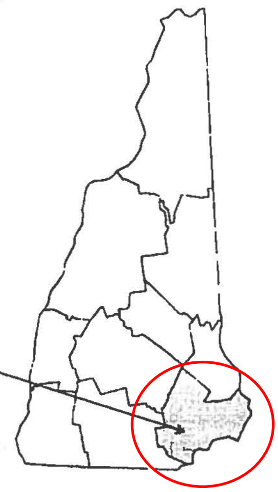
FLOOD INSURANCE STUDY

VOLUME 1 OF 3

ROCKINGHAM COUNTY, NEW HAMPSHIRE
ALL JURISDICTIONS



COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER
Atkinson, Town of	330175	New Castle, Town of	330135
Auburn, Town of	330176	Newfields, Town of	330228
Brentwood, Town of	330125	Newington, Town of	330229
Candia, Town of	330126	Newmarket, Town of	330136
Chester, Town of	330182	Newton, Town of	330240
Danville, Town of	330199	North Hampton, Town of	330232
Deerfield, Town of	330127	Northwood, Town of	330855
Derry, Town of	330128	Nottingham, Town of	330137
East Kingston, Town of	330203	Plaistow, Town of	330138
Epping, Town of	330129	Portsmouth, City of	330139
Exeter, Town of	330130	Raymond, Town of	330140
Fremont, Town of	330131	Rye, Town of	330141
Greenland, Town of	330210	Salem, Town of	330142
Hampstead, Town of	330211	Sandown, Town of	330191
Hampton Falls, Town of	330133	Seabrook Beach Village District	330854
Hampton, Town of	330132	Seabrook, Town of	330143
Kensington, Town of	330216	South Hampton, Town of	330193
Kingston, Town of	330217	Stratham, Town of	330197
Londonderry, Town of	330134	Windham, Town of	330144

PRELIMINARY
DECEMBER 9, 2013

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
33015CV001A

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.

Part or all of this FIS may be revised and republished at any time. In addition, part of this Preliminary FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: May 17, 2005

Revised Countywide FIS Effective Date: _______

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FLOOD INSURANCE STUDY
ROCKINGHAM COUNTY, NEW HAMPSHIRE
(ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for, the geographic area of Rockingham County, including: the City of Portsmouth; the Towns of Atkinson, Auburn, Brentwood, Candia, Chester, Danville, Deerfield, Derry, East Kingston, Epping, Exeter, Fremont, Greenland, Hampstead, Hampton, Hampton Falls, Kensington, Kingston, Londonderry, New Castle, Newfields, Newington, Newmarket, Newton, North Hampton, Northwood, Nottingham, Plaistow, Raymond, Rye, Sandown, Salem, Seabrook, South Hampton, Stratham, and Windham; and the Seabrook Beach Village District (hereinafter referred to collectively as Rockingham County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by the communities of Rockingham County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the 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.

This FIS report presents the contents of original community-based FIS reports as well as two updates. The first update was completed in 2005, when the community reports were combined into a countywide report and the Flood Insurance Rate Maps were presented in digital format. The second update was completed in 2013, when new coastal and riverine analyses were performed in 13 coastal communities in the eastern portion of Rockingham County.

Much of the information in this report is repeated from the 2005 countywide version of this FIS. Additional information regarding the 2013 update is included under the heading "2013 Coastal Study Update" located within appropriate sections throughout this report.

1.2 Authority and Acknowledgments

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

The community based FIS reports prior to 1979 were prepared for the Federal Insurance Administration (FIA). In 1979, an executive order merged the FIA into the newly formed Federal Emergency Management Agency (FEMA). Reports from that date forward were prepared for FEMA.

The May 17, 2005 FIS (FEMA, 2005) was prepared to include the incorporated communities within Rockingham County in a countywide FIS. Information on the authority and acknowledgments for each jurisdiction included in the 2005 countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Atkinson, Town of:	The hydrologic and hydraulic analyses for the FIS report dated April 2, 1993, were prepared by the U.S. Geological Survey (USGS) for the Federal Emergency Management agency (FEMA), under Inter-Agency Agreement No. EMW-88-E-2738, Project Order No. 4. That work was completed in August 1991. The hydrologic and hydraulic analyses for Island Pond were taken from the FIS for the Town of Derry (FEMA, 1981). The hydrologic and hydraulic analyses for Bryant Brook were taken from the FIS for the Town of Plaistow (FEMA, April1981).
Brentwood, Town of:	The hydrologic and hydraulic analyses for the FIS report dated October 15, 1980, were prepared by the Soil Conservation Service (SCS) for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-17-78. That work was completed in May 1979. The hydrologic and hydraulic analyses for the FIS report dated May 4, 2000, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-97-1A-0155, Project Order No. 1. That work was completed in June 1998.
Derry, Town of:	The hydrologic and hydraulic analyses for the FIS report dated April 15, 1980, were prepared by Anderson-Nichols and Company, Inc., for the FIA, under Contract No. H-3989. That work was completed in March 1978.

Epping, Town of:	The hydrologic and hydraulic analyses for the FIS report dated October 15, 1981, were performed by the SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 15. That work was completed in September 1979.
Exeter, Town of:	The hydrologic and hydraulic analyses for the FIS report dated November 17, 1981, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in May 1980.
Fremont, Town of:	The hydrologic and hydraulic analyses for the FIS report dated June 19, 1989, represent a revision of the original analyses prepared by the SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 15. The work for the original analyses was completed in May 1979. The hydrologic and hydraulic analyses for Spruce Swamp were prepared by Dewberry & Davis LLC, under agreement with FEMA. That work was completed in June 1988.
Greenland, Town of:	The hydrologic and hydraulic analyses for the FIS report dated May 17, 1989, were performed by the SCS for FEMA, under Inter-Agency Agreement No. EMW-86-E-2225, Project Order No. 01. That work was completed in September 1987
Hampstead, Town of:	The hydrologic and hydraulic analyses for the FIS report dated June 16, 1993, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-88-E-2738, Project Order No. 4. That work was completed in August 1991. The flooding information for Island Pond was taken from the FIS for the Town of Derry (FEMA, 1981).
Hampton, Town of:	The hydrologic and hydraulic analyses for the FIS report dated July 3, 1986, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in January 1984.
Hampton Falls, Town of:	The hydrologic and hydraulic analyses for the FIS report dated October 15, 1981, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in April 1980.

Kingston, Town of:	The hydrologic and hydraulic analyses for the FIS report dated April 15, 1992, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-87-E-2548, Project Order No. 1A. That work was completed in July 1989.
Londonderry, Town of:	The hydrologic and hydraulic analyses for the FIS report dated May 5, 1980, were prepared by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3989. That work was completed in March 1978.
New Castle, Town of:	The hydrologic and hydraulic analyses for the FIS report dated August 5, 1986, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in April 1984.
Newfields, Town of:	The hydrologic and hydraulic analyses for the FIS report dated June 5, 1989, were prepared by the SCS for FEMA, under Inter-Agency Agreement No. EMW-86-E-2225, Project Order No. 01. That work was completed in September 1987.
Newmarket, Town of:	The hydrologic and hydraulic analyses for the FIS report dated May 2, 1991, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 20. That work was completed in August 1989.
North Hampton, Town of:	The hydrologic and hydraulic analyses for the FIS report dated June 3, 1986, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in February 1984.
Plaistow, Town of:	The hydrologic and hydraulic analyses for the FIS report dated October 15, 1980, were prepared by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-4589. Approximate flood boundaries for portions of Seaver Brook and several unnamed streams and swampy areas were determined in August 1976, by Michael Baker, Jr. Inc., under contract to the FIA. That work was completed in October 1978.

Portsmouth, City of: The hydrologic and hydraulic analyses for the FIS report dated November 17, 1981, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in April 1980.

Raymond, Town of: The hydrologic and hydraulic analyses for the FIS report dated October 15, 1981, were prepared by the SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78. That work was completed in September 1979. The hydrologic and hydraulic analyses for the FIS report dated April 15, 1992, were prepared by Rivers Engineering Corporation for FEMA, under Contract No. EMW-89-C-2821, Project Order No. R89508. That work was completed October 1989. The hydrologic and hydraulic analyses for the FIS report dated May 2, 1995, were prepared by Roald Haestad, Inc., for FEMA, under Contract No. EMW-90-C-3126. That work was completed in March 1993.

Rye, Town of: The hydrologic and hydraulic analyses for the FIS report dated June 17, 1986, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in March 1984.

Salem, Town of: The hydrologic and hydraulic analyses for the December 1978 FIS report and June 15, 1979, FIRM (hereinafter referred to as the 1979 FIS), were prepared by the U. S. Army Corps of Engineers (USACE), New England District, for the FIA, under Inter-Agency Agreement No. 1AA-H-7-76, Project Order No. 24. That work was completed in August 1977. The hydrologic and hydraulic analyses for the FIS report dated April 6, 1998 were prepared by the U. S. Department of Agriculture, Natural Resources Conservation Service (NRCS), for FEMA, under Contract No. EMW-94-E-4437. That work was completed in September 1995.

Seabrook, Town of: The hydrologic and hydraulic analyses for the FIS report dated June 17, 1986, were prepared by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. That work was completed in December 1983.

Seabrook Beach Village District:	The hydrologic and hydraulic analyses for the FIS report dated August 5, 1986, were performed during the preparation of the FIS for the Town of Seabrook by Stone & Webster Engineering Corporation for FEMA, under Contract No. H-4772. The Town of Seabrook study was completed in December 1983.
South Hampton, Town of:	The hydrologic and hydraulic analyses for the FIS report dated July 15, 1992, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-89-E-2997, Project Order No. 5. That work was completed in September 1990.
Stratham, Town of:	The hydrologic and hydraulic analyses for the FIS report dated May 17, 1989, were prepared by the SCS for FEMA, under Inter-Agency Agreement No. EMW-86-E-2225, Project Order No. 1. That work was completed in September 1987.
Windham, Town of:	The hydrologic and hydraulic analyses for the FIS report dated were performed by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3989. That work was completed in March 1978.

The authority and acknowledgments for the Towns of Auburn, Candia, Chester, Danville, Deerfield, East Kingston, Kensington, Newington, Northwood, Nottingham, and Sandown were not available prior to the 2005 countywide study because no FIS reports had been published for those communities.

The 2005 countywide FIS was produced by Dewberry & Davis LLC under agreement with FEMA. The work was effective in May of 2005. The contract required the digital conversion of existing effective FIRMs and Flood Hazard Boundary Maps, and the preparation of a FIS and Digital FIRM (DFIRM) for Rockingham County (All Jurisdictions). No new hydrologic or hydraulic analyses were prepared.

Base map information shown on FIRM panels produced for the 2005 study was derived from USGS Digital Orthophoto Quadrangles (DOQs) produced at a scale of 1:12,000 from photography dated 1998 or later.

The digital FIRM was produced using New Hampshire State Plane Coordinate system, FIPS Zone 2800, referenced to the North American Datum of 1983 (NAD 83), GRS80 spheroid.

2013 Coastal Study Update

The 2013 coastal study update was prepared by the University of New Hampshire (UNH) for FEMA under Agreement No. EMB-2010-CA-0916 and completed in September of 2013. The study consisted of revisions to the coastal and riverine analyses in 13 contiguous communities located in eastern Rockingham County, including the City of Portsmouth and the Towns of Exeter, Greenland, Hampton, Hampton Falls, New Castle, Newfields, Newington, Newmarket, North Hampton, Rye, Seabrook, and Stratham.

The 2013 FIS includes revisions to detailed studies in the incorporated communities of Exeter and Newmarket, NH within Rockingham County. Information on the authority and acknowledgements for each of these jurisdictions included in this FIS is shown below.

Exeter, Town of:	The hydrologic and hydraulic analyses for the FIS report dated _______, were prepared by the U.S. Geological Survey, New England Water Science Center, for FEMA. That work was completed in November, 2012.
Newmarket, Town of:	The hydrologic and hydraulic analyses for the FIS report dated _______, were prepared by the U.S. Geological Survey, New England Water Science Center, for FEMA. That work was completed in November, 2012.

Base map information shown on FIRM panels produced for this 2013 revision was derived from 1-foot resolution orthophotography acquired in April-May, 2010. The projection used in the preparation the digital FIRM was New Hampshire State Plane Feet, FIPS Zone 2800, referenced to the North American Datum of 1983 (NAD 83), GRS80 spheroid.

1.3 Coordination

During the early years of the National Flood Insurance Program, Consultation Coordination Officer's (CCO) meetings were held for each jurisdiction in this countywide FIS. An initial CCO meeting was held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of an FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting was held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

Prior to the countywide FIS, the dates of the historical initial and final CCO meetings held for all jurisdictions within Rockingham County are shown in Table 1, "Initial and Final CCO Meetings."

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

Community Name	Initial CCO Meeting	Final CCO Meeting
Town of Atkinson	August 31, 1991	March 23, 1992
Town of Brentwood	July 15, 1997	*
Town of Derry	March 1976	February 13, 1979
Town of Epping	January 4, 1978	August 19, 1980
Town of Exeter	April 19, 1978	June 11, 1981
Town of Fremont	January 4, 1978	October 31, 1979
Town of Greenland	October 1, 1985	March 21, 1988
Town of Hampstead	August 31, 1987	January 21, 1992
Town of Hampton	April 19, 1978	January 16, 1985
Town of Hampton Falls	April 18, 1978	April 15, 1981
Town of Kingston	*	August 15, 1990
Town of Londonderry	March 1976	March 28, 1979
Town of New Castle	April 19, 1978	January 21, 1985
Town of Newfields	October 22, 1985	July 8, 1988
Town of Newmarket	February 1985	April 4, 1990
Town of North Hampton	April 19, 1978	January 16, 1985
Town of Plaistow	*	September 10, 1979
City of Portsmouth	April 19, 1978	June 11, 1981
Town of Raymond	December 9, 1992	*
Town of Rye	April 19, 1978	April 12, 1985
Town of Salem	August 3, 1993	October 17, 1996
Town of Seabrook	April 18, 1978	December 5, 1984
Seabrook Beach Village District	*	September 11, 1985
Town of South Hampton	*	May 28, 1991
Town of Stratham	October 22, 1985	June 20, 1988
Town of Windham	March 1976	October 16, 1978

**Data not available*

For the 2005 countywide study, letters were sent to all communities within Rockingham County notifying them of the scope of the FIS. Letters were mailed on July 10, 2002, and stated that the effective FIRMs and Flood Hazard Boundary Maps (FHBMs) of these communities would be digitally converted to a format that conforms to FEMA's Digital FIRM (DFIRM) specifications. The letters further stated that no new hydrologic and hydraulic analyses were prepared. The results of the 2005 countywide study were reviewed at the final CCO meetings held on November 13, 2003, and attended by representatives of the communities, FEMA, Dewberry and Davis LLC, the University of New Hampshire, and the NH Office of State Planning.

For this 2013 coastal study revising the maps for 13 communities within Rockingham County, invitations to attend a Risk MAP Discovery Meeting were sent to the 13 communities on August 31, 2011. The invitations included a request to submit pertinent information on local flood risks and hazards to UNH. The meetings were held on September 22, 2011, and were attended by representatives of the communities, the University of New Hampshire, the FEMA Regional Service Center (RSC), FEMA, AECOM, the NH Office of State Planning, and the New Hampshire-Vermont Water Science Center of the U.S. Geological Survey. Prior to the release of the preliminary maps, communities were invited to attend one of a daylong series of Workmap review sessions held on August 1, 2013, and attended by representatives of the communities, the University of New Hampshire, FEMA, AECOM, the NH Office of Energy and Planning (formerly known as the NH Office of State Planning), and the New Hampshire-Vermont Water Science Center of the U.S. Geological Survey. The final CCO meetings were held on ______, and attended by representatives of the communities, the _______. All problems raised at that meeting were addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Rockingham County, New Hampshire.

May 17, 2005 Countywide FIS

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods.

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS

Adams Pond	Lamprey River	Squamscott River
Atlantic Ocean	Little Cohas Brook	Taylor Brook (including Ballard Pond)
Beaver Brook	Little River No. 1	Taylor River
Beaver Lake	Little River No. 2	Tide Mill Creek
Black Brook	Little River No. 3	Tributary C to Beaver Brook
Bryant Brook	Lower Ballard Pond	Tributary E to Beaver Lake
Cohas Brook	Lower Beaver Lake	Tributary E to Little Cohas Brook
Country Pond	Meadow Pond	Tributary F to Beaver Lake
Cunningham Brook	Nesenkeag Brook	Tributary G to Beaver Brook
Drew Brook	Nudds Canal	Tributary H to Drew Brook
Dudley Brook	Pickering Brook	Tributary H to Nesenkeag Brook
Exeter River	Piscassic River	Tributary J to Black Brook
Flatrock Brook	Piscataqua River	Tributary O to Beaver Brook
Golden Brook	Policy Brook	Tuxbury Pond
Grassy Brook	Porcupine Brook	Upper Ballard Pond
Great Bay	Porcupine Brook Tributary	Upper Beaver Brook
Great Pond	Powwow Pond	Wash Pond

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS - continued

Hornes Brook
Hill Brook
Hog Hill Brook
Hidden Valley Brook
Island Pond
Kelly Brook
Powwow River (Downstream Reach)
Powwow River (Upstream Reach)
Shields Brook
Shop Pond
Spicket River
Wash Pond Tributary
West Channel Policy Brook
Winnicut River
World End Brook
World End Pond

The 2005 countywide FIS also incorporated 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 3, "Letters of Map Change."

TABLE 3 - LETTERS OF MAP CHANGE

Community Name	Flooding Source(s)/ Project Identifier	Effective Date	Type
Portsmouth, City of	Pickering Brook/Ocean Road Development Corporation project	October 6, 1999	LOMR
Rye, Town of	Atlantic Ocean/Brown Property shore protection project	February 15, 2001	LOMR
Salem, Town of	West Channel Policy Brook/Powers Builders property	September 15, 1999	LOMR
Epping, Town of	Lamprey River/downstream of Prescott Road bridge	September 7, 1993	BADL

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Numerous flooding sources in the county were studied by approximate methods. 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 communities in Rockingham County.

For the 2005 countywide study, several areas of approximate flooding were extended in order to match the approximate flooding across community corporate limits within Rockingham County and across the county boundary from contiguous counties. The delineation involved the use of topographic maps at a scale of 1:24,000 and contour intervals of 10 and 20 feet (U.S. Department of Interior, 1966).

Three "Little Rivers" exist in Rockingham County. For clarification purposes, they have been renamed in the FIS as follows: Little River in the Town of Exeter is Little River No. 1; Little River in the Town of North Hampton is Little River No. 2; Little River in the Town of Plaistow is Little River No. 3. In addition, Tributary D in the Town of Londonderry has been renamed in the FIS as Tributary O to Beaver Brook.

2013 Coastal Study Update

The 2013 study consisted of revisions to the coastal and riverine analyses in 13 contiguous communities located in eastern Rockingham County. These communities include: Exeter, Greenland, Hampton, Hampton Falls, New Castle, Newfields, Newington, Newmarket, North Hampton, Portsmouth, Rye, Seabrook, and Stratham.

The work performed in these communities consisted of revisions as follows:

- New Atlantic coastal analysis
- Revised Zone AE studies on the Exeter and Lamprey Rivers
- Revisions due to updated topographic data on the Piscataqua River, Great Bay shoreline, Squamscott River, Little River No. 1 (in Exeter), Pickering Brook, Piscassic River, and the Winnicut River.
- Zone A basic studies replaced all existing Zone A streams.

The updated topographic data used for the 2013 study was based on LiDAR collected at a 2.0 meter nominal post spacing (2.0m GSD) for approximately 8,200 mi^2 of coastal areas including parts of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York, as part of the American Recovery and Reinvestment Act (ARRA) of 2009. The data was collected by Photo Science Inc. in May of 2011. No snow was on the ground and rivers were at or below normal levels. Some areas of the project required 1.0 meter nominal post spacing (1.0m GSD), and a required 9.25cm Vertical Accuracy. The study area was covered by 1.0 meter post spacing LiDAR data and a portion of the contributing drainage area was covered by the 2.0 meter post spacing LiDAR data. A seamless Digital Elevation Model (DEM) at a 10 ft resolution was created combining the above datasets to create a base elevation for the coastal analyses.

2.2 Community Description

Rockingham County is located in southeastern New Hampshire. In Rockingham County, there are 37 communities. The Towns of Northwood, Nottingham, and Deerfield are located in the northwestern section of the county. The Towns of Epping, Newmarket, and Newfields are located in the northern section of the county. In the eastern part of the county, lie the City of Portsmouth and the Towns of Newington, Greenland, New Castle, Stratham, Exeter, North Hampton, and Rye. The Seabrook Beach Village District and the Towns of Hampton, Hampton Falls, and Seabrook are located in the southeastern part of the county. The Towns of Brentwood and Fremont are located in the center of Rockingham County. In the southern section of the county lie the Towns of Sandown, Danville, Kingston, East Kingston, Kensington, Hampstead, Atkinson, Plaistow, Newton, and South Hampton. In the southwestern section of the county, the Towns of Derry, Londonderry, Windham, and Salem are located. The Towns of Candia, Raymond, Auburn, and Chester are located in the western part of Rockingham County.

Rockingham County is bordered to the north by communities of Strafford County: the Towns of Strafford, Barrington, Lee, Durham, and Dover. To the northeast, the county is bordered by communities of York County, Maine: the Towns of Kittery and Eliot. It is bordered to the northwest by communities of Merrimack County: the Towns of Pittsfield, Epsom, Allenstown, and Hooksett. Rockingham County is bordered to the southwest by communities of Hillsborough County: the City of Manchester and the Towns of Bedford, Merrimack, Litchfield, Hudson, and Pelham. To the south, the county is bordered by the communities of Essex County, Massachusetts: the Cities of Methuen and Haverhill and the Towns of Amesbury and Salisbury.

According to the U.S. Census Bureau, the population of Rockingham County was 295,223 in 2010.

The topography of the county is flat coastal plains to the east, gently rolling hills to the south and center of the county, and more hilly terrain to the northwest. The Atlantic coast is characterized by sandy beaches, rocky headlands, wetlands, and offshore reefs and ledges. The development in Rockingham County is primarily residential.

The climate of the county can be classified as modified continental. The average annual temperature is approximately 47 degrees Fahrenheit (U.S. Department of Commerce). The average rainfall of the county is 42 inches per year (FEMA, 1993).

The main flooding sources in Rockingham County are the Atlantic Ocean to the east, Exeter River in the east, Lamprey River in the center, Little Cohas Brook in the west, and Beaver Brook in the south.

2.3 Principal Flood Problems

Past history within the county indicates that major floods occur during the spring, fall, and winter seasons. Some of the most severe flooding occurs in early spring as a result of snowmelt and heavy rains in conjunction with ice dams. Less frequently, flooding occurs later in the year as a result of localized thunderstorms or hurricanes. The largest of these floods occurred in March 1896, March 1936, March 1977, January 1978, March 1983, April 1987, July 1934, March 1936, and April 1987. No estimate of peak flow was available for the 1896 flood, but the 1936, 1977, and 1987 flows were estimated at 5,490, 5,000, and 7,500 cfs, respectively.

Low-lying areas are subject to periodic flooding caused by overflows of the Lamprey River, Exeter River, and Squamscott River. The most severe flooding occurs in early spring as a result of snow melt and heavy rains. In the past, portions of Prescott Road along Lamprey River have flooded nearly every year. The 1989 replacement of the Prescott Road Bridge over the Lamprey River should help alleviate this condition. During the April 1987 flood, up to two feet of water covered portions of Harriman Hill Road. Old Manchester Road and Main Street were also affected by flooding of the Lamprey River in 1987.

The low-lying areas along the Atlantic coast are subject to the periodic flooding and wave attack that accompany northeasters and hurricanes. The majority of these storms cause damage only to low coastal roads, boats, and seawalls. Occasionally, a major storm accompanied by strong onshore winds and high tides results in surge and wave activity that cause extensive property damage and erosion. Some of the more significant storms include those of December 1909, December 1959, February 1972, and February 1978. The recurrence intervals for these storms were 160 years, 15 years, 10 years, and 70 years, respectively. Other significant storms occurred in the vicinity of North Hampton in November 1945, November 1963, November 1968, and November 1969. These storms damaged harbors, marinas, and commercial and residential developments along the flood-prone coastline (FEMA, City of Portsmouth, 1981). Other more recent noteworthy storms causing significant flooding in the area have included May 2006, April 2007, and March 2010.

During spring runoff periods, the Exeter River frequently flooded roads on the south side of the Town of Exeter, including Court Street, Crawford Avenue, and Portsmouth Avenue. A USGS surface-water discharge station was active on the Exeter River at the Haigh Road Bridge in Brentwood during a 1996 storm and recorded a peak discharge of 3,060 cfs. This event had a recurrence interval of approximately 100 years. Additional areas were flooded by the Exeter River, due to rainfall associated with hurricanes in 1938 and 1954. The area on the north side of the Exeter River in Tib's Grove is subject to occasional backwater flooding from Phillips dam in the Town of Brentwood.

The major portion of the Spicket River floodplain lies between the Arlington Mill Reservoir and the Massachusetts State line. Because of its flat gradient and the numerous swamps and lakes in the watershed, peak flows and stages on the Spicket River are a function of high-volume rainfall.

The middle reach of Policy Brook between Rockingham Park Boulevard and Pleasant Street is subject to periodic flooding due to its flat gradient and the many restrictions caused by inadequately sized pipes and culverts.

The Squamscott River periodically floods the Swasey Parkway and other low-lying areas during unusually high tides. In the past, within the Town of Greenland, little significant damage has occurred in these areas, however, due to the general absence of buildings and other structures.

Low-lying areas adjacent to Great Bay are subject to periodic flooding. Little significant damage occurs in these areas, however, due to the general absence of buildings and other structures.

Areas along Pickering Brook are subject to flooding. Present damage potential is slight due to absence of structures in affected marshes. However, future flood damage could be significant if development upstream of State Route 151 is allowed to lower the road elevation of 31 feet. This road crest is the emergency spillway necessary if debris clogs the only culvert through the dam-like road fill. The extensive upstream beaver action and by-products of urbanization could be sources of flood-creating debris.

Extensive flooding in the low-lying areas surrounding the Powwow Pond system occurred in March 1983. During the flood, elevations on Great Pond peaked at approximately 2 feet above the dam crest. According to records at the New Hampshire Department of Water Resources, this is the maximum recorded elevation for Great Pond.

Minor damage to Cuba Road frequently occurs due to flooding of the Piscassic River. This flooding usually occurs during March and April during spring rains and snowmelt. Floods occurring during other seasons are often associated with debris clogging culverts. Due to the natural and manmade hydraulic structures along the Piscassic River, and the number of beavers in the watershed, collection of debris generally compounds flooding.

Flooding problems have occurred in the past and may be expected to occur in the future at the undersized culvert at State Route 125 crossing of Kelly Brook. Such situations can create backwaters of depth sufficient to inundate extensive areas of land.

2.4 Flood Protection Measures

The State of New Hampshire provides concrete seawalls and stone revetments to protect coastal highways. The USACE built shoreline protection structures at Wallis Sands State Beach (U.S. Department of the Interior, 1962) and at Hampton Beach (New England River Basins Commission, 1980). The Town of Rye maintains a small portion of the waterfront barrier in the southern end of town. Other protective coastal structures were constructed and are maintained by the local municipalities and private property owners to satisfy their individual requirements and financial capabilities. These structures include such backshore protection as timber and steel sheet piles, bulkheads, stone revetments, concrete seawalls, and pre- cast concrete units (U.S. Army Corps of Engineers, 1971). Limited financial resources sometimes result in less than adequate protection.

A breakwater located in the Town of Rye that is maintained by the USACE provides some protection for Little Harbor. There are some small-scale protective structures maintained by private homeowners that satisfy individual requirements.

A protective breakwater is located on the north shore of the Hampton Harbor inlet. It extends approximately 1,000 feet southeast into the Atlantic Ocean and protects the mouth of both Hampton and Seabrook Harbors from wave action.

The Water Division of the New Hampshire Department of Environmental Services controls the Trickling Falls Dam at the outlet of Powwow Pond and the dam at the outlet of Great Pond. During the fall and early winter, flash boards are removed from these dams and the ponds are lowered to provide extra storage capacity for spring runoff. There are also extensive low-lying areas surrounding the Powwow Pond system. These areas provide natural storage that serves to reduce flood peaks.

Dams at the outlet of Powwow Pond and Great Pond in East Kingston provide some flood protection in areas upstream of South Hampton; however, the effect on peak discharge in South Hampton is not significant (U.S. Department of the Interior,1962). Likewise, the dam at Tuxbury Pond provides negligible flood protection.

In the Town of Stratham, zoning has been established to prevent development within 150 feet of the Squamscott River and 100 feet of major freshwater streams.

There is a levee separating sewage treatment plant stabilization lagoons from the Squamscott River. FEMA specifies that all levees must have a minimum of 3 feet freeboard against 100-year flooding to be considered a safe flood protection structure. The levee has a nominal crest elevation of 14 feet, yielding a 6-foot freeboard which meets FEMA freeboard requirements. There are also several small dams within the town. However, they do not significantly alter flood flows.

The numerous swampy areas and small ponds within Rockingham County provide natural storage that serves to reduce flood peaks.

Newmarket has no existing or proposed flood control structures. During extreme flood events, floodwaters from the Lamprey River overflow State Route 108 upstream in Durham and are diverted into the Oyster River basin. These overflows or diversions reduce peak flood discharges of the Lamprey River before it reaches the Town of Newmarket. During a 100-year flood, diversions to the Oyster River basin reduce flood peaks in Newmarket by approximately 20 percent (FEMA, 1991).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year 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 which equals or exceeds the 100-year flood (1-percent chance of annual exceedance) in any 50-year period is approximately 40 percent (4 in 10), and, 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 county at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Riverine Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding sources studied in detail affecting the county.

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

Pre-countywide Analyses

Discharge-frequency data for the flooding sources studied by detailed methods were determined from equations based on multiple-regression analyses of data from USGS gaged sites in New Hampshire and adjacent areas of bordering states (U.S. Department of the Interior, 1978). The equations contain the independent variables basin drainage area, main-channel slope, and a precipitation intensity index.

No stream gages have been operated in the Powwow River Basin. To calculate the 100-year frequency flood discharges, three separate reports were consulted (U.S. Department of the Interior, 1975; U.S. Department of the Interior, 1978; and U.S.Department of the Interior, 1983). The three reports document techniques that can be used to estimate flood peaks on rural basins in Maine, New Hampshire, and Massachusetts. In each of the reports, regression equations were used to relate flood-peak discharges to basin characteristics such as drainage area, stream slope, basin storage, and precipitation. The Powwow River basin is located near coastal New Hampshire in an area close to both Massachusetts and Maine. Data from this portion of New Hampshire was included in each of three studies and as a result, information from all of the reports could be appropriate for use.

Flood discharges were computed using equations from each of the three reports and the results were carefully reviewed. Analysis indicated that use of the equation documented in the report for Massachusetts would be most appropriate (U.S. Department of the Interior, 1983). The Massachusetts report is the most current of the three and it used a larger data base. Most importantly, the area studied in the report was divided into three separate regions and regression equations were calculated for each. One of the three zones was the eastern or coastal area, the region in which the Powwow River basin is located. Regression equations developed for the eastern region were specific to the coastal type of watershed. The Massachusetts equations have also been used in two other studies in the Powwow River basin: East Kingston, New Hampshire, and Amesbury, Massachusetts (FEMA, April 1986; FEMA, 1982).

Due to the excessive amount of natural storage in the Powwow Pond system, adjustment of the peak discharge was required. Using techniques documented in a USGS report, a basin lag time and an inflow hydrograph were computed with a peak discharge of 1,240 cfs (U.S. Department of the Interior, 1983). The resultant hydrograph was routed through the Powwow Pond system using the Modified Puis Method (Linsley, R. K., et al., 1982). The Modified Puis method is based on a form of the continuity equation in which for any time period, average inflow less average outflow equals change in storage within the system. Based on this analysis, the resultant 100-year frequency outflow from Powwow Pond is 850 cfs. Drainage area ratios were used to compute 100-year frequency peak discharges at alternate points in the Powwow Pond system as a function of the outflow from Powwow Pond.

Due to the absence of gaged data, the principal source of data for defining discharge-frequency relationships for all detailed streams in Windham (Beaver Brook, Golden Brook, Flatrock Brook, and Hidden Valley Brook) was regional discharge-frequency equations developed by Manuel Benson. These regional equations relate topographical and precipitation characteristics to streamflow (U.S. Department of the Interior, 1962).

The Squamscott River, Exeter River, Little River No. 1, Little River No. 2, and Winnicut River are ungaged. The 10-, 50-, and 100-year discharges were based on regional peak discharge and frequency formulas developed by the USGS (U.S. Department of the Interior, 1978). A separate evaluation of these formulas was performed and found to be applicable to the Exeter region. In addition, the formulas were expanded and an equation was developed to predict the 500-year discharge. The USGS formulas predict discharges based on the parameters of watershed drainage area, main channel slope, and rainfall intensity.

Hydrologic analysis of the 100-year flood was performed for Dudley Brook. Discharge for the 100-year flood was based on a U.S. Water Resources Council log- Pearson Type Ill frequency analysis of gage data at the USGS gage no. 01073600 on Dudley Brook near the Town of Exeter, which has 23 years of record (1962 -1985) and a drainage area of 12.1 square miles (U.S. Water Resources Council, 1976). Discharges from the gage analysis were transferred to stream stations removed from the gage by the formula:

$$Q / Qg = (A/Ag)^{0.75}$$

Where Q is the discharge at the different specific site locations, Qg is the discharge at the USGS stream gage, and A and Ag are the drainage areas at the specific site and at the USGS stream gage, respectively.

Discharges for the Little River No. 3, Kelly Brook, and Bryant Brook were developed by combining the results of regional flood frequency equations with discharge values transposed from gaged basins in the region, which are similar in size and characteristics, to those studied. The regional equations, developed from regression analysis of gaging records for eastern Massachusetts using basin parameters to estimate flood peaks, were applied at several points along each stream (U.S. Geological Survey, 1977). USGS gage no. 0107300 on the Oyster River in Durham was used to transpose discharges to the Little River No.3. This gage has a period of record of 43 years and a drainage area of 12.1 square miles. The USGS gage no. 01073600 on Dudley Brook near Exeter was used to transpose discharges to Kelly Brook and Bryant Brook. The transposition was carried out using the formula as shown above.

The principal sources of data for defining discharge-frequency relationships for detailed study streams in Londonderry (Beaver Brook, Black Brook, Cohas Brook, Little Cohas Brook, Nesenkeag Brook, Shields Brook, Tributary C to Beaver Brook, Tributary E to Little Cohas Brook, Tributary H to Nesenkeag Brook, Tributary J to Black Brook, Tributary 0 to Beaver Brook, and Upper Beaver Brook) were the regional equations developed by Manuel Benson of the USGS. These regional equations relate topographical and precipitation characteristics to stream flow (U.S. Department of the Interior, 1962).

Discharges for Hidden Valley Brook were derived by comparing values predicted by regional equations and discharge-frequency relationships based on a log-Pearson Type III analysis (U.S. Water Resources Council, 1976) for the gages in the vicinity on Stony Brook (USGS Gage No. 093800) and on Dudley Brook (USGS Gage No. 073600) (U.S. Department of the Interior, 1976).

Discharge-frequency data for Hog Hill Brook, Wash Pond Tributary, Hill Brook, Wash Pond, and Shop Pond were determined from equations based on multiple- regression analyses of data from USGS gaged sites in New Hampshire and adjacent areas bordering states (U.S. Department of the Interior, 1978). The equations contain the independent variable basin drainage area, main-channel slope, and a precipitation intensity index.

Discharge values for the Exeter River in the Town of Brentwood were obtained from the previous FISs for the Towns of Brentwood and Exeter (FEMA, 1980; FEMA, May 1982). Peak discharges for the Exeter River were obtained from the Town of Exeter FIS, enacted on November 17, 1981, and were based on regional peak discharge and frequency formulas developed by the

USGS and expanded to predict the 500-year discharge (U.S. Department of the Interior, 1978). Peak discharges for the Exeter River obtained from the original FIS for the Town of Brentwood were based on a flow rate per unit area relationship with a USGS surface-water discharge station on the Lamprey River (FEMA, 1981).

For the Exeter River in the Town of Raymond, only the peak 100-year return period discharge was computed. The peak discharge at the Blueberry Hill Road bridge was available from NHDOT (U.S. Department of the Interior, 1962). The value was computed using regionally developed peak flows for more frequent storms in combination with a methodology involving a probability distribution to produce the 100-year peak discharge. The peak 100-year discharge computed by Rivers Engineering Corporation using methodology used as part of the FISs for other New Hampshire communities was not significantly different from the value computed by the NHDOT (U.S. Water Resources Council, 1977). The NHDOT value was adjusted to other location on the Exeter River based on the ratio of the drainage areas.

Gaging stations on the Lamprey River, located approximately 9 miles north of the Exeter River, and on Dudley Brook, a tributary of the Exeter River, were the principal sources of data for determining discharge-frequency relationships for the Exeter River in the Town of Fremont. The gages have been in operation since 1934 and 1962, respectively. Values for the 10-, 50-, 100-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data.

Flows for the various frequencies were transformed to a flow rate per unit area and plotted versus drainage area on log-log paper. A straight line was drawn through the pairs of flow-drainage area coordinates computed for the gages. Flows for drainage areas of the Exeter River at various locations in Fremont were taken from the plot.

A check on the procedure described above was made at the Fremont-Brentwood corporate limits by application of regional relationships developed in USGS Water-Supply Paper 1580-B and Water Resources Investigations 78-47 (U.S. Department of the Interior, 1962; U.S. Department of the Interior, 1978). The regression analyses developed in these reports relate peak discharge to drainage area, channel slope and rainfall intensity. The method in Water-Supply Paper 1580-B also considers indices for surface water area, January temperature, and orographic effect.

Since the Piscassic River is ungaged, discharge-frequency data for this flooding source was developed using the USGS Water Resources Investigation Report, WRI 78-47, a synthetic runoff procedure that relies on regionalized climatological data coupled with the individual stream physical characteristics for input (U.S. Department of the Interior, 1978).

For Beaver Brook, Cunningham Brook, Drew Brook, Taylor Brook, Tributary E to Beaver Lake, Tributary F to Beaver Lake, Tributary G to Beaver Lake, Tributary H to Drew Brook, and Tributary O to Beaver Brook, the principal source of data for defining discharge-frequency relationships was the regional discharge-frequency equations developed by the USGS (U.S. Department of the Interior, 1962). These regional equations relate topographical and precipitation characteristics to streamflow. Due to the extensive upstream channel and pond storage and flatter slopes, discharges for the Homes Brook-Shields Brook watershed were derived using a regional discharge-frequency equation based on streams with similar characteristics (U.S. Department of the Interior, 1974).

Discharges for Beaver Brook were modified due to the storage effects of Beaver Lake. Golden Brook was modified due to the storage effects of Cobbetts Pond and Moeckel (Simpson)-Rock Ponds. Taylor Brook was modified due to the storage effects of Ballard Pond. A reservoir routing using a numerical iteration method (Viessman, Warren J., et al., 1972) was performed on Beaver Lake and Island Pond. The results of this routing were used to adjust the discharges of Beaver Brook and Taylor Brook and to establish the water-surface elevations of Beaver Lake for the 10-, 50-, 100-, and 500-year floods. The results of the reservoir routing performed on Cobbetts Pond were used in conjunction with the results of Benson's equation to adjust the discharges of Golden Brook between Tributary C and Moeckel (Simpson)-Pond. Below Moeckel (Simpson) Pond, the discharges were adjusted using the results of the reservoir routing performed on Moeckel (Simpson)-Rock Ponds.

The principal source of data for defining the discharge-frequency relationships for the Lamprey River was the USGS gaging station located in Durham, which had been operating since 1934. Values of the 10-, 50-, 100-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data (U.S. Department of the Interior, 1967).

Discharge-frequency estimates for areas above the stream gage were developed using a regional relationship developed in a USGS report (U.S. Department of Agriculture, 1979). The regression analysis developed in this report relates peak discharge to drainage area, channel slope, rainfall intensity, surface storage, January temperature, and orographic influences. The flow estimates developed by the USGS were estimated by multiplying the ratio of discharge based on gage data to that based on the USGS method for the gaged area time the discharge developed by the USGS at locations within Raymond.

Flood flows for the Lamprey River were determined by using regional equations for peak discharges applicable to the area (Southeastern New Hampshire Regional Planning Commission, 1974). This method combines basin and climatic characteristics through specific regression equations to yield discharges for the 10-, 50-, and 100-year floods. Peak discharges for the 500-year return period storm were based on an equation developed as an extension of the methodology developed by the USGS and used for prediction of the peak 500-year return period discharge as part of the FISs for other New Hampshire communities

(U.S. Water Resources Council, 1977; Southeastern New Hampshire Regional Planning Commission, 1974). Peak flows computed by use of the regional equations were determined to be more appropriate for the Lamprey River in Raymond than a transposition of peak flows computed at the gaging station downstream in Durham. As described below, the transposition of flows from the gage produced peak flows in Raymond that did not adequately reflect the magnitude of flooding experienced by the community.

There are no continuous records of discharges on the Spicket River. A peak discharge for the March 1968 flood was computed and reported by the USGS for the Spicket River at a dam located approximately 1.5 miles below the Salem, New Hampshire-Methuen, Massachusetts, town line. A peak discharge of 1,440 cubic feet per second (cfs) was computed at this site, which has a total drainage area of 73.8 square miles.

A gaged stream in the region with similar hydrologic characteristics is the Parker River, located approximately 15 miles southeast of Salem. This river has 30 years of discharge records for a contributing watershed of 21.6 square miles. Discharge frequencies for the Spicket River were estimated using peak discharge frequency data for the Parker River. Frequencies for the Parker River were developed from historical flow data using the log-Pearson Type Ill statistical distribution (U.S. Water Resources Council, 1976, Bulletin 15). The frequencies for the Spicket River were then developed by multiplying the Parker River flows by the ratio of the known 1968 peak discharges on both streams. Discharges at other locations along the Spicket River were derived by multiplying the adopted discharges at the dam in Methuen by a factor equal to the ratio of the drainage areas to the 0.7 exponential power.

Over the years, Policy Brook has been modified by the installation of two long conduits under and adjacent to Rockingham Park. Conduit A extends from just upstream of Pleasant Street to just above the brook's second crossing of the Boston and Maine Railroad and State Route 28. It passes under the horse barn area of the race track. Conduit B and an excavated section of open ditch run along the railroad and bypass the second railroad/State Route 28 crossing. This bypass was installed to reduce the flooding of a mobile home park just to the east of State Route 28.

The installation of the bypass results in Policy Brook having two channels, an East Channel and a West Channel in this area. The West Channel (conduit-ditch) carries all of the flows from upper Policy Brook during non-flood periods as the second railroad/State Route 28 crossing has been partially blocked.

Flood discharges for the lower reaches of Policy Brook, its East Channel, and Unnamed Brook were developed by estimating the mean annual peak flows based on an appraisal of existing culvert size on the streams and the sluggish hydrologic character of the watersheds. Rarer flood flows for the brooks were determined as multiples of the mean annual flows by use of the "Bigwood-Thomas" type flood formula as well as by rainfall frequency comparisons (U.S. Geological Survey,1955). Both the Technical Release No. 20 (TR-20) and the Technical Release No. 55 (TR-55) models were used to develop the 100-year flood discharges at various points in the watershed (U.S. Department of Agriculture, 1992; U.S. Department of Agriculture, 1986). TR-20 is a synthetic rainfall runoff procedure that relies on regionalized climatological data coupled with the individual stream physical characteristics for input (U.S. Department of Agriculture, 1983). Drainage areas, land uses and times of concentration were computed using USGS quadrangle coverage. A rainfall of 6.5 inches in a 24-hour period was used to produce the unit hydrographs.

The peak discharge for the April 1987 flood at the USGS gage at Packers Falls was 7,500 cfs. The 100-year flood discharge at the gage was determined in Section 3.1 to be 7,300 cfs. The 1987 flood was therefore slightly greater than the 100-year flood. Peak flood elevations that occurred during the 1987 flood were identified and surveyed in the field by the study contractor. The 100-year profile for Lamprey was based on these elevations and data available for Durham (FEMA, 1991).

A TR-55 analysis was used to develop discharges on Porcupine Brook and Porcupine Brook Tributary.

For the analysis of the West Channel and the upper reaches of Policy Brook, temporary flood storage in Canobie Lake, in the large, flat area between Pleasant Street and South Policy Road and in Rockingham Park at the outlet of Conduit A were included in the TR-20 model. The area above Pleasant Street, because of its size and the limited capacity of Conduit A, is especially effective in reducing flood flows.

Since Pickering Brook is not gaged, discharge-frequency data for this stream were developed using TR-20.

For World End Pond, both the outlet channel and the constricted downstream road crossings (Lawrence Road and Farm Road) were modeled. For the 100-year flood, the road crossings were found to control the upstream water levels and these stage discharge relationships were used in the TR-20 model.

Only the 100-year flood elevations have been determined for stillwater elevations for Wash Pond, Country Pond, Great Pond, Piscataqua River, World End Pond, and Shop Pond. No adjustments to computed "Stillwater Elevations" were made to account for changes in storage in Wash Pond and Shop Pond. These changes in storage were considered insignificant.

Discharges for approximate study streams were also developed using Manuel Benson's regional discharge-frequency equations (U.S. Department of the Interior, 1962).

2005 Countywide Analyses

No hydrologic analyses were conducted for the 2005 countywide study.

2013 Coastal Study Update

For this countywide study (2013), hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by approximate methods in the communities studied, and for the flooding sources studied in detail affecting the towns of Exeter and Newmarket. Discharges for the 1-percent-annual-chance recurrence interval for all approximate study streams in these communities were determined using regression equations found in Olson, S.A., 2009, Estimation of flood discharges at selected recurrence intervals for streams in New Hampshire, U.S. Geological Survey Scientific Investigations Report 2008-5206.

Hydrologic analyses for the Lamprey River (Newmarket, NH) was based on a log-Pearson Type III frequency analysis of the stream gage data at the USGS stream gage no. 01073500 at Packers Falls at Durham, NH which has 77 years of record (1934 – 2011) and a drainage area of 185 square miles. Based on a recently completed Lamprey River watershed study at the University of New Hampshire (Scholz, 2011), it was assumed that 20% of Lamprey River flood flow is diverted to the Oyster River watershed via La Roche and Longmarsh Brooks.

Discharges from the stream gage analysis were transferred to stream locations removed from the stream gage by the formula:

$$Q/Q_g = (A/A_g)^{1.0}$$

Where Q is the discharge at the different specific site location, Q_g is the discharge at the USGS stream gage, and A and A_g are the drainage areas at the specific site and at the USGS stream gage, respectively.

Hydrologic analyses for the Exeter River (Exeter, NH) was based on a log-Pearson Type III frequency analysis of the stream gage data at the USGS stream gage no. 01073587 at Haigh Road near Brentwood, NH which has 15 years of record (1996-2011) and a drainage area of 63.5 square miles. The Exeter River stream gage record was extended with the Lamprey River Packers Falls stream gage (no. 01073500) data from 1934 to 1996 using the Line of Organic Correlation method. Discharges from the stream gage analysis were transferred to stream locations removed from the stream gage by the formula:

$$Q/Q_g = (A/A_g)^{0.75}$$

Where Q is the discharge at the different specific site location, Q_g is the discharge at the USGS stream gage, and A and A_g are the drainage areas at the specific site and at the USGS stream gage, respectively.

A summary of the drainage area-peak discharge relationships for all of the streams studied by detailed methods is shown in Table 4, "Summary of Discharges."

TABLE 4 - SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
BEAVER BROOK					
At Pelham-Windham corporate limits	51.0	1,500	2,560	3,180	4,930
At Pelham-Windham-Hudson corporate limits	48.6	1,450	2,470	3,070	4,750
Downstream of Robinson Pond Brook	48.3	1,400	2,430	3,010	4,670
Upstream of Robinson Pond Brook	45.0	1,310	2,360	2,900	4,490
At Londonderry-Windham-Hudson corporate limits	44.2	1,200	2,120	2,800	4,150
At confluence with Black Brook	38.3	1,040	2,100	2,580	4,050
Upstream of Tributary C to Beaver Brook near Station 20.5	32.7	860	1,760	2,160	3,600
From upstream of Tributary C to Beaver Brook in Londonderry to downstream of Tributary O to Beaver in Derry[1]	32.7[2]	800	1,660	2,050	3,500
From upstream of Tributary O to Beaver Brook to downstream of Hornes Brook[1]	24.3[2]	750	1,520	1,860	3,300
At Londonderry-Windham-Derry corporate limits	27.0	720	1,510	1,860	3,300
From upstream of Hornes Brook to downstream of Tributary G to Beaver Brook[1]	17.5[2]	400	1,150	1,440	2,880
At Londonderry-Derry corporate limits	26.3	720	1,510	1,860	3,300
From upstream of Tributary G to Beaver Brook to downstream of Tributary B to Beaver Brook	12.5[2]	130	510	650	1,410

[1]Reach Discharge

[2]Drainage area at downstream limit of reach

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
BEAVER BROOK (continued)					
From upstream of Tributary B to Beaver Brook to 650 feet downstream of outlet of Beaver Lake[1]	12.0[2]	65	380	430	960
At outlet of Beaver Lake	11.2	32	240	320	730
BLACK BROOK					
At mouth	5.6	185	345	425	830
At Adams Road	2.0	20	60	90	290
BRYANT BROOK					
Downstream limit of detailed study	3.9	175	290	355	550
COHAS BROOK					
At Londonderry-Manchester corporate limits	12.3	410	760	990	1,550
CUNNINGHAM BROOK					
At confluence with Leavitt and Drew Brooks	3.4	245	630	775	1,540
At confluence with Tributary H to Nesenkeag Brook	2.0	145	390	480	1,000
At Hampstead Road	1.1	75	215	260	560
DUDLEY BROOK					
At eastern corporate limits of town of Brentwood	6.1	*	*	589	*
At USGS gaging station 01073600	5.0	*	*	506	*
DREW BROOK					
From Island Pond to confluence of Leavitt and Cunningham Brooks[1]	5.0[2]	115	285	350	700
EXETER RIVER					
Downstream of the confluence of Little River No. 1	114.6	2,811	4,107	4,827	6,518

[1]Reach Discharge

[2]Drainage area at downstream limit of reach

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
EXETER RIVER (continued)					
Upstream of the confluence of Little River No. 1	100.8	2,453	3,589	4,219	5,704
Upstream of confluence of Great Brook	89.9	2,173	3,183	3,741	5,064
At eastern corporate limits of the Town of Brentwood	73.0	1,990	2,880	3,280	4,230
At Haigh Road	64.0	1,810	2,640	3,010	3,900
At eastern corporate limits of the Town of Fremont	60.0	1,740	2,520	2,880	3,750
At downstream corporate limits of the Town of Raymond	49.6	*	*	2,700	*
At Blueberry Hill Road bridge	46.8	*	*	2,550	*
At upstream corporate limits of the Town of Raymond	37.1	*	*	2,020	*
EXETER RIVER (TOWN OF EXETER)					
At High St. Bridge	107	2,910	4,740	5,690	8,350
At confluence with Little River	107	2,905	4,730	5,670	8,330
At confluence with Great Brook	87.8	2,510	4,080	4,890	7,190
At Linden St. Bridge	75.7	2,240	3,650	4,370	6,430
At confluence with Perkins Brook	75.3	2,230	3,630	4,360	6,410
At Pickpocket Dam	74.1	2,210	3,590	4,310	6,330
At USGS Stream Gage No. 01073587	63.5	1,970	3,200	3,830	5,630
FLATROCK BROOK					
At inlet to Shadow Lake	7.3	270	640	760	1,450
Downstream of tributary near Station 0.9	6.9	220	540	640	1,230
Upstream of tributary near Station 0.9	5.9	190	460	550	1,030
At outlet to Seavey Pond	5.3	170	420	495	960
GOLDEN BROOK					
At outlet to Moeckel (Simpson)-Rock Ponds	11.5	100	550	750	1,490

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
GOLDEN BROOK (continued)					
At inlet to Moeckel (Simpson)-Rock Ponds	10.5	340	805	960	1,700
At downstream confluence with Tributary B	5.9	273	665	791	1,400
At upstream confluence with Tributary B	3.1	142	369	439	860
At downstream confluence with Tributary A	2.4	103	273	325	630
GRASSY BROOK					
At confluence with Powwow River	1.67	*	*	198	*
HIDDEN VALLEY BROOK					
At confluence with Beaver Brook	2.5	150	270	325	540
At culvert near station 1.0	1.9	120	220	260	430
At Londonderry Road culvert	1.1	75	135	165	275
HILL BROOK					
At State Route 111	1.52	*	*	120	*
HOG HILL BROOK					
At Haverhill Road	8.38	*	*	680	*
At Kathi Lane	5.52	*	*	410	*
At Island Pond Road in the Town of Atkinson	4.75	*	*	380	*
HORNES BROOK					
From Beaver Brook to Hornes Pond[1]	6.82	260	313	368	500
KELLY BROOK					
Downstream limit of detailed study	4.9	285	405	495	735

[1]Reach Discharge

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
LAMPREY RIVER					
At MacCallen Dam**	212	4,320	7,320	8,920	13,600
At USGS Gage No. 01073500	185	4,720	7,990	9,740	14,900
LITTLE COHAS BROOK					
At Industrial Road	6.70	190	365	480	770
At Harvey Road	6.30	150	310	385	540
At Litchfield Road	1.00	70	135	170	275
LITTLE RIVER NO. 1					
At the confluence with the Exeter River	13.9	345	528	624	874
LITTLE RIVER NO. 2					
At Ocean Boulevard	4.67	118	189	226	330
LITTLE RIVER NO. 3					
Downstream limit of detailed study near Atkinson Depot Road	20.8	660	1,065	1,275	1,865
Upstream of Bryant Brook	17.1	560	900	1,075	1,585
Upstream of Seaver Brook	12.2	415	665	795	1,175
Upstream of Kelly Brook	7.0	255	405	485	715
At Plaistow-Kingston corporate limits	4.2	175	280	335	495
NESENKEAG BROOK					
At Londonderry-Litchfield corporate limits	6.90	380	720	870	1,390
At confluence with Tributary H to Nesenkeag Brook	4.80	260	500	625	1,000
PICKERING BROOK					
At Portsmouth Avenue (State Route 151)	2.45	39	48	53	62
At access road	0.80	*	*	86.54	*
PISCASSIC RIVER					
At Ice Pond	13.8	312	480	560	760

*Data not available

**Due to diversion to Oyster River

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
PISCASSIC RIVER (continued)					
At Cuba Road	9.0	206	318	371	503
POLICY BROOK					
At Rockingham Park Inlet	5.9	350	550	660	880
At State Route 28	5.2	250	390	460	620
At a point approximately 2,000 feet above State Route 28	5.0	180	290	330	440
At a point approximately 700 feet below Main Street	4.8	100	190	210	260
UNNAMED BROOK					
At the State Route 97 bridge	0.7	70	100	120	170
PORCUPINE BROOK					
At Interstate Route 93	3.1	*	*	650	*
At Old Causeway	2.2	*	*	450	*
PORCUPINE BROOK TRIBUTARY					
At Quill Lane	0.8	*	*	210	*
POWWOW RIVER					
At Lake Gardiner Dam in Amesbury, Massachusetts	49.1	*	*	1,720	*
Downstream reach at corporate limits near Lake Gardiner	48.3	*	*	1,700	*
At Tuxbury Pond Dam in Amesbury, Massachusetts	45.9	*	*	1,640	*
Upstream reach at corporate limits in Tuxbury Pond	41.4	*	*	1,540	*
SHIELDS BROOK					
From Hornes Pond to first crossing (looking upstream) of Derry-Londonderry corporate limits[1]	6.7[2]	260	313	368	500

[1]Reach Discharge

[2]Drainage area at downstream limit of reach

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
SHIELDS BROOK (continued)					
At first Londonderry-Derry corporate limits (looking upstream)	5.2	190	465	575	1,000
From first crossing (looking upstream) of Derry-Londonderry corporate limits to second crossing (looking upstream) of Derry-Londonderry corporate limits	5.2[2]	146	234	276	362
At confluence of Upper Beaver Brook	4.6	160	405	500	880
At second Londonderry-Derry corporate limits (looking upstream)	2.2	75	200	250	450
From second crossing (looking upstream) of Derry-Londonderry corporate limits to upstream study limit[1]	2.22	84	127	146	200
SHOP POND					
At outlet	2.52	*	*	150	*
SPICKET RIVER					
At Hampshire Road	61.6	900	1,600	1,900	2,900
At Town Farm Road	47.9	800	1,300	1,600	2,400
At the confluence of Providence Hill Brook	40.0	700	1,200	1,400	2,100
At Arlington Mill Reservoir	26.8	350	650	750	1,100
TAYLOR BROOK					
At Island Pond	5.3	75	365	525	1,345
At outlet to Ballard Pond	4.6	10	200[3]	320[3]	960[3]
At inlet to Ballard Pond	3.4	320	820	1,005	2,000
At confluence with Tributary J to Beaver Brook	2.5	210	560	690	1,400

[1]Reach Discharge

[2]Drainage area at downstream limit of reach

[3]Discharges reduced due to Ballard Pond Storage

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
THE POWWOW POND SYSTEM					
At Powwow Pond/Powwow River outlet	29.6	*	*	850	*
At Country Pond outlet	14.2	*	*	410	*
At Great Pond outlet	9.96	*	*	290	*
TRIBUTARY C TO BEAVER BROOK					
At mouth	2.8	185	365	450	740
At Chester Road	2.3	120	235	310	490
TRIBUTARY D					
At Londonderry-Derry corporate limits	1.5	70	200	245	520
TRIBUTARY E TO BEAVER LAKE					
At mouth	2.8	190	350	435	700
At Chester Road	1.6	125	235	290	470
TRIBUTARY E TO LITTLE COHAS BROOK					
At Beaver Lake	1.4	110	310	385	820
At Tsienneto Road	1.3	105	295	365	760
TRIBUTARY F TO BEAVER LAKE					
At Beaver Lake	7.2	250	590	725	1,350
At outlet to Adams Pond	6.0	195	475	585	1,150
TRIBUTARY G TO BEAVER BROOK					
At confluence with Beaver Brook	3.6	245	625	770	1,500
Downstream of confluence with West Running Brook	3.5	210	540	660	1,290
Upstream of confluence with West Running Brook	2.1	180	495	610	1,250
At Windham Road	1.3	120	335	410	900

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
TRIBUTARY H TO DREW LAKE					
At mouth	2.5	155	310	390	640
TRIBUTARY H TO NESENKEAG BROOK					
At confluence with Drew Brook	1.4	110	305	375	795
Approximately 1,000 feet upstream of Hampstead Road	1.0	25	40	120	150
TRIBUTARY J TO BLACK BROOK					
At mouth	1.6	110	140	180	285
TRIBUTARY O TO BEAVER BROOK					
At confluence with Beaver Brook	1.7	75	205	255	535
At Derry-Londonderry corporate limits	1.5	70	200	245	520
UPPER BEAVER BROOK					
At mouth	2.0	65	160	215	430
WASH POND					
At outlet	2.42	*	*	150	*
WASH POND TRIBUTARY					
At confluence with Wash Pond	1.03	*	*	62	*
At Kent Farm Road	0.9	*	*	54	*
WEST CHANNEL POLICY BROOK					
At Pleasant Street	2.8	*	*	200	*
At Pelham Road	2.5	*	*	380	*
WINNICUT RIVER					
At the downstream corporate limits of town of North Hampton	5.97	113	168	198	275

* Data not available

The stillwater elevations for the 100-year flood have been determined for all detailed studied ponds and tidal areas and are summarized in Table 5, "Summary of Stillwater Elevations." For a description of the methodologies used to compute these elevations, please refer to Section 3.2, Riverine Hydraulic Analyses, in this text.

TABLE 5 - SUMMARY OF STILLWATER ELEVATIONS

Flooding Source and Location	Elevation (feet NGVD[1], NAVD[2])			
	10-Year	50-Year	100-Year	500-Year
ADAMS POND				
At Derry	326.0[1]	327.1[1]	327.3[1]	328.1[1]
ATLANTIC OCEAN				
Entire shoreline from New Castle to Seabrook	7.24[2]	7.98[2]	8.36[2]	9.43[2]
BEAVER LAKE				
At Derry	287.9[1]	289.3[1]	289.6[1]	294.0[1]
COUNTRY POND				
Entire shoreline within Kingston	*	*	120.8[1]	*
GREAT BAY				
Entire shoreline of the Squamscott River within the Exeter corporate limits to a point approximately 370 feet downstream of Chestnut Hill Avenue	6.4[2]	6.9[2]	7.2[2]	7.7[2]
Entire shoreline within Greenland and Newington, and the entire shoreline of Great Bay and Lamprey River downstream of MacCallen Dam in Newmarket	5.7[2]	6.3[2]	6.5[2]	7.1[2]
Entire shoreline of the Squamscott River within Newfields, and the entire shoreline with Stratham	6.2[2]	6.8[2]	7.0[2]	7.5[2]
GREAT POND				
Entire shoreline within Kingston	*	*	121.8[1]	*
ISLAND POND				
At the Towns of Derry and Atkinson's corporate limits, in Derry, and the entire shoreline within Hampstead	205.5[1]	206.4[1]	206.8[1]	208.2[1]
LOWER BALLARD POND				
At Derry	251.5[1]	253.6[1]	254.6[1]	256.2[1]

[1]National Geodetic Vertical Datum of 1929
[2]North American Vertical Datum of 1988
*Data Not Available

TABLE 5 - SUMMARY OF STILLWATER ELEVATIONS – continued

Flooding Source and Location	Elevation (feet NGVD[1], NAVD[2])			
	10-Year	50-Year	100-Year	500-Year
LOWER BEAVER LAKE				
At Derry	287.9[1]	288.9[1]	289.2[1]	290.0[1]
PISCATAQUA RIVER				
At Newington	*	*	8.3[2]	*
POWWOW POND/POWWOW RIVER				
Upstream of New Boston Road	*	*	120.8[1]	*
Upstream of Boston & Maine Railroad bridge	*	*	119.1[1]	*
Downstream of Boston & Maine Railroad bridge	*	*	118.2[1]	*
SEAVEY POND				
At Windham	*	*	248.6[1]	*
SHOP POND				
Entire shoreline within Hampstead	*	*	232.4[1]	*
SQUAMSCOTT RIVER				
Entire length within Stratham	6.2[2]	6.8[2]	7.0[2]	7.5[2]
TUXBURY POND				
Entire shoreline	*	*	100.2[1]	*
UPPER BALLARD POND				
At Derry	253.7[1]	255.5[1]	258.4[1]	259.2[1]
WASH POND				
Entire shoreline within Hampstead	*	*	234.8[1]	*
WORLD END BROOK AND POND				
At Lawrence Road in Salem	*	*	117.0[1]	*

[1]National Geodetic Vertical Datum of 1929
[2]North American Vertical Datum of 1988
*Data Not Available

3.2 Riverine Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source 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 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. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

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 (Exhibit 2).

On detailed study streams, all bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

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

Precountywide Analyses

Cross sections and geometry of hydraulic structures were obtained from field surveys conducted during the 1990 field season by the study contractor. Cross-section extensions were based on information contained on USGS topographic maps (U.S. Department of the Interior, 1985, et cetera; U.S. Department of the Interior, 1981)

.

For the Town of Raymond FIS report dated April 15, 1992, cross sections for the Exeter and Lamprey Rivers were obtained from field surveys and interpolation from USGS topographic maps (U.S. Department of the Interior, September 1981). Elevation data and structural geometry for bridges and culverts on both rivers were obtained from a combination of record drawings and field survey. The Prescott Road bridge at the downstream end of the Lamprey River in the Town of Raymond was under construction at the time the revised hydraulic analyses were performed. For this reason, drawings issued for construction were used to obtain hydraulic data for this bridge.

The portions of the cross sections within the limits of the channel were obtained by field survey by Kenneth A. LeClair Associates (Kenneth A. LeClair Associates, 1978). Overbank cross-sectional data were read from topographic maps at a scale of 1:2,400 (State of New Hampshire, 1970). Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Where plans were unavailable or out-of-date, bridges were also surveyed.

Cross sections for the backwater analyses of the detailed study streams were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also surveyed.

For Hog Hill Brook, cross sections and geometry of hydraulic structures were obtained from field surveys conducted during the 1988 field season by the USGS. Cross-section extensions and basin characteristics were based on information contained on USGS topographic maps at a scale of 1:25,000 and 1:24,000 with contour intervals of 3 meters and 10 feet (U.S. Department of the Interior, 1985, et cetera). For Island Pond and Bryant Brook, cross sections for the backwater analyses were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures in developed areas. In long reaches between structures, appropriate valley cross sections were also surveyed.

Cross-section data for the Spicket River were taken from a USACE floodplain report (U.S. Army Corps of Engineers, 1975). For Policy Brook and Unnamed Brook, cross-section data were obtained by field survey.

For the Powwow Pond/Powwow River, cross sections and elevations and structural geometry of hydraulic structures were obtained from field surveys conducted by the study contractor during the 1987 field season. Upper-end extensions of cross sections and storage areas were based on information contained on USGS topographic maps (U.S. Department of the Interior, 1981).

Water-surface elevations of floods of the selected recurrence intervals were computed using the WSPRO step-backwater computer program (Federal Highway Administration, 1990; U.S. Department of the Interior, 1989).

Water-surface elevations of floods of the selected recurrence intervals for Beaver Brook, Exeter River, Little River No. 1, Shields Brook, Homes Brook, Taylor Brook, Drew Brook, Cunningham Brook, Tributary 0 to Beaver Brook, Tributary E to Beaver Lake, Tributary F to Beaver Lake, Tributary G to Beaver Brook, and Tributary H to Nesenkeag Brook were developed using the USACE HEC-2 step- backwater computer program (U.S. Army Corps of Engineers, 1973; U.S. Army Corps of Engineers, 1977). Elevation data and structural geometry for bridges and culverts on both rivers were obtained from a combination of record drawings and field survey. The Prescott Road bridge at the downstream end of the Lamprey River in the Town of Raymond was under construction at the time the revised hydraulic analyses were performed. For this reason, drawings issued for construction were used to obtain hydraulic data for this bridge. Water-surface elevations for Spicket River of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (U.S. Army Corps of Engineers, 1976).

Water-surface elevations of floods of the selected recurrence intervals were computed for all detailed study streams in the community through use of the USACE HEC-2 step-backwater computer program (U.S. Army Corps of Engineers, 1977).

Water-surface elevations of floods of the selected recurrence intervals for Hog Hill Brook, Pickering Brook, the Lamprey River, Piscassic River, West Channel Policy Brook, Porcupine Brook, and portions of the Exeter River in Fremont were computed using the SCS WSP-2 step-backwater computer program (U.S. Department of Agriculture, 1979; U.S. Department of Agriculture, 1976; U.S. Department of Agriculture, 1993).

The 100-year elevations for Hog Hill Brook were computed by applying WSPRO step-backwater computer model (Federal Highway Administration, 1986; Federal Highway Administration, 1990). Starting water-surface elevations for the 100-year flood discharge on Hog Hill at the downstream side of Haverhill Road bridge at the Salem-Atkinson corporate limits were determined using the slope/area method (Federal Highway Administration, 1986; Federal Highway Administration, 1990). Starting water-surface elevations for Bryant Brook were determined by the slope/area method. Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Starting water-surface elevations for Hog Hill Brook were based on computations of elevation versus discharge at Wadleigh Falls in the Town of Lee.

Starting water-surface elevations for the Lamprey River were taken from the lower reaches of the river in the FIS report dated May 2, 1995 (FEMA, 1995). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

The starting water-surface elevation for the downstream reach of the Powwow River was determined by rating the dam at the outlet of Lake Gardiner in Amesbury, Massachusetts using the weir equations referenced above. The starting water-surface elevation for Grassy Brook was computed by a slope conveyance calculation (Federal Highway Administration, 1986; U.S. Department of the Interior, 1989). The stream slope was determined from field surveys.

Starting water-surface elevations for the Exeter River in the Town of Raymond, Winnicut River, Little River No. 3, Kelly Brook, and Bryant Brook were determined by the slope/area method. Water-surface elevations of floods of the selected recurrence intervals were computed for the Little River, Kelly Branch, and Bryant Brook in the study area through use of the USACE HEC-2 step-backwater computer program (U.S. Army Corps of Engineers, 1976).

Starting water-surface elevations for the Exeter River in the Town of Exeter and Little River No. 2 were determined using critical depth. Starting water-surface elevations for the Exeter River in the Town of Fremont were based on computations of elevation versus discharge at Phillips Dam and for the Exeter River in the Town of Brentwood, starting water-surface elevations were taken from a previously studied downstream portion of the river (FEMA, October 15, 1980, FIS report; and April15, 1981, FIRM).

Starting water-surface elevations for the Little River No. 1 were determined using normal pool elevation for the Exeter River in the Town of Exeter for the 10-year flood and the slope/area method for the 50-, 100-, and 500-year floods.

Starting water-surface elevations for the 100-year flood discharges on Hill Brook at the downstream side of the State Route 111 bridge and Shop Pond Outlet at the downstream side of Mills Shore Drive were computed using the slope-conveyance method (Federal Highway Administration, 1986 and 1990). The starting water-surface elevation for the 100-year flood discharge on Wash Pond Tributary was the 100-year flood elevation for Wash Pond.

For Golden Brook and Hidden Valley Brook, starting water-surface elevations were determined through normal depth analysis. For Flatrock Brook, the starting water-surface elevation was determined from a rating curve developed at the outlet of Shadow Lake.

Starting water-surface elevations for Beaver Brook were obtained from the Londonderry FIS and Hudson FIS (U.S. Department of Housing and Urban Development, 1978); Shields Brook and Tributary D from the Derry FIS (U.S. Department of Housing and Urban Development, unpublished); and Nesenkeag Brook from the Litchfield FIS (U.S. Department of Housing and Urban Development, 1977). For Black Brook, Tributary E to Beaver Lake, Tributary J to Black Brook, Tributary C to Beaver Brook, Upper Beaver Brook, Cohas Brook, Tributary H to Drew Brook, Dudley Brook, Island Pond, and Shields Brook studied by detailed methods, starting water-surface elevations were determined by normal-depth analyses.

Starting water-surface elevations for Tributary E to Little Cohas Brook and Tributary F to Beaver Lake were obtained from the Beaver Lake flood elevations, and starting water-surface elevations for Drew Brook and Taylor Brook were obtained from Island Pond flood elevations. Starting water-surface elevations for Tributary H to Nesenkeag Brook were obtained from the Drew Brook flood profile because these streams have concurrent flood peaks.

Starting water-surface elevations for the Spicket River at the dam at Arlinpon Mills Reservoir were determined from the standard Weir Formula $Q=CLH^3$. At the southern corporate limit, the 100-year flood elevation was taken from the USACE floodplain report (U.S. Army Corps of Engineers, 1975). The starting water-surface elevation for the 10-, 50-, and 500-year floods exceeded the capacity of the 60-inch culvert, and it was assumed that the water level of 124 feet (also top of the culvert) would be the ponding level for all frequency events.

Starting water-surface elevations for West Channel Policy Brook and Porcupine Brook were taken from the 1978 FIS for the Town of Salem, and a Master Drainage Study done by Weston & Sampson Engineers, Inc., respectively (U.S. Department of Housing and Urban Development, Federal Insurance Administration, 1978;

Weston and Sampson Engineers, Inc., 1988). A rating curve for World End Pond was computed by backwater analysis of flows through the Lawrence Road-Farm Road culverts.

The starting water-surface elevations for the Piscassic River were determined by computing critical depths at the Piscassic Ice Pond Dam.

Pickering Brook was studied by detailed methods in the Town of Greenland FIS, dated May 17, 1989, from a point 2,400 feet upstream of its confluence with Great Bay extending up to the corporate limits for the Town of Greenland. Starting water-surface elevations for Pickering Brook were determined by assuming critical depth at the upstream normal high tide limits of Great Bay. Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the SCS WSP2 step-backwater computer program. Pickering Brook was also studied by detailed methods using the HEC-RAS hydraulic model by a LOMR effective October 6, 1999, in the Town of Portsmouth, New Hampshire, from a point approximately 2,482 feet upstream of the corporate limits for the City of Portsmouth to a point approximately 2,733 feet upstream of the corporate limits. The hydraulic analysis for Pickering Brook was extended downstream of the LOMR effective October 1999, using the HEC-RAS hydraulic model, to the corporate limits of the City of Portsmouth. The starting water-surface elevations were set at the 100-year water-surface elevation at the corporate limits for the Town of Greenland.

Elevations of MacCallen Dam and the State Route 108 bridge in Newmarket were obtained from field surveys conducted by the study contractor. The 100-year flood elevations for the Lamprey River upstream from MacCallen Dam were based upon high-water elevation data available for the April 1987 flood and data available from the FIS for the Town of Durham (FEMA, 1991).

The 100-year flood elevation for Tuxbury Pond was determined by rating the dam at the outlet of the pond. The rating curve for the dam was determined by applying the appropriate flow over weir equations documented in a USGS publication (U.S. Department of the Interior, 1967). This elevation was also used as the starting water-surface elevation for the upstream reach of the Powwow River.

The valley portions of the cross-section data for all detailed study streams were obtained photogrammetrically by James W. Sewall Company (James W. Sewall Company, 1977); the below-water portions were obtained by field measurement by Thomas F. Moran, Inc. (Thomas F. Moran, Inc., 1977). Bridge plans were utilized to obtain elevation data and structural geometry. All bridges for which plans were unavailable or out of date were surveyed.

In those areas where the analysis indicated supercritical flow conditions, critical depth was assumed for the flood elevation because of the inherent instability of supercritical flow.

Approximate methodologies for Hidden Valley Brook include hydrologic and hydraulic calculations based on the detailed study and field investigation.

Along certain portions of Piscassic River, a profile base line is shown on the maps to represent channel distances as indicated on the flood profiles and floodway data tables.

The 100-year flood for portions of both the Spicket River and Policy Brook was approximated, using information from an SCS Flood Prone Area Map (U.S. Department of Agriculture, 1974).

The 100-year flood on several smaller streams was approximated using the FHBM for the Town of Salem as a guide (U.S. Department of Housing and Urban Development, 1977).

The 100-year flood elevation for Powwow Pond/Powwow River downstream from the Boston and Maine Railroad bridge was determined by rating the dam (Trickling Falls Dam) at the outlet of the pond. For the purposes of this analysis, it was assumed that a total of 1 foot of stop logs in the gates of the dam have been removed, a practice commonly used by the Water Division of the New Hampshire Department of Environmental Services. The rating curve for the dam was determined by applying appropriate flow over weir equations documented in a USGS publication (U.S. Department of the Interior, 1967).

The 100-year flood elevation for Powwow Pond/Powwow River upstream from the Boston and Maine Railroad bridge is controlled by the dam at the outlet of the pond and the constriction caused by the bridge opening. The flood elevation was determined by treating the opening as a culvert and passing the 100-year discharge through it by applying appropriate formulas contained in a USGS publication (U.S. Department of the Interior, 1968).

The 100-year flood elevation for Powwow Pond/Powwow River upstream from New Boston Road is influenced by the constriction caused by the twin culverts at the crossing. The flood elevation was determined by passing the 100-year flood discharge through the twin culverts by applying appropriate formulas contained in a USGS publication (U.S. Department of the Interior, 1968). Road overflow at the site was computed by applying a step-backwater computer model (Federal Highway Administration, 1986).

The 100-year elevation for Country Pond is the same as determined for Powwow Pond/Powwow River upstream from New Boston Road. Backwater from the culverts at New Boston Road extends into Country Pond. The bridge at the outlet of Country Pond does not constrict the flow sufficiently to increase elevations in the pond. To verify this fact, a step-backwater run was made through the reach (Federal Highway Administration, 1986).

The 100-year elevation for Great Pond is influenced by backwater caused by the culvert under State Route 125 and Main Street bridge just downstream from the outlet. The dam at the outlet of the lake has only a small head and is drowned out during floods. Elevations upstream from State Route 125 were determined by passing the 100-year flood discharge through the culvert by applying appropriate formulas contained in a USGS publication (U.S. Department of the Interior, 1968). The elevation upstream from State Route 125 and the 100-year flood discharge were routed through the bridge opening of the State Route 111 crossing and into the pond using a step-backwater model (Federal Highway Administration, 1986).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 6, "Manning's "n" Values."

2005 Countywide Analyses

No hydraulic analyses were conducted for the 2005 countywide study.

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The Lamprey River was studied by detailed methods in the towns of Newmarket and Durham from the MacCallen Dam in Newmarket (Rockingham County) to the upstream corporate limit for the Town of Durham, NH (Strafford County). The Exeter River was studied by detailed methods in the Town of Exeter from the confluence with the Squamscott River to the upstream corporate limit for the Town of Exeter, NH.

For the Town of Newmarket, the Lamprey River channel and structural cross section data (elevation, northing and easting) were obtained from USGS field surveys and Wright-Pierce, Inc. field surveys. For the Town of Exeter, Exeter River channel and structural cross section data (elevation, northing and easting) were obtained from USGS field surveys along with Weston and Sampson, Inc. and Vanasse Hangen Brustlin (VHB), Inc. field surveys. The overbank portion of the cross section data for the Lamprey and Exeter Rivers were obtained from the 2011 coastal LiDAR dataset described above.

Cross sections for the backwater analyses of the detailed study streams were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also obtained from within channel surveys and from LiDAR on the overbanks.

Water-surface elevations of floods of the selected recurrence intervals were computed for the detailed study streams using U.S. Army Corps of Engineers HEC-RAS (version 4.1.0) step-backwater computer program (U.S. Army Corps of Engineers, January 2010). In those areas where the analysis indicated supercritical flow conditions, critical depth was assumed for the flood elevation because of the inherent instability of supercritical flow.

Starting water-surfaces for the Lamprey and Exeter Rivers were determined through computation of critical depth at the MacCallen Dam in Newmarket and downstream of Chestnut Hill Avenue (String Bridge) in Exeter.

The Exeter River HEC-RAS flood model was calibrated to the peak high-water mark data collected by the USGS along the Exeter River after the April 2007 flood. The Lamprey River HEC-RAS flood model was calibrated to the USGS streamgage 01073500 data and to the peak high-water mark data collected by the USGS along the Lamprey River after the April 2007 flood.

As in the pre-countywide analyses, roughness factors (Manning's "n") used in the coastal study hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for the Lamprey and Exeter Rivers are also shown in Table 6, "Manning's "n" Values".

TABLE 6 – MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Beaver Brook	0.020-0.055	0.040-0.100
Black Brook	0.020-0.055	0.040-0.100
Bryant Brook	0.035-0.040	0.060-0.090
Cohas Brook	0.020-0.055	0.040-0.100
Cunningham Brook	0.035-0.055	0.065-1.000
Drew Brook	0.035-0.055	0.065-1.000
Dudley Brook	0.035-0.080	0.035-0.130
Exeter River	0.015-0.060	0.015-0.100
Flatrock Brook	0.030-0.040	0.050-0.080
Golden Brook	0.022-0.045	0.060-0.080
Grassy Brook	0.030-0.040	0.140
Hidden Valley Brook	0.025-0.045	0.045-0.090
Hill Brook	0.040-0.055	0.035-0.110
Hog Hill Brook	0.035-0.065	0.075-0.100
Hornes Brook	0.035-0.055	0.065-1.000
Island Pond	0.035-0.055	0.065-1.000
Kelly Brook	0.030-0.040	0.050-0.090
Lamprey River	0.040-0.065	0.050-0.100
Little Cohas Brook	0.020-0.055	0.040-0.100
Little River No. 1	0.020-0.070	0.050-0.100
Little River No. 2	0.013-0.040	0.100
Little River No. 3	0.030-0.060	0.030-0.100
Nesenkeag Brook	0.020-0.055	0.040-0.100
Pickering Brook	0.040-0.120	0.070-0.120
Piscassic River	0.025-0.070	0.060-0.180

TABLE 6 – MANNING'S "n" VALUES - continued

Stream	Channel "n"	Overbank "n"
Policy Brook – Unnamed Brook	0.020-0.060	0.100
Porcupine Brook	0.020-0.060	0.100
Porcupine Brook Tributary	0.020-0.060	0.100
Powwow Pond System	0.025-0.035	0.030-0.090
Powwow River	0.030-0.040	0.035-0.140
Shields Brook	0.020-0.055	0.040-1.000
Spicket River	0.035	0.080
Taylor Brook (including Ballard Pond)	0.035-0.055	0.065-1.000
Tributary C to Beaver Brook	0.020-0.055	0.040-0.100
Tributary E to Beaver Lake	0.020-0.055	0.040-0.100
Tributary E to Little Cohas Brook	0.035-0.055	0.065-1.000
Tributary F to Beaver Lake	0.035-0.055	0.065-1.000
Tributary G to Beaver Brook	0.035-0.055	0.065-1.000
Tributary H to Drew Brook	0.020-0.055	0.040-0.100
Tributary H to Nesenkeag Brook	0.035-0.055	0.065-1.000
Tributary J to Black Brook	0.020-0.055	0.040-0.100
Tributary O to Beaver Brook	0.035-0.055	0.065-1.000
Upper Beaver Brook	0.020-0.055	0.040-0.100
Wash Pond Tributary	0.035-0.055	0.030-0.100
West Channel Policy Brook	0.020-0.060	0.100
Winnicut River	0.020-0.050	0.070
World End Brook and Pond	0.020-0.060	0.100

No Manning's "n" factors were assigned for computations on Catletts Creek since its flood hazard is dependent upon valley restrictions with their associated storage and not upon conveyance.

For this 2013 study, water-surface profiles for Zone A basic studies and for Zone AE detailed studies were computed through the use of the USACE HEC-RAS computer program (USACE 2010). Water surface profiles were computed for the 1-percent-annual-chance storm for the Zone A basic studies and for the 0.2, 1, 2, and 10-percent-annual chance storms for the Zone AE detailed studies.

The Zone A basic studies used the computer program Watershed Information SystEm (WISE) as a preprocessor to HEC-RAS (Watershed Concepts, 2008). WISE combined geo-referenced data from the terrain model and miscellaneous shapefiles (such as streams and cross sections). The WISE program was used to generate the input data file for HEC-RAS. Then HEC-RAS was used to determine the flood elevation at each cross section of the modeled stream. No floodway was calculated for the Zone A basic studies.

3.3 Coastal Analyses

Pre-countywide Analyses

The coastal analyses for the 2013 coastal study update supercede coastal analyses previously completed, except on the Piscataqua River, Great Bay, and the Squamscott River estuary.

Hydraulic analyses of the inland propagation of the coastal storm surge were performed for the Piscataqua River, Great Bay, and the Squamscott River estuary system using the 1-D Model. The 1-D Model is based on the hydrodynamic equations of motion and conservation of mass. The estuary system was divided into grids, with each cross section divided into areas of conveyance and storage. Cross-section data were obtained from U.S. Coast and Geodetic Survey nautical charts. The most downstream grid was located at the mouth of the Piscataqua River, while the most upstream grid was located just below the Chestnut Hill Avenue bridge over the Squamscott River in Exeter. A Chezy friction coefficient of 70 was used throughout the estuary. Wind effects were not included. Both upstream and downstream boundary conditions, the former being the function of freshwater inflow and the latter the sum of the astronomical tide and surge components, were specified initially and for the duration of the storm. Sensitivity analyses were performed for selected storm and hydraulic parameters.

2005 Countywide Analyses

No coastal analyses were conducted for the 2005 countywide study.

2013 Coastal Study Update

The 10-, 2-, 1- and 0.2 percent annual chance stillwater elevations for the coastal areas within Rockingham County were derived from FEMA (2008) "Updating Tidal Profiles for the New England Coastline" updating the U.S. Army Corps of Engineers 1988 tidal gage profiles developed for the entire New England Coastline. The New England Tidal Flood Profiles, from Bergen Point, New York, to the Maine border with Canada, were updated by conducting new flood frequency analyses of long-term tide gage records available from the NOS and USACE. Parametric probability distributions were fit to the tide gage data using the method of L moments. The suite of probability distributions applied to the gage records included the original Pearson Type III distribution to enable comparisons between the old tidal flood profiles and the results from the new analyses. The tidal flood profiles were updated using the best fitting probability distribution, as determined by goodness-of-fit criteria.

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 (U.S. Army Corps of Engineers, June 1975; U.S. Army Corps of Engineers, 1973). 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. Damages to structures from wave heights between 1.5 and 3 feet are similar to, but less severe than, those in areas where wave heights are greater than 3 feet. These areas have been designated as areas of moderate wave action, and areas up to the Limit of Moderate Wave Action (LiMWA) have been mapped on the FIRM.

Overland wave height analyses were performed along each transect using the FEMA Wave Hazard Analysis for Flood Insurance Studies (WHAFIS) model 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 wave runup elevation seaward to its intersection with the wave crest profile.

Figure 1, "Transect Schematic," illustrates a profile for a typical transect along with the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Figure 3 also illustrates the relationship between the local still water elevation, the ground profile and the location of the Zone V/Zone A boundary.

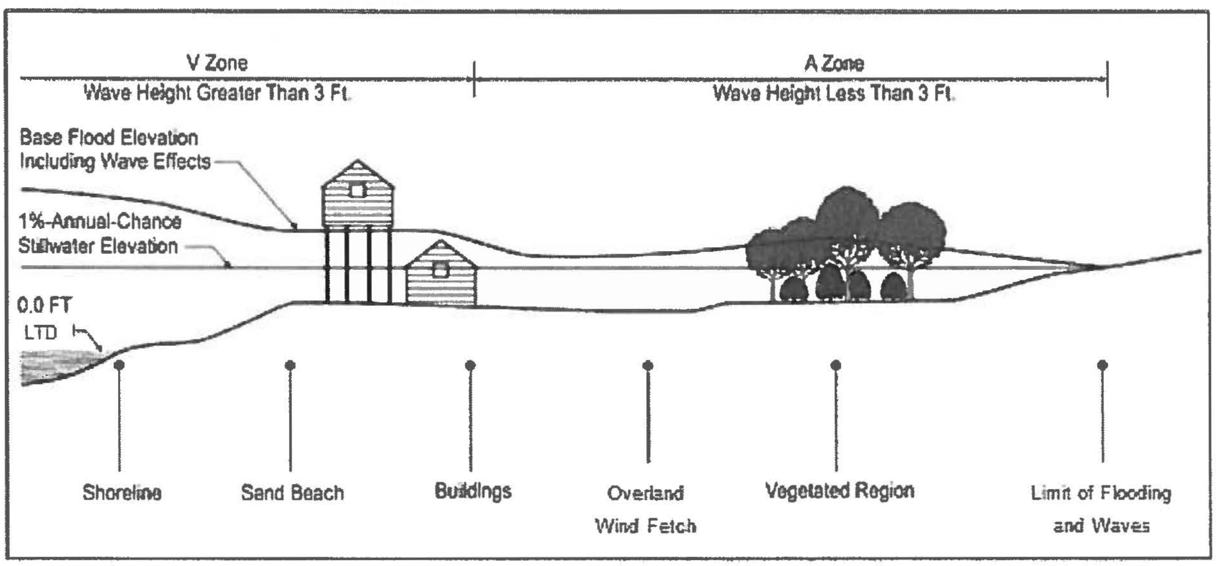


Figure 1

TRANSECT SCHEMATIC

Deepwater wave characteristics used as starting wave conditions to the wave setup, overland and wave runup analyses were derived from the USACE Wave Information Studies (WIS) hindcast stations, located offshore the New Hampshire coast. The USACE website (http://wis.usace.army.mil/) provides an extreme wave analysis performed on the yearly maxima (1980-1999) at the selected stations used as the source of the 1-percent annual chance event significant wave height. The wave period associated with the 1-percent wave significant wave height was derived using a wave steepness factor of 0.035, the average wave steepness of tropical and extra-tropical events. Such wave conditions were applied to all transects facing the Atlantic Ocean shoreline. Starting wave conditions for the New Castle area, located along the Piscataqua River, were derived using a limited fetch approach within the WHAFIS model.

FEMA guidelines for Zone V mapping define H_S as the significant wave height or the average over the highest one third of waves and T_S as the significant wave period associated with the significant wave height. Mean wave conditions are described as:

$$\overline{H} = H_s \times 0.626$$

$$\overline{T} = T_s \times 0.85$$

where $\overline{H}$ is the average wave height of all waves and $\overline{T}$ is the average wave period.

Wave heights and wave runup were computed along transects which were located perpendicular to the 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.

The transect profiles were obtained using topographic and bathymetric data from various sources.

The NOS Bathymetric data was acquired over several years by various agencies. The data is compiled and distributed by NOAA NOS. The bathymetric data for this project is a compilation of data acquired in 1947, 1950, 1953, 1954, 1955, 1997, 2000 and 2005. The NOS states that the accuracy of the data acquired before 1965 is difficult to determine but data acquired after 1965 must comply with standards set forth in the NOS Hydrographic Surveys Specifications and Deliverables. All bathymetric data received from the NOS has been found to meet these specifications. The data was received in Mean Low Datum and converted to NAD_1983_StatePlane_New Hampshire_FIPS_1600_Feet for use in this project.

LiDAR was collected at a 2.0 meter nominal post spacing (2.0m GSD) for approximately 8,200 mi2 of coastal areas including parts of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York, as part of the American Recovery and Reinvestment Act (ARRA) of 2010. No snow was on the ground and rivers were at or below normal levels. Some areas of the project required 1.0 meter nominal post spacing (1.0m GSD), and a required 9.25cm Vertical Accuracy. The area covered by the Piscataqua/Salmon Falls study area was covered by 1.0 meter post spacing LiDAR data and a portion of the contributing drainage area was covered by the 2.0 meter post spacing LiDAR data. A seamless Digital Elevation Model (DEM) at a 10 ft resolution was created combining the above datasets to create a base elevation for the coastal analyses.

Figure 2, "Transect Location Map", illustrates the location of the transects for the coastal study area.

Dune erosion was applied as per standard FEMA (2007) Guidelines and Specifications for Flood Hazard Mapping Partners methodology and VE Zones were mapped up to the extent of the Primary Frontal Dune (PFD).

Nearshore wave-induced processes, such as wave setup and wave runup, constitute a greater part of the combined wave envelope than storm surge due to location exposed to ocean waves. The Direct Integrated Method (FEMA, 2007) was used to determine wave setup along the coastline.

Wave height calculations used in this study follows the methodology described in the FEMA (2007) Guidelines and Specifications for Flood Hazard Mapping Partners. Overland wave analyses were performed along each transects using the FEMA WHAFIS 4.0 model.

Wave runup was computed in agreement with the FEMA (2005) "Procedure Memorandum No. 37" that recommends the use of the 2% wave runup for determining base flood elevations. For mild sandy beaches, Runup 2.0 was employed using mean wave conditions. Along armored shorelines, wave runup was determined using the Technical Advisory Committee for Water Retaining Structures (TAW) method (van der Meer, 2002). The Shore Protection Manual (SPM) Method was applied in cases of wave runup on vertical structures. For wave run-up at the crest of a slope that transitions to a plateau or down-slope, run-up values were determined using the "Methodology for wave run-up on a hypothetical slope" as described in the FEMA (2007) Guidelines and Specifications for Flood Hazard Mapping Partners. In areas where the wave runup overtopped the crest of a structure/bluff, the wave runup elevation was capped at 3 ft above the structure crest.

The transect data for Rockingham County is presented in Table 7, "Transect Descriptions," which describes the location of each transect. In addition, Table 8 provides the 1-percent annual chance stillwater, wave setup and maximum wave crest elevations for each transect along the coastline.

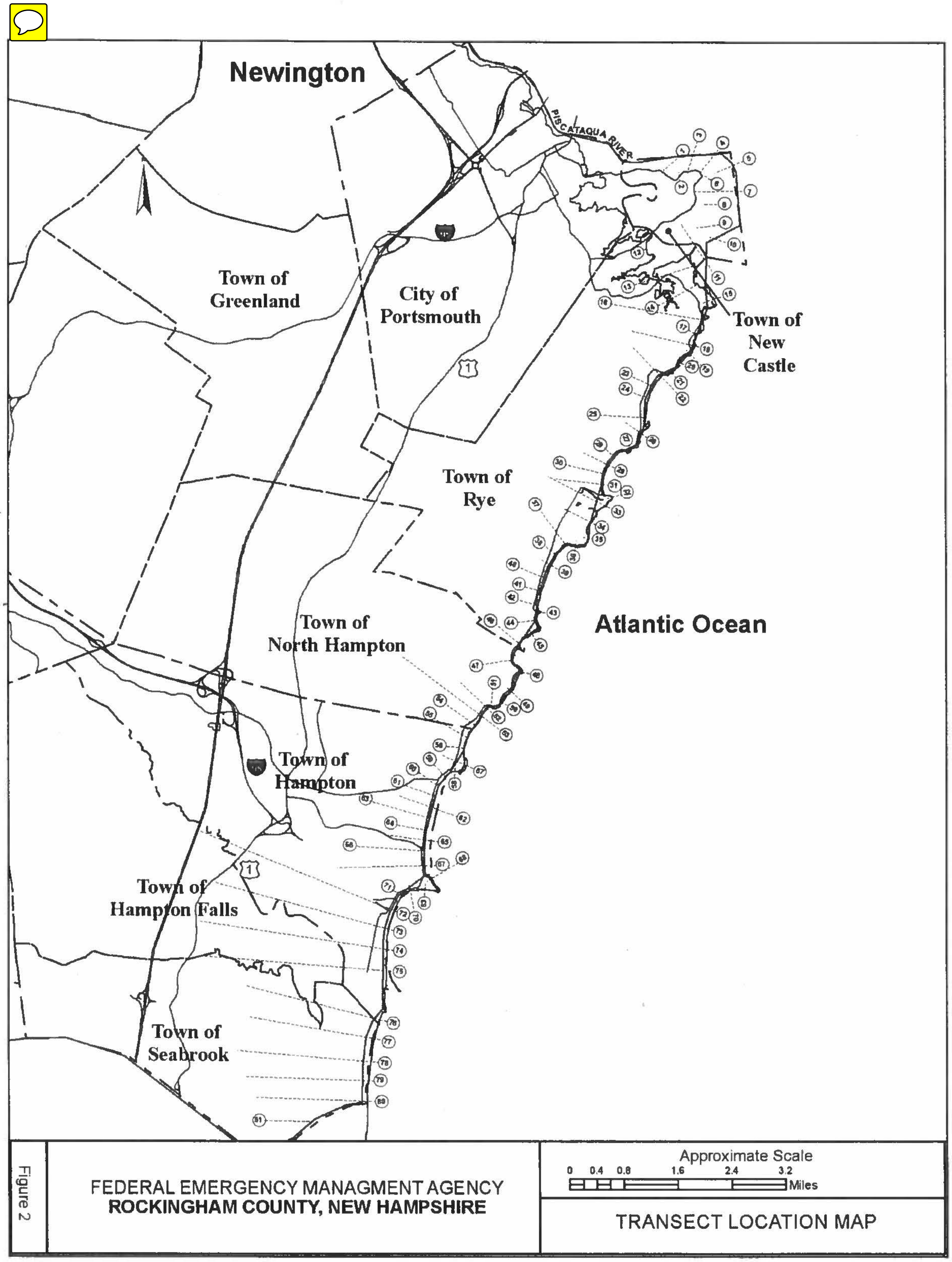


Figure 2

TRANSECT LOCATION MAP

TABLE 7 – TRANSECT DESCRIPTIONS*

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
1	On the Atlantic Ocean coastline, on the N side of Newcastle, approximately 0.149 miles NE of the intersection of Portsmouth Ave. and Cape Road at N 43.0727390°, W -70.241.097°	8.36	0.66	12.37
2	On the Atlantic Ocean coastline, on the N side of Newcastle, approximately 0.078 miles N of the intersection of Cranfield St and Neals Lane at N 43.071050°, W -70.718230	8.36	0.47	11.5
3	On the Atlantic Ocean coastline, on the NE side of Newcastle, approximately 0.018 miles E of the intersection of Elm Court and Piscataqua Street at N 43.072602°, W -70.718230°	8.36	0.59	11.82
4	On the Atlantic Ocean coastline, on the NE side of Newcastle, approximately 527 feet NW of the UNH Pier Facility base, at N 43.071906°, W -70.714279°	8.36	0.6	11.93
5	On the Atlantic Ocean coastline, on the NE side of Newcastle, approximately 160 feet NE of the Portsmouth Harbor Light, at N 43.071504°, W -70.708766°	8.36	4.29	18.5[1]
6	On the Atlantic Ocean coastline, on the NE side of Newcastle, approximately 656 feet from the intersection of Main St and Ocean St at, N 43.069579°, W -70.712462°	8.36	3.67	18.42
7	On the Atlantic Ocean coastline, on the E side of Newcastle, approximately 0.19 miles SE of the intersection of Main St and Shaw Circle, at N 43.067002°, W -70.713297°.	8.36	3.63	18.36
8	On the Atlantic Ocean coastline, on the E side of Newcastle, approximately 0.25 miles SE of the intersection of Wentworth Rd and Tabbutt Memorial Way, at N 43.064178°, W - 70.711922°.	8.36	3.95	20.1[1]
9	On the Atlantic Ocean coastline, on the SE side of Newcastle, approximately 0.37 miles SE of the intersection of Wentworth Rd and Wild Rose Lane, at N 43.059529°, W -70.713204°.	8.36	3.91	18.79
10	On the Atlantic Ocean coastline, on the SE side of Newcastle, approximately 0.56 miles SE of the intersection of Wentworth Rd and Wild Rose Lane, at N 43.056860°, W -70.711490°	8.36	2.91	17.27

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

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

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
11	On the Atlantic Ocean coastline, on the NE tip of Odiorne Point State Park, approximately 0.73 miles NE of the Ocean Boulevard bridge, at N 43.05517°, W -70.716776°	8.36	2.84	17.16
12	On the Atlantic Ocean coastline, approximately 755 feet SE of the intersection of Wentworth Rd and Heather Rd, at N 43.054768°, W -70.731232°	8.36	2.84	17.16
13	On the Atlantic Ocean coastline, on the E coast of Odiorne Point State Park, approximately .56 miles NE of the Ocean Boulevard bridge, at N 43.051140°, W -70.717197°	8.36	2.65	16.88
14	On the Atlantic Ocean coastline, on the E coast of Odiorne Point State Park, approximately 0.21 miles N of the intersection of the Seacoast Science Center entrance and Ocean Boulevard, at N 43.047073°, W -70.71641°	8.36	2.62	16.83
15	On the Atlantic Ocean coastline, on the E coast of Odiorne Point State Park, approximately 0.25 miles E of the intersection of the Seacoast Science Center entrance and Ocean Boulevard, at N 43.0438622°, W -70.711755°	8.36	3.16	17.65
16	On the Atlantic Ocean coastline, approximately 0.25 miles NE of the intersection of Pollack Dr and Ocean Boulevard, at N 43.039461°, W -70.715128°	8.36	3.17	17.67
17	On the Atlantic Ocean coastline, approximately 208 feet SE of the intersection of Pollack Dr and Ocean Boulevard, at N 43.036399°, W -70.717116°	8.36	3.25	17.79
18	On the Atlantic Ocean coastline, approximately 551 feet SE of the intersection of Parsons Road and Ocean Boulevard, at N 43.033897°, W -70.717479°	8.36	3.22	17.74
19	On the Atlantic Ocean coastline, approximately 287 feet SE of the intersection of Neptune Dr and Ocean Boulevard, at N 43.032123°, W -70.718778°	8.36	3.40	18.10
20	On the Atlantic Ocean coastline, approximately 314 feet S of the intersection of Shoals View Dr and Ocean Boulevard, at N 43.03039°, W -70.722316°	8.36	3.27	20.1[1]

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
21	On the Atlantic Ocean coastline, approximately 694 feet E of the intersection of Fairhill Avenue and Ocean Boulevard, at N 43.028312°, W -70.724441°	8.36	3.36	17.95
22	On the Atlantic Ocean coastline, approximately 387 feet SE of the Concession Stand at Wallis Sand Beach Park, at N 43.02738°, W -70.727493°	8.36	3.35	17.94
23	On the Atlantic Ocean coastline, approximately 485 feet SE of the intersection of Ocean Blvd. and Old Ocean Blvd near Wallis Sands State Park, at N 43.025270°, W -70.729617°	8.36	3.28	17.83
24	On the Atlantic Ocean coastline, approximately 671 feet NE of the intersection of Ocean Blvd. and Wallis Rd near Wallis Sands State Park, at N 43.022747°, W -70.731182°	8.36	3.39	18.00
25	On the Atlantic Ocean coastline, approximately 0.24 miles SE of the intersection of Ocean Blvd. and Wallis, at N 43.018597°, W -70.732173°	8.36	3.39	20.00[1]
26	On the Atlantic Ocean coastline, approximately 330 feet NE of the intersection of Ocean Blvd. and Highland Park Ave., at N 43.015226°, W -70.733395°	8.36	3.36	18.8[1]
27	On the Atlantic Ocean coastline, approximately 0.24 SW of the intersection of Ocean Blvd. and Highland Park Ave., at N 43.011954°, W -70.736492°	8.36	3.15	17.63
28	On the Atlantic Ocean coastline, approximately 289 feet S of the intersection of Ocean Blvd. and Washington Rd. at N 43.0102309°, W -70.741415°	8.36	3.21	19.2[1]
29	On the Atlantic Ocean coastline, approximately 1,015 feet SW of the intersection of Ocean Blvd. and Washington Rd. at N 43.0084721°, W -70.7431°	8.36	3.28	20.7[1]
30	On the Atlantic Ocean coastline, approximately 300 feet NE of Ray's Seafood located on Ocean Blvd, at N 43.006570°, W -70.744378°	8.36	3.31	21.3[1]
31	On the Atlantic Ocean coastline, approximately 0.52 miles NE of the intersection of Ocean Blvd and Harbor Rd., at N 43.004349°, W -70.7448644°	8.36	3.30	19.69[1]

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
32	On the Atlantic Ocean coastline, approximately .59 miles NE of the intersection of Ocean Blvd and Harbor Rd. near Rye Harbor State Park, at N 43.001628°, W -70.7422843°	8.36	3.38	17.98
33	On the Atlantic Ocean coastline, approximately .49 miles NE of the intersection of Ocean Blvd and Harbor Rd. near Rye Harbor State Park, at N 42.999736°, W -70.744238°	8.36	3.39	18.00
34	On the Atlantic Ocean coastline, approximately .39 miles SE of the intersection of Ocean Blvd and Harbor Rd., at N 42.996333°, W -70.748637°	8.36	3.11	18.2[1]
35	On the Atlantic Ocean coastline, approximately 75 feet E of the intersection of Straws Point Rd and Marshall St., at N 42.992949°, W -70.749540°	8.36	3.14	19.4[1]
36	On the Atlantic Ocean coastline, approximately 824 ft SE of the intersection of Wildwood Lane and Locke Rd, at N 42.991261°, W -70.753217	8.36	2.63	19.4[1]
37	On the Atlantic Ocean coastline, approximately 1,038 feet E of the intersection of Ocean Blvd. and Jenness Rd., at N 42.991335°, W -70.755859°	8.36	3.15	17.63
38	On the Atlantic Ocean coastline, approximately 609 feet SE of the intersection Ocean Blvd. and Cable Rd., at N 42.989358°, W -70.75873°	8.36	3.19	17.70
39	On the Atlantic Ocean coastline, approximately 1,168 feet SE of the intersection Ocean Blvd. and Cable Rd., at N 42.987200°, W -70.760358°	8.36	3.20	17.71
40	On the Atlantic Ocean coastline, approximately 714 feet SE of the intersection Ocean Blvd. and Perkins Rd., at N 42.984288°, W -70.761968°	8.36	3.18	17.68
41	On the Atlantic Ocean coastline, approximately .31 miles S of the intersection Ocean Blvd. and Perkins Rd., at N 42.9816514°, W -70.7634314°	8.36	3.19	20.90[1]
42	On the Atlantic Ocean coastline, approximately 432 feet NE of the intersection Ocean Blvd. and Sea Rd., at N 42.978573°, W -70.764351°	8.36	2.99	17.38
43	On the Atlantic Ocean coastline, approximately 679 feet SE of the intersection Ocean Blvd. and Sea Rd., at N 42.977074°, W -70.763627°	8.36	3.11	17.57

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
44	On the Atlantic Ocean coastline, approximately 593 feet SE of the intersection Ocean Blvd. and Sea Rd., at N 42.975361°, W -70.764815°	8.36	3.17	17.90[1]
45	On the Atlantic Ocean coastline, approximately 690 feet NE of the intersection Ocean Blvd. and Central Rd., at N 42.972524°, W -70.766268°	8.36	3.28	17.60[1]
46	On the Atlantic Ocean coastline, approximately 536 feet SW of the intersection Ocean Blvd. and Central Rd., at N 42.970282°, W -70.769807°	8.36	3.30	20.10[1]
47	On the Atlantic Ocean coastline, approximately 505 feet NW of the intersection Ocean Blvd. and Willow Ave., at N 42.966904°, W -70.772041°	8.36	2.85	23.60[1]
48	On the Atlantic Ocean coastline, approximately 784 feet SE of the intersection Ocean Blvd. and Willow Ave., at N 42.964257°, W -70.769130°	8.36	3.46	21.73
49	On the Atlantic Ocean coastline, approximately 1,028 feet NE of the intersection Ocean Blvd. and Atlantic Ave., at N 42.960135°, W -70.772513°	8.36	3.34	18.30[1]
50	On the Atlantic Ocean coastline, approximately 286 feet SE of the intersection Ocean Blvd. and Atlantic Ave., at N 42.957757°, W -70.775255°	8.36	3.34	26.9[1]
51	On the Atlantic Ocean coastline, approximately 202 feet SE of the intersection Ocean Blvd. and Sea Rd., at N 42.956776°, W -70.778349°	8.36	2.54	16.71
52	On the Atlantic Ocean coastline, approximately 359 feet SW of the intersection Ocean Blvd. and Sea Rd., at N 42.956563°, W -70.779446°	8.36	3.34	17.92
53	On the Atlantic Ocean coastline, approximately .27 miles NE of the intersection Ocean Blvd. and Appledore Ave., at N 42.954856°, W -70.781128°	8.36	3.34	17.92
54	On the Atlantic Ocean coastline, approximately 802 feet E of the intersection Ocean Blvd. and Appledore Ave., at N 42.952824°, W -70.782864°	8.36	3.39	18.2[1]
55	On the Atlantic Ocean coastline, approximately 948 feet SE of the intersection Ocean Blvd. and Appledore Ave., at N 42.950306°, W -70.785469°	8.36	3.34	18.00[1]

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
56	On the Atlantic Ocean coastline, approximately 446 feet NE of the intersection Ocean Blvd. and Cranberry Lane., at N 42.948053°, W -70.78646°	8.36	3.32	20.00[1]
57	On the Atlantic Ocean coastline, approximately 1,372 feet SE of the intersection Ocean Blvd. and Cranberry Lane., at N 42.944272°, W -70.785747°	8.36	3.30	19.60[1]
58	On the Atlantic Ocean coastline, approximately 579 feet E of the intersection Ocean Blvd. and Smith Avenue., at N 42.943092°, W -70.789112°	8.36	2.54	17.86
59	On the Atlantic Ocean coastline, approximately 368 feet SE of the intersection Ocean Blvd. and Cusack Rd., at N 42.941746°, W -70.791868°	8.36	3.15	16.70
60	On the Atlantic Ocean coastline, approximately 472 feet SW of the intersection Ocean Blvd. and High St., at N 42.939897°, W -70.7940118°	8.36	3.19	17.70
61	On the Atlantic Ocean coastline, approximately 1,262 feet SW of the intersection Ocean Blvd. and High St., at N 42.937821°, W -70.7949304°	8.36	3.24	17.77
62	On the Atlantic Ocean coastline, approximately .41 miles SW of the intersection Ocean Blvd. and High St., at N 42.935393°, W -70.796118°	8.36	3.22	17.74
63	On the Atlantic Ocean coastline, approximately .57 miles SW of the intersection Ocean Blvd. and High St., at N 42.933136°, W -70.796850°	8.36	3.22	17.74
64	On the Atlantic Ocean coastline, approximately .27 miles NE of the intersection Ocean Blvd. and Winnacunnet Rd., at N 42.930480°, W -70.797669°	8.36	3.26	17.79
65	On the Atlantic Ocean coastline, approximately .12 miles NE of the intersection Ocean Blvd. and Winnacunnet Rd., at N 42.928423°, W -70.798082°	8.36	3.20	17.70
66	On the Atlantic Ocean coastline, approximately 254 feet SE of the intersection Ocean Blvd. and Winnacunnet Rd., at N 42.926085°, W -70.798377°	8.36	3.19	17.70

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88**)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
67	On the Atlantic Ocean coastline, approximately 1,370 feet SE of the intersection Ocean Blvd. and Winnacunnet Rd., at N 42.922896°, W -70.798485°	8.36	3.30	17.86
68	On the Atlantic Ocean coastline, approximately 681 feet SE of the intersection Ocean Blvd. and Dumas Ave., at N 42.920102°, W -70.796257°	8.36	3.22	17.74
69	On the Atlantic Ocean coastline, approximately 527 feet SE of the intersection Ocean Blvd. and Great Boars Head Ave., at N 42.917779°, W -70.798271°	8.36	2,42	16.53
70	On the Atlantic Ocean coastline, approximately 478 feet SW of the intersection Ocean Blvd. and Archor St., at N 42.917694°, W -70.802532°	8.36	2.75	17.03
71	On the Atlantic Ocean coastline, approximately 426 feet E of the intersection Ocean Blvd. and Tilton St., at N 42.916583°, W -70.805151°	8.36	3.14	17.62
72	On the Atlantic Ocean coastline, approximately 376 feet E of the intersection Ocean Blvd. and eastbound Church St., at N 42.913316°, W -70.807427°	8.36	3.14	17.62
73	On the Atlantic Ocean coastline, approximately .27 miles S of the intersection Ocean Blvd. and eastbound Church St., at N 42.909361°, W -70.809015°	8.36	3.13	17.60
74	On the Atlantic Ocean coastline, approximately 976 feet NE of the intersection Ocean Blvd. and Bradford Ave.., at N 42.905084°, W -70.809722°	8.36	3.13	17.60
75	On the Atlantic Ocean coastline, approximately .27 miles NE of the intersection Ocean Blvd. and Bradford Ave., at N 42.900506°, W -70.809943°	8.36	3.13	17.6
76	On the Atlantic Ocean coastline, approximately 347 feet SE of the intersection Ashland St. and Ocean Dr., at N 42.890035°, W -70.811957°	8.36	3.28	17.83
77	On the Atlantic Ocean coastline, approximately .27 mi. SE of the intersection Ocean Blvd. and Hooksett St., at N 42.885943°, W -70.813515°	8.36	3.27	17.82
78	On the Atlantic Ocean coastline, approximately 990 feet SE of the intersection Ocean Blvd. and Andover St., at N 42.880987°, W -70.814699°	8.36	3.34	17.92

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

TABLE 7 – TRANSECT DESCRIPTIONS* - continued

Transect	Location	Elevation (feet NAVD88*)		
		1-Percent Annual Chance Stillwater	Wave Setup	Maximum 1-Percent Annual Chance Wave Crest
79	On the Atlantic Ocean coastline, approximately 802 feet E of the intersection Ocean Blvd. and Saugus St., at N 42.8769443°, W -70.815328°	8.36	3.36	17.95
80	On the Atlantic Ocean coastline, approximately 675 feet NE of the intersection Ocean Blvd. and Black Water Rd., at N 42.872535°, W -70.815788°	8.36	3.23	17.76
81	On the Atlantic Ocean coastline, approximately 540 feet SE of the intersection Ocean Blvd. and Brockline Ave., at N 42.868108°, W -70.815855°	8.36	N/A	10.04

*All elevations reflect the storm surge hazard only. Tsunami hazards may dominate in certain areas.
**North American Vertical Datum of 1988
[1]Wave runup elevation

In Table 8, "Transect Data," the flood hazard zone and base flood elevations for each transect flooding source are provided, along with the 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for the respective flooding source.

TABLE 8 – TRANSECT DATA

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*)				Zone	Base Flood Elevation (feet NAVD88*)
		10-Percent	2-Percent	1-Percent	0.2-Percent		
Atlantic Ocean	1	7.24	7.98	9.02[1]	9.43	VE AE	11-12 9-10
Atlantic Ocean	2	7.24	7.98	8.83[1]	9.43	VE AE	11-12 9-10
Atlantic Ocean	3	7.24	7.98	8.95[1]	9.43	VE AE	11-12 9-10

TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE

*North America Vertical Datum of 1988
[1]Includes wave setup

[1]Including stillwater elevation and effects of wave setup.

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

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*)				Zone	Base Flood Elevation (feet NAVD88*)
		10-Percent	2-Percent	1-Percent	0.2-Percent		
Atlantic Ocean	4	7.24	7.98	8.96[1]	9.43	VE	11-12
						AE	9-10
Atlantic Ocean	5	7.24	7.98	12.65[1]	9.43	VE	19[2]
						AE	19[2]
						AO	3
Atlantic Ocean	6	7.24	7.98	12.03[1]	9.43	VE	14-18
						AE	12-14
Atlantic Ocean	7	7.24	7.98	11.99[1]	9.43	VE	14-18
						AE	12-14
Atlantic Ocean	8	7.24	7.98	12.31[1]	9.43	VE	20[2]
						AE	18[2]
Atlantic Ocean	9	7.24	7.98	12.27[1]	9.43	VE	14-18
						AE	12-14
Atlantic Ocean	10	7.24	7.98	11.27[1]	9.43	VE	16[2]-17
						AE	16[2]
						AO	3
Atlantic Ocean	11	7.24	7.98	11.20[1]	9.43	VE	13-17
						AE	11-13
Atlantic Ocean	12	7.24	7.98	11.20[1]	9.43	VE	13-17
						AE	11-13
Atlantic Ocean	13	7.24	7.98	11.01[1]	9.43	VE	13-17
						AE	11-13
Atlantic Ocean	14	7.24	7.98	10.98[1]	9.43	VE	13-17
						AE	11-13
				8.36		AE	8-10
Atlantic Ocean	15	7.24	7.98	11.52[1]	9.43	VE	15[2]-18
						AE	15[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	16	7.24	7.98	11.53[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-9

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*)				Zone	Base Flood Elevation (feet NAVD88*)
		10-Percent	2-Percent	1-Percent	0.2-Percent		
Atlantic Ocean	17	7.24	7.98	11.61[1]	9.43	VE	17[2]-18
						AE	17[2]
						AO	3
Atlantic Ocean	18	7.24	7.98	11.58[1]	9.43	VE	17[2]-18
						AE	17[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	19	7.24	7.98	11.76[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
Atlantic Ocean	20	7.24	7.98	11.63[1]	9.43	VE	20[2]
						AE	20[2]
						AO	3
Atlantic Ocean	21	7.24	7.98	11.72[1]	9.43	VE	14-18
						AE	12-14
Atlantic Ocean	22	7.24	7.98	11.71[1]	9.43	VE	14-18
				8.36		AE	8-14
Atlantic Ocean	23	7.24	7.98	11.64[1]	9.43	VE	14-18
				8.36		AE	8-9
Atlantic Ocean	24	7.24	7.98	11.75[1]	9.43	VE	14-18
				8.36		AE	8-9
Atlantic Ocean	25	7.24	7.98	11.75[1]	9.43	VE	20[2]
						AE	20[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	26	7.24	7.98	11.72[1]	9.43	VE	19
						AE	19[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	27	7.24	7.98	11.51[1]	9.43	VE	17[2]-18
						AE	17[2]
						AO	3

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*)				Zone	Base Flood Elevation (feet NAVD88*)
		10-Percent	2-Percent	1-Percent	0.2-Percent		
Atlantic Ocean	28	7.24	7.98	11.57[1]	9.43	VE	19[2]
						AE	19[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	29	7.24	7.98	11.64[1]	9.43	VE	20[2]
						AE	20[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	30	7.24	7.98	11.67[1]	9.43	VE	21[2]
						AE	21[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	31	7.24	7.98	11.66[1]	9.43	VE	20[2]
						AE	20[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	32	7.24	7.98	11.74[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
Atlantic Ocean	33	7.24	7.98	11.75[1]	9.43	VE	14-18
						AE	10-14
				8.36		AE	8-10
Atlantic Ocean	34	7.24	7.98	11.47[1]	9.43	VE	18
						AE	18[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	35	7.24	7.98	11.50[1]	9.43	VE	19[2]
						AE	19[2]
						AO	3
Atlantic Ocean	36	7.24	7.98	10.99[1]	9.43	VE	19[2]
						AE	19[2]
						AO	3
Atlantic Ocean	37	7.24	7.98	11.51[1]	9.43	VE	14-18
				8.36		AE	8-13

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*)				Zone	Base Flood Elevation (feet NAVD88*)
		10-Percent	2-Percent	1-Percent	0.2-Percent		
Atlantic Ocean	38	7.24	7.98	11.55[1]	9.43	VE	14-18
Atlantic Ocean	39	7.24	7.98	11.56[1]	9.43	VE	15[2]-18
						AO	3
Atlantic Ocean	40	7.24	7.98	11.54[1]	9.43	VE	17[2]-18
						AE	17[2]
				8.36		AE	8-9
Atlantic Ocean	41	7.24	7.98	11.55[1]	9.43	VE	21[2]
						AE	21[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	42	7.24	7.98	11.35[1]	9.43	VE	16[2]-17
						AE	16[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	43	7.24	7.98	11.47[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
Atlantic Ocean	44	7.24	7.98	11.53[1]	9.43	VE	18[2]
						AE	18[2]
						AO	3
Atlantic Ocean	45	7.24	7.98	11.64[1]	9.43	VE	18[2]
						AE	18[2]
						AO	3
Atlantic Ocean	46	7.24	7.98	11.66[1]	9.43	VE	20[2]
						AE	20[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	47	7.24	7.98	11.21[1]	9.43	VE	24[2]
						AE	24[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	48	7.24	7.98	11.82[1]	9.43	VE	22[2]
						AE	22[2]

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*) 10-Percent	2-Percent	1-Percent	0.2-Percent	Zone	Base Flood Elevation (feet NAVD88*)
Atlantic Ocean	49	7.24	7.98	11.70[1]	9.43	VE	18[2]
						AE	18[2]
Atlantic Ocean	50	7.24	7.98	11.70[1]	9.43	VE	27[2]
						AE	27[2]
Atlantic Ocean	51	7.24	7.98	10.90[1]	9.43	VE	16[2]-17
						AE	16[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	52	7.24	7.98	11.70[1]	9.43	VE	17[2]-18
						AE	17[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	53	7.24	7.98	11.70[1]	9.43	VE	17[2]-18
							17[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	54	7.24	7.98	11.75[1]	9.43	VE	18[2]
						AE	18[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	55	7.24	7.98	11.70[1]	9.43	VE	18[2]
						AE	18[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	56	7.24	7.98	11.68	9.43	VE	20[2]
						AE	20[2]
						AO	2
				8.36		AE	8
Atlantic Ocean	57	7.24	7.98	11.66[1]	9.43	VE	14-18
						AE	12-13
				8.36		AE	8-9
Atlantic Ocean	58	7.24	7.98	10.90[1]	9.43	VE	13-17
						AE	11-12

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*) 10-Percent	2-Percent	1-Percent	0.2-Percent	Zone	Base Flood Elevation (feet NAVD88*)
Atlantic Ocean	59	7.24	7.98	11.51[1]	9.43	VE	15[2]-18
						AE	15[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	60	7.24	7.98	11.55[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-9
Atlantic Ocean	61	7.24	7.98	11.60[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	62	7.24	7.98	11.58[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	63	7.24	7.98	11.58[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	64	7.24	7.98	11.62[1]	9.43	VE	15[2]-18
						AE	15[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	65	7.24	7.98	11.56[1]	9.43	VE	15[2]-18
						AE	15[2]
						AO	3
						AE	8-9
Atlantic Ocean	66	7.24	7.98	11.55[1]	9.43	VE	15[2]-18
						AE	15[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	67	7.24	7.98	11.66[1]	9.43	VE	16[2]-18
						AE	16[2]
						AO	3
				8.36		AE	8-10

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*) 10-Percent	2-Percent	1-Percent	0.2-Percent	Zone	Base Flood Elevation (feet NAVD88*)
Atlantic Ocean	68	7.24	7.98	11.58[1]	9.43	VE	16[2]-18
						AE	16[2]
Atlantic Ocean	69	7.24	7.98	10.78[1]	9.43	VE	13[2]-17
						AE	13[2]
Atlantic Ocean	70	7.24	7.98	11.11[1]	9.43	VE	16[2]-17
						AE	16[2]
						AO	3
				8.36		AE	8-10
Atlantic Ocean	71	7.24	7.98	11.50[1]	9.43	VE	12[2]-18
						AE	12[2]
				8.36		AE	8-10
Atlantic Ocean	72	7.24	7.98	11.50[1]	9.43	VE	13[2]-18
						AE	13[2]
				8.36		AE	8-10
Atlantic Ocean	73	7.24	7.98	11.49[1]	9.43	VE	13[2]-18
						AE	13[2]
				8.36		AE	8-10
Atlantic Ocean	74	7.24	7.98	11.49[1]	9.43	VE	13[2]-18
						AE	13[2]
				8.36		AE	8-10
Atlantic Ocean	75	7.24	7.98	11.49[1]	9.43	VE	14-18
				8.36		AE	8-10
Atlantic Ocean	76	7.24	7.98	11.64[1]	9.43	VE	14-18
				8.36		AE	8-10
Atlantic Ocean	77	7.24	7.98	11.63[1]	9.43	VE	14-18
				8.36		AE	8-10
Atlantic Ocean	78	7.24	7.98	11.70[1]	9.43	VE	14-18
				8.36		AE	8-10
Atlantic Ocean	79	7.24	7.98	11.72[1]	9.43	VE	14-18
				8.36		AE	8-10

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

TABLE 8 – TRANSECT DATA – continued

Flooding Source	Transect	Stillwater Elevation (feet NAVD88*) 10-Percent	2-Percent	1-Percent	0.2-Percent	Zone	Base Flood Elevation (feet NAVD88*)
Atlantic Ocean	80	7.24	7.98	11.59[1] 8.36	9.43	VE AE	14-18 8-10
Atlantic Ocean	81	7.24	7.98	8.36	9.43	AE	8-10

*North America Vertical Datum of 1988
[1]Includes wave setup
[2]Wave runup elevation

Users of the FIRM should also be aware that coastal flood elevations are provided in Table 5 "Summary of Coastal Stillwater Elevations" in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave runup, and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

As defined in the July 1989 *Guidelines and Specifications for Wave Elevation Determination and V Zone Mapping,* the coastal high hazard area (Zone VE) is the area where wave action and/or high velocity water can cause structural damage (*Guidelines and Specifications for Wave Elevation Determination and V-Zone Mapping*, FEMA, 1989). It is designated on the FIRM as the most landward of the following three points:

1) The point where the 3.0 ft or greater wave height could occur;

2) The point where the eroded ground profile is 3.0 ft or more below the maximum runup elevation; or

3) The primary frontal dune as defined in the NFIP regulations.

These three points are used to locate the inland limit of the coastal high hazard area to ensure that adequate insurance rates apply and appropriate construction standards are used, should local agencies permit building in this area.

The Limit of Moderate Wave Action (LiMWA) was delineated in accordance with FEMA Procedure Memorandum 50 (2008). In coastal areas, Zone AE may be subdivided by a limit of moderate wave action boundary at the landward extent of the propagation of waves higher than 1.5 feet. Damages to structures from wave heights between 1.5 and 3 feet are similar to, but less severe than, those in areas where wave heights are greater than 3 feet, typically designated as Zone VE on the FIRM. Damages to structures from wave heights less than 1.5 feet are more similar to those in riverine or lacustrine floodplains. The inland limit of the area affected by waves greater than 1.5 feet is called the Limit of Moderate Wave Action (LiMWA).

3.4 Vertical Datum

All FISs 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 in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum (NGVD 29). With the finalization of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM for the following 13 coastal communities are referenced to NAVD 88: Exeter, Greenland, Hampton, Hampton Falls, New Castle, Newfields, Newington, Newmarket, North Hampton, Portsmouth, Rye, Seabrook, and Stratham. Structure and ground elevations in these communities must, therefore, be referenced to NAVD88.

Flood elevations shown in this FIS report and on the FIRM for the 24 remaining, interior communities in Rockingham County, including Atkinson, Auburn, Brentwood, Candia, Chester, Danville, Deerfield, Derry, East Kingston, Epping, Fremont, Hampstead, Kensington, Kingston, Londonderry, Newton, Northwood, Nottingham, Plaistow, Raymond, Sandown, Salem, South Hampton, and Windham are referenced to NGVD29. Structure and ground elevations in these communities must, therefore, be referenced to NGVD 29. It is important to note that adjacent communities may be referenced to NAVD 88. This may result in differences in base flood elevations across the corporate limits between the communities.

A summary of the vertical datum reference by town in Rockingham County is provided in Table 9, "Vertical Datum Reference by Community."

TABLE 9 – VERTICAL DATUM REFERENCE BY COMMUNITY

Community Name	Vertical Datum Reference
Atkinson	NGVD 29
Auburn	NGVD 29
Brentwood	NGVD 29
Candia	NGVD 29
Chester	NGVD 29

TABLE 9 – VERTICAL DATUM REFERENCE BY COMMUNITY – continued

Community Name	Vertical Datum Reference
Danville	NGVD 29
Deerfield	NGVD 29
Derry	NGVD 29
East Kingston	NGVD 29
Epping	NGVD 29
Exeter	NAVD 88
Fremont	NGVD 29
Greenland	NAVD 88
Hampstead	NGVD 29
Hampton	NAVD 88
Hampton Falls	NAVD 88
Kensington	NGVD 29
Kingston	NGVD 29
Londonderry	NGVD 29
New Castle	NAVD 88
Newfields	NAVD 88
Newington	NAVD 88
Newmarket	NAVD 88
Newton	NGVD 29
North Hampton	NAVD 88
Northwood	NGVD 29
Nottingham	NGVD 29
Plaistow	NGVD 29
Portsmouth	NAVD 88
Raymond	NGVD 29
Rye	NAVD 88
Sandown	NGVD 29
Salem	NGVD 29
Seabrook	NAVD 88
South Hampton	NGVD 29
Stratham	NAVD 88
Windham	NGVD 29

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address http://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 provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations of the 100-year and 500-year floodplains; and 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS 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

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Pre-countywide Analysis

Between the cross sections, the boundaries were interpolated using topographic maps (State of New Hampshire, 1970; USGS, 1956, 1966, 1973, 1974, 1977, 1981, 1985; James W. Sewall Company, 1976, 1977, 1978, 1979; Southeastern New Hampshire Regional Planning Commission, New Hampshire, August 1974; Avis Airmap, 1977; Southeastern New Hampshire Regional Planning Commission, Concord, New Hampshire, July 1975; and Underwood Engineers) and soil survey maps (U.S. Department of Agriculture, 1980, 1981, 1983, and 1986).

For the streams studied by approximate methods, the 100-year floodplain boundaries were delineated using a combination of the following: previously printed Flood Hazard Boundary Maps (U.S. Department of Housing and Urban Development, 1974, 1975, 1976, 1977; FEMA, 1986); previously printed FISs (FEMA, 1981 and 1988); topographic maps (USGS, 1953, 1956, 1966, 1968, 1973, 1974, and 1981; James W. Sewall Company, 1976, 1977, 1979; S.N.H.R.P.C., 1975, 1976); SCS Flood Prone Area Map (U.S. Department of Agriculture, 1974); and soil survey map (U.S. Department of Agriculture, 1983).

The 100- and 500-year floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year 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.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the FIRM (Exhibit 2).

100-year flood data elevations are shown in Table 10, "100-Year Flood Data."

2005 Countywide Analyses

No remapping was conducted in 2005.

2013 Coastal Update

For streams studied in detail, 1-percent and 0.2-percent annual chance floodplain boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated based on 2-foot contour interval topography from the 2011 LiDAR mission discussed in Section 2.1. The LiDAR was also utilized to support the basic Zone A modeling and delineations, as well as the redelineation of hydraulic analyses from previous studies.

For tidal areas without wave action, the 100-year and 500-year boundaries were also delineated using the 2011 LiDAR. 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 the topographic maps referenced above. The 100-year floodplain was divided into whole-foot elevation zones based on average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one-foot intervals, larger increments were used.

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 100-year 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 100-year flood can be carried with.out substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS 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.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. 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 floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Portions of the floodways for Beaver Brook extend beyond the county boundary. No floodway was computed for Grassy Brook, Hill Brook, Hog Hill Brook, Porcupine Brook, Porcupine Brook Tributary, Powwow River (Downstream Reach), Powwow River (Upstream Reach), Squamscott River, Wash Pond Tributary, West Channel Policy Brook, and portions of the Lamprey River and Pickering Brook.

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.

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 10 for certain downstream cross sections of Black Brook, Hidden Valley Brook, Homes Brook, Little River No. 1, Tributary C to Beaver Brook, Tributary G to Beaver Brook, Tributary O to Beaver Brook, Tributary E to Little Cohas Brook, and Tributary H to Nesenkeag Brook are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

The area between the floodway and 100-year 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 the 100-year 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 3.

FLOODING SOURCE		RIVER CHANNEL				1% ANNUAL CHANCE WATER-SURFACE ELEVATIONS (FEET NGVD)
CROSS SECTION	DISTANCE[1] (FEET)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	STREAM-BED ELEVATION (FT. NGVD)	
Hog Hill Brook						
A	20	125	603	1.1	127.2	137.4
B	1,540	140	682	1.0	128.0	137.9
C	1,600	180	713	1.0	129.4	138.0
D	2,580	50	93	7.3	140.7	143.6
E	2,650	126	761	0.9	142.5	154.3
F	2,800	147	531	1.3	145.6	154.3
G	2,850	200	220	3.1	149.1	154.3
H	4,000	73	125	3.3	149.8	154.5
I	4,390	30	54	7.6	161.1	164.4
J	4,460	214	436	0.9	164.1	168.6
K	5,400	57	84	4.9	168.6	172.0
L	6,100	67	148	2.8	174.7	178.5
M	7,820	147	355	1.2	176.2	181.5
N	8,910	289	553	0.7	178.3	181.8
O	8,980	95	421	0.9	180.3	188.5

[1]Distance in feet above Town of Atkinson corporate limits

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

100-YEAR FLOOD DATA

HOG HILL BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Beaver Brook								
A	13.926	135/25[2]	707	4.3	152.0	152.0	152.5	0.5
B	13.947	50/30[2]	415	7.4	154.7	154.7	154.7	0.0
C	14.037	85/65[2]	553	5.6	156.5	156.5	157.5	1.0
D	14.738	85/55[2]	573	5.4	163.5	163.5	164.1	0.6
E	14.942	180/120[2]	1,423	2.2	166.9	166.9	167.0	0.1
F	15.646	210/20[2]	1,266	2.4	167.8	167.8	168.8	1.0
G	15.990	50/20[2]	463	6.3	172.6	172.6	172.6	0.0
H	16.417	165/25[2]	1,105	2.6	175.4	175.4	175.9	0.5
I	17.057	160	663	4.2	176.7	176.7	177.7	1.0
J	17.964	50	327	8.2	192.1	192.1	193.1	1.0
K	18.993	110	821	3.3	209.1	209.1	209.1	0.0
L	20.017	50	444	6.1	210.0	210.0	211.0	1.0
M	20.482	90	634	4.2	213.5	213.5	214.2	0.7
N	21.305	80	617	3.3	219.2	219.2	220.2	1.0
0	21.799	195	560	3.7	219.9	219.9	220.6	0.7
P	22.802	260	1,565	1.3	226.0	226.0	227.0	1.0
Q	23.392	40	341	6.0	230.9	230.9	230.9	0.0
R	23.816	300	1,344	1.5	231.8	231.8	232.7	0.9
S	24.233	110	606	3.4	235.9	235.9	236.5	0.6
T	24.694	180	910	2.3	238.0	238.0	238.9	0.9
U	25.075	100	654	2.2	241.2	241.2	241.3	0.1
V	25.546	100	598	2.4	242.7	242.7	243.4	0.7
W	25.789	127	962	1.5	244.4	244.4	245.1	0.7
X	26.233	230	2,276	0.6	248.0	248.0	248.9	0.9
Y	26.648	300	2,677	0.2	248.0	248.0	248.9	0.9
Z	26.870	350	1,801	0.2	248.0	248.0	248.9	0.9

[1]Miles above confluence with Merrimack River
[2]Width/width within county boundary

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

BEAVER BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Beaver Brook (continued)								
AA	27.244[1]	80	437	1.0	248.1	248.1	248.9	0.8
AB	27.580[1]	24	55	7.8	253.6	253.6	253.8	0.2
AC	27.652[1]	32	112	3.8	263.7	263.7	263.9	0.2
AD	27.838[1]	30	59	7.3	282.0	282.0	282.1	0.1
Black Brook								
A	0.400[2]	115	288	0.9	214.0	212.0[4]	212.8	0.8
B	1.000[2]	30	90	2.9	216.4	216.4	216.8	0.4
C	1.545[2]	20	43	6.2	257.2	257.2	257.2	0.0
D	1.737[2]	20	19	4.7	264.5	264.5	264.5	0.0
E	2.095[2]	30	17	5.3	281.5	281.5	281.5	0.0
F	2.369[2]	20	14	6.4	298.6	298.6	298.6	0.0
G	3.176[2]	25	23	3.9	321.0	321.0	321.0	0.0
Bryant Brook								
A	660[3]	27	59	6.0	47.8	47.8	48.8	1.0
B	1,370[3]	27	41	8.7	67.3	67.3	67.3	0.0
C	1,760[3]	15	37	9.6	73.3	73.3	73.7	0.4
D	2,815[3]	228	473	0.8	74.7	74.7	75.7	1.0
E	4,010[3]	96	193	1.8	76.3	76.3	77.3	1.0
F	5,955[3]	80	240	1.5	78.7	78.7	79.7	1.0
G	6,810[3]	238	395	0.9	79.3	79.3	80.3	1.0

[1] Miles above confluence with Merrimack River
[2] Miles above confluence with Beaver Brook
[3] Feet above confluence with Little River No. 3
[4] Elevation computed without consideration of backwater effects from Beaver Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

BEAVER BROOK - BLACK BROOK - BRYANT BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cohas Brook								
A	0.000[1]	30	155	6.3	227.3	227.3	228.3	1.0
B	0.312[1]	30	120	8.2	233.7	233.7	234.1	0.4
C	0.700[1]	50	202	4.9	245.0	245.0	246.0	1.0
D	1.032[1]	40	163	6.0	249.4	249.4	250.1	0.7
E	1.350[1]	80	348	2.8	259.7	259.7	260.4	0.7
Cunningham Brook								
A	0.155[2]	31	149	2.5	218.9	218.9	218.9	0.0
B	0.514[2]	24	55	6.7	251.6	251.6	252.1	0.5
C	1.040[2]	276	833	0.4	296.0	296.0	297.0	1.0
Drew Brook								
A	0.100[3]	170	974	0.4	206.8	206.8	207.8	1.0
B	0.425[3]	140	854	0.4	207.6	207.6	208.0	0.4
C	0.705[3]	65	376	0.9	208.9	208.9	208.9	0.0
D	1.043[3]	40	165	2.1	209.2	209.2	209.4	0.2
E	1.800[3]	70	129	2.7	213.8	213.8	214.0	0.2

[1]Miles above county boundary
[2]Miles above confluence with Drew Brook
[3]Miles above confluence with Island Pond

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

COHAS BROOK - CUNNINGHAM BROOK - DREW BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Dudley Brook								
A	2,198	56	228	2.6	82.6	82.6	83.5	0.9
B	2,375	101	967	0.6	89.7	89.7	89.7	0.0
C	7,475	57	250	2.0	89.8	89.8	90.0	0.2
D	7,644	56	236	2.1	89.8	89.8	90.0	0.2
E	7,720	24	57	8.8	92.7	92.7	92.7	0.0
F	7,847	53	294	1.7	94.1	94.1	94.2	0.1
G	9,237	74	335	1.5	94.2	94.2	94.8	0.6
H	12,277	255	591	0.9	96.0	96.0	96.7	0.7
I	18,627	164	322	1.0	102.0	102.0	102.9	0.9
J	20,007	24	78	3.9	106.7	106.7	106.8	0.1
K	20,237	32	128	2.4	107.1	107.1	108.1	1.0
L	20,439	15	87	3.5	107.5	107.5	108.5	1.0
M	20,487	12	77	4.0	107.6	107.6	108.6	1.0

[1]Feet above Town of Brentwood corporate limits

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

DUDLEY BROOK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Exeter River (Town of Exeter)								
A	0	269	644	8.8	5.4	5.4	5.4	0.0
B	160	172	555	10.2	11.5	11.5	11.5	0.0
C	411	101	467	12.2	20.1	20.1	20.1	0.0
D	484	135	1531	3.7	27.9	27.9	28.8	0.9
E	842	114	1277	4.5	30.4	30.4	30.8	0.4
F	1236	113	1558	3.6	30.5	30.5	31.0	0.5
G	1619	104	1490	3.8	30.6	30.6	31.0	0.4
H	2080	123	2011	2.8	30.7	30.7	31.2	0.5
I	2420	129	1863	3.1	30.7	30.7	31.2	0.5
J	2667	146	2527	2.3	30.9	30.9	31.4	0.5
K	3029	185	2659	2.1	30.9	30.9	31.4	0.5
L	3443	186	3082	1.8	30.9	30.9	31.4	0.5
M	3851	293	2872	1.8	30.9	30.9	31.4	0.5
N	4258	510	4905	1.0	30.9	30.9	31.5	0.5
O	4562	542	6134	0.8	30.9	30.9	31.5	0.6
P	5022	533	4686	1.0	30.9	30.9	31.5	0.5
Q	5416	690	5217	0.9	30.9	30.9	31.5	0.5
R	6035	415	7567	0.7	30.9	30.9	31.5	0.6
S	6398	670	7160	0.7	31.0	31.0	31.5	0.6
T	6755	813	6859	0.7	31.0	31.0	31.5	0.6
U	7296	800	5606	0.9	31.0	31.0	31.5	0.6

[1]Feet above confluence with Squamscott River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

EXETER RIVER (TOWN OF EXETER)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Exeter River (Town of Exeter) (continued)								
V	7764	783	7017	0.7	31.0	31.0	31.6	0.6
W	8195	715	6443	0.8	31.0	31.0	31.6	0.6
X	8757	718	6706	0.7	31.0	31.0	31.6	0.6
Y	9184	793	7618	0.6	31.0	31.0	31.6	0.6
Z	9762	1079	6849	0.7	31.0	31.0	31.6	0.6
AA	10182	1108	7471	0.7	31.0	31.0	31.6	0.6
AB	10555	720	7223	0.7	31.0	31.0	31.6	0.6
AC	10964	642	6904	0.7	31.0	31.0	31.6	0.6
AD	11512	559	6995	0.7	31.0	31.0	31.7	0.7
AE	12158	429	6685	0.7	31.0	31.0	31.7	0.7
AF	12552	878	7159	0.6	31.0	31.0	31.7	0.7
AG	13006	634	6069	0.7	31.0	31.0	31.7	0.7
AH	13606	292	3233	1.4	31.0	31.0	31.7	0.6
AI	14170	845	6044	0.7	31.0	31.0	31.7	0.7
AJ	14560	1153	8722	0.5	31.0	31.0	31.8	0.7
AK	15148	1729	10913	0.4	31.0	31.0	31.8	0.7
AL	15569	1219	8871	0.5	31.0	31.0	31.8	0.8
AM	16161	976	10068	0.4	31.0	31.0	31.8	0.8
AN	16551	1492	8377	0.5	31.0	31.0	31.8	0.8
AO	17099	1500	7698	0.6	31.0	31.0	31.8	0.8
AP	17721	1593	6528	0.7	31.0	31.0	31.8	0.8

[1]Feet above confluence with Squamscott River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

EXETER RIVER (TOWN OF EXETER)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Exeter River (Town of Exeter) (continued)								
AQ	18507	1692	5326	0.8	31.1	31.1	31.8	0.8
AR	19151	2579	13753	0.3	31.1	31.1	31.9	0.8
AS	19589	2711	12217	0.4	31.1	31.1	31.9	0.8
AT	19698	2584	11676	0.4	31.4	31.4	31.9	0.5
AU	23294	997	7285	0.6	31.4	31.4	31.9	0.5
AV	24394	114	1259	3.5	31.4	31.4	31.9	0.5
AW	24478	87	718	6.1	31.5	31.5	32.0	0.5
AX	26903	125	1123	3.9	33.0	33.0	33.4	0.5
AY	28049	554	3831	1.1	33.3	33.3	33.9	0.6
AZ	29872	914	4748	0.9	33.4	33.4	34.0	0.6
BA	31235	522	3782	1.2	33.5	33.5	34.1	0.6
BB	31372	649	4531	1.0	34.0	34.0	34.8	0.8
BC	32007	690	3635	1.2	34.1	34.1	34.9	0.8
BD	36192	98	551	7.9	36.7	36.7	36.8	0.1
BE	37245	192	2195	2.0	45.6	45.6	45.9	0.3
BF	38306	211	1717	2.5	45.6	45.6	46.0	0.3
BG	39790	108	666	6.5	45.7	45.7	46.3	0.6
BH	40564	68	340	12.7	51.7	51.7	51.7	0.0
BI	40646	93	516	8.4	54.8	54.8	54.8	0.0
BJ	40765	160	918	4.7	58.2	58.2	58.9	0.7
BK	40782	225	2555	1.7	65.9	65.9	66.0	0.1

[1]Feet above confluence with Squamscott River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

EXETER RIVER (TOWN OF EXETER)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Exeter River (Town of Exeter) (continued)								
BL	41626	135	1,276	2.9	65.4	65.4	66.3	0.9
BM	42276	390	2,386	1.4	65.6	65.6	66.5	0.9
BN	52603	274	1,215	2.7	66.5	66.5	67.2	0.7

[1]Feet above confluence with Squamscott River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

EXETER RIVER (TOWN OF EXETER)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE'	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Exeter River								
AD	56,283	350	3,357	0.9	68.7	68.7	69.6	0.9
AE	58,143	99	508	5.9	70.0	70.0	70.5	0.5
AF	58,315	59	327	9.2	70.3	70.3	70.7	0.4
AG	61,175	97	1,104	2.7	73.7	73.7	74.0	0.3
AH	65,655	88	682	4.4	75.4	75.4	75.8	0.4
AI	66,895	67	555	5.4	76.7	76.7	77.0	0.3
AJ	69,895	74	621	4.8	80.3	80.3	80.6	0.3
AK	71,490	73	424	7.1	83.0	83.0	83.4	0.4
AL	72,560	43	233	12.9	91.4	91.4	92.0	0.6
AM	72,763	70	274	11.0	100.6	100.6	100.6	0.0
AN	72,842	70	467	6.4	104.5	104.5	104.6	0.1
AO	72,887	74	503	6.0	104.7	104.7	104.8	0.1
AP	73,031	36	297	10.1	104.7	104.7	104.8	0.1
AQ	73,165	164	1,218	2.5	107.2	107.2	107.2	0.0
AR	77,960	190	1,009	3.0	116.0	116.0	117.0	1.0
AS	78,530	64	393	7.7	120.4	120.4	120.4	0.0
AT	78,701	52	760	4.0	129.7	129.7	129.7	0.0
AU	78,751	89	1,468	2.1	133.7	133.7	133.7	0.0
AV	78,936	136	1,489	2.0	133.7	133.7	133.8	0.1
AW	80,076	109	743	3.9	133.9	133.9	134.0	0.1
AX	80,323	109	760	3.8	134.0	134.0	134.1	0.1
AY	80,373	219	1,519	1.9	134.2	134.2	134.3	0.1
AZ	80,360	219	1,546	1.9	135.3	135.3	135.3	0.0
BA	82,740	275	2,762	1.0	135.5	135.5	135.5	0.0
BB	84,960	185	1,684	1.9	135.6	135.6	135.8	0.2

'Feet above confluence with Squamscott River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

EXETER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Flatrock Brook								
A	0.209[1]	35	140	5.0	165.3	165.3	165.3	0.0
B	0.447[1]	68	272	2.6	169.1	169.1	170.0	0.9
C	0.737[1]	17	130	5.4	182.4	182.4	182.4	0.0
D	0.969[1]	37	180	2.9	182.9	182.9	183.9	1.0
E	1.325[1]	21	61	8.6	232.7	232.7	232.8	0.1
F	1.800[1]	24	89	4.0	240.1	240.1	240.8	0.7
Golden Brook								
A	3.705[2]	75	349	2.0	139.8	139.8	139.9	0.1
B	4.880[2]	100	524	1.4	151.4	151.4	152.3	0.9
C	5.728[2]	110	641	1.2	156.2	156.2	156.3	0.1
D	7.390[2]	21	57	6.7	177.9	177.9	177.9	0.0
E	7.962[2]	25	51	7.5	188.8	188.8	189.1	0.3
F	8.535[2]	21	65	5.9	208.4	208.4	208.7	0.3
G	8.649[2]	11	102	3.7	221.4	221.4	221.6	0.2
Hidden Valley Brook								
A	0.200[3]	17	81	3.6	210.2	208.4[4]	209.1	0.7
B	0.500[3]	13	93	3.1	218.0	218.0	218.0	0.0
C	0.900[3]	15	38	7.5	240.1	240.1	240.3	0.2
D	1.125[3]	20	51	4.1	249.1	249.1	249.5	0.4
E	1.383[3]	75	168	1.0	251.2	251.2	252.1	0.9
F	1.591[3]	40	63	2.7	267.7	267.7	267.9	0.2
G	2.073[3]	17	48	4.4	276.0	276.0	277.0	1.0

[1]Miles above confluence with Shadow Lake
[2]Miles above mouth
[3]Miles above confluence with Beaver Brook
[4]Elevation computed without consideration of backwater effects from Beaver Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

FLATROCK BROOK - GOLDEN BROOK - HIDDEN VALLEY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Homes Brook								
A	0.083[1]	18	91	4.0	241.0	239.4[3]	240.1	0.7
B	0.347[1]	16	81	4.5	243.2	243.2	244.0	0.8
C	0.620[1]	18	84	4.4	250.6	250.6	251.3	0.7
D	0.758[1]	20	92	4.0	252.8	252.8	253.7	0.9
Kelly Brook								
A	575[2]	25	114	4.4	96.4	96.4	97.4	1.0
B	1,160[2]	40	122	4.1	98.2	98.2	98.9	0.7
C	4,000[2]	65	697	0.7	111.9	111.9	112.0	0.1
D	5,410[2]	40	328	1.5	111.9	111.9	112.1	0.2
E	6,930[2]	20	160	3.1	116.3	116.3	117.1	0.8
F	7,490[2]	30	143	3.5	116.7	116.7	117.6	0.9
G	8,880[2]	45	104	4.8	123.5	123.5	124.1	0.6
H	9,135[2]	30	76	6.5	125.6	125.6	125.9	0.3

[1]Miles above confluence with Beaver Brook
[2]Feet above confluence with Little River No. 3
[3]Elevation computed without consideration of backwater effects from Beaver Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

HORNES BROOK - KELLY BROOK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Lamprey River								
A	0	86	597	14.9	10.3	10.3	10.3	0.0
B	36	140	3068	2.9	33.5	33.5	34.5	1.0
C	206	139	3494	2.6	33.6	33.6	34.6	1.0
D	247	92	1552	5.8	33.5	33.5	34.4	0.9
E	310	68	1406	6.4	34.6	34.6	35.4	0.8
F	345	132	2082	4.3	34.9	34.9	35.9	1.0
G	546	135	3039	2.9	35.1	35.1	36.1	1.0
H	754	195	4697	1.9	35.2	35.2	36.2	0.9
I	1764	203	4276	2.1	35.3	35.3	36.2	0.9
J	1947	277	5516	1.6	35.3	35.3	36.3	0.9
K	2885	385	7368	1.2	35.4	35.4	36.3	0.9

[1]Distances are measured in feet above confluence with MacCallen Dam.

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

LAMPREY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Cohas Brook								
A	0.141	20	52	9.2	200.4	200.4	200.4	0.0
B	0.547	30	112	4.3	212.1	212.1	212.2	0.1
C	0.678	30	73	6.6	229.2	229.2	229.2	0.0
D	0.900	40	56	6.9	242.7	242.7	242.7	0.0
E	1.165	180	720	0.5	261.1	261.1	261.1	0.0
F	1.228	630	3,062	0.1	263.7	263.7	263.7	0.0
G	1.775	105	487	0.8	263.7	263.7	263.7	0.0
H	2.365	30	175	1.8	264.3	264.3	264.4	0.1
I	2.717	300	396	0.8	264.3	264.3	265.1	0.8
J	3.405	20	25	6.8	306.8	306.8	306.8	0.0

[1]Miles above Industrial Drive

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE COHAS BROOK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	400	195	1,679	0.4	31.0	28.1[2]	28.1	0.0
B	610	80	803	0.8	31.0	28.1[2]	28.1	0.0
C	2,460	70	615	1.0	31.0	28.1[2]	28.2	0.1
D	2,604	99	839	0.7	31.0	28.2[2]	28.3	0.1
E	4,104	29	183	3.4	31.0	28.3[2]	28.4	0.1
F	5,104	44	351	1.8	31.0	28.3[2]	29.1	0.8
G	5,234	214	1,118	0.6	31.0	28.7[2]	29.5	0.8
H	7,634	76	504	1.2	31.0	29.0[2]	29.8	0.8
I	7,934	76	696	0.9	31.0	29.1[2]	30.0	0.9
J	8,069	78	287	2.2	31.0	29.9[2]	30.5	0.6
K	9,219	122	427	1.5	31.0	30.8[2]	31.5	0.7
L	10,169	164	800	0.8	31.0	31.0	31.7	0.7
M	10,246	21	128	4.9	31.0	31.0	31.7	0.7
N	10,566	80	430	1.5	31.7	31.7	32.3	0.6
O	11,866	32	173	3.6	32.0	32.0	32.7	0.7
P	12,666	55	87	7.2	39.7	39.7	40.0	0.3
Q	12,799	205	1,221	0.5	46.8	46.8	46.9	0.1

[1]Feet above confluence with Exeter River

[2]Elevation computed without consideration of backwater effects from Exeter River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

FLOODING SOURCE: LITTLE RIVER NO. 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little River No. 2								
A	3,048	67	304	0.7	10.0	10.0	10.1	0.1
B	5,048	*	78	2.9	10.3	10.3	10.8	0.5
C	5,185	*	59	3.8	10.7	10.7	11.1	0.4
D	5,385	*	32	7.2	12.5	12.5	12.5	0.0
E	5,490	*	31	7.3	14.5	14.5	14.7	0.2
F	5,780	*	25	9.0	21.6	21.6	21.7	0.1
G	6,420	*	31	7.4	27.0	27.0	27.0	0.0
H	6,495	*	32	7.2	31.6	31.6	31.7	0.1
I	6,561	75	410	0.6	35.3	35.3	35.5	0.2
J	6,771	*	25	9.0	35.5	35.5	35.5	0.0
K	6,867	*	49	4.6	39.0	39.0	39.0	0.0

[1]Feet above downstream dam in Town of North Hampton
*Floodway coincident with channel banks

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE RIVER NO. 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little River No. 3								
A	290	40	213	6.0	39.7	39.7	40.4	0.7
B	1,600	30	281	4.5	42.2	42.2	42.9	0.7
C	3,110	119	614	1.8	43.1	43.1	44.1	1.0
D	3,265	85	574	1.9	43.7	43.7	44.5	0.8
E	4,640	91	285	3.8	45.0	45.0	45.9	0.9
F	5,035	42	243	4.4	47.4	47.4	47.5	0.1
G	5,340	35	205	5.2	49.9	49.9	49.9	0.0
H	7,490	32	197	5.5	54.6	54.6	55.1	0.5
I	8,704	40	120	9.0	58.4	58.4	58.4	0.0
J	10,030	135	850	0.9	60.1	60.1	61.1	1.0
K	10,480	60	327	2.4	61.8	61.8	62.6	0.8
L	11,450	145	880	0.9	61.9	61.9	62.8	0.9
M	12,660	70	278	2.9	62.6	62.6	63.4	0.8
N	14,850	48	250	3.2	64.7	64.7	65.4	0.7
O	15,730	53	163	4.9	68.3	68.3	69.1	0.8
P	16,850	20	161	4.9	81.8	81.8	81.8	0.0
Q	17,770	39	91	8.7	86.4	86.4	86.4	0.0
R	19,420	33	142	5.6	93.3	93.3	93.8	0.5
S	20,690	70	314	2.5	95.2	95.2	96.0	0.8
T	21,970	34	153	5.2	96.3	96.3	97.1	0.8
U	23,066	50	254	1.9	102.9	102.9	102.9	0.0
V	25,410	51	326	1.5	103.1	103.1	103.5	0.4
W	27,555	58	225	1.5	103.5	103.5	104.2	0.7
X	28,240	22	127	2.6	106.9	106.9	106.9	0.0

[1]Feet above New Hampshire-Massachusetts State boundary

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE RIVER NO. 3

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nesenkeag Brook								
A	0.278	150	228	3.3	178.7	178.7	179.4	0.7
B	0.730	20	37	5.7	190.9	190.9	191.1	0.2
C	1.262	20	62	3.4	196.1	196.1	196.6	0.5
D	1.665	30	33	6.4	225.2	225.2	225.2	0.0
E	1.900	30	89	2.4	229.6	229.6	229.8	0.2
F	2.245	30	30	7.0	251.9	251.9	251.9	0.0
G	3.247	30	210	1.0	271.7	271.7	272.6	0.9
H	3.381	20	123	1.7	273.6	273.6	273.6	0.0
I	3.533	10	137	1.5	289.6	289.6	289.6	0.0

[1]Miles above county boundary

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

NESENKEAG BROOK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Piscassic River								
A	4,630	68	341	1.1	91.4	91.4	92.4	1.0
B	6,530	30	177	2.1	94.2	94.2	95.2	1.0
C	7,120	26	121	3.1	97.9	97.9	98.9	1.0
D	9,575	95	305	1.2	100.1	100.1	101.1	1.0

[1]Feet above Ice Pond Dam

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

FLOODING SOURCE: PISCASSIC RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Policy Brook								
A	0	50	160	4.1	124.0	124.0	125.0	1.0
B	1,030	50	170	3.9	126.0	126.0	126.6	0.6
C	1,105	50	250	1.8	126.4	126.4	127.0	0.6
D	1,190	50	230	2.0	126.5	126.5	127.1	0.6
E	1,240	50	400	1.1	126.5	126.5	127.1	0.6
F	3,185	50	300	1.1	126.6	126.6	127.3	0.7
G	4,025	50	280	0.7	126.6	126.6	127.3	0.7
Unnamed Brook								
H	4,075	50	210	0.6	126.6	126.6	127.3	0.7
I	4,750	50	95	1.3	127.0	127.0	127.7	0.7
J	4,965	50	170	0.7	127.1	127.1	127.8	0.7
K	5,755	50	95	0.6	127.1	127.1	127.9	0.8

[1]Feet above Rockingham park culvert

TABLE 11

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

POLICY BROOK – UNNAMED BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Shields Brook								
A	1.149	20	45	8.2	263.8	263.8	263.8	0.0
B	1.415	16	96	3.8	276.3	276.3	276.3	0.0
C	1.815	45	47	5.9	294.0	294.0	294.0	0.0
D	1.949	30	41	6.7	297.9	297.9	297.9	0.0
E	2.030	47	158	1.7	301.6	301.6	302.2	0.6
F	2.116	18	157	1.8	307.1	307.1	307.1	0.0
G	2.170	40	240	1.2	307.3	307.3	307.3	0.0
H	2.669	94	167	1.7	307.7	307.7	308.6	0.9
I	2.852	20	92	3.0	313.1	313.1	314.1	1.0
J	3.008	8	27	10.2	333.6	333.6	333.6	0.0
K	3.178	9	86	1.7	351.6	351.6	352.0	0.4
L	3.372	20	123	1.2	352.7	352.7	353.3	0.6
M	3.953	20	82	1.8	366.0	366.0	366.9	0.9
N	4.488	16	96	1.6	374.2	374.2	374.2	0.0

[1]Miles above confluence with Beaver Creek

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

SHIELDS BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Spicket River								
A	33.12	300	1,710	1.1	112.0	112.0	113.0	1.0
B	33.78	300	1,440	1.1	112.3	112.3	113.3	1.0
C	34.60	250	1,310	1.2	113.0	113.0	113.9	0.9
D	34.74	140	630	2.5	114.4	114.4	115.3	0.9
E	35.05	250	1,680	1.0	114.9	114.9	115.7	0.8
F	35.62	250	1,560	1.0	115.0	115.0	115.8	0.8
G	36.45	250	1,420	1.1	115.5	115.5	116.2	0.7
H	36.92	190	1,180	1.4	115.7	115.7	116.4	0.7
I	36.97	300	1,500	1.1	116.5	116.5	117.2	0.7
J	38.05	300	2,040	0.8	117.3	117.3	118.0	0.7
K	38.46	300	980	1.6	117.5	117.5	118.2	0.7
L	38.93	100	620	2.6	119.0	119.0	119.3	0.3
M	38.98	100	560	2.9	119.6	119.6	119.7	0.1
N	39.27	200	1,320	1.2	119.7	119.7	120.2	0.5
0	39.59	130	730	2.2	119.8	119.8	120.3	0.5
P	39.64	250	1,340	1.2	119.9	119.9	120.4	0.5
Q	40.66	250	1,380	1.2	120.6	120.6	121.1	0.5
R	40.82	250	1,500	1.2	120.7	120.7	121.3	0.6
S	40.87	250	1,840	0.8	121.8	121.8	122.5	0.7
T	41.87	180	760	1.8	122.3	122.3	122.9	0.6
U	42.47	200	1,350	1.0	126.3	126.3	126.3	0.0
V	42.74	60	460	1.6	126.4	126.4	126.5	0.1
W	43.11	100	450	1.7	127.1	127.1	127.2	0.1

[1] Miles above Newburyport Light

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

SPICKET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Taylor Brook (including Ballard Pond)								
A	0.225[1]	30	110	3.9	207.0	207.0	207.8	0.8
B	0.933[1]	19	87	4.9	218.2	218.2	218.9	0.7
C	1.638[1]	20	58	7.3	238.5	238.5	238.9	0.4
D	2.950[1]	208	1,085	0.8	258.4	258.4	259.4	1.0
E	3.153[1]	49	553	1.5	262.9	262.9	262.9	0.0
Tributary C to Beaver Brook								
A	0.092[2]	70	290	1.3	223.4	219.4[3]	220.3	0.9
B	0.571[2]	25	52	7.3	234.3	234.3	234.3	0.0
C	0.755[2]	30	51	7.5	247.1	247.1	247.1	0.0
D	0.960[2]	20	187	1.3	279.0	279.0	279.0	0.0
E	1.310[2]	40	47	5.1	292.3	292.3	292.3	0.0
F	1.800[2]	80	202	1.2	299.6	299.6	300.1	0.5
G	2.215[2]	160	230	1.0	304.6	304.6	305.6	1.0
Tributary G to Beaver Brook								
A	0.395[2]	50	489	1.5	248.0	243.7[3]	244.7	1.0
B	0.822[2]	18	532	1.0	265.4	265.4	265.8	0.4
C	1.181[2]	81	547	0.9	273.2	273.2	274.0	0.8
D	1.735[2]	16	567	0.9	281.9	281.9	282.8	0.9

[1]Miles above confluence with Island Pond
[2]Miles above confluence with Beaver Brook
[3]Elevation computed without consideration of backwater effects from Beaver Brook

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

TAYLOR BROOK (INCLUDING BALLARD POND) - TRIBUTARY C TO BEAVER BROOK – TRIBUTARY G TO BEAVER BROOK

TABLE 11

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary O to Beaver Brook								
A	0.019[1]	30	48	5.2	239.1	235.0[3]	235.3	0.3
B	0.184[1]	35	104	2.4	239.1	237.9[3]	238.7	0.8
C	0.387[1]	20	38	6.1	245.9	245.9	246.2	0.3
D	0.585[1]	20	107	2.2	283.6	283.6	283.6	0.0
E	0.726[1]	350	2,576	0.1	285.4	285.4	285.4	0.0
F	0.926[1]	20	38	6.1	286.1	286.1	286.1	0.0
G	1.009[1]	30	114	2.0	290.4	290.4	291.2	0.8
H	1.121[1]	10	92	2.5	292.1	292.1	292.9	0.8
I	1.234[1]	20	101	2.3	305.4	305.4	305.4	0.0
J	1.453[1]	10	29	7.9	320.3	320.3	320.5	0.2
Tributary E to Beaver Lake								
A	0.000[2]	28	162	2.3	289.6	289.6	290.6	1.0
B	0.184[2]	36	467	0.8	293.6	293.6	294.3	0.7
Tributary F to Beaver Lake								
A	0.169[2]	102	589	1.1	297.6	297.6	298.6	1.0
B	0.471[2]	311	1,133	0.6	299.3	299.3	300.2	0.9
C	0.770[2]	59	226	2.9	303.5	303.5	304.5	1.0
D	1.064[2]	19	65	10.1	320.7	320.7	320.7	0.0

[1]Miles above confluence with Beaver Brook
[2]Miles above confluence with Beaver Lake
[3]Elevation computed without consideration of backwater effects from Beaver Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY O TO BEAVER BROOK – TRIBUTARY E TO BEAVER LAKE - TRIBUTARY F TO BEAVER LAKE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary J to Black Brook								
A	0.191[1]		33	5.0	215.4	215.4	216.0	0.6
B	0.400[1]	20	94	1.8	221.1	221.1	221.5	0.4
C	0.613[1]	60	207	0.8	221.2	221.2	221.9	0.7
D	0.951[1]	30	103	1.6	221.8	221.8	222.8	1.0
E	1.145[1]	30	75	2.2	224.5	224.5	225.4	0.9
Tributary H to Drew Brook								
A	0.235[2]	26	52	4.8	216.9	216.9	217.3	0.4
B	0.503[2]	10	60	4.2	226.1	226.1	226.4	0.3
C	0.810[2]	14	30	8.4	245.1	245.1	245.3	0.2
D	1.030[2]	13	33	7.6	263.6	263.6	264.1	0.5
E	1.156[2]	17	40	6.3	277.3	277.3	277.6	0.3
Tributary E to Little Cohas Brook								
A	0.240[3]	60	205	2.1	264.1	262.4[4]	263.2	0.8
B	0.700[3]	40	118	2.8	264.1	262.5[4]	263.5	1.0
C	0.950[3]	30	107	3.1	266.1	266.1	266.1	0.0
D	1.083[3]	20	127	2.3	272.5	272.5	272.7	0.2
E	1.300[3]	100	538	0.5	276.9	276.9	277.3	0.4
F	1.535[3]	25	168	1.7	279.6	279.6	280.1	0.5
G	1.596[3]	10	63	4.6	281.3	281.3	281.3	0.0

[1]Miles above confluence with Black Brook
[2]Miles above confluence with Drew Brook
[3]Miles above confluence with Little Cohas Brook
[4]Elevation computed without consideration of backwater effects from Little Cohas Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY J TO BLACK BROOK – TRIBUTARY H TO DREW BROOK - TRIBUTARY E TO LITTLE COHAS BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary H to Nesenkeag Brook								
A	0.065[1]	30	69	5.4	185.0	185.0	185.0	0.0
B	0.350[1]	20	21	7.6	202.1	202.1	202.1	0.0
C	0.700[1]	20	23	7.0	232.3	232.3	232.3	0.0
D	1.151[1]	35	121	1.3	236.2	236.2	237.0	0.8
Upper Beaver Brook								
A	0.120[2]	20	38	5.7	314.3	314.3	314.3	0.0
B	0.300[2]	20	68	3.2	319.4	319.4	319.5	0.1
C	0.592[2]	20	45	4.8	331.6	331.6	331.6	0.0
D	0.900[2]	150	390	0.6	331.6	331.6	332.5	0.9
E	1.415[2]	300	824	0.3	331.7	331.7	332.7	1.0

[1]Miles above confluence with Nesenkeag Brook
[2]Miles above confluence with Shields Brook

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY H TO NESENKEAG BROOK – UPPER BEAVER BROOK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Winnicut River								
A	1,200	32	112	1.8	40.9	40.9	40.9	0.0
B	3,040	*	112	1.8	41.8	41.8	42.6	0.8
C	4,240	97	261	0.8	42.3	42.3	43.3	1.0
D	4,372	51	239	0.8	44.5	44.5	44.5	0.0
E	6,272	*	74	2.7	44.6	44.6	45.1	0.5
F	7,472	54	223	0.9	44.8	44.8	45.5	0.7
G	7,662	*	126	1.6	48.7	48.7	48.9	0.2
H	9,762	505	2,667	0.1	48.7	48.7	48.9	0.2
I	12,322	90	581	0.3	48.7	48.7	49.0	0.3
J	13,842	256	630	0.3	48.7	48.7	49.0	0.3
K	14,056	250	1,866	0.1	52.5	52.5	52.6	0.1
L	15,056	240	1,060	0.2	52.5	52.5	52.6	0.1
M	15,279	340	3,607	0.1	55.8	55.8	55.8	0.0

[1] Feet above Town of North Hampton corporate limits
*Floodway coincident with channel banks

TABLE 11

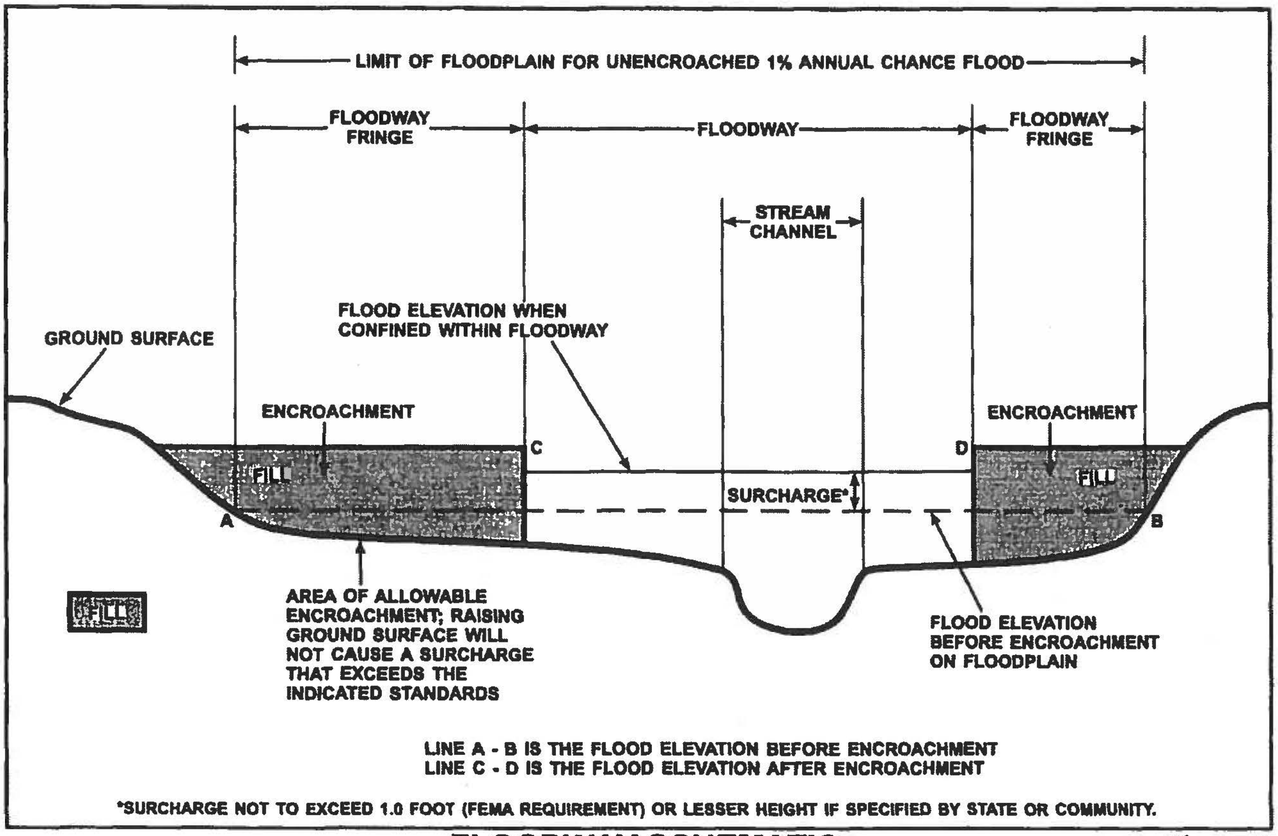
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOODWAY DATA

FLOODING SOURCE: WINNICUT RIVER



FLOODWAY SCHEMATIC Figure 3

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside of the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Rockingham County. Prior to the 2005 countywide study, separate FIRMs were prepared for each identified flood-prone incorporated community in the county. The countywide FIRM also included flood hazard information that was presented separately on FBFMs, where applicable. Historical data relating to the maps prepared for each community are presented in Table 12, "Community Map History."

TABLE 12 – COMMUNITY MAP HISTORY

Community Name	Initial Identification	Flood Hazard Boundary Map Revisions Date	FIRM Effective Date	FIRM Revisions Date
Atkinson, Town of	January 3, 1975	November 29, 1977	April 2, 1993	May 17, 2005
Auburn, Town of	February 28, 1975	None	April 4, 1986	May 17, 2005
Brentwood, Town of	June 28, 1974	December 10, 1976	April 15, 1981	May 4, 2000
Candia, Town of	February 21, 1975	November 19, 1976	May 17, 2005	May 17, 2005
Chester, Town of	February 21, 1975	None	March 1, 2000	May 17, 2005
Danville, Town of	January 17, 1975	None	April 1, 1994	May 17, 2005
Deerfield, Town of	February 21, 1975	November 12, 1976	September 1, 1989	May 17, 2005
Derry, Town of	September 13, 1974	March 4, 1977	April 15, 1981	May 17, 2005
East Kingston, Town of	February 28, 1975	None	April 2, 1986	May 17, 2005
Epping, Town of	July 19, 1974	November 15, 1977	April 15, 1982	May 17, 2005
Exeter, Town of	September 20, 1974	March 11, 1977	May 17, 1982	May 17, 2005
Fremont, Town of	August 9, 1974	October 29, 1976 August 17, 1979	April 15, 1981	June 19, 1989 May 17, 2005

TABLE 12 – COMMUNITY MAP HISTORY – (continued)

Community Name	Initial Identification	Flood Hazard Boundary Map Revisions Date	FIRM Effective Date	FIRM Revisions Date
Greenland, Town of	February 21, 1975	September 17, 1976	May 17, 1989	May 17, 2005
Hampstead, Town of	February 28, 1975	None	June 16, 1993	May 17, 2005
Hampton, Town of	July 19, 1974	December 10, 1976	July 3, 1986	May 17, 2005
Hampton Falls, Town of	December 6, 1974	June 11, 1976	April 15, 1982	May 17, 2005
Kensington, Town of	September 6, 1977	None	May 17, 2005	
Kingston, Town of	January 17, 1975	March 6, 1979	September 1, 1988	April 15, 1992 May 17, 2005
Londonderry, Town of	August 9, 1974	July 16, 1976	November 5, 1980	May 17, 2005
New Castle, Town of	May 31, 1974	December 3, 1976	August 5, 1986	May 17, 2005
Newfields, Town of	January 17, 1975	March 12, 1976	June 5, 1989	May 17, 2005
Newington, Town of	February 21, 1975	None	May 17, 2005	
Newmarket, Town of	June 28, 1974	December 10, 1976	May 2, 1991	May 17, 2005
Newton, Town of	May 17, 2005	None	May 17, 2005	
North Hampton, Town of	February 27, 1979	None	June 3, 1986	May 17, 2005
Northwood, Town of	January 2, 1987	None	January 2, 1987	May 17, 2005
Nottingham, Town of	June 28, 1974	November 19, 1976 September 7, 1979	April 2, 1986	May 17, 2005
Plaistow, Town of	October 18, 1974	August 27, 1976	April 15, 1981	May 17, 2005
Portsmouth, City of	July 19, 1974	July 23, 1976	May 17, 1982	May 17, 2005
Raymond, Town of	August 9, 1974	July 2, 1976	April 15, 1982	April 15, 1992 May 2, 1995 May 17, 2005
Rye, Town of	June 28, 1974	September 3, 1976	June 17, 1986	May 17, 2005
Salem, Town of	April 29, 1977	None	June 15, 1979	April 6, 1998 May 17, 2005
Sandown, Town of	January 3, 1975	None	May 17, 2005	
Seabrook, Town of	August 2, 1974	November 26, 1976	July 17, 1986	May 17, 2005
Seabrook Beach Village District	August 2, 1974[1]	November 26, 1976[1]	August 5, 1986	May 17, 2005
South Hampton, Town of	February 28, 1975	None	June 1, 1989	July 15, 1992 May 17, 2005
Stratham, Town of	February 28, 1975	None	May 17, 1989	May 17, 2005
Windham, Town of	August 16, 1974	January 23, 1976	April 1, 1980	November 3, 1989 May 17, 2005

[1]The land area for this community was previously shown on the FHBM for the Town of Seabrook as a portion of the town. It has now been identified as a separate NFIP community. Therefore, the dates for this community were taken from the FHBM for the Town of Seabrook.

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Rockingham County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FBFMs, and FIRMs for all jurisdictions within Rockingham County.

An FIS is currently being prepared for portions of Strafford County, New Hampshire.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this FIS can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region I, 99 High Street, 6th Floor, Boston, MA 02110.

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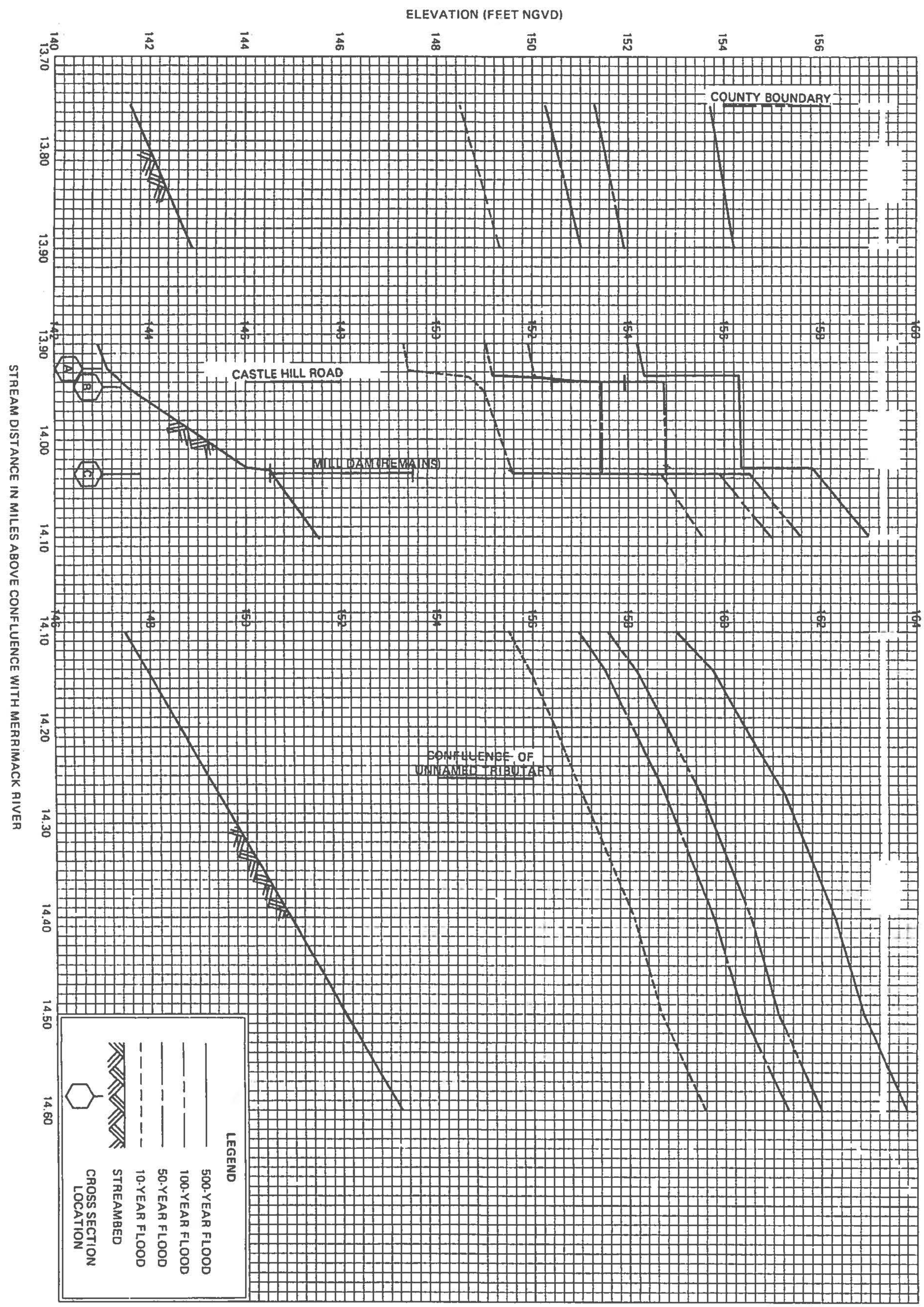


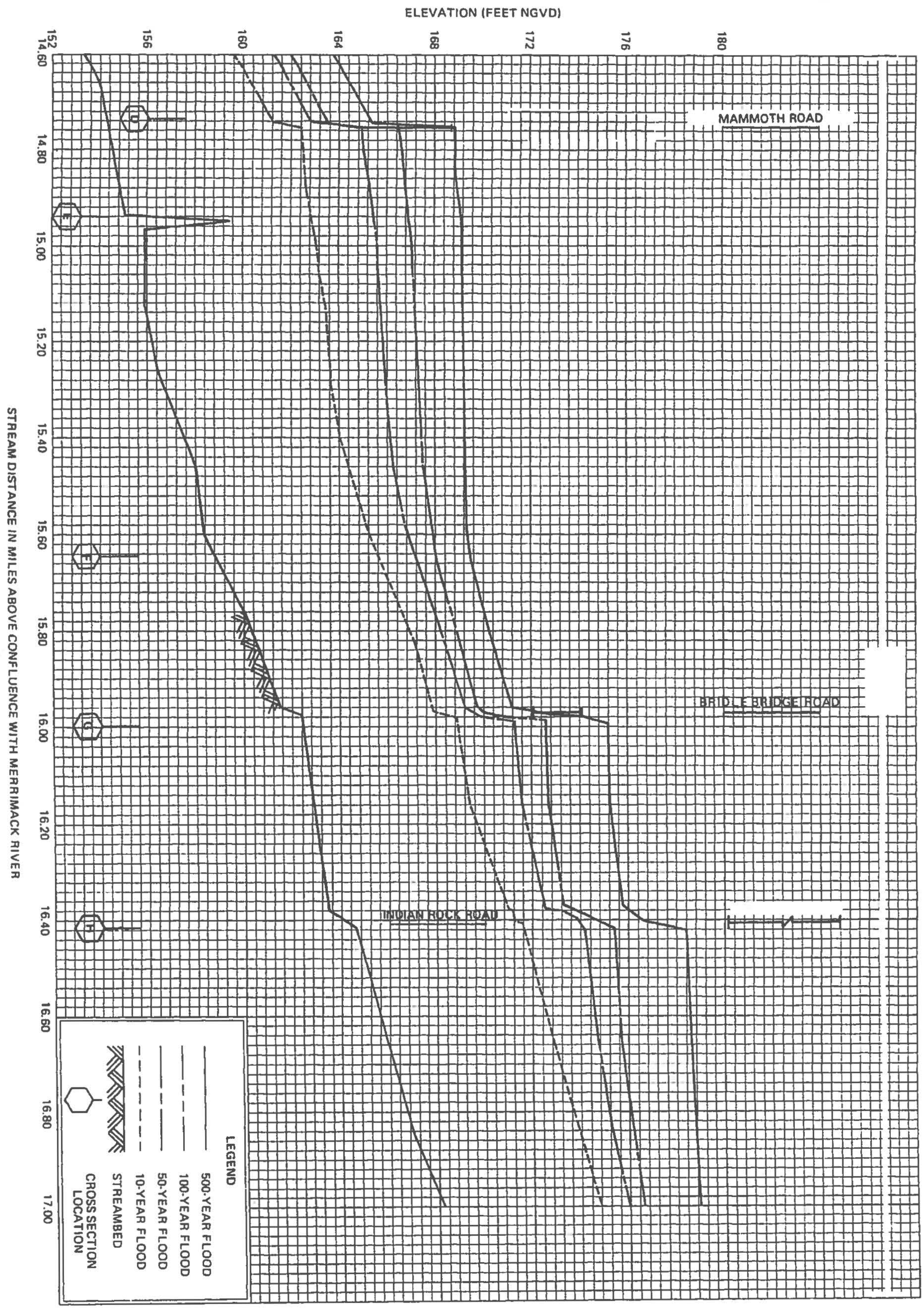
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOOD PROFILES

BEAVER BROOK



FEDERAL EMERGENCY MANAGEMENT AGENCY **ROCKINGHAM COUNTY, NH** (ALL JURISDICTIONS)	**FLOOD PROFILES** **BEAVER BROOK**

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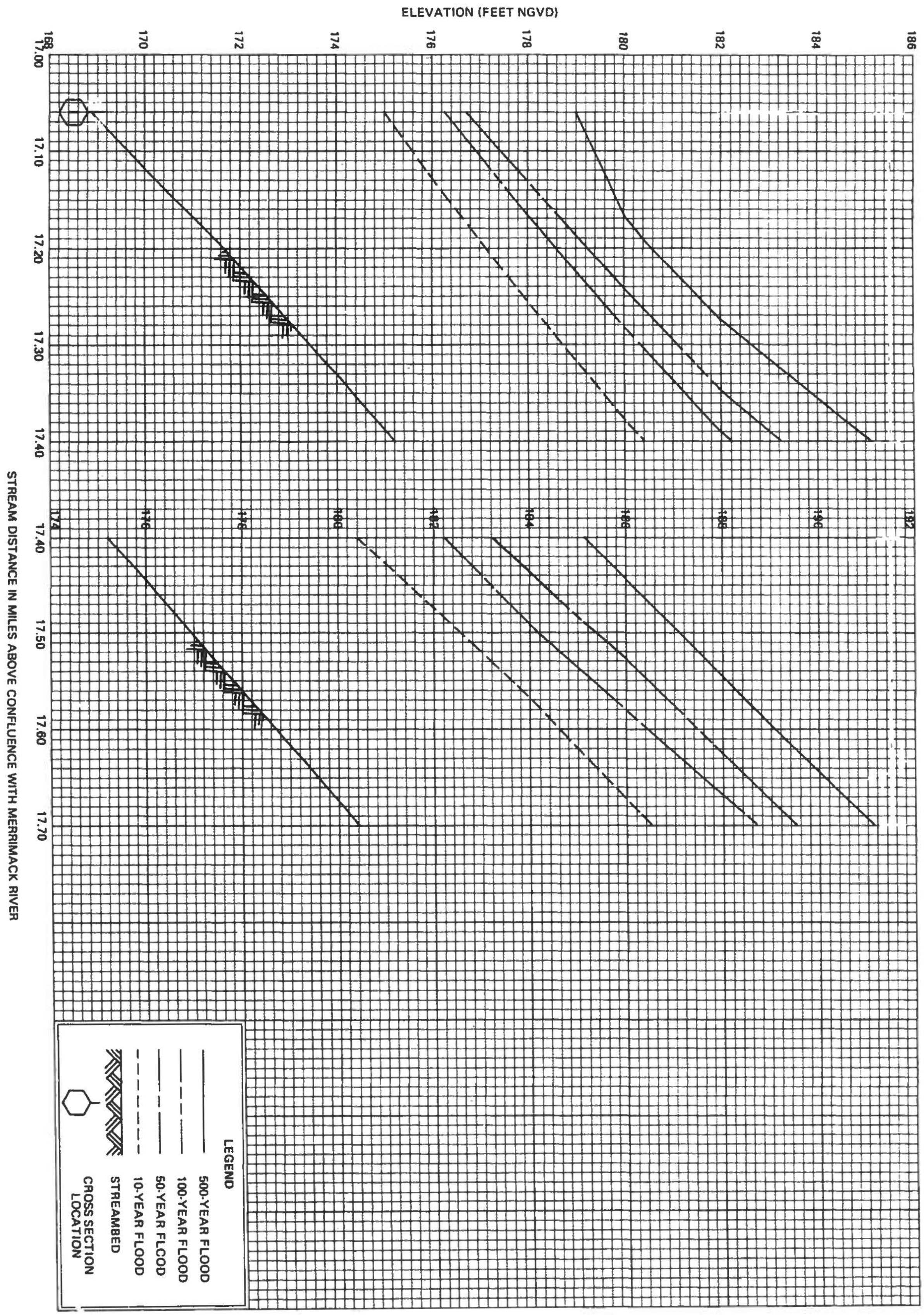


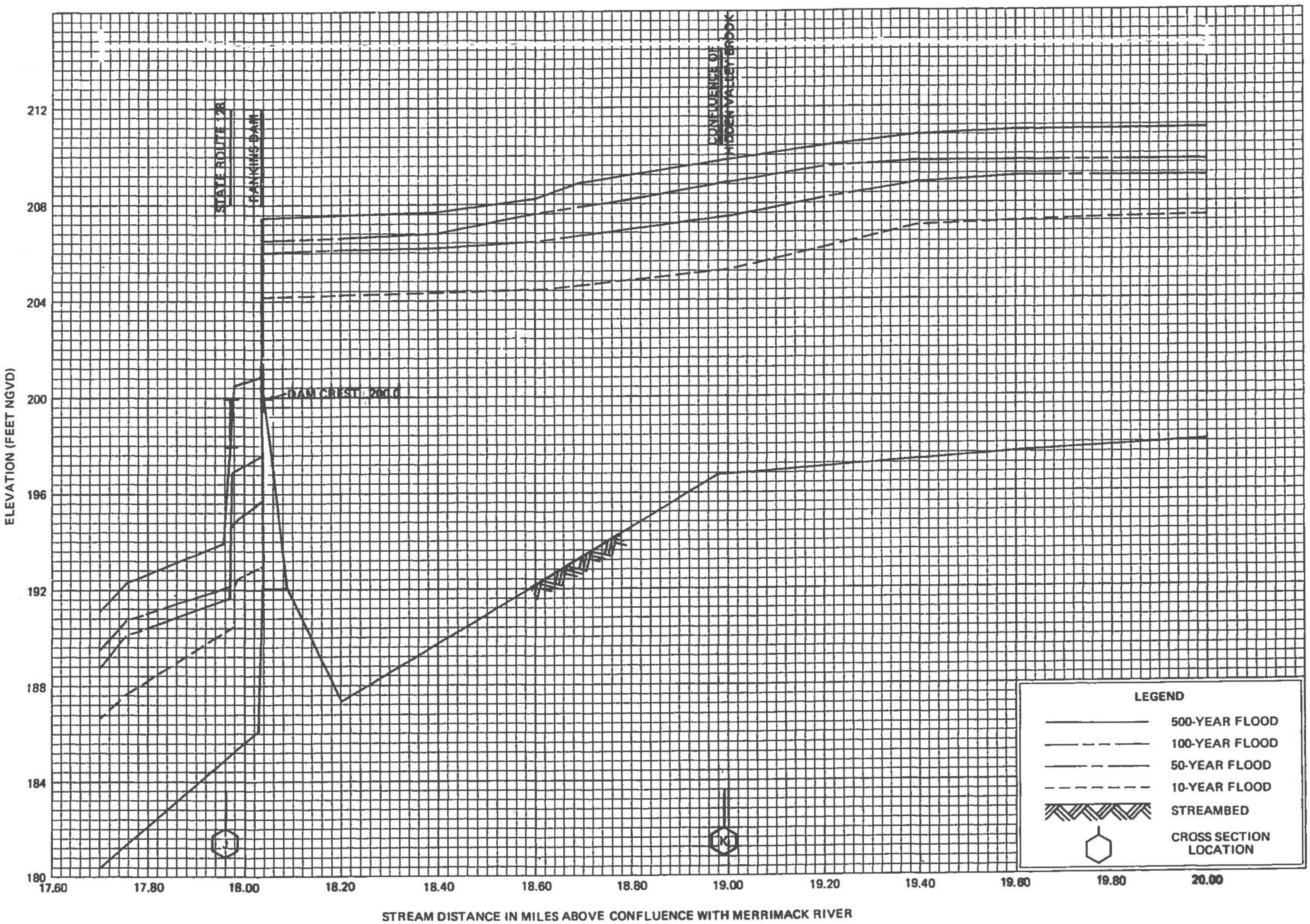
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOOD PROFILES

BEAVER BROOK

03P



FLOOD PROFILES

BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

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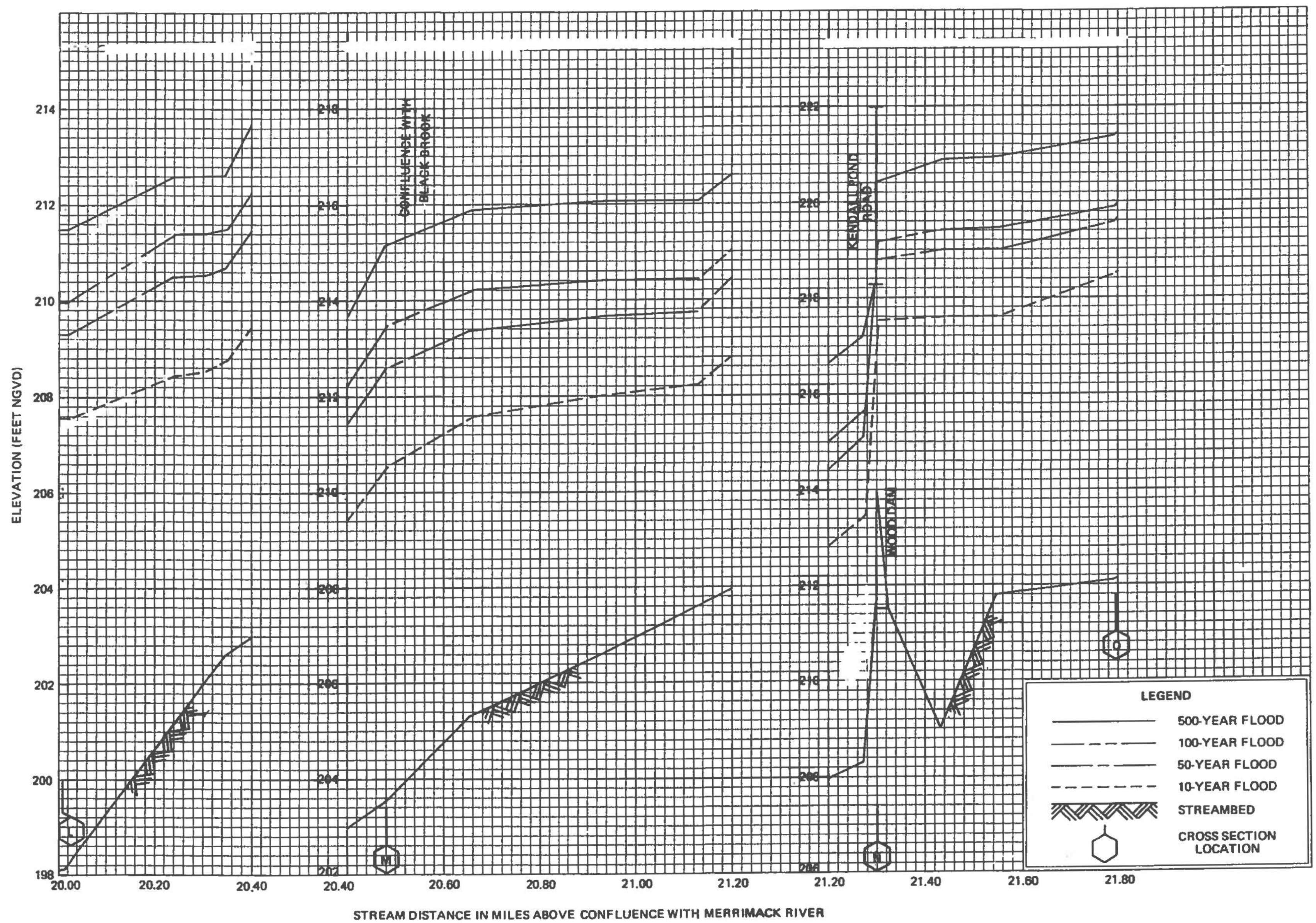

FLOOD PROFILES

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FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

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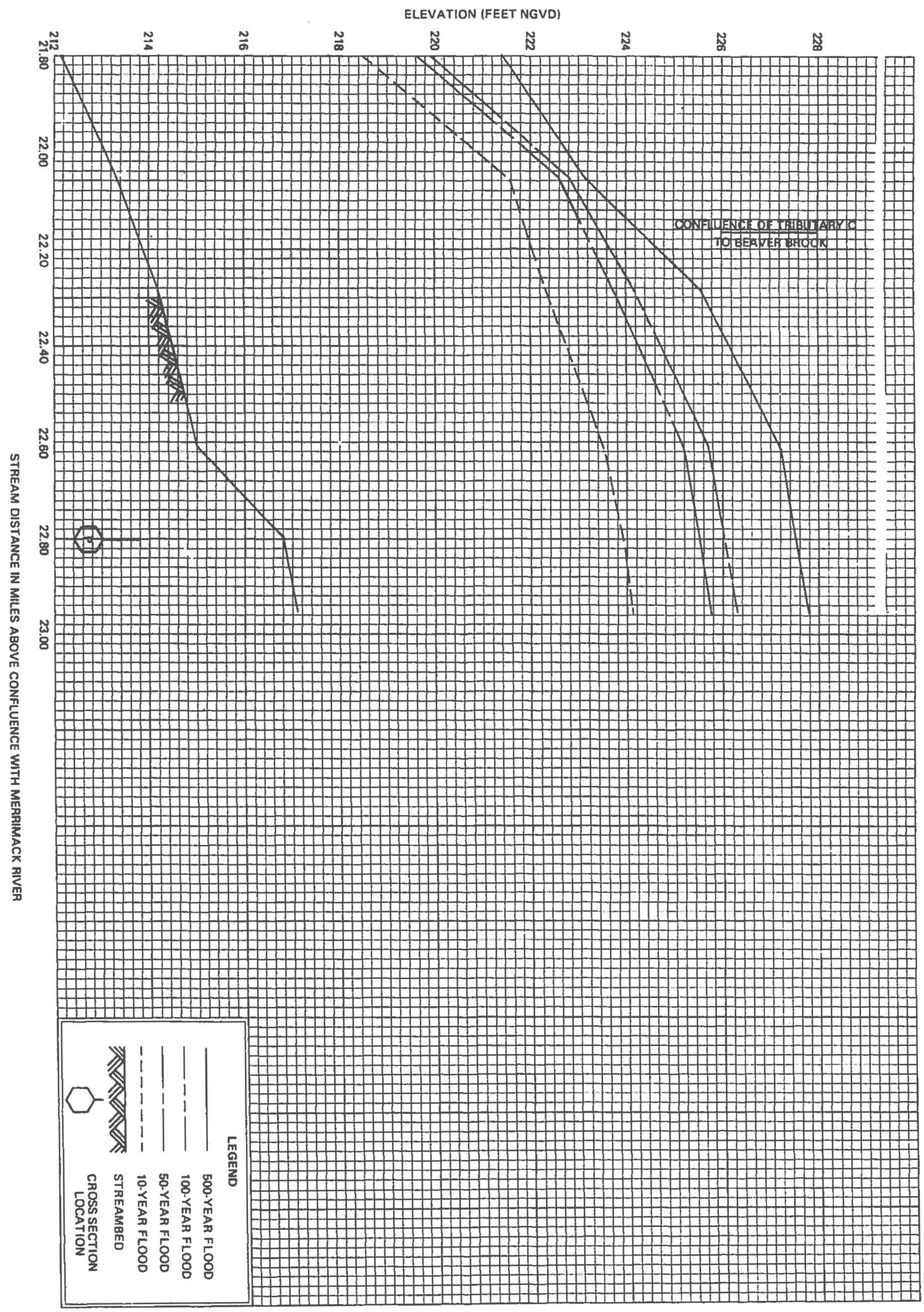

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISOICTIONS)

FLOOD PROFILES

BEAVER BROOK

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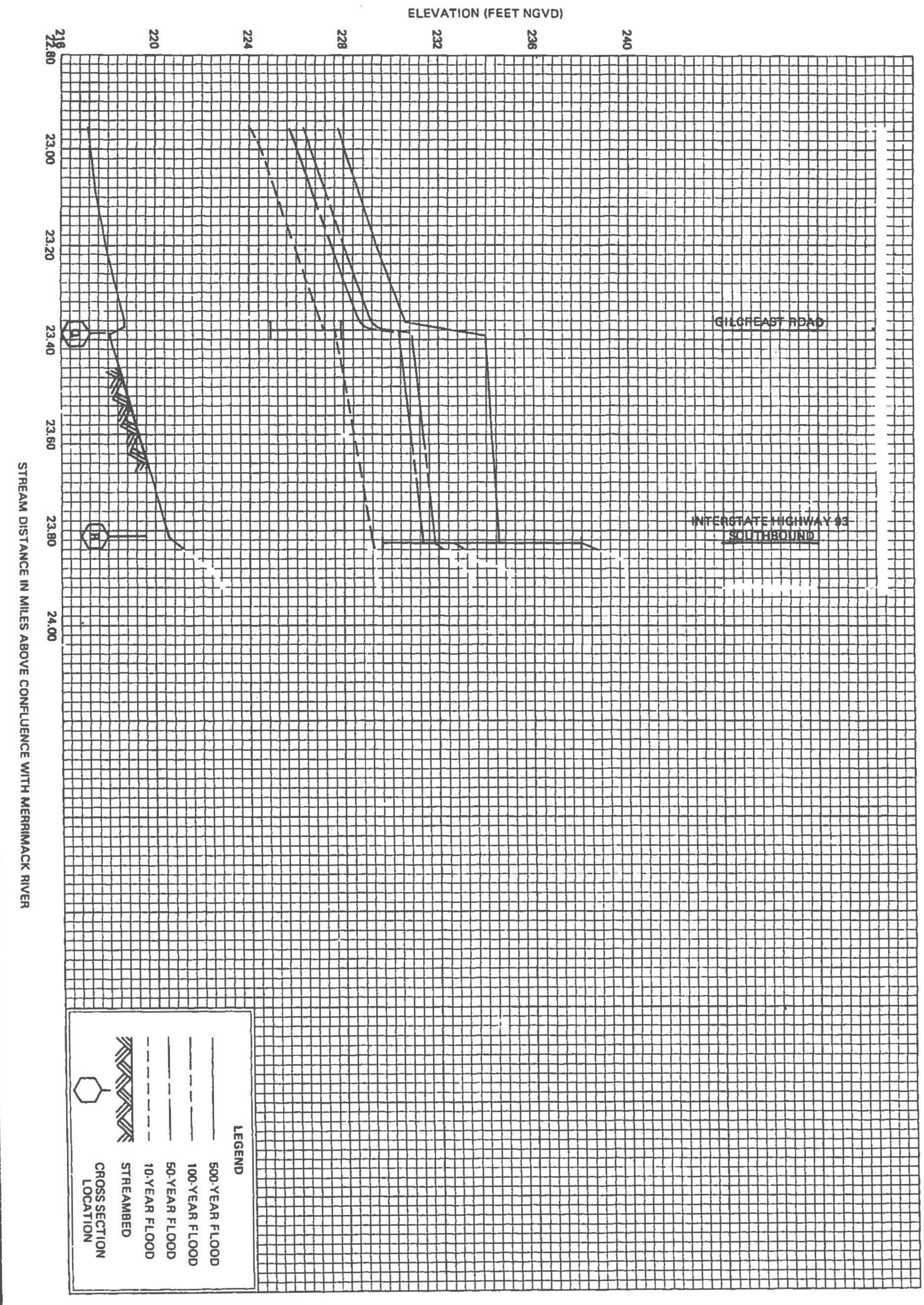


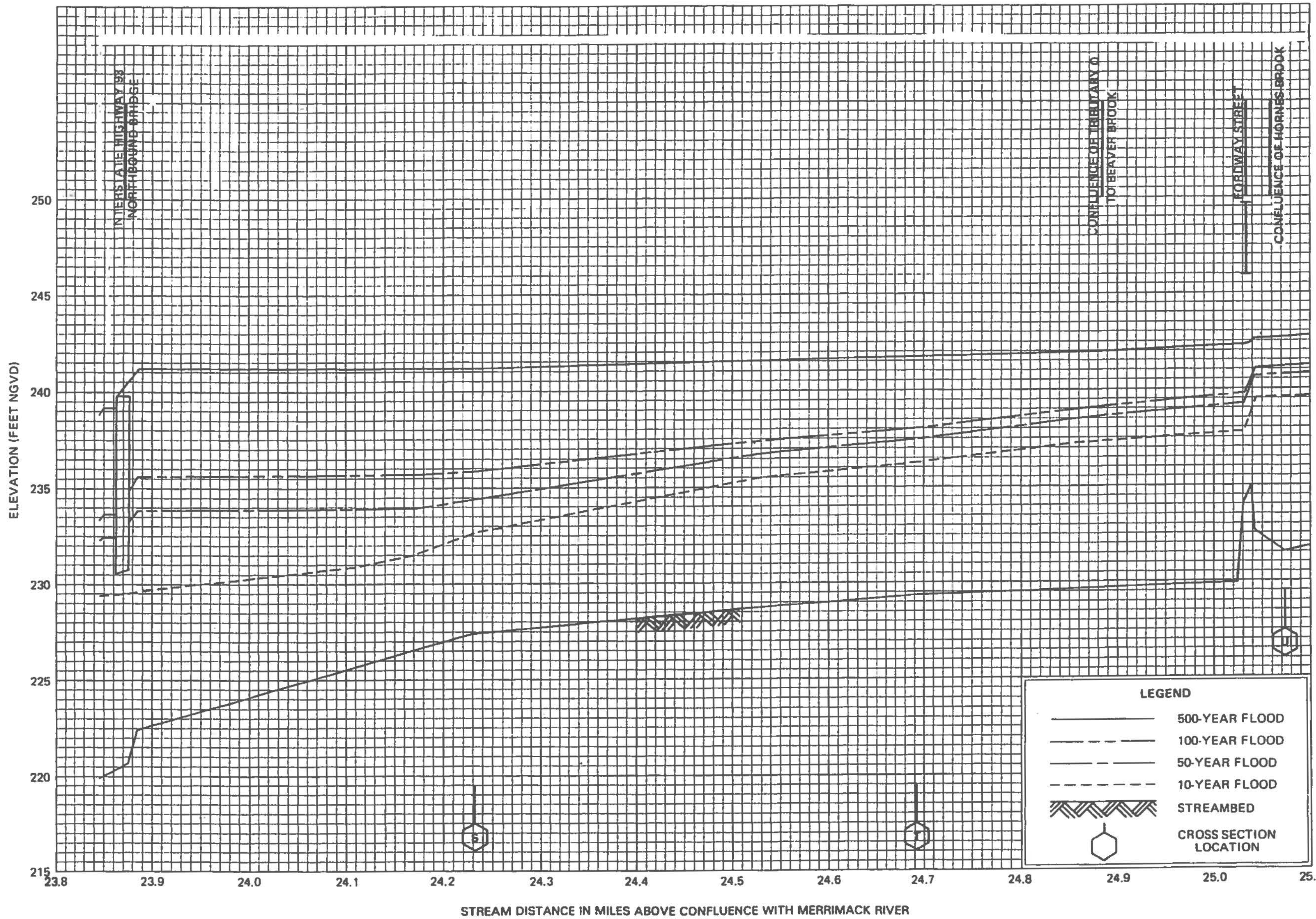
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH
(ALL JURISDICTIONS)

FLOOD PROFILES

BEAVER BROOK

07P



FLOOD PROFILES

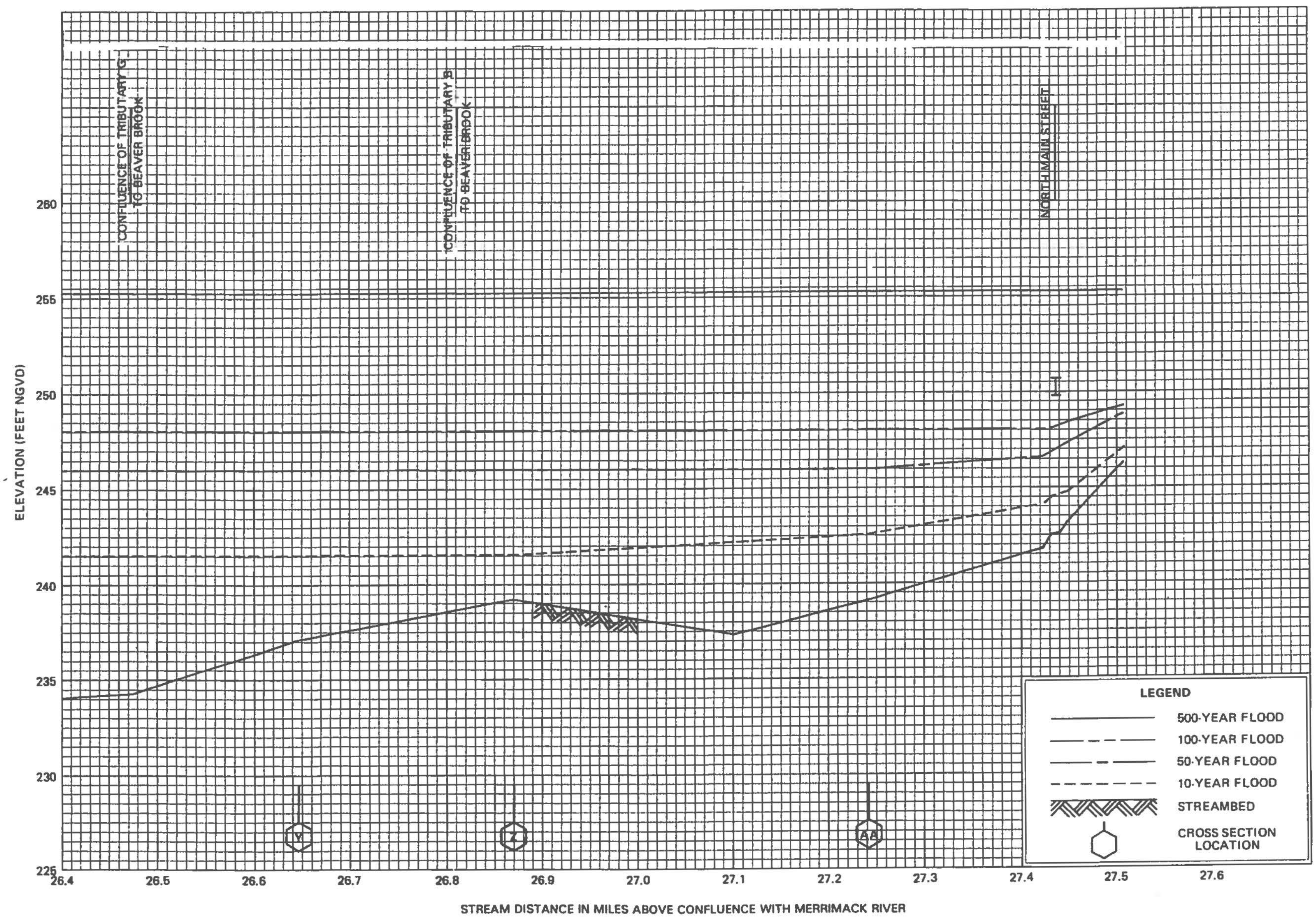
BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FEDERAL EMERGENCY MANAGEMENT AGENCY **ROCKINGHAM COUNTY, NH** (ALL JURISDICTIONS)	**FLOOD PROFILES** **BEAVER BROOK**



FLOOD PROFILES

BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

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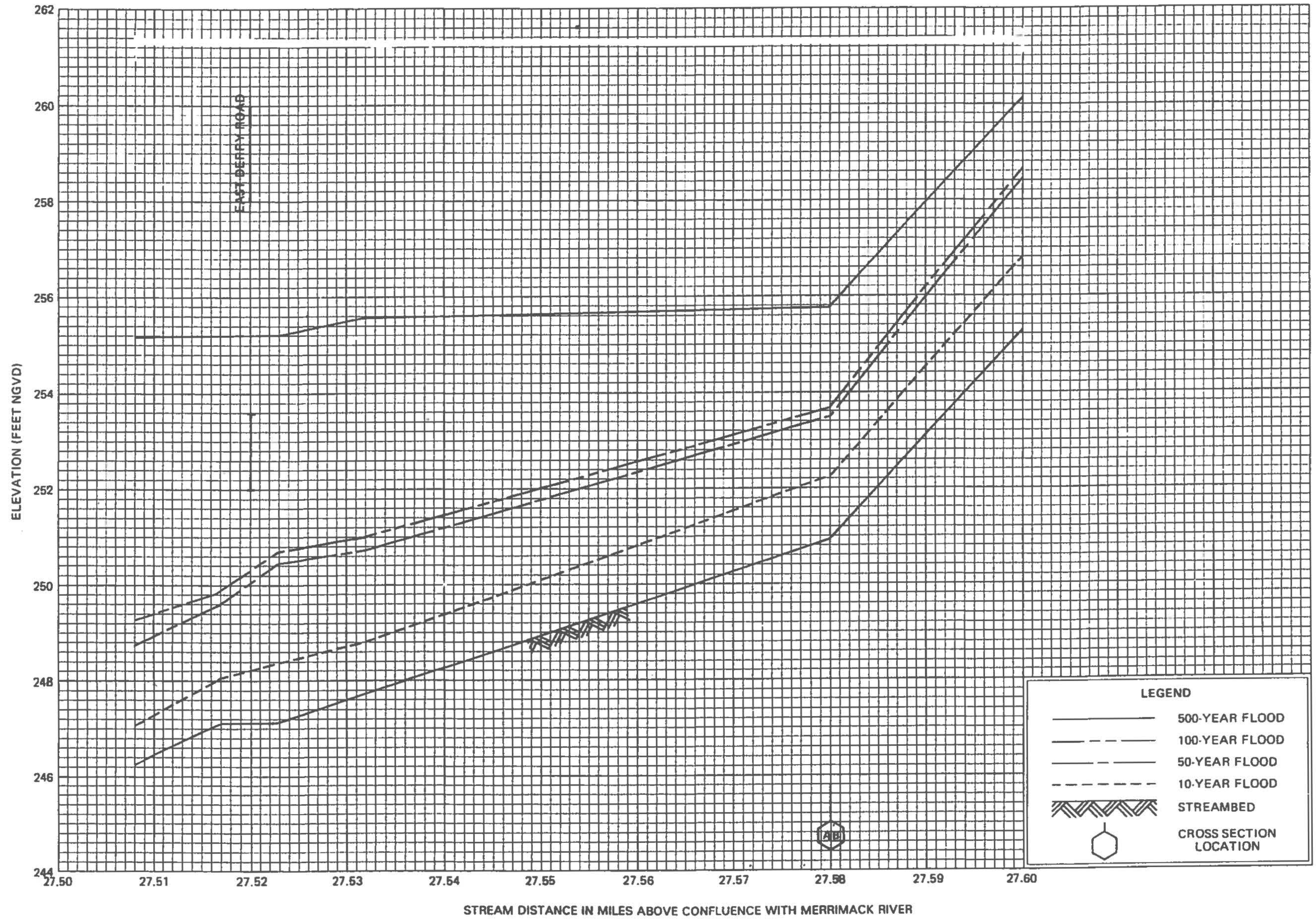

FLOOD PROFILES

BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

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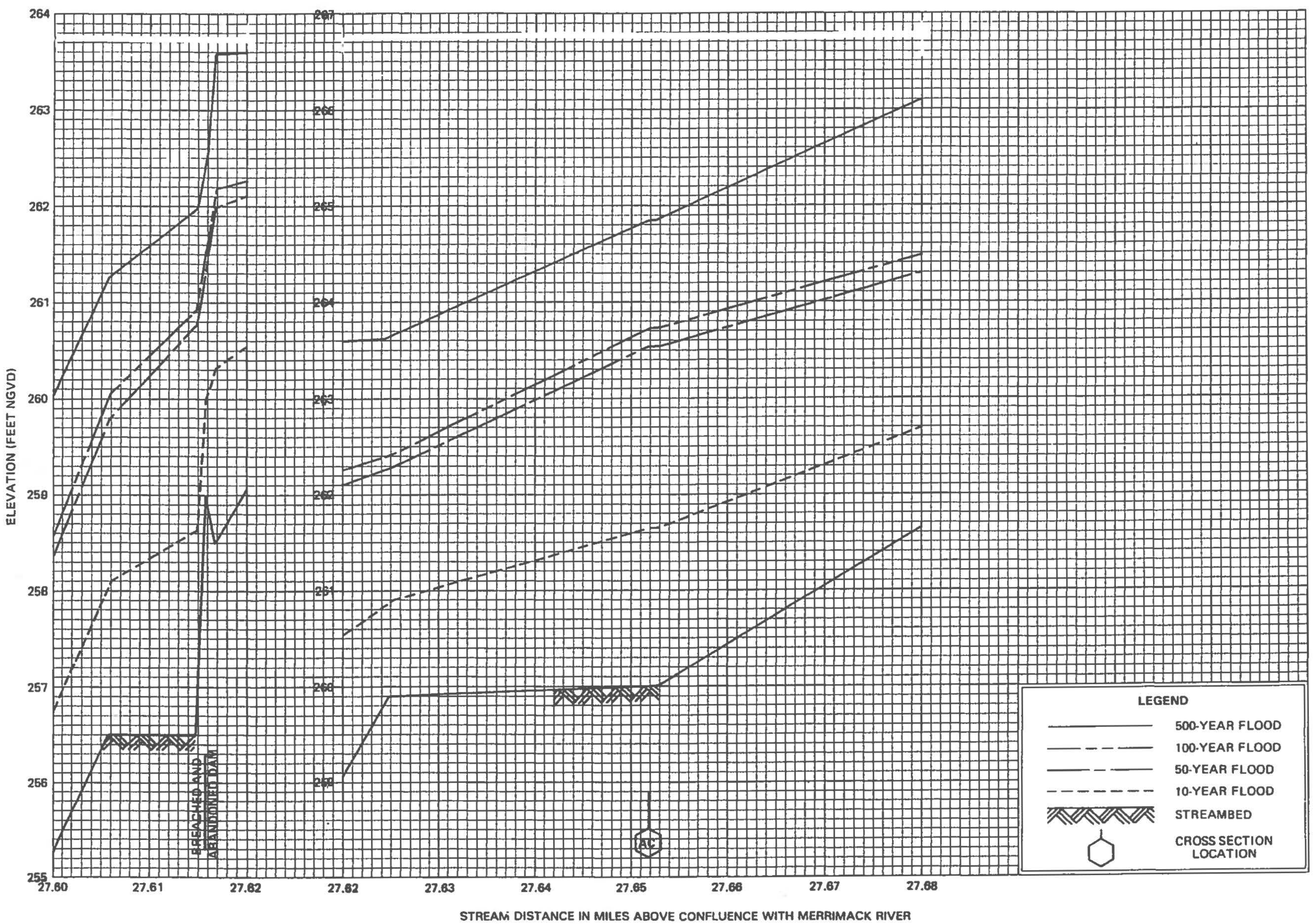

FLOOD PROFILES

BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

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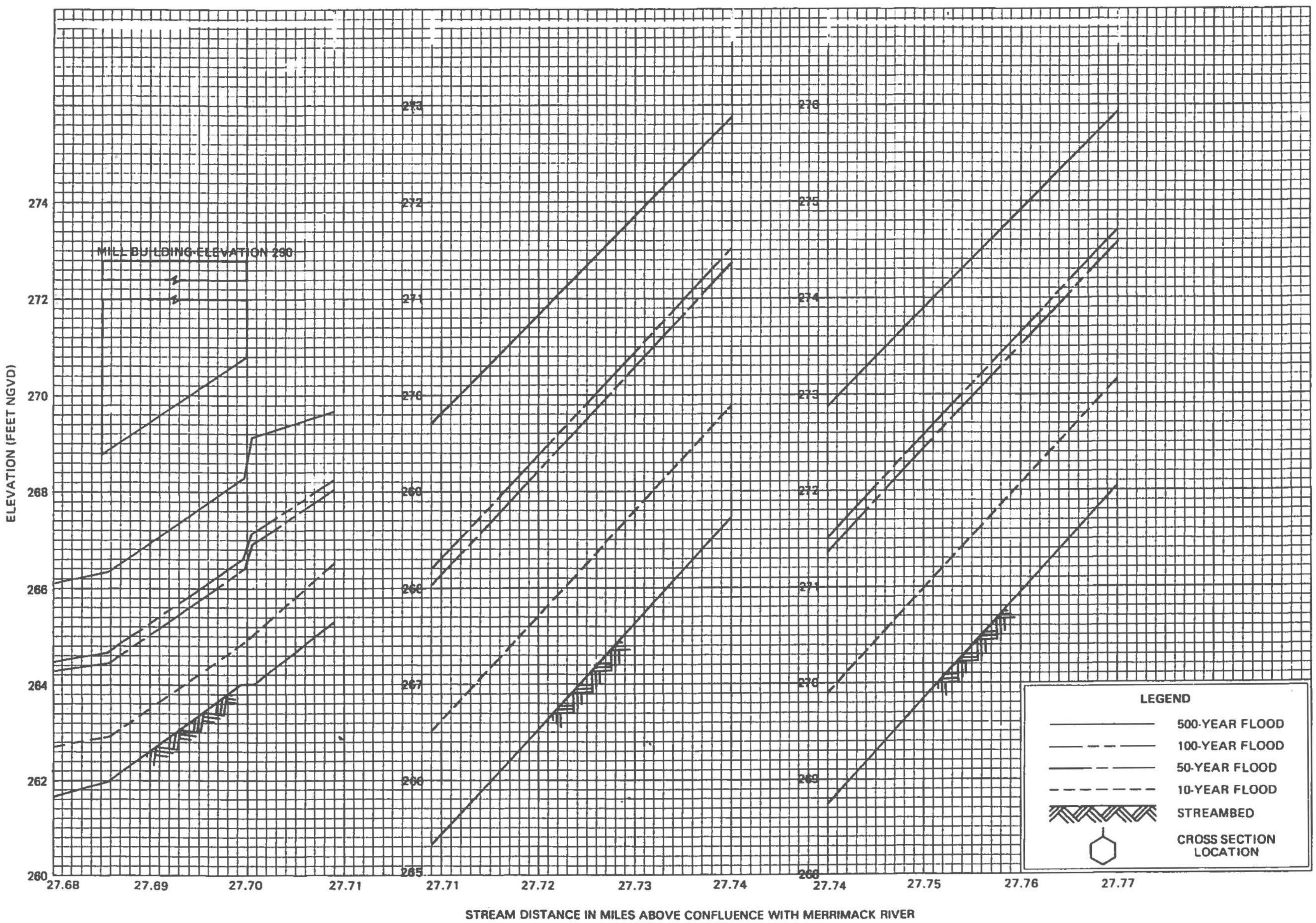


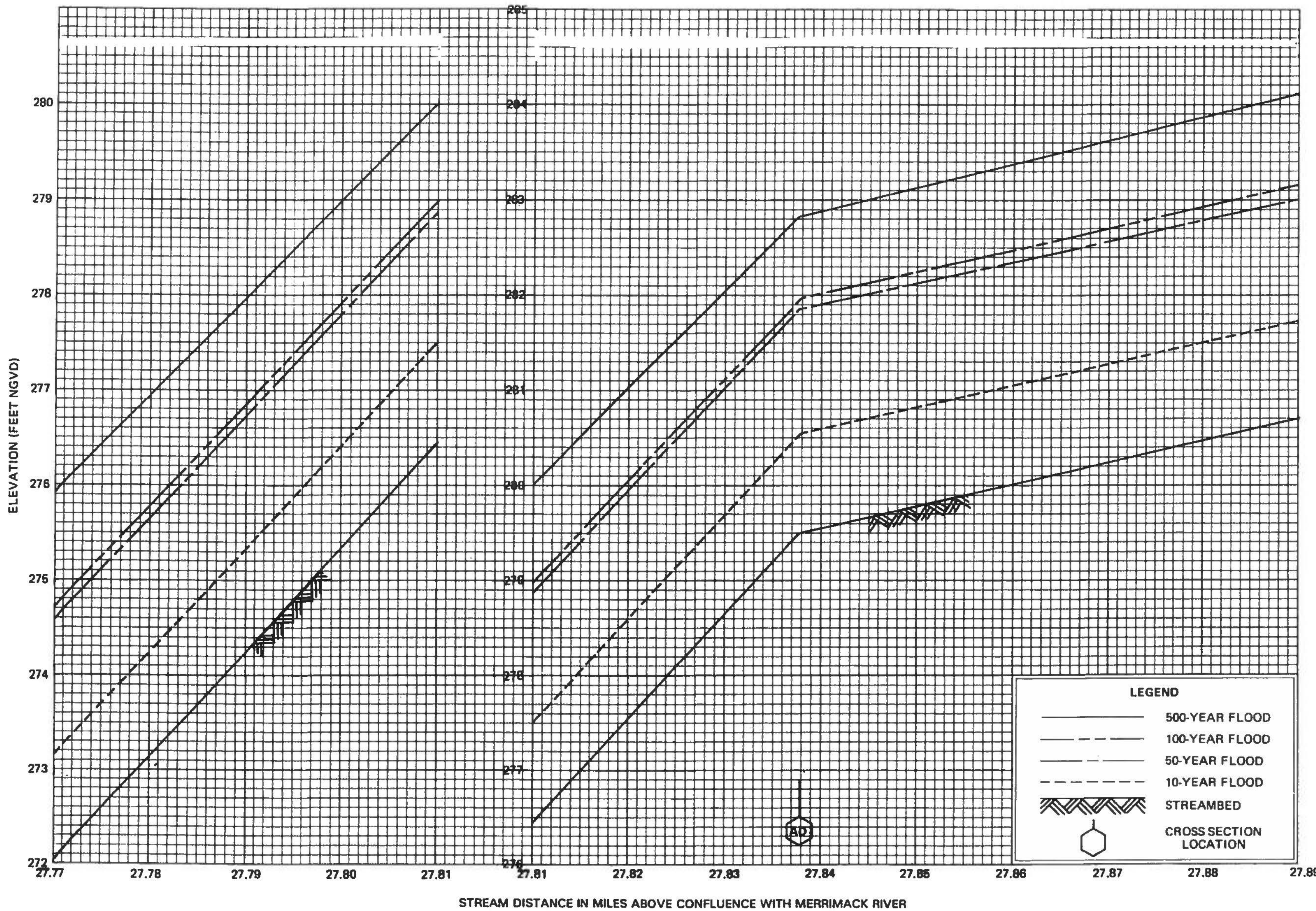
FLOOD PROFILES

BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)



FLOOD PROFILES

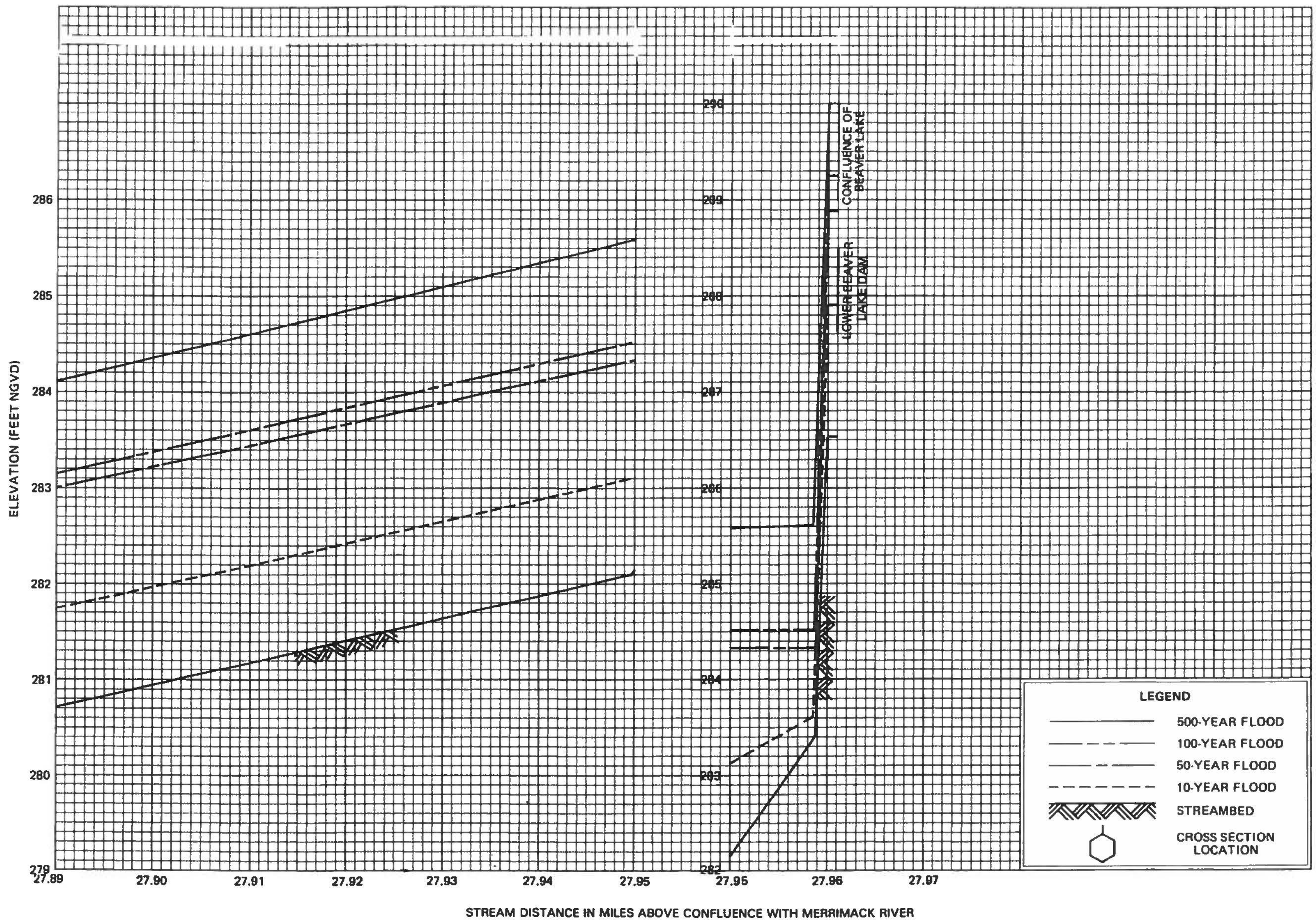
BEAVER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

14P



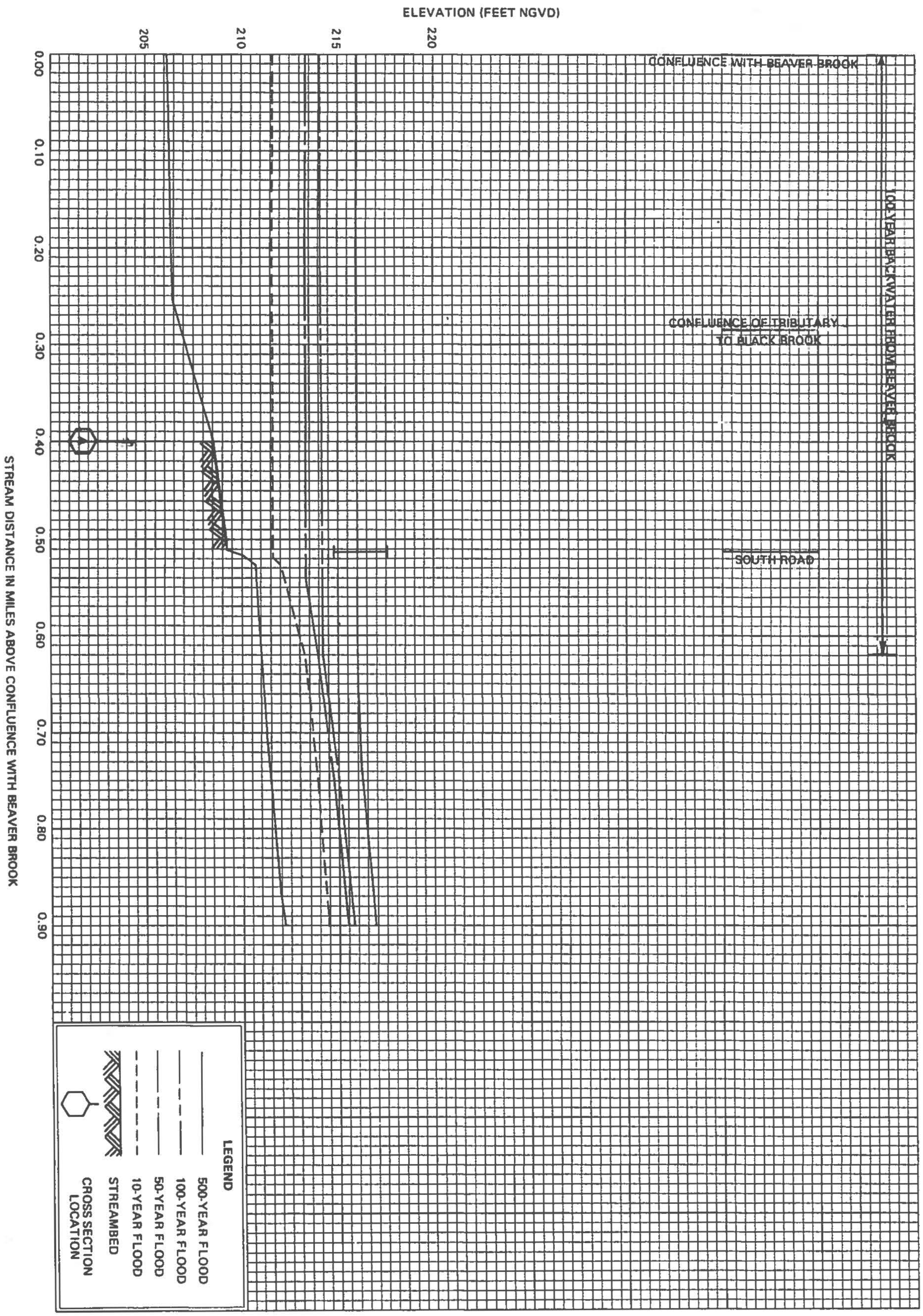
FLOOD PROFILES

BEAVER BROOK

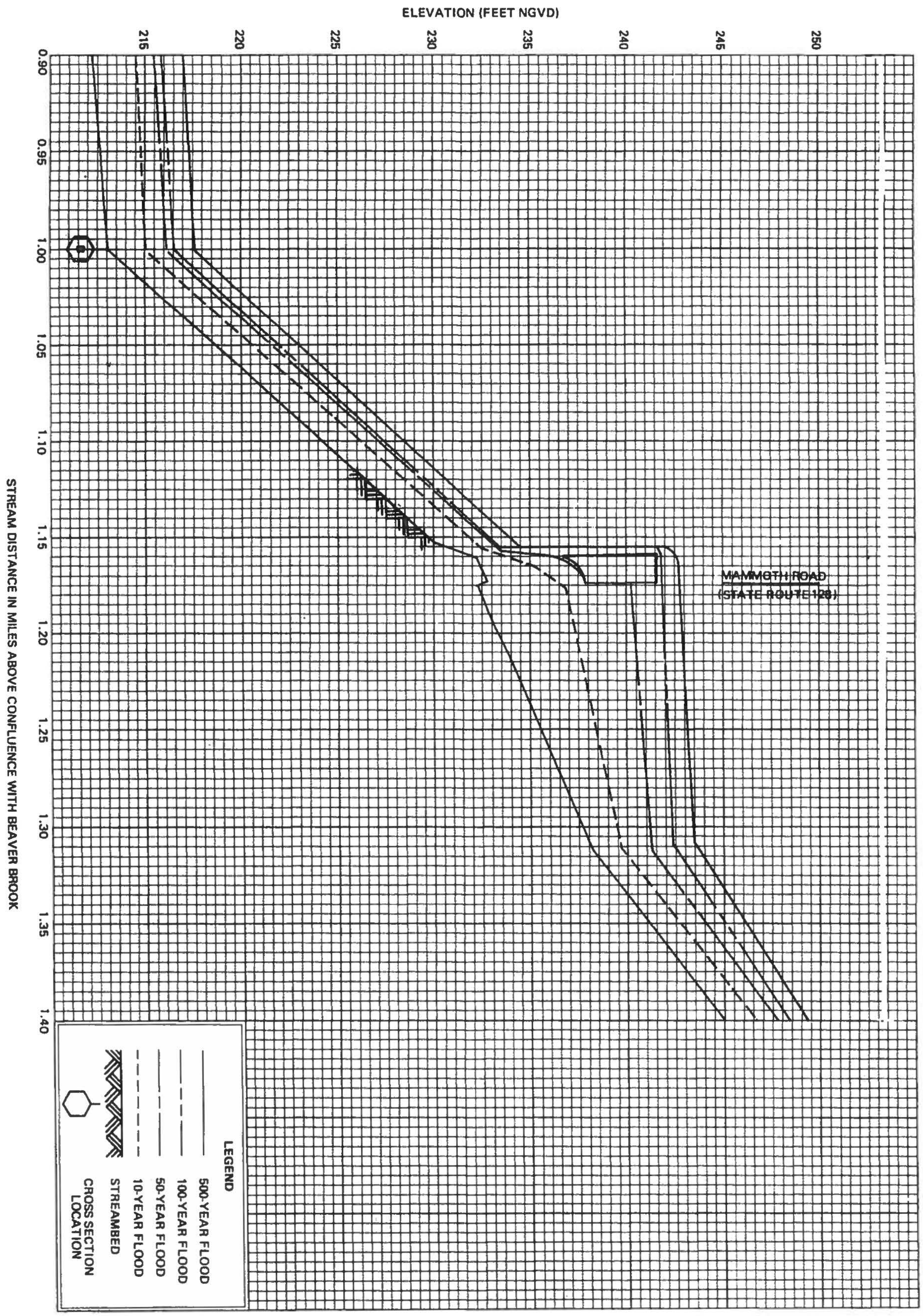
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)



16P	FEDERAL EMERGENCY MANAGEMENT AGENCY **ROCKINGHAM COUNTY, NH** (ALL JURISDICTIONS)	**FLOOD PROFILES** **BLACK BROOK**



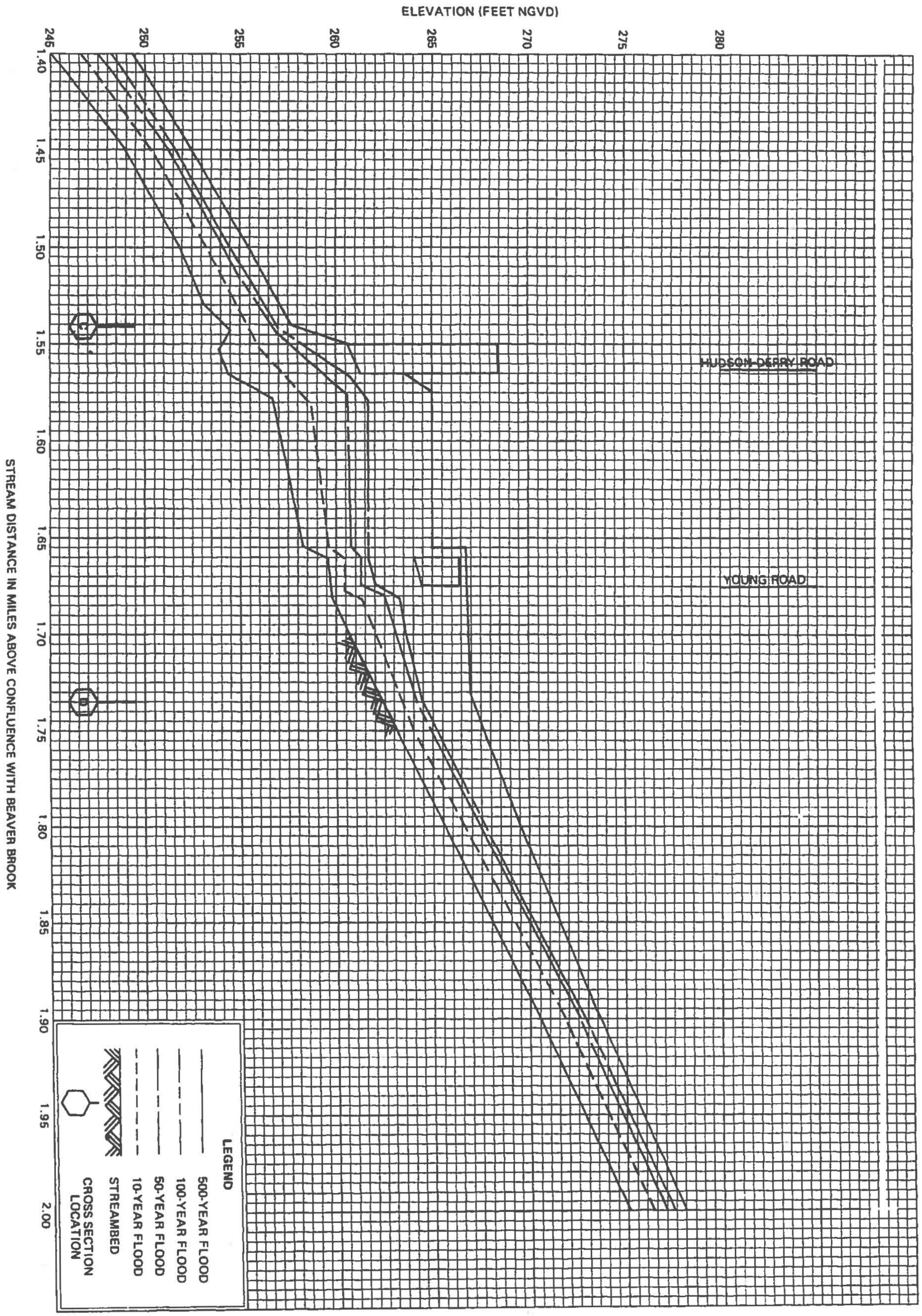
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOOD PROFILES

BLACK BROOK



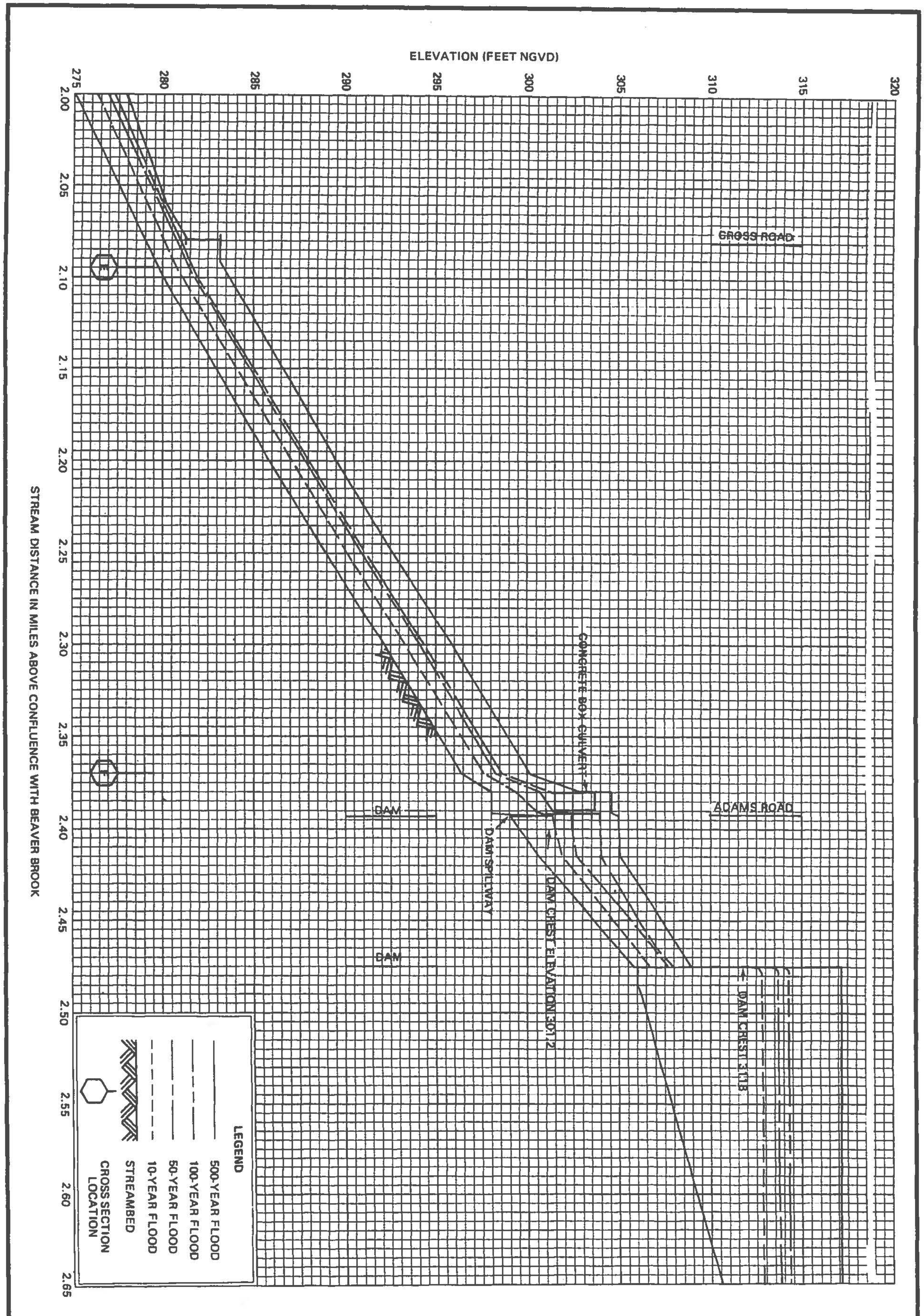
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

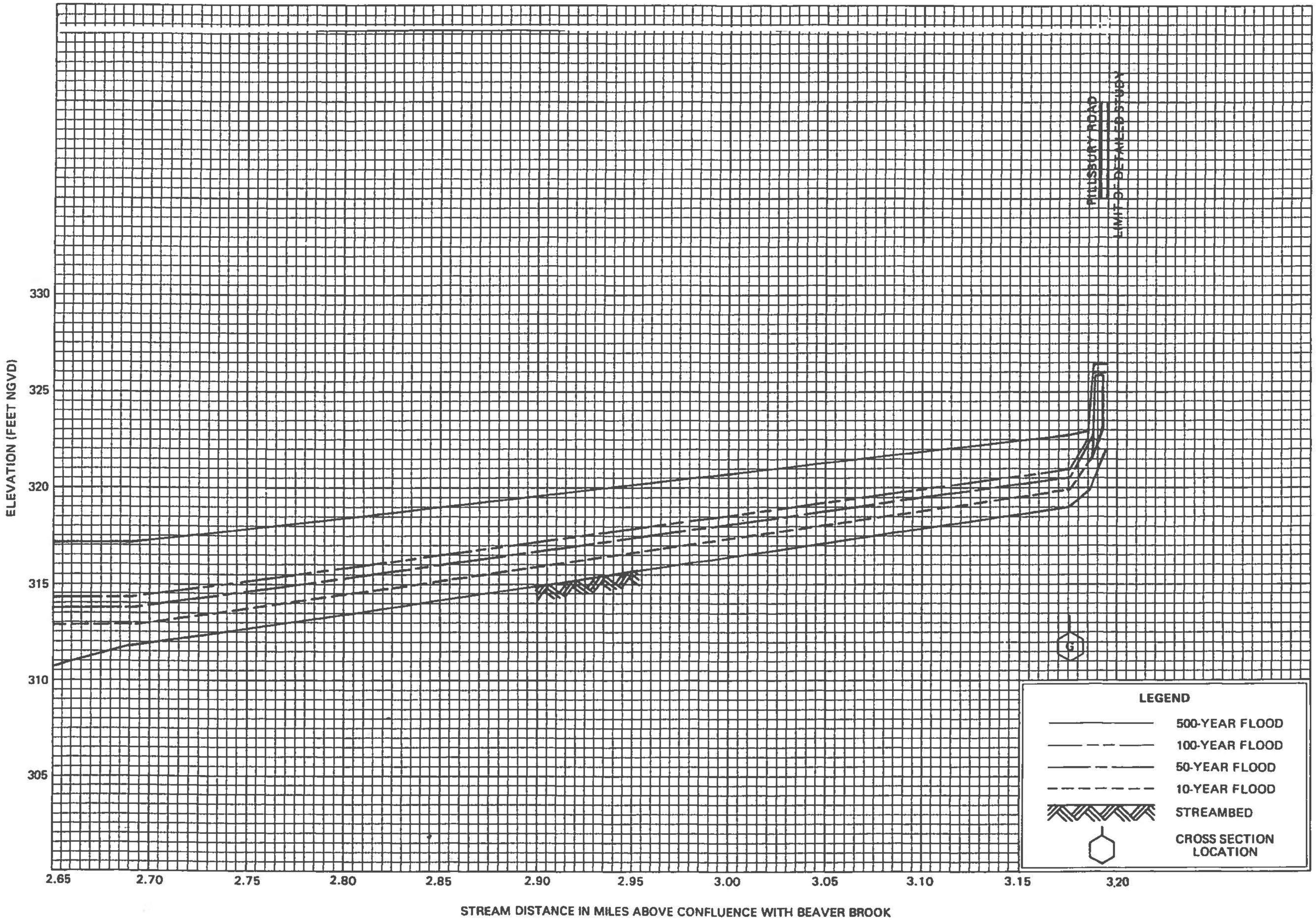
(ALL JURISDICTIONS)

FLOOD PROFILES

BLACK BROOK



19P	FEDERAL EMERGENCY MANAGEMENT AGENCY ROCKINGHAM COUNTY, NH (ALL JURISDICTIONS)	FLOOD PROFILES BLACK BROOK



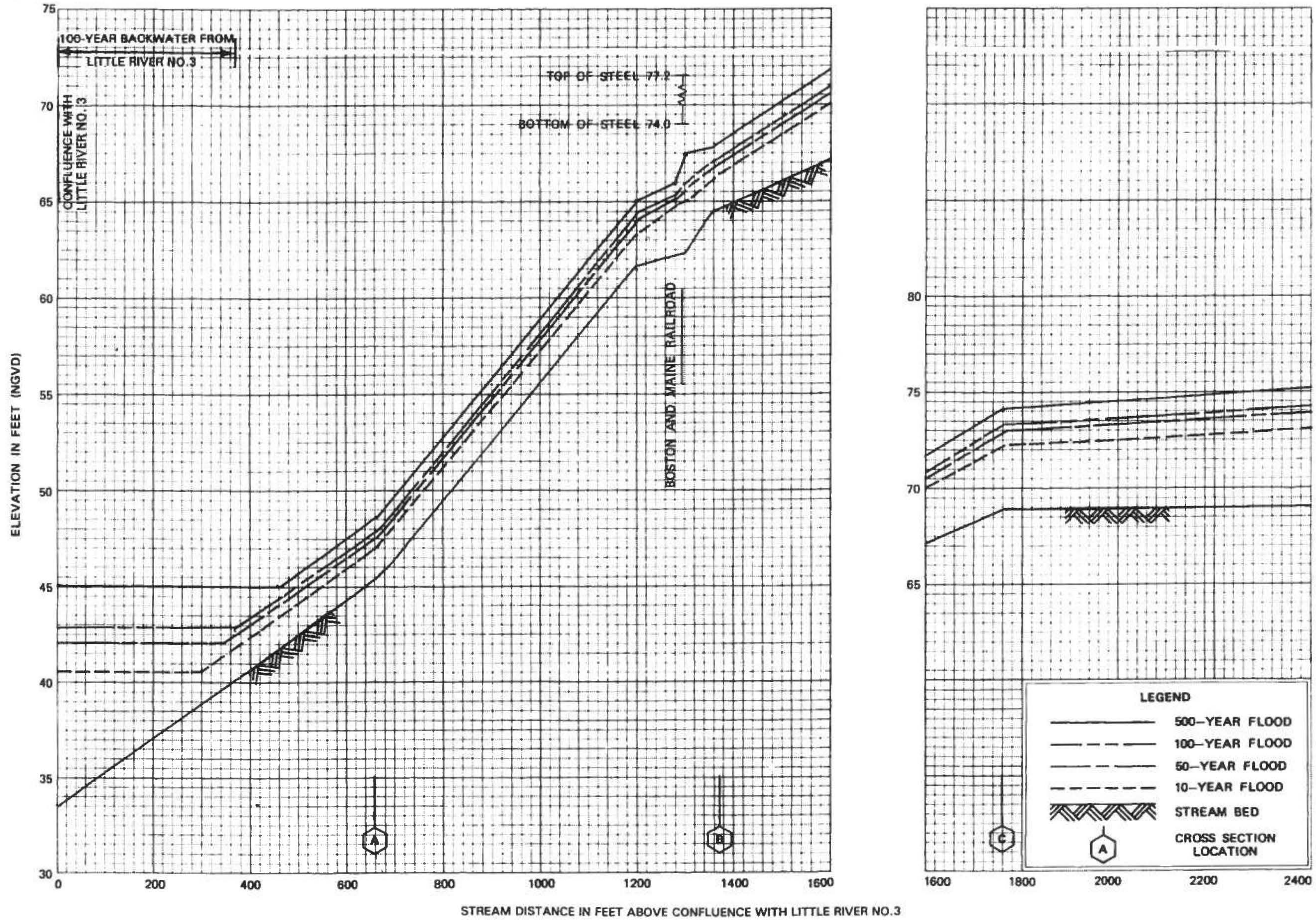
FLOOD PROFILES

BLACK BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)



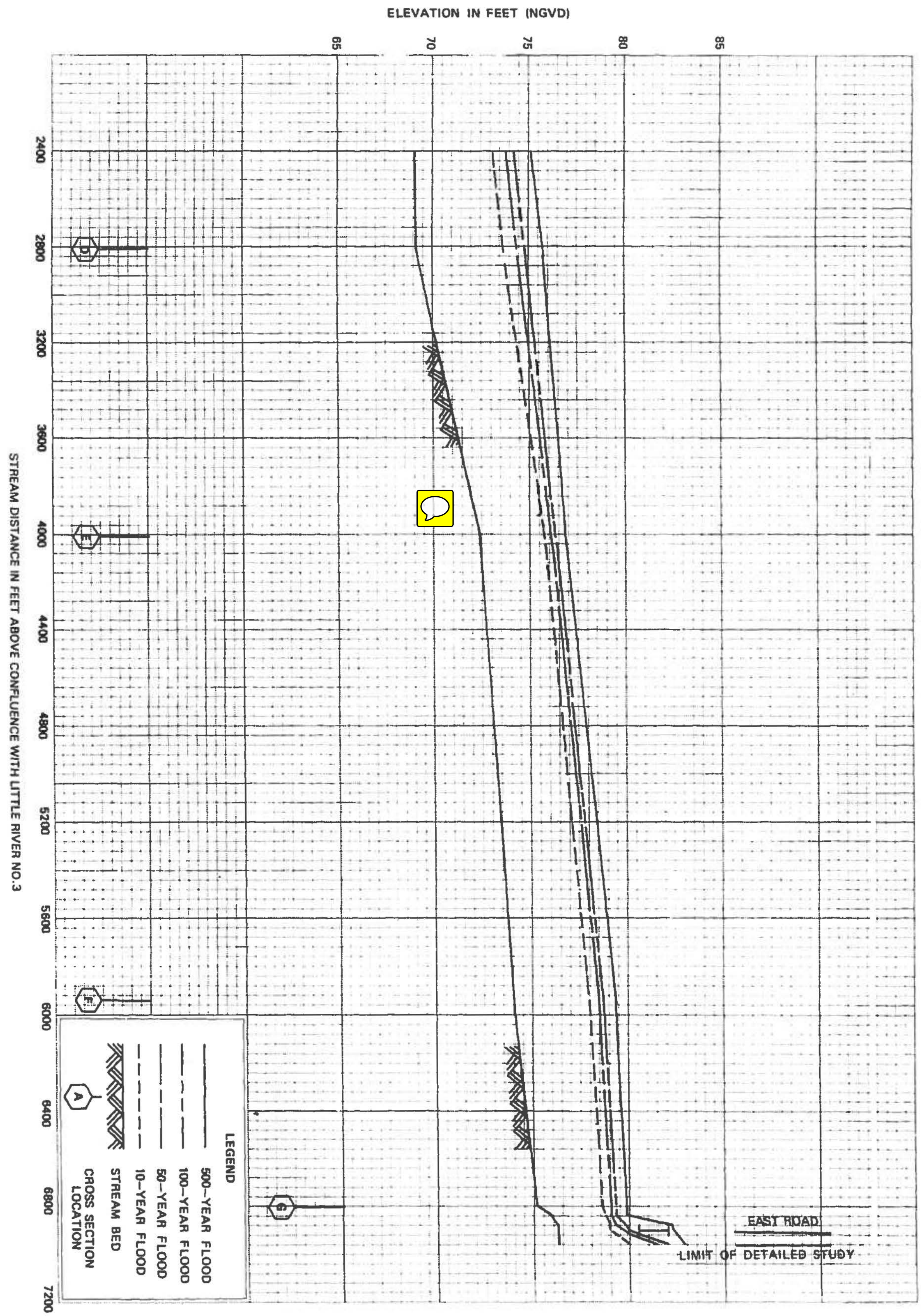
FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOOD PROFILES

BRYANT BROOK



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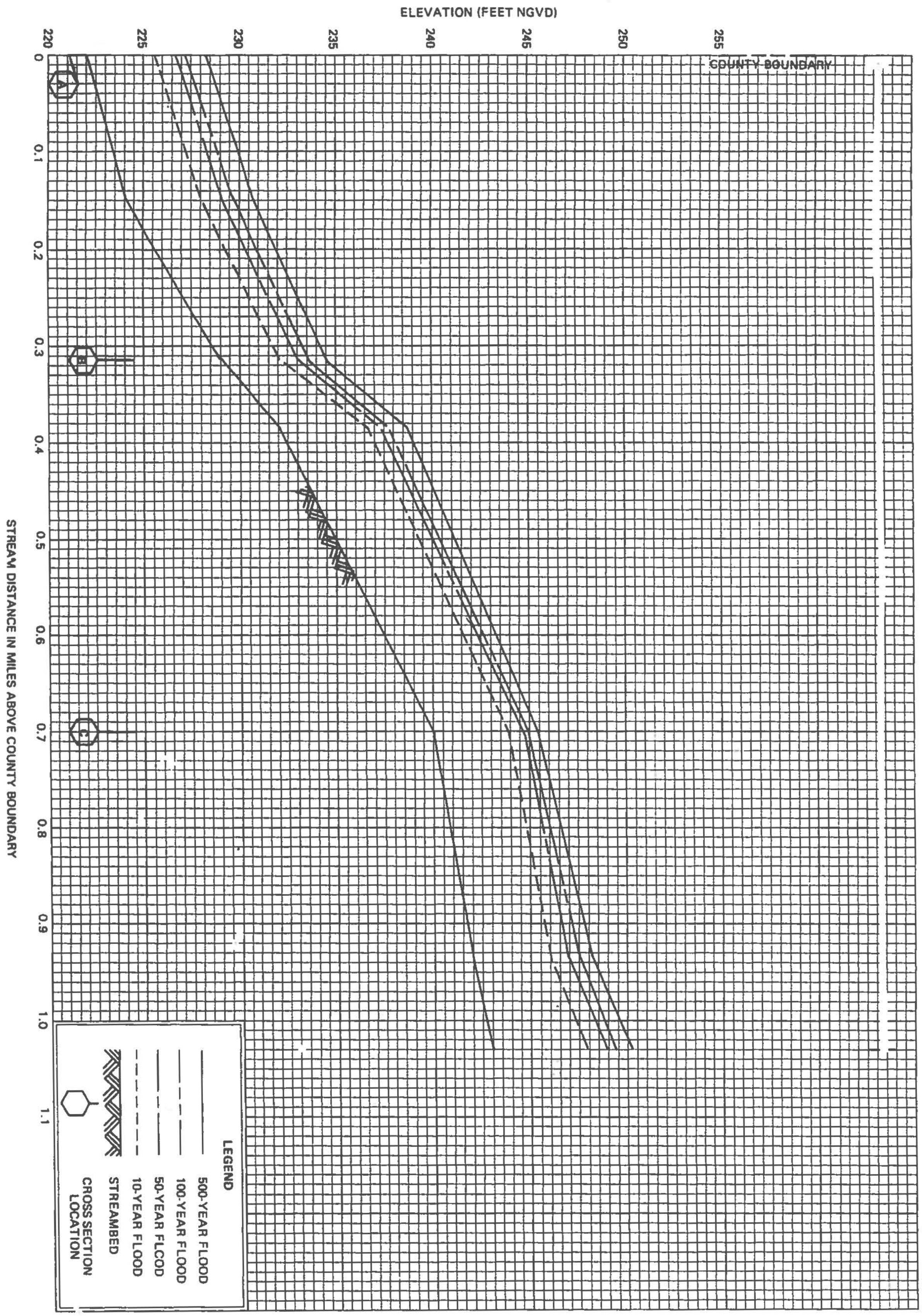
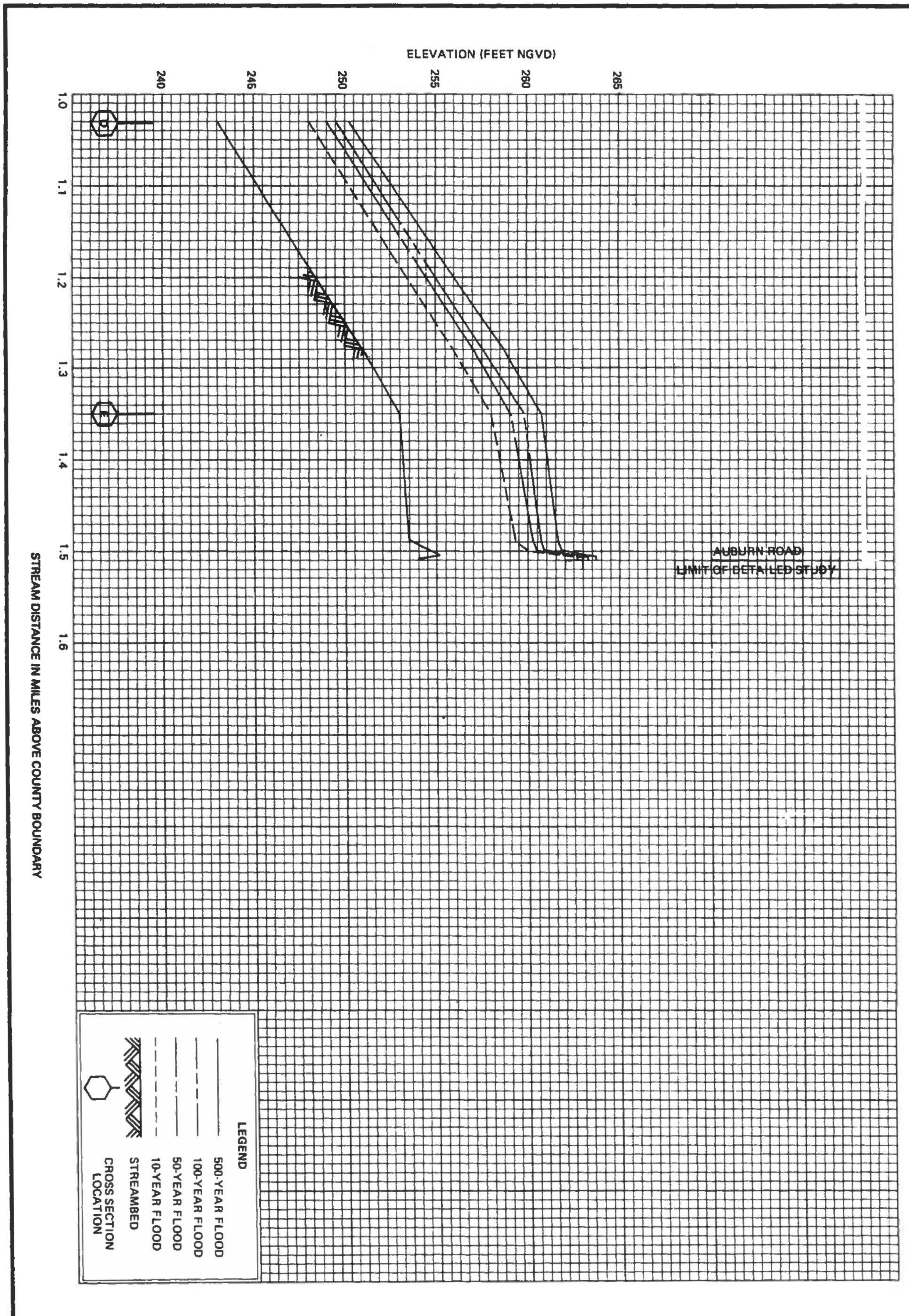


23P	FEDERAL EMERGENCY MANAGEMENT AGENCY **ROCKINGHAM COUNTY, NH** (ALL JURISDICTIONS)	**FLOOD PROFILES** **COHAS BROOK**



FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCKINGHAM COUNTY, NH

(ALL JURISDICTIONS)

FLOOD PROFILES

COHAS BROOK