NORTHEAST FLOOD STUDIES

FINAL REPORT
ON
REVIEW OF SURVEY
FOR
FLOOD CONTROL

CONNECTICUT RIVER BASIN

CONNECTICUT & MASSACHUSETTS

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

1 MARCH 1963

FOREWORD

This report is the eleventh in a series considering the advisability of adopting further improvements for flood control and allied purposes in areas of New England affected by the hurricane flood of August 1955. Five previous interim reports considered improvements on the principal tributaries of the Connecticut River affected by that flood and resulted in authorization of five dam and reservoir projects and three local protection projects. This report constitutes the final report on the Connecticut River under the authorizing resolution and covers the remainder of the basin affected by the 1955 flood not included in the previous reports.

S Y L L A B U S

The hurricane flood of August 1955 caused losses of $118,930,000 (exclusive of emergency expenditures under Public Law 875) in the Connecticut River basin in Massachusetts and Connecticut. Of this amount, $98,700,000 in losses was experienced in the Westfield, Chicopee and Farmington River tributary basins on which previous interim reports have been submitted. This report covers the remaining affected portion of the Connecticut River basin which experienced losses of $20,230,000.

The Division Engineer considered various methods of reducing this latter loss which was widely distributed throughout the area. He finds that, although local protection projects could provide additional flood protection at several localities, none of the studied projects is economically justified at this time.

Further studies of the Connecticut River basin, including the report area, will be undertaken under the outstanding authority for developing a comprehensive plan of improvement for the basin authorized by Resolution of the Committee on Public Works of the United States Senate adopted 11 May 1962.

The Division Engineer therefore concludes that no further projects should be recommended for authorization in the Connecticut River basin at this time.

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO. NEDGW

1 March 1963

SUBJECT: Final Report on Review of Survey for Flood Control, Connecticut River Basin, Connecticut and Massachusetts

TO: Chief of Engineers
ATTN: ENGCW-PD
Department of the Army
Washington, D. C.

AUTHORITY

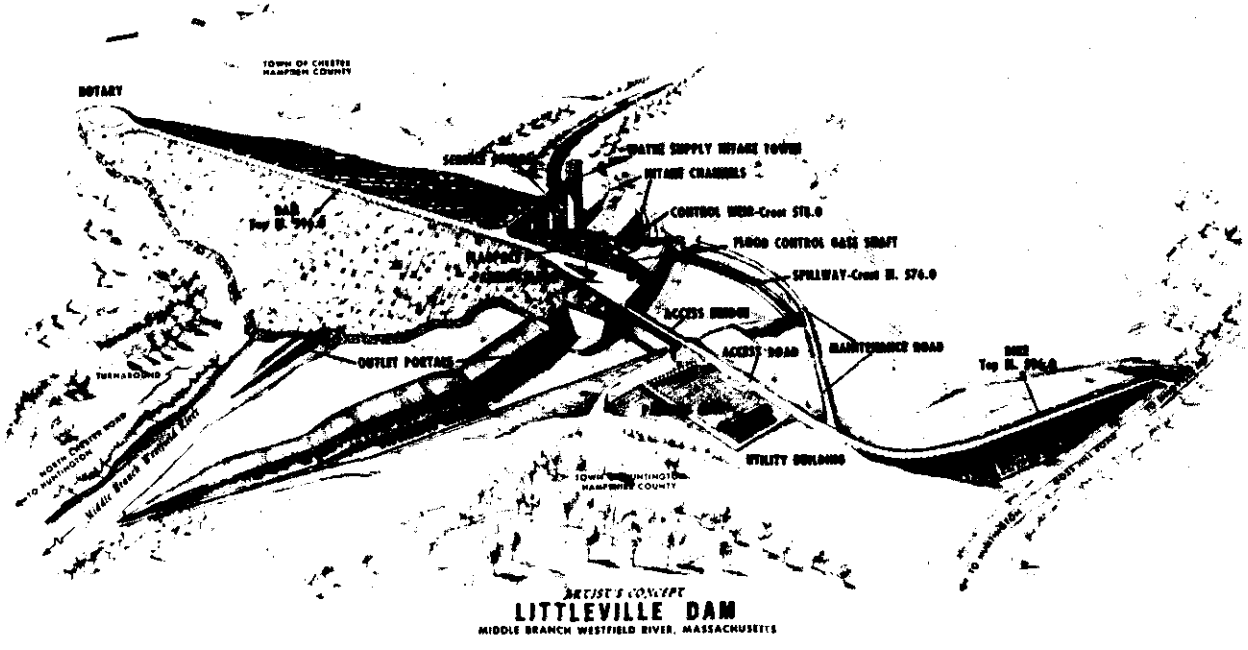
1. This final report and five previous interim reports considering improvements in the Connecticut River basin, Connecticut and Massachusetts, were authorized by resolution of the Committee on Public Works of the United States Senate, adopted September 14, 1955 which states in part:

> "That the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review previous reports on the . . . . . Connecticut River, Connecticut, Massachusetts, Vermont and New Hampshire . . . in the area affected by the hurricane flood of August 1955, to determine the need for modification of the recommendations in such previous reports and the advisability of adopting further improvements for flood control and allied purposes in view of the heavy damages and loss of life caused by such floods."

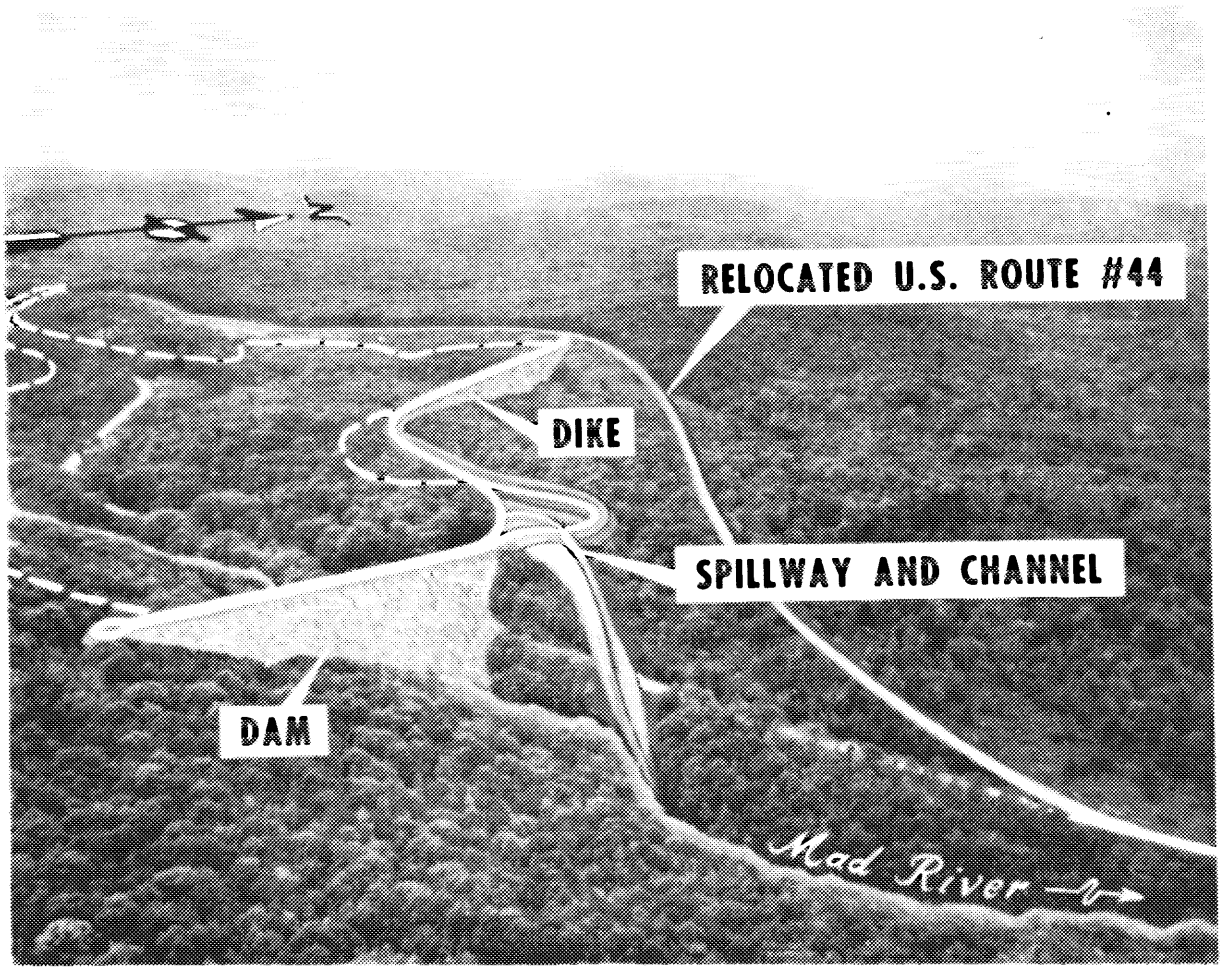
2. In a letter dated September 14, 1955, the Chairman of the Committee on Public Works of the United States Senate, requesting appropriate attention, transmitted the foregoing resolution to the Chief of Engineers who assigned the study and preparation of a report thereon to the Division Engineer, U. S. Army Engineer Division, New England.

3. Flood control and allied matters on tributaries of the Connecticut River, in areas affected by the hurricane flood of August 1955, have been considered in the following interim reports prepared under the authority quoted in paragraph 1 above:

a. Littleville Dam and Reservoir. An interim report, printed as Senate Document No. 17, 85th Congress, 1st session, reviewed the need for additional flood control reservoirs in the Westfield River watershed, Massachusetts. The report recommended that the authorized plan for flood control in the Connecticut River basin be revised to include the Littleville Dam and Reservoir on the Middle Branch of the Westfield River which was subsequently authorized by the Flood Control Act of 1958 (Public Law 85-500, 85th Congress), approved July 3, 1958. This project is being constructed as a dual purpose flood control and water supply reservoir in cooperation with the City of Springfield, Massachusetts.



b. Mad River Dam and Reservoir. A second interim report, printed as House Document No. 137, 85th Congress, 1st session, found the experienced flood losses in the Mad River valley sufficient to justify reservoir protection for Winsted, Connecticut, and the immediate downstream vicinity and determined that construction of the Mad River Dam and Reservoir on the main stem was more practical than construction of reservoirs on the tributaries. The recommended project was authorized by the Flood Control Act of 1958.



Artist's Concept
MAD RIVER DAM
Winsted, Conn.

c. Farmington River Basin, Connecticut and Massachusetts. The third interim report discussed flood control and related water resources development in the Farmington River basin, Connecticut and Massachusetts, and recommended a plan consisting of Sucker Brook Dam and Reservoir, located 400 feet upstream of Highland Lake, in Winsted, Connecticut, for flood control, and a dam and reservoir on the West Branch of the Farmington River, immediately upstream from the existing Hogback Dam in Colebrook, Connecticut, for flood control alone or a dual purpose project for flood control and municipal water supply in the event local interests wish to participate in the costs of the project allocated to water supply. The report was printed as House Document No. 443, 86th Congress, 2d session. The recommended plan was authorized by the Flood Control Act of 1960.

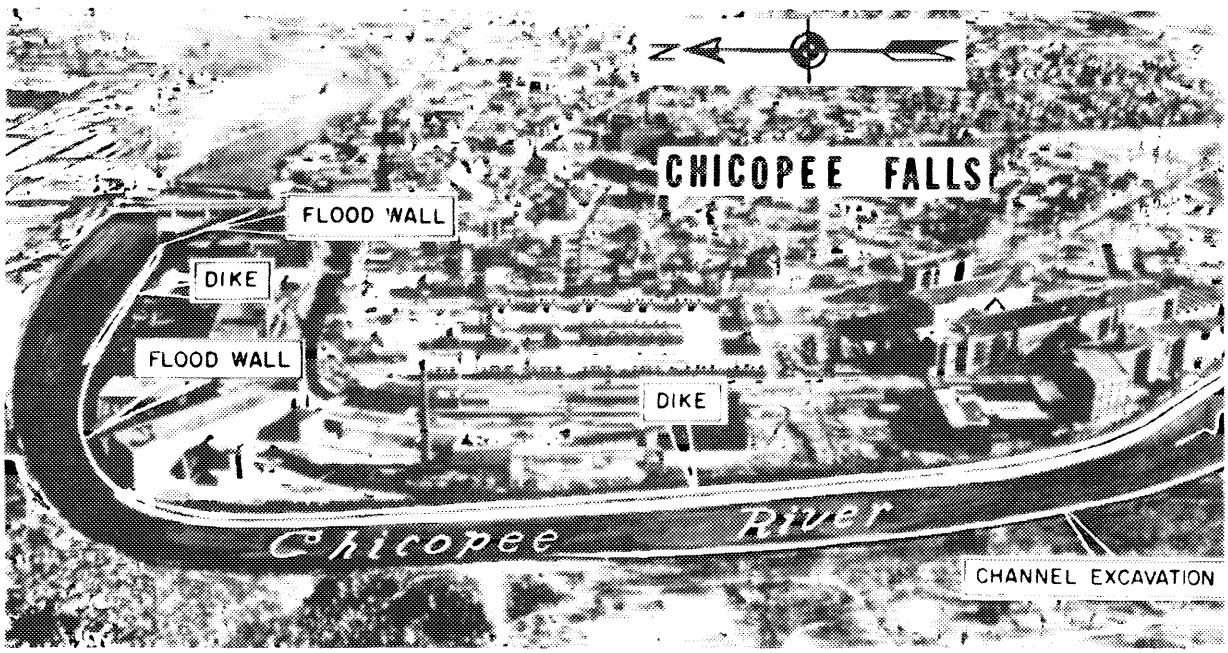
August 1955

Today

Main Street, Winsted, Conn.

Construction of Mad River and Sucker Brook Dams will prevent a recurrence of damages shown above at left.

d. Chicopee River Basin. The plan for flood protection in the Chicopee River basin, Massachusetts, recommended in the fourth interim report, includes the Conant Brook Dam and Reservoir at Monson, Massachusetts, and the Three Rivers (Palmer) and Chicopee Falls local protection projects. The report was printed as House Document No. 434, 86th Congress, 2d session; the recommended plan was authorized by the Flood Control Act of 1960.



Aerial View of Proposed Chicopee Falls Local Protection Project

e. Connecticut River Basin, Westfield River, Massachusetts. The fifth report, printed as Senate Document No. 109, 86th Congress, 2d session, considered the need for additional flood control in the Westfield River basin, Massachusetts, and the methods by which it could be best provided. A flood control dam was considered but found economically infeasible, while a local protection project for the city of Westfield was found necessary and economically justified. The project was authorized by the Flood Control Act of 1960.

4. The eight projects, including five dam and reservoir projects and three local protection projects recommended in the prior interim reports described in the preceding paragraph, have been authorized as additional units in the comprehensive plan for flood control in the Connecticut River basin. The status, costs, damages which would be prevented in a recurrence of the August 1955 flood, and the current benefit:cost ratio for each project authorized as a result of the basic resolution cited in paragraph 1 are summarized in Table 1 of this report.

PURPOSE AND EXTENT OF THIS REPORT

5. This report, of survey scope, is the sixth and final report on the Connecticut River basin under the authorization referred to in paragraph 1. The report considers the advisability and economic feasibility of further improvements for flood control and allied purposes in those portions of the basin affected by the August 1955 flood, all lying within the states of Connecticut and Massachusetts, excluding the drainage areas of tributary rivers previously studied and reported on, - the Farmington, Chicopee, and Westfield Rivers, - and the Park River, Connecticut, which will be covered under a separate, outstanding authorization. Also excluded from consideration is protection from tidal flooding caused by hurricanes and coastal storms at towns along the Connecticut River below Middletown, Conn. The areas covered in this report, hereinafter referred to as the report area, and in prior interim reports are shown on Plate No. 1.

6. Public hearings were held at Northampton, Mass., and Hartford, Conn., in November 1960 to determine the views and desires of those interested concerning additional improvements. Synopses of the hearings are given in paragraph 12.

7. Field reconnaissance of problem areas and sites of potential improvements was made by the Division Engineer and representatives of his office. Office studies utilized maps of the U. S. Army Map Service, U. S. Geological Survey, and local maps.

8. Aid and assistance in preparing this report was received from the Soil Conservation Service of the U. S. Department of Agriculture, the Connecticut and Massachusetts Water Resources Commissions, the Connecticut Board of Fish and Game, and the Waterways Division of the Massachusetts Department of Public

TABLE I

Projects Authorized As A Result of Senate Public Works Committee Resolution Adopted 14 September 1955

Connecticut River Basin

Project	Purpose	Status	Total Project Cost	Damages Preventable(1)	Benefit Cost Ratio
Littleville Dam	Flood Control(2)	Under Constr.	$ 7,000,000	$ 4,340,000(3)	2.1
Mad River Dam	" "	" "	5,550,000	21,740,000	2.3
Colebrook Dam	Flood Control & Water Supply	Under Design	11,300,000	18,800,000(4)	2.2
Sucker Brook Dam	Local Protec.	Active	1,030,000	2,580,000(4)	1.5
Conant Brook Dam	Flood Control	Under Design	2,080,000	5,265,000(5)	2.2
Three Rivers (Palmer)	Local Protec.	" "	1,730,000	3,765,000(6)	1.7
Chicopee Falls	" "	" "	1,940,000	2,700,000(6)	2.0
Westfield	" "	" "	3,680,000	4,850,000(7)	2.1

(1) Damages which would be prevented in recurrence of August 1955 flood (at 1963 price level)
(2) Water supply has been added at request of local interests
(3) After reductions by Knightville Reservoir (completed)
(4) After reductions by Mad River Reservoir (operational)
(5) After reductions by Barre Falls Reservoir (completed)
(6) After reductions by Barre Falls and Conant Brook Reservoirs
(7) After reductions by Knightville and Littleville Reservoirs

Works. Studies of the Corps of Engineers have been closely coordinated with those of the Soil Conservation Service in areas of common interest, especially in the Broad Brook watershed in Easthampton, Mass.

DESCRIPTION

9. The Connecticut River valley cuts a broad swath across New England, occupying an area of 11,151 square miles in Vermont, New Hampshire, Massachusetts, and Connecticut. Of this total area, 2,720 square miles lie in Massachusetts and 1,435 in Connecticut. In crossing west-central Massachusetts and central Connecticut, the basin occupies about one-third of the area of each state.

10. The main river rises in the northernmost part of New Hampshire and flows generally southward 404 miles to Long Island Sound. Of this total, a length of 137 miles crosses the states of Massachusetts and Connecticut.

11. The main tributaries of the Connecticut within the report area are the Millers and Deerfield Rivers, both in Massachusetts. Smaller tributaries include the Manhan in Massachusetts and Scantic and Hockanum Rivers in Connecticut.

IMPROVEMENTS DESIRED

12. In order to obtain the views of those interested in flood control and allied measures in the report area, public hearings were held in Northampton, Mass., and Hartford, Conn., on the 15th and 16th of November 1960, respectively. Nearly 100 persons attended these hearings, including representatives of Federal, State, municipal, and town governments, industrial interests, civic organizations, and individuals concerned. Requested improvements included construction of remaining dams in the authorized plan for flood control in the Connecticut River basin; local protection and river improvement at various communities along the main stem of the Connecticut River; a study of tributary streams at Chicopee; extension of the existing, Federally-constructed Park River Conduit in Hartford; and a study of the Middletown area. Loss of land through erosion was frequently cited as a problem in local areas. A digest of the requests presented at the public hearings is given in Appendix A.

PROBLEMS INVESTIGATED

13. With the completion of the dams and reservoirs currently under construction or under design, there will be a total of 15 flood control reservoirs constructed by the Corps of Engineers in the Connecticut River basin. Operation of these projects will effect reduction of 3 to 4 feet in flood stages on the main stem within the report area in a recurrence of the maximum flood of record, that of March 1936. This reduction was considered in estimating damages that would still occur at flood-prone areas and in establishing required heights of dikes and walls for considered projects. In addition, the State of Connecticut is establishing encroachment lines along the main stem and principal tributaries of the Connecticut River. This action will tend to prevent increases in losses in future floods. A comprehensive river basin study of the entire Connecticut River basin, including the report area, has been initiated under a separate authority. That study will consider means to conserve and protect the water resources of the basin.

14. Preliminary evaluations of possible local protection projects in the report area were made on the basis of comparisons of annual losses or benefits and annual costs. Annual costs were based on a Federal interest rate of 2-7/8 percent, a non-Federal interest rate of 3-1/2 percent, and a project life of 100 years. Studies of 15 problem areas and possible solutions indicated that protection was not warranted under present economic conditions at any location at this time. Considered plans of protection for the problem areas, locations of which are shown on Plate No. 2, are listed in Table II and described in Appendix B.

TABLE II

SUMMARY OF STUDIED LOCAL PROTECTION PROJECTS

CONNECTICUT RIVER BASIN

Location	River	Estimated Project Cost
Easthampton, Mass.	Broad Brook	$ 800,000
Agawam, Mass.	Connecticut	700,000
Windsor Locks, Conn.	"	4,500,000
Warehouse Point, Conn.	"	1,600,000
South Windsor, Conn.	"	3,300,000
Wilson, Conn.	"	2,250,000
East Hartford, Conn.	"	2,000,000
Wethersfield, Conn.	"	380,000
Rocky Hill, Conn. -Area A	"	610,000
" " " -Area B	"	666,000
" " " -Area C	"	530,000
Cromwell, Conn.	"	2,000,000
Portland, Conn.	"	1,600,000
Middletown, Conn. -Area A	"	3,500,000
" " -Area B	"	335,000

RESULTS OF THE INVESTIGATIONS

15. Studies made for this report indicate that local protective works are possible solutions to the flood problems remaining in the report area after flood stage reductions effected by upstream reservoirs currently under design, under construction, or completed. The costs of providing protection to existing improvements at the 15 areas investigated are, in each instance, greater than the residual, recurring losses or benefits which could be realized through construction of protective works, due in part to the degree of protection provided by upstream flood control reservoirs.

CONCLUSION

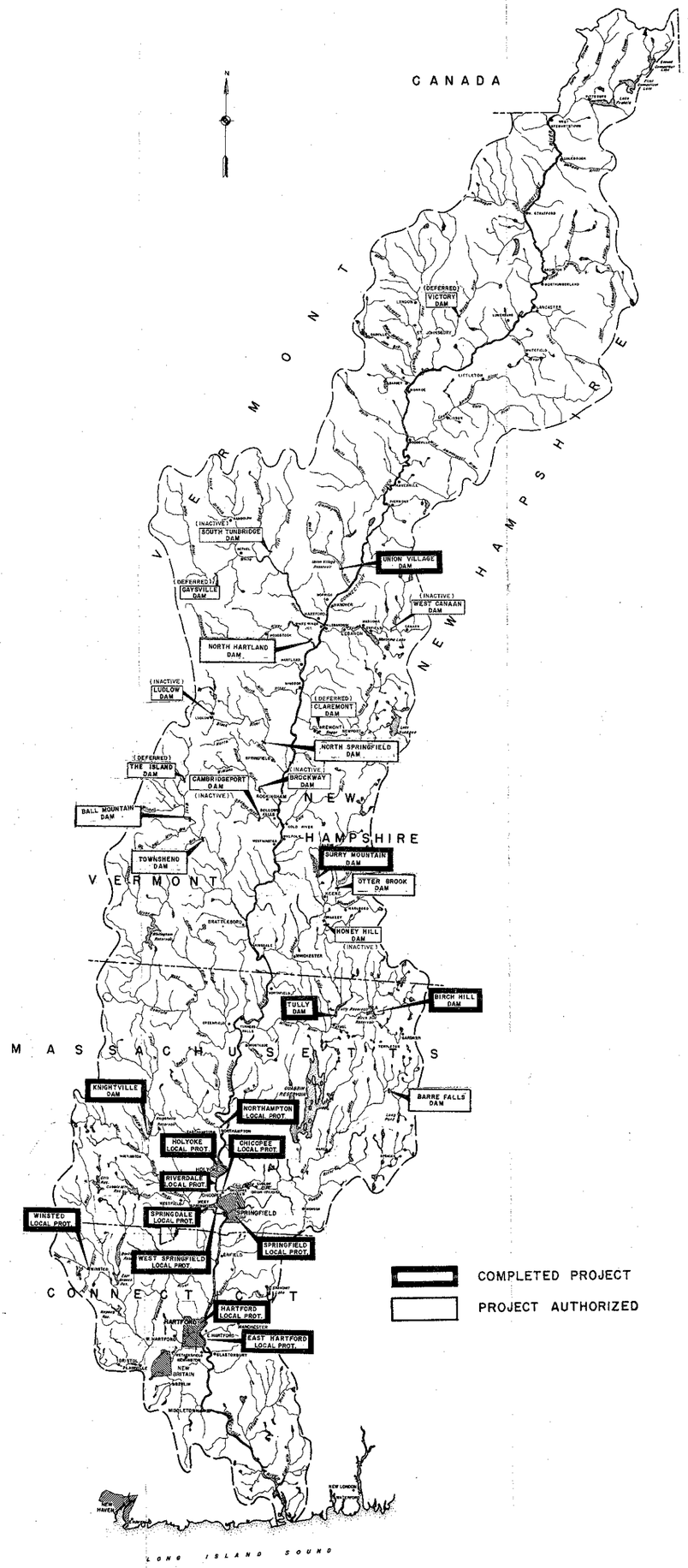
16. In view of the foregoing, the Division Engineer concludes that flood control works completed, under construction, and authorized in the period following the flood of August 1955 provide a substantial degree of protection in the area affected by the flood. He considers that this report fulfills the request in the authorizing resolution, quoted in part in paragraph 1, and concludes that no further investigations in the Connecticut River basin should be undertaken under this authority. The need for further improvements will be considered under the broad aspects of the Connecticut River comprehensive basin study.

RECOMMENDATION

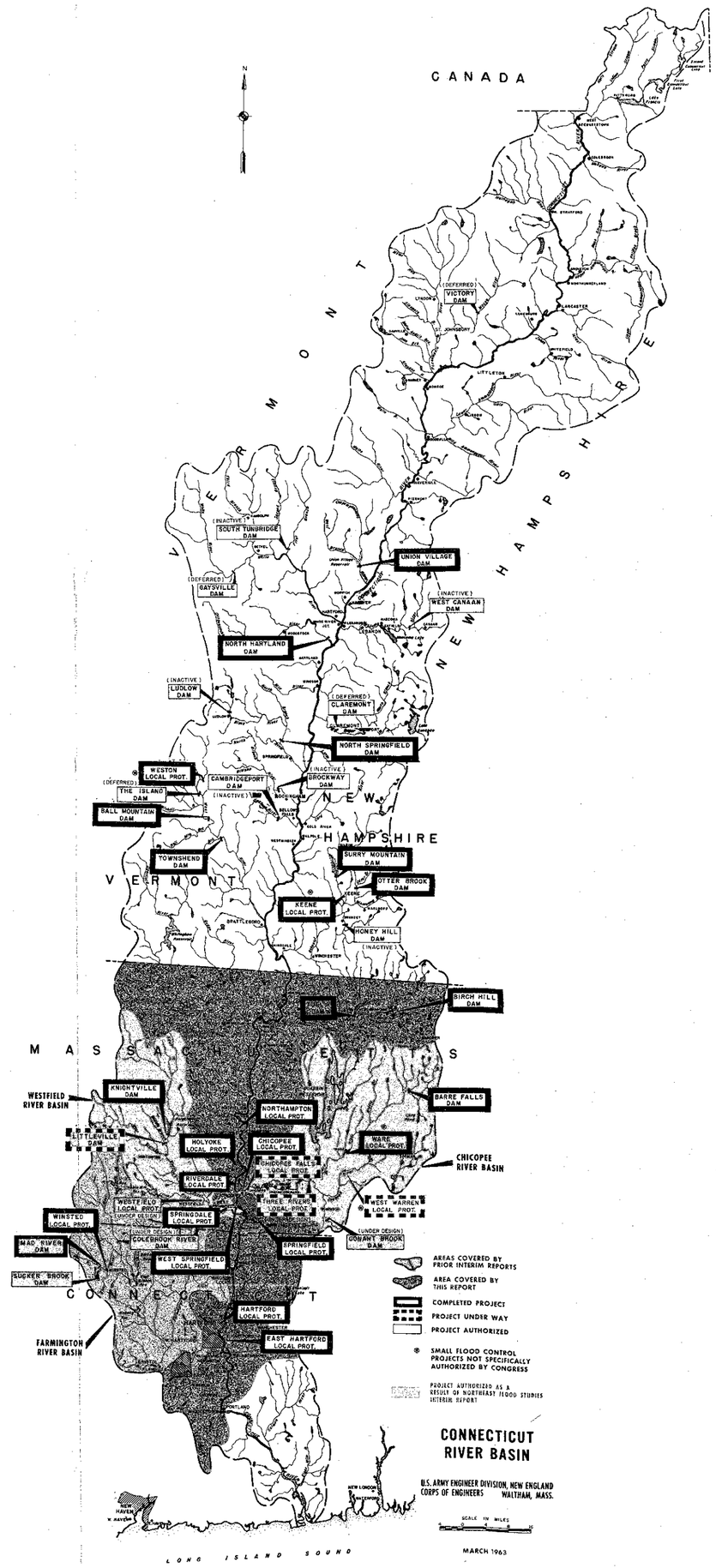
17. The Division Engineer recommends that this report be accepted as meeting the criteria and intent of the authorizing resolution.

Attachments-4
1. Basin Map
2. Appendix A - Digest of Public Hearings
3. Appendix B - Local Protection Projects
4. S-148 Supplement

P. C. HYZER
Colonel, Corps of Engineers
Division Engineer



STATUS OF PROJECTS PRIOR TO AUGUST 1955 FLOOD



CURRENT STATUS OF PROJECTS

PLATE NO. 1

APPENDIX A

DIGEST OF PUBLIC HEARINGS

13 November 1969 at Northampton, Mass.

14 November 1969 at Hartford, Conn.

Hearing Officer: Colonel Ned F. Edland
Deputy Division Engineer

APPENDIX A

DIGEST OF PUBLIC HEARING
AT NORTHAMPTON, MASSACHUSETTS
15 November 1960

The Honorable Edward P. Boland, Representative in Congress - Believes that some protection in Northampton, Agawam, and Springfield is necessary. The Corps of Engineers has moved very rapidly in developing flood protection for the Connecticut River basin as a result of the Senate resolution following the 1955 flood. Since the hearing in Chicopee in 1958, recommendations have been made to Congress including Monson, Chicopee Falls, and Westfield. The Congressional authorizations for Littleville and the Westfield basin were relatively rapid and money was made available in the 1961 budget for Littleville. Funds are also in that budget for the Conant Brook and Three Rivers projects. Total Federal expenditures for flood control in New England have been small in comparison with those in other areas. It is important to hold hearings and have them well attended in order to determine how to stop damage to life and property. New England has been moving ahead more rapidly than before on flood control plans. There have been some 60 projects authorized in New England.

Mr. Frank C. Reynolds, Selectman, Town of Hadley. - Board of Selectmen desires that Engineers study flood problems of Hadley, including threats to dikes from erosion, seepage and pressure from floodwaters. Town has suffered loss of land due to erosion and channel shifting. Bridge approaches are threatened. Bends in the river aggravate problems. Riprapping and channel improvement is needed. Another problem is flooding due to ice jams. Submitted statement of Board of Selectmen.

Mr. F. H. King, Manager of Gas and Electric Department, Holyoke, Representing Municipal Electric Association of Massachusetts - Urges that Federal government make a comprehensive study of water resources of New England including Connecticut River basin with emphasis on the power potential of the area. Believes that adequate multiple-purpose basin planning would increase employment and raise living standards by providing lower power costs. The Federal government should establish a regional agency to plan, coordinate, and follow through on the problems involved in utilization of water resources in the northeast area. With increasing population and industrial

expansion, the importance of conservation and utilization of water resources becomes increasingly apparent. Submitted statement by Municipal Electric Association of Massachusetts.

Mr. Thomas F. Robinson, City Engineer, City of Chicopee - States that Chicopee has benefited and will benefit more from flood control on the upper Connecticut River. Expresses desire of the City for flood control works along the industrial section and the business section of Chicopee Falls. Wants consideration of streams tributary to the Connecticut, as Bemis and Willimansett Brooks, which cause flood problems. The City will go forward with any future planning by the Corps of Engineers.

Mr. Walter A. Pickunka, Selectman, Town of Hatfield - Had asked a visiting representative of the Corps of Engineers about proposed raising of a flood-prone section of road in Hatfield. A flood problem also exists in a low area back of the Central School. The 1936 flood tore out a section of a Chapter 90 road, the main road in Hatfield.

Mr. E. R. Foster, Executive Director, Connecticut River Watershed Council - Has noted many miles of bank erosion along the length of the Connecticut River. Asks what recommendation Corps of Engineers would have for this problem.

Mr. Alexander T. Papafil, Connecticut River Watershed Council - Should have action on Connecticut River erosion problem. Since the river is an interstate waterway, a Federal agency should solve problems, whether roads and buildings are endangered or not. He believes river should be dredged so that it will hold more water, banks riprapped all along river, and more dams constructed on tributaries. Due to increasing population, by 1975 water will have to be taken from the river for water use purposes. Criticizes lack of citizen interest and failure to emphasize domestic needs.

Mr. William Chmura, Selectman, Town of Hadley - Erosion, rather than flooding, is the problem at Hadley. The authorization or legislation should be changed to allow Army Engineers to spend money on erosion problem, which needs a large scale approach. Asks whether Army Engineers' work is authorized when roads are endangered, or when possibility exists that they will be endangered.

Miss Persis Putnam, League of Women Voters, Northampton - Suggests preventing erosion by eliminating some of the bends in the river, making it run faster.

Mr. Edward T. Matuszko, Selectman, Town of Hadley - Suggests that perhaps there should be 4 or 5 times as much riprap to prevent river break-through.

Mr. John Y. Clark, Representative-elect, Town of Easthampton - Asks if there is any way to get at town's erosion problems through a Federal agency, possibly Department of Agriculture? Would Congressional legislation be required?

DIGEST OF PUBLIC HEARING
AT HARTFORD, CONNECTICUT
16 November 1960

Mr. Thomas J. Keena, presenting statement of Honorable Emilio A. Daddario, Representative in Congress - The primary factor the Federal government must consider is the explosive growth of the communities in Hartford County which border the river and the need to make effective use of all the land and resources within this expanding metropolitan area. South Windsor and Enfield have doubled; other communities almost doubled in population in the past ten years. Hopes that full consideration will be given requests of communities bordering the river. Protection of land against flooding, to benefit industry, jobs, production of food, housing, and wildlife, demands a far-sighted approach. Pledges support in any legislative action necessary.

Colonel Karl F. Eklund, Hearing Officer - Notes that Senator Bush wrote that he would have been in attendance but for the fact of being out of the country on an assignment for the Armed Services Committee.

Mr. William S. Wise, Director, Water Resources Commission of Connecticut, also representing the Governor - In view of studies made by the State for flood control and stream encroachment lines, suggests that Corps of Engineers review the project design floods for possible revision. The Commission requests that areas subject to intermittent flooding also be studied including parts of Windsor, Windsor Locks, Cromwell, New Britain, Berlin, South Windsor, Hartford, East Hartford, Wethersfield, Glastonbury, Rocky Hill, Portland and Middletown. Submitted statement.

Mr. James P. Galligan, Chief, Fisheries Division, Connecticut Board of Fisheries and Game - Asks that opportunity be given his agency to comment on proposed flood control structures. The basin area is very important for fishing, hunting, and other recreational activities. The Connecticut River is historically important for shad fishery. The Department stocks 100,000 trout annually, owns 13 access sites, 15 regulated shooting areas, and 2,200 acres of marshland for breeding, resting, and feeding areas as well as for gamebird shooting. Capitalized value of commercial and sport shad fishery totals $6,975,000 as estimated in report submitted with letter from Lyle M. Thorpe, Director of the Connecticut Board of Fisheries and Game. This fishery would be threatened by main river dam construction.

Mr. Charles W. Cooke, Director, Greater Hartford Flood Commission - Suggests that Army Engineers study problem of flooding along Park River. Several stretches of the river will be inclosed in conduit as part of proposed interstate highway construction. A two-mile reach of the river, including its North and South branches, must also be inclosed to make the works effective for flood control. Reaches will be subject to Connecticut River flooding; therefore, Corps of Engineers should consider whether this involves Federal responsibility. Damages from the August flood were more than $7 million; in a "project flood," damages would exceed $23 million, half of which would occur in the area of Hartford to be protected by the suggested pressure conduit extension. Stream encroachment lines are being established by the Connecticut Water Resources Commission. The City of Hartford will cooperate in meeting its fair share of cost. Submits statement of Commission. (This request will be studied under authority of Senate Public Works Committee Resolution adopted 16 October 1961).

Mr. Robert M. Weiss, Town Manager, Town of Windsor - Requests diking for Windsor, a proposal which has been under consideration by both Federal and local interests for several years. The Hartford dike should be extended to the Wolcott Avenue bridge. This would cost an estimated $3,500 per foot and would protect the flood-prone Wilson area in the town of Windsor. About 100 homes would be adversely affected by serious flooding. Protective works would enhance about 200 acres benefiting industrial development of Hartford. Dredging the river through the Hartford area to Enfield would enhance sport fishing, which is now curtailed by the silt in the river.

Mr. John Christensen, resident of Windsor (former Commissioner of Agriculture in Connecticut) - Expresses hope that Army Engineers will recommend extension of the Hartford dike, at least to the bridge, as Mr. Weiss suggested. This would protect three-quarters of the Wilson Fire District and the southern part of the town of Windsor and would promote further development of this area.

Mr. Joseph David, Member, Windsor Town Council - Urges favorable consideration of extension of the dike, as proposed by Mr. Weiss.

Mr. Irving Christensen, Councillor, Wilson Area - Reads a petition signed by 500 people some years ago endorsing the extension of the Hartford dike system. Speaker also agrees with Mr. Weiss' remarks.

Mr. Kenneth J. Dooley, Commissioner, City of Middletown - Hopes for a survey of Middletown area. City Council desires to participate in a flood control project.

Mr. Walter Glinski, Manager, Greater Middletown Chamber of Commerce - Desires Army Engineers' assistance in a study of flood damages and control in Middletown. Submits letters reporting $400,000 flood losses to small firms in the city.

Mr. James J. Harnett, town of Windsor - Wilson area people desire extension of the Hartford dike. Construction of the new road now gives a natural stopping point for the dike.

Mr. Albert Martino, resident, community of Wilson (Windsor) - Asks about effect land acquisition would have on landowners. (Mr. Weiss explained that Mr. Martino probably was thinking of the proposals for urban renewal considered a few years ago).

Mr. Maurice R. Cronan, resident of Wethersfield - Doesn't want flood control dike to interfere with the boating facilities of Wethersfield Cove.

Mr. Charles F. Erickson, resident of Windsor - Asks for a show of hands of those present from Windsor (and in favor of the proposal concerning Windsor).

Mr. Robert Black, resident of Windsor Locks, Windsor Outboard Boat Club - His organization favors the dredging of the river from Hartford to Windsor Locks.

Mr. E. R. Foster, Executive Director, Connecticut River Watershed Council. - Points out that many people desire to establish a marina in the Hartford area, and it would have to be on the east (river) side of the existing dike. Asks what recommendations the Corps would have if the marina were put in by the State.

Mr. A. G. Spielman, resident of Windsor Locks - Says dredging the river would not help the problem, but would raise taxes.

APPENDIX B

LOCAL PROTECTION PROJECTS STUDIED

APPENDIX B

LOCAL PROTECTION PROJECTS STUDIED

B-1. An analysis of costs and benefits for local protection flood control projects, made in connection with previous reports, indicates that, unless the total first cost of a project equals or is less than the potential loss (at current prices) in a recurrence of the maximum flood of record (in this instance the flood of March 1936), after reductions by upstream reservoirs, the project has little chance of being found justified in detailed studies. Using this yardstick for screening purposes, preliminary evaluations were made of possible local protection projects in the report area. Projects passing this initial screening were then evaluated on the basis of comparisons of annual losses and annual costs. As a final test of those projects passing the two initial screenings, annual benefits were compared with annual costs. Annual costs were based on a Federal interest rate of 2-7/8 percent, a non-Federal interest rate of 3-1/2 percent, and a project life of 100 years.

B-2. Preliminary studies of 15 problem areas and possible solutions indicated that protection was not warranted under present economic conditions at any location at this time, except for a project at Hampton Mills in Easthampton, Mass., which appeared worthy of detailed study. During the course of further studies of this latter project, the mills were shut down, the equipment sold, and the buildings left idle. Since there appears to be no immediate prospect of renewed use of the property and since benefits accruing to protection of the vacant property are substantially less than the cost of the protection, Federal participation is not warranted at this time. Considered plans of protection for the problem areas, locations of which are shown on Plate No. 1, are described briefly in the following paragraphs.

a. Easthampton, Mass. A local protection project in Easthampton, Mass., which appeared feasible and justified in preliminary studies, could be located on Broad Brook, a tributary of the Manhan River. The project would include a pressure conduit with a new weir intake replacing the open canal presently carrying flow from the Lower Mill Pond through the Hampton Mills property; a dike along the pond at the upper end of the project; and an impervious blanket on the slope of a railroad embankment at the lower

end of the area. The project, protecting a section of highway, the mill property, and the railroad embankment, would prevent flooding from Broad Brook and Lower Mill Pond flows and from backwater from the Manhan and Connecticut Rivers and would cost about $800,000. The preliminary benefit-cost ratio was 1.2. While studies were in progress, the Mills were shut down and the equipment sold, so reducing the potential benefits to be derived from protection that the project was no longer economically justified.

b. Hadley and Hatfield, Mass. Flooding at Hatfield and bank erosion at Hatfield and Hadley, Mass., were investigated and damages found to be low in relation to the probable cost of prevention. Lack of adequate justification for Federal participation in possible projects to protect these areas precluded further consideration of the problems.

c. Chicopee, Mass. Local protection in the Willimansett section of Chicopee, Mass., part of the authorized, and otherwise completed, Chicopee local protection project, is now in an inactive status. Investigation for this report showed the project lacks economic justification at this time since small benefits would be realized for a relatively large expenditure.

d. Agawam, Mass. Although the recently constructed highway fill, leading from the South End bridge crossing of the Connecticut River, could be utilized as the north end of a possible local protection project, a dike 3,800 feet long southerly from the bridge along the Connecticut, and a 1,400-foot tie-off at School Street would be required to complete protection of an area of approximately 100 acres. This project would have a first cost of $700,000 and annual charges in excess of $20,000. With a potential loss of only $11,200 in a recurrence of the 1936 flood, this project is not justified at this time.

e. Windsor Locks, Conn. A project to protect some 4,000 feet of river front industrial and commercial property, which experienced losses of $1.5 million in the 1936 flood and is centered 800 feet downstream of the Connecticut Route 20 highway bridge, would require 2,400 feet of dike, 2,600 feet of flood wall, and appurtenant structures, with an estimated cost of $4.5 million. A major portion of this area would be outside the limit of flooding in a recurrence of the 1936 flood because of reductions in flood stages effected by upstream flood control reservoirs completed, under

construction, or under design. In view of the relatively small residual damages, construction of the project is not warranted at this time.

f. Warehouse Point, Conn. The Warehouse Point area of West Windsor could be protected by construction of 8,300 feet of dikes and appurtenant structures at a cost of $1.6 million. Since the losses in a recurring 1936 flood are only $96,000, construction is not warranted at this time.

g. South Windsor, Conn. The annual loss of $1,160 in the Main Street area, extending 12,000 feet north from the Wolcott Avenue bridge, is insufficient to justify further consideration of a flood control project consisting of 24,400 feet of dike and appurtenant structures, estimated to cost $3.3 million.

h. Wilson, Conn. To protect the Wilson area of Windsor, a dike 7,500 feet in length would be required, costing $2,250,000. The losses in a recurrence of the flood of record which would be prevented by this project amount to $56,300 and, on an annual basis, would be small in comparison to the annual charges of $84,200.

i. East Hartford, Conn. A project for the protection of East Hartford, downstream of the existing project, would consist of a dike extending about 8,900 feet along the east bank of the Connecticut River from Willow Brook downstream and protecting the Wielgous Laboratory of the United Aircraft Company. The cost of the project would be over $2 million. With losses of $236,000 in a recurrence of the maximum flood of record, annual benefits would be insufficient to warrant further consideration at this time.

j. Wethersfield, Conn. At the request of local interests, several areas subject to flooding along the Connecticut River in Wethersfield were investigated as possible locations of local protection projects, including areas south of Wethersfield Cove which might use the planned or partially completed Interstate Highway, US-Conn. I-91, as a dike embankment. However, since there are only minor recurring flood losses, further consideration is not warranted.

At the request of local interests, a study was made of an upstream extension of the Federally-constructed Folly Brook

conduit. The study concluded that the entire drainage area upstream of the existing conduit lies within the town of Wethersfield and is, therefore, classified as a local drainage problem which ruled out further consideration for Federal participation.

k. Rocky Hill, Conn. Two local protection projects were studied for the town of Rocky Hill on the west bank of the Connecticut River. The first would protect the Hartford Fibre Company alone, or the company and a nearby oil tank farm, and require a dike with maximum height of 32 feet along the Connecticut River and Dividend Brook, for either alternative. To protect the Fibre Company alone, the dike would have a length of 4,650 feet and cost $610,000; to protect the oil farm and the company, the dike would be 4,900 feet long and cost $666,000. Under present conditions, recurring losses from the 1936 flood are estimated at $12,000.

Upstream of this project, another project in Rocky Hill would protect the Connecticut Foundry and an adjacent oil farm and urban area, by construction of 2,180 feet of dike, having a maximum height of 32 feet and appurtenant structures, costing an estimated $530,000. Losses in a recurrence of the 1936 flood would be $40,000.

l. Cromwell, Conn. To protect the low area in the center of Cromwell, which would experience losses of $252,000 in a recurrence of the maximum flood of record, about 7,000 feet of dike and appurtenant structures would be required, at a cost of over $2 million. Prospective benefits would be insufficient to warrant construction.

m. Portland, Conn. A project for protection of the business center of the town of Portland on the east bank of the Connecticut River would consist of about 7,600 feet of dike extending from a point 700 feet south of the railroad bridge along the elbow of the river to north of Brazos quarry. Prospective benefits are insufficient to justify the cost estimated to be over $1.6 million.

n. New Britain, Conn. An area in New Britain, on Willow Brook, a tributary of the Mattabesset River, which flows into the Connecticut just above Middletown, is subject to frequent back yard and cellar flooding. The New Britain Flood Control Commission is having a study of the problem made by a private engineering firm. Since losses are low, there is little likelihood that a project would be justified for Federal participation at this location and it was given no further consideration for this report.

o. Middletown, Conn. In the Middletown area, protection could be provided the Middletown Rubber Company and three residences on Walnut Street by construction of about 1,670 feet of dike and appurtenant structures aligned along three sides of the protected area at a total first cost of $335,000. Annual benefits of $12,350 and annual costs of $14,050 result in a benefit-cost ratio of less than 0.9.

Another studied project in Middletown, consisting of dikes and flood walls 770 feet in length with appurtenant structures, would extend from the Remington Rand plant on the Mattabesset River flood plain to the Connecticut River and thence along the west bank downstream to Sumner Brook. The first cost of the project is estimated to be over $3.5 million. Annual costs of $115,400 far exceed the estimated annual losses of $20,800.

CONNECTICUT RIVER BASIN

CONNECTICUT AND MASSACHUSETTS

Information Called for by

Senate Resolution 148, 85th Congress

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1. Flood Problem. The only project in the report area which, in the course of initial study, seemed feasible, consists of local protection for Hampton Mills, a mill complex in Easthampton, Mass., located at the outlet of Lower Mill Pond on Broad Brook. The protected area would include a portion of highway, the mill buildings and a railroad embankment for division tracks of the New Haven Railroad. The water of Lower Mill Pond normally discharges over a short weir into the mill canal, which carries it through the mill property and into a culvert under the railroad embankment; thence it flows into a short stretch of Broad Brook, emptying into the Manhan River. In times of flood, however, the discharge capacity of the weir is inadequate, causing the pond to overflow a section of Ferry Street and flood the mill properties. Furthermore, flooding along the Connecticut River causes Manhan River backwater to flood the lower end of the area.

2. Local Interests. Local interests have been much concerned by the flood problems in the Hampton Mills area. In 1956, the Company engaged a private engineering firm to make a preliminary study of the problems and possible solutions.

3. Discussion. Report studies by the Division Engineer initially determined that local protection for Hampton Mills was feasible and economically justified. However, prior to completion of the studies, the mill owners announced a forthcoming complete shutdown of the mills. A local protection project for this area is not now economically justified since the benefits previously justifying the project depended largely on the recurring losses that would be suffered by the operating mill plant.

Application of the various standards given in S. Res. 148 to this and all other projects considered in the report would not provide a basis for findings different from those reported.