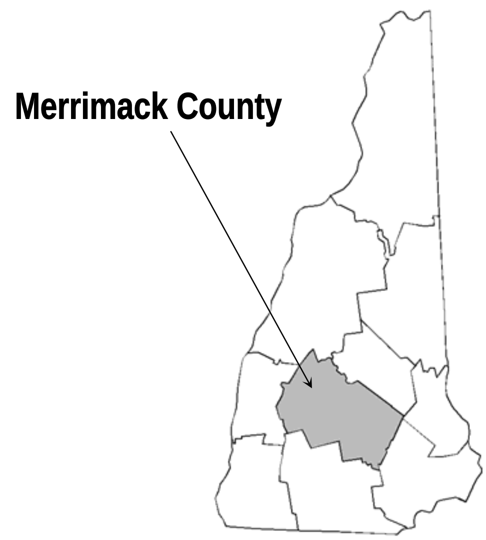
FLOOD INSURANCE STUDY

VOLUME 1 OF 2

MERRIMACK COUNTY, NEW HAMPSHIRE (ALL JURISDICTIONS)



COMMUNITY NAME	COMMUNITY NUMBER
ALLENSTOWN, TOWN OF	330103
ANDOVER, TOWN OF	330104
BOSCAWEN, TOWN OF	330105
BOW, TOWN OF	330107
BRADFORD, TOWN OF	330106
CANTERBURY, TOWN OF	330108
CHICHESTER, TOWN OF	330109
CONCORD, CITY OF	330110
DANBURY, TOWN OF	330111
DUNBARTON, TOWN OF	330202
EPSOM, TOWN OF	330112
FRANKLIN, CITY OF	330113
HENNIKER, TOWN OF	330114
HILL, TOWN OF	330214
HOOKSETT, TOWN OF	330115
HOPKINTON, TOWN OF	330116
LOUDON, TOWN OF	330117
NEW LONDON, TOWN OF	330230
NEWBURY, TOWN OF	330226
NORTHFIELD, TOWN OF	330118
PEMBROKE, TOWN OF	330119
PITTSFIELD, TOWN OF	330120
SALISBURY, TOWN OF	330121
SUTTON, TOWN OF	330122
WARNER, TOWN OF	330123
WEBSTER, TOWN OF	330236
WILMOT, TOWN OF	330124

EFFECTIVE:
APRIL 19, 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
33013CV001A

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 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: April 19, 2010

Revised Countywide FIS Date:

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FLOOD INSURANCE STUDY
MERRIMACK 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 Merrimack County, New Hampshire, including: the Towns of Allenstown, Andover, Boscawen, Bow, Bradford, Canterbury, Chichester, Danbury, Dunbarton, Epsom, Henniker, Hill, Hooksett, Hopkinton, Loudon, Newbury, New London, Northfield, Pembroke, Pittsfield, Salisbury, Sutton, Warner, Webster, and Wilmot; and the Cities of Concord and Franklin (hereinafter referred to collectively as Merrimack County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS 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 Merrimack County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used 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.

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.

This FIS was prepared to include the incorporated communities within Merrimack County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Allenstown, Town of:	the hydrologic and hydraulic analyses from the FIS report dated October 1978 were performed by Anderson-Nichols & Company, Inc., for the Federal Insurance Administration (FIA), under Contract No. H-3862. That work, which was completed in August 1977, covered all

significant flooding sources affecting the Town of Allenstown.

Boscawen, Town of: the hydrologic and hydraulic analyses from the FIS report dated January 1979 were performed by Anderson-Nichols & Company, Inc., for the FIA under Contract No. H-3862. That work, which was completed in October 1977, covered all significant flooding sources in the Town of Boscawen.

Bow, Town of: the hydrologic and hydraulic analyses from the original October 1978 FIS report and April 16, 1979, FIRM (hereinafter referred to as the 1979 FIS), were prepared by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3862. That work was completed in July 1977.

The hydraulic analyses for the Merrimack River from the FIS report dated November 20, 2000, were prepared by Roald Haestad, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMB-96-CO-0405. That work was completed in June 1997.

Bradford, Town of: the hydrologic and hydraulic analyses from the FIS report dated April 15, 1992, were prepared by the U.S. Geological Survey (USGS) for FEMA, under Inter-Agency Agreement No. EMW-88-E-2738, Project Order No. 4. That work was completed in December 1989.

Canterbury, Town of: the hydrologic and hydraulic analyses from the FIS report dated November 1978 were performed by Anderson-Nichols and Company, Inc., for the FIA under Contract No. H-3862. That work, which was completed in September 1977, covered all significant flooding sources affecting the Town of Canterbury.

Chichester, Town of: the hydrologic and hydraulic analyses from the FIS report dated March 1978 were performed by Hamilton Engineering Associates, Inc., for the FIA under Contract No. H-3990. That work, which was completed in April 1977, covered all significant flooding sources affecting the Town of Chichester.

Concord, City of: the hydrologic and hydraulic analyses from the FIS report dated September 1979 and the FIRM dated March 4, 1980 (hereinafter referred to as the 1980 FIS), were prepared by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3862. That work was completed in September 1977.

the hydrologic and hydraulic analyses for the Merrimack River from the FIS report dated August 23, 1999, were prepared by Roald Haestad, Inc., for FEMA, under Contract No. EMB-96-CO-0405. That work was completed in June 1997.

Epsom, Town of: the hydrologic and hydraulic analyses from the FIS report dated January 1978 were performed by Hamilton Engineering Associates, Inc., for the FIA under Contract No. H-3990. That work, which was completed in April 1977, covered all significant flooding sources affecting the Town of Epsom.

Franklin, City of: the hydrologic and hydraulic analyses from the FIS report dated March 1979 were performed by Anderson-Nichols for the FIA, under Contract No. H-3862. That work, which was completed in October 1977, covered all significant flooding sources in the City of Franklin.

Henniker, Town of: the hydrologic and hydraulic analyses from the FIS report dated November 1977 were performed by Hamilton Engineering Associates, Inc., for the FIA, under Contract No. H-3990. That work, which was completed in December 1976, covered all significant flooding sources affecting the Town of Henniker.

Hooksett, Town of: the hydrologic and hydraulic analyses from the FIS report dated March 1982 were performed by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3862. That work, which was completed in July 1977, covered all significant flooding sources affecting the Town of Hooksett.

Hopkinton, Town of: the hydrologic and hydraulic analyses from the FIS report dated May 17, 1988, were prepared by

Costello, Lomasney & deNapoli, Inc., for FEMA, under Contract No. EMW-84-R-1600. That work was completed in March 1986.

New London, Town of:	the hydrologic and hydraulic analyses from the FIS report dated July 16, 1991, were prepared by the Soil Conservation Service (SCS) during the preparation of the FIS for the Town of Sunapee.
Northfield, Town of:	the hydrologic and hydraulic analyses from the FIS report dated December 1978 were performed by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3862. That work, which was completed in October 1977, covered all significant flooding sources affecting the Town of Northfield.
Pembroke, Town of:	the hydrologic and hydraulic analyses from the FIS report dated October 1978 were performed by Anderson-Nichols & Company, Inc., for the FIA, under Contract No. H-3862. That work, which was completed in August 1977, covered all significant flooding sources affecting the Town of Pembroke.
Pittsfield, Town of:	the hydrologic and hydraulic analyses from the FIS report dated January 1978 were performed by Hamilton Engineering Associates, Inc., for the FIA under Contract No. H-3990. That work, which was completed in April 1977, covered all significant flooding sources affecting the Town of Pittsfield.
Warner, Town of:	the hydrologic and hydraulic analyses from the FIS report dated June 4, 1987, were prepared by Costello, Lomasney & deNapoli, Inc., for FEMA under Contract No. EMW-84-R-1600. That work was completed in January 1986.
Webster, Town of:	the hydrologic and hydraulic analyses from the FIS report dated June 2, 1993, were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-91-3535, Project Order No. 5. That work was completed in January 1992.

The authority and acknowledgments for the Towns of Andover, Danbury, Dunbarton, Hill, Loudon, Newbury, Salisbury, Sutton, and Wilmot are not available because no FIS reports were ever published for those communities.

Base map information for surface water features was derived from digital orthophoto quadrangles (DOQs) at an approximate scale of 1:1,000. Further information was derived from U.S. Geological Survey (USGS) Digital Line Graphs. Additional information may have been derived from other sources. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), North American Datum of 1983 (NAD 83), Clarke 1866 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

Consultation Coordination Officer's (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for the incorporated communities within Merrimack County are shown in Table 1, "Initial and Final CCO Meetings."

The results of this countywide study were reviewed at the final CCO meeting held on January 17, 2008, and attended by representatives of FEMA, Code Enforcement Officers, Planning Board members, Zoning Board members and Town Administrators of several jurisdictions. All problems raised at that meeting have been addressed in this study.

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

Community	Initial CCO Date	Final CCO Date
Allenstown, Town of	*	May 9, 1978
Boscawen, Town of	*	July 17, 1978
Bow, Town of	February 1976	February 2, 1978
	May 27, 1998[1]	September 17, 1998
Bradford, Town of	September 1, 1987	September 13, 1990
Canterbury, Town of	*	March 21, 1978
Chichester, Town of	March 31, 1976	August 18, 1977
	January 1976	January 10, 1979
Concord, City of	September 5, 1995	May 12, 1998
Epsom, Town of	March 19, 1976	August 16, 1977
Franklin, City of	February 1976	October 3, 1978
Henniker, Town of	March 23, 1976	May 26, 1977
Hooksett, Town of	February 1976	March 22, 1978
Hopkinton, Town of	April 13, 1984	September 24, 1986
New London, Town of	October 10, 1989[1]	September 11, 1990
Northfield, Town of	February 1976	July 25, 1978
Pembroke, Town of	February 1976	May 4, 1978
Pittsfield, Town of	March 18, 1976	August 10, 1977
Warner, Town of	April 13, 1984	July 22, 1986
Webster, Town of	July 31, 1991	July 22, 1992

[1]Notified by FEMA
*Data not available

2.0 AREA STUDIED

2.1 Scope of Study

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

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

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS

Blackwater River	Soucook River
Chance Pond Brook	Sunapee Lake
Contoocook River	Suncook River
Dalton Brook	Tannery Brook
Glines Brook	The Outlet
Lake Massasecum	Tioga River
Little Suncook River	Todd Lake
Merrimack River	Tributary A
Messer Brook	Warner River
Otter Pond	Webster Lake
Pemigewasset River	West Channel Suncook River
Peters Brook	Williams Brook
Sanders Brook	Winnipesaukee River

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.

All or portions of 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 Merrimack County.

2.2 Community Description

Merrimack County is located in the south-central part of New Hampshire.

The 2000 population of Merrimack County was 136,225. The population increased 13.3 percent from 1990 to 2000.

The climate of Merrimack County is typical of the Merrimack Valley with warm summers and cool winters. Temperatures during the month of July range from an average high of 82 degrees Fahrenheit (°F) to an average low of 58°F. Temperatures in January range from an average high of 32°F to an average low of 11°F. Prolonged periods of severe cold are rare. Average annual precipitation is 38 inches, of which approximately 17 percent is in the form of snow (U.S. Department of Commerce, 1975; U.S. Department of Commerce, 1968).

The hilly topography of Merrimack County is characterized by stratified and unstratified material transported by a retreating glacial ice sheet. Along the streams, alluvial silt covers the glacial outwash deposits to form the floodplains. The predominant soil group is comprised mainly of well-drained sandy loam in glacial till. Several glacial landforms are found in the area such as kames, terraces, deltas, and outwash plains. Elevations above the North American Vertical Datum (NAVD) range from approximately 200 feet at the Merrimack River to 830 feet at Bear Hill.

The principal stream in the Town of Allenstown is the Merrimack River, which originates at the confluence of the Pemigewasset and Winnipesaukee Rivers in the City of Franklin, New Hampshire, approximately 31 miles north of Allenstown. It flows in a southerly direction from Franklin through south-central New Hampshire and northeastern Massachusetts until it empties into the Atlantic Ocean near Newburyport, Massachusetts, a distance of 116 miles. The Suncook River originates at the outlet of the Upper and Lower Suncook Lakes in Barnstead and flows in a southwesterly direction to form the boundary between Allenstown and Pembroke before emptying into the Merrimack River below Suncook.

The Merrimack River floodplain ranges in width from 800 to 1,900 feet through the study area. This floodplain consists primarily of agricultural areas. The floodplain of the Suncook River ranges in width from 60 to 2,200 feet. This latter floodplain is generally open or wooded, with sparse development consisting of residential and some industrial buildings.

The principal stream in the Town of Boscawen is the Merrimack River, which enters Boscawen from the north and flows southeasterly through the town. The centerline of the river serves as the boundary between Boscawen and Canterbury.

The Contoocook River originates at Contoocook Lake in the southeastern part of Jaffrey, New Hampshire. In the Town of Boscawen, the Contoocook River is located in the extreme southeastern corner of Boscawen at its confluence with the Merrimack River.

Tannery Brook originates in the northwestern corner of Boscawen and flows in a southeasterly direction to its confluence with the Merrimack River. Tributary A originates in Boscawen and flows to the north and east until it empties into the Merrimack River. Glines Brook originates in northern Boscawen and flows east to the Merrimack River.

The Merrimack River floodplain varies in width from approximately 200 to 6,600 feet through the study area. Agriculture is the principal land use in the floodplain; however, some of the land is devoted to residential and commercial development. The heavily developed Penacook area occupies the floodplain of the Contoocook River between Concord and Boscawen. Tanneries and general retail commercial establishments are the principal industries. The floodplains of all other detail streams are wooded with sparse residential and commercial development.

The topography of Boscawen is dominated by three major hills: Knowlton Hill, Choate Hill, and the hill southeast of Walker Pond. Low-lying bogs extend between intermittent outwash terraces located parallel to the hills. Runoff from these low-lying bogs supply Tannery Brook, Glines Brook, and Tributary A. The soil complexes in the Boscawen area were developed from the past glacial action in the Merrimack River valley. In general, these soils are well drained, sorted sands with silt and gravel overlying glacial till. Because of glaciation, the floodplains contain greater accumulation of soils in the low areas with shallow mantles overlying the hillside slopes (Edwards and Kelcey, Inc., 1964; U.S. Department of Agriculture, 1965).

The hilly topography of the Town of Bow is characterized by stratified and unstratified material transported by a retreating glacial ice sheet. The predominant soil group is comprised mainly of well-draining sandy loam in glacial till. Several glacial land forms are found in the area such as kames, terraces, deltas, and outwash plains. Elevations range from approximately 195 feet NAVD at the Merrimack River to a high of over 910 feet NAVD on Picked Hill in the southwestern area of the town. Wet, swampy areas that serve as the headwaters for many of the streams in the area are scattered throughout the town. Streams flow from these high-lying bogs, but turn to steeper grades early in their courses. These bogs provide significant floodwater storage and tend to reduce the peak discharges on the streams in Bow (U.S. Department of Agriculture, 1965; U.S. Department of Agriculture, 1968).

Topography within the Town of Bradford varies widely. The town is located just east of the Lovewell Mountain-Sunapee Mountain area. Several locations within the town have elevations that approach or are slightly greater than 2,000 feet NAVD. In contrast, significant low-lying areas surround reaches of the Warner River and Lake Massasecum. The Warner River, Todd Lake, and Lake Massasecum are the most significant water bodies in the town.

The Warner River originates in the Sunapee Mountain area just northwest of Bradford. The river has an average slope of 100 feet per mile from its headwaters to State Route 114. Downstream of the State Route 114 bridge, the river has a mild gradient. In the vicinity of the Warner-Bradford corporate limits, the gradient of the river increases sharply. The principal tributary streams to the Warner River in Bradford include Todd Lake outlet, Lake Massasecum outlet, and Hoyt Brook. The drainage area of the Warner River at the downstream Warner-Bradford corporate limits is approximately 58.9 square miles.

In the Town of Warner, the Warner River flows in an eastern direction through the southern part of Warner and through Webster until it reaches its confluence with the Contoocook River in Hopkinton, New Hampshire.

The Warner River floodplain ranges in width from 45 to 1,050 feet throughout the Town of Warner. The floodplain contains swampy wetlands that provide natural storage areas. Elevations range from approximately 350 feet NAVD at the eastern end of the town to approximately 2,937 feet NAVD at the summit of Mount Kearsarge, the highest point in the town (U.S. Department of the Interior, 1949, et cetera).

Todd Lake has a drainage area of approximately 19.2 square miles at its outlet. Andrew Brook, the principal inlet stream to the lake, originates at Lake Solitude in the Sunapee Mountain area. Elevations on Todd Lake are controlled by the dam at its outlet. Lake Massasecum outlet stream has a drainage area of approximately 10.0 square miles at its mouth. Flood elevations on Lake Massasecum are controlled by backwater from the Warner River.

In the Town of Chichester, the principal watercourse is the Suncook River. Originating to the south of Lake Winnipesaukee in Gilford, New Hampshire, the Suncook River flows in a southerly direction entering Chichester at an elevation of approximately 415 feet NAVD, with a drainage area of approximately 145 square miles.

After forming a portion of Chichester’s eastern boundary, the Suncook River exits at an elevation of approximately 325 feet NAVD, with a drainage area of approximately 161 square miles. From this point, the river flows south for approximately 13 miles to its confluence with the Merrimack River below the Village of Suncook, New Hampshire. Sanders Brook begins near Bear Hill, and flows in a generally southeasterly direction to its confluence with the Suncook River below the State Route 28 bridge, a short distance away from the Chichester-Epsom town boundary. The stream has a drainage area of just under 3 square miles. In addition to the Suncook River and Sanders Brook, there are numerous smaller watercourses in the town which flow into these two streams.

The floodplains along the study streams are generally sparsely developed. Some development is present in North Chichester and at Websters Mill adjacent to the Suncook River.

Soils in the floodplain areas are primarily of the Ondawa-Windsor-Agawam association, and are characterized by rapid permeability and moderate susceptibility to frost action. Soils within the drainage basin are mostly made up of these from the Paxton-Shapleigh-Woodbridge or Gloucester-Shapleigh-Whitman associations noted for moderate to rapid permeability and moderate frost susceptibility.

Approximately 80 percent of Merrimack County is forested with transition hardwood, white pine and hemlock vegetation. Trees include sugar and red maples, beech, red and white pine, hemlock, red and white oak, paper and gray birch, balsam fir and hickory.

In the City of Concord, the Soucook River originates in Loudon, New Hampshire, at the confluence of Clark Brook and Gues Meadow Brook. It flows in a southwesterly direction until it empties into the Merrimack River at the Concord-Pembroke-Bow town boundary.

The Outlet originates from its diversion with the Contoocook River and runs generally parallel to the river until it reunites with the Contoocook River.

The floodplains of the Contoocook and Soucook Rivers and The Outlet range in width from 90 to 2,400 feet. These floodplains are generally wooded, and their development consists of residential and agricultural areas with some industrial development.

In the Town of Epsom, the Suncook River enters at an elevation of approximately 325 feet NAVD, with a drainage area of approximately 161 square miles. The river flows through the western portion of the town and exits to the south at an elevation of approximately 280 feet NAVD with a drainage area of approximately 225 square miles. The Suncook River continues in a southwesterly direction for approximately 5 miles, and converges with the Merrimack River below the Village of Suncook, New Hampshire. The Little Suncook River originates at Northwood Lake just to the west of the Epsom-Northwood town boundary. Flowing in a westerly direction, the Little Suncook River almost bisects Epsom as it converges with the Suncook River near Gossville. At this confluence, the river has a drainage area of approximately 41 square miles. In addition to the Suncook and Little Suncook Rivers, there are numerous smaller streams in the town which flow into these two rivers.

The floodplains along the Suncook and Little Suncook Rivers are generally sparsely developed. Exceptions are areas near the intersection of State Routes 4, 202, and 9 adjacent to the Suncook River and near Gossville and Epsom Center along the Little Suncook River.

The principal streams in the City of Franklin are the Merrimack, Winnipesaukee, and Pemigewasset Rivers and Chance Pond Brook.

The Pemigewasset River originates at Profile Lake in Franconia, New Hampshire. It flows in a southerly direction through central New Hampshire to its confluence with the Winnipesaukee River, where they combine to form the Merrimack River.

Chance Pond Brook originates at the outlet of Webster Lake in Franklin, New Hampshire. It flows in a southeasterly direction to its confluence with the Pemigewasset River in Franklin.

In the Town of Henniker, the Contoocook River flows in a northeasterly direction through Hillsborough, entering Henniker on the west, at an approximate elevation of 540 feet NAVD. The Contoocook River continues flowing in an easterly direction through the center of Henniker, where it has a drainage area of approximately 378 square miles (at the State Route 114 bridge). Entering Hopkinton at an approximate elevation of 360 feet NAVD, the Contoocook River flows in a northeasterly direction until it joins the Merrimack River in the City of Concord and the Town of Boscawen.

Henniker has certain natural features which affect flood conditions. Topographic maps indicate that there are no less than 30 distinct peaks within the town, the highest being Carter Hill at over 1,500 feet NAVD. Nearly 17% of Henniker consists of slopes greater than 25% and another 36% consists of slopes from 15 to 25%. These steep slopes produce land which is unsuitable for farming or residential use; consequently, the area is largely wooded, but has some pastureland.

The principal stream in the Town of Northfield is the Winnipesaukee River which originates at the outlet of Lake Winnipesaukee in Laconia. It flows in a southerly direction through Paugus and Opechee Bays and Winnisquam and Silver Lakes for a distance of approximately 12 miles, then in a westerly direction for 11 miles to its confluence with the Pemigewasset River in Franklin. The centerline of the stream serves as the boundary between Northfield and Tilton and then Northfield and Franklin.

The Tioga River originates northeast of Belmont center and flows in a westerly and then northwesterly direction to its mouth at the Winnipesaukee River.

Williams Brook originates near Bean Hill in south-central Northfield and flows in a northwesterly direction to its mouth at the Winnipesaukee River.

The Winnipesaukee River floodplain ranges in width from 100 to 900 feet through the study area. This floodplain is generally open or wooded, with some residential development in the area of Northfield Center. The floodplain of the Merrimack River ranges in width from 100 to 750 feet through the study area. This latter floodplain is primarily wooded although there are some open areas. The Tioga River floodplain ranges in width from 300 to 1,300 feet through the study area and is primarily wooded. The floodplain of Williams Brook ranges in width from 80 to

400 feet through the study area and is generally open or wooded with some residential development.

2.3 Principal Flood Problems

In the Towns of Allenstown, Boscawen, Bow, Canterbury, Hooksett, and Pembroke, and the Cities of Concord and Franklin major floods occur on the Merrimack River during the spring, fall, and winter seasons. Some of the more severe flooding occurs in early spring as a result of snowmelt and heavy rains in conjunction with ice jams. Autumn is another critical season for flood danger because of heavy rainfall associated with storms of tropical origin. Minor flooding incidences in the Towns of Allenstown, Boscawen, Bow, Canterbury, Hooksett, Northfield, and Pembroke, and the Cities of Concord and Franklin can occur at any time of the year, as even heavy thunderstorms can result in rapid runoff and flooding in the downstream portion of the small streams.

Repeated damage to structures in the floodplains has occurred in 1936, 1938, 1951, 1953, and 1960; with the 1936 flood being the largest of these floods (USGS, 1974). Analysis of USGS gage station records for the Merrimack River at Goffs Falls (No. 01092000) and other stages (discharge record maintained by Public Service Company of New Hampshire for Garvins Falls) indicates that this 1936 flood exceeded the 100-year event for the Towns of Allenstown, Boscawen, Bow, Canterbury, Hooksett, and Pembroke, and the City of Concord. This same 1936 flood was a 90-year event for the City of Franklin and the Town of Northfield. The estimated frequency of this flood was based on natural discharges, unmodified for the effects of upstream flood control structures built after 1936. Damage due to the 1936 flood was estimated (1936 dollars) at 35 million dollars over the entire Merrimack River watershed (USACE, 1973).

The USGS has operated 2 stream gage stations in the Warner River basin. Gage station No. 01085800 on the West Branch of Warner River near Bradford (drainage area 5.75 square miles) started operating in 1962. During the period from 1962 to 1988, the maximum flood peak recorded was 800 cubic feet per second (cfs). This flood occurred on May 29, 1984. Gage station No. 01086000, on the Warner River at Davisville (drainage area 146 square miles) was operated from 1939 through 1978. During the period of record, the maximum flood peak recorded was 4,510 cfs. This flood occurred on March 27, 1953.

Notable flooding occurred in the Town of Bradford in 1987. According to local residents and officials at the New Hampshire Department of Water Resources, peak elevations of 674.3 feet NAVD and 642.5 feet NAVD occurred on Todd Lake and Lake Massasecum, respectively. The 1987 flood elevations on Todd Lake and Lake Massasecum are less than those expected for a flood with a recurrence interval of 100 years. During flood events extensive low-lying areas along the shores of the Warner River, Todd Lake, and Lake Massasecum are subject to flooding.

In the Town of Chichester, flooding along the Suncook River may occur during all seasons of the year. Frequent flooding occurs along the Suncook River at its junctions with Perry Brook and Sanders Brook. At these locations, water overflows the banks of the Suncook River, flooding the surrounding lowlands.

In March 1936, two floods occurred resulting in one of the largest floods of record for the Towns of Chichester and Pittsfield. The second of these floods was larger and produced the more severe flood conditions. A combination of saturated ground, warm temperatures, melting snow, filled lakes and reservoirs, high river flows from the past storm, and heavy rains from the second storm resulted in a peak discharge of 12,900 cfs at a gage station in North Chichester along the Suncook River. Train service in the area was disrupted and the Suncook Bridge was destroyed. Another large flood resulted from hurricane rains falling on saturated ground in September of 1938. This produced a peak discharge of 12,100 cfs at the gage station. The earliest recorded major flood occurred in 1896.

In the Town of Epsom, flooding along the Suncook and Little Suncook Rivers may occur during all seasons of the year. Some natural floodwater storage exists in the upper portions of the Suncook River. Considerable storage exists in drainage areas contributing to the Little Suncook River. However, at the Little Suncook River confluence with the Suncook River there is considerable flooding. Flood problems also exist at the outlet of Northwood Lake.

Flooding occurred in Epsom on March 13 and 14, 1977, along the Suncook River at Bear Island Park, Epsom-Four Corners, and at the camps along Buck Street Extension.

In the Town of Henniker, flooding along the Contoocook River may occur throughout the year. River stages can rise from normal elevations to extreme flood stages in a relatively short period of time, due to the numerous steep tributaries. The watershed is hilly and largely forest-covered; other than the Edward MacDowell Reservoir on Nubanusit Brook, there is little effective pond or valley storage. During the 1936 flood, the USACE records at the USGS gage in Penacook indicate the Contoocook River was approximately an 80-year event.

One of the largest floods of record occurred along the Contoocook River, which resulted from the September 1938 hurricane (USGS, 1940).

Another large flood occurred in March 1936, which resulted from two closely occurring storms combined with considerable snowmelt. In addition, huge ice flows jammed at bridges and dams, with devastating effects (USGS, 1937).

Extensive flooding occurred in the flat area surrounding the Contoocook Valley Paper Company during both these floods. The State Route 114 bridge in the center of Henniker was destroyed during the 1938 flood.

2.4 Flood Protection Measures

There are five dams designed for flood control on the Merrimack River. They were constructed and are being operated by the New England Division, U.S. Army Corps of Engineers (USACE). These structures are the Franklin Falls Dam on the Pemigewasset River, the Edward MacDowell Dam on Nubanusit Brook, the Blackwater Dam on the Blackwater River, and two dams controlling Hopkinton-Everett Reservoir: Everett Dam on the Piscataquog River and the Hopkinton Flood Control Dam on the Contoocook River.

In 1950, the USACE completed the Edward MacDowell Dam, thereby creating MacDowell Reservoir, most of which lies in the Town of Peterborough, Hillsborough County. The Reservoir was built to protect properties along Nubanusit Brook, the Contoocook River, and the Merrimack River from extensive floodflows.

In 1962, the USACE completed the Hopkinton-Everett Reservoir, consisting of a dam, a canal, two large dikes, and a spillway in the Contoocook River watershed; and a dam, a spillway, and two large dikes in the Piscataquog River watershed. The two storage areas formed have a capacity of 70,800 acre-feet in the Contoocook River watershed and 86,500 acre-feet in the Piscataquog River watershed. These areas are connected by a second canal, 13,900 feet long, so that the floodwaters may be transferred. The project provided general protection for property along the Contoocook, Piscataquog, and Merrimack Rivers. The Hopkinton-Everett Reservoir provides no flood protection for the Town of Henniker, with the exception of the reservoir easement. The reservoir easement prevents the building of homes and businesses in areas which would be inundated if the reservoir reaches full capacity.

No flood protection measures exist on the Suncook River in the Towns of Allenstown and Pembroke and no plans have been disclosed for the implementation of any future flood protection measures. In addition, no flood protection measures exist on the Soucook River in the Town of Pembroke and no plans have been disclosed for the implementation of any future flood protection measures.

There are no formal flood fighting or emergency evacuation plans for the Town of Boscawen. The town's Civil Defense Office is responsible for alerting residents of impending disasters and coordinating any emergency operations with town and state public service agencies.

No flood protection measures exist on Tannery Brook, Glines Brook, Tributary A, or Allen Brook in the Town of Boscawen and no plans were disclosed for the implementation of any future flood protection measures.

The Garvins Falls Dam in the Town of Bow is not a flood control structure.

There are no flood protection measures in or affecting the Town of Bradford.

There are no formal flood fighting or emergency evacuation plans for the Town of Canterbury.

There are no flood protection measures on streams in the Town of Chichester. Some natural floodwater storage would occur, however, where wide floodplains or swamp areas exist along the Suncook River and Sanders Brook.

In the City of Concord, no flood protection measures exist on the Soucook River or on streams studied by approximate methods, and no plans have been disclosed for the implementation of any future flood protection measures. However, the city has prepared an emergency evacuation plan for the protection of its residents.

There are no significant flood protection structures on streams in the Town of Epsom. Although not a flood control structure, the dam on Northwood Lake could offer some degree of flood storage on the Little Suncook River.

The rivers and lakes of the Winnipesaukee River Basin undergo an intense degree of recreational usage. The New Hampshire Water Resources Board operates dams at Lakeport, Laconia, and Lochmere in order to regulate flow in the Winnipesaukee River and maintain the levels of Silver Lake, Lake Winnisquam, and Lake Winnipesaukee for recreational uses. Thus, natural flow conditions on the Winnipesaukee River are significantly modified by the interaction of these dams and lakes.

No flood protection measures other than this regulation exist on the Winnipesaukee River. Chance Pond Brook in the City of Franklin also has no flood protection measures. No plans have been disclosed for the implementation of any future flood protection measures on either of these streams.

In the Town of Hookset, no flood protection measures exist on Messer Brook, Dalton Brook, or Peters Brook, and no plans have been disclosed for the implementation of any future flood protection measures.

In the Town of New London, the dam at Sunapee Lake is operated and maintained by the Water Resources Division of the New Hampshire Department of Environmental Services. Sunapee Lake is used for recreational purposes and does not have flood control storage. However, the lake is drawn down in anticipation of floods to maintain the integrity of the structure. Conversion of Wendall Marsh Dam to hydropower will have a negligible effect on flood control. No other major structural flood protection measures exist or are planned for the Town of New London.

In the Town of Northfield, no flood protection measures exist on the Tioga River or Williams Brook, and no plans have been disclosed for the implementation of any future flood protection measures. The Town of Northfield has no formal flood fighting or emergency evacuation plans.

There are no flood protection measures on streams in the Town of Pittsfield. The Pittsfield Dam, located on the Suncook River above the Main Street Bridge, is not a flood control structure and affords only a small degree of flood storage.

There are no structural flood protection measures in the Town of Warner. The Wagner Dam and an unnamed dam located on the Warner River are recreational and were constructed for hydro-power for mills. They do not act as flood control structures or provide additional storage area.

In the Town of Webster, a major flood protection measure existing at this time, which affects flooding along the Blackwater River, is the Blackwater Reservoir. Built in 1941 by the USACE, this Flood Control Reservoir has a capacity of 1.5 billion gallons.

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 exceedence) 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 Hydrologic Analyses

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

Precountywide Analyses

Each incorporated community within Merrimack County, with the exceptions of the Towns of Andover, Danbury, Dunbarton, Hill, Loudon, Newbury, Salisbury, Sutton, and Wilmot, has a previously printed FIS report. The hydrologic analyses described in those reports have been compiled and are summarized below.

In the Towns of Allenstown, Bow, Hooksett, and Pembroke the principal sources of information for the Merrimack River were the discharges used in the Floodplain Information studies published by the USACE (USACE, 1972; USACE, 1976), the rating curves from the Master Regulation Manual for flood control reservoirs (USACE, 1953), and the Water Resources Investigation publication for the Merrimack River (USACE, 1972). The discharge values were developed by a log-Pearson Type III analysis using the 39-year record of flood data from the USGS

Goffs Falls gage station (No. 01092000) in Manchester, New Hampshire. The period of record for the Goffs Falls gage station was from 1936 to 1975. All discharge values were modified to reflect the effect of the four existing flood control structures.

Discharges for the Suncook River were derived from the transposition of flood discharges published in the Towns of Epsom and Pembroke FISs (U.S. Department of Housing and Urban Development, 1978). This river has no flood protection measures affecting it.

In the Town of Boscawen, discharges for the Contoocook River were obtained from information supplied by the New England Division of the USACE (USACE, 1972; USACE, July 23, 1975; USACE, March 10, 1975). These discharges were verified by comparing them to the modified peak discharges at the Contoocook River gage station at Penacook, New Hampshire.

Discharges for Glines Brook, Tannery Brook, and Tributary A were principally derived from regional discharge-frequency equations developed by Manuel Benson (U.S. Department of the Interior, 1962) in conjunction with comparisons to discharge-frequency relationships from stream gage records of nearby basins with similar hydrologic characteristics. The regional equations relate topographical and precipitation characteristics to streamflows. These streams have no flood protection measures affecting them.

In the Town of Bradford, the primary sources of peak flow data used to determine flood discharges for the Warner River, Todd Lake, and Lake Massasecum in Bradford were stream records from the USGS stream gage stations on the West Branch of the Warner River near Bradford (No. 01085800 – drainage area 5.75 square miles) and the Warner River at Davisville (No. 01086000 – drainage area 146 square miles) (U.S. Department of the Interior, published annually). These stations have operated at least 26 and 40 years, respectively. Peak discharges were developed for these stations using a log-Pearson Type III analysis of annual peak flow data (U.S. Department of the Interior, 1981). In addition, the same peak discharge methodology was used for the Warner River in the Town of Warner.

Peak discharges for the Warner River basin at intermediate sites in Bradford were established by adjusting the peak discharges computed for either the Bradford or Davisville gage stations using the following formula:

$$Q = Qg\ (A/Ag)^b$$

Where Q is the drainage at the intermediate site, Qg is the peak discharge as computed for either the Bradford or Davisville gage stations, A and Ag are the drainage areas at the intermediate site and the selected gage station, and b is an exponent (U.S. Department of the Interior, 1975). The exponent, b, was computed based on the 1-percent annual chance recurrence interval peak discharges and drainage areas for the Bradford and Davisville gage stations. For the 1-percent annual chance recurrence interval peak discharges, b is 0.49.

In the Town of Canterbury, discharges for approximate study streams were developed using Manuel Benson’s regional discharge-frequency equation (USGS, 1962).

In the Town of Chichester, USGS gage station No. 895 on the Suncook River, located in North Chichester, was the principal source for defining discharge-frequency relationships for the river. This gage station first began operating in 1919. Values of the 10-, 2-, 1-, and 0.2-percent annual chance peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data (U.S. Water Resources Council, 1976).

Discharge data for Sanders Brook were determined through transposition of annual peak flow data from a nearby gage station with similar hydrologic characteristics. The gage station used is on Mohawk Brook in Center Strafford, New Hampshire, where yearly maximum discharge records are available from 1964 to the present. A discharge-drainage area ratio formula was used to obtain the discharges at various points on Sanders Brook (Johnson, Don, and Cross, W. P., 1949).

In the City of Concord, discharges for the Soucook River were derived from a weighted average between those predicted by Manuel Benson’s regional discharge frequency equations and “WRC Adjusted” log-Pearson results from the Soucook River gage records (U.S. Department of the Interior, 1962; U.S. Department of the Interior, 1977).

Discharges for the Contoocook River were obtained from the New England Division of the USACE (USACE, 1972; USACE, July 23, 1975; USACE, March 10, 1975). These discharges were verified by comparing them with the modified peak discharges at the Contoocook River gage station at Penacook, New Hampshire.

Discharges for The Outlet were determined from a hydraulic analysis of the divergence of The Outlet from the Contoocook River. The analysis consisted of an iterative calculation to determine the flow in both the river and the diversion channel that would achieve a hydraulic balance with the discharges for the selected recurrence intervals of the Contoocook River just upstream of the diversion. These discharges were verified from information obtained from a report by Haynes Engineering Consultants, Inc. (Haynes Engineering Consultants, Inc., 1976).

Discharge data for the Little Suncook River were determined through transposition of annual peak flow data from a nearby gage station with hydrologically similar characteristics. The gage station used is on Big Brook in Pittsbury, New Hampshire, where yearly maximum discharges were measured starting in 1964. From these data, the inflow into Northwood Lake was determined for floods at various recurrence intervals. Maximum flood discharges at Northwood Lake Dam and flood storage in that lake were calculated using a flood routing technique (U.S. Department of the Interior, 1974). A discharge-drainage area ratio formula was used to obtain the discharge data at various points on the Little Suncook River downstream of the dam (Johnston, Don, and W. P. Cross, 1949).

In the City of Franklin, discharges for the Winnipesaukee River were determined from a log-Pearson Type III analysis of historic streamflow data recorded at the USGS gage station No. 810 at Tilton, New Hampshire (Water Resources Council, 1976). These discharges were modified to account for the present operating procedures of the New Hampshire Water Resources Board.

Discharges for the Pemigewasset River were determined using gaging information on the Winnipesaukee River at Tilton, the Merrimack River at Franklin Junction, and flood discharge rates through Franklin Falls Dam (USACE, March 3, 1976).

A reservoir routing using a numerical iteration method was performed on Webster Lake (Warren J. Viessman, 1972). The results of this routing were used to establish the water-surface elevations of Webster Lake for the 10-, 2-, 1-, and 0.2-percent annual chance floods.

In the Town of Henniker, a gage station on the Contoocook River, located 2.5 miles southwest of Henniker, was the principal source of data for defining discharge-frequency relationships for the river. The gage station started in operation in 1939. Values of the 10-, 2-, 1-, and 0.2-percent annual chance peak discharges were based on statistical analyses of past recorded flows at the gage station prepared by the USACE (USACE, 1974).

In the Town of Hopkinton, discharges for the Contoocook River and Blackwater River were obtained from information supplied by the New England Division of the USACE (USACE, 1977; USACE, 1985). These discharges were verified by comparing them to the FIS for the City of Concord (FEMA, 1980).

Flood discharge frequencies for the Warner River were computed using a historically adjusted log-Pearson Type III statistical analysis of peak discharges at USGS gage station No. 01086000, located on the Warner River downstream from the State Route 127 bridge at Davisville (U.S. Water Resources Council, 1976; U.S. Department of the Interior, 1976). The gage station used a recording duration of 39 years from 1940 to 1978 and with the additional consideration of two historic floods in 1936 and 1938.

In the Town of New London, hydrologic and hydraulic analyses for this study were taken from the FIS for the Town of Sunapee, Sullivan County, New Hampshire (FEMA, 1991).

Elevations for Sunapee Lake are based on statistical analysis of gage station records covering a 52-year period at gage station No. 01152000 (U.S. Department of the Interior, 1936-1987). This analysis followed the standard log-Pearson Type III Method (U.S. Department of the Interior, 1981). Discharges from Sunapee Lake for the elevations determined by the above method were determined from stage-discharge curves developed by the SCS at the outlet gates for Sunapee Lake.

Elevation-frequency data for Otter Pond were developed using a synthetic rainfall runoff procedure that relies on regionalized climatological data coupled with physical characteristics of the individual streams for input (U.S. Department of Agriculture, 1965).

In the Town of Northfield, discharges for the Winnipesaukee River were determined from a log-Pearson Type III analysis of historic streamflow data recorded at the USGS gage station No. 810 at Tilton, New Hampshire (U.S. Water Resources Council, 1976).

A summary of the drainage area-peak discharge relationships for all the streams studied by detailed methods is shown in Table 3, "Summary of Discharges."

TABLE 3 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BLACKWATER RIVER					
At confluence with Contoocook River	136.00	2,550	2,620	3,280	3,400
At USGS gage station No. 0108700	129.00	*	*	2,600	*
CHANCE POND BROOK					
At outlet of Webster Lake	17.29	402	586	653	847
COLD BROOK					
At confluence with Tannery Brook	2.14	230	460	580	980
CONTOOCOOK RIVER					
At confluence with Merrimack River	766.00	8,000	15,000	23,300	33,000
At Concord-Hopkinton corporate limits	747.00	8,000	15,000	23,300	33,000
At confluence of Blackwater River	591.00	7,900	12,600	19,300	28,000
At confluence of Warner River	439.00	7,200	7,300	9,500	13,000
At State Route 114 bridge	378.30	9,280	17,330	22,020	34,660
At USGS gage station No. 01085000	368.00	9,100	17,000	21,600	34,000
At upstream Town of Henniker corporate limit	365.30	9,050	16,910	21,490	33,830
DALTON BROOK					
At confluence with Merrimack River	1.40	138	271	339	580
At Londonderry Turnpike (Bypass 28)	1.06	100	210	260	440
GLINES BROOK					
At confluence with Merrimack River	1.52	225	475	590	1,010
LAKE MASSACECUM					
At mouth of outlet stream	10.00	*	*	1,490	*

*Data not available

TABLE 3 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
LITTLE SUNCOOK RIVER					
Above confluence with Suncook River	40.70	510	1,200	1,670	3,050
Below confluence of Lockes Brook	40.10	505	1,180	1,645	3,000
Above confluence of Lockes Brook	36.50	460	1,075	1,500	2,735
Below confluence of Blake Brook	35.90	450	1,060	1,475	2,690
Above confluence of Blake Brook	32.40	405	955	1,330	2,425
Below confluence of Gulf Brook	31.30	390	920	1,285	2,340
Above confluence of Gulf Brook	26.40	330	780	1,085	1,975
At Northwood Lake Dam	20.70	260	610	850	1,550
MERRIMACK RIVER					
At Amoskeag Dam (Manchester, NH)	2,854	42,000	51,000	65,000	122,000
At Concord/Pembroke corporate limits	*	31,750	43,500	55,750	106,000
At Garvins Falls Dam	2,427	21,500	36,000	46,500	90,000
Upstream of confluence of Turkey River	*	21,075	35,250	46,250	89,000
At Bridge Street gage station	2,385	19,300	33,750	44,000	86,250
Below confluence of Contoocook River	2,338	19,300	33,750	44,000	86,250
Above confluence of Contoocook River	1,572	17,650	30,150	37,950	75,700
Franklin Junction (USGS gage station No. 815)	1,570	14,800	25,000	30,000	62,000
Franklin Junction (USGS gage station No. 815)	1,509	14,800	25,000	30,000	62,000
MESSER BROOK					
At confluence with Merrimack River	2.62	235	458	568	986
At Route 3/28A Junction	1.52	190	370	460	800

*Data not available

TABLE 3 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
PEMIGEWASSET RIVER					
At Franklin Falls Dam	1,000	10,500	18,000	22,000	52,000
PETERS BROOK					
At confluence with Merrimack River	3.42	258	496	627	1,062
At Gravel Pit Road (Gravel Pit Culvert C)	1.01	73	140	184	310
SANDERS BROOK					
Approximately 600 feet downstream of Pittsfield Road	2.40	185	320	395	585
SOUCOOK RIVER					
At confluence with Merrimack River	91.00	2,745	4,620	5,690	8,540
At U.S. Route 3 bridge	88.30	2,705	4,560	5,615	8,515
At Pembroke Road bridge	81.70	2,620	4,450	5,475	8,255
At City of Concord corporate limit	72.60	2,410	4,100	5,045	7,605
SUNCOOK RIVER					
At confluence with Merrimack River	260.00	7,015	12,235	15,170	23,450
At confluence of Boat Meadow Brook	252.40	6,860	11,965	14,840	22,940
Above confluence of Bear Brook	224.60	6,260	10,925	13,545	20,930
Below confluence of Fowler Brook	224.50	6,255	10,920	13,540	20,925
At Town of Pembroke corporate limit	223.40	6,260	10,920	13,540	20,930
Above confluence of Fowler Brook	222.10	6,205	10,830	13,430	20,755
Below confluence of Deer Brook	221.10	6,185	10,795	13,385	20,685
Above confluence of Deer Brook	216.70	6,090	10,635	13,185	20,375

*Data not available

TABLE 3 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
Below confluence of Burnham Brook	214.10	6,040	10,540	13,065	20,195
Above confluence of Burnham Brook	211.10	5,970	10,425	12,925	19,975
Below confluence of Little Suncook River	206.50	5,875	10,255	12,715	19,650
Above confluence of Little Suncook River	165.80	4,985	8,695	10,780	16,665
Approximately 400 feet downstream of confluence of Sanders Brook	163.20	4,925	8,595	10,655	16,465
Below confluence of Sanders Brook	160.50	4,865	8,490	10,525	16,265
Approximately 1,700 feet upstream of Depot Road	156.50	4,775	8,335	10,330	15,970
Above confluence of Perry Brook	147.80	4,575	7,980	9,895	15,295
Approximately 200 feet downstream of Webster Mills Road	144.90	4,510	7,870	9,750	15,070
Below confluence of Gas House Brook	142.00	4,435	7,745	9,600	14,840
Above confluence of Gas House Brook	139.00	4,365	7,620	9,450	14,605
Pittsfield-Barnstead Town boundary	133.80	4,245	7,405	9,180	14,190
TANNERY BROOK					
At confluence with Merrimack River	8.13	640	1,255	1,570	2,630
At confluence of Cold Brook	5.62	440	875	1,100	1,860
THE OUTLET	**	960	2,100	3,730	5,280
TIOGA RIVER					
At confluence with Winnipesaukee River	29.90	1,678	3,049	3,648	5,600
TODD LAKE					
At outlet	19.20	*	*	2,060	*

*Data not available

TABLE 3 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
TRIBUTARY A					
At confluence with Merrimack River	1.25	145	290	370	630
WARNER RIVER					
At confluence with Contoocook River	150.00	4,690	7,960	9,700	14,850
At USGS gage station No. 01086000 in Warner, New Hampshire, on Warner River downstream from State Route 127 bridge	146.00	4,600	7,800	9,500	14,550
Upstream of confluence of Schoodac Brook	120.60	3,990	6,760	8,230	12,610
Upstream of confluence of Stevens Brook	83.30	3,020	5,120	6,240	9,550
Upstream of confluence of Lane River	53.30	2,160	3,660	4,460	6,830
At the Town of Bradford downstream corporate limits	58.90	*	*	3,580	*
At State Route 114	44.30	*	*	3,100	*
WEST CHANNEL SUNCOOK RIVER					
At confluence with Suncook River	***	1,715	2,920	3,675	5,790
WILLIAMS BROOK					
At confluence with Winnipesaukee River	8.00	704	1,334	1,572	2,500
WINNIPESAUKEE RIVER					
At Tilton Gage (Tilton, NH; USGS gage station No. 810)	471.00	3,420	4,900	5,640	7,570
At Lakeport Dam	363.00	2,600	2,600	3,500	4,300

*Data not available

**Not applicable (The Outlet is a diversion channel to the Contoocook River)

***Discharges for West Channel Suncook River were determined by Weir Equation for Huckins Mill Dam

In the Town of Bradford, the 1-percent annual chance flood elevation for Todd Lake downstream of the State Route 103 bridge was determined by rating the dam at the outlet of the pond. For the purposes of this analysis, it was assumed that any and all flashboards on the dam would fail prior to the peak discharge. The 1-percent annual chance flood elevation was determined by applying appropriate flow over weir equations documented in a USGS publication (U.S. Department of the Interior, 1967).

The 1-percent annual chance flood elevation for Todd Lake upstream of the State Route 103 bridge is controlled by the dam at the outlet of the pond and the constriction caused by the State Route 103 bridge opening. Using a step-backwater model, the 1-percent annual chance peak discharge and the 1-percent annual chance flood elevation determined for the dam at the outlet of the lake, were routed through the bridge opening to the upper part of Todd Lake to calculate the 1-percent annual elevation.

The 1-percent annual chance flood elevation for Lake Massasecum is controlled by backwater from the Warner River. As a result, the elevation of the Warner River at the confluence of Lake Massasecum outlet stream represents the 1-percent annual chance flood elevation for the lake.

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent annual chance floods for the flooding sources studied by detailed methods and are summarized in Table 4, "Summary of Stillwater Elevations."

TABLE 4 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD*) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
LAKE MASSASECUM				
For its entire shoreline within the Town of Bradford	**	**	643.5	**
OTTER POND				
Immediately upstream of Otter Pond Dam	1,126.6	1,128.0	1,128.6	1,129.5
SUNAPEE LAKE				
Immediately upstream of Sunapee Lake Dam	1,094.0	1,094.6	1,094.8	1,095.3
TODD LAKE				
Downstream of State Route 103	**	**	675.1	**
Upstream of State Route 103	**	**	675.8	**
WEBSTER LAKE				
For its entire shoreline within the City of Franklin	401.5	403.3	404.1	406.1

*North American Vertical Datum
**Data not available

3.2 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.

Cross sections were determined from topographic maps and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. All topographic mapping used to determine cross sections is referenced in Section 4.1.

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).

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.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD). Elevation reference marks (ERMs) used in this study, and their descriptions, are shown on the FIRM. ERMs shown on the FIRM represent those used during the preparation of this and previous FISs. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and floodplain boundaries shown on the FIRM. Users should be aware that these ERM elevations may have changed since the publication of this FIS. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs shown on the FIRM, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

All qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)

- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)

- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)

- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for any jurisdiction, please contact the Information

Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

Precountywide Analyses

Each incorporated community within Merrimack County, with the exceptions of the Towns of Andover, Danbury, Dunbarton, Hill, Loudon, Newbury, Salisbury, Sutton, and Wilmot, has a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and are summarized below.

In the Towns of Allenstown, Canterbury, and Pembroke the valley portions of the cross-section data for the Merrimack and Suncook Rivers were obtained from topographic maps photogrammetrically prepared by Geod Aerial Mapping, Inc. (Geod Aerial Mapping, Inc., 1977); the below-water portions were obtained by field measurement. Bridge plans were utilized to obtain elevation data and structural geometry. Bridges for which plans were unavailable or out-of-date were surveyed.

In the Town of Boscawen, the valley portions of the cross-section data for all detail study streams were obtained photogrammetrically by Geod Aerial Mapping, Inc. (Geod Aerial Mapping, Inc., February 1977). The below-water cross-section data were obtained by field measurements by Thos. F. Moran, Inc. (Thos. F. Moran, Inc., 1977 and 1976).

In the Town of Bow, the geometric data for Garvins Falls Dam was compiled from the topographic mapping and design drawings for the dam prepared by the Public Service Company of New Hampshire (Public Service Company of New Hampshire).

The 1-percent annual chance flood boundaries for approximate studies were determined using normal depth analyses. Cross-sectional geometry for these streams were obtained from USGS quadrangle maps (U.S. Department of the Interior, 1967, et cetera).

In the Town of Bradford, cross sections and structural geometry of hydraulic structures for the Warner River were obtained from field surveys conducted during the 1988 field season by the USGS. Upper-end extensions of cross sections and basin characteristics were based on information contained on USGS topographic maps (U.S. Department of the Interior, 1987, et cetera).

In the City of Concord, in the 1999 FIS, the study area for the Merrimack River was subdivided into two reaches for the analysis. The lower reach is from the Concord/Pembroke corporate limits to the upstream side of Interstate Route 93.

The upper reach is from the upstream side of Interstate Route 93 to the Concord/Boscawen corporate limits.

Cross-section data for the backwater analyses of the lower reach of the Merrimack River were compiled using contour information from the digital topographic maps with a contour interval of 2 feet and field-surveyed data (Liu Aerial Surveys, 1996).

The Manchester Street bridge and embankments were modeled using information from New Hampshire Department of Transportation (NHDOT) project construction drawings because a new bridge and approaches are currently under construction (New Hampshire Department of Transportation, Construction Drawings for the Bridge Structures Within the Study Reach).

Cross-section data for the backwater analyses of the upper reach of the Merrimack River were taken from the HEC-2 data set prepared for the 1980 FIS for Concord. The only change made to the data set was at Sewalls Falls Dam, because the dam has been partially breached.

Existing conditions for Sewalls Falls Dam were taken from construction drawings prepared by Kimball Chase for the stabilization of the remaining sections of the dam and field survey data provided by the New Hampshire Fish and Game Department (New Hampshire Department of Environmental Services, 1990; New Hampshire Fish and Game Department, 1997). The New Hampshire Fish and Game Department reported that as-built drawings were never prepared. The construction drawings and the field survey data do not provide specific elevation data for the breached section of the dam; however, a channel invert elevation of 227.0 feet NAVD was deemed to be appropriate.

In the Town of Epsom, rating curves were developed over both sections of the Huckins Mill Dam on the Suncook River at the north end of Bear Island. Channel discharges were obtained from the rating curves, with the major portion of the flow occurring in the easterly channel. Backwaters were calculated for both the channels of the Suncook River around Bear Island, starting just downstream of the Island at cross section AD.

In the Town of Henniker, for the reach between the State Route 114 bridge and the Contoocook Valley Paper Company Dam, cross-section data were obtained by field measurement. For the reach upstream from the Contoocook Valley Paper Company Dam, cross-section data developed by the USACE were used (USACE, 1974).

In the Town of Hopkinton, cross sections for the backwater analyses for the streams studied in detail were obtained from topographic maps at a scale of 1:4,800 with a contour interval of 4 feet and supplemented by field surveys and bridge plans (Quinn Associates, Inc., 1985).

In the Town of Warner, cross sections for the backwater analyses of the Warner River were obtained from aerial photographs flown in May 1984 at a scale of

1:4,800 with a contour interval of 4 feet and supplemented by field surveys and bridge plans (Quinn Associates, Inc., 1985)

In the Town of Allenstown, water-surface elevations of floods of the selected recurrence intervals were computed for the Merrimack and Suncook Rivers through use of the USACE HEC-2 step-backwater computer program (USACE, 1973). Flood profiles were developed showing computed water-surface elevation to an accuracy of 0.5 foot for these selected floods (Exhibit 1).

Starting water-surface elevations for the Merrimack River were obtained from stage-discharge curves published by the USACE for the Amoskeag Dam in Manchester, New Hampshire (USACE, 1976). For the Suncook River, starting water-surface elevations were taken from corresponding Merrimack River flood profiles.

In the Town of Boscawen, starting water-surface elevations for the Merrimack River were obtained from the City of Concord FIS (U.S. Department of Housing and Urban Development, 1977). For the Contoocook River, Tannery Brook, Glines Brook, and Tributary A starting water-surface elevations were determined by normal depth analysis.

In the Town of Bradford, water-surface elevations of floods of the selected recurrence intervals for the Warner River were computed using a Federal Highway Administration step-backwater computer program (U.S. Federal Highway Administration, 1986). Starting water-surface elevations for the Warner River were taken from the FIS for the Town of Warner (FEMA, 1987).

In the Town of Canterbury, starting water-surface elevations for the Merrimack River were obtained from the Concord FIS (U.S. Department of Housing and Urban Development, 1977).

In the Town of Chichester, starting water-surface elevations for the Suncook River were obtained from water surfaces for the backwaters of the Suncook River that appear in the Town of Epsom FIS. The starting water surfaces for Sanders Brook were taken from the Suncook River at their confluence. Records of river stages at the gage station in Chichester for the period 1919 through 1973 and historic data for 1936 and 1938 floods were evaluated to determine flood stages for the Suncook River.

For streams studied by approximate methods, the 1-percent annual chance flood was estimated at culverts using standard nomographs (New Hampshire Department of Public Works & Highways, 1976). Historic accounts and interpretation of topographic mapping were also used to estimate the 1-percent annual chance flood.
In the City of Concord, in the 1980 FIS, for the Soucook River, starting water-surface elevations were taken from the Merrimack River flood profiles and determined to be reasonable that flood peaks on these two rivers would coincide. Starting water-surface elevations for the Contoocook River were determined by normal depth analysis. Starting water-surface elevations for The Outlet were taken from the Contoocook River flood profiles.

In the City of Concord, in the 1999 FIS, the computed water-surface elevations for the upper reach were delineated using the contours on the digital aerial topographic mapping (Liu Aerial Surveys, 1996).

Starting water-surface elevations for the Merrimack River were taken from the FIS for the Town of Pembroke (FEMA, 1979).

Some modeling errors in the 1980 FIS for the City of Concord account for some of the changes in the 1999 revision. The HEC-2 data sets for the 1980 FIS stopped at the toe of Garvins Falls Dam and restarted upstream of the dam with an undocumented starting water-surface elevation. The water-surface elevations for the 1999 revision were calculated using the special bridge option with a discharge coefficient of 3.8 for the ogee spillway section. The computed water-surface elevations are slightly lower than those published in the 1980 FIS.

No calibration runs were made of the 1936 and 1938 high-water marks because of changes that have occurred in the floodplain since the flood events occurred. The 1936 peak discharge at Bridge Street and Garvins Falls Dam is equal to approximately 122,000 cubic feet per second (cfs), and the 1938 peak discharge at Bridge Street is equal to approximately 98,000 cfs. The 0.2-percent annual chance flood water-surface profile was calculated using a peak discharge of 90,000 cfs at Garvins Falls Dam and 86,250 cfs at Bridge Street. The computed 0.2-percent annual chance flood water-surface profile is slightly higher than the 1938 high-water marks below Manchester Street and slightly lower above Manchester Street. The new bridge at Manchester Street may account for some of the reduction in water-surface elevation. Upstream of Sewalls Falls Dam, the computed water-surface elevations deviate from the 1938 high-water marks because of the partial breach of the dam.

In the Town of Epsom, the flood profile for the Suncook River in the area of Bear Island reflects the water-surface elevations of the easterly channel. An additional flood profile shows the water-surface elevations of the westerly channel. Starting water-surface elevations for the Suncook River were determined by calculating a normal depth water-surface elevations some distance downstream of the town boundary and running the backwater elevations upstream from that point. Elevations from the Suncook River at the confluence of the Little Suncook River were used for starting water-surface elevations on that stream.

In the City of Franklin, starting water-surface elevations for the Merrimack River were obtained from the FIS for the Town of Boscawen (U.S. Department of Housing and Urban Development, 1979). Starting water-surface elevations for the Winnipesaukee and Pemigewasset Rivers were obtained from backwater from the Merrimack River. For Chance Pond Brook, starting water-surface elevations were determined by normal depth analysis.

In the Town of Henniker, analyses of tailwater elevations from the Hopkinton-Everett Reservoir were coordinated with the USACE. The elevations determined served as starting water-surface elevations for the Contoocook River below the

State Route 114 bridge. Records of river stages at the gage station in Henniker for the period 1939 through 1973 and historic data of floods of 1936 and 1938 were evaluated to determine flood stages for the Contoocook River.

In the Town of Hooksett, starting water-surface elevations for the Merrimack River were obtained from stage-discharge curves published by the USACE for the Amoskeag Dam in Manchester, New Hampshire (USACE, 1953). For Messer Brook, Dalton Brook, and Peters Brook, starting water-surface elevations were taken from the Merrimack River flood profiles.

In the Town of Hopkinton, starting water-surface elevations for the Contoocook River were taken from known elevations in the FIS for the City of Concord (FEMA, 1980). Starting water-surface elevations for the Warner River and the Blackwater River were calculated using the slope/area method.

In the Town of New London, hydrologic and hydraulic analyses were taken from the FIS for the Town of Sunapee (FEMA, 1991).

In the Town of Northfield, starting water-surface elevations for the Winnipesaukee River were obtained from the City of Franklin FIS (U.S. Department of Housing and Urban Development, 1977). For the Merrimack River, starting water-surface elevations were taken from the Town of Boscawen FIS (U.S. Department of Housing and Urban Development, 1977). For the Tioga River and Williams Brook, starting water-surface elevations were determined by normal depth analysis.

In the Town of Warner, starting water-surface elevations for the Warner River were calculated by the slope/area method at the confluence with the Contoocook River in Hopkinton, New Hampshire.

In the Town of Webster, the water-surface elevation for the Blackwater River was computed using the USGS step-backwater computer program (U.S. Department of the Interior, 1976). Starting water-surface elevations were obtained from the FIS for the Town of Hopkinton (FEMA, 1988).

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

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. For some reaches of the Contoocook and Merrimack Rivers, roughness factors were determined by calibrating high water marks from historic floods. Roughness factors for all streams studied by detailed methods are shown in Table 5, "Manning's "n" Values."

TABLE 5 - MANNING'S "n" VALUES

Stream	Channel “n”	Overbank “n”
Blackwater River	0.030 – 0.070	0.040 – 0.120
Chance Pond Brook	0.020 – 0.060	0.030 – 0.090
Contoocook River	0.030 – 0.110	0.035 – 0.200
Dalton Brook	0.030 – 0.040	0.030 – 0.100
Little Suncook River	0.030 – 0.060	0.050 – 0.125
Merrimack River	0.019 – 0.085	0.040 – 0.200
Messer Brook	0.040 – 0.050	0.070 – 0.100
Pemigewasset River	0.055	0.070 – 0.090
Peters Brook	0.040 – 0.045	0.070 – 0.120
Sanders Brook	0.065 – 0.085	0.050 – 0.120
Soucook River	0.030 – 0.050	0.060 – 0.120
Suncook River	0.030 – 0.065	0.040 – 0.150
The Outlet	0.030 – 0.050	0.060 – 0.120
Tioga River	0.030 – 0.055	0.040 – 0.120
Warner River	0.030 – 0.060	0.045 – 0.120
Williams Brook	0.030 – 0.055	0.040 – 0.120
Winnipesaukee River	0.030 – 0.055	0.030 – 0.120

3.3 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 of 1929 (NGVD). With the finalization of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD. Structure and ground elevations in the community must, therefore, be referenced to NAVD. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in base flood elevations across the corporate limits between the communities.

For more information on NAVD, 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 1-percent annual chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent annual chance flood elevations; delineations of the 1- and 0.2-percent annual chance floodplains; and 1-percent annual chance 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 flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 1- and 0.2-percent annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:4,800 and 1:2,400 with contour intervals of 5 feet (Geod Aerial Mapping, Inc., 1977; State of New Hampshire Department of Public Works and Highways, 1967); 1"=400' with a contour interval of 5 feet (Geod Aerial Mapping, Inc., 1977); 1:24,000 and 1:25,000 with contour intervals of 20 feet and 6 meters (U.S. Department of the Interior, 1987, et cetera); 1"=400' with a contour interval of 20 feet (USGS, 1957); 1"=100' with a contour interval of 2 feet (Concord, New Hampshire, Department of Public Works, 1966, et cetera); 1:4,800 with a contour interval of 4 feet (Quinn Associates, Inc., 1985); boundaries were interpolated using digital topographic maps with a contour interval of 2 feet (Liu Aerial Surveys, 1996); boundaries were interpolated using photo-enlarged topographic maps at a scale of 1:4,800, with a contour interval of 20 feet (USGS, 1957); boundaries were interpolated using topographic maps.

For each area studied by approximate methods, the boundary of the 1-percent annual chance flood was delineated on USGS quadrangle maps that were photographically enlarged to scales of 1:12,000 or 1:4,800, where available (USGS, 1968, et cetera; Geod Aerial Mapping, Inc., 1977); 1:1,000 or 1:400, where available (USGS, 1956); or 1:24,000, enlarged to a scale of 1:12,000 (U.S. Department of the Interior, 1967, et cetera). Additional approximate studied areas on several unnamed swamps and ponds were taken from the FIRM for the Town of Bow (FEMA, 2000). The boundaries of the 1-percent annual chance floodplain were delineated using the FIRM for the Town of Bradford (FEMA, 1992). The 1-percent annual chance floodplain boundaries were delineated using topographic maps at scales of 1"=400' and 1"=100' where these 2 coverages were available (Geod Aerial Mapping, Inc., 1977; USACE, 1973; Concord, New Hampshire, Department of Public Works, 1966, et cetera). In the Town of Henniker, for the Tributary from Morrill Pond, the 1-percent annual chance flood has been delineated using the estimated flood elevations determined at culverts; between culverts, the boundaries were interpolated using topographic maps at a scale of 1:12,000, with a contour interval of 20 feet (New Hampshire Department of Resources and Economic Development, 1972). The 1-percent annual chance flood boundaries were delineated using topographic maps and the FIRM for the Town of Hopkinton (Quinn Associates, Inc., 1985; U.S. Department of the Interior, 1949, et cetera; FEMA, 1988). The 1-percent annual chance floodplain boundaries were delineated using the FIRMs for the Town of New London and the Town of Warner (FEMA, 1991; FEMA, 1987).

In the Town of Webster, the 1-percent annual chance floodplain boundary remains essentially unchanged from the delineation shown on the previously printed FIS for the Town of Webster (FEMA, 1993).

In the Town of Northfield, Knowles Pond and several small swamps in the southeastern portion of the town were delineated from the FIRM (U.S. Department of Housing and Urban Development, 1979).

For the flooding sources studied by approximate methods, the boundaries of the 1-percent annual chance floodplains were delineated using topographic maps referenced within the previously printed FIS reports for the incorporated jurisdictions within Merrimack County, with the exception of the Towns of Andover, Danbury, Dunbarton, Hill, Loudon, Newbury, Salisbury, Sutton, and Wilmot.

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

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without 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.

In the Town of Allenstown, the floodways were determined using Method 4 and Method 1 encroachment analysis of the USACE HEC-2 computer program. No encroachment was attempted for cross sections at bridges. Encroachment limits were based on equal conveyance reduction of a magnitude that would produce a surcharge in water surface related to a corresponding maximum one foot surcharge in energy grade line or water-surface elevation. Because of the effects of downstream encroachment on energy grade line and water-surface elevations upstream, there may be numerous cross sections where minimal encroachment can be permitted without upstream energy grade line or water-surface elevation increases of more than one foot. This "domino" effect, therefore, imposes an additional constraint on floodplain encroachment.

Under certain flow conditions, as the cross-sectional flow area is reduced, the local effect is to lower the water-surface elevation and increase the velocity. The water surface drops due to the conversion of potential energy to kinetic energy as flow is accelerated through the restrictive section. Although the local effect of such an encroachment is a reduction of water-surface elevation, the increased velocity usually results in an increase in water-surface elevations at some point upstream. If further encroachment were allowed at the restrictive section, the water-surface elevation would continue to drop and the velocity would increase, causing a rise greater than one foot at upstream sections.

The floodways along the Merrimack and Suncook Rivers were computed on the basis of an equal conveyance reduction. For the Merrimack River, the floodway limits were determined to be at the limits of the natural stream channel.

In the Town of Boscawen, the floodways along the Contoocook River, Glines Brook, Tannery Brook, and Tributary A were computed on the basis of an equal conveyance reduction without consideration of backwater flooding from their respective confluent streams.

In the Town of Hooksett, a portion of the floodway at cross section A on the Merrimack River lies outside of the county boundary of Merrimack County. Some floodways, which closely follow stream courses, have not been delineated due to scale limitations.

In special cases of divided flow, the Winnipesaukee River floodway takes the most efficient path and consequently crosses the stream boundaries. Portions of the floodway for the Winnipesaukee River lie outside the county boundary.

In the Town of Northfield, the floodways along the Tioga River and Williams Brook were computed on the basis of an equal conveyance reduction without consideration of backwater flooding from its confluent stream, the Winnipesaukee River.

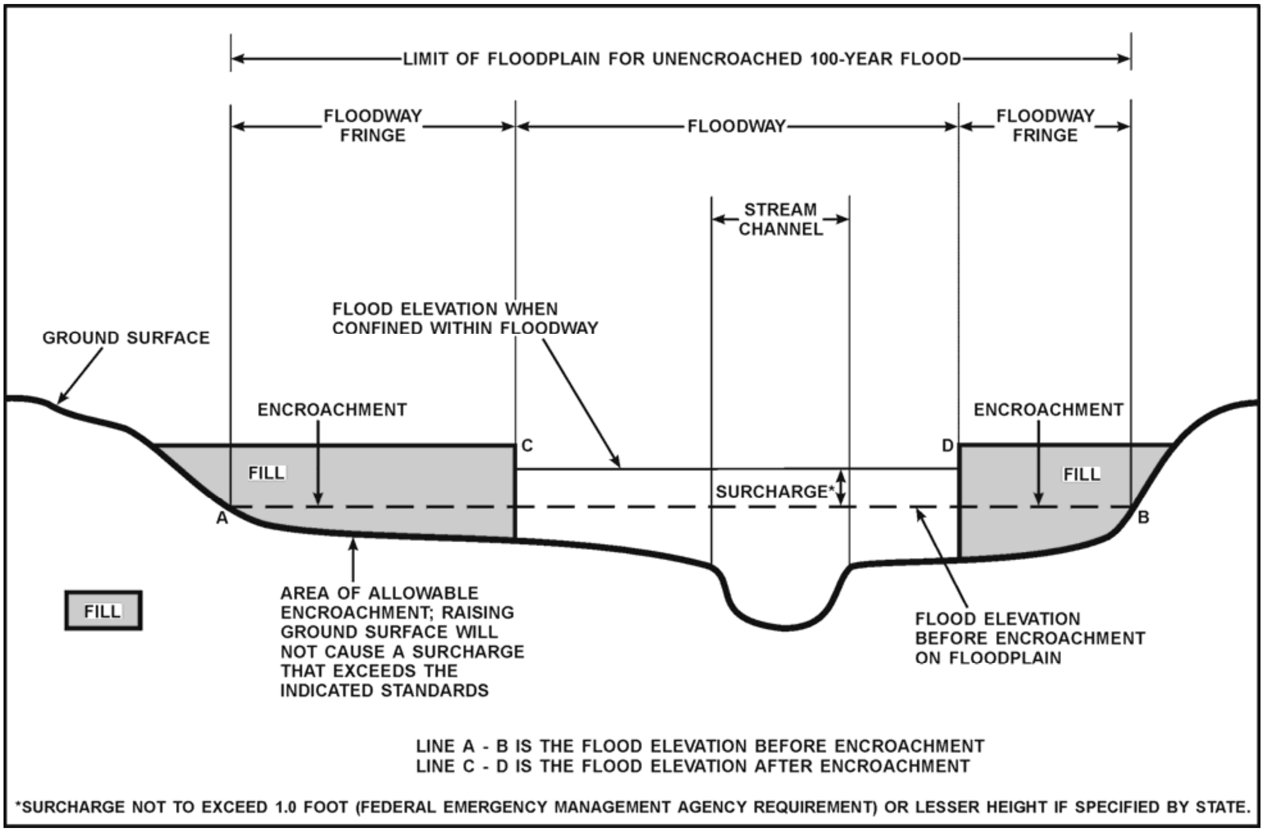
In the Town of Pembroke, the floodways along the Suncook and Soucook Rivers were computed on the basis of an equal conveyance reduction with consideration given to backwater flooding from their confluent stream, the Merrimack River.

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 6). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

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 6, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

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



FLOODWAY SCHEMATIC Figure 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Blackwater River								
A	1,300	90	1,659	1.80	359.7	359.3[2]	360.3	1.0
B	2,850	158	1,962	1.50	359.7	359.4[2]	360.4	1.0
C	4,910	85	1,639	1.80	359.7	359.6[2]	360.6	1.0
D	6,730	614	6,406	0.50	359.7	359.7[2]	360.7	1.0
E	8,110	457	4,781	0.60	359.7	359.7[2]	360.7	1.0
F	10,435	44	527	13.90	362.3	362.3	362.3	0.0
G	10,493	250	1,895	1.40	362.3	362.3	362.3	0.0
H	11,660	140	1,601	1.60	362.4	362.4	362.4	0.0
I	15,260	150	1,561	1.70	362.7	362.7	362.7	0.0
J	18,260	135	1,365	1.90	362.9	362.9	363.0	0.1
K	20,460	193	1,533	1.70	363.3	363.3	363.5	0.2
L	24,260	178	1,447	1.80	364.4	364.4	364.7	0.3
M	29,060	209	1,550	1.70	365.9	365.9	366.4	0.5
N	31,460	55	731	3.60	367.1	367.1	367.6	0.5
O	31,520	133	927	2.80	367.1	367.1	367.6	0.5
P	32,960	153	319	8.20	383.1	383.1	383.1	0.0
Q	34,660	173	633	4.10	408.0	408.0	408.0	0.0
R	36,560	108	295	8.80	423.9	423.9	423.9	0.0
S	37,735	41	261	10.00	435.4	435.4	435.7	0.3
T	41,560	57	560	4.40	444.8	444.8	445.3	0.5
U	41,608	84	666	3.90	445.1	445.1	445.7	0.6
V	44,160	86	266	9.80	460.5	460.5	460.5	0.0
W	48,085	83	846	3.10	470.7	470.7	471.5	0.8
X	50,285	82	707	3.70	471.8	471.8	472.6	0.8

[1]Feet above confluence with Contoocook River
[2]Elevation computed without consideration of backwater effects from Contoocook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

BLACKWATER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chance Pond Brook								
A	0.030[1]	16	59	11.00	290.0	290.0	290.4	0.4
B	0.206[1]	25	173	3.80	364.9	364.9	365.0	0.1
C	0.497[1]	20	64	10.20	373.0	373.0	373.0	0.0
D	0.763[1]	175	1,587	0.40	399.4	399.4	400.4	1.0
E	1.108[1]	230	1,613	0.40	399.4	399.4	400.4	1.0
F	1.594[1]	54	353	1.90	403.3	403.3	403.6	0.3
Contoocook River								
A	100.735[2]	1,075	6,165	3.80	253.7	249.9[3]	250.9	1.0
B	101.068[2]	570	2,965	7.90	271.5	271.5	271.5	0.0
C	101.303[2]	390	3,025	7.70	286.7	286.7	287.3	0.6
D	101.680[2]	160	3,055	7.60	307.8	307.8	308.1	0.3
E	102.140[2]	220	1,927	10.20	311.2	311.2	311.7	0.5
F	103.330[2]	300	5,917	3.90	353.2	353.2	353.4	0.2
G	104.040[2]	230	4,569	5.10	354.2	354.2	354.5	0.3
H	104.580[2]	225	4,575	5.10	355.6	355.6	355.9	0.3
I	105.130[2]	250	4,931	4.70	356.3	356.3	356.6	0.3
J	106.110[2]	230	4,963	4.70	357.2	357.2	357.5	0.3
K	107.860[2]	735	4,013	5.80	357.9	357.9	358.8	0.9
L	108.510[2]	515	6,287	3.70	358.8	358.8	359.5	0.7
M	108.809[2]	667	12,757	1.80	359.2	359.2	360.0	0.8
N	108.942[2]	221	4,712	4.90	359.2	359.2	360.0	0.8
O	109.218[2]	853	11,051	2.10	359.5	359.5	360.3	0.8
P	109.590[2]	850	8,789	2.70	359.7	359.7	360.5	0.8
Q	109.792[2]	1,100	12,941	1.50	359.9	359.9	360.8	0.9
R	110.169[2]	1,405	10,845	1.80	360.0	360.0	360.9	0.9

[1]Miles above confluence with Pemigewasset River
[2]Miles above Newburyport Light, Newburyport, MA
[3]Elevation computed without consideration of backwater effects from Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

CHANCE POND BROOK – CONTOOCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Contoocook River (continued)								
S	110.378[1]	737	7,135	2.70	360.0	360.0	360.9	0.9
T	110.883[1]	221	5,091	3.80	360.6	360.6	361.5	0.9
U	111.395[1]	494	6,048	3.20	361.0	361.0	361.9	0.9
V	111.948[1]	230	4,850	4.00	361.3	361.3	362.3	1.0
W	112.372[1]	740	7,413	2.60	361.8	361.8	362.7	0.9
X	112.987[1]	984	9,856	1.00	362.1	362.1	363.1	1.0
Y	113.563[1]	216	3,162	3.00	362.6	362.6	363.5	0.9
Z	113.810[1]	168	2,602	3.70	363.6	363.6	364.4	0.8
AA	114.033[1]	210	3,557	2.70	364.0	364.0	364.7	0.7
AB	114.696[1]	240	3,435	2.80	364.8	364.8	365.5	0.7
AC	114.895[1]	536	5,505	1.70	364.9	364.9	365.7	0.8
AD	115.739[1]	1,050	6,590	1.40	365.1	365.1	366.0	0.9
AE	116.673[1]	1,182	7,078	1.30	365.3	365.3	366.3	1.0
AF	117.128[1]	407	4,291	2.20	365.5	365.5	366.5	1.0
AG	117.624[1]	912	6,996	1.40	365.8	365.8	366.8	1.0
AH	118.120[1]	294	3,004	3.20	366.1	366.1	367.1	1.0
AI	118.611[1]	430	4,104	2.30	366.6	366.6	367.6	1.0
AJ	119.021[1]	100	865	11.00	367.0	367.0	367.9	0.9
AK	119.374[1]	477	7,731	1.20	382.8	382.8	383.1	0.3
AL	0.090[2]	204	3,792	5.70	421.8	421.8	421.8	0.0
AM	0.180[2]	229	4,062	5.32	423.4	423.4	423.4	0.0
AN	0.420[2]	316	4,957	4.36	423.9	423.9	424.0	0.1
AO	0.660[2]	200	2,408	8.97	423.9	423.9	423.9	0.0
AP	0.750[2]	184	2,980	7.25	425.0	425.0	425.3	0.3
AQ	1.010[2]	178	3,264	6.62	427.6	427.6	427.7	0.1
AR	1.260[2]	320	5,759	3.75	428.1	428.1	428.6	0.5

[1]Miles above Newburyport Light, Newburyport, MA
[2]Miles above State Route 114

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

CONTOOCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Contoocook River (continued)								
AS	1.470[1]	219	3,392	6.37	428.1	428.1	428.7	0.6
AT	1.580[1]	212	2,471	8.74	431.0	431.0	431.0	0.0
AU	1.670[1]	236	2,171	9.95	431.8	431.8	432.5	0.7
AV	1.700[1]	323	2,233	9.67	438.3	438.3	438.3	0.0
AW	1.960[1]	313	5,218	4.14	440.9	440.9	440.9	0.0
AX	2.150[1]	209	2,434	8.88	440.9	440.9	440.9	0.0
AY	2.400[1]	180	1,388	15.56	451.0	451.0	451.1	0.1
AZ	2.620[1]	242	1,985	10.88	464.5	464.5	464.5	0.0
BA	2.790[1]	306	2,469	8.75	471.6	471.6	471.7	0.1
BB	3.240[1]	215	2,784	7.76	491.1	491.1	491.1	0.0
BC	3.820[1]	244	2,353	9.18	522.2	522.2	522.2	0.0
BD	4.090[1]	158	1,546	13.97	538.0	538.0	538.0	0.0
BE	4.420[1]	186	1,570	13.76	550.4	550.4	550.4	0.0
Dalton Brook								
A	0.020[2]	10	41	8.30	186.7	182.4[3]	182.4	0.0
B	0.600[2]	35	99	3.40	241.7	241.7	242.3	0.6
C	1.210[2]	20	43	6.00	289.8	289.8	290.0	0.2
D	1.316[2]	25	79	3.30	294.6	294.6	295.0	0.4
E	1.409[2]	8	45	5.80	297.6	297.6	297.7	0.1
Glines Brook								
A	0.124[2]	30	250	2.40	264.5	260.7[3]	261.7	1.0
B	0.245[2]	20	65	9.10	284.5	284.5	284.7	0.2

[1]Miles above State Route 114
[2]Miles above confluence with Merrimack River
[3]Elevation computed without consideration of backwater effects from Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

CONTOOCOOK RIVER – DALTON BROOK – GLINES BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Suncook River								
A	0.000	766	1,361	1.20	338.4	326.0[2]	326.9	0.9
B	0.070	800	3,899	0.40	338.4	333.8[2]	333.9	0.1
C	0.380	48	159	10.44	339.5	339.5	340.0	0.5
D	0.470	49	208	7.98	344.1	344.1	345.1	1.0
E	0.510	49	295	5.63	346.7	346.7	346.9	0.2
F	0.640	51	174	9.54	349.9	349.9	350.1	0.2
G	0.770	60	280	5.93	356.7	356.7	356.7	0.0
H	0.920	53	176	8.47	362.0	362.0	362.2	0.2
I	1.050	65	271	5.50	370.0	370.0	370.0	0.0
J	1.130	57	157	9.49	377.6	377.6	377.6	0.0
K	1.320	79	301	4.95	388.9	388.9	389.0	0.1
L	1.420	80	175	8.51	394.4	394.4	394.4	0.0
M	1.480	67	187	7.97	398.3	398.3	398.5	0.2
N	1.640	28	190	7.84	408.8	408.8	409.0	0.2
O	1.720	128	518	2.88	410.9	410.9	411.2	0.3
P	1.760	190	701	2.13	411.5	411.5	411.8	0.3
Q	1.880	45	234	6.37	415.5	415.5	416.4	0.9
R	2.020	77	221	6.74	424.5	424.5	424.5	0.0
S	2.100	83	242	6.16	429.8	429.8	429.9	0.1
T	2.150	90	943	1.58	436.7	436.7	436.7	0.0
U	2.490	58	144	9.06	439.5	439.5	439.5	0.0
V	2.600	66	299	3.23	442.8	442.8	443.1	0.3
W	2.760	284	1,045	0.92	443.5	443.5	444.2	0.7
X	3.000	36	121	7.98	444.8	444.8	445.4	0.6
Y	3.230	55	210	4.60	460.7	460.7	461.1	0.4

[1]Miles above confluence with Suncook River
[2]Elevation computed without consideration of backwater effects from Suncook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE SUNCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Suncook River (continued)								
Z	3.350[1]	64	123	7.85	473.2	473.2	473.4	0.2
AA	3.440[1]	50	165	5.85	482.4	482.4	482.9	0.5
AB	3.550[1]	39	103	9.37	504.9	504.9	504.9	0.0
AC	3.620[1]	236	1,270	0.76	518.7	518.7	518.7	0.0
Merrimack River								
A	76.390[2]	435[3]	10,854	6.00	184.7	184.7	185.2	0.5
B	77.443[2]	520	10,896	6.00	186.6	186.6	187.0	0.4
C	78.725[2]	520	13,565	4.50	189.0	189.0	189.3	0.3
D	80.500[2]	390	11,679	5.20	190.4	190.4	190.7	0.3
E	80.960[2]	450	11,235	5.00	191.4	191.4	191.6	0.2
F	82.257[2]	635	10,512	5.30	197.1	197.1	197.4	0.3
G	82.983[2]	602	10,624	5.20	198.0	198.0	198.3	0.3
H	84.498[2]	562	10,288	5.40	200.2	200.2	200.4	0.2
I	85.396[2]	247	5,510	10.10	201.4	201.4	201.5	0.1
J	85.876[2]	798	14,217	3.90	203.3	203.3	203.5	0.2
K	86.523[2]	617	13,624	4.10	203.7	203.7	203.9	0.2
L	86.785[2]	612	8,379	5.50	224.2	224.2	224.2	0.0
M	87.306[2]	602	10,335	4.50	225.6	225.6	225.6	0.0
N	87.795[2]	436	5,411	8.50	226.1	226.1	226.1	0.0
O	88.138[2]	509	8,827	5.20	227.7	227.7	227.7	0.0
P	88.873[2]	575	10,815	4.30	229.1	229.1	229.1	0.0
Q	89.963[2]	482	8,910	5.20	230.2	230.2	230.2	0.0
R	90.471[2]	661	11,182	4.10	231.0	231.0	231.0	0.0
S	91.531[2]	506	10,400	4.20	231.9	231.9	232.3	0.4

[1]Miles above confluence with Suncook River
[2]Miles above confluence with Newburyport Light, Newburyport, MA
[3]This width extends beyond the county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE SUNCOOK RIVER – MERRIMACK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Merrimack River (continued)								
T	91.651	493	10,022	4.40	232.0	232.0	232.4	0.4
U	92.418	475	10,303	4.30	232.7	232.7	233.1	0.4
V	92.815	371	8,984	4.90	233.2	233.2	233.4	0.2
W	93.092	2,072	24,679	1.80	233.3	233.3	233.8	0.5
X	93.878	514	10,326	4.30	233.6	233.6	234.3	0.7
Y	94.230	429	9,647	4.60	234.0	234.0	234.5	0.5
Z	95.624	543	8,645	5.10	235.2	235.2	235.9	0.7
AA	97.140	685	7,311	6.00	237.8	237.8	238.4	0.6
AB	98.112	389	4,134	10.60	241.4	241.4	241.6	0.2
AC	98.640	363	4,606	9.60	246.2	246.2	246.2	0.0
AD	98.684	352	4,807	9.20	247.2	247.2	247.2	0.0
AE	99.805	440	8,873	5.00	250.2	250.2	250.4	0.2
AF	100.992	435	9,710	3.90	253.9	253.9	254.8	0.9
AG	101.898	930	11,935	3.20	254.9	254.9	255.7	0.8
AH	102.870	490	6,990	5.40	256.3	256.3	257.2	0.9
AI	104.290	730	12,785	3.00	258.6	258.6	259.5	0.9
AJ	105.070	290	7,175	5.30	259.3	259.3	260.2	0.9
AK	106.760	1,170	18,860	2.00	261.2	261.2	262.1	0.9
AL	108.130	250	6,135	6.20	262.4	262.4	263.3	0.9
AM	108.760	275	6,625	5.70	263.6	263.6	264.6	1.0
AN	110.250	705	9,310	4.10	266.1	266.1	267.1	1.0
AO	111.370	290	7,595	5.00	267.3	267.3	268.3	1.0
AP	112.160	715	10,599	3.00	268.3	268.3	269.2	0.9
AQ	113.000	325	9,230	3.40	268.8	268.8	269.8	1.0
AR	113.560	726	11,775	2.70	269.2	269.2	270.1	0.9
AS	114.780	260	6,109	5.10	269.9	269.9	270.9	1.0

[1] Miles above confluence with Newburyport Light, Newburyport, MA

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

MERRIMACK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Messer Brook								
A	0.024[1]	12	84	6.80	185.6	179.0[4]	179.0	0.0
B	0.174[1]	20	124	4.60	196.8	196.8	196.8	0.0
C	0.655[1]	20	56	8.20	220.2	220.2	220.2	0.0
D	0.975[1]	8	37	12.40	233.2	233.2	233.6	0.4
E	1.255[1]	12	48	9.60	258.2	258.2	258.2	0.0
Pemigewasset River								
A	116.245[2]	247	2,789	7.90	273.0	273.0	273.7	0.7
B	116.590[2]	180	1,465	15.00	278.4	278.4	278.4	0.0
C	117.200[2]	319	6,405	3.40	308.2	308.2	308.2	0.0
Peters Brook								
A	0.374[1]	30	161	3.90	222.5	222.5	222.5	0.0
B	0.770[1]	10	50	12.50	253.9	253.9	254.2	0.3
C	0.910[1]	20	180	3.50	278.2	278.2	278.7	0.5
D	1.070[1]	20	98	4.10	287.9	287.9	287.9	0.0
E	1.285[1]	17	130	3.10	293.5	293.5	294.0	0.5
F	1.705[1]	45	81	5.00	301.2	301.2	301.3	0.1
Sanders Brook								
A	0.050[3]	36	371	1.06	343.0	341.7[5]	342.3	0.6
B	0.120[3]	36	307	1.29	343.0	341.7[5]	342.4	0.7
C	0.240[3]	37	137	2.88	349.4	349.4	349.5	0.1
D	0.330[3]	27	60	6.58	352.7	352.7	353.3	0.6

[1]Miles above confluence with Merrimack River
[2]Miles above Newburyport Light, Newburyport, MA
[3]Miles above confluence with Suncook River
[4]Elevation computed without consideration of backwater effects from Merrimack River
[5]Elevation computed without consideration of backwater effects from Suncook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

MESSER BROOK – PEMIGEWASSET RIVER – PETERS BROOK – SANDERS BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Soucook River								
A	0.350	295	2,660	2.10	203.4	203.1[2]	204.1	1.0
B	1.165	100	960	5.90	205.8	205.8	206.3	0.5
C	4.116	265	1,623	3.40	229.2	229.2	229.4	0.2
D	6.665	70	454	12.20	248.3	248.3	248.3	0.0
E	7.582	105	1,129	4.90	261.4	261.4	262.2	0.8
F	9.032	200	1,603	3.30	270.4	270.4	271.1	0.7
G	12.213	75	1,027	5.10	303.5	303.5	304.3	0.8
Suncook River								
A	0.050	265	3,236	4.70	197.9	197.9	198.9	1.0
B	0.439	207	3,877	3.90	236.7	236.7	236.7	0.0
C	0.564	87	2,744	5.50	261.1	261.1	261.1	0.0
D	0.847	252	4,126	3.70	283.7	283.7	283.8	0.1
E	1.186	142	1,747	8.70	285.5	285.5	285.8	0.3
F	1.654	192	3,165	4.80	288.3	288.3	288.6	0.3
G	2.010	221	2,665	5.60	289.2	289.2	289.4	0.2
H	2.995	1,041	9,953	1.50	290.5	290.5	291.3	0.8
I	4.137	980	10,142	1.40	292.8	292.8	293.8	1.0
J	4.785	1,235	9,024	1.60	293.4	293.4	294.4	1.0
K	5.490	322	2,584	5.60	299.0	299.0	299.0	0.0
L	5.525	287	4,472	3.20	301.4	301.4	301.4	0.0
M	5.570	147	3,015	4.80	301.5	301.5	301.6	0.1
N	6.330	230	3,864	3.70	302.9	302.9	303.5	0.6
O	6.667	155	2,670	5.20	303.3	303.3	304.1	0.8
P	6.937	225	3,238	4.30	304.3	304.3	305.3	1.0
Q	7.035	626	6,817	3.72	304.5	304.5	305.5	1.0

[1]Miles above confluence with Merrimack River
[2]Elevation computed without consideration of backwater effects from Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

SOUCOOK RIVER – SUNCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Suncook River (continued)								
R	7.060	626	6,817	3.72	304.5	304.5	305.5	1.0
S	7.900	449	6,285	3.76	305.5	305.5	306.5	1.0
T	8.270	450	5,956	2.25	305.9	305.9	306.9	1.0
U	8.650	440	4,085	3.21	306.3	306.3	307.2	0.9
V	9.250	290	3,872	3.39	307.4	307.4	308.1	0.7
W	9.470	450	8,314	1.58	307.7	307.7	308.5	0.8
X	9.540	106	1,719	7.63	308.3	308.3	308.7	0.4
Y	9.580	129	1,855	7.07	308.9	308.9	309.3	0.4
Z	9.670	228	3,643	3.60	309.4	309.4	310.0	0.6
AA	10.080	600	7,766	1.65	309.7	309.7	310.4	0.7
AB	10.630	817	8,428	1.52	309.7	309.7	310.6	0.9
AC	10.720	900	8,891	1.44	309.7	309.7	310.6	0.9
AD	10.850	400	4,043	3.17	309.7	309.7	310.7	1.0
AE	11.030	215	2,146	5.97	310.0	310.0	311.0	1.0
AF	11.220	200	1,494	6.12	311.5	311.5	312.0	0.5
AG	11.410	148	1,313	6.96	313.0	313.0	314.0	1.0
AH	11.570	350	3,139	2.91	314.7	314.7	315.7	1.0
AI	11.660	88	587	15.57	320.4	320.4	320.4	0.0
AJ	11.760	116	1,309	6.98	325.4	325.4	325.9	0.5
AK	11.900	128	687	13.30	331.2	331.2	331.2	0.0
AL	11.970	135	1,390	6.58	335.0	335.0	335.0	0.0
AM	12.460	600	5,121	2.50	337.8	337.8	338.4	0.6
AN	12.870	506	3,880	2.75	338.6	338.6	339.3	0.7
AO	12.960	625	4,460	2.39	338.8	338.8	339.6	0.8
AP	13.010	625	4,869	2.19	339.4	339.4	340.3	0.9
AQ	13.620	630	3,935	2.71	340.4	340.4	341.4	1.0

[1]Miles above confluence with Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

SUNCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Suncook River (continued)								
AR	13.930	190	2,338	4.56	341.2	341.2	342.2	1.0
AS	14.910	880	8,999	1.18	342.9	342.9	343.8	0.9
AT	15.330	550	5,118	2.08	343.2	343.2	344.1	0.9
AU	15.700	171	1,535	6.73	343.7	343.7	344.5	0.8
AV	15.840	105	1,665	6.20	345.4	345.4	345.8	0.4
AW	16.110	175	2,249	4.59	345.9	345.9	346.7	0.8
AX	16.230	361	3,601	2.87	346.2	346.2	346.9	0.7
AY	16.640	700	5,050	2.05	346.7	346.7	347.7	1.0
AZ	16.800	900	6,011	1.62	346.9	346.9	347.9	1.0
BA	16.980	900	2,495	3.91	348.6	348.6	349.1	0.5
BB	17.140	950	2,978	3.27	352.6	352.6	352.7	0.1
BC	17.370	142	886	11.00	360.5	360.5	361.3	0.8
BD	17.690	160	1,240	7.86	375.5	375.5	375.7	0.2
BE	17.910	142	1,022	9.54	381.0	381.0	381.7	0.7
BF	18.140	181	926	10.53	391.6	391.6	391.6	0.0
BG	18.200	185	1,026	9.50	395.8	395.8	395.9	0.1
BH	18.260	138	816	11.95	399.4	399.4	399.6	0.2
BI	18.450	160	1,196	8.15	408.6	408.6	409.4	0.8
BJ	19.130	138	1,060	9.20	424.9	424.9	424.9	0.0
BK	19.530	115	1,260	7.74	430.5	430.5	431.2	0.7
BL	19.780	136	1,391	7.01	433.4	433.4	434.3	0.9
BM	19.970	110	1,127	8.65	435.7	435.7	436.6	0.9
BN	20.340	142	1,492	6.24	440.1	440.1	441.0	0.9
BO	20.700	126	1,175	7.92	443.8	443.8	444.2	0.4
BP	20.940	200	1,258	7.40	447.4	447.4	447.8	0.4
BQ	21.190	150	1,002	9.29	455.7	455.7	456.1	0.4

[1]Miles above confluence with Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

SUNCOOK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Suncook River (continued)								
BR	21.250	98	941	9.89	458.1	458.1	458.3	0.2
BS	21.330	368	5,546	1.68	480.1	480.1	480.1	0.0
BT	21.460	139	1,992	4.67	480.1	480.1	480.1	0.0
BU	21.490	138	1,935	4.81	480.1	480.1	480.1	0.0
BV	21.550	270	3,335	2.79	480.5	480.5	480.5	0.0
BW	21.940	468	5,849	1.59	480.7	480.7	480.7	0.0
BX	22.000	128	1,809	5.15	481.5	481.5	481.5	0.0
BY	22.390	135	1,658	5.62	482.2	482.2	482.3	0.1
BZ	22.560	170	1,277	7.29	482.2	482.2	482.8	0.6
CA	23.040	152	1,746	5.33	487.3	487.3	487.7	0.4
CB	23.410	161	1,896	4.91	488.6	488.6	489.3	0.7
CC	23.520	180	2,031	4.58	489.0	489.0	489.8	0.8
Tannery Brook								
A	0.168	85	290	5.40	259.4	253.6[2]	253.8	0.2
B	0.540	199	920	1.70	259.4	256.8[2]	257.8	1.0
C	0.712	53	578	2.70	266.8	266.8	267.3	0.5
D	0.933	52	370	4.20	293.3	293.3	294.1	0.8
E	1.294	90	450	3.50	296.7	296.7	297.7	1.0
F	1.593	20	120	13.10	303.7	303.7	303.8	0.1
G	1.783	310	3,380	0.50	364.9	364.9	365.0	0.1
H	2.092	100	1,050	1.50	364.9	364.9	365.0	0.1
I	2.365	34	170	9.20	378.6	378.6	378.6	0.0
J	2.710	43	170	9.20	412.4	412.4	412.4	0.0
K	3.078	230	1,020	1.50	416.6	416.6	417.6	1.0

[1]Miles above confluence with Merrimack River
[2]Elevation computed without consideration of backwater effects from Merrimack River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

SUNCOOK RIVER – TANNERY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
The Outlet								
A	0.000[1]	300	3,438	1.10	309.8	309.8	310.2	0.4
B	0.220[1]	125	569	6.60	317.7	317.7	318.2	0.5
C	0.540[1]	80	696	5.40	321.5	321.5	322.0	0.5
D	0.630[1]	190	2,282	1.60	337.2	337.2	337.2	0.0
E	0.960[1]	75	709	5.30	346.5	346.5	346.7	0.2
F	1.270[1]	50	730	5.10	353.5	353.5	353.7	0.2
Tioga River								
A	1.165[2]	76	485	7.50	471.7	471.7	472.5	0.8
B	1.712[2]	364	2,350	1.60	476.1	476.1	477.1	1.0
Tributary A								
A	0.175[3]	10	30	12.30	256.2	250.2[5]	250.2	0.0
B	0.445[3]	530	4,210	0.10	256.2	251.2[5]	252.2	1.0
C	0.667[3]	25	50	7.40	256.2	252.6[5]	253.1	0.5
Warner River								
A	1,140[4]	96	1,070	9.10	361.5	355.1[6]	355.8	0.7
B	2,300[4]	713	4,495	2.20	361.5	357.5[6]	358.3	0.8
C	4,360[4]	388	2,442	4.00	361.5	358.8[6]	359.4	0.6
D	8,100[4]	250	2,781	3.50	361.9	361.9	362.5	0.6
E	12,240[4]	308	3,305	2.90	363.4	363.4	364.1	0.7
F	13,040[4]	480	5,380	1.80	363.7	363.7	364.4	0.7
G	13,790[4]	254	750	12.70	371.1	371.1	371.1	0.0
H	14,040[4]	102	659	14.40	381.4	381.4	381.4	0.0
I	14,565[4]	106	1,265	7.50	392.5	392.5	392.5	0.0

[1]Miles above confluence with Contoocook River
[2]Miles above confluence with Winnipesaukee River
[3]Miles above confluence with Merrimack River
[4]Feet above confluence with Contoocook River
[5]Elevation computed without consideration of backwater effects from Merrimack River
[6]Elevation computed without consideration of backwater effects from Contoocook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

THE OUTLET – TIOGA RIVER – TRIBUTARY A – WARNER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Warner River (continued)								
J	16,310	400	3,512	2.70	393.7	393.7	393.9	0.2
K	18,740	550	5,079	1.90	394.5	394.5	395.1	0.6
L	21,440	399	3,490	2.70	394.5	394.5	395.5	1.0
M	21,990	200	2,423	3.90	395.4	395.4	396.0	0.6
N	22,170	350	2,693	3.50	395.4	395.4	396.1	0.7
O	23,910	1,050	9,907	1.00	396.0	396.0	396.7	0.7
P	26,550	684	4,195	2.30	396.3	396.3	397.1	0.8
Q	28,740	648	4,514	2.10	397.3	397.3	398.3	1.0
R	30,970	900	6,037	1.40	398.0	398.0	399.0	1.0
S	32,860	776	5,636	1.50	398.4	398.4	399.3	0.9
T	33,960	356	2,007	4.10	398.4	398.4	399.3	0.9
U	34,500	130	1,366	6.00	400.9	400.9	401.6	0.7
V	35,380	150	1,388	5.90	402.0	402.0	402.6	0.6
W	36,570	164	1,562	5.30	403.1	403.1	404.1	1.0
X	37,270	319	2,691	3.10	404.0	404.0	404.9	0.9
Y	37,592	200	1,744	4.70	405.0	405.0	405.3	0.3
Z	38,670	294	2,729	3.00	405.5	405.5	406.2	0.7
AA	38,936	111	1,311	6.30	405.5	405.5	406.2	0.7
AB	39,940	250	2,686	3.10	406.9	406.9	407.5	0.6
AC	41,740	500	3,516	2.30	407.8	407.8	408.8	1.0
AD	42,122	163	1,483	5.60	408.0	408.0	408.9	0.9
AE	42,980	350	2,877	2.90	409.2	409.2	409.8	0.6
AF	44,740	325	2,631	3.10	409.9	409.9	410.9	1.0
AG	45,035	170	1,718	4.80	410.6	410.6	411.5	0.9
AH	46,540	116	1,115	7.40	412.6	412.6	413.3	0.7
AI	47,210	200	1,607	5.10	413.6	413.6	414.6	1.0

[1]Feet above confluence with Contoocook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

WARNER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Warner River (continued)								
AJ	47,580	86	1,196	6.90	415.0	415.0	415.3	0.3
AK	47,890	125	1,440	5.70	415.3	415.3	416.1	0.8
AL	49,100	147	1,736	4.70	416.8	416.8	417.6	0.8
AM	49,419	200	2,370	3.50	417.7	417.7	418.3	0.6
AN	51,240	186	1,848	4.50	418.5	418.5	419.2	0.7
AO	53,290	400	4,308	1.90	420.7	420.7	421.3	0.6
AP	54,560	560	4,924	1.70	421.0	421.0	421.8	0.8
AQ	55,140	300	2,302	3.60	421.0	421.0	421.9	0.9
AR	55,400	170	1,344	4.60	421.2	421.2	422.2	1.0
AS	55,558	126	1,130	5.50	421.5	421.5	422.4	0.9
AT	57,430	135	1,391	4.50	423.2	423.2	423.9	0.7
AU	59,390	125	1,145	5.50	424.9	424.9	425.6	0.7
AV	61,220	122	602	10.40	443.1	443.1	443.1	0.0
AW	61,282	155	1,292	4.80	446.2	446.2	447.0	0.8
AX	61,399	92	885	7.00	446.6	446.6	447.3	0.7
AY	63,080	300	1,859	3.40	448.7	448.7	449.1	0.4
AZ	64,305	461	2,598	2.40	449.8	449.8	450.4	0.6
BA	66,730	297	1,266	4.90	452.6	452.6	452.8	0.2
BB	68,570	138	668	9.30	461.3	461.3	461.3	0.0
BC	69,470	136	757	8.20	468.5	468.5	468.9	0.4
BD	71,780	100	935	6.70	507.0	507.0	507.1	0.1
BE	72,150	200	1,523	4.10	508.2	508.2	508.3	0.1
BF	74,140	173	1,242	3.60	509.3	509.3	509.8	0.5
BG	74,420	200	903	4.90	509.4	509.4	509.8	0.4
BH	74,880	250	1,357	3.30	510.3	510.3	511.1	0.8
BI	75,090	132	1,162	3.80	510.8	510.8	511.8	1.0

[1]Feet above confluence with Contoocook River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

WARNER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Warner River (continued)								
BJ	75,340	80	919	4.90	511.6	511.6	512.6	1.0
BK	75,690	70	924	4.80	511.9	511.9	512.8	0.9
BL	77,044	80	702	6.40	519.4	519.4	520.3	0.9
BM	77,155	150	1,358	3.30	520.1	520.1	521.0	0.9
BN	77,490	146	1,628	2.70	520.5	520.5	521.3	0.8
BO	78,810	200	1,558	2.90	520.9	520.9	521.6	0.7
BP	80,520	45	301	14.80	544.9	544.9	544.9	0.0
BQ	81,640	83	757	5.90	558.0	558.0	558.1	0.1
BR	81,897	48	387	11.50	562.4	562.4	562.4	0.0
BS	83,260	57	446	10.00	589.1	589.1	589.9	0.8
BT	85,060	61	504	8.80	612.4	612.4	612.8	0.4
BU	85,890	50	439	10.20	624.8	624.8	625.8	1.0
BV	87,020	55	322	13.90	628.3	628.3	628.3	0.0
BW	87,190	71	884	5.00	638.3	638.3	638.3	0.0
BX	89,750	492	1,750	2.00	641.9	641.9	*	*
BY	89,823	485	2,600	1.40	642.2	642.2	*	*
BZ	91,780	221	1,790	2.00	642.6	642.6	*	*
CA	94,078	352	2,010	1.80	643.1	643.1	*	*
CB	94,160	297	2,050	1.70	643.3	643.3	*	*
CC	100,353	699	4,240	0.70	643.9	643.9	*	*
CD	100,552	86	723	4.30	643.9	643.9	*	*

[1]Feet above confluence with Contoocook River

*Data not available

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

WARNER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
West Channel Suncook River								
A	0.300[1]	200	1,764	2.08	312.1	312.1	312.9	0.8
B	0.430[1]	107	825	4.45	312.2	312.2	313.2	1.0
C	0.610[1]	70	362	10.15	316.3	316.3	316.4	0.1
D	0.840[1]	97	931	3.95	320.7	320.7	321.2	0.5
E	0.970[1]	90	620	5.93	321.6	321.6	322.1	0.5
Williams Brook								
A	0.027[2]	92	562	2.60	412.2	411.1[5]	421.1	1.0
B	0.188[2]	62	404	3.70	413.7	413.7	414.2	0.5
C	0.560[2]	118	656	2.00	415.6	415.6	416.6	1.0
D	0.807[2]	48	274	4.70	417.3	417.3	418.1	0.8
E	1.187[2]	80	253	5.10	428.0	428.0	428.6	0.6
F	1.308[2]	26	279	4.60	441.4	441.4	441.4	0.0
Winnipesaukee River								
A	115.954[3]	180	2,194	2.60	271.7	271.7	272.7	1.0
B	116.185[3]	157	2,140	2.70	286.0	286.0	286.0	0.0
C	116.575[3]	130	1,274	4.00	287.5	287.5	287.7	0.2
D	116.928[3]	185	1,526	3.30	300.4	300.4	300.4	0.0
E	117.080[3]	135	2,097	2.40	322.7	322.7	322.7	0.0
F	117.532[3]	126	615	9.30	353.2	353.2	353.3	0.1
G	117.937[3]	100	618	9.30	385.0	385.0	385.4	0.4
H	118.341[3]	159	1,349	4.20	406.1	406.1	406.3	0.2
I	119.085[3]	181/ 98[4]	1,475	3.90	407.6	407.6	407.9	0.3
J	119.794[3]	145/ 70[4]	1,029	5.60	410.3	410.3	410.4	0.1
K	120.676[3]	106/ 53[4]	731	7.80	415.8	415.8	416.1	0.3

[1]Miles above confluence with Suncook River
[2]Miles above confluence with Winnipesaukee River
[3]Miles above Newburyport Light, Newburyport, MA
[4]Width/ width within county boundary
[4]Miles above confluence with Winnipesaukee River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

WEST CHANNEL SUNCOOK RIVER – WILLIAMS BROOK – WINNIPESAUKEE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Winnipesaukee River (continued)								
L	121.094	99/ 49	686	8.30	446.1	446.1	446.1	0.0
M	121.275	140/ 68	1,386	4.10	451.6	451.6	452.5	0.9
N	121.610	180/ 97	1,260	4.50	454.2	454.2	454.5	0.3
O	121.985	175/ 87	1,004	5.70	456.2	456.2	456.3	0.1
P	122.583	136/ 66	591	9.70	462.5	462.5	463.0	0.5
Q	122.915	169/ 81	1,148	5.00	468.1	468.1	468.2	0.1
R	124.027	275/ 137	2,463	2.20	470.1	470.1	470.3	0.2

[1]Miles above Newburyport Light, Newburyport, MA
[2]Width/ width within county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

FLOODWAY DATA

WINNIPESAUKEE RIVER

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 1-percent annual chance 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 1-percent annual chance 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 1-percent annual chance 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 1-percent annual chance 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-percent 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-percent annual chance or greater flood event.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 1-percent annual chance 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 1-percent annual chance 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 1-percent annual chance 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 the 0.2-percent annual chance floodplain, areas within the 0.2-percent annual chance floodplain, and to areas of 1-percent annual chance flooding where average depths are less than 1 foot, areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent annual chance 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 1-percent annual chance 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 1- and 0.2-percent annual chance 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 Merrimack County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community of the county. This countywide FIRM also includes flood hazard information that was presented separately on

Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community, up to and including this countywide FIS, are presented in Table 7, "Community Map History."

7.0 OTHER STUDIES

FISs have been prepared for the Town of Allenstown (U.S. Department of Housing and Urban Development, 1978); Town of Boscawen (U.S. Department of Housing and Urban Development, 1979); Town of Bow (FEMA, 2000); Town of Bradford (FEMA, 1992); Town of Canterbury (U.S. Department of Housing and Urban Development, 1978); Town of Chichester (U.S. Department of Housing and Urban Development, 1978); City of Concord (FEMA, 1999); Town of Epsom (U.S. Department of Housing and Urban Development, 1978); City of Franklin (U.S. Department of Housing and Urban Development, 1979); Town of Henniker (U.S. Department of Housing and Urban Development, 1977); Town of Hooksett (FEMA, 1982); Town of Hopkinton (FEMA, 1988); Town of New London (FEMA, 1991); Town of Northfield (U.S. Department of Housing and Urban Development, 1978); Town of Pembroke (U.S. Department of Housing and Urban Development, 1978); Town of Pittsfield (U.S. Department of Housing and Urban Development, 1978); Town of Warner (FEMA, 1987); Town of Webster (FEMA, 1993); Town of Hillsborough (U.S. Department of Housing and Urban Development, 1978); and Town of Sunapee (FEMA, 1991). The previously published FIS for the Town of Dunbarton was rescinded.

This FIS also supersedes the FBFM for the Town of Allenstown; Town of Boscawen; Town of Canterbury; Town of Chichester; Town of Epsom; City of Franklin; Town of Henniker; Town of Hooksett; Town of Northfield; Town of Pembroke; and Town of Pittsfield which was published as part of the previously printed FIS. This study supersedes the FHBM for the Town of Loudon (U.S. Department of Housing and Urban Development, 1979).

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

8.0 LOCATION OF DATA

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

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Allenstown, Town of	April 5, 1974	November 5, 1976	April 2, 1979	None
Andover, Town of	June 28, 1974	November 8, 1977	April 2, 1986	None
Boscawen, Town of	March 15, 1974	December 24, 1976	July 16, 1979	None
Bow, Town of	May 3, 1974	September 24, 1976	April 16, 1979	October 16, 1981 November 20, 2000
Bradford, Town of	June 28, 1974	August 27, 1976	April 15, 1992	None
Canterbury, Town of	April 5, 1974	January 14, 1977	May 15, 1979	None
Chichester, Town of	April 5, 1974	None	September 1, 1978	None
Concord, City of	August 2, 1974	None	March 4, 1980	August 23, 1999
Danbury, Town of	June 14, 1977	None	January 1, 2003	None
Dunbarton, Town of	April 19, 2010	None	April 19, 2010	None
Epsom, Town of	March 15, 1974	November 12, 1976	July 3, 1978	None
Franklin, City of	March 8, 1974	August 20, 1976	September 28, 1979	None
Henniker, Town of	March 15, 1974	None	May 1, 1978	None

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Hill, Town of	February 7, 1975	None	April 2, 1986	None
Hooksett, Town of	June 28, 1974	April 15, 1977	April 2, 1979	March 12, 1982
Hopkinton, Town of	August 23, 1974	September 3, 1976	May 17, 1988	None
Loudon, Town of	August 2, 1974	May 31, 1977 September 28, 1979	August 1, 2004	None
New London, Town of	January 31, 1975	September 21, 1979	July 16, 1991	None
Newbury, Town of	January 31, 1975	September 6, 1977	April 2, 1986	None
Northfield, Town of	March 22, 1974	February 11, 1977	June 15, 1979	None
Pembroke, Town of	May 3, 1974	None	April 2, 1979	None
Pittsfield, Town of	March 15, 1974	April 9, 1976	July 3, 1978	None
Salisbury, Town of	February 21, 1975	May 21, 1976	April 15, 1986	None
Sutton, Town of	June 28, 1974	November 26, 1976	May 17, 1977	None
Warner, Town of	August 9, 1974	May 8, 1977	June 4, 1987	None

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Webster, Town of	January 17, 1975	None	April 15, 1986	June 2, 1993
Wilmot, Town of	August 16, 1974	November 19, 1976	April 1, 1986	None

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERRIMACK COUNTY, NH (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

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