FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2

OCEAN COUNTY, NEW JERSEY

(ALL JURISDICTIONS)

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
BARNEGAT, TOWNSHIP OF	340396	LITTLE EGG HARBOR, TOWNSHIP OF	340380	SURF CITY, BOROUGH OF	345324
BARNEGAT LIGHT, BOROUGH OF	345280	LONG BEACH, TOWNSHIP OF	345301	TOMS RIVER, TOWNSHIP OF	345293
BAY HEAD, BOROUGH OF	345281	MANCHESTER, TOWNSHIP OF	340382	TUCKERTON, BOROUGH OF	340395
BEACH HAVEN, BOROUGH OF	345282	MANTOLOKING, BOROUGH OF	340383		
BEACHWOOD, BOROUGH OF	340368	OCEAN, TOWNSHIP OF	340518		
BERKELEY, TOWNSHIP OF	340369	OCEAN GATE, BOROUGH OF	340384		
BRICK, TOWNSHIP OF	345285	PINE BEACH, BOROUGH OF	340385		
EAGLESWOOD, TOWNSHIP OF	340372	PLUMSTED, TOWNSHIP OF	340386		
HARVEY CEDARS, BOROUGH OF	345296	POINT PLEASANT, BOROUGH OF	345313		
ISLAND HEIGHTS, BOROUGH OF	340374	POINT PLEASANT BEACH, BOROUGH OF	340388		
JACKSON, TOWNSHIP OF	340375	SEASIDE HEIGHTS, BOROUGH OF	340389		
LACEY, TOWNSHIP OF	340376	SEASIDE PARK, BOROUGH OF	345319		
LAKEHURST, BOROUGH OF	340377	SHIP BOTTOM, BOROUGH OF	345320		
LAKEWOOD, TOWNSHIP OF	340378	SOUTH TOMS RIVER, BOROUGH OF	340392		
LAVALLETTE, BOROUGH OF	340379	STAFFORD, TOWNSHIP OF	340393		

* No Special Flood Hazard Areas Identified

REVISED:

PRELIMINARY MARCH 28, 2014

FLOOD INSURANCE STUDY NUMBER

34029CV001B

Version 1.0.0.0

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: September 29, 2006

Revised Countywide FIS Date: [TBD] - to incorporate new detailed coastal flood hazard analyses, to add Base Flood Elevations, floodway, and Special Flood Hazard Areas; to change zone designations and Special Flood Hazard Areas; and to reflect updated topographic information.

This Preliminary FIS report only includes revised Floodway Data Tables and revised Flood Profiles. The unrevised components will appear in the final FIS report.

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FLOOD INSURANCE STUDY
OCEAN COUNTY, NEW JERSEY (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of Ocean County, New Jersey, including: the Boroughs of Barnegat Light, Bay Head, Beach Haven, Beachwood, Harvey Cedars, Island Heights, Lakehurst, Lavallette, Mantoloking, Ocean Gate, Pine Beach, Point Pleasant, Point Pleasant Beach, Seaside Heights, Seaside Park, Ship Bottom, South Toms River, Surf City, and Tuckerton; and the Townships of Barnegat, Berkeley, Brick, Eagleswood, Jackson, Lacey, Lakewood, Little Egg Harbor, Long Beach, Manchester, Ocean, Plumsted, Stafford, and Toms River (hereinafter referred to collectively as Ocean 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 Ocean 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.

The original September 29, 2006 countywide FIS was prepared to include all jurisdictions within Ocean County into 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.

Barnegat, Township of:	The hydrologic and hydraulic analyses from the FIS report dated June 15, 1982, were performed by T & M Associates for the Federal Emergency Management Agency (FEMA), under Contract No. H-4807. That study was completed in August 1980.

Barnegat Light, Borough of	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the U.S. Army Corps of Engineers (USACE), Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analyses from the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Bay Head, Borough of:	For the June 15, 1983, Wave Height Supplement to the FIS report and the December 15, 1983, FIRM (hereinafter referred to as the 1983 FIS), the wave height analyses were prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982. For the September 7, 2000, revision, the coastal hydrologic and hydraulic analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in September 1996.
Beach Haven, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Beachwood, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated September 2, 1982, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830. The updated version was also prepared by Tetra Tech, Inc., under agreement with FEMA. That work was completed in August 1981.

Berkeley, Township of: For the original FIS dated November 19, 1980, and the May 19, 1981, FIRM (hereinafter referred to collectively as the 1980 FIS), the hydrologic and hydraulic analyses were performed by the USACE, for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 11, Amendment No. 4. That work, which was completed in July 1978, covered all significant flooding sources affecting the Township of Berkeley.

For the September 4, 1987, FIS, the hydrologic and hydraulic analyses were prepared by Dewberry & Davis for FEMA, under Contract No. EMW-85-C-2004. That work was completed in July 1986.

For the June 3, 2002, revision, the hydrologic and hydraulic analyses for the South Seaside Park area and adjoining areas of the Atlantic Ocean and Barnegat Bay were prepared by the USACE, Philadelphia District, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in July 1996. The June 3, 2002, revision also incorporated Letters of Map Revision dated July 8, 1994, and January 25, 1999.

Brick, Township of: For the September 1, 1983, Wave Height Analysis Supplement to the FIS report and the March 1, 1984, FIRM (hereinafter referred to as the 1984 FIS), the wave height analysis was prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982.

For the August 3, 1998, revision, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. That work was completed in March 1996.

Eagleswood, Township of:	The hydrologic and hydraulic analyses from the FIS report dated August 16, 1982, were performed by T & M Associates for FEMA, under Contract No. H-4807. That work was completed in August 1980.
Harvey Cedars, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Island Heights, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated November 16, 1982, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830.
Jackson, Township of:	The hydrologic and hydraulic analyses from the FIS report dated March 16, 1982, were prepared by the New Jersey Department of Environmental Protection (NJDEP) for FEMA under Contract No. H-4759. That work was completed in August 1980. The hydrologic and hydraulic analyses were performed by T & M Associates under subcontract to the NJDEP.
Lacey, Township of:	The hydrologic and hydraulic analyses from the FIS report dated September 1, 1977, were performed by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-2-73, Project Order No. 4. That work, which was completed in February 1974, covered all flooding sources affecting the Township of Lacey.
Lakehurst, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated June 15, 1982, were prepared by the NJDEP for FEMA, under Contract No. H-4546. That work was completed in August 1980. The hydrologic and hydraulic analyses

were conducted by T & M Associates under subcontract to the NJDEP.

Lakewood, Township of: The hydrologic and hydraulic analyses from the FIS report dated September 1976 were performed by Pfisterer, Tor & Associates for the FIA, under Contract No. H-3737. That work, which was completed in December 1975 covered all flooding sources affecting the Township of Lakewood, New Jersey.

Lavallette, Borough of: For the November 22, 1999, revision, the analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in July 1996.

For the July 5, 1983, Wave Height Analysis Supplement to the original FIS report and the January 5, 1984, FIRM (hereinafter referred to as the 1983 FIS), the wave height analyses were prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982.

Little Egg Harbor, Township of: The hydrologic and hydraulic analyses from the FIS report dated March 1, 1983, were prepared by T & M Associates for FEMA, under Contract No. H-4807. That work was completed in August 1981.

Long Beach, Township of: For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996.

The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in January 1983.

Manchester, Township of: The hydrologic and hydraulic analyses from the FIS report dated November 2, 1982, were prepared for FEMA, under Contract No. H-4759. That work was completed in August 1980. The hydrologic and hydraulic analyses for this study were performed by T & M Associates under subcontract to the NJDEP.

Mantoloking, Borough of: For the original September 30, 1977, FIS, the hydrologic and hydraulic analyses were performed by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-15-72, Project Order No. 13. That work was completed in April 1972.

The July 5, 1983, Wave Height Analysis Supplement to the FIS report was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. That work was completed in October 1982.

For the December 20, 2000, revision, the coastal hydrologic and hydraulic analyses were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. That work was completed in March 1996.

Ocean, Township of: The hydrologic and hydraulic analyses from the FIS report dated July 6, 1982, were performed by T & M Associates for FEMA under Contract No. H-4807. That work was completed in August 1980.

Ocean Gate, Borough of: The hydrologic and hydraulic analyses from the FIS report dated November 19, 1980, were prepared by the NJDEP for the FIA, under Contract No. A 14516. That work was completed in November 1979. The hydrologic and hydraulic analyses were conducted by T & M Associates under subcontract to the NJDEP.

Plumsted, Township of: The hydrologic and hydraulic analyses from the FIS report dated March 30, 1981, were prepared by the NJDEP, Division of Water Resources, for the FIA, under Contract No. H-4623. That work was completed in April 1980. The hydrologic and hydraulic analyses were conducted by Gannett Fleming Corddry and Carpenter, Inc., under subcontract to the State of New Jersey.

Point Pleasant Beach, Borough of: For the original August 15, 1983, FIS report and the February 15, 1984, FIRM (hereinafter referred to as the 1984 FIS), the hydrologic and hydraulic analyses were prepared by Tetra Tech, Inc., for FEMA, under Contract No. 4-3830. That work was completed in August 1981.

For the June 2, 1999, revision, the analyses were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in September 1996.

Seaside Heights, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated June 15, 1983, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830. The updated version was also prepared by Tetra Tech, Inc., under agreement with FEMA. That work was completed in August 1981.
Seaside Park, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated July 5, 1983, were prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Ship Bottom, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
South Toms River, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated July 6, 1982, were prepared by the NJDEP for FEMA, under Contract No. H-4546. That work was completed in August 1980. The hydrologic and hydraulic analyses were performed by T & M Associates under subcontract to the NJDEP.
Stafford, Township of:	For the original March 1979 FIS report and September 14, 1979, FIRM (hereinafter referred to as the 1979 FIS), the hydrologic and hydraulic analyses were performed by the National Oceanic and Atmospheric Administration (NOAA), for

the FIA, Inter-Agency Agreement No. IAA-H-5-73, Project Order No. 5. That work was completed in June 1978. The FIRM was subsequently revised on July 15, 1992.

For the May 21, 2001, revision, the updated riverine analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed on January 27, 1997. Flooding information for Manahawkin Bay and Barnegat Bay was taken from the FISs for the Townships of Long Beach and Berkeley, respectively (FEMA, 1999; FEMA, 1992).

Surf City, Borough of: For the March 23, 1999 FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996.

The wave height analysis from the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in January 1983.

Toms River, Township of: Formerly the Township of Dover, the FIS report was created at the June 15, 1983, revision. The community name was changed from Township of Dover to Township of Toms River in November 2006. A wave height analysis for the June 15, 1983, revision was prepared by FEMA in conjunction with the State of New Jersey.

In the August 5, 1991, revision, Dewberry & Davis prepared erosion analyses for FEMA. The work for that revision was completed in August 1989. In addition, hydrologic and hydraulic analyses for a portion of the FIS for Toms River were taken from the FIS for the Township of Manchester (FEMA, 1983).

Tuckerton, Borough of: The hydrologic and hydraulic analyses from the FIS report dated November 2, 1982, were prepared by T & M Associates for FEMA, under

Contract No. H-4807. That work was completed in August 1981.

The authority and acknowledgments for the Boroughs of Pine Beach and Point Pleasant are not available because no FIS reports were ever published for those communities.

For the September 29, 2006 countywide revision, no new hydrologic and hydraulic or coastal analyses were performed.

The Borough of Point Pleasant was updated to the more recent coastal studies performed for the adjacent communities.

Other minor adjustments were made to the flood elevation boundaries along community boundaries in order to produce a seamless FIRM for the entire county.

For the September 29, 2006 countywide revision, base map information is from the New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). This information was derived from digital orthophotos produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution from photography dated April 2002.

The coordinate system used for the production of the FIRM dated September 29, 2006, is New Jersey Stateplane FIPS Zone 2900, North American Datum of 1983 (NAD 83), GRS80 spheriod. 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 accuracy of information shown on the FIRM.

For the [date] countywide revision, detailed hydrologic and hydraulic analyses were performed on flooding sources Cedar Creek and North Branch Forked River.

For the [date] countywide revision, redelineation was performed on the following previously detailed studied flooding sources: Cabinfield Branch, Green Branch, Giffords Branch, Jakes Branch, Kettle Creek, Manahawkin Mill Creek, Potter Creek, North Branch Metedeconk River, Schoolhouse Branch, South Branch Metedeconk River, Tarkiln Branch Kettle Creek and Willis Creek.

For the [date] countywide revision, the following flood sources were updated using Approximate methods: Cabin Field Branch, Cedar Bridge Branch, Cedar Branch Tributaries, Cedar Run Brook, Cedar Creek, Clamming Creek, Gifford Mill Branch, Green Branch, Jakes Branch, Jakes Branch Tributaries, Kettle Creek, Lochiel Creek, Long Swamp Creek, Middle Branch Forked River, Mills Branch, Mill Creek, Oyster Creek, Oyster Creek Tributary, Potter Creek, South Branch Metedeconk, North Branch Forked River, South Branch Forked River, Tributary to Toms River, Watertown Creek and numerous unnamed tributaries.

This countywide FIS, [date] also replaces outdated coastal analyses as well as previously published storm surge stillwater elevations.

For the September 29, 2006, base map information is from the New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). This information was derived from digital orthophotos produced at a scale of 1:2,400 (1”=200’) with a 1 foot pixel resolution from photography dated 2002.

For the [date] countywide revision, base map information was obtained from the New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). This information was derived from digital orthophotos produced at a scale of 1:2400 (1”=200’) with a 1 foot pixel resolution from photography dated 2012.

The projection used in the preparation of this map was New Jersey State Plane (FIPS Zone 2900). The horizontal datum was North America Datum 1983 (NAD 83), Geodetic Reference System 1980 (GRS 80) spheroid. Differences in datum, spheroid, projection, or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this 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 pre-countywide initial and final CCO meetings held for the communities within Ocean County are shown in Table 1, “Initial and Final CCO Dates.

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

Community	For FIS Dated	Initial CCO Date	Final CCO Date
Barnegat, Township of	June 15, 1982	May 11, 1978	January 26, 1982
Barnegat Light, Borough of	March 23, 1999	*	March 3, 1983
Bay Head, Borough of	December 15, 1983 September 7, 2000	* May 2, 1997[1]	February 2, 1983 *
Beachwood, Borough of	September 2, 1982	*	April 14, 1982
Beach Haven, Borough of	November 1, 1983	*	March 3, 1983
Berkeley, Township of	November 19, 1980 September 4, 1987 June 3, 2002	July 3, 1975 * October 6, 1995[1]	May 12, 1980 October 24, 1986 *
Brick, Township of	March 1, 1984 August 3, 1998	* August 1, 1996[1]	April 13, 1983
Dover, Township of	August 5, 1991	*	*
Eagleswood, Township of	February 16, 1983	May 22, 1978	January 26, 1982
Harvey Cedars, Borough of	March 23, 1999	*	March 3, 1983
Island Heights, Borough of	June 15, 1979	*	June 29, 1982
Lacey, Township of	September 1, 1977	*	September 23, 1976
Jackson, Township of	September 16, 1982	July 25, 1978	October 28, 1981
Lakehurst, Borough of	December 15, 1982	June 6, 1977	January 26, 1982
Lavallette, Borough of	November 22, 1999	December 31, 1996[1]	May 26, 1998
Long Beach, Township of	March 23, 1999	*	March 18, 1983
Manchester, Township of	November 2, 1982	June 6, 1977	June 17, 1982
Mantoloking, Borough of	September 30, 1977 December 20, 2000	* August 1, 1996[1]	November 29, 1976 *

[1]Notified by letter

*Data not available

TABLE 1 - INITIAL AND FINAL CCO MEETINGS - continued

Community	For FIS Dated	Initial CCO Date	Final CCO Date
Ocean Gate, Borough of	May 19, 1981	June 25, 1978	June 3, 1980
Plumsted, Township of	September 30, 1981	*	October 28, 1980
Point Pleasant Beach, Borough of	June 2, 1999	May 2, 1997[1]	*
Seaside Heights, Borough of	June 15, 1983	*	November 10, 1982
Seaside Park, Borough of	July 5, 1983	*	February 15, 1983
Ship Bottom, Borough of	March 23, 1999	*	March 3, 1983
South Toms River, Borough of	July 6, 1982	June 8, 1977	February 8, 1982
Stafford, Township of	March 1979 May 21, 2001	June 8, 1969 October 23, 1997[1]	September 14, 1978 February 9, 1998
Surf City, Borough of	March 23, 1999	*	March 3, 1983
Tuckerton, Borough of	May 2, 1983	May 22, 1978	June 16, 1982

[1]Notified by letter
*Data not available

For the September 29, 2006 first-time county wide study, the CCO meeting information was not published in the September 29, 2006, initial countywide FIS and is not available.

For the [date] countywide revision, an initial CCO meeting was held on December 16, 2010, and attended by representatives of NJDEP, RAMPP, FEMA, and local officials. The Flood Risk Review (FRR) meeting was held on September 29, 2013.

The results of the study were reviewed at the final CCO meeting held on ______________________________, and attended by representatives of ____. All concerns raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Ocean County, New Jersey.

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).

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.

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS
FROM THE SEPTEMBER 29, 2006 COUNTY-WIDE STUDY

Atlantic Ocean	Metedeconk River
Barnegat Bay	Mill Branch
Blacks Branch	North Branch Forked River
Cabinfield Branch	North Branch Metedeconk River
Cedar Creek	Old Hurricane Brook
Colony Lakes	Potter Creek
Crosswicks Creek	Ridgeway Branch
Davenport Branch	Schoolhouse Branch
Giffords Mill Branch	South Branch Metedeconk River
Green Branch	Stony Ford Brook
Holiday Lake	Sunken Branch
Jakes Branch	Tarklin Branch Kettle Creek
Kettle Creek	Toms River
Little Egg Harbor	Tributary to Ridgeway Branch
Manahawkin Bay	Tributary to Toms River
Manahawkin Lake	Union Branch
Manahawkin Mill Creek	Watering Place Brook
Manapaqua Brook	Willis Creek
Manasquan River	Wrangel Brook

Long Swamp Creek, Manasquan River, Metedeconk River, Polhemus Branch, and Silver Bay Tributary are studied by limited detailed methods and do not have flood profiles.

TABLE 3 - SCOPE OF STUDY- DETAILED

Stream Name	Limits of Revised or New Detailed Study
	New Detailed Study
Cedar Creek	From approximately 2800 feet downstream of U.S. Highway 9 to approximately 600 feet upstream of the Garden State Highway South.
North Branch Forked River	From 200 feet downstream of South Main Street to the Garden State Parkway
Atlantic Ocean	135 miles of Atlantic Ocean Coastline

TABLE 4 - SCOPE OF STUDY- REDELINEATION

Stream Name	Redelineation
Cabinfield Branch	From the confluence with North Branch Metedeconk River to 150 feet upstream of Park Avenue
Giffords Mill Branch	From the confluence with Mill Branch to 50 feet upstream of Otis Bog Road
Green Branch	From the confluence with Kettle Creek to 1050 feet upstream of Chesterfield Court
Jakes Branch	From the confluence with Toms River to 2000 feet upstream of Double Trouble Road
Kettle Creek	From the confluence of Green Branch to Albert Avenue
Manahawkin Mill Creek	From approximately 1.3 miles downstream of State Route 72 to approximately .3 miles downstream of State Route 72
North Branch Metedaconk	From approximately 100 feet downstream of US route 88 to 100 feet upstream of Ridge Avenue. Then from approximately 100 feet State Route 547/Squakam Road to 1100 feet upstream of US Route 9/ Madison Avenue
Potter Creek	From approximately 3000 feet upstream of US Route 9 to approximately 5300 feet upstream of US Route 9
Schoolhouse Branch	From the confluence with Cabinfield Branch to approximately 300 feet upstream of Woodlake Drive
South Branch Metedaconk	From approximately 150 feet downsteam of Chambers Bridge Road to 100 feet upstream of New Hampshire Avenue. Then from US route 9 to approximately 100 feet upstream of Hope Chapel Road

TABLE 4 - SCOPE OF STUDY- REDELINEATION- CONTINUED

Stream Name	Redelineation
Tarkilin Branch Kettle Creek	From the confluence with Kettle Creek to approximately 1000 feet upstream of Huntington Drive
Toms River	From the confluence of Union Branch to approximately 1000 feet upstream of railroad
Willis Creek	From Atlantis Boulevard to approximately 50 feet upstream of Center Street
Wrangel Brook	From approximately 5000 feet downstream of the confluence with Davenport Branch to approximately 1400 feet upstream of the confluence with Michael's Branch

TABLE 5 - SCOPE OF STUDY- APPROXIMATE

	Approximate
Cabinfield Branch	From downstream of Somerset Avenue to Ridge Avenue
Cedar Bridge Branch	From upstream of New Hampshire Avenue to the Hooper Avenue
Cedar Bridge Branch Trib 1	From upstream of Cedar Bridge Avenue to upstream of Cedar Bridge Avenue
Cedar Creek and Tributaries	From downstream of Lacey Road to The Garden State Parkway
Cedar Run Creek	From downstream of Garden State Parkway to downstream of U.S. Route 9
Clamming Creek	From upstream of Wheaton Avenue to U.S. Route 9
Giffords Mill Branch	From the Ocean County Boundary to Otis Bog Road
Green Branch	From downstream of Kensington Circle to upstream of Portsmouth Drive
Jakes Branch and Tributaries	From upstream of Pinewald Keswick Road to upstream of Double Trouble Road
Kettle Creek	From downstream of Buckingham Drive to downstream of Brick Boulevard
Lochiel Creek	From downstream of Bengal Boulevard to U.S. Route 9
Long Swamp Creek	From downstream of Garden State Parkway to downstream of Whitty Road
Middle Branch Forked River and Tributaries	From upstream of Garden State Parkway to the confluence with Barnegat Bay

TABLE 5 - SCOPE OF STUDY- APPROXIMATE CONTINUED

	Approximate
Mill Branch and Tributaries	From downstream of The Garden State Parkway to the Nugentown Road
Mill Creek	From upstream of Railroad Avenue to downstream of Chelsea Avenue
North Branch Forked River and Tributaries	From downstream of Cows Head Road to The Garden State Parkway
North Branch Metedeconk River	From downstream of Squankum Road to Ridge Avenue
Oyster Creek and Tributaries	From upstream of Cluen boulevard to downstream of The Garden State Parkway
Potter Creek	From downstream of Wheaton Avenue to downstream od U.S. Route 9
South Branch Metedeconk River	From U.S. Route 9 to New Hampshire Avenue
Tributary to Toms River	From downstream of Scott Drive to West Atlantic Avenue
Unknown Tributaries to Barnegat Bay	From upstream of the Garden State Parkway to the confluence with Barnegat Bay
Waretown Creek	From downstream of the Garden State Parkway to US Route 9
Westcunk Creek and Tributary	From downstream of the Garden State Parkway to upstream of Railroad Avenue

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, the local communities, and Ocean County.

2.2 Community Description

According to the 2010 United States Census, the population of Ocean County was 576,567, with a population increase of 12.8 percent from 2000 to 2010. Ocean County is comprised of a total of 915.40 square miles; 628.78 sq miles of land and 286.62 sq. miles of water.

Ocean County lies entirely within the Atlantic Coastal Plain, which extends along the east coast of the U.S. from Massachusetts to Florida. The Coastal Plan consists of unconsolidated sands, silts, clays, and marls with the Cohansey and Kirkwood sand formations being prevalent in the area.

The Coastal Plain sediments in this region are underlain by gneiss and schists. This basement complex slopes toward the Atlantic Ocean from a depth of about 1,100 feet in New Egypt to over 5,000 feet at the Atlantic Ocean (U.S. Department of the Interior, 1971; New Jersey Department of Environmental Protection, 1977). The bedrock formations were worn to a peneplain which slopes toward the Atlantic Ocean and were subsequently warped so that the Coastal Plain is depressed to the southeast. This resulted in the deposition of eroded material from the northern mountains.

Prior to 1620, the only inhabitants of New Jersey were the Lenni Lenapes, a division of the Indians of the Eastern Algonquin Confederacy. In 1620, the Dutch settled along the Hudson River and soon colonized all of New Jersey. In 1664, their colony, New Netherlands, was taken over by the English and given in proprietorship to Berkeley and Carteret. Nineteen years later, the Proprietary Assembly formed Monmouth County, named in honor of Monmouthshire, England. This county included the New Jersey coastal area north of Little Egg Harbor. In 1850, the southern townships of Monmouth County were established as Ocean County. The Toms River area, now part of Ocean County, continued to develop and within a few years several communities were incorporated: the Township of Berkeley in 1875, Island Heights in 1887, and Seaside Park in 1898. On April 22, 1917, the Borough of Beachwood was formed from a portion of the Township of Berkeley.

Ocean County has a temperate climate with warm summers and moderate winters. The average annual temperature is approximately 53 degrees Fahrenheit (°F), with January being the coldest month (mean temperature 32°F) and July being the warmest month (mean temperature 74°F). Summer temperatures rarely exceed 100°F and winter temperatures rarely fall below 0°F. The average frost-free period is almost 200 days per year. Precipitation averages approximately 50 inches annually, with July and August being the wettest months. Snowfall, which can occur from October through May, averages almost 25 inches annually (U.S. Department of Commerce, 1961).

2.3 Principal Flood Problems

Ocean County is subject to flooding from tropical storms, extratropical cyclones and, to a lesser extent, severe thunderstorm activity. Most serious tidal flooding problems are attributed to hurricanes, which occur during the late summer and early autumn. In addition to heavy precipitation, hurricanes produce high tides and strong waves, which can result in severe damage to coastal areas. Although extratropical cyclones, referred to as northeasters, can develop at almost any time of the year, they are more likely to occur during the winter and spring. Thunderstorms are a common occurrence during the summer months.

<u>September 14, 1944</u>

The Great Atlantic Hurricane of 1944 struck the entire shoreline of New Jersey with wind velocities ranging from 90 mph at Atlantic City to over 100 mph in New York City. During the passage of this storm, many communities reported extremely high tides.

<u>November 25, 1950</u>

The Great Appalachian Storm of November 1950 caused severe flood occurred on Thanksgiving Day. This strong northeaster struck the entire shoreline of New Jersey with gale force winds and more than 3 inches of rainfall. The total damage in Ocean County exceeded 1 million dollars.

March 6-8, 1962

This northeaster, also known as The Ash Wednesday Storm, was one of the most memorable storms to strike the Ocean County shoreline in recent years. This storm struck the entire coastline of New Jersey with gale force winds, extremely high tides and heavy precipitation in the form of wet snow. Generating winds of 70 mph, this northeaster remained in the study area for 60 hours. The unusually long duration coincided with five successive high spring tides. Along the river front, many docks were under water for several days. Severe flooding conditions, not only in the study area but along the entire coastline of New Jersey, resulted from the high storm water, waves and gale force winds.

During The Ash Wednesday Storm, water from Barnegat Bay and the Manasquan River flooded extensively developed areas along the 30-mile reach between Manasquan Inlet and Barnegat Inlet, affecting the Townships of Barnegat and Brick. The depth of flooding reached 1.5 feet over several streets in Seaside Park and 2 feet over portions of Ortley Beach in Township of Toms River (formerly the Township of Dover). Although the depth of flooding was not as severe as other coastal areas in New Jersey, a total of 5,759 residences and commercial establishments in this reach were damaged by inundation, of which 163 residences were structurally damaged. Much of the damage resulted from ocean water being carried by wave energy across the island and flowing to the lower inland water areas. Major damage was inflicted to the beaches, dunes, and boardwalks throughout the length of the reach (USACE, 1963).

August 26-28, 1971

A heavy frontal storm in combination with Tropical Storm Doria produced the greatest flooding in the area. This storm caused the President to declare New Jersey a National Disaster Area. An extensive high water mark survey was conducted jointly by the State of New Jersey and the USGS following Doria. These data are on file with the Division of Water Resources.

The August 1971 flood resulted from heavy antecedent rainfall in the morning and afternoon of August 27 followed by precipitation associated with the passage of Tropical Storm Doria across New Jersey in the evening of August 27 and early-morning hours of August 28. On August 26-28, 1971, intense thunderstorm activity followed by the passage of Tropical Storm Doria brought heavy precipitation to south-central, central, and northeast New Jersey for 32 hours. Total storm rainfall amounts during a 32-hour period ranged from about 3 to over 11 inches across New Jersey. Storm runoff increased rapidly to peak flows greater than previously experienced prior to August 1971 recorded at 47 stream gaging stations in New Jersey.

August 31, 1978

There are descriptions of the flooding caused by Hurricane Carol, which occurred during the late evening of August 31, 1978, and the following day as recorded in newspaper accounts on Friday, September 1, 1978, and in the Saturday Times from Trenton on September 2, 1978, as well as in The Trentonian on September 2, 1978.

The official damage assessment compiled on September 5, 1978, on file at the Municipal Offices, recorded 55 persons evacuated with no injuries or deaths. Total damage to homes, businesses, and industry was estimated to be $1,636,500 while damage to public property totaled $326,800.

September 22, 1992

Tropical Storm Danielle dropped light rain fall across much of New Jersey. The southwest portion of the state experienced over 3 inches of rain. The storm washed out miles of beaches along the coastline.

December 11, 1992

A northeaster struck the New Jersey shoreline with winds reaching 90 miles per hour. Boardwalks were torn up and flooding occurred from Longport to Sea Bright.

Winter storms, though more frequent than hurricanes, are less likely to generate large surges; the storm of March 1962 produced tides to 7.2 feet and the 1950 storm, with a slightly larger surge, occurred at low water. Storm histories over this region have been outlined and analyzed in some detail in a similar flood insurance report by the National Oceanic and Atmospheric Administration and by a tide frequency analysis (U.S. Department of Housing and Urban Development, 1970; U.S. Department of Commerce, 1970). Storm histories were obtained from a tropical cyclone analysis, records of the U.S. Weather Bureau, and from the USACE (U.S. Department of Commerce, 1965; U.S. Department of Commerce, 1961; USACE, 1963).

In the Township of Barnegat, discussions with the township engineer, the county engineer, and the township clerk, as well as field reconnaissance of the community and literature research, have indicated some localized areas of problem flooding. Tidal flooding occurs along the bayfront during extreme high tides, and Yellow Dam Branch has flooded as a result of simultaneous snowmelt and extreme rainfall.

In the Boroughs of Beachwood and Island Heights, the area is subject to fluvial flooding from Toms River and Jakes Branch and to tidal flooding from Barnegat Bay. The tide at the mouth of Toms River reaches the same height as that in Barnegat Bay, which responds to the tidal fluctuations in the Atlantic Ocean and the effects of storms over the bay. High tidal stages in the Atlantic Ocean affect the tidal stages of Toms River from its mouth to approximately 4 miles upstream. During severe storms, a combination of a high flood flow on Toms River with a high tidal surge on Barnegat Bay aggravates flooding by increasing the duration and height of the backwater in the river. Although Toms River has crested numerous times since 1929, the most disastrous flooding has resulted from a combination of the high tide surge with the high riverine flood flow. These storms occurred in 1944, 1950, and 1962 (USACE, 1960; USACE, 1972).

The Township of Berkeley is subject to flooding from the Atlantic Ocean and Barnegat Bay along its eastern border. Inland, flooding is caused by a combination of tidal flooding, hurricanes, and localized thunderstorms. Tidal conditions prevail upstream for almost the entire length of the Toms River and for a portion of Cedar Creek.

In the Township of Eagleswood, during discussions with township officials, it was determined that flooding occurs on Westecunk Creek between Little Egg Harbor and U.S. Route 9. Flooding in this area has caused evacuation of residents on Bay Avenue. The flooding on Westecunk Creek is due to the tidal influence of Little Egg Harbor.

Island Beach and the broad, shallow Barnegat Bay protect the mainland of the Township of Lacey from the direct wave action of the Atlantic Ocean; however, high tides on the bay may inundate many new residential communities that have developed along the bay and mouth of the North Branch Forked River. Inundation may also be caused by fluvial flooding along the North Branch Forked River.

The Borough of Lavallette is located on the 30-mile reach between Manasquan Inlet and Barnegat Inlet. During the March 1962 storm, water from Barnegat Bay and the Manasquan River flooded developed areas in this reach.

During the Ash Wednesday storm of 1962 storm, Long Beach Island was breached at five locations, four of which were in the vicinity of Harvey Cedars. The fifth location was at Holgate on the southern end of the island. The deepest breach cut through the most densely developed portion of Harvey Cedars. At the areas of breaching, stormwaters completely traversed the island. The dunes were completely destroyed, beaches were eroded, and manmade structures were damaged. A total of 5,361 residences were damaged, of which 998 were structural damaged. Because of the severe breaching, portions of the island were isolated from the mainland, most of the public utility systems failed, and the general evacuation of residents was undertaken. Seven persons lost their lives on Long Beach Island as a direct result of the storm (USACE, 1963).

During severe storm conditions localized flooding occurs in numerous areas of the Township of Manchester. This flooding is due primarily to poor drainage in developed areas. Flooding has been caused by Union Branch in the area of Pine Lake and downstream from the Pine Lake dam during more severe storms. Major portions of the floodplain of the streams studied by detailed methods are undeveloped areas predominated by marshland and bogs. There is no record of flood problems in these areas.

In the Borough of Ocean Gate, discussions with the Borough Engineer and reconnaissance of the community have indicated no areas of problem flooding. Flooding due to tidal influence from Barnegat Bay occurs during severe storms.

In the Township of Plumsted, the USGS has maintained a crest-stage partial record gage (no. 01464400) on the Crosswicks Creek in New Egypt since 1968. Although there are only 11 years of record at this site, the record includes the floods of September 1, 1978, and August 28, 1971. The estimated discharges at the gage associated with these floods are estimated to be 4,500 cfs and 1,940 cfs, respectively. These flows correspond to recurrence intervals of 125 years and 10 years, as determined from the frequency curve prepared from the gage records using Water Resources Council guidelines (Water Resources Council, 1977).

More complete records of flooding are available on Crosswicks Creek from the long-term USGS gage at Extonville, New Jersey (No. 01464500). A review of this data, which dates from 1938, indicates that flooding has occurred on September 1, 1978 (4,900 cfs), August 28, 1971 (4,800 cfs), September 22, 1938 (4,100 cfs), September 1, 1940 (3,360 cfs) and September 13, 1960 (3,200 cfs). These floods correspond to recurrence intervals of 36 years, 33 years, 20 years, 12 years, and 10 years, respectively, as determined from the frequency curve computed by using Water Resources Council guidelines from the recorded data at this site (Water Resources Council, 1977). Stony Ford Brook attained a discharge of 340 cfs at Lakewood Road during the flooding of 1978. This flow equals the estimated 1-percent annual chance (100-year) flow of Stony Ford Brook at Moorhouse Road and indicates that the flood of September 1, 1978, because of the localized nature of the storm, was more severe and had a higher recurrence interval on the smaller watersheds of the affected areas.

By comparison, an intense localized storm produced the flooding of 1978 in the Crosswicks Creek basin. Over 9 inches of rain were recorded at the fire tower on the Fort Dix Military Reservation within 6 hours, with 1 inch occurring in a 20-minute time span. This amount of rain is in contrast to trace amounts recorded at Burlington approximately 14 miles away (U.S. Department of Commerce, 1967 through 1977). This storm was associated with localized intense thunderstorm activity as opposed to the passing of a tropical storm.

The flooding which occurred on Crosswicks Creek in 1978 was between 3 and 4 feet higher in stage than the flooding experienced in August 1971 in the vicinity of New Egypt. High-water marks at the State Route 537 bridge over Crosswicks Creek are 65.4 feet for the crest-stage gage 30 feet upstream of State Route 528 bridge; the 1971 flood elevation was 69.8 feet and the high-water elevation of the 1978 flood was 73.7 feet. The estimated 1-percent annual chance flood elevations at these two locations are 67.9 feet and 73.2 feet, respectively.

In the Borough of South Toms River, the borough engineer indicated that localized flooding occurs in several areas in the vicinity of Jakes Branch, particularly the area of Brook Forest Drive. This area, as well as other flood prone areas, has been recently filled for home construction.

The Township of Stafford is subject to tidal flooding from both hurricanes and winter storms. Much of the area is low marshland that is very open to tidal surge through Little Egg Inlet to the south and to a lesser extent through Barnegat Inlet to the north. Long Beach Island, approximately 13 miles long, provides only a limited barrier to direct effects of the surge because it is subject to erosion during storms.

Among the more severe storm events that have affected the Township of Toms River (formerly Township of Dover) are the northeaster of November 25, 1950, and Hurricane Donna in 1960. During both of these flooding events, heavy precipitation and gale-force winds combined to cause extensive property damage. Intense precipitation, strong winds, and high tides of long duration accompanied the Ash Wednesday Storm of 1962. Hurricane Agnes, in June 1972, brought extensive rains to already saturated grounds, and resulted in flooding of low-lying areas. Tidal heights of 3 to 4 feet above normal, and a rainfall of 4 to 5 inches were generated by Hurricane Belle in 1976 (FEMA, 1983; U.S. Department of Commerce, 1978; U.S. Department of Commerce, 1971; U.S. Department of Commerce, 1971 et cetera).

Special consideration was given to storms which caused damages to the area in recent years, including Hurricane Floyd in 1999, Hurricane Irene in 2011, and Hurricane Sandy in 2012 (FEMA, 2013).

Hurricane Floyd originally made landfall in Cape Fear, North Carolina as a Category 2 hurricane on September 16, 1999. The storm crossed over North Carolina and southeastern Virginia, before briefly entered the western Atlantic Ocean. The storm reached New Jersey on September 17, 1999. Record breaking flooding was recorded throughout the State of New Jersey. The Raritan River basin experienced record floods of up to 4.5 ft. higher than any previous record flood crest. The areas of Bound Brook and Manville were especially hit hard. A Federal Emergency Declaration was issued on September 17, 1999. Overall damage estimates for Hurricane Floyd, in the State of New Jersey are estimated around $250 million.

Having earlier been downgraded to an extra-tropical storm, Hurricane Irene came ashore in Little Egg Inlet in Southern New Jersey; on August 28, 2011. In anticipation of the storm Governor Chris Christy declared a state of emergency of August 25th, with President Obama reaffirming the declaration on August 27th. Mandatory evacuations were ordered throughout the Ocean County Barrier Islands. Wind Speeds were recorded at 75 mph and rain totals reached over 10 inches in many parts of the state. Long Beach Boulevard, the main road on Long Beach Island, was reported under about 6 to 8 inches of water in Beach Haven. In Mantoloking, the eastern foot of the Mantoloking Bridge was completely submerged underwater. The bay has spilled out on to streets in Mantoloking, Bay Head and further south into Normandy Beach and Chadwick Beach. 45,000 customers in Ocean County had lost power during the storm. Overall damage estimates, for the State of New Jersey, came to over $1 billion; with over 200,000 homes and buildings being damaged.

Hurricane Sandy came ashore as an immense tropical storm in Brigantine, New Jersey, on October 29, 2012. Sandy dropped heavy rain on the area; almost a foot in some areas. Wind gust were recorded at 90 mph. A full moon made the high tides 20 percent higher than normal and amplified the storm surge. The New Jersey shore suffered the most damage. Some barrier island communities suffered severe "wash over" including the creation of two temporary inlets. NOAA's gage #8534720 at Atlantic City, NJ; the high water mark (which is considered as a stillwater elevation without waves) was 8.76 ft. NAVD88 at 11:42 PM on October 29, 2012 and NOAA's gage #8531680 at Sandy Hook, NJ; the high water mark (which is considered as a stillwater elevation without waves) was 9.21 ft NAVD88 at 6:00 PM on October 29, 2012. Seaside communities were damaged and destroyed up and down the coastline. Some 252,000 households in Ocean County had lost power. Initial reports suggest that well over 24,000 homes and businesses were damaged or destroyed by the storm. Governor Chris Christy declared a state of emergency on October 31. Hurricane Sandy is estimated to cost the State of New Jersey over $36 billion.

2.4 Flood Protection Measures

No flood protection measures exist within the Borough of Bay Head, Borough of Beachwood, Township of Berkeley, Township of Brick, Township of Eagleswood, Borough of Island Heights, Township of Jackson, Borough of Lakehurst, Borough of Lavallette, Township of Little Egg Harbor, Borough of Mantoloking, Borough of Ocean Gate, Borough of South Toms River, Township of Stafford, Township of Toms River, and Borough of Tuckerton. However, in the Township of Toms River along both shores of Barnegat Bay, there are many individual bulkheads that reduce the effects of wave action during the 1-percent annual chance event. Also, the Township of Jackson, Borough of Lakehurst, and Borough of Ocean Gate provides cleaning for stream channels and drainage facilities of debris and siltation when necessary.

There are no structural devices designed specifically for flood protection in the Township of Plumsted. The drainage area above New Egypt is relatively flat and a large percentage of the area consists of lakes and swamps and this condition provides natural storage for floodwaters of Crosswicks Creek (U.S. Department of the Interior, 1971; USGS, 1972). The dam across Crosswicks Creek forming Oakford Lake is not a flood control structure and the lake provides negligible storage since it is a low dam and is normally maintained at full capacity.

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations adopted from the Code of Federal Regulations which control construction within areas that have a high risk of flooding as identified by the Flood Hazard Boundary Map (U.S. Department of Housing and Urban Development, 1976).

There is a pumping station for the purpose of handling storm runoff in the area of Sea Avenue. There are no other major civil works for flood protection existing or planned in the Borough of Point Pleasant Beach.

Ocean County has no levee type structure that would require analysis of levee failure and removal under Section D.2.10.3.4.1 of the Draft Atlantic Ocean and Gulf of Mexico Coastal Guidelines update.

In alignment with standard practice used in other FEMA studies, all coastal armoring structures and beach stabilization structures have been included in the analysis without adjusting the analysis to remove the structure or reduce the effects of the structure.

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.

Prior to the September 29, 2006, countywide FIS each incorporated community within the areas of Ocean County, with the exception of the Boroughs of Pine Beach and Point Pleasant, has a previously printed FIS report. The hydrologic analyses described in those reports have been compiled and are summarized below.

On Davenport Branch, Wrangel Brook, and Sunken Branch, the discharges were calculated by using regional relationships contained in Special Report 38, developed by the USGS in cooperation with the New Jersey Department of Environmental Protection (State of New Jersey, 1974). This analysis takes into consideration drainage area, main-channel slope, surface storage, and manmade impervious land cover; it was developed from a regression analysis of 103 stream gaging stations throughout New Jersey.

On Potter Creek, discharges were calculated using TR-20 hydrologic analysis (U.S. Department of Agriculture, 1965).

In the Township of Toms River, the hydrologic analysis for the Toms River was taken from the FIS for the Township of Manchester (U.S. Department of Commerce, 1971 et cetera). Peak discharges for the Toms River were based on information developed using drainage area-discharge transfer methods. The methods were based on discharge values recorded at USGS gaging station No. 01408500, on the Toms River near Toms River, New Jersey, with a period of record beginning in October 1928 and ending in November 1928 (U.S. Department of the Interior, 1978; U.S. Department of the Interior, 1976).

The 1-percent annual chance discharges used for the analyses of the areas studied by approximate methods were determined by using the Regional Equations from Special Report 38 for the tributaries with drainage areas greater than one square mile (State of New Jersey, 1974). For tributaries with drainage areas of less than one square mile, the 1-percent annual chance discharges were determined by the Rational Method using Sandy Hook intensity curves (U.S. Department of Commerce, Sandy Hook Intensity Curves).

North Branch Metedeconk River: Discharge-frequency estimates for this stream were obtained by comparison of the 2-year gaging records (USGS, annual) published for North Branch Metedeconk River at Lakewood, New Jersey (drainage area 34.9 square miles) with the 46-year gaging records available for Toms River near Toms River, New Jersey (drainage area 124 square miles, USGS gage number 01408500, in operation since October 1928). A log-Pearson Type III analysis, adjusted by manual fit, was furnished for the Toms River gage by the USGS (USGS, Worksheets for Tidal Stage-Frequency Data). Peak discharge-frequency relationships for tributary to Toms River were based on the Regional Equations outlined in USGS Special Report 38 (State of New Jersey, 1974). Based on physical similarities of both drainage basins and an analysis of the concurrent flow records for North Branch Metedeconk River, a discharge of the North Branch to that of the Toms River is equal to the ratio of the respective drainage areas raised by an exponent of 0.6 ($A^{0.6}$).

Cabinfield Branch: Discharge-frequency estimates for Cabinfield Branch (drainage area 2.82 square miles) were obtained by applying the relationship that discharge varies with $A^{0.85}$ to the discharges of North Branch of Metedeconk River near Lakewood (drainage area 34.9 square miles). This relationship was derived by considering the effects of basin physical characteristics on peak flow.

Schoolhouse Branch: Discharge-frequency estimates for Schoolhouse Branch (drainage area 0.81 square miles) were obtained by applying the relationship that discharge varies with $A^{0.7}$ to the discharges of Cabinfield Branch at its mouth (drainage area 2.82 square miles).

South Branch Metedeconk River: Discharge-frequency estimates for South Branch Metedeconk River were obtained by comparison of the available two-year record at the gaging station South Branch Metedeconk River near Lakewood, New Jersey (drainage area 26.0 square miles) to the 46-year record of Toms River at the gaging station near Toms River, New Jersey (drainage area 124 square miles). A log-Pearson Type III analysis, adjusted by manual fit for the Toms River gaging station covering the 46-year period, was furnished by the USGS (USGS, Worksheets for Tidal Stage-Frequency Data). On the basis of physical similarity of both basins and analysis of concurrent flow records, the relationship that discharge varies with $A^{0.6}$ was applied to obtain discharges for the South Branch Metedeconk River.

Watering Place Brook: Discharge-frequency estimates at the mouth of Watering Place Brook (drainage area 2.01 square miles) were obtained by applying the relationship that discharge varies with $A^{0.8}$ to the discharges of South Branch Metedeconk River (drainage area 26.0 square miles).

Kettle Creek: Discharge-frequency estimates for Kettle Creek at the township line (drainage area 5.25 square miles) were obtained by applying the relationship that discharge varies with $A^{0.5}$ to the discharges of Toms River at Toms River, New Jersey (drainage area 124 square miles). The estimates derived at the township line were applied to the upstream reaches of Kettle Creek by use of different exponents according to the difference in the physical characteristics of the smaller order basins. A check with the relational method, for basins with a drainage area less than one square mile, showed good agreement with these estimates.

Green Branch: Discharge-frequency estimates for Green Branch of Kettle Creek at its confluence with Kettle Creek (drainage area 1.22 square miles) were obtained by applying the relationship that discharge varies with $A^{0.65}$ to the discharges of Kettle Creek at the township line (drainage area 5.25 square miles).

Tarkiln Branch: Discharge-frequency estimates for Tarkiln Branch of Kettle Creek (drainage area 0.48 square mile) were obtained by applying the relationship that discharge varies with $A^{0.65}$ to the discharges of Kettle Creek at the township line (drainage area 5.25 square miles). The obtained estimates checked well with those obtained by the rational method.

In the Township of Little Egg Harbor, peak discharge-frequency relationships for Mill Branch, Giffords Mill Branch, and Willis Creek within the community were based on the regional equations outlined in Special Report 38 (State of New Jersey, 1974). These relationships were developed through a statistical regression analysis of data collected at over 100 gages across the State of New Jersey. The analysis accounts for urban development, natural retention created by lakes and swamps, stream slope and drainage area. The relationships were extended to include the 0.2-percent annual chance storm.

In the Township of Plumsted, for Stony Ford Brook, the peak flood discharges were determined using USGS Special Report 38, Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization (State of New Jersey, 1974). This method of estimating peak flow was developed through a regression analysis considering flood frequency relationships for 103 gaging stations in New Jersey, using the log-

Pearson Type III method of statistical analysis (Water Resources Council, 1977). The method relates basin characteristics such as drainage area, slope, storage, and impervious cover to peak discharges for various frequencies through empirical equations. The peak flows were determined for the selected frequencies by this method and adjusted by a factor related to available storage in the drainage basin.

Peak discharge-frequency relationships for the portion of Jakes Branch affected by fluvial flooding were developed using drainage area-discharge transfer methods based on information compiled at the USGS gaging station No. 01408500 located on the Toms River near Toms River, New Jersey (U.S. Department of the Interior, 1976). The discharges at this gage were developed using a log-Pearson Type III flood flow frequency analysis with a period of record from October 1928 to 1975 (U.S. Department of the Interior, 1978).

In the Township of Stafford, discharge data were taken from dam inspection reports developed in accordance with analytical procedures contained in the report Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization (USACE, Holiday Lake Dam, NJ 00061, 1979; USACE, Manahawkin Lake Dam, NJ 00057, 1979; State of New Jersey, 1974).

In the Borough of Tuckerton, peak discharge-frequency relationships for Mill Branch within the community were based on the regional equations outlined in Special Report 38 (State of New Jersey, 1974). These relationships were developed through a statistical regression analysis of data collected at over 100 gages across the State of New Jersey. The analysis accounts for urban development, natural retention created by lakes and swamps, stream slope and drainage area.

For the September 29, 2006, county wide revision no new hydrologic and hydraulic or coastal analyses were performed

Detailed Hydrologic Analyses for the [date] countywide FIS, were carried out to establish peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events for Cedar Creek and North Branch Forked River.

Flood flow frequencies for Cedar Creek and North Branch Forked River were developed using USGS regression equations for New Jersey. Gage analysis for USGS gaging station number 01409000 was also used for Cedar Creek. The gage analysis was performed using the Bulletin 17B methodology and was carried out using PeakFQ program.

Peak discharge-frequency relationships for a portion of Cedar Creek were developed using gage analysis from USGS gaging station No. 01409000 at Lanoka Harbor along the Cedar Creek, with a period of record extending from 1933 to 2009, using a log-Pearson Type III flood flow frequency analysis.

Flood flow frequencies developed through a regression analysis used the log-Pearson Type III distribution. The method relates basin characteristics such as drainage area, slope, storage, and population density to peak discharges for various frequencies through regression equations.

The peak discharge computation procedure for using regression equations and gage analysis is presented in the USGS publication, *Methodology for Estimation of Flood Magnitude and Frequency for New Jersey Streams*, by Kara M. Watson and Robert D. Schopp (Scientific Investigation Report [SIR] 2009-5167).

In addition, the New Jersey Flood Hazard Area Design Flood (NJFHADF) was computed for the USGS gaging stations and the additional flow locations. The NJFHADF is equal to the 1-percent-annual-chance flood plus an additional 25% in flow, and is not to exceed the 0.2-percent-annual-chance flood. NFJHADF boundary is to regulate disturbance to the land and vegetation within the flood hazard area of a water body. This regulation is set forth by the State of New Jersey Flood Hazard Area Control Act Rules N.J.A.C. 7:13.

Hydrologic analysis for approximate study streams were performed using the USGS regression equations for New Jersey.

A summary of the drainage area-peak discharge relationships for all the streams studied by detailed methods is shown in Table 6, "Summary of Discharges."

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BLACKS BRANCH					
At State Route 70	7.1	460	534	667	742
CEDAR CREEK					
At USGS gage at Lanoka Harbor	53.2	730	1,118	1,307 / 1,634 [1]	1,829
Approximately 0.30 miles upstream from Ocean County 85	48.6	701	1,094	1,280 / 1,600 [1]	1,798
Downstream of Garden State Parkway	47.0	686	1,071	1,254 / 1,568 [1]	1,763
CROSSWICKS CREEK					
At the downstream corporate limits	41.0	2,065	3,624	4,510	7,236
At USGS gage no. 01464400	36.5	1,928	3,387	4,215	6,782
At the upstream corporate limits	35.7	1,903	3,344	4,161	6,698

[1] Peak discharge calculated for New Jersey Flood Hazard Area Design Flood (NJFHADF) is equal to the 1-percent annual chance flow plus and addition 25 percent in flow, and not to exceed the 0.2-percent annual chance flow.
*Data not available

TABLE 6 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
DAVENPORT BRANCH					
At confluence with Wrangel Brook	14.1	298	523	650	1,041
Downstream of Pinewald Keswick Road	7.7	252	447	562	920
At corporate limits	6.1	210	375	472	776
GIFFORDS MILL BRANCH					
Upstream of the confluence with Mill Branch	2.32	57	220	279	456
HOLIDAY LAKE					
At dam	*	*	*	985	*
JAKES BRANCH					
At the confluence with Toms River	9.6	359	534	620	863
MANAHAWKIN LAKE					
At dam	*	*	*	1,660	*
MANAHAWKIN MILL CREEK					
At Colony Lakes	*	*	*	1,660	*
MANAPAQUA BROOK					
Upstream of the confluence with Union Branch	6.5	284	422	491	742
MILL BRANCH					
Upstream of U.S. Route 9 crossing	12.84	351	613	764	1,232

[1] Peak discharge calculated for New Jersey Flood Hazard Area Design Flood (NJFHADF) is equal to the 1-percent annual chance flow plus and addition 25 percent in flow, and not to exceed the 0.2-percent annual chance flow.

*Data not available

TABLE 6 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
NORTH BRANCH FORKED RIVER					
Approximately 0.8 miles downstream from U.S. Route 9	15.1	499	787	928 / 1,160 [1]	1,265
Approximately 150 feet downstream from Lakeside Drive	14.9	496	784	925 / 1,156 [1]	1,265
Approximately 270 feet downstream from Lakeside Drive	14.2	465	747	887 / 1,109 [1]	1,231
NORTH BRANCH METEDECONK RIVER					
At downstream corporate limits	18.08	500	730	850	1,180
At Bethel-Church Road	15.4	455	625	785	1,100
At Aldrich Road	11.25	390	580	670	935
At upstream corporate limits	7.2	310	465	540	750
OLD HURRICANE BROOK					
Upstream of the confluence with Union Branch	8.7	342	509	591	821
POTTER CREEK					
Approximately 3,800 feet Upstream of U.S. Route 9	0.11	*	*	117	*
Approximately 4,800 feet Upstream of U.S. Route 9	0.08	*	*	82	*
STONY FORD BROOK					
At the confluence with Crosswicks Creek	2.9	371	641	809	1,324
At Moorehouse Road	1.2	149	267	340	564

[1] Peak discharge calculated for New Jersey Flood Hazard Area Design Flood (NJFHADF) is equal to the 1-percent annual chance flow plus and addition 25 percent in flow, and not to exceed the 0.2-percent annual chance flow.

*Data not available

TABLE 6 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
SUNKEN BRANCH					
At confluence with Wrangel Brook	4.8	319	523	633	939
Upstream of Bananier Drive	3.0	167	287	348	534
At corporate limits	1.6	122	217	273	444
TOMS RIVER					
Upstream of the Toms River-Manchester corporate Limits	56	877	1,306	1,516	2,108
TRIBUTARY TO TOMS RIVER					
At Cassville-Toms River Road	5.92	198	346	431	688
UNION BRANCH					
Upstream of the confluence of Manapaqua Brook	16.6	477	710	825	1,147
WILLIS CREEK					
Upstream of the golf course crossing	1.49	107	192	244	403
WRANGEL BROOK					
At confluence with Toms River	40.0	749	1,261	1,546	2,403
Downstream of confluence with Davenport Branch	35.3	743	1,252	1,535	2,386
Downstream of confluence with Sunken Branch	20.6	512	867	1,063	1,649
Downstream of confluence with Michaels Branch	11.4	221	395	494	804

The lacustrine stillwater elevations have been determined for the 1-percent annual chance floods for the flooding sources studied by detailed methods and are summarized in Table 7, "Summary of Lake Stillwater Elevations."

TABLE 7 - SUMMARY OF LAKE STILLWATER ELEVATIONS

	ELEVATION (feet NAVD*)			
FLOODING SOURCE AND LOCATION	10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
HOLIDAY LAKE				
Entire shoreline within the Township of Stafford	**	**	55.4	**
MANAHAWKIN LAKE				
Entire shoreline within the Township of Stafford	**	**	26.4	**

*North American Vertical Datum of 1988
**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.

Prior to the September 29, 2006, countywide FIS, each incorporated community within the areas of Ocean County, with the exceptions of the Boroughs of Pine Beach and Point Pleasant, has a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and are summarized below.

Cross sections for the backwater analyses of the North Branch Metedeconk River and Tributary to Toms River were field surveyed and were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects of these structures.

Approximate flood elevations were either obtained from the USGS Flood-Prone Area Maps, or from hydraulic analyses conducted for this study (U.S. Department of the Interior, 1970 et cetera). For the streams requiring hydraulic analysis, the elevation of the 1-percent annual chance flood was developed using the method described in Circular No. 14 by D. M. Thomas (State of New Jersey, 1964).

Cross sections for the backwater analyses of the streams studied by detailed methods were field surveyed and were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects of these structures. Additional cross-section information for Union Branch was provided by the Philadelphia District of the USACE, as used in their report, Floodplain Information – Toms River, Union Branch, Ridgeway Branch, and Long Swamp Creek – Ocean County, New Jersey (USACE, 1972). This data was field checked to ensure its accuracy, and updated where necessary.

Starting water-surface elevations for Union Branch were taken from the FIS for the Township of Manchester, New Jersey (FEMA, Flood Insurance Study, Township of Manchester, Unpublished). Starting water-surface elevations for Blacks Branch and Old Hurricane Brook were taken from Union Branch. Starting water-surface elevations for Manapaqua Brook were determined by analysis of rating curves based on channel geometry and hydrologic information developed for the study area.

Starting water-surface elevations for Mill Branch were taken from a spillway rating curve. Starting water-surface elevations for Giffords Mill Branch were taken from the water-surface profiles for Mill Branch. Starting water-surface elevations for Willis Creek were taken from the mean annual tide.

Cross sections for the backwater analyses of Crosswicks Creek and Stony Ford Brook were obtained from detailed topographic maps compiled from aerial photographs at a scale of 1:2,400 with a contour interval of 5 feet (Quinn and Associates, 1978). The below-water sections were obtained by field measurements.

Starting water-surface elevations for Crosswicks Creek were computed by the slope/area method. The hydraulic model for Crosswicks Creek was adjusted to match the high-water profile of the 1971 and 1978 floods. Starting water-surface elevations for Stony Ford Brook were based on critical depth, assuming non-coincidental flooding conditions.

Cross sections for the backwater analyses of Jakes Branch were located at close intervals upstream and downstream of bridges and culverts in order to model these structures accurately.

Water-surface elevations for floods of the selected recurrence intervals for Jakes Branch were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1977). Starting water-surface elevations for Jakes Branch were determined by analysis of rating curves based on channel geometry and hydrologic information developed for study areas. In addition, consideration was given to the influence of tidal flooding from the Toms River.

Starting water-surface elevations were taken from the following sources: Manahawkin Mill Creek, critical depth; Manahawkin Lake and Holiday Lake, 1-percent annual chance pool elevation.

Cross sections for the backwater analyses of Jakes Branch were located at close intervals upstream and downstream of bridges and culverts in order to model these structures accurately.

Water-surface elevations for floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (USACE, 1977).

Starting water-surface elevations for Jakes Branch were determined by analysis of the rating curves based on channel geometry and hydrologic information developed for the study area.

Starting water-surface elevations for Wrangel Brook were developed from coincident analyses of tidal and fluvial events on the Toms River and Wrangel Brook. Starting water-surface elevations for Davenport Branch and Sunken Branch were taken at their confluences with Wrangel Brook. Starting water-surface elevations for Potter Creek were determined by the slope/area method.

For the September 29, 2006, county wide revision, no new hydrologic and hydraulic or coastal analyses were performed.

Hydraulic computations and analyses for the [date] countywide FIS consists of determining the 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations for Cedar Creek and North Branch Forked River.

The water surface elevations for the 1-percent-annual-chance flood events for streams studied by approximate methods, and 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations, including the NJFHADF for streams studied by detailed methods for this [date] study, were computed using the USACE HEC-RAS 4.1.0 step backwater program. The hydraulic analyses for this study used a steady-state riverine analysis and also included cross sections and field data collected during detailed field surveyed. For the hydraulic simulations, all structures were assumed to remain fully functional and have unobstructed flows.

The detailed study reaches in this update were field surveyed in 2010. All structures along Cedar Creek and North Branch Forked River were field surveyed. Natural cross-sections were also surveyed along these stream reaches. Cross sections were placed at representative locations; usually no greater than 500 feet apart along the stream centerline. Field surveyed channel geometry was combined in overbank areas with Light Detection and Ranging (LiDAR) data collected in 2011 to complete the modeled cross-sectional geometry.

In addition to the field survey cross-sections, non-surveyed or interpolated cross sections were also used to complete the hydraulic modeling along detailed study streams. Field surveyed cross sections were used to interpolate the channel geometry for non-surveyed cross section. All cross section overbank ground information was obtained from the LiDAR data collected in 2011.

The downstream boundary conditions for profiles along Cedar Creek and North Branch Forked River in the HEC-RAS models were based on tidal water surface elevations. Vertical Datums Transformation Tool Version 2.3.3 (VDatum) developed by NOAA was used for computing Mean Higher High Water (MHHW). Latitude and Longitude at the mouth of study streams were input to the VDatum program, which computed MHHW, and were applied in the HEC-RAS models.

Manning’s n-values for detailed study reaches were estimated based on land use/land cover shape file obtained from New Jersey Department of Environmental Protection. The channel n-values were all between 0.03 and 0.05. It is typical for stream channels to have lower n-values than the overbanks. The overbank n-values range between 0.03 and 0.11. The differences in these assigned n-values from stream to stream are a result of slight differences in the terrain and engineering judgment. The n-values used in the HEC-RAS models are summarized in Table 8, “Manning’s ‘n’ Values” below.

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).

TABLE 8 - MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Blacks Branch	0.025-0.030	0.080-0.100
Cedar Creek	0.030-0.045	0.030-0.110
Crosswicks Creek	0.035-0.075	0.055-0.085
Davenport Branch	.0030-0.045	0.050-0.085
Giffords Mill Branch	0.030-0.040	0.060-0.150
Jakes Branch	0.030-0.060	0.060-0.150
Manahawkin Mill Creek	0.030	0.100
Manapaqua Brook	0.030-0.040	0.050-1.000
Mill Branch	0.030-0.080	0.080-0.100
North Branch Forked River	0.030-0.050	0.040-0.110
North Branch Metedeconk River	0.050	0.450
Old Hurricane Brook	0.030-0.035	0.060-0.100
Potter Creek	0.035-0.060	0.090-0.100
Ridgeway Branch	0.030	0.040-0.160
Stony Fork Brook	0.030-0.065	0.030-0.090
Sunkin Branch	0.035-0.060	0.090-0.100
Toms River	0.030	0.050-1.000
Tributary to Ridgeway Branch	0.030-0.035	0.100-0.450
Tributary to Toms River	0.011-0.030	0.040-0.100
Union Branch	0.025-0.050	0.030-1.000
Willis Creek	0.030-0.045	0.080-0.100
Wrangel Branch	0.035-0.060	0.090-0.100

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 88).

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 this 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.

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

3.3 Coastal Analyses

The FEMA, Region II office, initiated a study in 2009 to update the coastal storm surge elevations within the states of New York and New Jersey including the Atlantic Ocean, the Barnegat Bay, the Raritan Bay, the Jamaica Bay, the Long Island Sound and their tributaries. The study replaces outdated coastal analyses as well as previously published storm surge stillwater elevations for all FIS Reports in the study area, including Ocean County, NJ, and serves as the basis for updated FIRMs. The coastal study for the New Jersey Atlantic Ocean coast and New York City coast was conducted for FEMA by RAMPP under contract HSFEHQ-09-D-0369 task order HSFE02-09-J-0001.

The region-wide storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) for simulation of 2-dimensional hydrodynamics. ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating Waves Nearshore (unSWAN) to calculate the contribution of waves to total storm surge (FEMA, 2010). The resulting model system is typically referred to as SWAN+ADCIRC (FEMA, 2010). A seamless modeling grid was developed to support the storm surge modeling efforts. The modeling system validation consisted of a comprehensive tidal calibration followed by a validation using carefully reconstructed wind and pressure fields for six major flood events for the Region II domain: the 1938 hurricane, the Great Atlantic Hurricane of 1944, Hurricane Donna, Hurricane Gloria, and two extra-tropical storms, from 1984 and 1992. Two of the more recent storm events, Hurricane Irene and Hurricane Sandy were not used in this study for validation. Both Hurricane Irene and Hurricane Sandy occurred during the study or after this storm surge was completed. Hurricane Irene was a major rainfall event and did not produce major coastal flooding. The climatology of Hurricane Sandy, at this time, is not well studied.

Model skill was assessed by quantitative comparison of model output to wind, wave, water level and high water mark observations. The model was then used to simulate 30 historical extra-tropical storms and 159 synthetic hurricanes to create a synthetic water elevation record from which the 10-, 2-, 1-, and 0.2- percent annual chance of exceedence elevations were determined.

Wave setup results in an increased water level at the shoreline due to the breaking of waves and transfer of momentum to the water column during hurricanes and severe storms. For the New York and New Jersey surge study, wave setup was determined directly from the coupled wave and storm surge model. The total stillwater elevation (SWEL) including storm surge and wave setup was then used for the erosion and wave modeling.

The total stillwater elevations for the 10-, 2-, 1-, and 0.2- percent annual chance floods determined for the primary sources of flooding in Ocean County: Atlantic Ocean, Barnegat Bay, Kettle Creek, Little Egg Harbor, Manahawkin Bay, Manasquan River, Metedeconk River, and Toms River are shown in Table 9, "Transect Data." The analyses reported herein reflect the total stillwater elevations due to tidal and wind setup effects. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height or wave runup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

The Atlantic Ocean, Barnegat Bay, Kettle Creek, Little Egg Harbor, Manahawkin Bay, Manasquan River, Metedeconk River, and Toms River are the primary coastal flooding sources in Ocean County.

In Ocean County, along the Atlantic Ocean, the entire shoreline is comprised of a mostly vegetated dune, ranging in height from 5-15 feet. The entire Atlantic Ocean coastline is comprised of high density residential area, except for the barrier island located in the Township of Berkeley, which is comprised of shrubs, dune grass, and pine trees. The shoreline in the northern portion of Ocean County, along back bay and along inland coastal flooding sources is predominantly comprised of high density residential areas. In the southern portion of Ocean County (south of Borough of Seaside Park and Township of Toms River), the bay shorelines along the back barrier are comprised of marsh, dense shrubs, trees, and high density residential areas.

The tidal surge in the Atlantic Ocean affects 46 miles of Ocean County coastline, and is open fetch. The tidal surge in the back bay, comprised of Barnegat Bay, Little Egg Harbor, and Manahawkin Bay, affects 136 miles of Ocean County coastline. Tidal surge in Kettle Creek affects 4 miles; along the Manasquan River affects 4 miles; along Metedeconk River affects 8 miles; and along the Toms River affects 12 miles of the Ocean County coastline. The entire length of Ocean County coastline was modeled for overland wave propagation. The fetch length across the back bay is limited, varies from approximately 0.2 mile to 4.4 miles; across Kettle Creek varies from approximately 0.4 to 0.7 mile; across Manasquan River varies from approximately 0.1 to 0.6 mile; across Metedeconk River varies from approximately 0.2 to 0.7 mile; and across the Toms River varies from approximately 0.1 to 1.0 mile.

The coastal hydraulic analysis for this revision involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height, and wave run-up analysis.

Transects represent the locations where the overland wave height analysis was modeled and are placed with consideration given to topography, land use, shoreline features and orientation, and the available fetch distance. Each transect was placed to capture the dominant wave direction, typically perpendicular to the shoreline and extended inland to a point where coastal flooding ceased. Along each transect, wave heights were computed considering the combined effects of changes in ground elevation, obstructions, and wind contributions. Transects were placed along the shoreline along all sources of primary flooding in Ocean County, as illustrated on the FIRM and in the "Transect Location Map" provided in Figure 1. Transects also represent locations visited during field reconnaissance to assist in parameterizing obstructions and observing shore protection features.

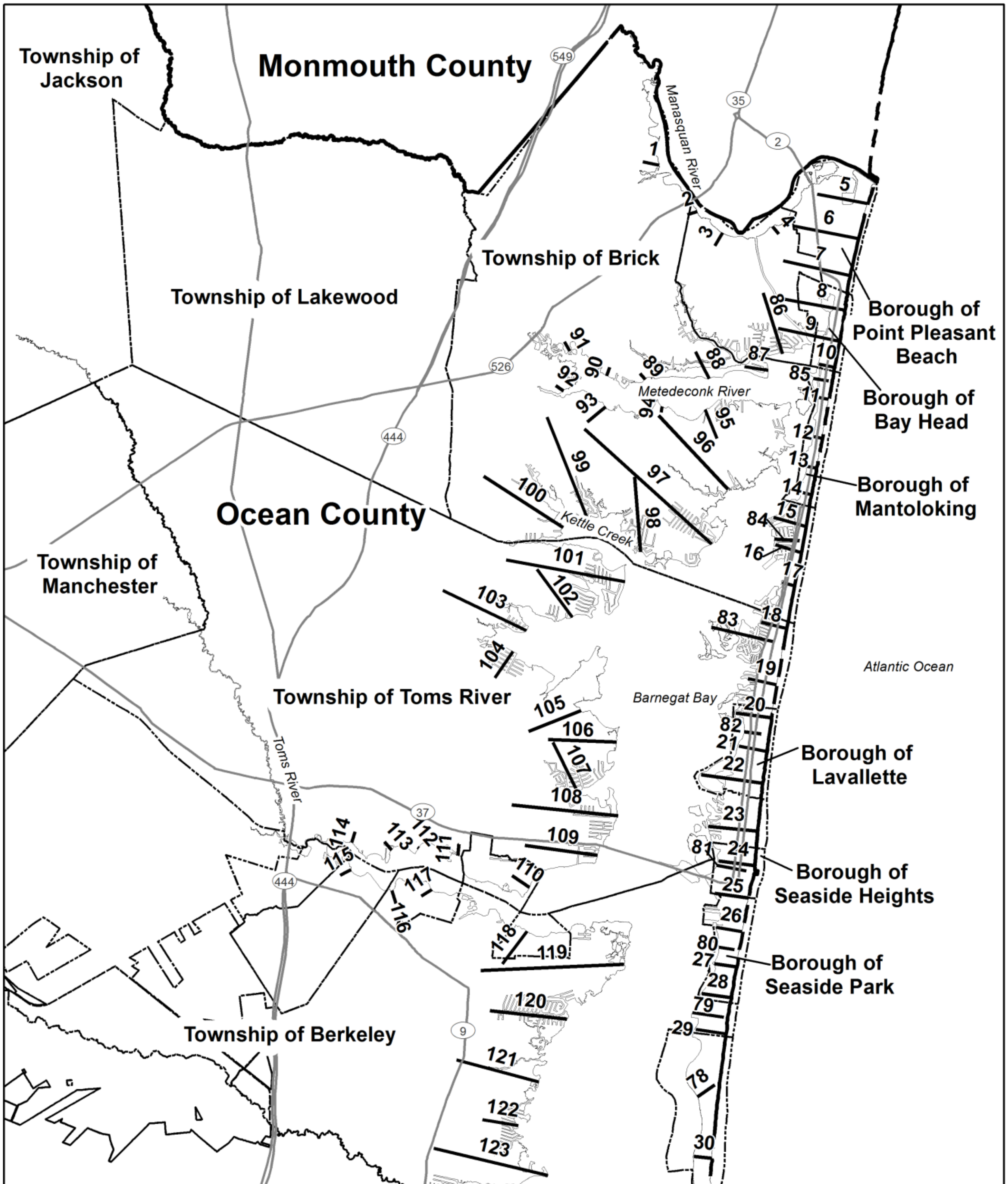

Figure 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NEW JERSEY AND INCORPORATED AREAS

Approximate Scale
0 1 2 4 6 8 Miles

TRANSECT LOCATION MAP

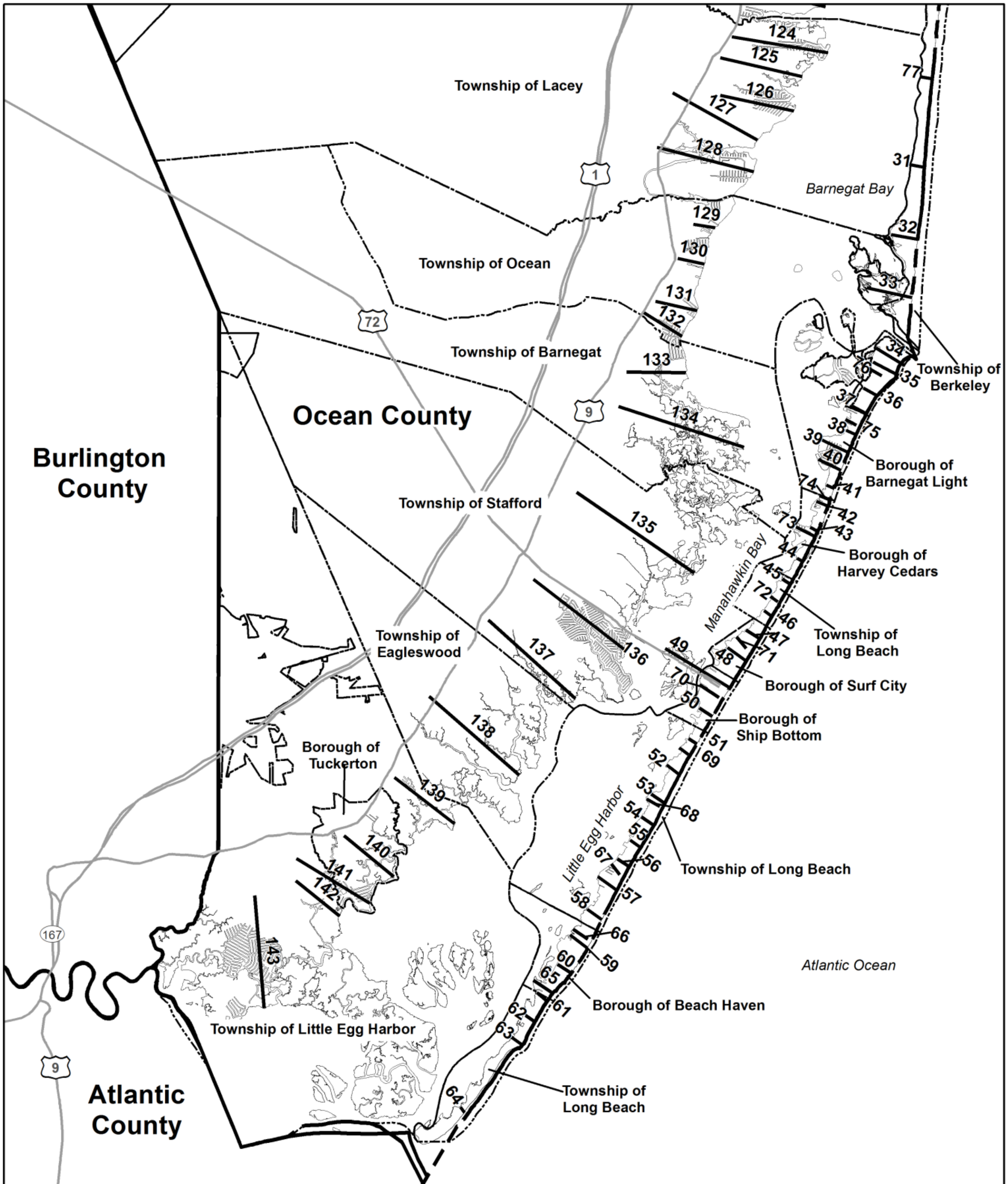

Figure 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NEW JERSEY AND INCORPORATED AREAS

Approximate Scale
0 1 2 4 6 8 Miles

TRANSECT LOCATION MAP

Erosion was modeled at transects where a dune was identified; this included the entire Atlantic Ocean shoreline. Along the northern barrier a primary frontal dune (PFD) is situated along the Atlantic Ocean shoreline. The PFD is defined as the point where the ground profile changes from relatively steep to relatively mild. The southern barrier island, named Long Beach Island, has a continuous dune feature along the Atlantic Ocean shoreline from the Borough of Barnegat Light to south of the Holgate Marina. A review of the geology and shoreline type in Ocean County supported using FEMA's standard erosion methodology for PFDs, referred to as the "540 rule," (FEMA, 2007). Beach profiles collected before and after Hurricane Sandy were also used to qualitatively assess the beach response during an extreme event and found to be in good agreement with standard erosion methodology. The field reconnaissance data along with imagery collected after Hurricane Sandy was used to identify the resilience of shore protection in preventing dune erosion during storm events.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS) (NAS, 1977). This method is based on three major concepts. First, depth-limited waves in shallow water reach maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the NAS Report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Simulations of inland wave propagation were conducted using FEMA's Wave Height Analysis for Flood Insurance Studies (WHAFIS) model Version 4.0 (FEMA, August 2007). WHAFIS is a one-dimensional model that was applied to each transect in the study area. The model uses the total stillwater and starting wave information extracted from the coupled wave and storm surge model. In Table 9, "Transect Data," the 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for each transect are provided along with the starting wave height and period. Simulations of wave transformations were then conducted with WHAFIS taking into account the storm-induced erosion and overland features of each transect. The model outputs the combined flood elevation from the total SWEL and wave height along each cross-shore transect allowing for the establishment of base flood elevations (BFEs) and flood zones from the shoreline to points inland within the study area. Wave heights were calculated to the nearest 0.1 foot, and BFEs were determined at whole-foot increments along the transects.

Wave runup is defined as the maximum vertical extent of wave uprush on a beach or structure. FEMA's 2007 Draft Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update require the 2-percent wave runup level be computed for the coastal feature being evaluated (cliff, coastal bluff, dune, or structure) (FEMA, February 2007). The 2-percent runup level is the elevation exceeded by runup from 2-percent of waves occurring within the duration of the 1-percent-annual-chance flood event. Each transect defined within the Region II study area was evaluated for the applicability of wave runup, and if necessary, the appropriate runup methodology was selected and applied to each transect. Runup elevations were then compared to WHAFIS results to determine the dominant process affecting BFEs and associated flood hazard levels. Based on wave runup rates, wave overtopping was computed following the FEMA 2007 Guidelines and Specifications.

The results of the overland wave height and runup calculations are accurate until local topography, vegetation, or cultural development within the community undergoes major changes. Consequently between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and engineering judgment to determine the extent of coastal flood zones.

TABLE 9 - TRANSECT DATA

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Manasquan River	1	N 40.105073 W 74.096389	1.62	2.28	6.8	8.6	9.3	10.5
Manasquan River	2	N 40.094354 W 74.085057	1.67	2.33	6.8	8.5	9.1	10.3
Manasquan River	3	N 40.089444 W 74.077523	1.81	2.31	6.8	8.5 8.2 - 8.5	9.1	10.2 10.1 - 10.2
Manasquan River	4	N 40.090828 W 74.062600	2.03	2.38	6.6	8.3	8.9	10.1 9.9 - 10.1
Atlantic Ocean	5	N 40.096041 W 74.034330	20.14	14.28	7.0 6.5 - 8.2	9.1 8.0 - 9.1	10.0 8.6 - 10.0	12.2 9.6 - 12.2
Atlantic Ocean	6	N 40.087976 W 74.036917	19.99	14.07	7.0 6.5 - 8.1	9.1 8.2 - 9.1	9.9 8.9 - 9.9	12.2 9.8 - 12.2
Atlantic Ocean	7	N 40.079434 W 74.039351	19.90	14.17	7.0 5.4 - 7.1	9.2 8.3 - 9.2	10.0 9.0 - 10.1	12.2 10.1 - 12.3
Atlantic Ocean	8	N 40.071590 W 74.041387	19.66	14.16	7.0 0.4 – 7.0	9.1 6.2 - 9.1	10.0 7.2 - 10.0	12.2 9.2 - 12.2
Atlantic Ocean	9	N 40.064487 W 74.043096	19.74	14.22	7.2 3.8 - 7.2	9.3 5.9 - 9.3	10.1 6.9 - 10.1	12.3 9.4 - 12.3
Atlantic Ocean	10	N 40.058435 W 74.044461	19.58	14.24	7.1 3.8 - 7.1	9.2 6.4 - 9.2	10.1 7.5 - 10.1	12.2 10.0 - 12.2
Atlantic Ocean	11	N 40.051088 W 74.046205	19.46	14.03	7.2 4 - 7.2	9.3 6.5 - 9.3	10.1 7.5 - 10.1	12.3 9.7 - 12.3
Atlantic Ocean	12	N 40.042146 W 74.048246	18.88	14.10	7.1 4.1 - 7.1	9.2 6.5 - 9.2	10.1 7.5 - 10.1	12.2 9.8 - 12.2

* For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	13	N 40.035303 W 74.049881	18.86	13.99	7.1 3.8 - 7.1	9.2 6.3 - 9.2	10 7.3 - 10	12.2 9.7 - 12.2
Atlantic Ocean	14	N 40.029256 W 74.051492	18.92	14.00	7.1 4 - 7.1	9.2 6.4 - 9.2	10.1 7.4 - 10.1	12.2 9.6 - 12.2
Atlantic Ocean	15	N 40.021936 W 74.053220	19.15	13.98	7.1 3.9 - 7.1	9.2 6.3 - 9.2	10.0 7.3 - 10.0	12.2 9.5 - 12.2
Atlantic Ocean	16	N 40.015948 W 74.054657	19.44	14.00	7.2 4.0 - 7.2	9.3 6.3 - 9.3	10.1 7.3 - 10.2	12.2 9.5 - 12.3
Atlantic Ocean	17	N 40.008315 W 74.056716	19.28	14.07	7.3	9.3 6.2 - 9.3	10.1 7.2 - 10.2	12.2 9.5 - 12.2
Atlantic Ocean	18	N 39.998537 W 74.059064	19.75	14.05	7.2 3.9 - 7.2	9.3 6.2 - 9.3	10.1 7.2 - 10.1	12.1 9.4 - 12.1
Atlantic Ocean	19	N 39.985632 W 74.062109	19.98	13.89	7.2 3.8 - 7.2	9.3 6.1 - 9.3	10.1 7.0 - 10.1	12.1 9.2 - 12.1
Atlantic Ocean	20	N 39.978005 W 74.063692	20.01	13.89	7.2 3.8 - 7.3	9.3 6.0 - 9.3	10.1 7.0 - 10.2	12.1 9.1 - 12.2
Atlantic Ocean	21	N 39.970351 W 74.065204	19.58	13.97	7.2 3.8 - 7.2	9.2 6.0 - 9.3	10.0 7.0 - 10.0	12.1 9.2 - 12.1
Atlantic Ocean	22	N 39.963054 W 74.066535	19.12	13.84	7.3 3.8 - 7.3	9.3 5.9 - 9.3	10.1 6.9 - 10.1	12.1 9.1 - 12.1
Atlantic Ocean	23	N 39.952065 W 74.068191	17.91	13.90	7.1 3.4 - 7.2	9.2 5.9 - 9.3	10.3 6.8 - 10.3	12.4 9.0 - 12.4
Atlantic Ocean	24	N 39.944119 W 74.068794	17.49	14.02	7.0 3.8 - 7.0	9.1 5.8 - 9.1	9.9 6.8 - 10.1	11.9 9.0 - 12.3
Atlantic Ocean	25	N 39.936667 W 74.070745	17.41	13.92	7.1 3.8 - 7.1	9.1 6.0 - 9.1	10.0 6.9 - 10.0	12.0 9.3 - 12.0
Atlantic Ocean	26	N 39.928924 W 74.072777	17.14	14.15	7.0 3.7 - 7.0	9.0 5.9 - 9.0	9.8 6.9 - 9.8	11.9 9.3 - 11.9
Atlantic Ocean	27	N 39.920873 W 74.074502	17.80	14.08	7.0 3.7 - 7.0	9.1 5.9 - 9.1	9.8 6.9 - 9.9	11.9 9.3 - 11.9
Atlantic Ocean	28	N 39.913810 W 74.076240	17.46	13.42	7.0 3.7 - 7.0	8.3 5.9 - 8.3	9.9 6.8 - 9.9	11.9 9.2 - 11.9
Atlantic Ocean	29	N 39.905494 W 74.077862	17.25	13.26	7.0 3.8 - 7.0	9.0 5.9 – 9.0	9.8 6.9 - 9.8	11.8 9.2 - 11.8
Atlantic Ocean	30	N 39.876923 W 74.082083	15.33	14.06	7.3 3.8 - 7.3	9.2 5.8 - 9.2	10.0 6.8 - 10.0	11.9 9.3 - 12.0
Atlantic Ocean	31	N 39.820267 W 74.088875	14.36	14.21	7.2 3.8 - 7.2	9.1 5.7 - 9.1	9.8 6.6 - 9.8	11.6 8.9 - 11.7
Atlantic Ocean	32	N 39.796554 W 74.091849	14.33	13.91	7.1 3.9 - 7.1	8.9 5.7 - 8.9	9.6 6.5 - 9.6	11.5 8.4 - 11.5
Atlantic Ocean	33	N 39.777414 W 74.094450	13.31	14.37	6.9 4.1 - 7.0	8.9 5.7 - 9.0	9.6 6.4 - 9.8	11.7 8.0 - 11.9

* For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	34	N 39.755170 W 74.097983	14.63	14.11	6.7 4.9 - 7.2	8.7 6.0 - 9.1	9.5 6.3 - 9.9	11.5 7.6 - 11.8
Atlantic Ocean	35	N 39.751828 W 74.100195	14.75	14.06	6.7 4.8 - 6.8	8.7 5.9 - 9.3	9.5 6.4 - 10.0	11.6 8.2 – 12.0
Atlantic Ocean	36	N 39.745107 W 74.109306	14.11	14.14	7.0 4.1 – 7.0	9.0 5.9 – 9.0	9.8 6.8 - 10.0	12.1 8.7 - 12.6
Atlantic Ocean	37	N 39.739249 W 74.114085	14.03	14.51	7.1 4.1 - 7.1	9.1 5.9 - 9.1	9.9 6.7 - 10.0	12.2 8.5 - 12.5
Atlantic Ocean	38	N 39.732338 W 74.118654	14.05	14.39	7.2 4.2 - 7.2	9.1 5.9 - 9.1	10.0 6.7 - 10.0	12.3 8.6 - 12.4
Atlantic Ocean	39	N 39.726510 W 74.121864	14.42	14.50	7.2 4.2 - 7.2	9.1 5.9 - 9.1	9.9 6.6 - 9.9	12.2 8.4 - 12.2
Atlantic Ocean	40	N 39.720701 W 74.125008	14.31	14.37	7.0 4.2 – 7.0	9.0 5.9 – 9.0	9.8 6.7 - 9.9	12.3 8.2 - 12.5
Atlantic Ocean	41	N 39.714688 W 74.127950	13.82	14.43	7.0	8.9 6.0 - 8.9	9.7 6.7 - 9.7	12.1 8.5 - 12.2
Atlantic Ocean	42	N 39.708830 W 74.130404	13.72	14.38	6.9 4.3 - 6.9	8.9 6.0 – 9.0	9.7 6.7 - 10.0	12.0 8.5 - 12.5
Atlantic Ocean	43	N 39.700363 W 74.134471	13.86	14.58	6.8 4.3 - 6.8	8.8 6.0 - 8.9	9.6 6.8 - 9.8	12.0 8.5 - 12.4
Atlantic Ocean	44	N 39.690584 W 74.140877	13.51	13.58	6.8 4.4 - 6.8	8.8 6.2 - 8.8	9.6 6.9 - 9.7	12.0 8.7 - 12.4
Atlantic Ocean	45	N 39.683235 W 74.146752	13.02	13.18	6.8 4.3 - 6.8	8.8 6.1 - 8.8	9.7 6.8 - 9.7	12.3 8.6 - 12.5
Atlantic Ocean	46	N 39.672764 W 74.154825	12.89	13.66	6.9 4.5 - 6.9	9.0 6.2 - 9.0	9.8 6.9 - 9.8	12.3 8.5 - 12.3
Atlantic Ocean	47	N 39.665444 W 74.160036	13.65	13.41	7.0 4.5 – 7.0	8.8 6.2 - 8.8	9.8 6.9 - 9.8	12.5 8.5 - 12.6
Atlantic Ocean	48	N 39.657983 W 74.165532	14.84	13.72	6.9 4.5 - 6.9	8.9 6.2 - 8.9	9.8 7.0 - 9.9	12.4 8.3 - 12.6
Atlantic Ocean	49	N 39.649233 W 74.172623	15.63	13.80	7.0 4.5 – 7.0	9.0 6.2 – 9.0	9.9 6.8 - 9.9	12.5 8.2 - 12.8
Atlantic Ocean	50	N 39.639867 W 74.180223	16.01	13.56	6.9 4.7 - 6.9	9.0 6.4 - 9.0	9.9 7.2 - 9.9	12.6 9.0 - 12.8
Atlantic Ocean	51	N 39.630860 W 74.186820	14.90	13.17	6.9 4.8 - 6.9	8.9 6.6 - 8.9	9.8 7.3 - 9.8	12.5 9.0 - 12.6
Atlantic Ocean	52	N 39.620744 W 74.194285	13.68	13.03	7.0 4.7 - 7.0	9.0 6.5 - 9.0	9.8 7.2 - 9.9	12.4 8.9 - 12.5
Atlantic Ocean	53	N 39.611305 W 74.200476	12.44	13.18	6.9 4.8 - 6.9	8.9 6.5 - 8.9	9.8 7.2 - 9.8	12.3 8.7 - 12.3
Atlantic Ocean	54	N 39.604196 W 74.205507	12.20	13.05	6.9 4.8 - 6.9	8.8 6.5 - 8.8	9.7 7.2 - 9.7	12.4 8.6 - 12.4

* For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	55	N 39.596668 W 74.210701	12.90	13.89	6.9 4.9 - 6.9	8.9 6.5 - 8.9	9.7 7.2 - 9.7	12.4 8.6 - 12.4
Atlantic Ocean	56	N 39.590556 W 74.215787	13.85	13.75	6.9 4.9 - 6.9	9.0 6.5 - 9.0	9.8 7.2 - 9.8	12.4 8.6 - 12.4
Atlantic Ocean	57	N 39.582861 W 74.221073	13.64	13.65	7.0 4.9 – 7.0	8.9 6.5 - 8.9	9.8 7.2 - 9.8	12.5 8.5 - 12.6
Atlantic Ocean	58	N 39.573129 W 74.227510	13.09	13.27	6.9 5.0 - 6.9	8.9 6.6 - 8.9	9.7 7.2 - 9.8	12.4 8.4 - 12.5
Atlantic Ocean	59	N 39.563789 W 74.233706	11.85	12.99	6.8 5.0 - 6.8	8.8 6.6 - 8.8	9.7 7.2 - 9.7	12.3 8.5 - 12.4
Atlantic Ocean	60	N 39.555482 W 74.240468	13.49	13.40	6.8 5.1 - 6.8	8.8 6.7 - 8.8	9.7 7.3 - 9.7	12.4 8.5 - 12.5
Atlantic Ocean	61	N 39.546336 W 74.250822	12.20	12.85	6.8 5.1 - 6.8	8.9 6.7 – 9.0	9.9 7.3 - 10.1	12.6 9.9 – 13.0
Atlantic Ocean	62	N 39.539725 W 74.256357	11.43	12.86	6.8 5.1 - 6.8	9.0 6.8 – 9.0	10.0 7.4 - 10.2	12.9 8.6 - 13.2
Atlantic Ocean	63	N 39.531955 W 74.261370	11.31	13.01	6.8 5.2 - 6.8	8.8 6.8 - 8.9	9.8 7.4 - 10.0	12.5 8.8 – 13.0
Atlantic Ocean	64	N 39.509809 W 74.286081	7.28	13.45	8.3 7.8 - 8.3	8.8 8.5 - 8.8	9.8 8.7 - 9.8	12.8 10.8 - 12.8
Little Egg Harbor	65	N 39.553294 W 74.256608	2.02	2.65	5.0 5.0 - 5.1	6.7 6.7 - 6.8	7.2 7.2 - 7.3	8.5 8.5 - 12.4
Little Egg Harbor	66	N 39.570048 W 74.239721	2.32	2.58	5.0	6.6	7.2	8.5
Little Egg Harbor	67	N 39.591485 W 74.223361	2.94	2.84	4.9	6.5 6.5 - 6.6	7.2	8.5
Little Egg Harbor	68	N 39.612729 W 74.208293	3.49	3.19	4.8	6.5	7.2	8.7
Little Egg Harbor	69	N 39.629580 W 74.194273	3.27	3.22	4.8	6.6 6.6 - 6.8	7.3 7.3 - 7.4	9.0 8.9 – 9.0
Manahawkin Bay	70	N 39.650340 W 74.185590	2.53	3.17	4.7	6.4 6.4 - 6.5	7.2 7.2 - 7.3	8.9
Manahawkin Bay65	71	N 39.666010 W 74.169815	2.71	2.77	4.5	6.2	6.9 6.8 - 6.9	8.4
Manahawkin Bay	72	N 39.679261 W 74.155353	2.80	3.20	4.5	6.2	6.9	8.6
Manahawkin Bay	73	N 39.702129 W 74.144205	2.52	3.36	4.3 4.3 - 4.4	6.0 6.0 - 6.1	6.8	8.4 8.4 - 8.5
Manahawkin Bay	74	N 39.712405 W 74.134153	2.59	2.98	4.3	6.0	6.7	8.5
Manahawkin Bay	75	N 39.737455 W 74.122956	2.60	2.67	4.2	5.9	6.7	8.6

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TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Barnegat Bay	76	N 39.753899 W 74.112374	1.61	2.29	5.0 4.9 - 5.4	6.4 5.9 - 6.4	6.9 6.5 - 6.9	8.3 8.2 - 10.3
Barnegat Bay	77	N 39.850004 W 74.090183	3.20	3.40	3.8 3.8 - 7.1	5.8 5.8 - 9	6.7 6.7 - 9.8	9.3 9.3 - 11.7
Barnegat Bay	78	N 39.891014 W 74.086187	3.62	3.11	3.8 3.7 - 3.8	5.9 5.8 - 5.9	6.9	9.4
Barnegat Bay	79	N 39.910398 W 74.087606	3.32	3.17	3.8	5.9 5.8 - 5.9	6.8 6.8 - 6.9	9.2 9.2 - 9.3
Barnegat Bay	80	N 39.925416 W 74.079595	3.65	3.28	3.8 3.7 - 3.8	5.9	6.9	9.3
Barnegat Bay	81	N 39.944220 W 74.080129	1.75	3.81	3.8	5.9 5.8 - 5.9	6.8	9.0 9.0 - 10.5
Barnegat Bay	82	N 39.974858 W 74.071801	2.24	3.05	3.9	6.1	7.0	9.2
Barnegat Bay	83	N 39.998920 W 74.081430	3.19	3.26	3.9 3.7 - 3.9	6.1 6.1 - 6.2	7.1 7.1 - 7.2	9.3 9.2 - 9.3
Barnegat Bay	84	N 40.019071 W 74.062531	3.31	3.49	4.0	6.3	7.3	9.5
Barnegat Bay	85	N 40.055943 W 74.050655	2.57	2.75	3.9 3.8 - 3.9	6.4 6.3 - 6.4	7.5 7.4 - 7.5	10.1 10 - 10.1
Barnegat Bay	86	N 40.061586 W 74.059790	2.56	2.75	3.8	6.1 5.9 - 6.8	7.2 7.0 - 7.8	10.0 9.1 - 10.1
Barnegat Bay	87	N 40.057795 W 74.064079	2.60	2.74	3.8 3.6 - 3.9	6.3 6.1 - 6.4	7.4 7.2 - 7.5	10.1 10.1 - 10.2
Metedeconk River	88	N 40.055952 W 74.081676	2.26	2.62	3.9 3.7 - 3.9	6.3 6.0 - 6.3	7.4 7.0 - 7.5	10.2 10.1 - 10.4
Metedeconk River	89	N 40.055865 W 74.100744	2.10	2.53	3.8	6.3	7.4	10.3
Metedeconk River	90	N 40.056693 W 74.112268	1.68	2.23	3.7	6.1 6 - 6.1	7.3 7.0 - 7.3	10.2 10.1 - 10.2
Metedeconk River	91	N 40.062490 W 74.123279	1.58	2.19	3.8	6.3	7.4 7.1 - 7.4	10.4 10.2 - 10.4
Metedeconk River	92	N 40.053320 W 74.125179	1.44	2.21	3.7	6.0	7.1	10.2
Metedeconk River	93	N 40.049649 W 74.112644	1.75	2.27	3.8	6.3	7.4	10.3
Metedeconk River	94	N 40.049611 W 74.095754	2.08	2.53	3.5 3.4 - 3.5	6.3 6.2 - 6.3	7.4	10.2
Metedeconk River	95	N 40.048871 W 74.082997	2.20	2.56	3.6 3.6 - 3.8	6.3 5.8 - 6.3	7.4 7.0 - 7.4	10.2 9.8 - 10.2
Barnegat Bay	96	N 40.030559 W 74.076239	2.90	3.29	3.9 2.7 - 3.9	6.3 5.8 - 6.3	7.3 7.0 - 7.3	9.5 9.4 - 9.9

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TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Barnegat Bay	97	N 40.017982 W 74.081212	3.29	3.45	3.9 3.2 - 3.9	6.2 5.8 - 6.2	7.2 6.9 - 7.2	9.4 9.1 - 9.4
Kettle Creek	98	N 40.016300 W 74.102401	3.05	3.32	3.9 3.6 - 3.9	6.2 5.7 - 6.2	7.1 6.8 - 7.1	9.4 9.1 - 9.4
Kettle Creek	99	N 40.024288 W 74.118366	2.21	2.55	3.9 1.0 - 3.9	6.3 5.5 - 6.3	7.2 6.8 - 7.2	9.4 9.1 - 9.4
Kettle Creek	100	N 40.021940 W 74.125405	2.19	2.46	3.9 3.5 - 3.9	6.2 6.1 - 6.2	7.2 7.0 - 7.2	9.4 9.1 - 9.5
Barnegat Bay	101	N 40.009435 W 74.107082	3.17	3.33	3.8 3.2 - 3.8	6.1 5.9 - 6.1	7.1 7.0 - 7.8	9.3 9.0 - 9.4
Barnegat Bay	102	N 40.001313 W 74.122838	2.47	2.70	3.4 3.3 - 3.5	6.1 5.5 - 6.1	7.0 6.7 - 7.1	9.3 9.1 - 9.4
Barnegat Bay	103	N 39.998322 W 74.136534	2.37	2.55	3.8 3.4 - 3.8	6.1 6.0 - 6.2	7.1 6.8 - 7.2	9.4 9.1 - 9.7
Barnegat Bay	104	N 39.993550 W 74.140535	2.34	2.53	3.8	6.1	7.1	9.4 9.4 - 9.5
Barnegat Bay	105	N 39.979913 W 74.120369	2.22	2.59	3.3 3.1 - 3.8	5.9 5.5 - 5.9	6.9 6.5 - 6.9	9.2 8.9 - 9.2
Barnegat Bay	106	N 39.972624 W 74.109815	2.62	2.95	3.7 3.0 - 3.7	5.9 5.3 - 5.9	6.9 6.5 - 6.9	9.2 8.9 - 9.2
Barnegat Bay	107	N 39.961345 W 74.121583	0.81	1.78	3.1 2.5 - 3.1	5.8 5.7 - 5.8	6.7 6.6 - 6.7	9.1 9.0 - 9.1
Barnegat Bay	108	N 39.955677 W 74.109426	2.69	3.06	3.6 3.0 - 3.6	5.8 5.4 - 5.8	6.7 6.5 - 6.7	9.2 9.0 - 9.2
Barnegat Bay	109	N 39.946652 W 74.115643	3.38	3.05	3.5 3.2 - 3.6	5.7 5.3 - 5.9	6.7 6.4 - 6.9	9.2 9.0 - 9.5
Toms River	110	N 39.939321 W 74.135876	2.78	2.72	3.6	5.6 5.5 - 5.6	6.4 6.3 - 6.4	9.0
Toms River	111	N 39.946695 W 74.157211	1.77	2.38	3.6 3.2 - 3.6	5.9 5.6 - 5.9	6.9 6.6 - 6.9	9.3 9.2 - 9.3
Toms River	112	N 39.948407 W 74.168860	2.28	2.75	3.7	6.0	7.0	9.4
Toms River	113	N 39.948053 W 74.176922	2.38	2.83	3.7 3.6 - 3.7	6.0 5.8 – 6.0	7.0 6.9 – 7.0	9.4 9.4 - 9.5
Toms River	114	N 39.949748 W 74.188760	1.45	2.16	3.7	6.1	7.1	9.6
Toms River	115	N 39.943570 W 74.189032	2.49	2.91	3.7	6.0	7.0 6.9 – 7.0	9.5
Toms River	116	N 39.938717 W 74.176846	1.96	2.56	3.7	5.9	6.9	9.4
Toms River	117	N 39.938936 W 74.164997	2.03	2.62	3.7	5.9	6.9	9.2 8.9 - 9.2

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TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Toms River	118	N 39.929239 W 74.136690	2.42	2.55	3.6 3.6 – 7.0	5.7 5.2 – 6.0	6.7 6.3 - 6.9	9.2 8.9 - 9.2
Barnegat Bay	119	N 39.921574 W 74.107836	3.65	3.23	3.6 3.2 - 4.2	5.8 5.5 - 5.8	6.7 6.5 - 6.8	9.2 8.9 - 9.4
Barnegat Bay	120	N 39.909061 W 74.124882	4.09	3.65	3.6 0.6 - 3.7	5.8 5.3 - 5.9	6.7 6.6 – 7.0	9.3 9.2 - 9.6
Barnegat Bay	121	N 39.894594 W 74.133356	3.97	3.71	3.7 2.7 – 6.0	5.7 5.1 - 5.8	6.7 6.3 - 6.8	9.2 8.9 - 9.3
Barnegat Bay	122	N 39.884630 W 74.139514	3.37	3.55	3.7 3.7 - 3.9	5.7 5.5 - 5.8	6.6 6.4 - 6.7	9.1 8.8 - 9.1
Barnegat Bay	123	N 39.873173 W 74.130801	3.54	3.68	3.7 3.5 - 5.1	5.6 5.2 - 5.8	6.5 6.5 - 6.9	9.0 8.8 - 9.1
Barnegat Bay	124	N 39.858109 W 74.129820	3.65	3.51	3.7 0.6 - 3.8	5.6 5.5 - 5.8	6.4 6.4 - 6.7	8.9 8.9 – 9.0
Barnegat Bay	125	N 39.850228 W 74.140913	3.02	3.20	3.7 3.6 - 3.8	5.6 5.6 - 5.9	6.4 6.4 - 6.8	8.8 8.8 - 9.2
Barnegat Bay	126	N 39.838971 W 74.144556	2.19	2.82	3.7 3.7 - 3.8	5.6 5.6 - 5.8	6.4 6.3 - 6.8	8.6 8.6 - 8.9
Barnegat Bay	127	N 39.829373 W 74.160000	2.95	3.18	3.8 3.6 - 4.2	5.7 5.6 - 5.8	6.5 6.5 - 6.7	8.6 8.5 - 8.9
Barnegat Bay	128	N 39.818979 W 74.161695	3.51	3.51	3.8 1.5 - 3.9	5.7 5.5 - 5.9	6.5 6.3 - 6.8	8.5 8.5 – 9.0
Barnegat Bay	129	N 39.800603 W 74.178252	4.26	3.62	4.0 3.8 – 4.0	5.9 5.7 - 5.9	6.7 6.5 - 6.7	8.6 8.6 - 8.7
Barnegat Bay	130	N 39.788665 W 74.182868	4.12	3.53	4.0 4.0 - 4.1	5.9 5.8 - 5.9	6.7 6.3 - 6.8	8.5 8.3 - 8.6
Barnegat Bay	131	N 39.773416 W 74.186007	4.03	3.34	4.1 4.1 - 4.2	5.9 5.9 – 6.0	6.7 6.7 - 6.8	8.4 8.4 - 8.7
Barnegat Bay	132	N 39.764934 W 74.192527	3.97	3.50	4.2 4.2 - 4.3	6.0 6.0 - 6.2	6.8 6.8 – 7.0	8.5 8.5 - 8.9
Manahawkin Bay	133	N 39.752982 W 74.190912	3.99	3.48	4.3 4.3 - 4.5	6.1 5.9 - 6.4	6.8 6.8 - 7.3	8.4 8.4 - 9.4
Manahawkin Bay	134	N 39.728403 W 74.166367	2.49	2.66	4.2 0.9 - 5.5	5.9 5.6 - 7.6	6.6 6.4 - 7.8	8.2 8.1 - 9.3
Manahawkin Bay	135	N 39.687082 W 74.187724	2.72	2.74	4.9 3.7 - 5.5	6.0 5.9 - 7.7	6.6 6.5 - 7.8	8.2 8.0 - 9.2
Manahawkin Bay	136	N 39.662095 W 74.217792	2.77	2.82	5.5 5.0 - 5.5	6.1 6.1 - 8.6	6.8 6.8 - 7.9	8.4 8.4 - 10.2
Little Egg Harbor	137	N 39.645941 W 74.238405	3.46	2.97	4.6 1.1 - 5.5	6.5 6.0 - 8.7	7.3 7.2 - 7.9	9.0 9.0 - 10.3
Little Egg Harbor	138	N 39.620717 W 74.262457	2.80	3.02	4.9 4.9 - 5.5	6.6 6.5 - 7.7	7.3 7.1 - 7.9	8.7 8.5 - 9.2

* For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

TABLE 9 - TRANSECT DATA (continued)

Flood Source	Transect	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations* (ft NAVD88)			
		Coordinates	Significant Wave Height	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Little Egg Harbor	139	N 39.604829 W 74.289976	3.79	3.53	5.0 5.0 - 5.5	6.8 6.8 - 7.7	7.5 7.5 - 7.9	8.9 8.9 - 9.1
Little Egg Harbor	140	N 39.587437 W 74.315901	4.03	3.45	5.1 5.1 - 5.2	7.0 6.9 - 7.1	7.7 7.7 - 7.8	9.1 9.1 - 9.4
Little Egg Harbor	141	N 39.578717 W 74.326213	3.85	3.21	5.3 5.3 - 5.4	7.2 7.2 - 7.4	7.9 7.9 - 8.1	9.4 9.4 - 9.8
Little Egg Harbor	142	N 39.574567 W 74.338923	4.56	3.42	5.4	7.4	8.1 8.1 - 8.2	9.7 9.7 - 10.7
Little Egg Harbor	143	N 39.544261 W 74.371058	3.84	3.54	7.9 6.0 - 8.4	8.7 8.1 - 8.8	9.0 9.0 - 9.2	11.1 10.9 - 11.5

* For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones. The 3-foot wave has been determined to be the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures. The one exception to the 3-foot wave criteria is where a PFD exists. The limit of the coastal high hazard area then becomes the landward toe of the PFD or where a 3-foot or greater breaking wave exists, whichever is most landward. The coastal high hazard zone is depicted on the FIRMs as Zone VE, where the delineated flood hazard includes wave heights equal to or greater than three feet. Zone AE is depicted on the FIRMs where the delineated flood hazard includes wave heights less than three feet. A depiction of how the Zones VE and AE are mapped is shown in Figure 2 (Transect Schematic).

Post-storm field visits and laboratory tests have confirmed that wave heights as small as 1.5 feet can cause significant damage to structures when constructed without consideration to the coastal hazards. Additional flood hazards associated with coastal waves include floating debris, high velocity flow, erosion, and scour which can cause damage to Zone AE-type construction in these coastal areas. To help community officials and property owners recognize this increased potential for damage due to wave action in the AE zone, FEMA issued guidance in December 2008 on identifying and mapping the 1.5-foot wave height line, referred to as the Limit of Moderate Wave Action (LiMWA). While FEMA does not impose floodplain management requirements based on the LiMWA, the LiMWA is provided to help communicate the higher risk that exists in that area. Consequently, it is important to be aware of the area between this inland limit and the Zone VE boundary as it still poses a high risk, though not as high of a risk as Zone VE, see Figure 2, "Transect Schematic”.

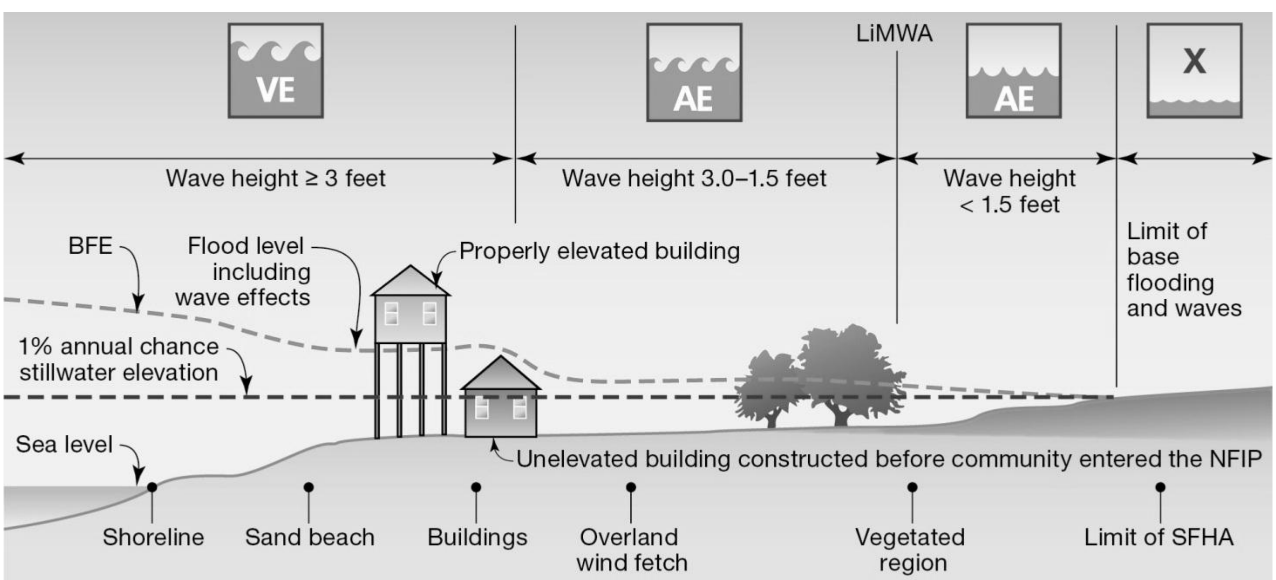

Figure 2. Transect Schematic

3.4 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the finalization of NAVD 88, 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 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in apparent differences in base flood elevations across the corporate limits between the communities.

Prior versions of the FIS report and FIRM were referenced to NGVD 29. When a datum conversion is effected for an FIS report and FIRM, the Flood Profiles and base flood elevations (BFEs) reflect the new datum values. To compare structure and ground elevations to 1-percent annual chance flood elevations shown in the FIS and on the FIRM, the subject structure and ground elevations must be referenced to the new datum values.

As noted above, the elevations shown in the FIS report and on the FIRMs for Ocean County referenced to the North American Vertical Datum of 1988 (NAVD 88). Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The conversion factor to NGVD 29 is +1.2 feet.

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the National Geodetic Survey at the following address:

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations of the 100-year and 500-year floodplains; and 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance 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.

Prior to the September 29, 2006, countywide FIS, 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.

In the Township of Berkeley, between cross sections, the boundaries were interpolated using topographic maps (U.S. Department of the Interior, 1953 et cetera; Berkeley Sewerage Authority, 1976; Ernst, Ernst and Lissenden, 1978; Leisure Technology, 1979; Township of Berkeley, 1979; Fellows, Read and Weber, Inc., 1979; Ernst, Ernst and Lissenden, 1974; Ernst, Ernst and Lissenden, 1968; Fellows, Read and Weber, Inc., 1976; U.S. Department of the Interior, 1989; USACE, 1995).

For the streams studied by approximate methods, the boundary of the 1-percent annual chance flood has been delineated using topographic maps (U.S. Department of the Interior, 1953 et cetera; Leisure Technology, 1976; Ernst, Ernst and Lissenden, 1979; Leisure Technology, 1979).

In the 1984 FIS, aerial photographs and glass aerial plotting plates (stereoscopic coverage) of the Township of Brick were obtained from Keystone Aerial Surveys (Keystone Aerial Surveys of Philadelphia, Pennsylvania, 1979). The aerial plotting plates generated the topographic maps used in the wave height analysis. The aerial photographs were used to determine the type, size, and density of vegetation and physical features. The 1- and 0.2-percent annual chance floodplain boundaries were delineated using topographic maps at a scale of 1:2,400, with a contour interval of 4 feet, developed by Dewberry & Davis (Dewberry & Davis, 1982).

For the September 29, 2006, countywide FIS, the topographic maps used to delineate the floodplain boundaries were from a digital base map prepared by Greenhorne and O'Mara, Inc., under contract to the USACE, Philadelphia District, and based on a Digital Terrain Model (DTM) compiled from aerial photography (Greenhorne and O'Mara, Inc., 1995; USACE, 1995). These topographic maps are at a scale of 1"=400' with a contour interval of 4 feet.

For the area studied by approximate methods, the 1-percent annual chance floodplain boundaries were delineated using the previously printed FIS for the Township of Toms River (FEMA, 1983).

For the Township of Eagleswood, the 1- and 0.2-percent annual chance boundaries were delineated using topographic maps of the study area at a scale of 1:4,800, with a contour interval of 4 feet (Digital Aerial Surveys, Inc., 1979).

For the areas studied by approximate methods, the boundary of the 1-percent annual chance flood was taken directly from the Flood Hazard Boundary Map (FHBM) for the Township of Eagleswood (U.S. Department of Housing and Urban Development, 1976).

For the portion of Blacks Branch studied by approximate methods, the boundary of the 1-percent annual chance flood was taken directly from the FHBM for the Borough of Lakehurst (U.S. Department of Housing and Urban Development, 1976).

For the flooding sources studied by approximate methods, the boundaries of the 1-percent annual chance floodplains were delineated using topographic maps taken from the previously printed FIS reports, FHBMs, and/or FIRMs for all of the incorporated jurisdictions within Ocean County.

For the [date] countywide FIS, the coastal boundaries were mapped using LiDAR data originated by RAMPP, collected in 2010, as part of the FEMA FIS update. For streams restudied in detailed methods, the 1- and 0.2-percent annual chance floodplain boundaries were mapped using LiDAR data acquired by Furgo EarthData, Inc, collected in 2011. Streams restudied by approximate methods were mapped using LiDAR data acquired by Furgo EarthData, Inc, collected in 2011.

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 VE, AE, AO, and A), 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 FIRMs (Exhibit 2).

New Jersey Flood Hazard Area Design Flood

For Cedar Creek and North Branch Forked River, the NJFHADF floodplain boundary was delineated in addition to the 1- and 0.2-percent-annual-chance boundaries. The State of New Jersey, Department of Environmental Protection (the Department) is mandated to delineate and regulate flood hazard areas pursuant to N.J.S.A. 58:16A-50 et seq., the Flood Hazard Area Control Act. This Act authorizes the Department to adopt land use regulations for development within the flood hazard areas, to control stream encroachments and to integrate the flood control activities of the municipal, county, State and Federal Governments.

The State's Flood Hazard Area delineations are defined by the New Jersey Flood Hazard Area Design Flood. In 1974, the Water Policy and Supply Council passed a resolution stating that the NJFHADF shall be equal to a design flood discharge 25 percent greater in flow than the 1-percent-annual chance flood.

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 foot and the State of New Jersey standards limit the increase to 0.2 feet, provided that hazardous velocities are not produced.. The floodways in this FIS are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain.

Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 10). 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.

In the Borough of Lakehurst, for Horicon Lake, which is formed on Blacks Branch, Old Hurricane Brook, and the uppermost portion of Union Branch, the floodway boundary is adjacent to the shoreline of the lake.

No floodways were computed for Long Swamp Creek, Manahawkin Mill Creek, Polhemus Branch, and Silver Bay Tributary.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 10 "Floodway Data" for certain downstream cross sections of Cedar Creek, North Branch Forked River, and Wrangel Brook are lower than the regulatory flood elevations in that area, which must take into account the 1-percent annual chance flooding due to backwater from other sources.

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 10, "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 0.2 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3.

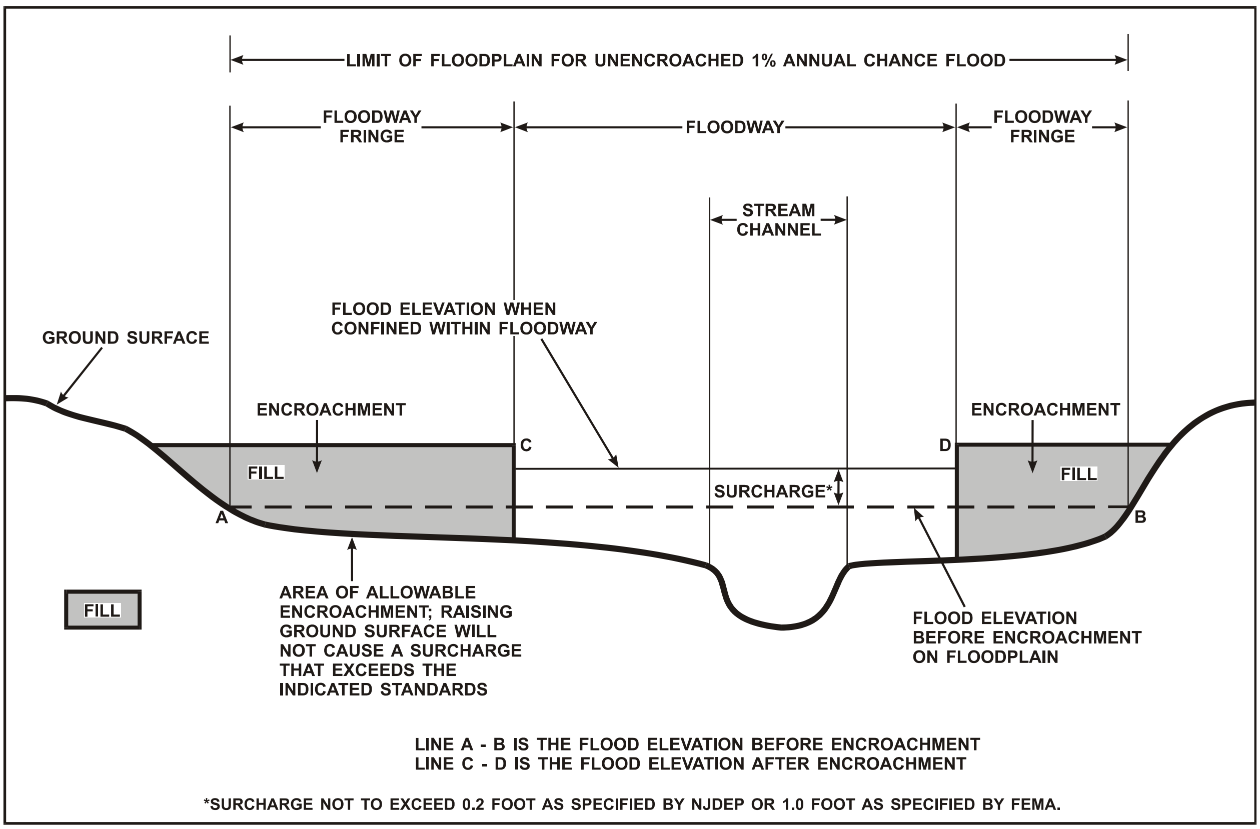

Figure 3. Floodway Schematic

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
Cabinfield Branch								
A	285	158	385	0.4	9.1	9.1	9.3	0.2
B	715	58	190	0.7	9.2	9.2	9.4	0.2
C	1,525	8	17	7.9	14.1	14.1	14.3	0.2
D	1,737	321	612	0.2	16.9	16.9	17.1	0.2
E	2,790	26	60	2.2	17.4	17.4	17.6	0.2
F	6,759	37	79	1.2	23.8	23.8	23.8	0.0
G	9,100	156	1,740	0.1	31.3	31.3	31.3	0.0
H	9,700	15	34	2.0	32.5	32.5	32.5	0.0
I	10,783	56	51	1.3	36.7	36.7	36.8	0.1
J	16,932	267	264	0.2	50.0	50.0	50.1	0.1
K	18,339	14	22	3.1	51.1	51.1	51.3	0.2
L	19,150	42	50	0.9	54.3	54.3	54.4	0.1
Cedar Creek								
A	23	139	510	2.6	*	0.3[2]	0.3[2]	0.0[2]
B	940	114	386	3.4	*	1.0[2]	1.0[2]	0.0[2]
C	1.249	96	359	3.6	*	1.2[2]	1.2[2]	0.0[2]
D	1.993	545	742	1.8	*	2.5[2]	2.5[2]	0.0[2]
E	2.382	479	334	3.9	*	2.7[2]	2.7[2]	0.0[2]
F	3.104	292	665	2.0	*	4.1[2]	4.1[2]	0.0[2]
G	4.501	420	734	1.8	*	5.2[2]	5.3[2]	0.1[2]
H	5.535	545	771	1.7	*	6.2[2]	6.3[2]	0.1[2]
I	6.453	770	1.438	0.9	*	7.1[2]	7.3[2]	0.2[2]
J	8.553	720	1.090	1.2	*	8.2[2]	8.4[2]	0.2[2]
K	10.354	530	839	1.6	8.6	8.6	8.8	0.2
L	11.686	554	649	2.0	9.4	9.4	9.6	0.2
M	14,099	841	993	1.3	10.8	10.8	10.9	0.1

[1] Feet above mouth

[2]Coastal flooding effects control NFIP regulatory Base Flood Elevations in this area. Riverine floodway data are provided for the purpose of a no-rise analysis in accordance with floodway determinations for development within the SFHA.

* Controlled by Tidal Flooding from Barnegat Bay

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

CABINFIELD BRANCH – CEDAR CREEK

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
Cedar Creek (continued)								
N	15,194[1]	520	1,085	1.2	12.0	12.0	12.1	0.1
O	15,803[1]	679	1,360	1.0	12.5	12.5	12.7	0.2
P	17,087[1]	756	1,581	0.8	13.1	13.1	13.3	0.2
Q	18,555[1]	790	1,337	1.0	13.9	13.9	14.0	0.1
R	20,239[1]	655	986	1.3	14.4	14.4	14.6	0.2
S	22,637[1]	609	1,078	1.2	16.0	16.0	16.1	0.1
T	24,513[1]	565	1,535	0.8	17.7	17.7	17.9	0.2
U	25,648[1]	472	1,136	1.1	18.5	18.5	18.7	0.2
V	27,095[1]	125	348	3.6	20.1	20.1	20.3	0.2
Crosswicks Creek								
A	90[2]	212	2,212	2.0	66.8	66.8	67.0	0.2
B	1,820[2]	269	2,723	1.7	67.3	67.3	67.5	0.2
C	2,840[2]	372	3,786	1.2	67.5	67.5	67.7	0.2
D	4,080[2]	226	2,134	2.1	67.7	67.7	67.9	0.2
E	5,220[2]	214	2,011	2.2	68.1	68.1	68.3	0.2
F	6,080[2]	160	1,958	2.3	68.5	68.5	68.7	0.2
G	6,180[2]	135	1,751	2.6	71.2	71.2	71.4	0.2
H	7,060[2]	175	2,644	1.7	71.5	71.5	71.7	0.2
I	7,330[2]	235	3,095	1.5	71.6	71.6	71.8	0.2
J	7,639[2]	160	1,988	2.1	72.2	72.2	72.3	0.1
K	7,919[2]	332	3,881	1.1	72.5	72.5	72.7	0.2
L	9,284[2]	341	3,263	1.3	72.5	72.5	72.7	0.2
M	10,528[2]	235	3,123	1.3	72.5	72.5	72.7	0.2
N*	12,338[2]	199	2,459	1.7	72.6	72.6	72.8	0.2

*Cross Section is outside the Ocean County boundary
[1] Feet above mouth
[2] Feet above Township of Plumsted/Monmouth County corporate limits

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

CEDAR CREEK – CROSSWICKS CREEK

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
Giffords Mill Branch								
A	2,040[1]	378	762	0.4	10.0	10.0	10.2	0.2
B	2,720[1]	120	95	2.9	10.8	10.8	10.8	0.0
C	4,185[1]	250	1,048	0.3	12.8	12.8	13.0	0.2
D	5,000[1]	232	940	0.3	14.1	14.1	14.2	0.1
E	6,140[1]	188	440	0.6	14.4	14.4	14.5	0.1
F	7,110[1]	84	224	1.2	17.0	17.0	17.0	0.0
Green Branch								
A	100[2]	800	1,501	0.2	34.4	34.4	34.6	0.2
B	2,000[2]	90	77	2.9	36.2	36.2	36.4	0.2
C	3,025[2]	29	70	3.1	38.1	38.1	38.3	0.2
D	3,278[2]	245	1,883	0.1	42.9	42.9	42.9	0.0
E	4,200[2]	159	1,019	0.2	42.9	42.9	42.9	0.0
F	4,592[2]	269	2,058	0.1	47.7	47.7	47.7	0.0
G	5,345[2]	219	2,331	0.1	47.7	47.7	47.7	0.0
H	5,645[2]	208	2,099	0.1	48.8	48.8	48.8	0.0
I	6,450[2]	176	1,684	0.1	48.8	48.8	48.8	0.0

[1]Feet above confluence with Mill Branch
[2]Feet above confluence with Kettle Creek

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

GIFFORDS MILL BRANCH – GREEN BRANCH

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
Jakes Branch								
A	3,320[1]	247	652	1.0	9.1	9.1	9.1	0.0
B	4,075[1]	478	379	1.6	9.3	9.3	9.3	0.0
C	5,350[1]	46	217	2.9	10.6	10.6	10.6	0.0
D	5,424[1]	205	438	1.4	10.8	10.8	10.8	0.0
E	6,580[1]	41	125	5.0	13.8	13.8	13.9	0.1
F	6,830[1]	293	503	1.2	15.0	15.0	15.1	0.1
G	7,447[1]	47	159	3.9	16.8	16.8	16.8	0.0
H	8,355[1]	166	349	1.8	17.9	17.9	18.1	0.2
I	9,360[1]	483	541	1.1	19.3	19.3	19.5	0.2
Kettle Creek								
A	28,600[2]	620	1,592	0.3	34.4	34.4	34.6	0.2
B	29,090[2]	640	6,008	0.1	40.4	40.4	40.6	0.2
C	30,150[2]	691	5,729	0.1	40.4	40.4	40.6	0.2
D	31,050[2]	348	2,666	0.2	40.4	40.4	40.6	0.2
E	31,900[2]	220	1,622	0.3	40.4	40.4	40.6	0.2
F	32,215[2]	96	304	0.3	41.1	41.1	41.3	0.2
G	35,005[2]	141	105	3.9	45.5	45.5	45.7	0.2
H	36,443[2]	95	244	0.4	51.1	51.1	51.1	0.0

[1]Feet above confluence with Toms River
[2]Feet above mouth

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

JAKES BRANCH – KETTLE CREEK

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
North Branch Forked River								
A	9.803[1]	131	956	1.0	*	0.3[4]	0.3[4]	0.0[4]
B	10.748[1]	1.135	5.930	0.2	*	7.5[4]	7.5[4]	0.0[4]
C	11.788[1]	743	2.058	0.5	7.7	7.7	7.8	0.1
D	12.039[1]	605	1.869	0.5	7.7	7.7	7.8	0.1
E	13.119[1]	670	5.301	0.2	14.9	14.9	14.9	0.0
F	13.852[1]	993	6.710	0.1	14.9	14.9	14.9	0.0
G	14.790[1]	1.217	5.802	0.2	14.9	14.9	14.9	0.0
H	15.790[1]	415	795	1.2	14.9	14.9	14.9	0.0
I	16.790[1]	482	810	1.1	15.8	15.8	15.9	0.1
J	17.244[1]	627	923	1.0	16.4	16.4	16.6	0.2
K	18.769[1]	872	4.598	0.2	22.5	22.5	22.5	0.0
L	19.792[1]	729	3.095	0.3	22.5	22.5	22.5	0.0
M	20.698[1]	454	750	1.2	22.5	22.5	22.5	0.0
N	21.790[1]	575	966	0.9	23.8	23.8	24.0	0.2
O	22.411[1]	528	767	1.0	24.8	24.8	24.9	0.1
P	23.292[1]	89	315	2.5	27.9	27.9	27.9	0.0
North Branch Metedeconk River								
A	1,000[2]	427[3]	2,231	0.6	8.5	8.5	8.7	0.2
B	1,765[2]	208[3]	866	1.5	9.2	9.2	9.4	0.2
C	2,064[2]	344[3]	1,108	1.1	9.4	9.4	9.6	0.2
D	5,934[2]	347[3]	1,235	1.0	11.4	10.8	11.0	0.2
E	9,350[2]	300[3]	664	1.9	14.4	14.4	14.5	0.1
F	12,400[2]	179[3]	1,000	1.3	19.2	19.2	19.4	0.2

[1]Feet above Barnegat Bay
[2]Feet above mouth
[3]This width extends beyond county boundary
*Controlled by Tidal Flooding from Barnegat Bay
[4]Coastal flooding effects control NFIP regulatory Base Flood Elevations in this area.
Riverine floodway data are provided for the purpose of a no-rise analysis in accordance with floodway determinations for development within the SFHA.

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

NORTH BRANCH FORKED RIVER – NORTH BRANCH METEDECONK 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
North Branch Metedeconk River (continued)								
G	14,740	162	804	1.6	23.4	23.4	23.5	0.1
H	26,310	105	362	2.2	37.1	37.1	37.3	0.2
I	26,800	262	676	1.2	39.0	39.0	39.1	0.1
J	29,900	371	1,437	0.6	44.3	44.3	44.5	0.2
K	32,390	88	446	2.0	49.0	49.0	49.2	0.2
L	34,000	115	386	2.3	51.0	51.0	51.2	0.2
M	39,685	184	1,129	0.8	59.7	59.7	59.9	0.2
N	41,800	357	2,335	0.4	63.0	63.0	63.2	0.2
O	42,700	455	2,823	0.3	63.5	63.5	63.7	0.2
P	44,445	231	557	1.5	63.5	63.5	63.7	0.2
Q	45,395	330	1,053	0.8	65.3	65.3	65.4	0.1
R	46,260	321	1,147	0.7	66.5	66.5	66.7	0.2
S	47,095	452	1,798	0.5	67.5	67.5	67.7	0.2
T	49,570	125	878	1.0	68.7	68.7	68.9	0.2
U	50,675	152	525	1.5	69.7	69.7	69.9	0.2
V	51,815	166	693	1.1	71.0	71.0	71.2	0.2
W	52,915	190	609	1.3	72.3	72.3	72.4	0.1
X	53,715	180	650	1.2	73.4	73.4	73.4	0.0
Y	54,545	131	569	1.4	74.5	74.5	74.5	0.0
Z	55,110	183	617	1.3	75.3	75.3	75.4	0.1
AA	55,805	196	819	1.0	76.5	76.5	76.6	0.1
AB	56,965	130	859	0.0	77.6	77.6	77.7	0.1
AC	57,945	110	342	2.3	78.4	78.4	78.5	0.1
AD	59,710	97	398	1.7	79.9	79.9	80.1	0.2

[1]Feet above mouth
[2] This width extends beyond county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

NORTH BRANCH METEDECONK 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
North Branch Metedeconk River (continued)								
AE	60,530[1]	424[4]	1,017	0.7	80.5	80.5	80.7	0.2
AF	61,840[1]	402[4]	1,349	0.5	81.6	81.6	81.7	0.1
AG	62,845[1]	178[4]	1,012	0.7	84.5	84.5	84.6	0.1
AH	63,930[1]	99[4]	283	2.1	85.4	85.4	85.6	0.2
AI	64,480[1]	125[4]	665	0.9	87.5	87.5	87.7	0.2
AJ	65,930[1]	212[4]	890	0.7	88.3	88.3	88.5	0.2
AK	66,960[1]	194[4]	871	0.7	89.2	89.2	89.4	0.2
AL	67,960[1]	90[4]	476	1.3	90.0	90.0	90.1	0.1
AM*	69,640[1]	40[4]	247	2.3	91.1	91.1	91.3	0.2
AN*	70,845[1]	78[4]	424	1.3	92.0	92.0	92.2	0.2
Old Hurricane Brook								
A	3,975[2]	693	2,837	0.2	62.5	62.5	62.7	0.2
B	5,430[2]	484	1,988	0.3	62.5	62.5	62.7	0.2
Potter Creek								
A	3,200[3]	174	269	0.4	22.3	22.3	22.4	0.1
B	3,500[3]	17	19	6.1	23.2	23.2	23.2	0.0
C	4,100[3]	119	107	0.8	26.5	26.5	26.7	0.2
D	4,900[3]	34	46	1.5	29.6	29.6	29.8	0.2

*Cross Section is outside the Ocean County boundary
[1]Feet above mouth
[2]Feet above confluence with Union Branch
[3]Feet above U.S. Route 9
[4]This width extends beyond county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

NORTH BRANCH METEDECONK RIVER – OLD HURRICANE BROOK – POTTER CREEK

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
Ridgeway Branch								
A	520[1]	58	273	4.2	34.2	31.4[3]	31.6[3]	0.2
B	2,150[1]	89	355	3.2	34.2	33.8[3]	34.0[3]	0.2
C	4,150[1]	200	918	1.2	35.9	35.9	36.0	0.1
D	7,220[1]	118	699	1.6	38.6	38.6	38.7	0.1
E	7,755[1]	86	345	3.3	39.4	39.4	39.5	0.1
F	9,700[1]	68	371	4.2	40.4	40.4	40.6	0.2
G	10,900[1]	45	345	4.5	41.5	41.5	41.7	0.2
H	12,225[1]	45	176	6.2	42.9	42.9	43.1	0.2
I	14,360[1]	56	281	3.9	46.9	46.9	47.1	0.2
J	15,620[1]	120	516	2.1	47.6	47.6	47.8	0.2
K	16,700[1]	225	589	1.9	49.3	49.3	49.5	0.2
L	17,365[1]	92	501	2.2	49.5	49.5	49.7	0.2
M	18,460[1]	52	201	5.4	49.7	49.7	49.8	0.1
N	20,450[1]	35	186	5.9	50.9	50.9	51.1	0.2
O	22,875[1]	548	1,487	0.7	55.8	55.8	56.0	0.2
P	23,140[1]	310	1,012	1.1	56.0	56.0	56.2	0.2
Schoolhouse Branch								
A	305[2]	31	70	0.9	18.0	18.2	18.2	0.2
B	2,565[2]	13	26	2.3	22.1	22.1	22.1	0.0
C	3,105[2]	22	40	1.5	22.8	23.0	23.0	0.2
D	3,743[2]	9	37	2.2	24.1	24.3	24.3	0.2
E	3,978[2]	9	45	1.3	24.2	24.4	24.4	0.2

[1]Feet above confluence with Union Branch
[2]Feet above confluence with Cabinfield Branch
[3]Elevation computed without consideration of backwater effects from Union Branch

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

RIDGEWAY BRANCH – SCHOOLHOUSE BRANCH

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
South Branch Metedeconk River								
A	1,505[1]	363	1,029	1.1	8.8	8.8	9.0	0.2
B	5,200[1]	364	1,251	0.9	13.9	13.9	14.0	0.1
C	9,178[1]	149	770	1.4	17.2	17.2	17.3	0.1
D	21,980[1]	140	970	1.1	42.9	42.9	43.1	0.2
E	22,305[1]	183	1,433	0.8	42.9	42.9	42.9	0.0
F	22,775[1]	66	666	1.6	43.0	43.0	43.0	0.0
G	25,000[1]	550	3,816	0.3	43.0	43.0	43.0	0.0
H	28,100[1]	600	3,502	0.2	43.1	43.1	43.1	0.0
I	31,175[1]	448	1,237	0.8	43.2	43.2	43.4	0.2
J	34,347[1]	146	511	2.1	45.8	45.8	45.9	0.1
K	35,280[1]	83	290	3.7	46.6	46.6	46.8	0.2
Stony Ford Brook								
A	310[2]	122	1,453	0.6	71.2	71.2[3]	71.2[3]	0.0
B	505[2]	82	827	1.0	71.2	71.2[3]	71.2[3]	0.0
C	840[2]	138	1,229	0.7	71.2	71.2[3]	71.2[3]	0.0
D	1,600[2]	152	617	1.1	71.2	71.2[3]	71.2[3]	0.0
E	2,500[2]	120	463	1.1	71.2	71.3[3]	71.3[3]	0.0
F	2,780[2]	50	117	4.2	71.2	71.3[3]	71.3[3]	0.0
G	2,945[2]	60	315	1.6	73.2	73.2	73.2	0.0
H	3,332[2]	49	95	5.2	74.2	74.2	74.3	0.1
I	3,728[2]	81	208	1.6	75.9	75.9	76.0	0.1

[1]Feet above mouth
[2]Feet above confluence with Crosswicks Creek
[3]Elevation computed without consideration of backwater effects from Crosswicks Creek

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

FLOODWAY DATA

SOUTH BRANCH METEDECONK RIVER – STONY FORD 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
Sunken Branch								
A	1,225[1]	60	705	0.9	19.4	19.4	19.5	0.1
B	1,715[1]	65	230	2.8	21.8	21.8	21.8	0.0
C	2,820[1]	66	443	1.4	22.2	22.2	22.2	0.0
D	3,655[1]	61	377	1.7	28.0	28.0	28.0	0.0
E	4,300[1]	175	1,575	0.4	28.0	28.0	28.0	0.0
F	6,245[1]	134	660	0.6	29.8	29.8	29.8	0.0
G	9,080[1]	55	256	1.4	33.8	33.8	33.8	0.0
H	10,044[1]	125	124	2.8	37.6	37.6	37.6	0.0
I	10,295[1]	248	652	0.5	41.9	41.9	42.1	0.2
J	11,890[1]	374	150	2.3	43.2	43.2	43.2	0.0
K	13,390[1]	39	180	1.9	46.9	46.9	47.1	0.2
Tarkiln Branch Kettle Creek								
A	100[2]	179	1,171	0.1	44.9	44.9	50.1	0.2
B	1,355[2]	212	1,114	0.1	44.9	44.9	50.1	0.2
C	1,645[2]	263	2,515	0.1	50.2	50.2	50.4	0.2
Toms River								
A	56,630[3]	53	257	5.9	20.9	20.9	21.1	0.2
B	57,830[3]	140	392	3.9	24.7	24.7	24.9	0.2
C	58,575[3]	65	299	5.1	25.8	25.8	25.9	0.1
D	60,600[3]	62	296	5.1	27.5	27.5	27.7	0.2
E	62,650[3]	127	366	4.1	31.8	31.8	32.0	0.2
F	65,600[3]	175	713	2.1	33.5	33.5	33.7	0.2
G	68,690[3]	60	384	3.9	34.4	34.4	34.6	0.2
H	71,240[3]	85	319	4.8	36.9	36.9	37.0	0.1

[1]Feet above mouth
[2]Feet above confluence with Kettle Creek
[3]Feet above confluence with Barnegat Bay

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

SUNKEN BRANCH – TARKILN BRANCH KETTLE CREEK – TOMS 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
Toms River (continued)								
I	74,440[1]	204	525	2.9	40.1	40.1	40.3	0.2
J	76,100[1]	313	1,048	1.4	41.5	41.5	41.7	0.2
K	76,434[1]	213	698	2.2	42.0	42.0	42.0	0.0
L	78,240[1]	156	344	4.4	43.6	43.6	43.8	0.2
M	80,170[1]	289	857	1.8	45.9	45.9	46.1	0.2
N	82,900[1]	35	238	6.4	47.7	47.7	47.9	0.2
O	87,000[1]	192	714	2.1	52.0	52.0	52.2	0.2
P	89,400[1]	128	369	4.1	53.7	53.7	53.9	0.2
Q	90,500[1]	607	1,664	0.9	55.0	55.0	55.2	0.2
Tributary to Ridgeway Branch								
A	365[2]	20	57	4.7	42.7	42.7	42.9	0.2
B	1,330[2]	138	449	0.6	54.6	54.6	54.6	0.0
C	2,230[2]	170	324	0.8	54.7	54.7	54.7	0.0
D	3,250[2]	556	2,498	0.1	58.3	58.3	58.5	0.2
Tributary to Toms River								
A	3,069[3]	323	2,133	0.2	114.8	114.8	115.0	0.2
B	3,729[3]	323	2,133	0.2	114.8	114.8	115.0	0.2
C	4,729[3]	203	711	0.6	114.8	114.8	115.0	0.2
D	5,799[3]	29	103	4.2	114.8	114.8	115.0	0.2
E	6,799[3]	28	91	4.7	116.6	116.6	116.8	0.2
F	7,649[3]	61	163	2.6	118.2	118.2	118.4	0.2
G	8,689[3]	53	108	4.0	120.0	120.0	120.2	0.2
H	9,654[3]	53	147	2.9	122.7	122.7	122.9	0.2
I	10,774[3]	122	285	1.5	124.1	124.1	124.3	0.2

[1]Feet above confluence with Barnegat Bay
[2]Feet above confluence with Ridgeway Branch
[3]Feet above confluence with Toms River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

TOMS RIVER – TRIBUTARY TO RIDGEWAY BRANCH – TRIBUTARY TO TOMS 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
Wrangel Brook								
A	650	293	662	2.3	*	3.0[2]	3.1[2]	3.1[2]
B	3,230	296	1,118	1.4	7.3	7.3	7.4	0.1
C	5,090	206	1,057	1.5	8.7	8.7	8.8	0.1
D	11,140	53	204	5.2	12.6	12.6	12.7	0.1
E	12,770	90	371	2.9	15.6	15.6	15.7	0.1
F	13,140	122	623	1.7	16.6	16.6	16.8	0.2
G	16,030	80	329	3.2	19.3	19.3	19.4	0.1
H	20,480	189	550	1.9	25.3	25.3	25.3	0.0
I	23,355	433	1,253	0.5	27.1	27.1	27.3	0.2
J	25,935	277	499	1.2	30.8	30.8	31.0	0.2

[1]Feet above mouth
[2]Coastal flooding effects control NFIP regulatory Base Flood Elevations in this area. Riverine floodway data are provided for the purpose of a no-rise analysis in accordance with floodway determinations for development within the SFHA.
* Data superseded by updated coastal analyses

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

WRANGEL BROOK

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 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 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.

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 NJFHADF line is also shown for Cedar Creek and North Branch Forked River.

The current FIRM presents flooding information for the entire geographic area of Ocean County. Historical data relating to the maps prepared for each community are presented in Table 11, "Community Map History."

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Barnegat Light, Borough of	June 5, 1970	None	April 2, 1971	July 1, 1974 May 14, 1976 May 1, 1984 March 23, 1999
Barnegat, Township of	May 31, 1974	June 4, 1976 March 14, 1980	December 15, 1982	
Bay Head, Borough of	November 6, 1970	None	August 17, 1971	July 1, 1974 April 18, 1975 March 19, 1976 December 15, 1983 September 7, 2000
Beach Haven, Borough of	June 17, 1970	None	April 2, 1971	September 2, 1975 March 18, 1977 May 1, 1984 March 23, 1999
Beachwood, Borough of	June 28, 1974	None	May 1, 1979	March , 1983

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Berkeley, Township of	August 2, 1974	August 13, 1976	May 19, 1981	September 18, 1987 July 15, 1992 June 3, 2002
Brick, Township of	August 4, 1972	None	August 4, 1972	June 10, 1977 March 1, 1984 July 15, 1992
Eagleswood, Township of	July 26, 1974	March 19, 1976	February 16, 1983	
Harvey Cedars, Borough of	May 26, 1970	None	April 2, 1971	July 1, 1974 February 13, 1976 May 1, 1984 March 23, 1999
Island Heights, Borough of	July 19, 1974	December 19, 1975	July 15, 1979	May 16, 1983
Jackson, Township of	January 24, 1975	None	September 16, 1982	
Lacey, Township of	January 24, 1975	None	September 1, 1977	
Lakehurst, Borough of	June 28, 1974	February 6, 1976	December 15, 1982	
Lakewood, Township of	January 16, 1974	None	March 15, 1977	January 18, 1989

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Lavallette, Borough of	September 11, 1970	None	June 11, 1971	July 1, 1974 May 23, 1975 January 5, 1984 November 22, 1999
Little Egg Harbor, Township of	May 10, 1974	February 27, 1976	September 1, 1983	July 15, 1992
Long Beach, Township of	May 26, 1970	None	July 1, 1974	March 5, 1976 July 15, 1992 March 23, 1999
Manchester, Township of	October 18, 1974	June 4, 1976	May 2, 1983	
Mantoloking, Borough of	May 31, 1974	None	September 30, 1977	January 5, 1984 December 20, 2000
Ocean Gate, Borough of	May 31, 1974	June 3, 1977	May 19, 1981	
Ocean, Township of	February 28, 1975	January 6, 1983	September 26, 1986	
Pine Beach, Borough of	June 28, 1974	March 19, 1976	August 11, 1978	November 6, 1981
Plumsted, Township of	June 28, 1974	July 23, 1976	September 30, 1981	March 2, 1982
Point Pleasant Beach, Borough of	November 23, 1973	September 12, 1975	June 15, 1979	February 15, 1984 June 2, 1999

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Point Pleasant, Borough of	July 2, 1972	None	July 2, 1972	July 1, 1974 April 9, 1976 June 13, 1980
Seaside Heights, Borough of	March 22, 1974	March 19, 1976	July 16, 1979	December 15, 1983
Seaside Park, Borough of	August 17, 1971	None	August 17, 1971	July 1, 1974 September 5, 1975 March 19, 1976 May 5, 1984
Ship Bottom, Borough of	May 26, 1970	None	April 2, 1971	July 1, 1974 August 29, 1975 May 1, 1984 March 23, 1999
South Toms River, Borough of	July 26, 1974	July 23, 1976	January 6, 1983	
Stafford, Township of	September 2, 1970	None	September 14, 1979	July 15, 1992 May 21, 2001
Surf City, Borough of	May 26, 1970	None	April 2, 1971	July 1, 1974 November 7, 1975 May 1, 1984 March 23, 1999

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Toms River, Township of*	March 22, 1972	None	March 22, 1972	July 1, 1974 April 23, 1976 June 15, 1983 August 5, 1991
Tuckerton, Borough of	March 1, 1974	June 25, 1976	May 2, 1983	

*Formerly Township of Dover. Community Name was changed in November 2006.

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

FISs have been prepared for the following communities in Ocean County, New Jersey: the Boroughs of Barnegat Light, (FEMA, 1999), Bay Head, (FEMA, 2000), Beach Haven, (FEMA, 1999), Beachwood (FEMA, 1982), Harvey Cedars, (FEMA, 1999), Island Heights, (FEMA, 1982), Lakehurst, FEMA, 1982), Lavallette, (FEMA, 1999), Mantoloking, (FEMA, 2000), Ocean Gate, (FEMA, 1980), Point Pleasant Beach (FEMA, 1999), Seaside Heights, (FEMA, 1983), Seaside Park, (FEMA 1983), Ship Bottom, (FEMA, 1999), South Toms River, (FEMA, 1982), Surf City, (FEMA, 1999), and Tuckerton, (FEMA, 1982); Townships of Barnegat (FEMA, 2000), Berkeley, (FEMA, 2002), Brick, (FEMA, 1989), Toms River (FEMA, 1991), Eagleswood (FEMA, 1982), Jackson, (FEMA, 1982), Lacey, (U.S. Department of Housing and Urban Development, 1977), Lakewood, (U.S. Department of Housing and Urban Development, 1977), Little Egg Harbor (FEMA, 1983), Long Beach, (FEMA, 1999), Manchester, FEMA, 1982), Ocean, (FEMA, 1982), Plumsted, (FEMA, 1981), and Stafford (FEMA, 1991).

FIRMs have been published for the Boroughs of Pine Beach, (FEMA, 1981) and Point Pleasant, (U.S. Department of Housing and Urban Development, 1980).

A FIS has been prepared for the Township of Galloway, (FEMA, 1982), Atlantic County, New Jersey. FISs have been prepared for the following communities in Burlington County, New Jersey: the Townships of Bass River, (FEMA, 1982), Pemberton, (FEMA, 1979), and Woodland, (FEMA, 1981).

FIRMs have been published for the following communities in Burlington County, New Jersey: the Townships of New Hanover, (U.S. Department of Housing and Urban Development, 1979), and North Hanover, (U.S. Department of Housing and Urban Development, 1979).

FISs have been prepared for the following communities in Monmouth County, New Jersey: the Boroughs of Brielle, (FEMA, 1983), and Manasquan, (FEMA, 1983), and the Townships of Freehold, (FEMA, 1982), Howell, (FEMA, 1982), Millstone, (FEMA, 1981), and Wall (U.S. Department of Housing and Urban Development, 1976).

A FIRM has been published for the Township of Upper Freehold (FEMA, 1981), Monmouth County, New Jersey.

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Ocean County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS Reports, FHBMs, FBFMs, and FIRMs for all of the incorporated jurisdictions within Ocean 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, 26 Federal Plaza, Room 1351, New York, New York 10278.

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