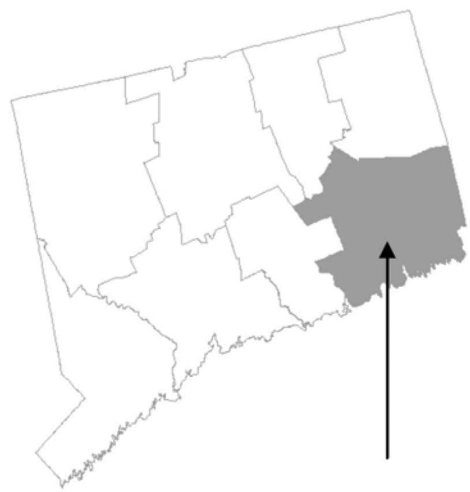
FLOOD INSURANCE STUDY

Volume 1 of 3

NEW LONDON COUNTY, CONNECTICUT
(ALL JURISDICTIONS)



COMMUNITY NAME	COMMUNITY NUMBER
BOZRAH, TOWN OF	090094
COLCHESTER, TOWN OF	090095
EAST LYME, TOWN OF	090096
FRANKLIN, TOWN OF	090154
GRISWOLD, TOWN OF	090173
GROTON LONG POINT ASSOCIATION	090167
GROTON, CITY OF	090126
GROTON, TOWN OF	090097
JEWETT CITY, BOROUGH OF	090098
LEBANON, TOWN OF	090155
LEDYARD, TOWN OF	090157
LISBON, TOWN OF	090172
LYME, TOWN OF	090127
MONTVILLE, TOWN OF	090099
NEW LONDON, CITY OF	090100
NOANK FIRE DISTRICT	090129
NORTH STONINGTON, TOWN OF	090101
NORWICH, CITY OF	090102
OLD LYME, TOWN OF	090103
PRESTON, TOWN OF	090139
SALEM, TOWN OF	090156
SPRAGUE, TOWN OF	090105
STONINGTON, BOROUGH OF	090193
STONINGTON, TOWN OF	090106
VOLUNTOWN, TOWN OF	090143
WATERFORD, TOWN OF	090107

Effective: July 18, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
09011CV001A

New London County, Connecticut
(All Jurisdictions)

NOTICE TO FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this Preliminary FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Selected Flood Insurance Rate Map panels for this community contain the most current information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

Old Zone(s)	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

Initial Countywide FIS Effective Date: July 18, 2011

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EXHIBITS - continued

Exhibit 1 - Flood Profiles – continued

FLOOD INSURANCE STUDY
NEW LONDON COUNTY, CONNECTICUT (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of New London County, including the Cities of Groton, New London and Norwich, the Towns of Bozrah, Colchester, East Lyme, Franklin, Griswold, Groton, Lebanon, Ledyard, Lisbon, Lyme, Montville, North Stonington, Old Lyme, Preston, Salem, Sprague, Stonington, Voluntown, and Waterford, the political subdivisions of Noank Fire District, and Groton Long Point Association, and the Boroughs of Jewett City and Stonington (referred to collectively herein as New London County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. In addition, the boundaries of the Pequot Indian Reservation are shown on the FIRMs. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to incorporate all the communities within New London County in a countywide format. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports and FIS Supplement-Wave Height Analysis Reports, is shown below:

Bozrah, Town of:	In the original March 30, 1981 study, the hydrologic and hydraulic analyses were prepared by the U.S. Army Corps of Engineers (USACE) for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-9-79. That work was completed in March 1980. In the 1995 revision, the hydrologic and hydraulic analyses for the Yantic River were prepared by Roald Haestad, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-90-C-3126. This work was completed in December 1992. Additional hydrologic and hydraulic analyses were prepared by Roald Haestad, Inc., during the preparation of the FIS for the City of Norwich. That work was completed in March 1992.
Colchester, Town of:	In the original December 15, 1981 study and June 15, 1982 FIRM, the hydrologic and hydraulic analyses were prepared by the U.S. Geological Survey (USGS) for the FIA, under Inter-Agency Agreement No. IAA-H-14-78. That work was completed in March 1980. In the July 15, 1992 revised study, hydrologic and hydraulic analyses for Meadow Brook and Day Meadow Brook were prepared by the USGS for the Federal Emergency Management Agency (FEMA) under Inter-Agency Agreement No. EMW-87-E-2764, Project Order No. 1. This study was completed in December 1990. For the June 4, 1996 revision, the hydrologic and hydraulic analyses for Judd Brook were taken from the precountywide FIS for the Borough of Colchester.

East Lyme, Town of:	For the December 15, 1980 study, the hydrologic and hydraulic analyses were prepared by James P. Purcell Associates, Inc., for the FIA, under Contract No. H-4561. That work was completed in March 1979. The wave height analysis, dated December 15, 1983, was prepared by Dewberry & Davis for the FEMA, under Contract No. EMW-C-0543. That work was completed in January 1982. For the June 16, 1992 revision, the hydrologic and hydraulic analyses were prepared by Green International Affiliates, Inc., for FEMA, under Contract No. EMW-93-C-4144 This work was completed in January 1994.
Franklin, Town of	The hydrologic and hydraulic analyses for the 1981 study were prepared by the USACE, New England Division for the FIA, under Inter-Agency Agreement NO. IAA-H-9-79. This work was completed in May 1980.
Griswold, Town of:	The hydrologic and hydraulic analyses for the 1983 study were completed by Dewberry & Davis, a technical evaluation contractor, for FEMA, under Contract No. EMW-C-0543. This work was completed in May 1983.
Groton, City of – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in March 1983.
Groton Long Point Association – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA. This work was completed in March 1982.

Groton, Town of:	The hydrologic and hydraulic analyses in the February 15, 1984 study represent a revision of the original analyses by the USACE for FEMA, under Inter-Agency Agreement No. lAA-H-2-73, project Order 1, and lAA-H-19-74, project Order 22. The updated riverine analysis was prepared by James P. Purcell Associates, Inc., under agreement with FEMA. The updated riverine analysis was completed in March 1979. The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C0543. This work was completed in March 1983.
Jewett City, Borough of:	The hydrologic and hydraulic analyses for the 1984 study were prepared by Dewberry & Davis, taken from the FIS for the Town of Griswold, Connecticut, for FEMA under Contract No. EMW-C-0968. This work was completed in May 1983.
Lebanon, Town of:	The hydrologic and hydraulic analyses for the 1988 study were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 20. This work was completed in December 1986.
Ledyard, Town of:	The hydrologic and hydraulic analyses for the 1980 study were prepared by Luchs and Beckerman for the FIA, under Contract No. H-4725. This study was completed in April 1979.
Lisbon, Town of:	The hydrologic and hydraulic analyses for the 1984 study were completed by Dewberry & Davis, a technical evaluation contractor, for FEMA, under Contract No. EMW-C-0543. This work was completed in April 1983.

Lyme, Town of:	The hydrologic and hydraulic analyses for the 1978 study were performed by the Soil Conservation Service (SCS NRSC), Storrs, Connecticut, for the FIA, under Inter-Agency Agreement No. IAA-H-9-76, Project Order No. 1. This work, which was completed in November 1976, covered all flooding sources affecting the Town of Lyme, with the exception of Uncas Pond and Norwich Pond, which were determined to be Zone A in December 1976, by Dames and Foore, under Contract to FIA.
Montville, Town of:	In the original January 1980 study, the hydrologic and hydraulic analyses were prepared by James P. Purcell Associates, Inc., for the FIA, under Contract No. H-4561. That work was completed in March 1979. In the December 5, 1995 revision, the hydrologic and hydraulic analyses for Latimer Brook were prepared by Green International Affiliates, Inc., for FEMA, under Contract No. EMW-93-C-4144. This work was completed in February 1994. The hydrologic and hydraulic analyses for Trading Cove Brook were obtained from the March 1994 study for the City of Norwich.
New London, City of – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in March 1983.
Noank Fire District – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in December 1982.

North Stonington, Town of:	The hydrologic and hydraulic analyses for the 1984 study were completed by Dewberry & Davis, a technical evaluation contractor, for FEMA under Contract No. EMW-H-4833. This work was completed in August 1983.
Norwich, City of:	The hydrologic and hydraulic analyses for the June 15, 1978 study were prepared by Anderson-Nichols and Company, Inc., for FEMA, under Contract No. H-3862. In the November 1, 1985 revision, the updated analyses for the Thames and Yantic Rivers were prepared by Dewberry & Davis under agreement with FEMA. That revised study was completed in July 1984. In the April 15, 1992 revision updated information for the Shetucket River was prepared by the USGS for FEMA under Inter-Agency Agreement No. EMM-86-E-2224, Project Order No. 1. That work was completed in December 1989. In the 1994 revision, the hydrologic and hydraulic analyses for the streams studied by detailed methods were prepared by Roald Haestad, Inc., for FEMA, under Inter-Agency Agreement No. EMW-90-C-3126. That work was completed in March 1992.
Old Lyme, Town of – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in February 1983.
Preston, Town of:	The hydrologic and hydraulic analyses for the 1984 study were completed by Dewberry & Davis, a technical evaluation contractor, for FEMA, under Contract No. EMW-C-0543. This work was completed in April 1983.
Salem, Town of:	The hydrologic and hydraulic analyses for the 1981 study were prepared by the USACE for FEMA, under Inter-Agency Agreement No. IAA-H-9-79. This work was completed in January 1980.

Sprague, Town of:	The hydrologic and hydraulic analyses for the 1984 study were completed by Dewberry & Davis, a technical evaluation contractor, for FEMA, under Contract No. EMW-C-0543. This work was completed in July 1983.
Stonington, Borough of – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract NO. W-C-0543. This work was completed in November 1982.
Stonington, Town of – Wave Height Analysis:	The wave height analysis for this study was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in January 1983.
Voluntown, Town of:	The hydrologic and hydraulic analyses for the 1984 study were prepared by the USGS for the FEMA, under Inter-Agency Agreement No. EMU-85-E-1823, Project Order No. 20. This work was completed in September 1985.
Waterford, Town of:	The hydrologic and hydraulic analyses for the February 4, 1981 study were prepared by James P. Purcell Associates, Inc., for FEMA, under Contract No. H-4561. The work for the original study was completed in March 1979.
	The hydrologic and hydraulic analyses, including wave height analysis, in the September 5, 1990 revision were prepared by the USACE, New England Division, for FEMA, under Inter-Agency Agreement No. EMW-E-0941, Project Order No. 1, Amendment No. 26. The work for this revision was completed in August 1987.

For this countywide FIS, redelineation of coastal flood hazard data was performed for open water flooding sources in the Town of East Lyme, City of Groton, Groton Long Point Association, Town of Groton, Noank Fire District, Town of Old Lyme, City of New London, Borough of Stonington, Town of Stonington and Town of Waterford. It was prepared by CDM for FEMA, under Contract No. EME-2003-CO-0340, and by Ocean and Coastal Consultants, Inc. for

CDM, under Contract No. 2809-999-003-CS. This study was completed July 11, 2008.

Base map information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital form by the Connecticut Department of Environmental Protection. Ortho imagery was produced at a scale of 1:12,000. Aerial photography is dated 2000, 2004 and 2005. The projection used in the preparation of this map was Connecticut State Plane zone (FIPSZONE0600). The horizontal datum was NAD83, GRS1980 spheroid

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. A final meeting is held to review the results of the study.

The dates of the initial, intermediate and final CCO meetings held for the incorporated communities within New London County are shown in Table 1, "CCO Meeting Dates for Precountywide FIS."

TABLE 1 – CCO MEETING DATES FOR PRECOUNTYWIDE FIS

Community Name	Initial CCO Date	Intermediate CCO Date	Final CCO Date
Town of Bozrah	August 3, 1992	*	*
Town of Colchester	July 18, 1988	*	*
Town of East Lyme	*	*	November 18,1994
Town of Franklin	November 1978	*	January 29, 1981
Town of Griswold	March 19, 1978	November 26, 1980	October 20, 1983
Town of Groton	June 8, 1977	January 11, 1979	April 19, 1983
Groton Long Point Association	*	*	September 30, 1981
City of Groton	*	*	April 20, 1983
Borough of Jewett City	*	*	March 28, 1984
Town of Lebanon	February 5, 1985	December 1986	May 7, 1987
Town of Ledyard	March 22, 1978	*	May 1, 1980
Town of Lisbon	May 12, 1978	November 25, 1980	October 20, 1983
Town of Lyme	March 1975	November 1975	November 3, 1976
Town of Montville	July 15, 1993	*	November 18, 1994
City of New London	*	*	*
Noank Fire District	*	*	January 14, 1983
Town of North Stonington	April 13, 1978	March 5, 1980	April 26, 1984
City of Norwich	April 21, 1992	*	*
Town of Old Lyme	*	*	March 30, 1983
Town of Preston	April 14, 1978	November 25, 1980	October 19, 1983
Town of Salem	November 1978	*	March 24, 1981

TABLE 1 – CCO MEETING DATES FOR PRECOUNTYWIDE FIS (Continued)

Community Name	Initial CCO Date	Intermediate CCO Date	Final CCO Date
Town of Sprague	April 13, 1978	December 9, 1980	October 20, 1983
Town of Stonington	*	*	February 25, 1983
Borough of Stonington	*	*	January 13, 1983
Town of Voluntown	February 5, 1985	December 1986	May 7, 1987
Town of Waterford	May 1, 1985	*	May 31, 1989

*Data not available

For this revision, the initial CCO meetings were held on October 24th and 25th of 2006 and were attended by representatives of FEMA, USACE, Connecticut Department of Transportation (DOT), Southeastern Connecticut Council of Governments (SCCOG), Connecticut Department of Environmental Protection (DEP), University of Connecticut (UCONN), Natural Resources Conservation Service (NRCS), CDM, and New London County communities.

The results of the study were reviewed at the final CCO meeting held on Wednesday, July 15, 2009, and attended by representatives of Town of Montville, Town of Colchester, Town of Lebanon, Town of East Lyme, Town of Salem, Town of Preston, Groton Long Point Association, Town of Waterford, Town of Groton, City of Norwich, Town of North Stonington, Town of Griswold, City of New London, Town of Old Lyme, Town of Sprague, Town of Franklin and Town of Voluntown. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of New London, Connecticut, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods in the pre-countywide FISs. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM.

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Flooding Source Name	Description of Study Reaches
Amston Lake	For the entire shoreline within the Town of Lebanon
Beaver Brook (Town of Lyme)	From its confluence with Eight Mile River to approximately 6,075 feet upstream of Route 156
Beaver Brook (Town of Sprague)	From its confluence with the Shetucket River to the Sprague-Franklin corporate limits
Birch Plain Creek	From its confluence with Baker Cove to just upstream of the Town of Groton-City of Groton corporate limits
Blissville Brook	From its confluence with the Shetucket River to approximately 400 feet upstream of Ames Road
Bobbin Mill Brook	From its confluence with the Yantic River to just upstream of Scotland Road in the City of Norwich
Connecticut River	Storm tides from Long Island Sound that affect Connecticut River in the Town of Lyme
Day Meadow Brook	From River Road to a point approximately 3,800 feet upstream (near State Route 2)
Denison Brook	From State Route 138 to Fish Road
East Branch Eight Mile River	From approximately 900 feet downstream of Darling Road to the confluence of Harris Brook
Eccleston Brook	From 4,800 feet upstream of State Route 215 to 6,150 feet upstream of State Route 215
Eight Mile River	From its confluence with the Connecticut River to just upstream of Route 156

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(Continued)

Flooding Source Name	Description of Study Reaches
Fishers Island Sound	Transects 74-79 and 83-85 in the Town of Stonington
	Transects 67 - 70 in Noank Fire District.
	Transects 60 - 65 in Groton Long Point Association
	From its confluence with Mill Cove to approximately 100 feet upstream of Baldwin Hill Road
Fishtown Brook	From Fishtown Road to U.S. Route 1
Flat Brook	From its confluence with Mill Cove to approximately 100 feet upstream of Baldwin Hill Road
Ford Brook	From its confluence with Trading Cove Brook to approximately 100 feet upstream of Newton Street
Fort Hill Brook	From Mumford Cove to Interstate 95
Fourmile River	From its confluence with Long Island Sound to Boston Post Road
Gardner Brook	From its confluence with the Yantic River to a point approximately 13,700 feet upstream
Glasgo Pond	Within the Town of Griswold
Goldmine Brook	From its confluence with Trading Cove Brook to approximately 100 feet upstream of Salem Turnpike
Great Meadow Brook	From its confluence with Pachaug River to approximately 4,850 feet upstream of Wyle School Road
Great Plain Brook	From its confluence with Trading Cove Brook to approximately 700 feet upstream of Norman Road

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(Continued)

Flooding Source Name	Description of Study Reaches
Green Fall River	From 2,100 feet upstream of Wellstown Road in the Town of Hopkinton, Washington County, Rhode Island, to Clarks Falls Pond Dam
Harris Brook	From its confluence with East Branch Eight Mile River to approximately 4,500 feet upstream of dam
Hunter Brook	From the confluence with the Shetucket River to approximately 1,800 feet upstream of the second crossing of Hunters Road
Jeremy River	From 4,600 feet upstream of State Route 149 to Old Hartford Road
Joe Clark Brook	From its confluence with Poquetanuck Cove to a point approximately 7,600 feet upstream from the Preston-Ledyard corporate limits
Jordan Brook	From its confluence with Jordan Cove to approximately 1,600 feet upstream from Douglas Lane
Judd Brook	From Old Hebron Road to approximately 2,350 feet upstream of Norwich Avenue
Latimer Brook	From its confluence with Niantic River to approximately 400 feet upstream of Beckwith Road
Little River	From its confluence with the Shetucket River to approximately 2,750 feet upstream of State Route 138
Long Island Sound	For the entire length of the Town of East Lyme
Long Island Sound and Connecticut River	Transects 1 - 8 in the Town of Old Lyme

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(Continued)

Flooding Source Name	Description of Study Reaches
Long Island Sound and Thames River	For the entire length of the Town of Groton
Meadow Brook	From its confluence with Jeremy River to a point approximately 3,250 feet upstream of State Route 16
Nevins Brook	From its confluence with Jordan Brook to approximately 4,950 feet upstream of Fog Plain Road
Niantic River	Within the Town of East Lyme
Norwichtown Brook	From its confluence with the Yantic River to approximately 550 feet upstream of Case Street
Oxoboxo Brook	From Horton Cove to Rockland Pond Dam
Pachaug Pond	Within the Town of Griswold
Pachaug River	From its confluence with Quinebaug River to its confluence with dam at Pachaug Pond
Pachaug River (Town of Voluntown)	From a point approximately 800 feet upstream of Carol Road to 5,000 feet upstream of Beach Pond Dam
Pattagansett River	From its confluence with Long Island Sound to Pattagansett Lake Dam
Pawcatuck River	From 31,000 feet upstream of the confluence with Little Narragansett Bay to the North Stonington, Connecticut-Hopkinton, Rhode Island boundary
Pine Swamp Brook	From its confluence with Thames River to approximately 1,300 feet upstream of Harvard Terrace
Poquetanuck Cove	From its confluence with the Thames River to the confluence of Joe Clark Brook

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(Continued)

Flooding Source Name	Description of Study Reaches
Quinebaug River	From its confluence with the Shetucket River to the Lisbon, New London County-Canterbury, Windham County boundary
Red Cedar Lake	For its entire length
Shewville Brook	From 10,650 upstream of its confluence with Hewitt Brook to approximately 750 feet upstream of Shewville Road
Shetucket River	From 16,000 feet upstream of Route 2A to approximately 300 feetupstream of North Main Street in the Town of Sprague
Shunock River	From its confluence with the Pawcatuck River to approximately 5,200 feet upstream of Main Street
Spaulding Pond Brook	From its confluence with Shetucket River to approximately 150 feet upstream of dam
Susquetonscut Brook (Town of Franklin)	From 2,000 feet upstream of its confluence with the Yantic River to Champion Road
Susquetonscut Brook (Town of Lebanon)	From 15,000 feet upstream of its confluence with the Yantic River to Bender Road
Tenmile River	From its confluence with the Willimantic River upstream to Palmer Pond
Thames River and Shetucket River	From just downstream of the Town of Montville-City of Norwich corporate boundary to just upstream of its confluence with Yantic River
Trading Cove Brook	From its confluence with the Thames River to approximately 300 feet upstream of the confluence with Goldmine Brook
Tributary A	From its confluence with Birch Plain Creek approximately 2,070 feet upstream of Tower Road

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(Continued)

Flooding Source Name	Description of Study Reaches
Tributary B	From its confluence with the Yantic River to approximately 75 feet upstream of Mediterranean Lane
Tributary C	From its confluence with Shetucket River to approximately 60 feet upstream of the Main Street Culvert
Tributary D	From its confluence with the Shetucket River to approximately 600 feet upstream of Saint Regis Avenue
Tributary E	Within the City of Norwich
Tributary F	From its confluence with Thames River to Albert Street
Whitford Brook (Town of Groton)	From its confluence with Mystic River to the Groton-Stonington corporate limits
Whitford Brook	From approximately 1,800 feet upstream of Lantern Hill Road to approximately 400 feet upstream of the second crossing of Lantern Hill Road
Williams Brook	From approximately 750 feet upstream of its confluence with Whitford Brook Swamp to approximately 4,950 feet upstream of Town Farm Drive
Williams Pond	For its entire length
Yantic River	From its confluence with Thames River to Sisson Road
Yantic River East Channel	From approximately 1,000 feet upstream of its confluence with the Thames River to approximately 3,700 feet upstream

Tributary E was studied in detail, however, no flooding is shown on the FIRM because the floodplains were less than 200 feet wide.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the individual communities within

New London County. For this countywide revision, no new approximate studies were executed. All or portions of the flooding sources listed in Table 3, “Flooding Sources Studied by Approximate Methods,” were studied by approximate methods in the precountywide FISs.

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS

Flooding Source Name	Community
Adams Brook	Sprague
Amos Lake	Preston
Ashwillet Brook	North Stonington
Assekonk Brook	North Stonington
Avery Pond	Preston
Ayer Pond	Preston
Babcock Pond	Colchester
Bailey Pond	Voluntown
Baltic Reservoir	Sprague
Bartlett Brook	Lebanon
Bates Pond	Preston
Beaver Brook	East Lyme, Franklin
Beaver Dam Brook	East Lyme, Groton (Town)
Beebe Pond	Groton (Town)
Bentley Brook	Bozrah
Billings Avery Brook	Ledyard
Billing's Brook	Griswold
Bindloss Brook	Groton (Town)
Blissville Brook	Lisbon
Bog Meadow Reservoir	Norwich
Bogue Brook	Montville
Then Brandegee Lake	Waterford
Brewster Pond	Lebanon
Bride Brook	East Lyme
Broad Brook	Preston
Burton Brook	Griswold
Byron Brook	Norwich
Cabin Brook	Colchester
Cedar Swamp	Preston, Voluntown
Choate Brook	Preston
Church Brook	Waterford
Clayville Pond	Griswold
Cold Brook	Franklin
Cold Brook	Norwich
Cooks Pond	Preston
Cote Pond	Norwich
Cranberry Meadow Brook	East Lyme
Crooked Brook	Griswold
Crowley Brook	Preston
Dawley Pond	Voluntown
Deep Hollow Brook	Montville

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS
(continued)

Flooding Source Name	Community
Deep River	Lebanon
Deep River Reservoir	Colchester
Denison Brook	Voluntown
Dickinson Creek	Colchester
Doaneville Pond	Griswold
Douglas Swamp	Voluntown
East Branch Eight Mile River	Lyme, Salem
Eccleston Brook (upper portions)	Groton (Town)
Elisha Brook	Norwich
Exeter Brook	Lebanon
Fairview Reservoir	Norwich
Falls Brook	Montville
Fenger Brook	Waterford
Fishtown Brook (upper portions)	Groton (Town)
Folwix Brook	Preston
Fort Hill Brook (upper portions)	Groton (Town)
Fox Brook	Montville
Gagers Pond	Franklin
Gardner Lake	Bozrah
Gay Pond	Preston
Glade Brook	North Stonington
Goldmine Brook	Norwich
Grassy Hill Brook	Lyme
Great Brook	Groton (Town)
Great Meadow Brook	Voluntown
Green Fall Pond	Voluntown
Green Fall River	Voluntown
Green Swamp Brook	Waterford
Haleys Brook	Ledyard, Groton (Town)
Hall Brook	Colchester, Lebanon
Hallville Pond	Preston
Hampstead Brook	Groton (Town)
Hanover Reservoir	Sprague
Harris Brook	Salem
Hatching House Brook	Groton (Town)
Havey Brook	Griswold
Hazard Pond	Voluntown
Hetchel Swamp Brook	North Stonington
Hewitt Brook	Preston
Hunts Brook	Montville, Waterford
Indiantown Brook	Ledyard, Preston
Jeremy River	Colchester
Jordan Brook	Lebanon
Judd Brook	Colchester

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS
(continued)

Flooding Source Name	Community
Kahn pond and adjacent pond areas	Franklin
Koistenen Brook	Voluntown
Lake of Isles Brook	North Stonington, Preston
Lakes Pond Brook	Waterford
Lantern Hill Brook	Ledyard
Lantern Hill Pond	North Stonington
Latimer Brook	Montville, Salem
Ledyard Lake	Ledyard
Lee Brook	Ledyard
Lewis Pond	Preston
Lisbon Brook	Lisbon
Lowden Brook	Voluntown
Main Brook	North Stonington, Preston
McAlpine Brook	Montville
McCarthy Brook (NE of Baltic Road)	Franklin
Meadow Brook	Colchester
Mill Brook	Griswold
Miller Brook	North Stonington, Preston
Mineral Spring Brook	Bozrah
Mohegan Brook	Montville
Morgan Pond	Ledyard
Mount Misery Brook	Voluntown
Mountain Brook	Franklin
Myers Brook	Preston
Myron Kinney Brook	Voluntown
Nelkin Brook	Colchester
Norwich Pond	Lyme
Norwichtown Brook	Norwich
Oil Mill Brook	Waterford
Papermill Pond	Sprague
Pattagansett River	East Lyme
Pease Brook	Franklin, Lebanon
Pendleton Hill Brook	North Stonington
Phelps Brook	North Stonington
Pine Brook	Colchester
Poquetanuck Brook	Preston
Prentice Brook	North Stonington
Rattlesnake Brook	Griswold, Preston
Red Brook	East Lyme
Red Brook	Ledyard, Groton (Town)
Roaring Brook	Lyme
Rogers Lake	Lyme
Rosemond Lake	Ledyard
Round Brook	Bozrah
Salmon River	Colchester

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS
(continued)

Flooding Source Name	Community
Savin Lake	Lebanon
Sheep Barn Brook	Griswold
Sherman Brook	Lebanon
Shetucket River	Sprague
Shewville Brook	Preston
Spaulding Pond Brook	Norwich
Spinnging Mill Brook	Lebanon
Stone Hill Reservoir	Griswold
Stony Brook	Montville, Waterford
Susquetonscut Brook	Franklin
Swamp area along Hartshorn Brook	Franklin
Swamp area along Norwich Lebanon Road southeast of Brush Hill Road	Franklin
Swamp area at the southern end of Bellows Brook	Franklin
Swamp area northeast of the intersection of Champion Road and State Route 87	Franklin
Swamp area northeast of the intersection of Kahn Road and Blue Hill Road	Franklin
Swamp area south of Turkey Hill	Franklin
Tadman Pond	Bozrah
Taftville Reservoir	Norwich
Tenmile River	Lebanon
The Fourmile River	East Lyme
Thompson Brook	Ledyard
Trading Cove Brook	Bozrah, Montville
Tributary A (upper portions)	Groton (Town)
Uncas Pond	Lyme
West Branch Brook	Ledyard
West Branch Red Brook	Groton (Town)
Whalebone Creek	Lyme
Whittle Brook	Montville
Wood River	Voluntown
Wyassup Brook	North Stonington
Yantic River	Lebanon
Yawkucs Brook	North Stonington

No new detailed-studies were performed for this countywide FIS.

Detail-studied streams that were not re-studied as part of this revision may include a profile baseline on the FIRM. The profile baselines for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases the transferred profile baseline may deviate significantly from the channel or may be outside of the floodplain.

As part of this countywide update, redelineation of coastal flood hazard data was performed for open water flooding sources in the communities of Town of East Lyme, City of Groton, Groton Long Point Association, Town of Groton, Noank Fire District, Town of Old Lyme, City of New London, Borough of Stonington, Town of Stonington and Town of Waterford.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision [LOMR], Letter of Map Revision - based on Fill [LOMR-F], and Letter of Map Amendment [LOMA]), as shown in Table 4, "Letters of Map Change."

TABLE 4 – LETTERS OF MAP CHANGE

Community	Case Number	Flooding Source	Letter Date
East Lyme, Town of	93-01-003P	Niantic Bay	02/261993
Groton, Town of	96-01-051P	Haleys Brook, West Branch Red Brook	01/20/1997
East Lyme, Town of	97-01-051P	Pattagansett River	02/21/1999
Norwich, City of	03-01-077P	Great Plain Brook	01/16/2004
New London, City of	05-01-0174P	Thames River	04/19/2005
Colchester, Town of	09-01-1230P	Unnamed Tributary To Sherman Brook	02/15/2010

2.2 Community Description

New London County is located in southeast Connecticut. In New London County, there are nineteen (19) towns, three (3) cities, and two (2) boroughs. The Towns of Colchester, Franklin, Griswold, Lebanon, Lisbon, Sprague, Voluntown, and the Borough of Jewett City are located in northern New London County. The Towns of Bozrah, Ledyard, Montville, North Stonington, Preston, Salem, and the City of Norwich are in the central portion of the county. The Towns of East Lyme, Lyme, Old Lyme, Stonington, Waterford, the Cities of Groton and New London, Groton Long Point Association, the Borough of Stonington, and the Noank Fire District are located in the southern portion of the county. The Pequot Indian Reservation is located in the Town of North Stonington.

New London County is bordered on the north by Windham County, Connecticut, and on the west by Middlesex County, Connecticut. It is bordered on the northwest by the Counties of Tolland and Hartford, Connecticut. New London County is bordered on the east by Washington County, Rhode Island. It is bordered on the south by Fishers Island Sound and Long Island Sound.

According to census records, the population of New London County was 259,088 in 2000 (Reference 1). The total area in New London County consists of 772 square miles (sq. mi.), including 106 sq. mi. of water area. All communities in New London County, along with their population and total area, are listed in Table 5 "Population and Total Area by Community."

TABLE 5 – POPULATION AND TOTAL AREA BY COMMUNITY

Community	Total Area (sq. mi)[1]	Population[1]
Bozrah, Town of	20.24	2,357
Colchester, Town of	49.8	14,551
East Lyme, Town of	41.97	18,118
Franklin, Town of	19.58	1,835
Griswold, Town of	37.1	10,807
Jewett City, Borough of *	0.75	3,053
Groton, Town of	45.20	39,907
Groton, City of*	6.74	10,010
Groton Long Point Association*	0.45	667
Noank Fire District (CDP)*	2.21	1,830
Lebanon, Town of	55.24	6,907
Ledyard, Town of	40	14,687
Lisbon, Town of	16.63	4,069
Lyme, Town of	34.48	2,016
Montville, Town of	44.13	18,546
New London, City of	10.76	25,671
North Stonington, Town of	54.97	4,991
Norwich, City of	29.48	36,117
Old Lyme, Town of	28.82	7,406
Preston, Town of	31.76	4,688
Salem, Town of	29.79	3,858
Sprague, Town of	13.83	2,971
Stonington, Town of	50.04	17,906
Stonington, Borough of*	0.69	1,032
Voluntown, Town of	39.76	2,528
Waterford, Town of	44.39	19,152

[1]2000 Census of Population and Housing (Reference 1)

*In the State of Connecticut, incorporated places are described legally as boroughs and cities. The Census Bureau treats all incorporated places and Census Designated Places (CDPs) as dependent within towns. Therefore, population for cities, boroughs, and CDPs are included within the respective total town population count and not included in the total population count for the county.

The terrain of New London County is mostly level, becoming more elevated only in its northern extreme. The topography then ranges from gently rolling terrain in the valleys to steep hilly terrain in several upland areas. The highest point in the county is Gates Hill in the Town of Lebanon at approximately 660 feet above sea level, and the lowest point is sea level. (Reference 2)

The land area of the county consists primarily of soil developed on till and bedrock in the uplands. Glacial deposits, and the erosion of these deposits by running water from glacial melt, have created an irregular earth surface in some areas. The most common soils in New London County are loams formed on glacial till. The remainder of the soils are alluvial, formed on glacial outwash or floodplains. The bedrock in this area of Connecticut is predominantly unweathered gneiss and schist overlain by glacial till or outwash. The soils were formed from glacial till, outwash and wind-blown deposits. Glacial deposits over bedrock are primarily of two types: nonstratified material or till composed of clay, sand, gravel, and boulders, intermingled; and stratified material composed of sand and gravel. These soils are deep and well drained with moderate to moderately rapid permeability. The characteristics of these soils facilitate precipitation retention where the hills are slightly to moderately sloped. The result is numerous streams, valleys, hills, steep slopes, inland wetlands, lakes, ponds, and bedrock outcroppings (Reference 3).

Outside the residential, commercial, and industrial areas, the vegetation is composed primarily of trees and undergrowth in woodlands, grasses in the open fields and pastures, farm crops in the few fields devoted to agriculture, and various swamp plants in the inland wetlands. Woodlands predominate, especially on slopes and summits of the many hills. In the woodlands, hardwoods far outnumber the softwoods.

New London County is part of the Coastal Lowlands that cover the entire New England Coast. The Connecticut Coastal Lowlands form a narrow strip of land, 6 to 16 miles wide, that runs along the southern shore of New London County at Long Island Sound. The Coastal Lowlands are characterized by lower ridges and beaches and harbors along the coast (Reference 4).

The County of New London has many rivers and brooks, some of which flow to Long Island Sound. The Thames River, which flows south into Long Island Sound, is one of the principal rivers in Connecticut. Although the Thames River is only 15 miles long, the basin extends approximately 75 miles north, with the Shetucket and Quinnebaug Rivers being the main contributing sources of water. The drainage area of the Thames River basin is 1,478 square miles.

The mean annual temperature for the county is 50 degrees Fahrenheit (ºF). Generally, summer temperatures range from 70°F to 90 ºF; temperatures over 100 ºF do occur, but infrequently. Winter temperatures range between 10 ºF and 40 ºF. The prevailing winds are northwesterly in the winter and southwesterly in the summer. Hurricanes occur most frequently during the months of August, September, and October. The average annual precipitation is 46 inches.

2.3 Principle Flood Problems

Floods in the New London County have occurred in every season of the year. Floods in late summer and fall are usually the result of hurricanes or other storms moving northeast along the Atlantic coast. The most severe flooding occurs during hurricanes or coastal storms. These storms, with their intense winds and rainfall, can create abnormally high tidal surges, wave runup, and peak runoff. The low-lying tidal shoreline areas of New London County are subjected to periodic flooding by severe storms. The shoreline along Long Island Sound, with its high concentration of residential structures, is highly susceptible to heavy damage. When the hurricane's track is west of the coastal communities, the hurricane's counterclockwise winds tend to increase the adverse effect of the tidal surge.

Winter floods result from occasional thaws, particularly in years of heavy snowfall. Flooding has also occurred in early spring when the ground was frozen. Spring floods are common and are caused by rainfall in combination with snowmelt. When coastal storms occur in winter and spring, the flooding problem is compounded by ice jams and runoff from melting snow.

Flood problems for New London County have been compiled and are summarized below:

Historic flooding in eastern Connecticut extends back to the early 17th century. The two earliest hurricanes of record in New England, namely August 15, 1635, and August 3, 1638, created flood levels apparently higher than the recent floods of 1938 and 1954, and probably were the greatest experienced in New England during the past 300 years (Reference 5). Though no records exist for Connecticut, it is reasonable to assume that these hurricanes also caused extensive tidal flooding along the Connecticut coast. Records indicate that the coast of Connecticut has experienced hurricane tidal flooding on over 60 occasions since 1769. On nine of these occasions, severe tidal flooding occurred. The five greatest, as far as can be determined from existing records, were the hurricanes of 1938, 1893, 1954, 1815, and 1944 (in descending order of estimated magnitude). Historical information regarding flood problems due to hurricanes is included in the USACE study entitled, Hurricane Survey, Connecticut Coastal and Tidal Areas (Reference 6).

The hurricanes of 1938 and 1954 caused some of the worst flooding in New London County. The 1938 hurricane resulted in the greatest disaster in Connecticut's history up to that time, because of the combined effects of flooding, gale winds, and storm surge. The tide was high when the storm surge struck and resulted in a maximum tidal elevation of 8.8 feet. The recurrence interval of this flood height is approximately 2.2-percent-annual-chance. The hurricane of 1954 moved up the Atlantic coast and entered Connecticut in the New London area causing a maximum tidal elevation of 8.0 feet, with a recurrence interval of approximately 5-percent-annual-chance (Reference 7). Tidal surges during severe storms cause flooding along both the Niantic and the Thames Rivers, the larger rivers in the area, and along other smaller streams flowing into either these rivers or Long Island Sound. Where structures are located in the floodplains, damage occurs. In Waterford, hurricane tidal flood damages for the 1938 and 1954 hurricanes were scattered along the entire shoreline, with principal concentrations at the head of Niantic Bay and in the Ridgewood area on the west bank of Alewife Cove. Much of the loss in 1954 was from damage to boats (Reference 6).

Shoreline damages in the Town of East Lyme resulted in losses of $1,070,000 and $990,000 during the 1938 and 1954 hurricanes, respectively (Reference 6). In addition, the Town of Montville suffered losses of $900,000 and $700,000 during the 1938 and 1954 hurricanes, respectively due to shoreline damages. At the

CCO meetings for the March 1979 study for the Town of East Lyme, comments were made regarding repeated coastal and riverine flooding. Tidal flooding occurs along Shore Drive, Shore Road, and Atlantic Street, just off Niantic Bay. Also, tidal flooding was reported on both the east and west shores of Black Point. Flooding at Giants Neck Road because of Bride Brook overflowing its banks was reported.

The September 1938 storm was the maximum flood of record for the Town of Norwich. If this flood were to occur at the present time, it would have an estimated recurrence interval of approximately 0.3-percent-annual-chance flood. During the September 1938 flood, high water marks of 8 feet and 1 inch were recorded at the corner of Bath and Franklin Streets and marks of 5 feet and 5 inches were recorded above the railroad tracks to Laurel Hill at the Shetucket River.

The most notable flood along the Quinebaug River occurred in August, 1955, as the result of Hurricane Diane. The peak discharge caused by that storm was 40,700 cubic feet per second (cfs). Other notable floods were the two floods of March 1936, which were caused by extra-tropical storms. These had peak discharges of 22,800 cfs and 25,000 cfs. Also, a peak discharge of 2,240 cfs was recorded for the Pauchaug River in 1938 at a gage near the borough of Jewett City. Flooding also occurred in July and September of 1938 as the result of hurricanes.

Two severe floods in Preston occurred in March 1936 and were caused by extra-tropical storms. Serious flooding also occurred in July and September of 1938 as the result of hurricanes.

The flood of record for the Shetucket River, affecting the Towns of Preston, Sprague, Norwich, and Lisbon occurred in September 1938 as the result of a hurricane. This hurricane is often referred to as the "New England Hurricane." Severe flooding also occurred along the Shetucket and Quinebaug Rivers as the result of Hurricane Diane which occurred on August 19, 1955.

Major floods in the Town of Lebanon occurred in March 1936, September 1938, and August 1955. Of these, the flood of September 1938, caused by a hurricane, was the most severe. Streamflow records at USGS gaging station No. 01193500 on the Salmon River at East Hampton and No. 01127500 on the Yantic River at Yantic, which are in the vicinity of Lebanon, indicate that the September 1938 flood has a recurrence interval of approximately 1-percent-annual-chance. The small segment of the Yantic River within the Town of Franklin has been a source of frequent overbank flooding, due at least in part to a dike which was built to protect a sanitary sewer siphon. There are several houses in the floodplain in this area.

Hurricane Gloria hit the Town of Waterford on September 27, 1985. Total damages, estimated at $650,000, were a result of one or a combination of the following: previous shoreline instability, wind and wave action during the storm, and the degree of exposure at the shoreline. Rainfall was insignificant compared to other storm effects due to the location of the town east of the eye of the storm. Damages were generally classified as dock damage, structural damage (sea walls, retaining walls, and bulkhead damage), and beach erosion (approximately 4,000 linear feet) (Reference 12). In Waterford, further inland, riverine flooding, not directly related to tidal surges of the Niantic and the Thames Rivers, has occurred with resulting damage incurred.

In the Town of Colchester, major floods have occurred in March 1913, November 1927, March 1936, September 1938, August 1955, February 1973, January 1978, and January 1979. Streamflow records at the USGS gaging station on the Salmon River in the nearby Town of East Hampton indicate that the September 1938 and January 1979 floods had approximate recurrence intervals of 1-percent-annual-chance.

Major floods also occurred in Voluntown in March 1936 and in September 1938 (caused by a hurricane); the September 1938 flood was the most severe.

Areas adjacent to the Eight Mile River are subject to flooding caused by the overflow of the river or water from the tidally affected Connecticut River. The most severe flooding is the result of the rainfall from hurricanes. The flood events that had the most effect on the Town of Lyme occurred in 1936, 1938, 1944, 1950, 1954, and 1955.

The low elevation of Groton Long Point Association makes it very susceptible to tidal flooding. Residences are heavily concentrated along the coastline and they are subject to damage from tidal flooding with wave action. Many residential and commercial structures are located in low-lying areas further inland and, though not subject to damage from the surf, they are subject to tidal flooding. The southern portion of the point, in the Shore Avenue area, is exposed to the wave action from Fishers Island Sound and it is here that the most damage has occurred in the past. The shoreline structures along Mumford and Palmer Coves have also experienced wave action damage, but to a lesser degree.

Damage has been sustained by structures located in the floodplains of the Fourmile River and Latimer Brook. In 1982, a major riverine flooding event occurred in the Town of East Lyme, which damaged bridges and structures in the surrounding area. The event is the highest on record at the USGS gaging station on the Fourmile River.

A small dam failure occurred on March 6, 1963 on Spaulding Pond Brook. This failure occurred during a moderate storm on the Spaulding Pond Dam, 400 feet above the center of the City of Norwich. Thousands of gallons of water poured into the city, leaving 6 dead and property damage in the millions of dollars (Reference 11).

Flooding problems exist in the Horton Cove area in the community of Montville. Also, tidal flooding is a recurring problem in the industrial area at Montville Station, just south of the mouth of Horton Cove. In 1982, a major riverine flooding event occurred in Montville, which caused damage to bridges and structures along Latimer Brook and the surrounding area. The event is the highest on record at the USGS gaging station on the Fourmile River in East Lyme. A regional storm drainage study confirms reports that localized inland flooding occurs in the Oxoboxo, Stony, and Trading Cove Brooks due to culverts with inadequate capacity (Reference 8).

Streamflow records collected in the vicinity of North Stonington by the USGS indicate that annual peak flow can occur during any season of the year; however, it occurs most frequently during the months of December through April. The highest peak flows usually occur during March or April because of runoff from spring rains, which are often increased by snowmelt; or during September or October, due to runoff from tropical storms. Flooding has not been a major problem on the Pawcatuck River. The vast amount of swampland within the basin has caused very slow flood formation with only minor peak floods (Reference 9). Based on historical information obtained from the USGS gaging station No. 01118500 on the Pawcatuck River at Westerly, the worst flood since gage operation began in 1886 was that of November 1927. This flood was caused by a tropical storm. No discharges were calculated for this flood; however, it is estimated to have been a 0.5-percent-annual-chance flood. The flood of March 1968 was the second most severe. Peak discharges for this flood were 4,470 cfs on the Pawcatuck River at the Westerly gage. This was estimated to be approximately 3.3-percent-annual-chance flood. More recent floods in January 1978 and January 1979 at the Westerly gage produced peak discharges of 4,110 cfs and 4,010 cfs, respectively. Both of these storms had an estimated recurrence interval of approximately 5-percent-annual-chance (Reference 10).

The USGS gaging station at North Lyme recorded high stages on September 21, 1938, October 16, 1955, and August 19, 1955. This gaging station is located downstream of Salem on the East Branch Eight Mile River. There has been significant flooding in the past at Salem Four Corners, where State Routes 82 and 85 intersect, particularly at the area on State Route 82 immediately west of the intersection. This route was described as having been overtopped by approximately one foot of water during a past flood.

2.4 Flood Protection Measures

Flood protection measures for New London County have been compiled and are summarized below:

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations adopted from the code of Federal Regulations which control building within areas that have a high risk of flooding.

One significant development from the aftermath of the 1982 flooding was the development of a statewide flood warning system under the management of the Connecticut Department of Environmental Protection. While this will not prevent flooding to occur in the future, it may help provide advance warning and prevent the loss of lives and property.

There are no known flood protection measures existing at this time that affect flooding along any body of water in the Towns of Colchester, Lebanon, Ledyard, Lyme, North Stonington, Salem, Voluntown, and Waterford.

The only existing structural flood protection measure in the Town of Bozrah is the Gilman Dam, which is located on the Yantic River.

Consideration was given to protection of the flooded area in the vicinity of Oak Beach in the Town of Lyme. The considered plan located in Oak Brach consisted of sand fill and diking along the shore with necessary tieback dikes to high ground. However, no work to construct such protection has ever begun (Reference 6).

Following the record flood of September 1938 on the Shetucket River, the USACE constructed the Mansfield Hollow flood control dam. That project was completed in March 1952. The dam is located on the Natchaug River about five miles upstream from its confluence with the Shetucket River. Floods with the recurrence interval of the September 1938 flood on the Shetucket River at Willimantic, Connecticut modified by the Mansfield Hollow dam would have a peak discharge of about 25,700 cfs compared to an experienced flow of 52,200 cfs. Though the reservoir reduces the frequency and severity of floods, there still remains a flood hazard on the unprotected floodplains.

Flooding along the Quinebaug River, in the communities of Griswold, Lisbon, and Preston, is reduced by USACE dams which were built to form the following lakes: Hodges Village Lake, located at Oxford, Massachusetts; Buffumville Lake, at Oxford and Charlton, Massachusetts; Westville Lake, at Southbridge, Massachusetts; East Brimfield Lake, at Fiskdale, Massachusetts; West Thompson Lake, at North Grosvenordale, Connecticut; and Mansfield Hollow Lake, at Mansfield, Connecticut. West Thompson Lake, finished in October 1965, was the last of these projects to be completed. The storage provided by several ponds on the Pachaug River also diminishes the effects of storms in Griswold.

Dams located at Stony and Bogue Brooks reservoirs and at Oxoboxo Lake retain large amounts of storage water. Also, dams at several small reservoirs provide further moderate control of upland runoff. The topography of the study area enables quick discharge of runoff to the lower reaches of the numerous watershed areas with a minimal lag time (Reference 8). A preliminary study by the USACE for the Montville Station area on the Thames River indicated that tidal flooding damage could be reduced with dikes and walls. At this time, no work has commenced on flood protection measures for this community (Reference 6). Channel encroachment limit lines have not been proposed along the Thames River by the State of Connecticut since the Thames River is influenced by tidal surges from Long Island Sound.

The existing dams on the streams studied in detail in North Stonington are old mill dams, and none of these are regulated. However, storm runoff intensity is greatly moderated by large areas of swamp, numerous ponds, and low gradient streams in the surrounding countryside.

Between 1952 and 1965, the USACE constructed six flood control reservoirs in the Thames River Basin. These reservoirs control runoff from the upper watersheds of the Shetucket and Quinebaug Rivers above the City of Norwich. The city also has several small reservoirs that provide moderate control of upland runoff. Two such reservoirs were constructed by the SCS in 1963 and 1964 on Spaulding Pond Brook (References 11, 13, 17). The Shetucket River Channel Improvement Project was completed in January 1959 by the USACE. In conjunction with regular navigational dredging on the Thames River, the rock excavation and the raising of the Laurel Avenue Bridge have significantly increased the flood-carrying capacity of the lower Shetucket River. State Channel Encroachment Lines have been adopted along the Yantic and Shetucket Rivers in Norwich to restrict building in potentially hazardous areas. The City Council has also adopted a map prepared by the Inland Wetlands Watercourses and Conservation Commission which regulates building in wetland areas. The City of Norwich has adopted floodplain regulations that require 100 percent compensatory storage be provided for all new encroachments in the floodplain

There are two dams located on Harris Brook in Salem but neither structure provides flood protection.

Beech Pond does exert a dampening effect on flood peaks on the Pachaug River in Voluntown.

A hurricane survey prepared by the USACE indicates a preliminary study has been made for breakwater protection of the New London Harbor area in the Town of Groton. Construction of the breakwaters would be beneficial to the City of Groton and perhaps to the Town of Groton since tidal surges along the Thames River would be reduced, as well as damage. However, the construction of the breakwaters has not begun and is not under consideration at this time (Reference 7).

The Town of Waterford has incorporated into its zoning laws a set of floodplain management regulations to help minimize future flood damages and related hazards. The zoning regulations for the Town of Waterford require that the following conditions be met to obtain a Zoning Compliance Permit for new construction and substantial improvement within a Flood Hazard Area: a) all new construction and substantial improvements to residential structures have their lowest floor (including basement) elevated to or above the base flood level; b) all new construction and substantial improvements to nonresidential structures have their lowest floor (including basement) elevated or flood-proofed to or above the base flood level; and c) adequate drainage is provided so as to reduce exposure to flood damage. Further floodplain management measures regarding manufactured homes (mobile homes), water-supply and sewage-disposal systems, alterations of existing water courses and floodways are included in the zoning regulations (Reference 15).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 2-, 1-, or 0.2-percent-annual-chance period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 2-, 1-, and 0.2-percent-annual-chance floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

For each community within New London County that has a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below.

Precountywide Analyses

Since no stream gage records were available for Beaver Brook (Town of Sprague), a regression analysis of stream gages in the region developed by L. Weiss and revised by P. Biscuti was used to determine discharges for this brook (References 25 and 39). The results of this analysis were extended using a log-Pearson Type III analysis.

The USDA NRSC computer program (Reference 36) for synthetic rainfall-runoff methods was used for Beaver Brook (Town of Lyme) and the Eight Mile River to obtain the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharge. The results were checked with the USGS stream gages 01194500 on the East Branch Eight Mile River and 1-1940 on Eight Mile River (period of record 1937-1966).

USGS flood flow formulas for Connecticut and for ungaged streams were used to determine discharge-frequency data for Birch Plain Creek, Fort Hill Brook, Tributary A, and Whitford Brook (Town of Groton) (Reference 25). Since there are no gaging stations on these streams, these formulas were empirically derived from stream gaging stations and precipitation gaging stations in Connecticut with

10 to 45 years of record. The formulas utilized drainage basin characteristics and precipitation data, and yielded the 1-percent-annual-chance peak discharge.

Since no stream gage records were available for Blissville Brook, a regression analysis of stream gages in the region developed by L. Weiss and revised by P. Biscuti was used to determine discharges for this brook (References 25 and 33). The results of this analysis were extended using a log-Pearson Type III analysis (Reference 19).

For Bobbin Mill Brook, Ford Brook, Great Plain Brook, Goldmine Brook, Hunter Brook, Norwichtown Brook, Spaulding Pond Brook, Trading Cove Brook, Tributary A, Tributary B, Tributary C, Tributary D, Tributary E, Tributary F, and the Yantic River East Channel, regional frequency-discharge formulas for Connecticut were used and weighted with gaged data on streams with similar basin characteristics (Reference 22). No flooding is shown for Tributary A and E in the City of Norwich because the floodplains were less than 200 feet wide.

For Denison Brook, Great Meadow Brook and the Pachaug River (Town of Voluntown), the 1-percent-annual-chance flood discharge for the streams studied by detailed methods was based on equations developed from Connecticut Water Resource Bulletin No. 36 (Reference 23). This regional method relates drainage area, channel slope, and 24-hour rainfall intensity values to the peak discharge by regression equations.

Discharges for Eccleston Brook and Fishtown Brook were determined in the original FIS for the Town of Groton (Reference 25). The discharges were determined using the USDA NRSC TR-20 computer program based on procedures described in the USDA NRSC National Engineering Handbook (References 27 and 32). Twenty-four hour rainfall was determined from Weather Bureau Technical Paper 29 (Reference 29). Infiltration effects were accounted for through hydrologic soil grouping based on soil maps and land use.

USGS flood flow formulas for ungaged streams were used to define discharge-frequency data for the Fourmile River, Pattagansett River and Latimer Brook in East Lyme (Reference 22). These formulas were empirically derived from stream-gaging and precipitation-gaging stations in Connecticut with 10 to 45 years of record. The formulas used drainage basin characteristics and precipitations data and yielded the 1-percent-annual-chance peak discharge. Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were determined from a log-Pearson Type III distribution, which is obtained from the calculated 1-percent-annual-chance peak discharges and a standard deviation and skew coefficient or annual maximum flows. Flood flows for Latimer Brook in Montville were calculated in 1994 using revised USGS regional flood flow formulas (Reference 23). For the1995 restudied portion of Latimer Brook (approximately 2,800 feet upstream of Darrow Pond to the East Lyme-Montville corporate limits), these flood flows were verified using USGS regional flood flow formulas (Reference 23). The Town of East Lyme has one stream gaging station that has provided data since the early 1960s. Nevertheless, the data gives only the mean annual flood levels. No continuous recording data are available. The available information was used and calculations were made using the log-Pearson Type III distribution. The resulting discharge frequency data compared reasonably well with that obtained with the flood flow formulas for ungaged streams.

There are no discharge records for Gardner Brook; the peak discharge frequencies were determined by regional regression equations. Discharges were related to basin characteristics such as drainage area, stream length, streambed slope, and rainfall parameters as described in a statewide flood flow formula determination (Reference 18). The resulting flow values were also compared with statistically analyzed gaged stream records in the region and were found to be in general agreement.

Flood flow frequency analyses for the Jeremy River, Judd Brook, and Meadow Brook, followed the log-Pearson Type III method, as outlined in Water Resources Council Bulletin 17 (Reference 19). The 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were related to basin characteristics such as drainage area, stream length, streambed slope, and rainfall parameters, as described in a statewide flood flow formula determination (Reference 20).

The 1-percent-annual-chance flood discharges for Day Meadow Brook and the restudied portion of Meadow Brook (approximately 2,140 feet downstream of Levy Road to a point approximately 3,250 feet upstream of State Route 16) were based on equations developed from a report on flood magnitude and frequency of Connecticut streams (Reference 21). This regional method related drainage area, area of stratified drift, and 24-hour rainfall intensity values to the peak discharge through regression equations.

The USGS maintains a gaging station on the East Branch Eight Mile River near North Lyme, which is located about two miles below Salem. The period of record for this gage extends from September 1937 to the present. Based on records of this gage, peak discharge frequencies were developed using a log-Pearson Type III statistical distribution in accordance with procedures outlined by the Water Resources Council (Reference 19). The 1-percent-annual-chance discharge was obtained from a statewide flood flow formula determination (Reference 25). Discharges for the 10-, 2-, and 0.2-percent-annual-chance floods were obtained from the Hartford office of the USGS.

Since stream gage records were not available for Joe Clark Brook, Flat Brook, Pine Swamp Brook, and Williams Brook, multiple regression analysis of stream gages in the region developed by L. Weiss and revised by P. Biscuti was used to determine discharges for these brooks (Reference 33).

Flow frequencies for Jordan and Nevins Brooks were based on USGS flood flow formulas for ungaged streams (Reference 25). These formulas were empirically derived from stream-gaging and precipitation gaging stations in Connecticut with 10 to 45 years of record. The formulas utilize drainage basin characteristics and precipitation data to yield the 1-percent-annual-chance peak discharge. The values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were determined from a log-Pearson Type III distribution, which was obtained from the calculated

1-percent-annual-chance peak discharge, the standard deviation and skew coefficient of annual maximum flow.

There are no discharge records for Harris Brook. Peak discharge frequencies for Harris Brook were determined by regional regression equations. Discharges were related to basin characteristics such as drainage area, stream length, streambed slope, and rainfall parameters as described in the statewide flood flow formula determination (Reference 25). The resulting flow values were also compared with statistically analyzed gaged stream records in the region and were found to be in general agreement.

Discharges for the Little River were determined using a regional regression analysis recently developed by L. Weiss based on records at 96 gaging stations in Connecticut (Reference 40). Discharges computed with regression equations at the USGS gaging station on the Little River at Hanover (No. 01123000 with 31 years of record) were first compared to discharges determined by a log-Pearson Type III analysis of the gage data. The percent difference between the discharges computed by the two methods for each frequency was then applied to discharges determined by the regression equations at other sites along the Little River. Discharges for the 0.2-percent-annual-chance flood were determined by graphical extrapolation.

For Oxoboxo Brook, USGS flood flow formulas for ungaged streams from the Town of Montville January 1980 FIS, and the City of Norwich study, were used to establish the peak discharge-frequency relationships (References 22 and 37). These formulas were empirically derived from stream-gaging and precipitation-gaging stations in Connecticut with 10 to 45 years of record. There are several gaging stations on streams in Montville, however, only water quality data, daily flows and groundwater runoff data are recorded. No flood peak elevations are obtained, and monitoring is not continuous. Also, less than 10 years of records are available (References 38 and 39). The flood flow formulas used drainage basin characteristics and precipitation data to yield the 1-percent-annual-chance peak discharge. Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were determined from a log-Pearson Type III distribution, which was obtained from the calculated 1-percent-annual-chance peak discharge, the standard deviation of annual maximum flows, and a regional skew coefficient

The discharges for the Pachaug River in Griswold and Jewett City were determined using data from USGS gage No. 01126950 with 11 years of record (Reference 25). The statistical characteristics of these records were adjusted to conform to the regional patterns reflected by a log-Pearson Type III analysis of long-term gage records in the area (Reference 19).

USGS gaging stations on the Quinebaug River (No. 0112550 at Putnam with 33 years of record and No. 01127000 at Jewett City with 40 years of record) were used for defining the frequency/discharge relationships of this river in Griswold and Jewett City (Reference 30). The 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were obtained from log-Pearson Type III analyses of annual peak flow data performed by the USGS and the USDA NRSC (Reference 19).

Discharges were then adjusted for reductions due to the flood control reservoirs on the Quinebaug River by a factor obtained by the USACE (Reference 31).

USGS gaging stations on the Shetucket River near Willimantic, (No. 01122500 with 25 years of record) and on the Quinebaug River (No. 0 112550 at Putnam with 33 years of record and No. 01127000 at Jewett City with 40 years of record) were used for defining the frequency-discharge relationships of these streams (Reference 46). The 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were obtained from log-Pearson Type III analyses of annual peak flow data performed by the USGS and the USDA NRSC (Reference 19). In Libson, Preston, and Sprague, discharges were then adjusted for reductions due to the flood control reservoirs on the Shetucket and Quinebaug Rivers by a factor obtained by the USACE (Reference 35). In Norwich, these values were cross verified with results of evaluations performed on the Shetucket River by the USACE in 1957, prior to construction of flood control reservoirs.

In North Stonington, discharges for the Shunock River were determined using a regional regression analysis recently developed by L. Weiss based on records at 96 gaging stations in Connecticut (Reference 40). Discharges were then adjusted for storage using a storage correction multiplier determined from the Federal Highway Administration publication, Runoff Estimates for Small Rural Watersheds and Development of a Sound Design Method (Reference 47).

Peak discharges for the Green Fall River were also based on the L. Weiss regional regression analysis (Reference 40). An additional procedure was also used to account for the storage behind the Clarks Falls Pond Dam and the Spalding Pond Dam. The time of peak discharge is delayed when water is retained in the ponds and in Bell Cedar Swamp; therefore, it does not coincide with the peak discharge on the other fork of the Green Fall River. This causes discharges on the Green Fall River downstream of the confluence of the two forks of the river to be lower than they would be under coincident peak conditions. In the hydrologic analysis, discharges were first computed with regression equations at the USGS gaging station on the Pendleton Hill Brook tributary to the Green Fall River near Clarks Falls (No. 01118300 with 24 years of record). These discharges were compared with discharges determined by a log-Pearson Type III analysis of the gage data. The percent difference between the discharges computed by the two methods for each frequency was then applied to discharges determined by the regression equations at other sites along the Green Fall River. Discharges for the 0.2-percent-chance-annual flood were determined by graphical extrapolation. Next, an analysis of the discharges determined at the confluence of the two forks of the Green Fall River was performed using a dimensionless curvilinear unit hydrograph from the USDA NRSC, National Engineering Handbook combining the peak of the flow over the Clarks Falls Pond Dam with the flow of the other fork of the Green Fall River at the determined lag time (Reference 42). The percent reduction in discharge due to storage in the ponds and swampland was then calculated for each flood frequency being studied. These percentages of reduction were then applied to the discharges calculated at other locations downstream on the Green Fall River. The discharges used for the fork of the Green Fall River flowing over the Clark Falls Pond Dam to the fork in the river were determined using the procedures used to calculate the 1-percent-annual-chance discharge in a report on the Clarks Falls Pond Dam (Reference 43).

Peak discharges for the Pawcatuck River were obtained from the FISs for the Towns of Westerly, Rhode Island, and Ledyard, Connecticut, respectively (References 44 and 45). For the Pawcatuck River in Westerly, frequency discharges were determined at two gaging stations and then computed at other locations based on a transfer equation of the form:

$$Q1/Q2 = [A1/A2]^{n}$$

where Q1 is the frequency discharge and A1 is the drainage area at the Wood River Junction gage; and Q2 is the frequency discharge and A2 is the drainage area at the desired location. The exponent n is a value representing the slope of a straight line fitted between plotted points of drainage area and frequency discharge on log-log paper using data from the two gages. To obtain frequency discharges for the Pawcatuck River in North Stonington, this same transfer equation was applied using the drainage area upstream of the confluence of the Shunock River.

For Susquetonscut Brook (Town of Franklin), a discharge frequency analysis was performed using data from the USGS gaging station located 0.5 miles upstream of its confluence with the Yantic River in Franklin. Peak discharge frequencies were developed using a standard log-Pearson Type III statistical distribution in accordance with procedures outlined by the Water Resources Council (Reference 19). The 1-percent-annual-chance flood discharge for Susquetonscut Brook, in Franklin is published in a report entitled "Floodflow Formulas for Urbanized and Nonurbanized Areas of Connecticut" (Reference 25). Discharges for the 10-, 2-, and 0.2-percent-annual-chance floods were obtained from the Hartford office of the USGS.

For Susquetonscut Brook (Town of Lebanon), the 1-percent annual-chance flood discharge for the Susquetonscut Brook was based on the American Society of Civil Engineers journal article Flood Flows for Urbanized and Non-urbanized Areas of Connecticut (Reference 32). This regional method relates drainage area, channel slope, and 24-hour rainfall intensity values to the peak discharge by regression equations.

For the Tenmile River, the 1-percent annual-chance flood discharge was based on the American Society of Civil Engineers journal article Flood Flows for Urbanized and Non-urbanized Areas of Connecticut (Reference 32). This regional method relates drainage area, channel slope, and 24-hour rainfall intensity values to the peak discharge by regression equations.

Peak discharges for Whitford Brook in North Stonington were obtained from the FISs for the Towns of Westerly, Rhode Island, and Ledyard, Connecticut, respectively (References 44 and 45). In North Stonington, a regression analysis of stream gages in the region developed by L. Weiss and revised by P. Biscuti was used to determine discharges for this brook (References 25 and 33). For

Whitford Brook in Ledyard, multiple regression analyses of stream gages in the region were applied. The regression analysis developed by L. Weiss was used (Reference 33). The 1-percent-annual-chance discharge were computed directly. Values of the 10-, 2-, and 0.2-percent-annual-chance peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data (Reference 19).

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance recurrence intervals for the Yantic River in Bozrah and Norwich were obtained from the 1992 FIS for the City of Norwich (Reference 16). In Franklin, discharge frequencies for the Yantic River were taken from the June 15, 1978 FIS for the downstream community of the City of Norwich (Reference 24). In Lebanon, 1-percent annual-chance flood discharge for the Yantic River was based on the American Society of Civil Engineers journal article Flood Flows for Urbanized and Non-urbanized Areas of Connecticut (Reference 32). This regional method relates drainage area, channel slope, and 24-hour rainfall intensity values to the peak discharge by regression equations. In Bozrah and Franklin, the Norwich flows were adjusted by multiplying the adopted discharges in Norwich by a factor equal to the ratio of the drainage areas to the 0.7 exponential power. In 1992, the USGS office in Hartford, Connecticut, performed a peak flow frequency analysis on the Yantic River gage. The peak discharges shown in the previously printed City of Norwich FIS, dated April 15, 1992, fall within the 90 percent confidence interval of the revised City of Norwich 1994 FIS analysis; therefore, the established discharges in the City of Norwich 1992 FIS were used. In the 1995 FIS revision for the Town of Bozrah, the 1-percent-annual-chance peak discharge for the Yantic River at Gilman Dam, which was computed using the ratio of the drainage areas, is approximately 1.2 percent higher than the value shown in the Town of Lebanon FIS. To maintain consistency with the upstream community, the 1-percent-annual-chance peak discharge was taken from the FIS for the Town of Lebanon (Reference 17).

In Norwich, the method used for approximate study was based on a regression analysis of Connecticut streams. Stages were then determined from a stage-drainage area curve. Existing dams and reservoirs with moderate flood control storage, located on the upper portions of the Shetucket and Quinebaug River watersheds, reduce the peak flows in the vicinity of Norwich. Similar structures on Spaulding Pond Brook (Reservoir sites 1 and 2), Hunter Brook (Taftville Reservoir), and Norwichtown Brook (Bog Meadow Reservoir) also reduce the peak discharges on these streams. This reduction in discharge was taken into account in the hydrologic analyses.

Countywide Analysis

For this countywide FIS, no new hydrologic analyses were conducted.

Peak discharge-drainage area relationships for New London County are shown in Table 6, Summary of Discharges.

TABLE 6 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
BEAVER BROOK (TOWN OF SPRAGUE)					
At confluence with Shetucket River	11	697	1,064	1,254	1,763
BIRCH PLAIN CREEK					
At the Contrail tracks	3.12	410	670	800	1,200
At Thomas Road	1.73	230	370	450	670
At Poquonnock Road	0.98	160	250	300	450
At Clarence B. Sharp Highway	0.62	150	240	290	430
BLISSVILLE BROOK					
At confluence with Shetucket River	4.09	245	387	461	674
Upstream of Graham Pond	3.4	215	340	400	590
BOBBIN MILL BROOK					
Junction at Yantic River	0.98	240	430	560	670
Junction at Tributary B	0.46	130	230	300	360
DAY MEADOW BROOK					
At River Road	0.49	*	*	200	*
DENISON BROOK					
At its confluence with the Pachaug River	4.21	*	*	375	*
EAST BRANCH EIGHT MILE RIVER					
At the downstream Salem corporate limits	19.6	1,160	1,920	2,300	3,350
Below Harris Brook	14.3	930	1,540	1,860	2,700

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
ECCLESTON BROOK					
At State Route 215	2.70	510	840	1,000	1,550
At U.S. Route 1	0.80	185	305	365	550
EIGHT MILE RIVER	*	*	*	*	*
FISHTOWN BROOK					
At its confluence with Eccleston Brook	0.80	185	305	365	550
FLAT BROOK					
At mouth	1.45	195	315	380	575
FORD BROOK					
Junction at Trading Cove Brook	2.96	430	700	820	1,200
Junction at Gardner Brook	1.83	300	480	570	830
At New London Turnpike	0.34	85	140	160	240
FORT HILL BROOK					
At the Contrail Tracks	2.21	290	470	560	830
At U.S. Route 1	1.61	250	410	490	730
At Interstate 95	0.56	140	230	270	400
FOURMILE RIVER					
At Long Island Sound	6.57	450	740	910	1,400
At State Route 156	6.25	430	700	860	1,300
At Interstate Route 95	5.8	410	680	830	1,250
At State Route 51	5.26	400	660	800	1,200

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
GARDNER BROOK					
At the confluence with Yantic River	13.5	725	1,250	1,500	2,200
Below Parson Brook	10.4	600	1,040	1,250	1,830
GOLDMINE BROOK					
Junction at Trading Cove Brook	2.58	340	550	650	1,000
GREAT MEADOW BROOK					
At its confluence with the Pachaug River	6.33	*	*	860	*
GREAT PLAIN BROOK					
Junction at Trading Cove Brook	0.6	290	525	695	830
At New London Turnpike	0.4	215	390	510	610
At cross section F	0.2	130	230	300	360
GREEN FALL RIVER					
At downstream North Stonington corporate limits	26.3	944	1,670	2,134	3,905
Upstream of confluence of Parmenter Brook	23.1	869	1,543	1,973	3,625
Upstream of confluence of Glade Brook	17.7	700	1,244	1,589	2,923
Upstream of fork with Green Fall River	9.7	593	1,100	1,335	2,076

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
HARRIS BROOK					
At the confluence with East Branch Eight Mile River	7	500	800	1,000	1,400
Above Fraser Brook	3	275	440	550	770
HUNTER BROOK					
At cross section1	0.64	100	160	210	260
Junction at Shetucket River	1.13	150	250	320	390
JEREMY RIVER					
At confluence with Meadow Brook	23.9	1,450	2,450	3,000	4,150
JOE CLARK BROOK					
At confluence with Poquetanuck Cove	3.35	270	480	610	950
JORDAN BROOK					
At its confluence with Jordan Cove	6.39	760	1,200	1,500	2,200
Above its confluence with Nevins Brook	4.53	420	680	820	1,200
Approximately 900 feet downstream of Boston Post Road	3.85	370	600	730	1,100
At Interstate Route 95	2.66	300	500	600	900
Approximately 3,500 feet downstream of State Route 52	1.76	220	350	430	640
At State Route 52	0.72	160	270	330	480

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
JUDD BROOK					
At Hebron Avenue	3.93	300	500	600	900
Approximately 2,500 feet upstream of Hebron Avenue	2.6	200	350	400	600
Approximately 2,000 feet upstream of Sate Route 85	1.27	100	160	200	300
LATIMER BROOK					
At downstream Montville corporate limits	11.48	945	1,595	1,965	2,790
At State Route 85	6.8	735	1,295	1,600	2,350
At confluence with Niantic River	17.18	1,100	1,800	2,100	3,200
Above confluence with Cranberry Meadow Brook	11.74	945	1,595	1,965	2,780
At Grassy Hill Road	9.11	880	1,525	1,890	2,770
LITTLE RIVER					
Downstream of confluence of Negro Brook	43.2	2,390	3,920	4,770	6,990
MEADOW BROOK					
At Interchange 16 State Route 2	35.2	2,450	4,000	4,800	6,650
At confluence of Jeremy River	11.3	1,000	1,550	1,800	2,500
Upstream of Mill Hill Road	7.58	700	1,150	1,400	1,950

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
MEADOW BROOK – cont'd					
At Levy Road	6.39	*	*	750	*
NEVINS BROOK					
Above its confluence with Jordan Brook	1.86	220	360	440	660
At Fog Plain Road	1.23	180	280	350	510
At Interstate Route 95	0.29	90	150	180	270
NORWICHTOWN BROOK					
Junction at Yantic River	2.51	290	530	650	820
Junction at Tributary A	1.59	130	250	300	400
OXOBOXO BROOK					
At confluence with Horton Cove	11.92	860	1,400	1,700	2,600
At Connecticut Turnpike (State Route 52)	10.86	840	1,400	1,700	2,500
At outlet of Rockland Pond	9.33	780	1,300	1,600	2,300
PACHUAG RIVER					
At confluence of Quinebaug River	63.1	1,150	1,825	2,150	3,050
At Gage1269.5 (Griswold)	53	1,000	1,575	1,875	2,650
At Glasgo Dam between Pachaug and Glasgo Ponds	37.8	763	1,206	1,435	2,022

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
PACHUAG RIVER (TOWN OF VOLUNTOWN)					
At downstream Griswold-Voluntown corporate limits	29.6	*	*	2,100	*
Upstream of confluence of Mount Misery Brook	15.2	*	*	1,300	*
Upstream of confluence of Great Meadow brook	7.11	*	*	400	*
PATTAGANSETT RIVER					
At Long Island Sound	8.91	610	1,000	1,200	1,800
At State Route 156	7.53	560	930	1,100	1,700
At confluence with Dodge Pond Branch	6.7	500	840	1,000	1,500
At Interstate Route 95	4.98	450	740	900	1,400
At Pattagansett Lake outfall	3.83	390	640	780	1,200
PAWCATUCK RIVER					
Upstream of confluence of Shunock	279.2	3,300	4,600	5,200	6,850
PINE SWAMP BROOK					
Above Mill Cove	2.13	210	375	475	790
QUINEBAUG RIVER					
Upstream of confluence of Broad Brook	717	9,514	17,125	21,565	38,055
Upstream of confluence of Pachaug River	651	8,500	15,500	18,038	36,077

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
QUINEBAUG RIVER – cont'd					
At confluence with Shetucket River	744	9,799	17,639	22,212	39,197
SHETUCKET RIVER					
Upstream of confluence of Qunebaug River	516	13,200	25,200	32,400	57,600
Junction at Quinebaug River(Norwich)	516	13,200	25,200	32,400	57,600
Junction at Tributary D (Norwich, Preston	1269	22,100	36,300	45,100	76,600
Junction at Little River (Norwich, Sprague	465	12,100	23,100	29,700	52,800
SHEWVILLE BROOK					
At Shewville Road	11.8	550	1,010	1,290	2,150
SHUNOCK RIVER					
At confluence with Pawtucket River	16	1,036	1,586	2,016	3,058
At State Route 184	13.8	944	1,456	1,853	2,819
At Rocky Hollow Road (North Stonington)	8	596	917	1,165	1,775
SPAULDING POND BROOK					
At Chestnut Avenue (Norwich)	0.98	140	230	300	370
At Mohegan Park Road No. 2 (Norwich)	0.5	85	140	180	220

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
SUSQUETONSCUT BROOK (TOWN OF FRANKLIN)					
At Franklin corporate limits	15.8	1,080	1,790	2,180	3,200
At Meeting House Hill Road (Franklin)	12.7	930	1,540	1,870	2,750
SUSQUETONSCUT BROOK (TOWN OF LEBANON)					
At Franklin-Lebanon corporate limits	10.9	*	*	2,470	*
Upstream from Route 207	5.65	*	*	1,900	*
Upstream from Chappel Road (Lebanon)	4.41	*	*	1,500	*
Upstream from confluence of Burgess Brook	2.53	*	*	822	*
TENMILE RIVER					
At its confluence with the Williamantic River	17	*	*	3,000	*
Upstream of confluence of Giffords Brook	6.09	*	*	1,500	*
THAMES RIVER	*	*	*	*	*
TRADING COVE BROOK					
At confluence with Trading Cove	13.4	1,240	2,100	2,380	400
At Connecticut Turnpike (State Route 52)	8.57	900	1,540	1,740	2,980

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
TRIBUTARY A					
At its confluence with Birch Plain Creek	1.39	170	270	330	500
At. U.S. Route 1	0.90	150	250	300	440
Junction at Norwichtown Brook	0.72	160	270	350	420
TRIBUTARY B (Norwich)					
Junction at Yantic River	0.98	240	430	560	670
Junction at Bobbin Mill Brook	0.52	110	200	260	310
TRIBUTARY C (Norwich)					
Junction at Shetucket River	0.09	30	60	80	90
TRIBUTARY D					
At Saint Regis Avenue (Norwich)	0.22	70	130	175	200
Junction at Shetucket River	0.47	130	240	315	375
TRIBUTARY E					
Junction at Tributary D (Norwich)	0.09	35	60	80	90
TRIBUTARY F					
At Dunham Street (Norwich)	0.13	50	98	130	153
At Woodside Street (Norwich)	0.05	24	48	65	75

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
WHITFORD BROOK					
At its confluence with Mystic River	15.03	1,400	2,200	2,700	4,000
At the inlet to Hyde Pond	13.79	1,250	1,950	2,400	3,550
Downstream of Long Pond	4.6	620	800	900	1,110
Below Long Pond	4.56	620	800	884	1,100
Below Lee Brook	4.31	620	800	900	1,110
WILLIAMS BROOK	*	*	*	*	*
YANTIC RIVER					
Junction at Bobbin Mill Brook	95.65	5,650	10,360	11,530	23,655
At USGS gaging station (Norwich)	90	5,400	9,900	11,015	22,600
At Franklin-Norwich town line	89.3	5,400	9,900	11,015	22,600
At the Bozrah-Norwich corporate limits	88.3	5,400	9,900	11,015	22,600
Below Susquetonscut Brook	86.5	5,300	9,700	10,800	22,100
Above Susquetonscut Brook	70.7	4,560	8,360	9,300	19,000
At Fitchville Road	52.7	3,700	6,800	7,600	15,500
Upstream of confluence with Pease Brook	39.4	3,030	5,550	6,180	12,680
At Gilman Dam	38.6	2,990	5,470	6,020	12,500

*No Data Available

TABLE 6 – SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
YANTIC RIVER – cont’					
Upstream of confluence of Polly Brook	37	*	*	5,690	*
Upstream of confluence of Waterman Brook	36.4	*	*	5,460	*
Upstream of confluence of Gillette Brook	34.7	*	*	4,580	*
Upstream of confluence of Goshen Brook	33	*	*	4,100	*

*No Data Available

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for the flooding sources studied by detailed methods and are summarized in Table 7, “Summary of Pond Stillwater Elevations.”

TABLE 7 – SUMMARY OF POND STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT[2] ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
AMSTON LAKE				
Entire shoreline within the community of Lebanon	*	*	526.1	*
GLASCO POND				
Entire shoreline within the community of Griswold	184.7	185.3	185.6	186.3
PACHAUG POND				
Entire shoreline within community of Griswold	158.1	158.6	158.8	159.3
RED CEDAR LAKE				
Entire shoreline within community of Lebanon	*	*	440.1	*

TABLE 7 – SUMMARY OF POND STILLWATER ELEVATIONS (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT[2] ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
WILLIAMS POND				
Entire shoreline within the community of Lebanon	*	*	446.1	*

[1] North American Vertical Datum of 1988
*Data Not Available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

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Cross section data for the below-water sections were obtained from field surveys and/or topographic maps compiled from aerial photographs. Cross sections were located at close intervals above and below bridges, culverts, and dams in order to compute the significant backwater effects of these structures. In addition, cross sections were taken between hydraulic controls whenever warranted by topographic changes.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For flooding sources studied by approximate methods, only 1-percent-annual-chance flood elevations were computed.

For the communities of Stonington and Noank Fire District, no flood profiles existed in their precountywide FISs, thus no flood profiles exist for those reaches of streams in this countywide FIS. For the Pawcatuck River in the Town of Stonington, the Washington County, Rhode Island FIS was used to create Flood Profiles. For the Town of Groton, the Flood Hazard Boundary Map (FHBM) did not cover the entire town, thus some cross-sections and floodways that appear on the profiles do not appear on the countywide FIRM. Where available, cross-sections for these communities were taken off of their respective FHBMs and are shown on this countywide FIRM (Exhibit 2). In some cases cross-section data was missing from the precountywide FHBMs, and thus could not be reproduced for this countywide FIS.

For the Fourmile River in Old Lyme, cross-sections and Flood Profiles were created using data from the precountywide East Lyme FIS.

For each community within New London County that has a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below.

<u>Precountywide Analyses</u>

Water-surface elevations for Birch Plain Creek, Bobbin Mill Brook, Eccleston Brook, Fishtown Brook, Ford Brook, Fort Hill Brook, Great Plain Brook, Goldmine Brook, Hunter Brook, Norwichtown Brook, Oxoboxo Brook, Spaulding Pond Brook, Shetucket River, Thames River, Trading Cove Brook, Tributary A, Tributary B, Tributary C, Tributary D, Tributary E, Tributary F, Yantic River, and Yantic River East Channel, were computed using the USACE HEC-2 step-backwater computer program (Reference 50). Water-surface elevations for the revised portions of Norwichtown Brook were computed using the USDA NRSC WSP-2 computer program (Reference 58).

At various locations along the streams in Norwich, the analysis indicates that flow would be supercritical. Because of the inherent instability of supercritical flow, critical depth was assumed at those locations when establishing the profile elevations for this study. Water-surface elevations on the Thames River were started at a cross section located 0.68 river miles downstream of the corporate limits. Two backwater evaluations were performed and the elevations obtained from the higher of the two evaluations were used in the profiles. The first evaluation utilized the 10-, 2-, 1-, and 0.2-percent-annual-chance tidal elevations with smaller riverine flows used in the backwater. The riverine flows used were 10-, 2-, l-, and 0.2-percent-annual-chance flows, respectively. The second evaluation utilized the 10-, 2-, 1-, and 0.2-percent-annual-chance flows backwatered from a normal tidal elevation, specifically meaning the spring high tide. The tidal flow dominated throughout the studied reach of Thames. At approximate River Mile 1.06 on the Shetucket River, the riverine flow dominated and was used from this point on upstream. The starting water-surface elevations for all upstream tributaries were taken directly from the profiles of the downstream river at their confluence.

In the Norwich, March 15, 1994 revision, starting water-surface elevations for the Yantic River were computed using the discharge capacity rating curve for Mill Dam No. 2. Starting water-surface elevations for Trading Cove Brook were obtained from the HEC-2 data file prepared by Anderson-Nichols and Company, Inc. Starting water-surface elevations for the revised portion of Norwichtown Brook were computed based on historical flooding where the starting water-surface elevations for the 1-, and 0.2-percent-annual-chance floods were based on the 5-year discharge for the Yantic River. Starting water-surface elevations for Hunter Brook were computed assuming critical depth at the downstream end of the railroad culvert, located at the confluence with the Shetucket River. The HEC-2 Graphical Method for Solving Island Divided Flows was used to determine the peak discharge and natural flood elevations (without tidal effects) for the east and west channels of the Yantic River where it is separated by Holly Lock Island (Reference 50). Since the majority of the flow is carried in the west channel, it will be referred to as the Yantic River. The east channel will be referred to as the Yantic River East Channel.

Starting water-surface elevations for the Shetucket River outside of Norwich were taken from the FIS for the City of Norwich (References 16).

Starting water-surface elevations for Birch Plain Creek, Tributary A, Fort Hill Brook, Eccleston Brook, Fishtown Brook, and Whitford Brook (Town of Groton) were determined by combining the mean spring tide levels and the coastal storm surge levels for the various recurrence intervals. Approximate flood elevations for the upper portion of Tributary A were determined from normal depth calculations.

Because tidal influence predominates throughout the reaches of the Thames River, the starting water-surface levels for Oxoboxo Brook were estimated between the mean spring tide levels and the storm surge levels of the Thames River for the various return frequency floods. Starting water-surface elevations for Trading Cove Brook were obtained from the HEC-2 data file prepared by Anderson-Nichols and Company, Inc., prepared for the FIS for the City of Norwich (Reference 37).

Water-surface elevations for Beaver Brook (Town of Sprague), Blissville Brook, Green Fall River, Joe Clark Brook (Town of Preston), Little River, Pawcatuck River, Shunock River, and Whitford Brook (North Stonington) were computed using the USACE HEC-2 step-backwater computer program (Reference 50). Starting water-surface elevations for Beaver Brook (Town of Sprague), Blissville Brook, and the Little River were determined using the slope/area method. Starting water-surface elevations for Joe Clark Brook in Preston were taken from the FIS for the City of Norwich and the Town of Ledyard (References 16 and 45). Starting water-surface elevations for the Shunock and Green Fall Rivers were calculated using critical depth. For the Pawcatuck River and Whitford Brook, starting water-surface elevations were obtained by normal depth calculations

Starting water-surface elevations for Flat Brook, Pine Swamp Brook, Joe Clark Brook, Shewville Brook, Williams Brook, and Whitford Brook in Ledyard were obtained by normal depth calculations, critical depth was used on streams where structures were at the beginning of the run. Water-surface elevations for the streams studied in detail were computed using the USACE HEC-2 step-backwater computer model (Reference 50). This was supplemented by analysis using the SCS WSP-2 computer step-backwater model (Reference 57), for a complex condition on Pine Swamp Brook at Harvard Terrace. Profiles of tributaries were based on normal depth conditions at the downstream ends. Cross section data for these flood sources were obtained from field surveys. All bridges and culverts within detailed study areas were field surveyed to obtain elevation data and structural geometry.

For Denison Brook, Great Meadow Brook, Pachaug River (Town of Voluntown), the 1-percent-chance-annual flood elevations were determined using a USGS regional analysis that relates depth of flooding to basin drainage area. Approximately 100 gaging station records were used to develop a relationship between depth in the channel at each USGS gaging station versus the drainage area of each station (Reference 59). Changes in flood elevations caused by hydraulic structures such as dams, culverts, or bridges were computed using the appropriate survey technique (References 55, 56, and 60). For the Pachaug River (Town of Voluntown), the discharge at the downstream corporate limits was used to check the corresponding flood elevation at Pachaug Pond Dam downstream of Voluntown in the Town of Griswold using USGS techniques for dam computations (Reference 55). Water-surface elevations of floods of the selected recurrence intervals were then used along with topographic maps at a scale of 1:24,000 with a contour interval of 10 feet to determine the extent of flooding (Reference 52). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Water-surface elevations for the East Branch Eight Mile River and Harris Brook in Salem were computed through the use of the USACE HEC-2 computer program (Reference 51). Starting water-surface elevations for the East Branch Eight Mile River were calculated using the slope/area method. Starting water-surface elevations for Harris Brook were taken from the last cross section on the East Branch Eight Mile River. Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected intervals.

Water-surface profiles for the Eight Mile River and Beaver Brook (Town of Lyme) were developed using the SCS WSP2 computer step-backwater model (Reference 58). Profiles were determined for the 10-, 2-, 1-, and 0.2-percent-chance-annual floods using a starting elevation at the l0- percent-chance-annual floodtide. Analyses of levels of the Connecticut River and Long Island Sound were conducted by the USACE, New England Division. The elevations used for 10-, 2-, 1-, and 0.2-percent-chance-annual flood levels were obtained from the USACE publication, "Tidal Hydrology" (Reference 6). These elevations were extended into the Eight Mile River until they intersected the riverine stage for the appropriate frequency event. Flooding limits on stream studied by approximate methods were based on hydrologic considerations and visual inspection.

Water-surface elevations for Gardner Brook, Jordan Brook, and Nevins Brook, were computed using the USACE HEC-2 step-backwater computer program (Reference 50). Starting water-surface elevations for Gardner Brook were developed using normal depth calculations at the confluence with the Yantic River. Starting water surface elevations for Jordan Brook, and Nevins Brook were estimated between the mean spring tide and the coastal storm surge levels for the various return frequency floods.

Flood elevations for the Susquetonscut Brook in Franklin were determined using the HEC-2 step-backwater computer program (Reference 51). Starting water-surface elevations on Susquetonscut Brook were calculated using the slope/area method at the mouth (approximately 2,000 feet downstream from the corporate limits).

Water-surface elevations for the Fourmile River, Pattagansett River and Latimer Brook were computed using the USACE HEC-2 step-backwater computer program (Reference 50). Starting water-surface elevations were calculated between the mean spring tide levels and the coastal storm surge levels for the various return frequency floods. Comparisons of the profiles of the floods of the selected recurrence intervals were made with the estimated profiles and elevations of historic floods reasonable correlation was evident. The estimated profiles and elevations were obtained by field observations and interviews with town officials and local citizens. Starting water-surface elevations for Latimer Brook in Montville were obtained from the water-surface elevation at the downstream contiguous community of East Lyme.

In the December 15, 1981 FIS for Colchester, starting water-surface elevations for Meadow Brook were obtained from normal depth calculations, while the starting water-surface elevation for the Jeremy River was taken from the initially determined Meadow Brook profile at the point of confluence. In the July 15, 1992, FIS, starting water-surface elevations for the restudied portion of Meadow Brook (approximately 2,140 feet downstream of Levy Road to a point approximately 3,250 feet upstream of State Route 16) and for Day Meadow Brook were obtained by computing the critical depth at their downstream limits. Starting water-surface elevations for Judd Brook were obtained from normal depth calculations. Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Except for in Griswold, water-surface elevations for the Quinebaug and Pachaug Rivers were computed through the use of the USACE HEC-2 step-backwater computer model (Reference 50). Starting water-surface elevations for the Quinebaug and Pachaug Rivers were determined using the slope/area method.

Water-surface elevations for the Quinebaug River and the Pachaug River in Griswold were computed using the USACE HEC-2 step-backwater computer model (Reference 112). Starting water-surface elevations for the Quinebaug River and the Pachaug River were determined using the slope/area method.

Water-surface elevations for the Yantic River in Bozrah and Norwich were computed using the USACE HEC-2 step-backwater computer program (Reference 50). In the Bozrah, March 30, 1981 study and in the November 2, 1995 revision, starting water-surface elevations for the Yantic River were obtained from the FIS for the City of Norwich (Reference 16).

Flood elevations for the Yantic River in Franklin were determined using the HEC-2 step-backwater computer program (Reference 51). Starting water-surface elevations for the Yantic River were taken from the FIS for the City of Norwich, Connecticut (Reference 24).

Streambed elevations for Susquetonscut Brook, Tenmile River, and Yantic River in Lebanon were plotted on the flood profiles and were determined both by field surveys at structures such as dams, culverts, and bridges, and from contours crossing the stream channel on the topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (Reference 52). Streambed elevations for the Yantic River were taken directly from the channel encroachment line report (Reference 53). For Susquetonscut Brook and the Tenmile River, the 1-percent-chance-annual flood elevations were determined using a USGS regional analysis that relates depth of flooding to basin drainage area. Approximately 100 gaging station records were used to develop a relationship between depth in the channel at each USGS gaging station versus the drainage area of each station (Reference 54). Changes in flood elevations caused by hydraulic structures such as dams, culverts, or bridges were computed using the appropriate survey technique (References 52, 58, 59). The 1-percent-annual-chance flood elevations for the Yantic River were determined as part of a recent report on the establishment of channel encroachment lines and floodplain delineation (Reference 53). Results from the Yantic River were reviewed and the published 1-percent-annual-chance flood elevations were incorporated directly in this report. Water-surface elevations of floods of the selected recurrence intervals were then used along with topographic maps at a scale of 1:24,000 with a contour interval of 10 feet and the channel encroachment line report to determine the extent of flooding (References 33 and 34).

Countywide Analyses

For this countywide revision, no new Hydraulic Analyses were conducted.

Roughness factors (Manning's "n" values) used in the hydraulic computations were determined from field observations, guided by U.S. Geological Water Supply Publications. Table 8, "Mannning's "n" values" shows the channel and overbank "n" values for the streams studied by detailed methods:

TABLE 8 – MANNING'S "n" VALUES

Flooding Source	Channel "n"	Overbanks "n"
Beaver Brook (Town of Lyme)	0.025-0.075	0.025-0.075
Beaver Brook (Town of Sprague)	0.035 - 0.045	0.040 - 0.090
Birch Plain Creek	0.018-0.030	0.020-0.070
Blissville Brook	0.025 - 0.055	0.050 - 0.070
Bobbin Mill Brook	0.040 - 0.060	0.060 - 0.120
Day Meadow Brook	0.04	0.070 - 0.080
Denison Brook	*	*
East Branch Eight Mile River	0.035	0.07
Eccleston Brook	0.015-0.070	0.020-0.100
Eight Mile River	0.025-0.075	0.025-0.075
Fishtown Brook	0.015-0.070	0.020-0.100
Flat Brook	0.015 - 0.050	0.050 - 0.080
Ford Brook	0.040 - 0.060	0.060 - 0.120
Fort Hill Brook	0.030-0.080	0.015-0.080
Fourmile River	0.020 - 0.080	0.030 - 0.070
Gardner Brook	0.030 - 0.040	0.070 - 0.085
Goldmine Brook	0.040 - 0.060	0.060 - 0.120
Great Meadow Brook	*	*
Great Plain Brook	0.040 - 0.060	0.060 - 0.120
Green Fall River	0.035 -0.070	0.030 - 0.050
Harris Brook	0.035	0.07
Hunter Brook	0.040 - 0.060	0.030 - 0.200
Jeremy River	0.030 - 0.040	0.045 - 0.080
Joe Clark Brook	0.030 - 0.035	0.050 - 0.060
Jordan Brook	0.015 - 0.080	0.030 - 0.080
Judd Brook	0.025 - 0.050	0.060 - 0.080
Latimer Brook (East Lyme)	0.030 - 0.100	0.010 - 0.100
Latimer Brook (Montville)	0.030 - 0.045	0.040 - 0.120
Little River	0.040 - 0.050	0.050 - 0.060
Meadow Brook	0.035 - 0.040	0.060 - 0.070
Nevins Brook	0.015 - 0.060	0.030 - 0.080
Norwichtown Brook	0.035 - 0.045	0.050 - 0.085
Oxoboxo Brook	0.009 - 0.060	0.030 - 0.080
Pachaug River	0.020 - 0.050	0.025 - 0.060
Pachaug River (Town of Voluntown	*	*
Pattagansett River	0.01	0.010 - 0.020
Pawcatuck River	0.025 - 0.050	0.035 - 0.150
Pine Swamp Brook	0.030 - 0.055	0.050 - 0.075
Quinebaug River (Jewett City, Griswold)	0.020 - 0.050	0.035 - 0.085
Quinebaug River (Lisbon)	0.030 - 0.050	0.040 - 0.080
Quinebaug River (Preston)	0.030 - 0.045	0.040 - 0.060
Shetucket River (Lisbon, Preston)	0.050 - 0.080	0.08

*Data Not Available

TABLE 8 – MANNING'S "n" VALUES (continued)

Flooding Source	Channel "n"	Overbanks "n"
Shetucket River (Norwich)	0.040 - 0.060	0.060 - 0.120
Shetucket River (Sprague)	0.030 - 0.080	0.040 - 0.090
Shewville Brook	0.035 - 0.050	0.035 - 0.080
Shunock River (N. Stonington)	0.030 - 0.055	0.030 - 0.100
Spaulding Pond Brook	0.040 - 0.060	0.060 - 0.120
Susquetonscut Brook (Town of Franklin)	0.035 - 0.060	0.06 - 0.12
Susquetonscut Brook (Town of Lebanon)	*	*
Ten Mile River	*	*
Thames River	*	*
Trading Cove Brook	0.060 - 0.100	0.080 - 0.120
Tributary A	0.016-0.080	0.030-0.080
Tributary B	0.040 - 0.060	0.060 - 0.120
Tributary C	0.040 - 0.060	0.060 - 0.120
Tributary D	0.040 - 0.060	0.060 - 0.120
Tributary E	0.040 - 0.060	0.060 - 0.120
Tributary F	0.040 - 0.060	0.060 - 0.120
Whitford Brook (Groton)	0.015-0.050	0.030-0.090
Whitford Brook (N. Stonington)	0.020 - 0.050	0.040 - 0.065
Williams Brook	0.024 - 0.060	0.035 - 0.080
Yantic River (Bozrah)	0.025 - 0.070	0.050 - 0.100
Yantic River (Franklin)	0.035 - 0.060	0.06 - 0.12
Yantic River (Norwich)	0.040 - 0.050	0.025 - 0.100
Yantic River East Channel	0.040 - 0.060	0.060 - 0.120

*Data Not Available

3.3 Coastal Analysis

In New England, the flooding of low-lying areas is caused primarily by storm surges generated by extratropical coastal storms called northeasters. Hurricanes also occasionally produce significant storm surges in New England, but they do not occur nearly as frequently as northeasters. Hurricanes in New England typically have a more severe impact on the south facing coastlines. Due to its geographic location, New London County is susceptible to flooding from both hurricanes and northeasters.

A northeaster is typically a large counterclockwise wind circulation around a low pressure. The storm is often as much as 1,000 miles wide, and the storm speed is approximately 25 mph as it travels up the eastern coast of the United States. Sustained wind speeds of 10-40 mph are common, with short-term wind speeds of up to 70 mph. Such information is available on synoptic weather charts published by the National Weather Service (Reference 61).

As part of this countywide update, no new coastal analysis was performed. Redelineation of coastal flood hazard data was performed for open water flooding sources in the communities of Town of East Lyme, City of Groton, Groton Long Point Association, Town of Groton, Noank Fire District, Town of Old Lyme, City of New London, Borough of Stonington, Town of Stonington and Town of Waterford.

A description of this redelineation is presented in the Countywide Analysis later in this section.

Tidal flooding for the Thames River, Poquetanuck Cove, Niantic River, Long Island Sound, and Fishers Island Sound, which affects the Mystic River, for the inland communities of Montville, Ledyard, Norwich, Preston, Waterford and Groton were also studied in the precountywide analysis, but were not redelineated as part of the Countywide Analysis. For these communities, no precountywide Supplement – Wave Height Analysis FIS was completed.

In the Precountywide Analyses, a description of the methods used for all tidally affected communities is described below.

Precountywide Analyses

Coastal flooding including its wave action from the Thames River and Fishers Island Sound, which affects the Mystic River, was also studied by detailed methods in Groton. Stillwater elevations for the Thames River and Fishers Island Sound were developed by Dewberry & Davis (References 114 and 47). These elevations were developed by adjusting the elevations contained in Tidal Flood Profiles for the New England Coastline, prepared by the USACE (Reference 48). The adjustment was made using the New London, Connecticut, tidal gage analysis and the profiles for the 1938 and 1954 storm events (Reference 49). The inclusion of wave heights, which is the distance from the trough to the crest of the wave, increases the water-surface elevations. The height of a wave is dependent upon wind speed and its duration, depth of water, and length of fetch. The wave crest elevation is the sum of the stillwater elevation and the portion of the wave height above the stillwater elevation. Wave heights and corresponding wave crest elevations were determined using the National Academy of Sciences (NAS) methodology and the Users Manual for Wave Height Analysis (References 63 and 78).

In Ledyard, the Thames River and Poquetanuck Cove are both affected by tidal flooding from Long Island Sound. Tidal elevation frequency relationships were determined using analyses developed from previous hurricane and storm flood elevation records by the USACE in 1962 for Montville and Norwich, Connecticut (Reference 113). The storm surge elevations for the 10-, 2-, 1-, or 0.2-percent-annual-chance floods have been determined for the Thames River. The analyses reported herein reflect the still water elevations due to tidal and wind setup effects, but do not include contributions from wave action effect such as the wave crest height and wave run-up. Nonetheless, any additional hazard due to wave action effect should be considered in the planning of future development.

Water-surface profiles for the Thames River in Montville were determined from a storm surge-frequency curve published in the USACE report entitled Hurricane Survey, Eastern Connecticut (Reference 113). Additional frequency tidal data, compiled by the USACE at Thamesville (Norwich) and Uncasville (Montville), substantiate the water surface profiles published in the hurricane survey report.

Tidal influence on the Thames River in Norwich & Preston was evaluated using frequency-tide elevation relationships. Tidal and riverine flood frequencies are completely independent of each other. The combined frequency depends on the type of storm, rainfall intensity and distribution, wind velocities and resultant tidal surge, and the predicted tide stage coincident with the storm. Stillwater elevations for the Thames River were developed by Dewberry & Davis (Reference 47). These elevations were developed by adjusting the elevations contained in Tidal Flood Profiles for the New England Coastline, prepared by the USACE (Reference 48). The adjustment was made using the New London, Connecticut, tidal gage analysis and the profiles for the 1938 and 1954 storm events (Reference 49). In Preston, Poquetanuck Cove was found to be completely controlled by flooding on the Thames River

Tidal flooding in Waterford, including its wave action, from the Thames River, Niantic River and Long Island Sound was studied in detail with priority given for all known flood hazard areas and areas of projected development and proposed construction through August 1992. Tidal flood elevations for Long Island Sound, the Niantic River, and other tidally-affected streams (except the Thames River) were developed from information contained in the report entitled, Tidal Flood Profiles for the Connecticut Shoreline of Long Island Sound (Reference 114). Flood elevations along the Thames River are based on information contained in the report entitled, Thames River Profiles (Reference 115).

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 62). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures.

Wave height analyses were performed in the coastal communities of New London County to determine wave heights and corresponding wave crest elevations for the areas inundated by the tidal flooding. A wave runup analysis was performed to determine the height and extent of runup beyond the limit of tidal inundation. The results of these analyses were combined into a wave envelope, which was constructed by extending the maximum wave runup elevation seaward to its intersection with the wave crest profile.

The methodology for analyzing wave heights and corresponding wave crest elevations was developed by the NAS (Reference 63). The NAS methodology is based on three major concepts.

First, a storm surge on the open coast is accompanied by waves. The maximum height of these waves is related to the depth of water by the following equation:

$$Hb = 0.78d$$

Where Hb is the crest to trough height of the maximum or breaking wave and d is the stillwater depth. The elevation of the crest of an unimpeded wave is determined using the equation:

$$Zw = S^* + 0.7H^* = S^* + 0.55d$$

Where Zw, is the wave crest elevation, S* is the stillwater elevation at the site, and H* is the wave height at the site. The 0.7 coefficient is the portion of the wave height which reaches above the Stillwater elevation. Hb is the upper limit for H*.

The second major concept is that the breaking wave height may be diminished by dissipation of energy by natural or man-made obstructions. The wave height transmitted past a given obstruction is determined by the following equation:

$$Ht = BHi$$

Where Ht is the transmitted wave height, Hi is the incident wave height, and B is a transmission coefficient ranging from 0.0 t o 1.0. The coefficient is a function of the physical characteristics of the obstruction. Equations have been developed by the NAS to determine B for vegetation, buildings, natural barriers such as dunes, and man-made barriers such as breakwaters and seawalls (Reference 63).

The third concept deals with unimpeded reaches between obstructions. New wave generation can result from wind action. This added energy is related to distance and mean depth over the unimpeded reach.

These concepts and equations were used to compute wave heights and wave crest elevations associated with the 100-year storm surge. Accurate topographic, land-use, and land cover data are required for the wave height analysis. Topographic maps of the shoreline areas were obtained for the following: For the City of New London at a scale of 1:4,800 and a contour interval of 1 foot and from the New England Division of the USACE at a scale of 1:1,200 and a contour interval of 1 foot (References 72 and 73); for Noank Fire District and Town of Old Lyme, at a scale of 1:2,400 and a contour interval of 4 feet were developed by Dewbery & Davis (Reference 74); for City of Groton, Groton Long Point Association, at a scale of 1:1,200 and a contour interval of 2 feet (Reference 75); and for the Town and Borough of Stonington, at a scale of 1:2,400 and a contour interval of 5 feet (Reference 76). The land-use and land cover data were obtained from aerial photographs (Reference 65).

Wave heights were computed along transects which were located perpendicular to the average mean shoreline. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, the transects were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Along each transect, wave heights and wave crest elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. Wave heights were calculated to the nearest 0.1 foot, and wave crest elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V Zone (area with velocity wave action) was also computed at each transect.

For the City of Groton, Groton Long Point Association, City of New London, Noank Fire District, Town of Old Lyme, Town of East Lyme, Borough of Stonington, and Town of Stonington, Wave Height Analysis FIS supplements were completed based on the methods compiled below. The supplemental analysis were completed in those coastal communities where a coastal FIS had been published previous to the NAS recommendations adopted by FEMA that would predict wave heights in FISs for coastal communities subject to strom surge flooding and report the estimated wave crest elevations as BFEs on the FIRMs.

The information in those reports is compiled below:

Storm stillwater elevations used in the analysis were developed by Dewberry & Davis by adjusting the elevations contained in the USACE publication, Tidal Flood Profiles for the New England Coastline (References 68, 69, and 70). The adjustment was made using a New London, Connecticut, tidal gage analysis and the profiles for the 1938 and 1954 storm events (Reference 71). The elevations determined for this study supersede the elevations used in the previous FIS for the City of New London (Reference 67), City of Groton (Reference 68), Borough of Stonington (Reference 69), Groton Long Point Association Reference 70), and Town of Old Lyme (Reference 71).

All available source data applicable for the wave height analysis were collected and reviewed. Because wave height calculations are based on such parameters as the size and density of vegetation, natural barriers (sand dunes), buildings, and other manmade structures, it was necessary to obtain detailed information on the physical and cultural features of the study area.

During the course of this analysis, Aero Graphics Corporation of Bohemia, New York, the Connecticut Departments of Transportation and Public Works, the USACE, and the City of New London, City of Groton, Groton Long Point Association, the Town of Stonington, the Borough of Stonington, Noank Fire District, and the Town of Old Lyme were contacted for data. The principal source materials for the wave height analysis are described below.

1. Aerial photographs and glass aerial plotting plates (stereoscopic coverage) were obtained from Aero Graphics Corporation of Bohemia, New York (Reference 65). The photographs were used to determine the type, size, and density of vegetation and physical features. The topographic maps used in the analysis were developed from these aerial plotting plates.

2. Topographic maps of the shoreline areas were obtained for the following: For the City of New London at a scale of 1:4,800 and a contour interval of 1 foot and from the New England Division of the USACE at a scale of 1:1,200 and a contour interval of 1 foot (References 72 and 73); for Noank Fire District and Town of Old Lyme, at a scale of 1:2,400 and a contour interval of 4 feet were developed by Dewbery & Davis (Reference 74); for City of Groton, Groton Long Point Association, at a scale of 1:1,200 and a contour interval of 2 feet (Reference 75); and for the Town and Borough of Stonington, at a scale of 1:2,400 and a contour interval of 5 feet (Reference 76); .

3. USGS quadrangles of Niantic, Old Lyme, Uncasville, Mystic, and New London, Connecticut, were used for the creation of base maps, the placement of transects and for fetch calculations (Reference 77).

4. Stillwater elevations for the storm surges were obtained from Tidal Flood Profiles for the Connecticut Shoreline of Long Island Sound and Tidal Flood Profiles for the Thames River (References 68 and 69).

For Groton Long Point Association, all dunes and structures were assumed to remain intact for purposes of this analysis. Areas exist within Groton Long Point Association where greater flood hazards may be expected than are presently indicated on the revised FIRM due to potential wave action. These areas include, but may not be limited to, Mumford Cove. Due to limitations of the data and engineering methodology, including knowledge of wave generation and propagation mechanisms and wind-surge correlations in time, the magnitude and extent of wave hazard cannot be accurately determined at present and these areas have been omitted from rigorous analysis.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences report, Methodology for Calculating Wave Action Effects Associated with Storm Surges, (Reference 66). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in Reference 66. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross section lines) that were located along the coastal areas in accordance with the Users Manual for Wave Height Analysis (Reference 78). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 1-percent-annual-chance flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The locations of the 3-foot breaking wave for determining the terminus of the V Zone (area with velocity wave action) was also computed at each transect. It was assumed that the beach areas would erode during a major storm, thus reducing its effectiveness in decreasing wave heights.

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including the topographic work maps, aerial photographs, and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects. Computed wave heights and elevations associated with the 1-percent-annual-chance storm surge are summarized below for various reaches in the study area.

Niantic Bay and Long Island Sound (Transects 18-41) – The wave height data for these transects is not available for the Town of Waterford.

Long Island Sound and the Thames River (Transects 42-49) - The maximum wave crest elevation affecting the New London shoreline from Long Island Sound to the Thames River is 14 feet. Waves that are greater than 3 feet do not propagate inland significantly due to the sharp rise in ground elevations. Waves less than 3 feet affect the few low-lying areas of Alewife Cove, Long Island Sound, and the Thames River. In the southern areas, waves less than 3 feet propagate inland as far as 400 feet at Ocean Beach and as far as 350 feet to Pequot Avenue. Near the northern portion of Greens Harbor, waves less than 3 feet may propagate inland 1,200 feet. At the piers near Water Street, waves less than 3 feet may propagate 1,800 feet inland. Wave action and inundation are reduced by the sharp rise in ground elevations in New London.

Fishers Island Sound (Transects 74-85) - The maximum wave crest elevation from Fishers Island Sound affecting the Town of Stonington is 15 feet. Waves greater than 3 feet affect the low-lying shoreline areas and marsh areas in the community. Waves greater than 3 feet propagate through Stonington Harbor as far north as U. S. Route 1, through Mystic Harbor as far north as Conrail, up Wequetequack Cove to Conrail, and up the Pawcatuck River to a point approximately 1 mile upstream of Pawcatuck Point. Waves greater than 3 feet also affect the Little Narragansett Bay coast. The waves are reduced to less than 3 feet by rising ground elevations, vegetation, and development. Waves less than 3 feet propagate up Copps Brook, the Mystic River, the Pawcatuck River, and Stony Brook to the point where elevations from riverine flooding are higher.

Fishers Island Sound (Transects 80-82) - The maximum wave crest elevation from Fishers Sound affecting the Borough of Stonington is 15 feet. Waves greater than 3 feet propagate through Stonington Harbor and affect the shoreline areas. The waves propagate inland approximately 200 to 350 feet along most of the Stonington Harbor shoreline, with the exception of the dock area near Northwest Street where waves greater than 3 feet propagate across the area. The waves are reduced to less than 3 feet by rising ground elevations and development. Along Fishers Island Sound, waves greater than 3 affect the entire shoreline. In the Stonington Point area, waves greater than 3 feet propagate inland 50 to 100 feet, with the exception of the beach area at the end of the point where waves greater than 3 feet propagate 200 feet inland. Around Harmony Street, waves greater than 3 feet propagate inland 250 to 500 feet. Around East Grand Street, waves greater than 3 feet propagate inland 450 to 700 feet. Along the east shoreline, waves greater than 3 feet propagate as much as 600 feet inland. The waves are reduced to less than 3 feet by rising ground elevations and development. Waves less than 3 feet affect the areas of the community which are below the 1-percent-annual-chance surge level.

Long Island Sound (Transects 9-16) - The maximum wave crest elevation affecting the Long Island shoreline of East Lyme is 14 feet. From the western corporate limits to a point near West Pattagansett Road, extended, waves greater than 3 feet can propagate inland 80 feet where the ground elevation reduces the waves to less than 3 feet. Waves less than 3 feet continue inland and affect the low-lying areas of the Fourmile River, Bridge Brook, and the small lake near Giants Neck Road. Wave action in these areas is reduced by vegetation and ground elevations. East of West Pattagansett Road, extended, to Black Point Road north of its intersection with Gravel Road, waves greater than 3 feet propagate inland significantly due to the low marsh elevation. Wave heights are reduced as waves propagate across the marsh by the high ground elevations of Long Rock Island, Huntley Island, and the west side of Watts Island, but waves greater than 3 feet continue past these islands and across the marsh up to the Conrail tracks. The higher ground elevation at the Conrail tracks reduces waves to less than 3 feet. Waves less than 3 feet continue inland and affect the low areas of a stream near Marshfield Road and the area around the Pattagansett River, but there is little wave generation in these areas due to insufficient fetch. South of the intersection of Old Black Point Road and Gravel Road and east through Niantic Bay, waves greater than 3 feet do not propagate inland more than 80 feet due to the sharp rise in ground elevation. Waves less than 3 feet do not continue much farther inland, except areas near Indian Pond and near Atlantic Street where the ground elevations are low enough to be affected by the 1-percent-annual-chance storm.

Niantic River (Transect 17) - The maximum wave crest elevation affecting the Niantic River shoreline of East Lyme is 12 feet. Waves greater than 3 feet from Long Island Sound are reduced by the high ground elevations of the Bar. Approximately 1,800 feet north of The Bar, waves greater than 3 feet are generated in the river and affect the shoreline areas to a point 50 feet inland where they are reduced by the sharp rise in ground elevation. Waves greater than 3 feet continue upstream approximately 8,600 feet where they are reduced by the constriction of the river. Waves less than 3 feet continue north to where riverine flooding becomes predominant. Waves less than 3 feet affect the Smith Cove shoreline.

Long Island Sound and the Thames River (Transects 52-56) - The maximum wave crest elevation affecting the Long Island Sound and Thames River shorelines in the City of Groton is 14 feet. Waves greater than 3 feet propagate across Pine Island to the immediate shoreline areas of Baker Cove up to the Conrail bridge where flooding from Birch Plain Creek becomes predominant. Waves less than 3 feet propagate inland from Baker Cove to Jupiter Point Road where they are reduced by ground elevations. Waves greater than 3 feet affect the entire Long Island Sound and Thames River shorelines but do not propagate further inland more than 50 feet in most areas due to the rise in ground elevations near the shorelines. Waves less than 3 feet can propagate further inland in areas between Jupiter Point and Avery Point, around Eastern Point, and in the dock areas on the Thanes River. These waves do not propagate inland more than 300 to 400 feet due to rising ground elevations.

Fishers Island Sound (Transects 57-59 and 71-73) - The wave height data for these transects is not available for the Town of Groton.

Fishers Island Sound (Transects 60-65) - The flooding source for all flooding affecting Groton Long Point Association is Fishers Island Sound which affects Mumford Cove to the northwest of the community and Palmer Cove to the east. Waves greater than 3 feet affect the low-lying shoreline of the southwest, south and east areas of the community. In the southwest, waves greater than 3 feet propagate past the seawall and through the first row of buildings where the waves are reduced to less than 3 feet by the development. In the south, waves greater than 3 feet propagate past Shore Avenue South and up to the first row of buildings where the waves are again reduced by the development. In the east, waves greater than 3 feet propagate up to Shore Avenue East where they are reduced to less than 3 feet by rising ground elevations. Waves less the 3 feet propagate over Lower and Upper Lagoons and over the low marsh areas in the north and central areas of the community. Most of the community is subject to wave attack with the exceptions of some areas of high ground. These areas of high ground include a small area east of Weston Road and areas around Club House Circle, Ridge Road and Prospect Street, and Burrows Street.

Long Island Sound and the Connecticut River (Transects 1-8) - The maximum wave crest elevation affecting the Long Island shoreline of Old Lyme is 15 feet. With the exception of the area near Griswold Point, waves greater than 3 feet propagate inland 100 feet where they are reduced by ground elevations. Near Griswold Point, waves greater than 3 feet propagate over the sand spit and into the Connecticut River. Waves less than 3 feet affect the low-lying areas of the Back Hall River, the Duck River, and the Lieutenant River.

The maximum wave crest elevation affecting the Connecticut River shoreline of Old Lyme is 13 feet. Waves greater than 3 feet propagate over Great Island and affect areas as far east as Smiths Neck and as far north as the Conrail bridge. North of the Conrail Bridge, waves less than 3 feet propagate up the river and increase in height to greater than 3 feet at Lord Cove. Waves less than 3 feet affect the low areas of Mile Creek, the Threemile River, and the Fourmile River. It was assumed that all structures would remain intact, and the sand spit near Griswold Point would erode during a major storm.

Fishers Island Sound (Transects 67-70) - The maximum wave crest elevation affecting Noank Fire District shoreline from Fishers Island Sound is 14 feet. Waves greater than 3 feet affect the shoreline from the Groton Long Point Road bridge over Palmer Cove to the Conrail tracks over Beebe Cove. With a few exceptions, waves greater than 3 feet do not propagate inland significantly. Around Noble Avenue, waves greater than 3 feet propagate inland as far as 200 feet, where they are reduced by the rising ground elevation and development. At Morgan Point, waves greater than 3 feet can propagate inland 200 feet; they can propagate up to 250 feet inland near Front Street in the area between Bayside Avenue and Latham Lane. Also, there is some regeneration of waves across Beebe Cove, but the waves are reduced by the steep rise in ground elevation at the shoreline. Waves less than 3 feet propagate up Palmer Cove to the point on Eccleston Brook where riverine flooding dominates. Waves less than 3 feet also affect the low shoreline areas, but are diminished by the rising ground elevation and development.

The USACE has established the 3-foot breaking wave as the criterion for identifying coastal high hazard zones (Reference 62). This was based on a study of wave action effects on structures. This criterion has been adopted by FEMA for the determination of V Zones. Because of the additional hazards associated with high-energy waves, the NFIP regulations require much more stringent floodplain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in V Zones are higher than those in A Zones with similar numerical designations.

Countywide Analysis

As part of this countywide update, redelineation of coastal flood hazard data was performed for open water flooding sources in the communities of Town of East Lyme, City of Groton, Groton Long Point Association, Town of Groton, Noank Fire District, Town of Old Lyme, City of New London, Borough of Stonington, Town of Stonington and Town of Waterford. Redelineation of coastal flood hazards is defined as applying the results of the effective coastal analyses to new or more detailed topographic data. Provided below is a summary of the analyses performed. All revised coastal analyses and redelineation of coastal flood hazards were performed in accordance with Appendix D "Guidance for Coastal Flooding Analyses and Mapping," (Reference 80) of the Guidelines and Specifications, as well as, the "Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update", (Reference 81).

Previous to this update, 8 miles in the Town of East Lyme was redelineated using updated topographic data.

For redelineation of coastal flood hazard data, the 10-, 2-, 1- and 0.2-percent-annual-chance stillwater elevations are the same as published in the previous effective Flood Insurance Studies.

For the New London County communities, the elevations presented in the effective Flood Insurance Studies are referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). These elevations were converted to the North American Vertical Datum of 1988 (NAVD 88). The vertical datum shift between NGVD29 and NAVD88 was determined in accordance with Appendix B "Guidance for Converting to the North American Vertical Datum of 1988," of the Guidelines and Specifications, as well as, the "Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update", (Reference 82).

Transect data for the communities with redelineation of coastal hazard data are referenced to each community's previous effective FIS. Transect descriptions for the New London County coastal communities are shown in Table 10 at the end of this section and have been re-numbered to conform to countywide standards.

Two (2) primary topographic data sources were used in communities with redelineation of coastal flood hazard data: 2-foot contour topography developed from Light Detection and Ranging (LiDAR) data collected for FEMA in 2007 for the Long Island Sound shoreline and 2-foot contour topography developed from LiDAR data collected for FEMA in 2000 for the Connecticut River shoreline. The results of the previous effective coastal analyses were then applied to this topographic data to determine the coastal flood hazards.

In accordance with the FEMA Guidelines (Reference 82) the effect of the Primary Frontal Dune (PFD) on coastal flood hazard mapping was evaluated for all communities. In areas that had appropriate topographic data, the extent of the PFD was calculated in accordance with the Massachusetts Office of Coastal Zone Management methodology (Reference 83), then field verified. For other areas, the extent of the PFD was determined from field survey.

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for the flooding sources studied by detailed methods and are summarized in Table 9, "Summary of Stillwater Elevations."

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT[2] ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
CONNECTICUT RIVER				
Transects 1 - 3 in the Town of Old Lyme	6.3	8.4	9.3	11.5
FISHERS ISLAND SOUND				
At the southwestern Town of Groton corporate limits	6.2	8.1	9.1/11	11.5
At the southeastern Town of Groton corporate limits	6.3	8.4	9.2/14	11.6
Transects 60 - 65 in the community of Groton Long Point Association	6.3	8.3	9.31	11.5
Noank Fire District	6.4	8.4	9.4	11.6
Borough of Stonington	6.5	8.7	9.7	11.6
At Mystic Harbor in Town of Stonington	6.2	8.9	10.6	13.3
At Pawcatuck River in Town of Stonington	6.2	8.9	10.6	13.8
Transects 74 - 76 in the Town of Stonington	8.5	8.7	9.7	11.6
Transects 77 - 78 in the Town of Stonington	6.4	8.5	9.6	11.6
Transect 79 in the Town of Stonington	6.5	8.6	9.7	11.6
Transect 83 in the Town of Stonington	6.6	8.7	9.8	11.6
Transects 84 - 85 in the Town of Stonington	6.8	8.7	9.9	11.7
Entire shoreline within the community of Griswold	184.7	185.3	185.6	186.3

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT[2] ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
LONG ISLAND SOUND				
Transect 4 in the Town of Old Lyme	6.5	8.4	9.3	11.5
Transects 5 - 8 in the Town of Old Lyme	6.4	8.3	9.3	11.5
Transects 19 - 29, The Niantic River to White Point in Waterford	6.3	8.2	9.2	11.5
Transects 30 - 40, White Point to Alewife in Waterford	6.2	8.1	9.1	11.5
LONG ISLAND SOUND AND THE THAMES RIVER				
Transects 42 - 46 in the Town of Groton and the City of New London	6.2	8.1	9.1	11.5
In the City of Groton	6.2	8.1	9.1	11.5
Transects 46 - 48 in the City of New London	6.2	8.1	9.1	11.5
Transect 49 in the City of New London	6.4	8.5	9.6	12.1
NIANTIC RIVER				
Transect 18 in the Town of Waterford	6.3	8.2	9.2	11.5
Entire shoreline within the community of Waterford	6.3	8.2	9.2	11.5
Town of East Lyme	6.3	8.2	9.2	11.5
NIANTIC BAY				
Town of East Lyme	6.5	8.4	9.3	11.5
THAMES RIVER				
At the southern Town of Groton corporate limits (Town of Groton)	6.2	8.1	9.1/14	11.5
At the northern Town of Groton corporate limits (Town of Groton)	6.6	8.8	9.9/12	12.6
At the Waterford-Montville corporate limits (Town of Montville)	6.6	9.5	11.1	14.7

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT[2] ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
THAMES RIVER – cont'd				
At the City of Norwich-Montville corporate limits (Town of Montville)	7.8	11.1	13.1	16.9
At confluence of Trading Cove Brook (City of Norwich)	8.9	11.6	12.9	16.4
At confluence of Yantic River (City of Norwich)	9.6	12.6	14.4	17.9
At the City of Norwich-Preston corporate limits (Town of Preston)	8.4	11.1	12.6	15.9
At the Ledyard-Preston corporate limits (Town of Preston)	7.9	10.5	11.9	15.1
At the City of New London-Waterford corporate limits (Town of Waterford)	8.3	7.7	9.6	12.3
At the Montville-Waterford corporate limits (Town of Waterford)	6.9	9.6	10.7	14.1
At New London Harbor entrance (City of New London)	6.2	8.1	9.1	11.5
At the northern City of New London corporate limits (City of New London)	6.4	8.5	9.6	12.1

1 North American Vertical Datum of 1988
*Data Not Available

TABLE 10 - TRANSECT DESCRIPTIONS

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
1	Northern corporate limits to Raymond E. Baldwin Bridge	9.3	12
2	Raymond E. Baldwin Bridge to Coulkins Road	9.3	12

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
3	Coulkins Road to Griswold Point	9.3	12
4	Griswold Point to Springfield Road	9.3	12
5	Springfield Road to Finnigan Farm Road	9.3	15
6	Finnigan Farm Road to Hatchett Point	9.3	15
7	Hatchett Point to Hillcrest Road	9.3	15
8	Hillcrest Road to eastern corporate limits	9.3	14
9	From 1670 feet north of the Access Road within the Rocky Neck State Park, extending south into Long Island Sound in the Town of East Lyme	9.3	14
10	From 80 feet northeast of its Oakwood Road Int extending southwest into Long Island Sound in the Town of East Lyme	9.3	14
11	From its intersection with Oakwood Road extending southeast through Huntley Island into Long Island Sound in the Town of East Lyme	9.3	14
12	From 2650 feet north of Bathing Beach Road onto Watts Island, extending South into Long Island Sound in the Town of East Lyme	9.3	14
13	From 890 feet north of Old Black Point Road extending south into Long Island Sound in the Town of East Lyme	9.3	14
14	From 550 feet west of West Lane, extending east into Niantic Bay in the Town of East Lyme	9.3	14

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
15	From its intersection with West Main Street extending southeast into Niantic Bay in the Town of East Lyme	9.2	14
16	From 50 feet north of Wells Street Int, extending south into Niantic Bay in the Town of East Lyme	9.2	14
17	From its intersection with Quarry Dock Road in the Town of East Lyme, extending east into Niantic bay in the Town of Waterford	9.2	12
18	The Bar and the Niantic River (Sandy Point)	9.2	15
19	Western Corporate Limits to Millstone Road No. 2 Extended	9.2	15
20	Millstone Road No.2 Extended to Bay Point	9.2	15
21	Bay Point to Millstone Nuclear Access Road Extended	9.2	15
22	Millstone Nuclear Access Road Extended to Millstone Point	9.2	15
23	Millstone Point to Fox Island	9.2	15
24	Fox Island to Gun Shot Road, Extended	9.2	15
25	Gun Shot Road, Extended to Gardiners Wood Road, Extended	9.2	14
26	Gardiners Wood Road, Extended to Reed Avenue, Extended	9.2	14
27	Reed Avenue, Extended, to Cliff Street, Extended	9.2	14

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
28	Cliff Street, Extended, to Leaonard Road, Extended	9.2	14
29	Leonard Road, Extended, to White Point	9.2	14
30	White Point to Magonk Point	9.1	14
31	Magonk Point to Magonk Point Road, Extended	9.1	14
32	Magonk Point Road, Extended, to West Strand Road, Extended	9.1	14
33	West Neck Road, Extended, to a point approximately 0.15 mile east	9.1	14
34	West Strand Road, Extended, to West Neck Road, Extended	9.1	14
35	A point approximately 0.15 mile east of West Neck Road, Extended, to mouth of Goshen Cove	9.1	14
36	Mouth of Goshen Cove to a point approximately 0.10 mile north of Goshen Point	9.1	14
37	A point approximately 0.15 mile east of West Neck Road, Extended, to mouth of Goshen Cove	9.1	14
38	A point approximately 0.10 mile north of Goshen Point to a point approximately 0.4 mile north	9.1	14
39	A point approximately 0.40 mile north of Goshen Point to a point approximately 0.19 mile north	9.1	14
40	A point approximately 0.19 mile south of northeast corporate limits to Ridgewood Road	9.1	14

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
41	Ridgewood Road, Extended, to eastern corporate limits	9.1	14
42	Ocean Beach	9.1	14
43	Osprey Beach	9.1	14
44	Quinnipeag Rocks	9.1	14
45	New London Harbor - Mitchell College	9.1	12
46	Greens Harbor	9.1	11
47	Shaw Cove	9.1	11
48	Thames River - Gold Star Memorial Bridge	9.1	11
49	Thames River - Connecticut College	9.6	12
50	From 70 feet northeast of Military Highway in the Town of Groton, extending southwest into the Thames River to Mamacoke Hill in Town of Waterford	9.5	12
51	From 200 feet east of Military Highway in the Town of Groton, extending west into the Thames River in the City of New London	9.1	11
52	From 390 feet northeast of Military Highway, extending southwest into New London Harbor in the City of Groton	9.1	11
53	From 110 feet east of Eastern Point Road, extending west into New London Harbor in the City of Groton	9.1	11
54	From its intersection with West Meech Avenue, extending southwest into New London Harbor in the City of Groton	9.1	14

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
55	From 270 feet north of Eastern Point Road, extending south into Long Island Sound in the City of Groton	9.1	14
56	From approximately 50 feet southeast of Shennecossett Road, extending southeast into Fishers Island Sound in the City of Groton	9.1	14
57	From 1670 feet north of Bushy Point Beach, extending south into Fishers Island Sound in the Town of Groton	9.1	14
58	From approximately 2375 north of Mumford Point, extending southeast into Fishers Island Sound in the Town of Groton	9.3	13
59	From approximately 400 feet south of Railroad, extending south into Mumford Cove in the Town of Groton	9.3	12
60	From 60 feet northeast of Atlantic Avenue, extending southwest into Fishers Island Cove in the Groton Long Point Association	9.3	15
61	From 85 feet northeast of Atlantic Avenue, extending southwest into Fishers Island Cove in the Groton Long Point Association	9.3	15
62	From approximately 210 feet southwest of Sound Breeze Avenue, extending southwest into Fishers Island Sound in the Groton Long Point Association	9.3	15
63	From its intersection with the Venetian Harbor (Upper Lagoon), 750 feet north of South Shore Avenue Int, extending south into Fishers Island Sound in the Groton Long Point Association	9.3	14

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
64	From its intersection with Oak Street, extending south into Fishers Island Sound in the Groton Long Point Association	9.3	14
65	From 60 feet west of Prospect Street, extending east into Fishers Island Sound in the Groton Long Point Association	9.3	14
66	From approximately 380 feet north of Haley Crescent, extending southeast into Palmers Cove in the Town of Groton	9.3	13
67	From approximately 500 feet northwest of Esker Point, extending south into Palmers Cove in the Town of Groton	9.4	12
68	From 330 feet north of Marsh Road, extending south into Fishers Island Sound in the Town of Groton	9.4	14
69	From its intersection with Pearl Street, extending southeast into Mystic Harbor in the Town of Groton	9.4	14
70	From Beebe Cove extending into Mystic Harbor in the Town of Groton	9.4	11
71	From 1410 feet northwest of Elm Street, extending southeast into Beebe Cove in the Town of Groton	9.4	14
72	From 480 feet northwest of Noank Road, extending southeast into Mystic Harbor in the Town of Groton	9.4	13
73	From its intersection with Prospect Street in the Town of Groton, extending southeast into Mystic Harbor in the Town of Stonington	9.4	12

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
74	From approximately 50 feet south of Money Point Road, extending southwest into Fishers Island Sound	9.5	15
75	From 170 feet northwest of Yacht Club Road, extending southeast into Fishers Island Sound	9.5	15
76	From approximately 320 feet north of Gled Hill Street, extending south into Fishers Island Sound in the Borough of Stonington	9.5	12
77	From 150 feet north of Wilcox Road, extending south into Fishers Island Sound in the Borough of Stonington	9.6	15
78	From 280 feet north of Skipper Street, extending south into Fishers Island Sound in the Borough of Stonington	9.6	15
79	From approximately 50 feet east of Wamphassuc Road, extending southeast into Stonington Harbor in the Borough of Stonington	9.7	15
80	From 80 feet northeast of Water Street, extending southwest into Stonington Harbor in the Borough of Stonington	9.7	13
81	From 50 feet northwest of Harmony Street, extending southeast into Fishers Island Sound in the Borough of Stonington	9.7	15
82	From 160 feet northwest of Salt Acres Road, extending southeast into Fishers Island Sound in the Borough of Stonington	9.7	15

TABLE 10 - TRANSECT DESCRIPTIONS (continued)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
83	From approximately 500 feet south of Donahue Brook near the Landing field, extending South into Wequetequock Cove in the Town of Stonington	9.8	15
84	From approximately 1500 feet east of Palmer Neck Road, extending south into Little Narragansett Bay in the Town of Stonington	9.9	15
85	From 750 feet northeast of Osbrook Point, extending southwest into Little Narragansett Bay in the Town of Stonington	9.9	15

[1] Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

Table 11 "Transect Data," lists the flood hazard zone and base flood elevations for each transect, along with the 1-percent-annual-chance stillwater elevation for the respective flooding source.

TABLE 11 – TRANSECT DATA

FLOODING SOURCE	STILLWATER ELEVATIONS (feet NAVD[1])				ZONE	BASE FLOOD ELEVATION (feet NAVD)[2]
	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE		
CONNECTICUT RIVER						
Transect 1	6.5	8.4	9.3	11.5	VE	11-12
					AE	9-11
Transects 2 and 3	6.5	8.4	9.3	11.5	VE	11-12
					AE	9-11
FISHERS ISLAND SOUND						
Transect 57	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11
Transect 58	6.3	8.2	9.3	11.6	VE	11-13
					AE	9-11

TABLE 11 – TRANSECT DATA (continued)

FLOODING SOURCE	STILLWATER ELEVATIONS (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD) [2]
FISHERS ISLAND SOUND - cont'd						
Transect 59	6.3	8.2	9.3	11.6	VE	11-13
					AE	9-11
Transects 60-62	6.3	8.3	9.3	11.5	VE	11-15
					AE	9-11
Transects 63-65	6.3	8.3	9.3	11.5	VE	11-14
					AE	9-11
Transect 66	6.3	8.2	9.3	11.6	VE	13-14
					AE	9-10
Transect 67	6.4	8.4	9.4	11.6	VE	11-12
					AE	9-11
Transect 68	6.4	8.4	9.4	11.6	VE	11-14
					AE	9-11
Transect 69	6.4	8.4	9.4	11.6	VE	11-14
					AE	9-11
Transect 70	6.4	8.4	9.4	11.6	VE	12-13
					AE	10
Transect 71	6.4	8.3	9.4	11.6	VE	11-14
					AE	9-11
Transect 72	6.4	8.3	9.4	11.6	VE	11-14
					AE	9-11
Transect 73	6.4	8.3	9.4	11.6	VE	11-14
					AE	9-11
Transects 74-75	6.4	8.4	9.5	11.6	VE	15
					AE	11
Transect 76	6.4	8.4	9.5	11.6	VE	12-15
					AE	9-11
Transects 77-78	6.5	8.4	9.6	11.6	VE	12-15
					AE	10-12

TABLE 11 – TRANSECT DATA (continued)

FLOODING SOURCE	STILLWATER ELEVATIONS (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD)[2]
FISHERS ISLAND SOUND – cont'd						
Transect 79	6.5	8.5	9.7	11.6	VE	12-15
					AE	10-12
Transects 80-82	6.5	8.7	9.7	11.6	VE	12-15
					AE	9-12
Transect 83	6.6	8.7	9.8	11.6	VE	12-15
					AE	10-12
Transect 84-85	6.7	8.7	9.9	11.7	VE	12-15
					AE	10-12
LONG ISLAND SOUND						
Transect 4	6.5	8.4	9.3	11.5	VE	11-15
					AE	9-11
Transects 5-8	6.4	8.3	9.3	11.5	VE	11-15
					AE	9-11
Transects 19-24	6.3	8.2	9.2	11.5	VE	11-15
					AE	9-11
Transects 25-29	6.3	8.2	9.2	11.5	VE	11-14
					AE	9-11
Transects 30-40	6.3	8.1	9.1	11.5	VE	11-14
					AE	9-11
Transects 42-43	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11
LONG ISLAND SOUND and the THAMES RIVER						
Transects 52-56	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11

TABLE 11 – TRANSECT DATA (continued)

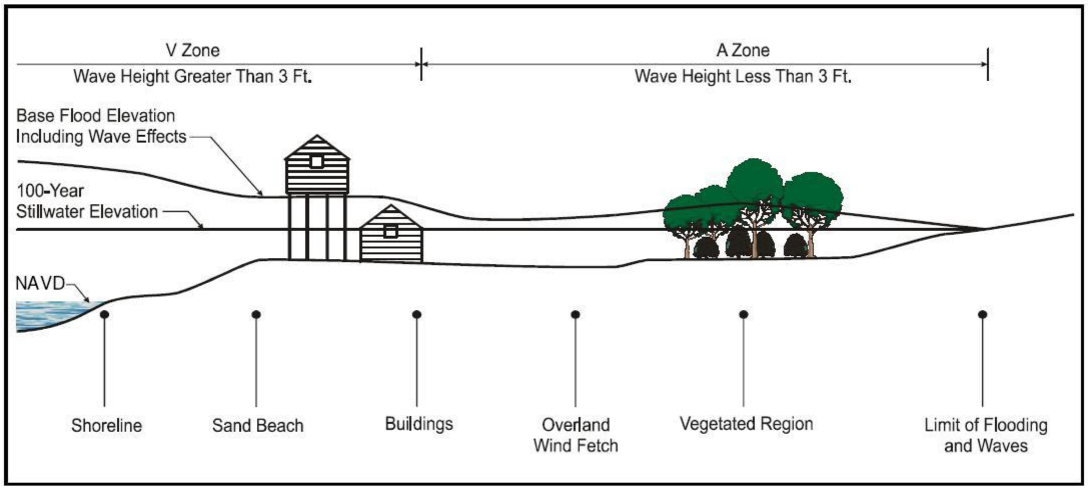
FLOODING SOURCE	STILLWATER ELEVATIONS (feet NAVD[1]) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD)[2]
NIANTIC BAY						
Transect 15	6.5	8.4	9.3	11.5	VE	11-14
					AE	9-11
Transect 16	6.5	8.4	9.3	11.5	VE	12-14
					AE	9-11
NIANTIC RIVER						
Transect 17	6.5	8.4	9.3	11.5	VE	12-13
					AE	9-11
Transect 18	6.3	8.2	9.2	11.5	VE	11-15
					AE	9-11
THAMES RIVER						
Transect 41	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11
Transects 44-45	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11
Transects 46-48	6.2	8.1	9.1	11.5	VE	11-14
					AE	9-11
Transect 49	6.4	8.5	9.6	11.5	VE	12
					AE	10-12
Transect 50	6.6	8.5	9.5	12.1	VE	12
					AE	9-11
Transect 51	6.2	8.1	9.1	11.5	VE	11
					AE	9-11

[1]North America Vertical Datum of 1988

[2]Due to map scale limitations, base flood elevations shown on the FIRM may represent average elevations for the zones depicted.

Figure 1, "Transect Schematic," represents a sample transect that illustrates the relationship between the stillwater elevation , the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

FIGURE 1 – TRANSECT SCHEMATIC



3.4 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. **The conversion factor from NGVD 29 to NAVD 88 is -0.96, and from NAVD 88 to NGVD 29 is +0.96.**

For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the

Technical Support Data Notebook associated with the FIS report and FIRM for this county. Interested individuals may contact FEMA to access these data.

The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD 29 should apply the stated conversion factor to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

In order to provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

For unrevised streams in New London County, data was taken from previously printed FISs for each individual community and are compiled below.

For the streams studied in detail, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. The boundaries were interpolated between cross sections, using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Reference– 84), at a scale of 1:2,400 with a contour interval of 2 feet (Reference– 85), at a scale of 1:24,000 with a contour interval of 10 feet (Reference– 86), at a scale of 1:2,400, with a contour interval of 4 feet (Reference 87, at a scale of 1:2,400, with a contour interval of 10 feet (Reference– 88), at a scale of 1:4,800 feet with a contour interval of 4 feet (Reference– 89), at a scale of 1:4,800 with a contour interval of 5 feet (Reference 90), at a scale of 1:4,800 with a contour interval of 10 feet, and 1:9,600, with a contour interval of 10 feet.

For the flooding sources studied by approximate methods, the 1-percent-annual-chance flood boundary was delineated using the Flood Hazard Boundary Maps for the Town of Griswold (Reference 91), the Town of Lebanon (Reference 92), the Town of North Stonington (Reference 93), the Town of Preston (Reference 94), the Town of Voluntown (Reference 95), also using field inspection and USGS topographic maps, the Town of Bozrah (Reference 96), the Town of Franklin (Reference 97), the Town of Ledyard, the Town of Lisbon (References 88 and 98), the Town of Salem (References 99 and 100), for the Town of Sprague (References 101 and 102), also using field surveys, community and historic data, engineering judgment for the Town of East Lyme (Reference 79), the Town of Montville (Reference 103), also previously printed FIS, the Town of Colchester, and the Borough of Colchester (References 104 and 105), the City of Norwich (Reference 106), and the Town of Waterford (Reference 107).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). For the flooding sources studied by approximate methods, only the 1-percent annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

In the Town of East Lyme, for the tidal areas, flood boundaries are indicated on the FIRM. On this map, special flood hazards inundated by the 1-percent-annual-chance flood that have additional hazards due to wave action have been designated as Zone VE

In the City of Groton and Groton Long Point Association, areas inundated by the 1-percent-annual-chance flood are shown as A and V Zones on the community's FIRM. It is in these areas that FEMA requires local communities to exercise floodplain management measures as a condition for participation in the National Flood Insurance Program.

In the Town of Groton, for the tidal areas with wave action, the flood boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land cover data, and topographic maps at a scale of 1:2,400 with a contour interval of 4 feet (References 108 and 109). The 1-percent-annual-chance floodplain was divided into whole-foot elevation zones based on the average wave crest elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

For the upper portion of Tributary A in the Town of Groton, the boundary of the 1-percent-annual-chance flood was delineated using a topographic map at a scale of 1"=200' with a contour interval of 25 feet along with USGS topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (References 110 and 111 in T Groton). For the remaining areas studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps at a scale of 1:24,000 enlarged to a scale of 1:12,000, with a contour interval of 10 feet (Reference 111). Locations of elevations between contour lines were determined by interpolation.

In the Town of Montville, the boundaries for Latimer Brook were interpolated between cross sections using a USGS quadrangle map enlarged.

In the Town of Norwich, Tributaries A and E were considered to be areas of minimal flooding because the 1-percent-annual-chance floodplain width was less than 200 feet; therefore, they are not included on the FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 11, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

The area between the floodway 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 11). The computed floodway is shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplains and using an optimization scheme to obtain a difference in energy grade line elevations between natural and encroached conditions. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 11).

Floodways were computed separately for the Yantic River and the Yantic River East Channel by using the HEC-2 divided flow analyses, as mentioned in Section 3.0.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 11 for certain downstream cross sections of Pachaug River in Jewett City, Fourmile River, the Pattagansett River, and Latimer Brook in East Lyme, Birch Plain Creek, Tributary A, Fort Hill Brook, and Whitford Brook in Town of Groton, Blissville Brook in Lisbon, Oxoboxo Brook in Montville, Joe Clark Brook in Preston, Beaver Brook in Sprague, Shetucket River, the Yantic River East Channel, Tributary F, the Yantic River, and Hunter Brook in Norwich, and Jordan Brook in Waterford are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

A floodway generally is not appropriate in areas such as those that may be inundated by floodwaters from Long Island Sound. Thus, no floodway was prepared for the lower reaches of the Eight Mile River or Connecticut River, where flooding results from high levels of Long Island Sound rather than from high stream flow.

Because flooding on the Thames River and Poquetanuck Cove is tidally influenced, no floodway has been delineated for these two flooding sources.

Floodways were not determined for Day Meadow Brook and the portion of Meadow Brook upstream of Levy Road.

On the Eight Mile River upstream of the dam at Mt. Archer Road, the floodway has been deleted up to the farthest point of backwater from the dam. It is not appropriate to delineate a floodway within the confines of such an impoundment because the friction slope for the dam-created impoundment is equal to zero.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2, "Floodway Schematic".

FIGURE 2 – FLOODWAY SCHEMATIC

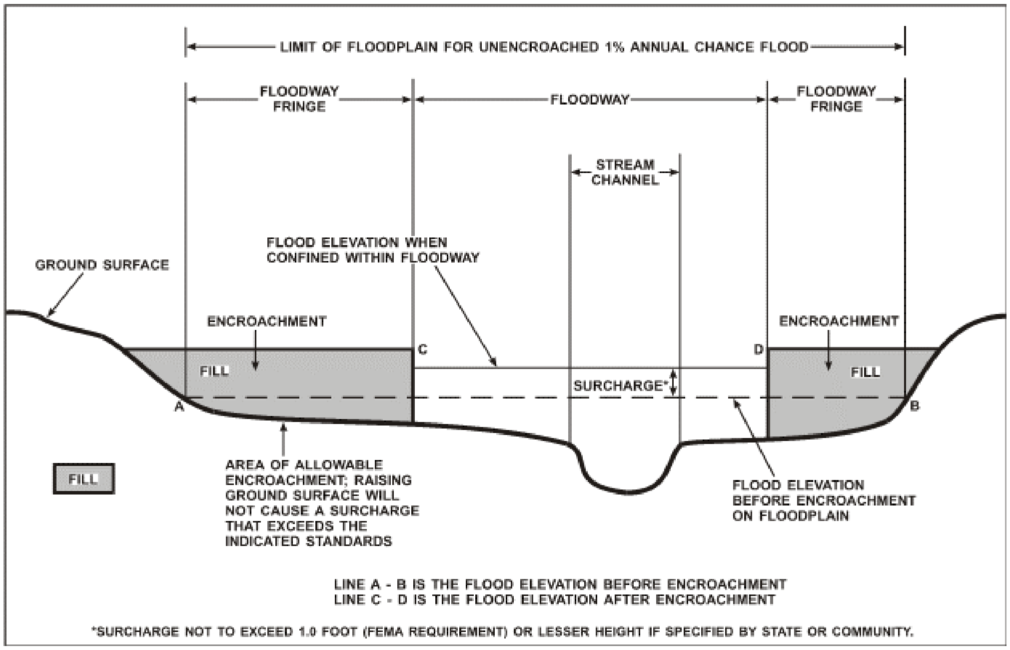


Table 12, Floodway Data, has been compiled in the following pages.