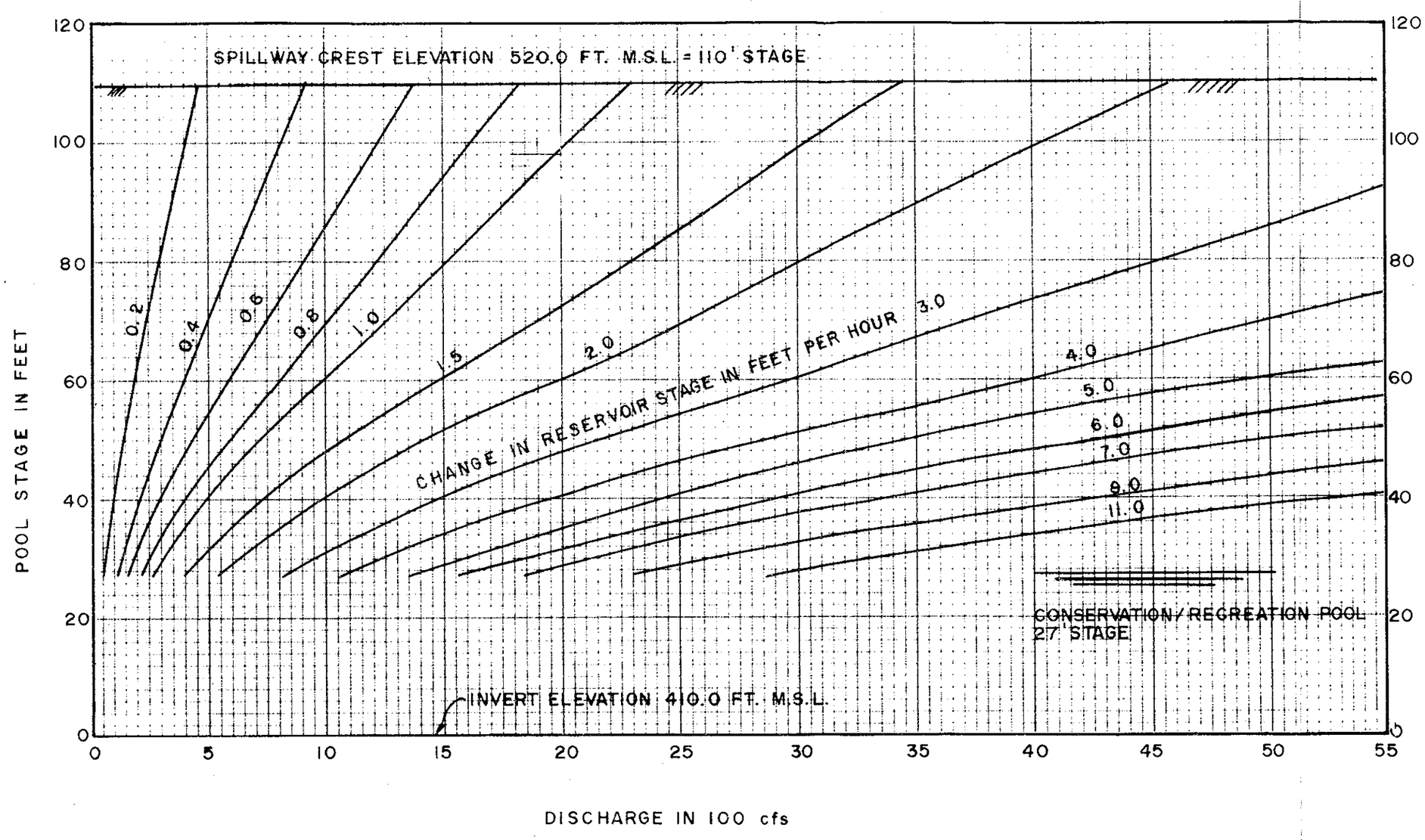
PLATE A-5



WATER RESOURCES DEVELOPMENT PROJECT
HOUSATONIC RIVER BASIN
HOP BROOK LAKE

INFLOW CURVES

NEW ENGLAND DIVISION, WALTHAM, MA.
SEPTEMBER 1976



WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
BLACK ROCK LAKE

INFLOW CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPTEMBER 1976

STANDARD OPERATING PROCEDURE (SOP)

FLOOD CONTROL REGULATION

THOMASTON DAM, BLACK ROCK AND HOP BROOK LAKES

PHASE	STORM RAINFALL (WITHIN 24 HR. PERIOD) ANTECEDENT CONDITIONS: SNOW-COV'R'D WET OR FROZEN GROUND	STORM RAINFALL: DRY GROUND	POOL STAGE IN FEET: THOMASTON DAM (97.2 SQ. MI.)	POOL STAGE IN FEET: BLACK ROCK LAKE (20.4 SQ.MI.)	POOL STAGE IN FEET: HOP BROOK LAKE (16.4 SQ.MI.)	RIVER INDEX STATIONS (STAGE IN FEET): NAUGATUCK RIVER AT BEACON FALLS (261 SQ. MI.)	HOUSATONIC RIVER AT DERBY (PUMP STA.) (1580 SQ. MI.)	HOUSATONIC RIVER AT STEVENSON (1545 SQ. MI.)	REGULATION INSTRUCTIONS: THOMASTON DAM	REGULATION INSTRUCTIONS: BLACK ROCK LAKE	REGULATION INSTRUCTIONS: HOP BROOK LAKE
I APPRAISAL			20' AND RISING	29' AND RISING	20' AND RISING	6.0' (2580 CFS)	—	11.0' (13,700 CFS)	NORMAL SETTING		
FIRST ALERT	1.0"	1.0"									
SECOND ALERT	1.5" (OR AS INSTRUCTED)	2.0"	AS INSRUCTED	AS INSTRUCTED	AS INSTRUCTED	7.0' (3690 CFS)		13.0' (19,900 CFS)	3'-3'	4'-0	0-4'
II REGULATION	2.0" (OR AS INSTRUCTED)	3.0"	AS INSTRUCTED	AS INSTRUCTED	AS INSTRUCTED	8.0' (4,990 CFS)	12.0*	15.0' (27,300 CFS)	RESTRICT OUTFLOW TO MINIMUM RELEASES 0.1'-0	0.1'-0	0-0.1'
III - EMPTYING THE RESERVOIRS	STORM HAS ABATED		—	—	—	10.0' (8,250 CFS	—	—	MAXIMUM 3500 CFS	MAXIMUM 800+CFS	MAXIMUM 400+CFS

DUTIES DURING EACH PHASE

FLOOD CONTROL-PROJECT MANAGER

PHASE I

1. COLLECT AND TRANSMIT RAINFALL AND STAGE DATA TO RCC.
2. OPERATE ACCORDING TO INSTRUCTIONS FROM RCC.

PHASE II

1. OPERATE ACCORDING TO INSTRUCTIONS FROM RCC.
2. NOTE ALL UNUSUAL CONDITIONS AT DAM, DOWNSTREAM CHANNELS AND INDEX STATIONS.
3. COLLECT AND TRANSMIT RAINFALL AND STAGE DATA AT MINIMUM 2-HOUR INTERVALS OR AS DIRECTED BY RCC.

PHASE III

1. CONTINUE PHASE II, STEP 3.
2. RECONNOITER DOWNSTREAM CHANNELS AND POTENTIAL DAMAGE AREAS.
3. REPORT TO RCC FOR FURTHER INSTRUCTIONS.

BASIN REGULATOR

PHASE I

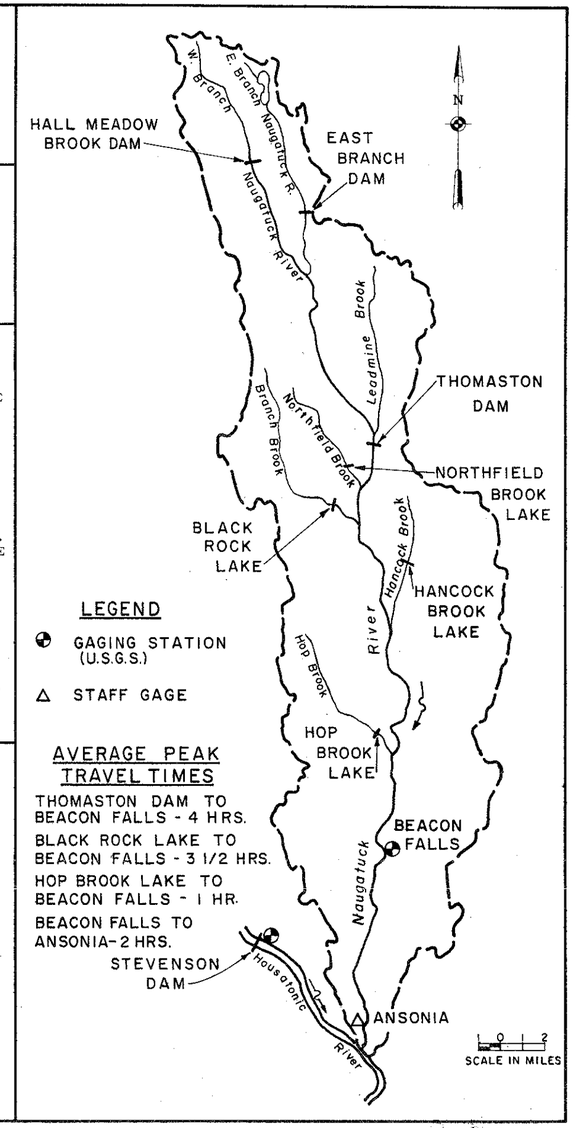
1. COMPILE DATA.
2. PLAN AND COORDINATE NEXT TRANSMISSION TO PROJECT MANAGERS.
3. INFORM CHIEF, RCC OF ACTIONS.

PHASE II

1. RESTRICT OUTFLOW TO MAINTAIN NONDAMAGING DOWNSTREAM CHANNEL CAPACITIES.
2. INFORM CHIEF, RCC OF INSTRUCTIONS GIVEN.

PHASE III

1. CONTINUE TO COLLECT DATA FROM PROJECT MANAGER.
2. CONSULT WITH CHIEF, RCC.
3. TRANSMIT INSTRUCTIONS TO PROJECT MANAGER.



EMERGENCY OPERATING PROCEDURE (EOP)
(During Communication Failure with RCC)

Domplete closure for any of the following conditions:

	Growing/Nongrowing
Precipitation	
Wet Ground	1.5"
Dry Ground	2.5"
Rising Beacon Falls Stage	7.0'
Rising Stevenson Stage	13.0'

	Thomaston	Black Rock	Hop Brook
Gate Settings	0.1'-0	0.1'-0	0-0.1'

Refer to paragraph 8 in this appendix

NOTES:

1. Emptying the reservoirs shall not be initiated until contact has been established with RCC.
2. The rate of increase in reservoir discharge in cfs per hour shall not exceed the following:

Thomaston	Black Rock	Hop Brook
500 up to 3,000 cfs	200 up to 600 cfs	100 up to 400 cfs
200 up to 3,500 cfs	100 up to 800 cfs	50 up to 550 cfs

3. Maximum rate of reservoir drawdown per 24 hours should not exceed the following:

   Thomaston - 10' Black Rock - 10' Hop Brook - 5'

4. Refer to the following paragraphs in this appendix for explicit regulation instructions concerning:

Phase III Release	7d
Snowmelt Regulation	7e
* Tidal Flooding	7f
Gate Release Schedule for Pools above Spillway Crest Elevation	7g
Closure of Reservoir Roads	7i

(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 01208[illegible]0

Table No. 09

Begin 75 03 20 __ __
YR MO. D. HR.

Rating table for Naugatuck River at Beacon Falls, Connecticut

from 20 Mar 1975 *to* ....., *from* ..... *to* ....., *from* ..... *to* .....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
1.00			3.00	375	45	5.00	1670	80	7.00	3690	120	9.00	6500	160	11.00	10250	250	13.00	15800	300
.10			.10	420	50	.10	1750	80	.10	3810	120	.10	6660	160	.10	10500	250	.10	16100	300
.20			.20	470	50	.20	1830	90	.20	3930	120	.20	6820	170	.20	10750	250	.20	16400	350
.30	28	6	.30	520	60	.30	1920	90	.30	4050	130	.30	6990	170	.30	11000	250	.30	16750	350
.40	34	7	.40	580	60	.40	2010	90	.40	4180	130	.40	7160	170	.40	11250	250	.40	17100	350
.50	41	9	.50	640	60	.50	2100	90	.50	4310	130	.50	7330	180	.50	11500	250	.50	17450	350
.60	50	11	.60	700	60	.60	2190	90	.60	4440	130	.60	7510	180	.60	11750	250	.60	17800	350
.70	61	12	.70	760	60	.70	2280	100	.70	4570	140	.70	7690	180	.70	12000	250	.70	18150	350
.80	73	13	.80	820	60	.80	2380	100	.80	4710	140	.80	7870	190	.80	12250	250	.80	18500	350
.90	86	14	.90	880	70	.90	2480	100	.90	4850	140	.90	8060	190	.90	12500	300	.90	18850	350
2.00	100	16	4.00	950	70	6.00	2580	100	8.00	4990	140	10.00	8250	200	12.00	12800	300	14.00	19200	350
.10	116	19	.10	1020	70	.10	2680	100	.10	5130	140	.10	8450	200	.10	13100	300	.10	19550	350
.20	135	22	.20	1090	70	.20	2780	110	.20	5270	150	.20	8650	200	.20	13400	300	.20	19900	350
.30	157	25	.30	1160	70	.30	2890	110	.30	5420	150	.30	8850	200	.30	13700	300	.30	20250	350
.40	182	28	.40	1230	70	.40	3000	110	.40	5570	150	.40	9050	200	.40	14000	300	.40	20600	350
.50	210	30	.50	1300	70	.50	3110	110	.50	5720	150	.50	9250	200	.50	14300	300	.50	20950	350
.60	240	30	.60	1370	70	.60	3220	110	.60	5870	150	.60	9450	200	.60	14600	300	.60	21300	350
.70	270	30	.70	1440	70	.70	3330	120	.70	6020	160	.70	9650	200	.70	14900	300	.70	21650	350
.80	300	35	.80	1510	80	.80	3450	120	.80	6180	160	.80	9850	200	.80	15200	300	.80	22000	400
.90	335	40	.90	1590	80	.90	3570	120	.90	6340	160	.90	10050	200	.90	15500	300	.90	22400	400

This table is applicable for open-channel conditions. It is based on 1 discharge measurements made during 1975 (116) and is fairly well defined between 160 cfs and 11,000 cfs.

Same as RT 8 below 1.9 feet and above 3.5 feet

Comp. by ..... date .....

Ckd. by ..... date .....

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—249-763

9-210
(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 0 1 2 0 5 5 0 0

Table No. 1 2

Begin 7 2 0 6 2 7 — —
YR. MO. D. HR.

Rating table for Housatonic River at Stevenson, Connecticut

from 27 June 1972 *to* ....., *from* ..... *to* ....., *from* ..... *to* .....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
0.00	12	4	2.00	285	30	4.00	1250	70	6.00	3350	140	8.00	6600	200	10.00	11200	250	12.00	16600	300
.10	16	5	.10	315	30	.10	1320	80	.10	3490	140	.10	6800	200	.10	11450	250	.10	16900	300
.20	21	6	.20	345	35	.20	1400	80	.20	3630	150	.20	7000	200	.20	11700	250	.20	17200	300
.30	27	6	.30	380	35	.30	1480	80	.30	3780	150	.30	7200	200	.30	11950	250	.30	17500	300
.40	33	7	.40	415	35	.40	1560	90	.40	3930	150	.40	7400	200	.40	12200	250	.40	17800	350
.50	40	8	.50	450	40	.50	1650	90	.50	4080	150	.50	7600	220	.50	12450	250	.50	18150	350
.60	48	8	.60	490	40	.60	1740	90	.60	4230	150	.60	7820	220	.60	12700	250	.60	18500	350
.70	56	10	.70	530	40	.70	1830	100	.70	4380	160	.70	8040	220	.70	12950	250	.70	18850	350
.80	66		.80	570	45	.80	1930	100	.80	4540	160	.80	8260	220	.80	13200	250	.80	19200	350
.90	76		.90	615	45	.90	2030	100	.90	4700	160	.90	8480	220	.90	13450	250	.90	19550	350
1.00	86	10	3.00	660	50	5.00	2130	110	7.00	4860	160	9.00	8700	250	11.00	13700	250	13.00	19900	350
.10	96	14	.10	710	50	.10	2240	110	.10	5020	160	.10	8950	250	.10	13950	250	.10	20250	350
.20	110	16	.20	760	50	.20	2350	110	.20	5180	160	.20	9200	250	.20	14200	300	.20	20600	350
.30	126	17	.30	810	50	.30	2460	120	.30	5340	180	.30	9450	250	.30	14500	300	.30	20950	350
.40	143	19	.40	860	60	.40	2580	120	.40	5520	180	.40	9700	250	.40	14800	300	.40	21300	350
.50	162	21	.50	920	60	.50	2700	120	.50	5700	180	.50	9950	250	.50	15100	300	.50	21650	350
.60	183	23	.60	980	60	.60	2820	130	.60	5880	180	.60	10200	250	.60	15400	300	.60	22000	350
.70	206	24	.70	1040	70	.70	2950	130	.70	6060	180	.70	10450	250	.70	15700	300	.70	22350	350
.80	230	25	.80	1110	70	.80	3080	130	.80	6240	180	.80	10700	250	.80	16000	300	.80	22700	350
.90	255	30	.90	1180	70	.90	3210	140	.90	6420	180	.90	10950	250	.90	16300	300	.90	23050	350

This table is applicable for open-channel conditions. It is based on 2 discharge measurements made during 1969 and 1972 and Rating Table No. 9, above 1.1 feet and is ..... well defined between 30 cfs and 70,000 cfs.

Comp. by ..... date .....

Ckd. by ..... date .....

Sheet 1 of 2 sheets

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—243-763

PLATE A-10

9-210
(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. _____
Table No. _____
Begin _____ YR. MO. D. HR.

Rating table for Housatonic River at Stevenson, Connecticut

from 2 June 1960 *to* 26 Feb 1961, *from* 27 June 1972 *to* _____, *from* _____ *to* _____

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
14.00	23400	350	16.00	31400	450	18.00	40500	500	20.00	50500	550	22.00	61500	550	24.00	72750	600	.00		
.10	23750	350	.10	31850	450	.10	41000	500	.10	51050	550	.10	62050	550	.10	73350	600	.10		
.20	24100	400	.20	32300	450	.20	41500	500	.20	51600	550	.20	62600	550	.20	73950	600	.20		
.30	24500	400	.30	32750	450	.30	42000	500	.30	52150	550	.30	63150	550	.30	74550	600	.30		
.40	24900	400	.40	33200	450	.40	42500	500	.40	52700	550	.40	63700	550	.40	75150	600	.40		
.50	25300	400	.50	33650	450	.50	43000	500	.50	53250	550	.50	64250	550	.50	75750		.50		
.60	25700	400	.60	34100	450	.60	43500	500	.60	53800	550	.60	64800	550	.60			.60		
.70	26100	400	.70	34550	450	.70	44000	500	.70	54350	550	.70	65350	550	.70			.70		
.80	26500	400	.80	35000	450	.80	44500	500	.80	54900	550	.80	65900	550	.80			.80		
.90	26900	400	.90	35450	450	.90	45000	500	.90	55450	550	.90	66450	550	.90			.90		
15.00	27300	400	17.00	35900	450	19.00	45500	500	21.00	56000	550	23.00	67000	550	.00			.00		
.10	27700	400	.10	36350	450	.10	46000	500	.10	56550	550	.10	67550	550	.10			.10		
.20	28100	400	.20	36800	450	.20	46500	500	.20	57100	550	.20	68100	550	.20			.20		
.30	28500	400	.30	37250	450	.30	47000	500	.30	57650	550	.30	68650	550	.30			.30		
.40	28900	400	.40	37700	450	.40	47500	500	.40	58200	550	.40	69200	550	.40			.40		
.50	29300	400	.50	38150	450	.50	48000	500	.50	58750	550	.50	69750	600	.50			.50		
.60	29700	400	.60	38600	450	.60	48500	500	.60	59300	550	.60	70350	600	.60			.60		
.70	30100	400	.70	39050	450	.70	49000	500	.70	59850	550	.70	70950	600	.70			.70		
.80	30500	450	.80	39500	500	.80	49500	500	.80	60400	550	.80	71550	600	.80			.80		
.90	30950	450	.90	40000	500	.90	50000	500	.90	60950	550	.90	72150	600	.90			.90		

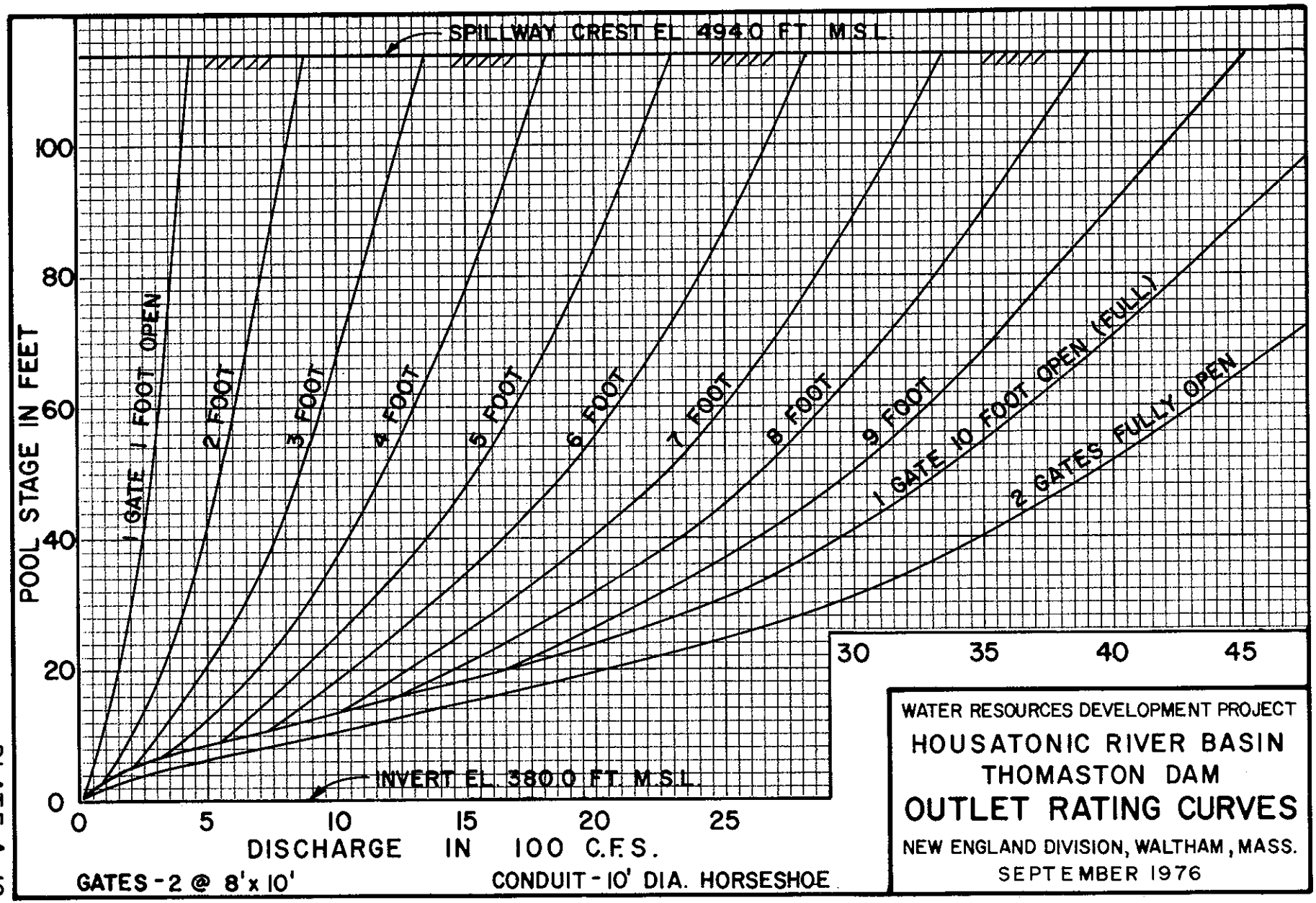
This table is applicable for open-channel conditions. It is based on _____ discharge measurements made during _____ and is _____ well defined between _____ cfs and _____ cfs.

Comp. by _____ date _____

Ckd. by _____ date _____

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—249-763

PLATE A-11



WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN

THOMASTON DAM

OUTLET RATING CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976

9-210
(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 0 1 2 0 6 9 0 0

Table No. 0 7

Begin 6 7 1 0 0 1 _ _ (YR. MO. D. HR.)

Rating table for Naugatuck River at Thomaston, Connecticut

from 1 Oct. 1967 *to* ....., *from* ..... *to* ....., *from* ..... *to* .....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
1.00			3.00	450	65	5.00	2700	170	7.00	6900	230	9.00	11500	230	11.00	16100	230	13.00	20700	230
.10			.10	515	70	.10	2870	170	.10	7130	230	.10	11730	230	.10	16330	230	.10	20930	230
.20			.20	585	75	.20	3040	180	.20	7360	230	.20	11960	230	.20	16560	230	.20	21160	230
.30			.30	660	80	.30	3220	190	.30	7590	230	.30	12190	230	.30	16790	230	.30	21390	230
.40	9.0	5	.40	740	80	.40	3410	190	.40	7820	230	.40	12420	230	.40	17020	230	.40	21620	230
.50	14	6	.50	820	90	.50	3600	190	.50	8050	230	.50	12650	230	.50	17250	230	.50	21850	230
.60	20	8	.60	910	90	.60	3790	200	.60	8280	230	.60	12880	230	.60	17480	230	.60	22080	230
.70	28	10	.70	1000	100	.70	3990	200	.70	8510	230	.70	13110	230	.70	17710	230	.70	22310	230
.80	38	12	.80	1100	110	.80	4190	210	.80	8740	230	.80	13340	230	.80	17940	230	.80	22540	230
.90	50	15	.90	1210	110	.90	4400	210	.90	8970	230	.90	13570	230	.90	18170	230	.90	22770	230
2.00	65	20	4.00	1320	120	6.00	4610	220	8.00	9200	230	10.00	13800	230	12.00	18400	230	14.00	23000	230
.10	85	25	.10	1440	120	.10	4830	230	.10	9430	230	.10	14030	230	.10	18630	230	.10	23230	230
.20	110	30	.20	1560	130	.20	5060	230	.20	9660	230	.20	14260	230	.20	18860	230	.20	23460	230
.30	140	30	.30	1690	130	.30	5290	230	.30	9890	230	.30	14490	230	.30	19090	230	.30	23690	230
.40	170	30	.40	1820	130	.40	5520	230	.40	10120	230	.40	14720	230	.40	19320	230	.40	23920	230
.50	200	40	.50	1950	140	.50	5750	230	.50	10350	230	.50	14950	230	.50	19550	230	.50	24150	230
.60	240	45	.60	2090	140	.60	5980	230	.60	10580	230	.60	15180	230	.60	19780	230	.60	24380	230
.70	285	50	.70	2230	150	.70	6210	230	.70	10810	230	.70	15410	230	.70	20010	230	.70	24610	230
.80	335	55	.80	2380	160	.80	6440	230	.80	11040	230	.80	15640	230	.80	20240	230	.80	24840	230
.90	390	60	.90	2540	160	.90	6670	230	.90	11270	230	.90	15870	230	.90	20470	230	.90	25070	230

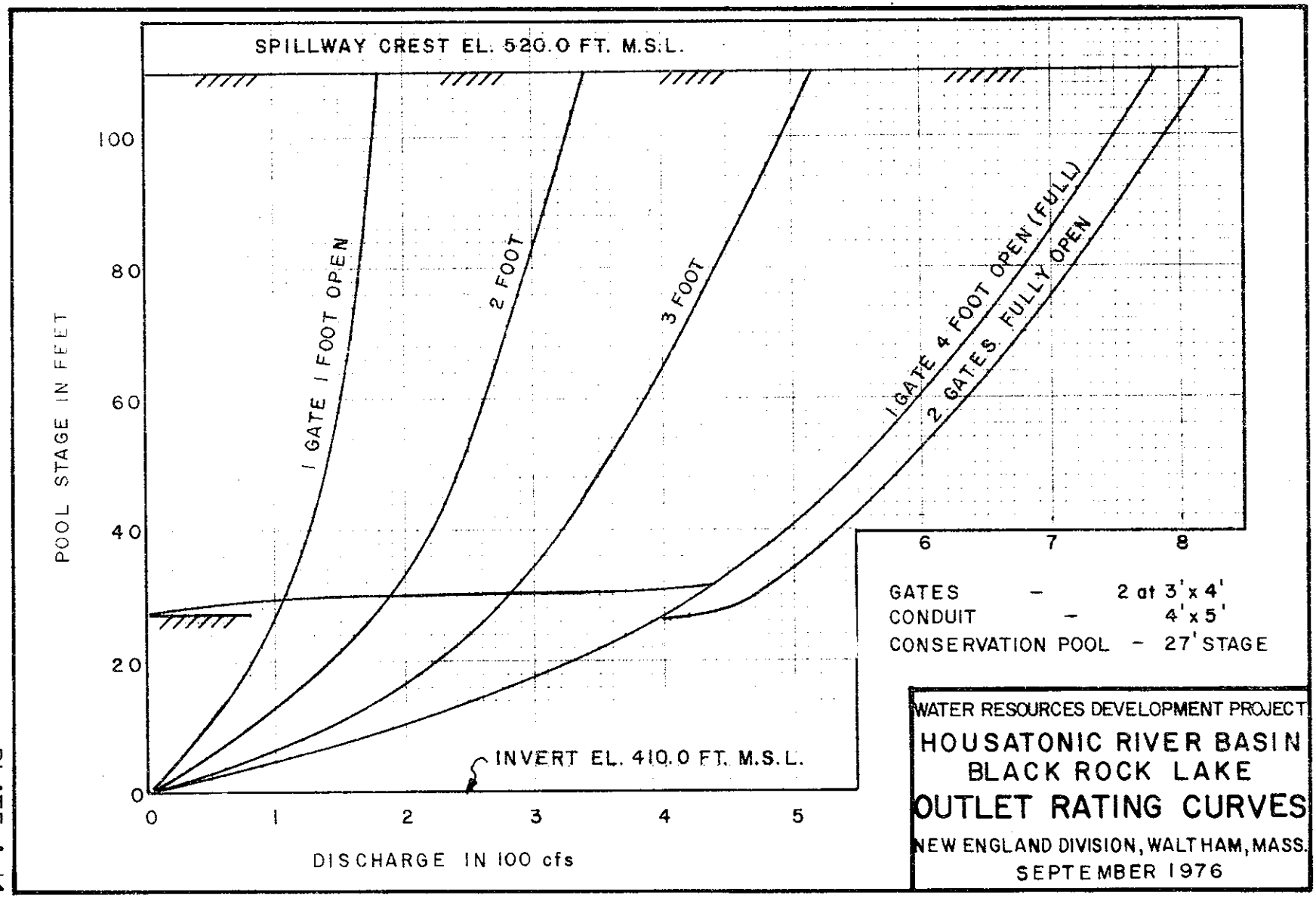
This table is applicable for open-channel conditions. It is based on 10 discharge measurements made during 1968 (87-93); 1969 (94). and is fairly well defined between 20 cfs and 5,000 cfs.

Same as RT 6 above 2.5 ft.

Comp. by ..... date .....

Ckd. by ..... date .....

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—849-768



WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
BLACK ROCK LAKE

OUTLET RATING CURVES

NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPTEMBER 1976

9-210
(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 0 1 2 0 8 0 1 3
Table No. 0 2
Begin 7 5 0 9 2 8 _ _ (YR. MO. D. HR.)

Rating table for Branch Brook near Thomaston, Connecticut
from 28 Sept. 1975 *to* _____, *from* _____ *to* _____, *from* _____ *to* _____

Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs
.00			2.00	89	17	4.00	770	50	.00			.00			.00			.00		
.10			.10	106	19	.10	820	60	.10			.10			.10			.10		
.20			.20	125	20	.20	880	60	.20			.20			.20			.20		
.30			.30	145	20	.30	940	60	.30			.30			.30			.30		
.40			.40	165	20	.40	1000		.40			.40			.40			.40		
.50			.50	185	25	.50			.50			.50			.50			.50		
.60			.60	210	30	.60			.60			.60			.60			.60		
.70			.70	240	30	.70			.70			.70			.70			.70		
.80			.80	270	30	.80			.80			.80			.80			.80		
.90			.90	300	30	.90			.90			.90			.90			.90		
1.00			3.00	330	30	.00			.00			.00			.00			.00		
.10	9	5	.10	360	40	.10			.10			.10			.10			.10		
.20	14	6	.20	400	40	.20			.20			.20			.20			.20		
.30	20	6	.30	440	40	.30			.30			.30			.30			.30		
.40	26	7	.40	480	40	.40			.40			.40			.40			.40		
.50	33	8	.50	520	50	.50			.50			.50			.50			.50		
.60	41	9	.60	570	50	.60			.60			.60			.60			.60		
.70	50	11	.70	620	50	.70			.70			.70			.70			.70		
.80	61	13	.80	670	50	.80			.80			.80			.80			.80		
.90	74	15	.90	720	50	.90			.90			.90			.90			.90		

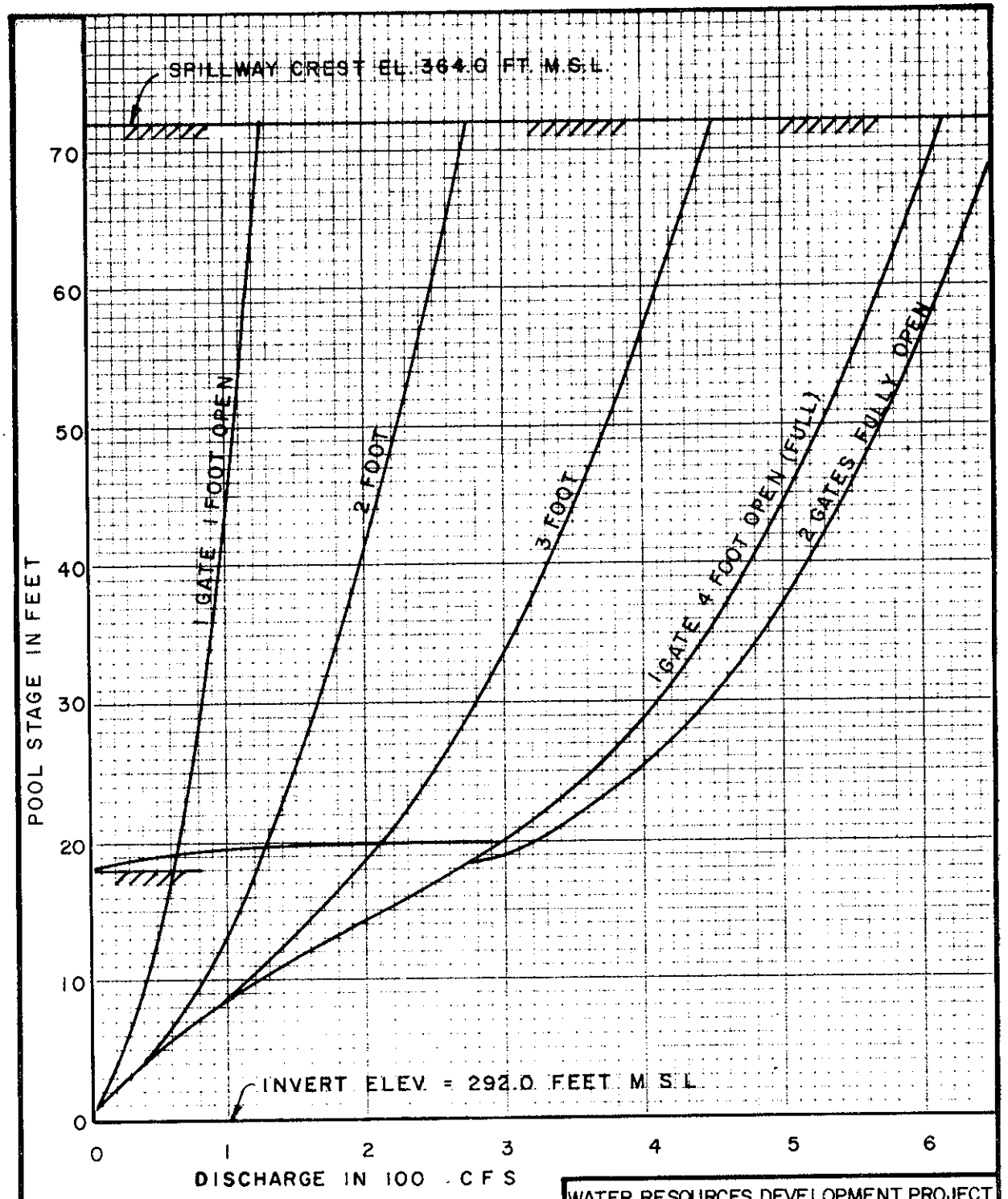
This table is applicable for open-channel conditions. It is based on 5 discharge measurements made during 1975 (16-18); 1976 (19, 20) and is fairly well defined between 30 cfs and 700 cfs.

Same as RT 1 above 2.8 ft.

Comp. by _____ date _____
Ckd. by _____ date _____

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—249-765

PLATE A-15



RECREATION POOL - 18' STAGE
GATES - 2 at 3'x4'
CONDUIT - 3'x5'

WATER RESOURCES DEVELOPMENT PROJECT
HOUSATONIC RIVER BASIN
HOP BROOK LAKE
OUTLET RATING CURVES
NEW ENGLAND DIVISION, WALTHAM, MASS.
SEPTEMBER 1976

PLATE A-16

9-210
(Rev. 2-67)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 0 1 2 0 8 4 2 0
Table No. 0 4
Begin 7 4 1 0 0 1 _ _ (YR. MO. D. NR.)

Rating table for Hop Brook near Naugatuck, Connecticut

from 1 Oct 1974 *to* _____, *from* _____ *to* _____, *from* _____ *to* _____

Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs	Gage height Feet	Discharge Cfs	Difference Cfs
1.00			3.00	195	25	5.00	1170	80	7.00	3200		.00			.00			.00		
.10			.10	220	30	.10	1250	80	.10			.10			.10			.10		
.20	0.55	0.85	.20	250	30	.20	1330	80	.20			.20			.20			.20		
.30	1.4	1.4	.30	280	30	.30	1410	90	.30			.30			.30			.30		
.40	2.8	2.2	.40	310	30	.40	1500	100	.40			.40			.40			.40		
.50	5.0	3	.50	340	30	.50	1600	100	.50			.50			.50			.50		
.60	8.0	5	.60	370	40	.60	1700	100	.60			.60			.60			.60		
.70	13	6	.70	410	50	.70	1800	100	.70			.70			.70			.70		
.80	19	7	.80	460	50	.80	1900	100	.80			.80			.80			.80		
.90	26	8	.90	510	50	.90	2000	100	.90			.90			.90			.90		
2.00	34	8	4.00	560	50	6.00	2100	110	.00			.00			.00			.00		
.10	42	10	.10	610	50	.10	2210	110	.10			.10			.10			.10		
.20	52	12	.20	660	60	.20	2320	110	.20			.20			.20			.20		
.30	64	13	.30	720	60	.30	2430	110	.30			.30			.30			.30		
.40	77	15	.40	780	60	.40	2540	110	.40			.40			.40			.40		
.50	92	18	.50	840	60	.50	2650	110	.50			.50			.50			.50		
.60	110	20	.60	900	60	.60	2760	110	.60			.60			.60			.60		
.70	130	20	.70	960	70	.70	2870	110	.70			.70			.70			.70		
.80	150	20	.80	1030	70	.80	2980	110	.80			.80			.80			.80		
.90	170	25	.90	1100	70	.90	3090	110	.90			.90			.90			.90		

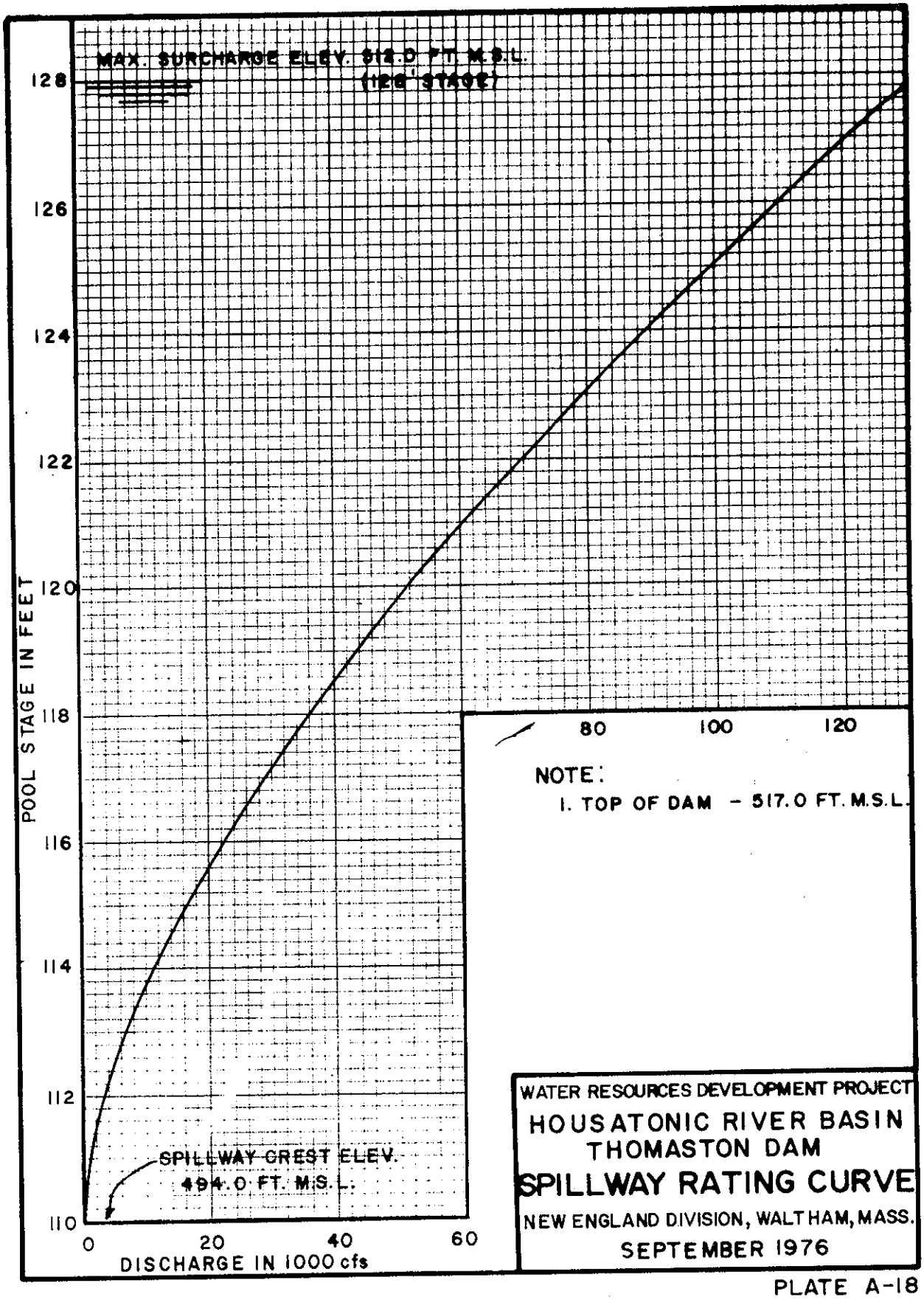
This table is applicable for open-channel conditions. It is based on 11 discharge measurements made during 1974 (47, 48); 1975 (49, 51-58), and is fairly well defined between 4 cfs and 2600 cfs.

Comp. by Law date 3-1-76

Ckd. by _____ date _____

Same as RT 3 above 2.7 ft.

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—249-765



NOTE:

1. TOP OF DAM - 517.0 FT. M.S.L.

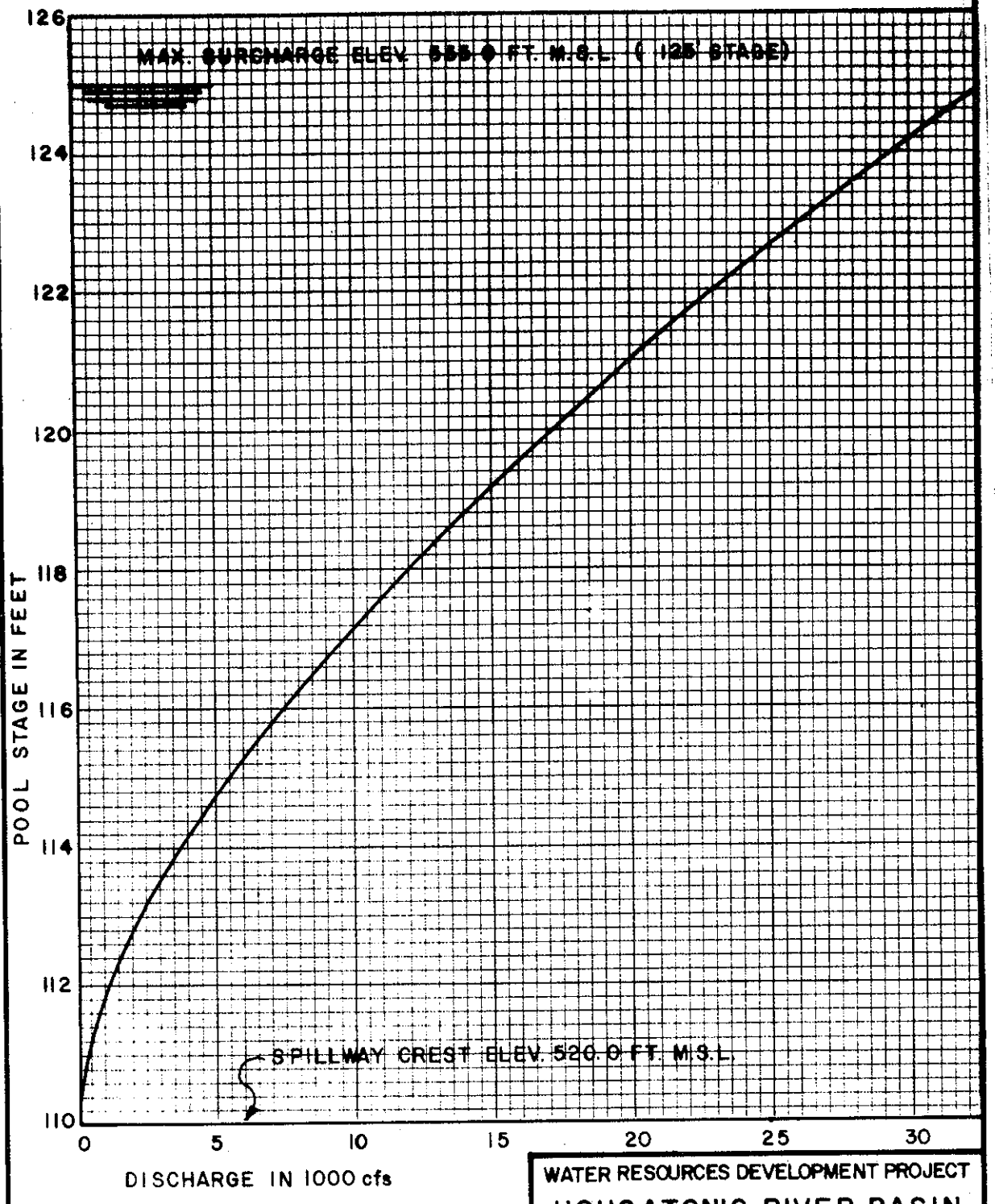
WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN
THOMASTON DAM

SPILLWAY RATING CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



NOTE:

TOP OF DAM – 540.0 FT. M.S.L.

WATER RESOURCES DEVELOPMENT PROJECT

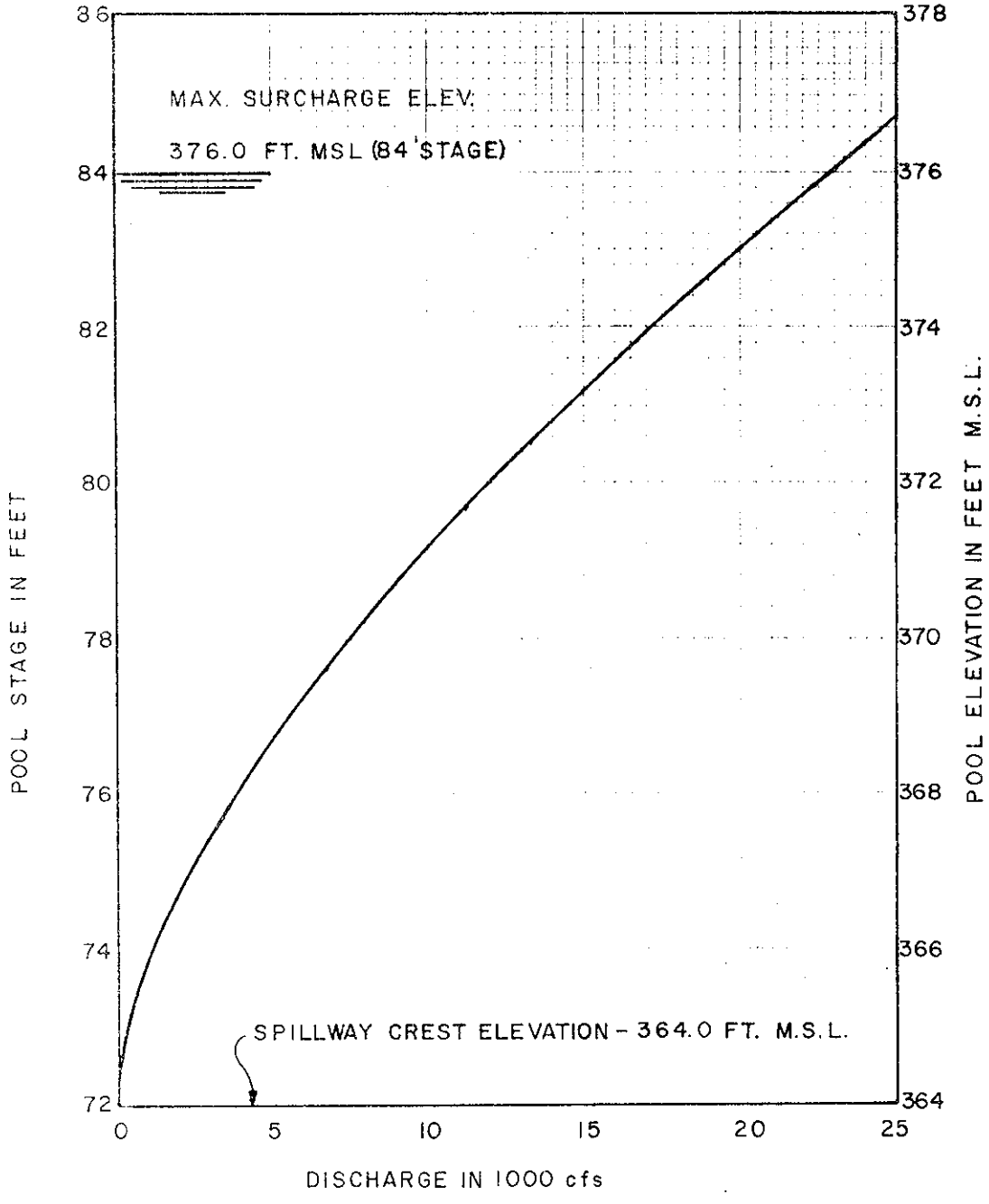
HOUSATONIC RIVER BASIN

BLACK ROCK LAKE

SPILLWAY RATING CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976



NOTE:

1. TOP OF DAM - 381.0 FT. MSL (89' STAGE)

WATER RESOURCES DEVELOPMENT PROJECT

HOUSATONIC RIVER BASIN

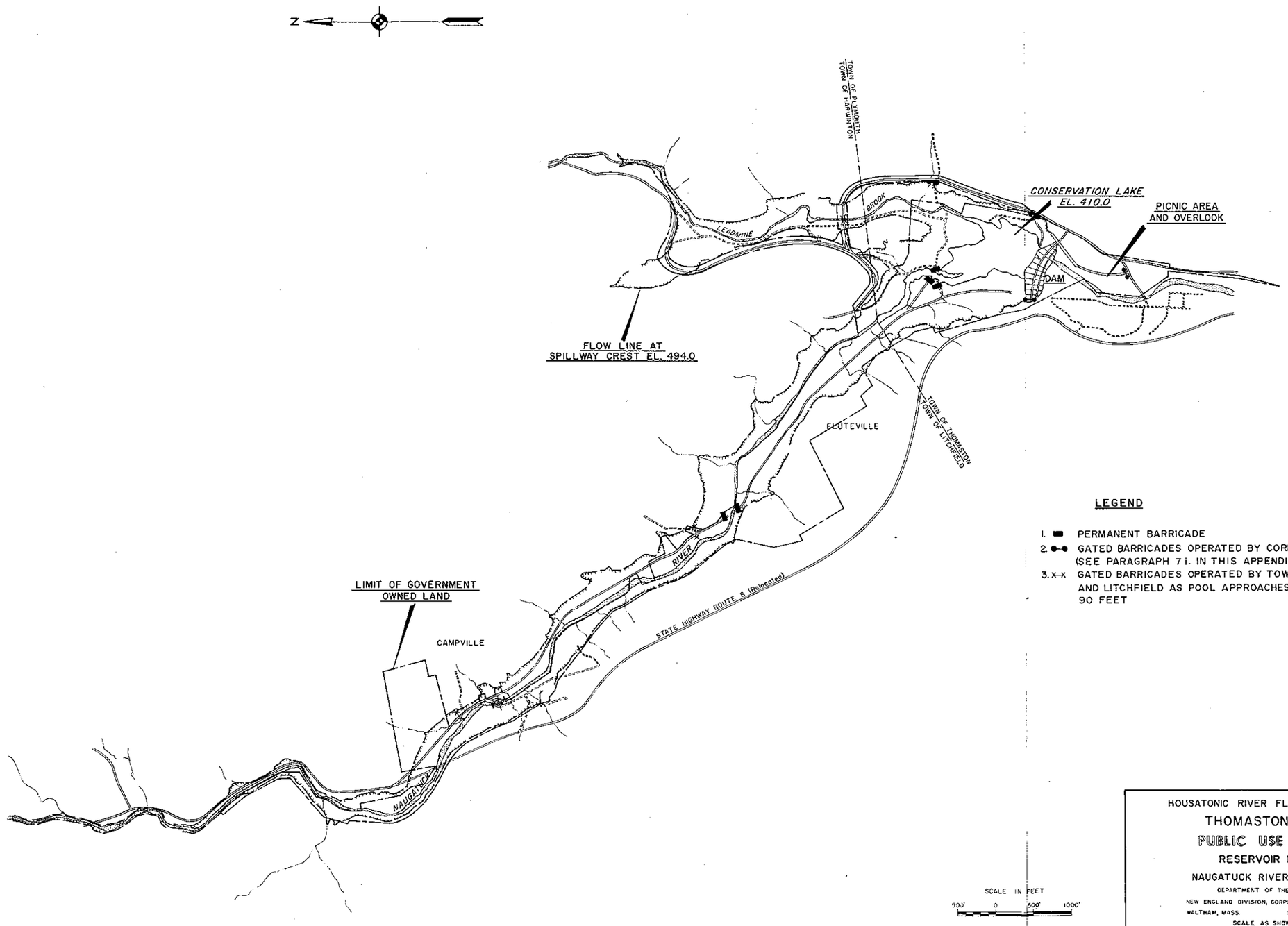
HOP BROOK LAKE

SPILLWAY RATING CURVE

NEW ENGLAND DIVISION, WALTHAM, MASS.

SEPTEMBER 1976

PLATE A-20



LEGEND

1. ▬ PERMANENT BARRICADE
2. ●-● GATED BARRICADES OPERATED BY CORPS PERSONNEL (SEE PARAGRAPH 7 i. IN THIS APPENDIX)
3. x-x GATED BARRICADES OPERATED BY TOWNS OF HARWINTON AND LITCHFIELD AS POOL APPROACHES STAGE 59 AND 90 FEET

HOUSATONIC RIVER FLOOD CONTROL

THOMASTON DAM

PUBLIC USE PLAN

RESERVOIR MAP

NAUGATUCK RIVER, CONN.

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. SEPTEMBER, 1971

SCALE AS SHOWN

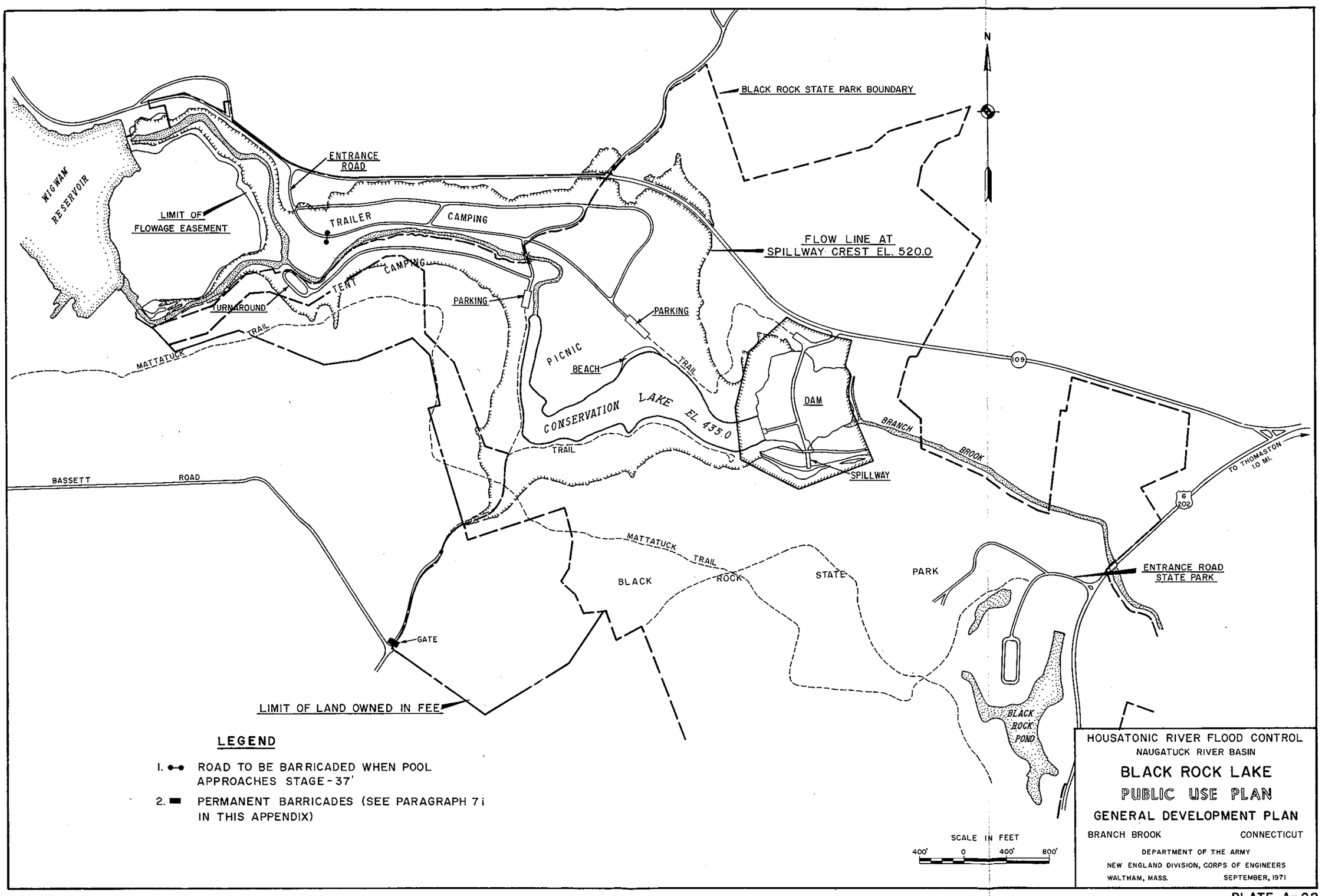

BLACK ROCK STATE PARK BOUNDARY
N
ENTRANCE ROAD
WIGWAM RESERVOIR
LIMIT OF FLOWAGE EASEMENT
TRAILER
CAMPING
FLOW LINE AT SPILLWAY CREST EL. 520.0
TENT
CAMPING
TURNAROUND
PARKING
PARKING
MATTATUCK
TRAIL
PICNIC
BEACH
TRAIL
CONSERVATION LAKE EL. 435.0
DAM
BRANCH
BROOK
109
TO THOMASTON 1.0 MI.
6
202
SPILLWAY
TRAIL
BASSETT
ROAD
MATTATUCK
TRAIL
BLACK
ROCK
STATE
PARK
ENTRANCE ROAD STATE PARK
GATE
LIMIT OF LAND OWNED IN FEE
BLACK ROCK POND
LEGEND
1. ROAD TO BE BARRICADED WHEN POOL APPROACHES STAGE-37'
2. PERMANENT BARRICADES (SEE PARAGRAPH 7i IN THIS APPENDIX)
SCALE IN FEET
400' 0 400' 800'
HOUSATONIC RIVER FLOOD CONTROL
NAUGATUCK RIVER BASIN
BLACK ROCK LAKE
PUBLIC USE PLAN
GENERAL DEVELOPMENT PLAN
BRANCH BROOK
CONNECTICUT
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.
SEPTEMBER, 1971

PLATE A-22

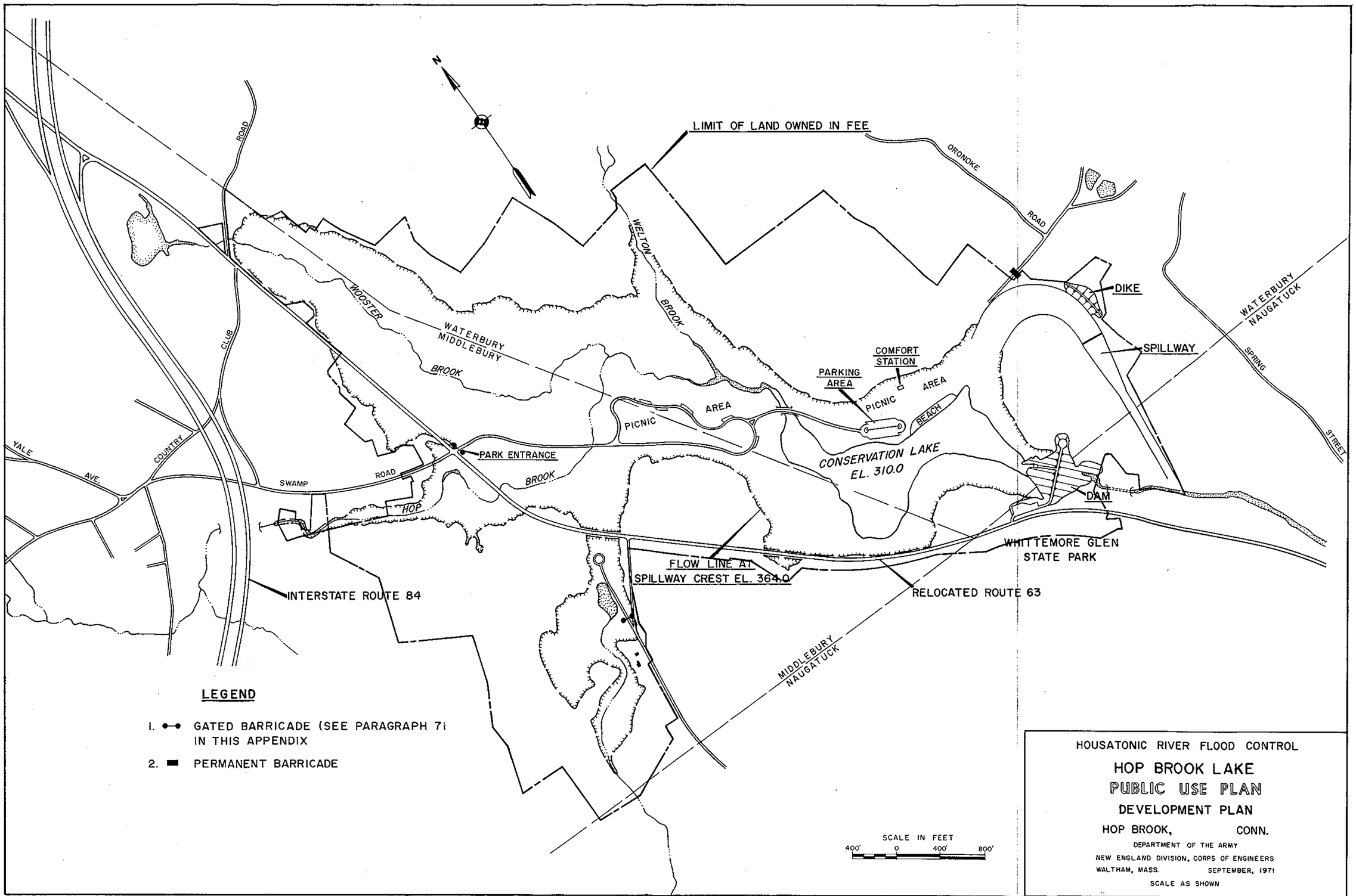

N
LIMIT OF LAND OWNED IN FEE
ORONOKE ROAD
DIKE
SPILLWAY
WATERBURY NAUGATUCK
SPRING STREET
COMFORT STATION
PARKING AREA
PICNIC AREA
BEACH
CONSERVATION LAKE
EL. 310.0
DAM
WHITTEMORE GLEN STATE PARK
RELOCATED ROUTE 63
MIDDLEBURY NAUGATUCK
WELTON BROOK
WOOSTER BROOK
WATERBURY MIDDLEBURY
PICNIC AREA
PARK ENTRANCE
HOP BROOK
SWAMP ROAD
YALE AVE
COUNTRY CLUB ROAD
FLOW LINE AT SPILLWAY CREST EL. 364.0
INTERSTATE ROUTE 84
LEGEND
1. GATED BARRICADE (SEE PARAGRAPH 7i IN THIS APPENDIX
2. PERMANENT BARRICADE
SCALE IN FEET
400' 0 400' 800'
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK LAKE
PUBLIC USE PLAN
DEVELOPMENT PLAN
HOP BROOK, CONN.
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. SEPTEMBER, 1971
SCALE AS SHOWN

PLATE A-23

GATE OPERATION RECORD

Hop Brook Lake **RESERVOIR** Jan. 16-31 **MONTH** 76 **YEAR**

OPERATOR

I.D.	DAY	HOUR	RES. STAGE	OUTFLOW	PRECIP.	T. W.	GATE SETTING	REMARKS
67	16	0800	18.84	30	.00	210	04	
67	17	0800	18.89	30	.20		04	Rain
67	18	0800	18.74	30	.00		04	
67	19	0800	18.61	30	.00		04	
67	20	0800	18.63	30	.00		04	
67	21	0800	18.65	30	.00		04	2" Snow
67	22	0800	18.67	30	.00		04	6" Snow
67	23	0800	18.63	30	.00		04	
67	24	0800	18.64	30	.00		04	
67	25	0800	18.62	30	.00		04	
67	26	0800	18.63	30	.10		04	Freezing Rain
67	27	0630	20.40	40	.00		04	
67	27	0730	21.35	15	.00		05	Close
67	27	0800	22.59	15	1.60	230	05	Rain
67	27	1220	32.50	15	.00		05	
67	27	1320	33.62	85	.00		01	Open
67	27	1400	33.80	85	.00		01	
67	27	1500	35.08	170	.00		11	Open RCC
67	27	2100	38.30	190	.00		11	
67	27	2200	38.65	20	.00	303	01	Close RCC
67	28	0800	43.96	20	1.95	175	01	Rain
67	28	0900	44.10	210	.00		20	Open RCC
67	28	1000	43.63	210	.00		20	
67	28	1100	44.40	20	.00		01	Close RCC
67	29	0800	47.23	20	.00	175	01	
67	29	0900	47.26	110	.00		01	Open RCC
67	29	1000	47.27	110	.00		01	
67	29	1100	47.26	220	.00	260	02	Open RCC
67	30	0800	45.60	210	.00	305	02	
67	31	0800	43.14	210	.00		02	
67	31	0900	43.09	210	.00		02	
67	31	1000	42.97	340	.00		03	Open RCC
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NED FORM SEP 70 90 REPLACES EDITION OF MAR 62 WHICH IS OBSOLETE

PLATE A-24

APPENDIX B

PERTINENT DATA

LIST OF PERTINENT DATA SHEETS

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DRAINAGE AREAS	Square Miles
MAIN STEM - HOUSATONIC RIVER	
Near Great Barrington, Mass. (USGS Gage)	280
At Falls Village, Conn. (USGS Gage)	632
At Gaylordsville, Conn. (USGS Gage)	994
At Stevenson, Conn. (USGS Gage)	1545
At Shelton, Conn. (Derby Dam)	1574
Above Confluence with Naugatuck River	1578
At Mouth	1949
TRIBUTARIES (Excluding Naugatuck River)	
East Branch - Housatonic River	71
West Branch - Housatonic River	59
Ten Mile River	210
Still River	71.5
Shepaug River	156
Pomperaug River	88.8
MAIN STEM - Naugatuck River	
At Torrington, Conn.	47.2
At Thomaston Dam, Conn.	97.2
At Waterbury, Conn.	178
At Beacon Falls, Conn. (USGS Gage)	261
At Ansonia, Conn.	306
At Mouth	312
TRIBUTARIES (Naugatuck)	
East Branch Naugatuck River	13.8
West Branch Naugatuck River	33.4
Branch Brook	23.0
Hancock Brook	15.6
Mad River	26.1
Hop Brook	16.7

TEMPERATURE (Degrees F.)	Bridgeport Connecticut	Cream Hill Connecticut	Waterbury Connecticut
Mean Annual	51.5	47.0	50.2
Maximum Recorded	103 (July)	98 (July-Aug)	105 (July)
Minimum Recorded	-20 (Feb)	-23 (Feb)	-25 (Feb)
Years of Record	80	76	73
Through	1975	1972	1966

PRECIPITATION (inches)	Bridgeport Connecticut	Cream Hill Connecticut	Pittsfield Massachusetts
Mean Annual	45.39	45.23	40.77
Maximum Annual	73.93 (1972)	64.26 (1945)	58.13 (1898)
Minimum Annual	23.03 (1964)	28.11 (1965)	28.58 (1964)
Years of Record	82	74	70
Through	1975	1972	1967

WATER EQUIVALENT IN SNOW COVER (Naugatuck Watershed)

	1957-1976 Mean (inches)	Maximum (inches)	Minimum (inches)
1 February	1.5	4.4	0.0
15 February	1.8	4.5	0.0
1 March	1.9	6.1	0.0
15 March	1.4	5.0	0.0
1 April	0.5	4.1	0.0
15 April	0.0	0.5	0.0

FLOW RECORDS	Housatonic River near Great Barrington, Mass. Date	Flow (cfs)	Housatonic River at Stevenson Connecticut Date	Flow (cfs)	Naugatuck River at Beacon Falls Connecticut Date	Flow (cfs)	Still River near Lanesville Connecticut Date	Flow (cfs)
Min. Ave. Daily	18 Oct 14	1	*		5 Oct 30	40	8 Sep 48	8
Min. Ave. Monthly	Sep 13	75	Sep 64	151	Aug 66	38	Sep 48	16
Min. Ave. Annual	1965	211	1965	970	1965	224	1966	55
Max. Ave. Daily	1 Jan 49	11,100	16 Oct 55	62,400	19 Aug 55	56,400	16 Oct 55	6,120
Max. Ave. Monthly	Apr 20	2,624	Mar 36	13,202	Aug 55	2,920	Oct 55	636
Max. Ave. Annual	1928	962	1938	3,956	1973	803	1952	197

* No flow at times due to regulation

FLOOD ROUTING COEFFICIENTS (Naugatuck River) Reach	Routing Coefficient (1 hr.)	River Miles Between Points
Hall Meadow Brook Dam to Torrington	3/1	5.5
East Branch Dam to Torrington	2/1	3.0
Torrington to Thomaston Dam	3/1	9.0
Thomaston Dam to Waterbury	3/2	11.0
Black Rock Lake to Waterbury	3/2	8.8
Waterbury to Naugatuck	3/1	6.0
Hop Brook Lake to Naugatuck	0/0	1.3
Naugatuck to Beacon Falls	3/1	3.8
Beacon Falls to Seymour	3/1	4.1
Seymour to Ansonia	3/1	4.4

HIGH FLOW TRAVEL TIMES	Hours
Thomaston Dam to Beacon Falls	4
Black Rock Lake to Beacon Falls	3 1/2
Hop Brook Lake to Beacon Falls	1
Beacon Falls to Shelton-Ansonia	2-2 1/2

PERTINENT DATA
THOMASTON DAM

LOCATION — Naugatuck River, Thomaston, Connecticut

DRAINAGE AREA — 97.2 Gross, 70.75 Net square miles

STORAGE USE — Flood Control

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity: Acre-Feet	Capacity: Inches on Gross Drainage Area
Invert	380.0	0	0	0	0
Spillway Crest	494.0	114.0	960	42,000	8.1
Maximum Surcharge	512.0	132.0	1,290	21,000 (net)	4.1 (net)
Top of Dam	517.0	137.0	----	----	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	2,000
Top Width (ft)	24
Top Elevation (ft msl)	517.0
Height (ft)	142
Volume (cy)	1,459,100
Dike	None

SPILLWAY

Location	Left-East Abutment
Type	Uncontrolled, side channel spillway in rock
Crest Length (ft)	435
Crest Elevation (ft msl)	494.0
Surcharge (ft)	18.0
Design Head (ft)	18.0
Maximum Discharge Capacity (cfs)	132,200

OUTLET WORKS

Type	Horseshoe Conduit
Tunnel Inside Diameter (ft)	10
Tunnel Length (ft)	455
Service Gate Type	Hydraulic slide
Service Gate Size	Two, 5'8" x 10' high
Emergency Gate Type	None (stoplogs only)
Downstream Channel Capacity (cfs)	3,500+
Maximum Discharge Capacity at Spillway Crest Elevation (cfs)	5,800
Stilling Basin	Bedrock Channel

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	465	85	838
Easement	499	119	439

MAXIMUM POOL OF RECORD

Date	Dec. 22, 1973
Stage (ft)	68.9
Percent Full	27

SPILLWAY DESIGN FLOOD

	Original Design (1960)
Peak Inflow (cfs)	158,000
Peak Outflow (cfs)	136,000*

*132,200 Spillway Discharge; 5,800 Conduit Discharge

UNIT RUNOFF

One Inch Runoff (acre-ft) — 5,185

OPERATING TIME

Open/Close all Gates — 20 min. (Hydraulic Operation)

PROJECT COST (thru FY75) — $14,282,000

DATE OF COMPLETION — November 1960

MAINTAINED BY — New England Division, Corps of Engineers

PERTINENT DATA
BLACK ROCK LAKE

LOCATION — Branch Brook, Thomaston and Watertown, Connecticut

DRAINAGE AREA — 20.4 square miles

STORAGE USES — Flood Control, Recreation

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity: Acre-Feet	Capacity: Inches on Drainage Area
Invert	410.0	0	0	0	0
Recreation Pool	437.0	27.0	21	305	0.3
Spillway Crest	520.0	110.0	190	8450 (net)	7.8 (net)
Maximum Surcharge	535.0	125.0	233	3600 (net)	3.3 (net)
Top of Dam	540.0	130.0	---	----	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	933
Top Width (ft)	25
Top Elevation (ft msl)	540.0
Height (ft)	154
Volume (cy)	1,250,000
Dike	None

SPILLWAY

Location	Right-South Abutment
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	140
Crest Elevation (ft msl)	520.0
Surcharge (ft)	15.0
Design Head (ft)	15.0
Maximum Discharge Capacity (cfs)	33,500

OUTLET WORKS

Type	Rectangular Concrete Conduit
Tunnel Inside Diameter (ft)	4' x 5'
Tunnel Length (ft)	704
Service Gate Type	Hydraulic Slide
Service Gate Size	Two, 3'0" x 4'0" high
Emergency Gate Type	None (stoplogs only)
Downstream Channel Capacity (cfs)	800+
Maximum Discharge Capacity at Spillway Crest Elevation (cfs)	900+
Stilling Basin	Bedrock channel

RECREATION POOL

Length (ft)	4,000
Shoreline Length (ft)	8,530
Area (acres)	321

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	520 + 300' Horiz. Strip	110	177
Easement	------	---	152
Clearing	439	29	

MAXIMUM POOL OF RECORD

Date	Dec. 22, 1973
Stage (ft)	78.5
Percent Full	42

SPILLWAY DESIGN FLOOD

	Original Design (1964)
Peak Inflow (cfs)	35,000
Peak Outflow (cfs)	33,500

UNIT RUNOFF

One Inch Runoff (acre-ft) — 1,090

OPERATING TIME

Open/Close all Gates — 8 min. (Hydraulic Operation)

PROJECT COST (thru FY75) — $8,182,300

DATE OF COMPLETION — July 1971

MAINTAINED BY — New England Division, Corps of Engineers

PERTINENT DATA
HOP BROOK LAKE

LOCATION — Hop Brook, Waterbury and Naugatuck, Connecticut

DRAINAGE AREA — 16.4 square miles

STORAGE USES — Flood Control, Recreation

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity: Acre-Feet	Capacity: Inches on Drainage Area
Invert	292.0	0	0	0	0
Recreation Pool	310.0	18	21	120	.1
Spillway Crest	364.0	72	270	6,850 (net)	7.8 (net)
Maximum Surcharge	376.0	84	365	3,730 (net)	4.3 (net)
Top of Dam	381.0	89	---	-----	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	520
Top Width (ft)	25
Top Elevation (ft msl)	381.0
Height (ft)	97
Volume (cy)	282,800
Dike	1 @ 400' Long, 33' High

SPILLWAY

Location	Saddle 1000' East of dam
Type	Uncontrolled, broad crested weir, chute spillway in rock
Crest Length (ft)	200
Crest Elevation (ft msl)	364.0
Surcharge (ft)	12
Design Head (ft)	12
Maximum Discharge Capacity (cfs)	23,000

OUTLET WORKS

Type	Rectangular conduit
Tunnel Inside Diameter (ft)	3' x 5'
Tunnel Length (ft)	425
Service Gate Type	Hydraulic slide
Service Gate Size	Two @ 3' x 4' high
Emergency Gate Type	None (stoplogs only)
Downstream Channel Capacity (cfs)	550+
Maximum Discharge Capacity at Spillway Crest Elevation (cfs)	600
Stilling Basin	31.5' x 14.0' wide, baffle blocks and end sill

RECREATION POOL

Length (ft)	2,200
Shoreline Length (ft)	8,660
Area (acres)	21

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	364+300' Horiz. Strip	72	573
Easement	---	--	3
Clearing	312	20	

MAXIMUM POOL OF RECORD

Date	29 January 1976
Stage (ft)	47.3
Percent Full	29

SPILLWAY DESIGN FLOOD

	Original Design (1964)
Peak Inflow (cfs)	26,400
Peak Outflow (cfs)	23,400*

*23,000 Spillway Discharge; 400 Conduit Discharge

UNIT RUNOFF

One Inch Runoff (acre-ft) — 875

OPERATING TIME

Open/Close all Gates — 6 min. (Hydraulic Operation)

PROJECT COST (thru FY75) — $6,008,000

DATE OF COMPLETION — December 1968

MAINTAINED BY — New England Division, Corps of Engineers

PERTINENT DATA
HANCOCK BROOK LAKE

LOCATION — Hancock Brook, Plymouth, Connecticut

DRAINAGE AREA — 12.0 square miles

STORAGE USES — Flood Control, Conservation

RESERVOIR STORAGE

	Elevation msl	Stage Feet	Area acres	Capacity Acre-Feet	Capacity Inches on Drainage Area
Invert	454.0	0	0	0	0
Conservation Pool	460.0	6	40	130	0.2
Spillway Crest	48[illegible].0	30	266	3,900 (net)	6.1 (net)
Maximum Surcharge	49[illegible].7	45.7	348	4,820 (net)	7.6 (net)
Top of Dam	505.0	51.0	---	---	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	630
Top Width (ft)	20
Top Elevation (ft msl)	505.0
Height (ft)	57
Volume (cy)	176,900
Dike	1 Railroad, 2,300' long, 35' high

SPILLWAY

Location	Right-West Abutment
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	100
Crest Elevation (ft msl)	484.0
Surcharge (ft)	15.7
Design Head (ft)	15.7
Maximum Discharge Capacity (cfs)	16,600

OUTLET WORKS

Type	Rectangular concrete, conduit
Tunnel Inside Diameter (ft)	3' x 4.5'
Tunnel Length (ft)	250
Service Gate Type	Ungated
Downstream Channel Capacity (cfs)	350
Discharge Capacity at Spillway Crest Elevation (cfs)	377
Stilling Basin	Bedrock channel

CONSERVATION POOL

Length (ft)	4,300
Shoreline Length (ft)	21,690
Area (acres)	40

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	464+300' Horz. Strip	30	665
Easement	---	--	14
Clearing	462	8	

MAXIMUM POOL OF RECORD

Date	Dec. 22, 1973
Stage (ft)	16.1
Percent Full	24

SPILLWAY DESIGN FLOOD

	Original Design (1961)
Peak Inflow (cfs)	20,700
Peak Outflow (cfs)	16,600

UNIT RUNOFF

One Inch Runoff (acre-ft) — 640

PROJECT COST (thru FY75) — $4,180,000

DATE OF COMPLETION — August 1966

MAINTAINED BY — New England Division, Corps of Engineers

PERTINENT DATA
NORTHFIELD BROOK LAKE

LOCATION Northfield Brook, Thomaston, Connecticut

DRAINAGE AREA 5.7 square miles

STORAGE USES Flood Control, Recreation

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity Acre-Feet	Capacity Inches on Drainage Area
Conduit Invert	476.0	---	---	---	---
Weir Gate Invert	480.5	0	0	0	0
Recreation Pool	500.0	19.5	7	80	0.3
Spillway Crest	576.0	95.5	67	2,350 (net)	7.7 (net)
Maximum Surcharge	586.1	105.6	81	780	2.6 (net)
Top of Dam	591.0	110.5	---	---	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	810
Top Width (ft)	20
Top Elevation (ft msl)	591.0
Height (ft)	118
Volume (cy)	644,100
Dike	None

SPILLWAY

Location	Left Abutment
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	72
Crest Elevation (ft msl)	576.0
Surcharge (ft)	10.1
Design Head (ft)	10.1
Maximum Discharge Capacity (cfs)	8,800

OUTLET WORKS

Type	Circular concrete conduit
Tunnel Inside Diameter (ft)	3.0
Tunnel Length (ft)	544
Conduit Service Gate Type	Sluice
Conduit Service Gate Size	One, 3' x 3'*
Downstream Channel Capacity (cfs)	200
Discharge Capacity at Spillway Crest Elevation (cfs)	160
Stilling Basin	Bedrock channel

*Conduit discharge controlled at entrance by a 3' gate locked in partially opened setting of 1.1 feet.

RECREATION POOL

Length (ft)	1,120
Shoreline Length (ft)	3,340
Area (acres)	10

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	576+300' Horiz. Strip	100	208
Easement	---	---	27
Clearing	503	27	

MAXIMUM POOL OF RECORD

Date	Sept. 27, 1975
Stage (ft)	57.4
Percent Full	27

SPILLWAY DESIGN FLOOD

	Original Design (1962)
Peak Inflow (cfs)	9,000
Peak Outflow (cfs)	8,800

UNIT RUNOFF

One Inch Runoff (acre-ft) 305

OPERATING TIME

Open/Close Gate 10 min. (Manual Operation: 100 turns/ft)

PROJECT COST (thru FY75) $2,830,000

DATE OF COMPLETION November 1965

MAINTAINED BY New England Division, Corps of Engineers

PERTINENT DATA
EAST BRANCH DAM

LOCATION East Branch Naugatuck River, Torrington, Connecticut

DRAINAGE AREA 9.3 square miles

STORAGE USES Flood Control

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity Acre-Feet	Capacity Inches on Drainage Area
Conduit Invert	795.0	---	---	---	---
Gate Invert	798.0	0	0	0	0
Spillway Crest	865.0	67.0	158	4,350	8.8
Maximum Surcharge	876.0	78.0	202	2,000 (net)	4.0 (net)
Top of Dam	881.0	83.0	---	---	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	700
Top Width (ft)	20
Top Elevation (ft msl)	881.0
Height (ft)	92
Volume (cy)	321,738
Dike	None

SPILLWAY

Location	Right-West Abutment
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	100
Crest Elevation (ft msl)	865.0
Surcharge (ft)	11.0
Design Head (ft)	11.0
Maximum Discharge Capacity (cfs)	14,300

OUTLET WORKS

Type	Circular concrete conduit
Tunnel Inside Diameter (ft)	3.0
Tunnel Length (ft)	450
Service Gate Type	Ungated
Downstream Channel Capacity (cfs)	300
Discharge Capacity Spillway Crest Elevation (cfs)	225
Stilling Basin	25' x 12' wide, baffle blocks and end sill

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	865+300' Horiz. Strip	67	580
Easement	----	--	0

MAXIMUM POOL OF RECORD

Date	Sept. 27, 1975
Stage (ft)	38.1
Percent Full	27

SPILLWAY DESIGN FLOOD

	Original Design (1961)
Peak Inflow (cfs)	15,500
Peak Outflow (cfs)	14,300

UNIT RUNOFF

One Inch Runoff (acre-ft) 495

PROJECT COST (thru FY73) $1,960,000

DATE OF COMPLETION June 1974

OWNED AND MAINTAINED BY State of Connecticut Dept. of Environmental Protection, Water and Related Resources Unit

PERTINENT DATA
HALL MEADOW BROOK DAM

LOCATION — Hall Meadow Brook, Torrington, Connecticut

DRAINAGE AREA — 17.2 sq. mi. (Includes 5.0 sq. mi. of Hart Brook at R. Hart Reservoir)

STORAGE USES — Flood Control

RESERVOIR STORAGE

	Elevation msl	Stage Feet	Area acres	Capacity Acre-Feet	Capacity Inches on Drainage Area
Conduit Invert	842.0	---	---	----	---
Stream Channel Invert	850.0	0	0	0	0
Spillway Crest	898.0	48.0	372	8,620	9.4
Maximum Surcharge	912.1	62.1	476	6,000 (net)	6.5 (net)
Top of Dam	917.0	67.0	---	----	---

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection impervious core
Length (ft)	1,200
Top Width (ft)	20
Top Elevation (ft msl)	917.0
Height (ft)	73
Volume (cy)	582,944
Dike	1 @ 135' Long, 47' High

SPILLWAY

Location	Right-West Abutment of Dike
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	100
Crest Elevation (ft msl)	898.0
Surcharge (ft)	14.1
Design Head (ft)	14.1
Maximum Discharge Capacity (cfs)	19,200

REUBEN HART DIVERSION

Location	Right-West Abutment of Hall Meadow Brook Dam
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	125
Crest Elevation (ft msl)	911.0
Design Head (ft)	5.4
Design Discharge Capacity (cfs)	6,100

OUTLET WORKS

Type	Circular concrete conduit
Tunnel Inside Diameter (ft)	4
Tunnel Length (ft)	315
Service Gate Type	Ungated
Downstream Channel Capacity (cfs)	500
Maximum Discharge Capacity Spillway Crest Elevation (cfs)	455
Stilling Basin	Bedrock channel

LAND ACQUISITION

	Elev. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	898+300' Horiz. Strip	48	678
Easement	---	---	0

MAXIMUM POOL OF RECORD

Date	Dec. 22, 1973
Stage (ft)	17.2
Percent Full	13

SPILLWAY DESIGN FLOOD

	Original Design (1960)
Peak Inflow (cfs)	26,600
Peak Outflow (cfs)	19,200

UNIT RUNOFF

One Inch Runoff (acre-ft) — 915

PROJECT COST (thru FY73) — $2,572,400

DATE OF COMPLETION — June 1962

OWNED AND MAINTAINED BY — State of Connecticut, Dept. of Environmental Protection, Water and Related Resources Unit

PERTINENT DATA
HOUSATONIC RIVER BASIN
LOCAL PROTECTION PROJECTS

PROJECT LOCATION	TORRINGTON, CT	TORRINGTON, CT	WATERBURY & WATERTOWN, CT	ANSONIA, CT	DERBY, CT	DANBURY, CT
RIVER	E. Branch and Naugatuck Rivers	W. Branch Naugatuck River	Naugatuck River	Naugatuck R. and Beaver Brook	Housatonic and Naugatuck Rivers	Still River
CHANNEL IMPROVEMENTS						
Length (ft)	9,500	2,510	---	7,400	---	2,725
Bottom Width (ft)	varies 30' to 130'	varies 60' to 85'	---	varies 10' to 220'	---	varies 55' to 80'
Side Slopes	1 on 2	1 on 2	---	1 on 2	---	1 on 2.5
DIKES						
Length (ft)	4,600	---	1,465	10,400	4,950	1,350 (partial)
Top Width (ft)	10	---	varies 8' to 12'	12	12	20
Side Slopes	1 on 2	---	varies 1 on 1; 1 on 2	varies 1 on 2; 1 on 3	varies 1 on 2.5; 1 on 3	varies 1 on 2; 1 on 2.5
FLOOD WALLS (ft)	1,000	1,520	2,711	6,420	370	3,615 Rectangular Channel
INTERIOR DRAINAGE	Modification to existing drains, new flap valve, and sluice gate.	Modification to existing drains, new storm drain inlets.	New flap valves, and sluice gates.	4 pumping stations, sluice gates, flap valves.	1 pumping station, sluice gates, flap valves	None
MISC. FEATURES	3 new bridges	---	Existing rubble wall grouted, 1 stoplog structure	4 street gates, 4 railroad gates, Beaver Brook conduit 1,042 ft.	4 railroad gates	4 railroad crossings, 2 highway crossings, 3 box culverts, total length - 520.5'
PROJECT FLOOD (cfs)	3,700 (E. Branch) 16,300 (Naugatuck)	12,600	25,000	75,000	220,000	6,900
FREEBOARD	3 feet (min.)	3 feet (min.)	2 feet (min.)	2 feet (min.)	2.6 feet (min.)	2.3 feet (min.)
TOTAL COST (Thru FY75)						
Federal	$389,200	$228,300	$263,300	$17,760,000	$7,553,000	$8,900,000 (est)
Local	151,300	141,800	15,000	633,000	590,000	1,600,000 (est)
DATE STARTED	June 1957	July 1959	January 1961	September 1968	May 1970	July 1974
DATE COMPLETED	September 1958	May 1960	November 1961	January 1973	June 1973	Scheduled January 1977
MAINTAINED BY	City of Torrington	City of Torrington	State of Conn.	City of Ansonia	City of Derby	City of Danbury

September 1976