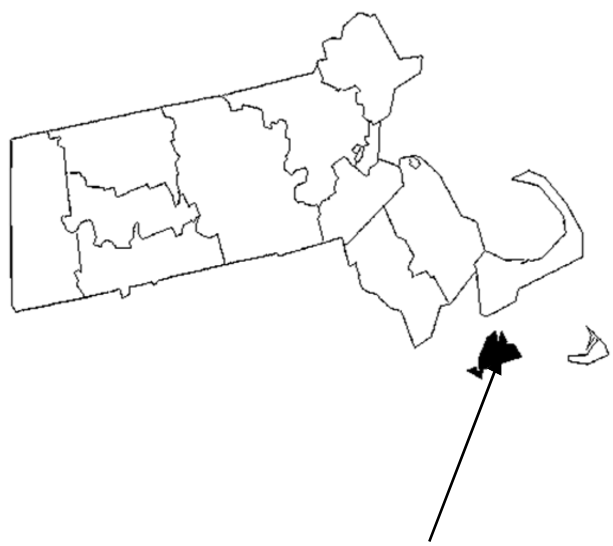
FLOOD INSURANCE STUDY

DUKES COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
AQUINNAH, TOWN OF	250070
CHILMARK, TOWN OF	250068
EDGARTOWN, TOWN OF	250069
GOSNOLD, TOWN OF	250071
OAK BLUFFS, TOWN OF	250072
TISBURY, TOWN OF	250073
WEST TISBURY, TOWN OF	250074



Dukes County

REVISED PRELIMINARY
APRIL 27 2015

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
25007CV000B

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.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

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

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

Initial Countywide FIS Effective Date: July 6, 2010

Revised Coastal FIS Effective Date:

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FLOOD INSURANCE STUDY
DUKES COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Dukes County, including the Towns of Aquinnah (formerly known as Gay Head), Chilmark, Edgartown, Gosnold, Oak Bluffs, Tisbury, and West Tisbury; the Wampanoag Tribe of Gay Head (Aquinnah) (referred to collectively herein as Dukes County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgments

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

This FIS was prepared to incorporate all the communities within Dukes County into a countywide FIS. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below:

Aquinnah, Town of:	For the original October 15, 1985, FIS, the hydrologic and hydraulic analyses were prepared by PRC Harris for FEMA, under Contract No. H-4776. That work was completed in September 1983. (Reference 1)
	For the September 29, 1996 revision, the hydraulic analyses were prepared by ENSR Consulting and Engineering for FEMA, under Contract No. EMW-91-C-3374. This work was completed in March 1991. (Reference 1)

Chilmark, Town of:	The hydrologic and hydraulic analyses for the October 15, 1985 FIS were prepared by PRC Harris for the Federal Emergency Management Agency (FEMA), under Contract NO. H-4776. This work was completed in September 1983. (Reference 2)
Edgartown, Town of:	The hydrologic and hydraulic analyses for the original September 18, 1984, FIS, were prepared by Anderson-Nichols & Co., Inc., for FEMA, under Contract No. H-4605. That work was completed in August 1983. (Reference 3)
	The hydrologic and hydraulic analyses for the July 16, 1997 FIS revision, were prepared by ENSR Consulting for FEMA, under Contract No. EMW-91-C-3374. This work was completed in March 1991. (Reference 3)
Gosnold, Town of:	The hydrologic and hydraulic analyses for the June 3, 1986 FIS were prepared by Anderson-Nichols & Co., Inc., for the FEMA, under Contract No. H-4605. This work was completed in August 1983. (Reference 4)
Oak Bluffs, Town of:	The hydrologic and hydraulic analyses for the September 18, 1984 FIS were prepared by Anderson-Nichols & Co., Inc., for FEMA, under Contract No. H4605. This work was completed in August 1983. (Reference 5)
Tisbury, Town of:	The hydrologic and hydraulic analyses for the December 15, 1983 FIS were prepared by Anderson-Nichols and Co., Inc., for FEMA, under Contract No. H-4605. The wave height analysis was performed by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. This work was completed in July 1982. (Reference 6)

West Tisbury, Town of:	The hydrologic and hydraulic analyses for the original October 15, 1985, FIS, were prepared by PRC Harris for FEMA, under Contract No. H-4776. That work was completed in August 1983. (Reference 7) The hydrologic and hydraulic analyses for the September 29, 1996 FIS revision, were prepared by ENSR Consulting for FEMA, under Contract No. EMW-91-C-3374. This work was completed in March 1991. (Reference 7)

Base map information shown on the FIRM for the countywide revision was derived from digital orthophotography. Base map files were provided in digital form by Massachusetts Geographic Information System (MassGIS). Ortho imagery was produced at a scale of 1:5,000. Aerial photography is dated April 2005. The projection used in the preparation of this map was Massachusetts State Plane island zone (FIPSZONE2002). The horizontal datum was NAD83, GRS1980 spheroid.

The coastal hydrologic and hydraulic analyses for this coastal study, was performed by Strategic Alliance for Risk Reduction (STARR) for FEMA under Contract No. HSFE01-09-J-001. This study was completed November 6, 2012. This new study resulted in revisions to the Special Flood hazard Areas (SFHAs) within the coastal communities of the Towns of Aquinnah, Chilmark, Edgartown, Gosnold, Oak Bluffs, Tisbury, and West Tisbury and the Wampanoag Tribe of Gay Head (Aquinnah).

For this coastal revision, STARR collected Light Detection and Ranging (LiDAR) covering 64.2 square miles of the Dukes County coastline in 2011. The LiDAR was captured to the ‘highest’ vertical accuracy requirement which is the equivalent of a 2-foot contour accuracy. A 2 foot Digital Elevation Model (DEM) was derived from the LiDAR data. The DEM was projected in State Plane Massachusetts FIPS Zone 2002 NAD 1983 US foot and used as the basis for coastal analysis and floodplain boundary delineation.

The LiDAR data does not cover elevations below the water surface; therefore, bathymetry data was downloaded from the National Oceanic and Atmospheric Administration (NOAA) Coastal Relief Model (CRM), (Reference 8). The source data for the bathymetric products were soundings collected by The National Ocean Service. Bathymetric data was converted from MLLW datum to NAVD88 with the NOAA VDatum Software. Where the CRM failed to provide data, elevations were taken from current NOAA nautical charts.

1.3 Coordination

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

The dates of the pre-countywide initial, intermediate and final CCO meetings held for the incorporated communities within Dukes County are shown in Table 1, "CCO Meeting Dates for Pre-countywide FISs."

TABLE 1 – CCO MEETING DATES FOR PRE-COUNTYWIDE

Community Name	Initial CCO Date	Intermediate CCO Dates	Final CCO Date
Aquinnah, Town of	June 21, 1990	*	September 21, 1995
Chilmark, Town of	April 6, 1978	November 9, 1983	October 23, 1984
Edgartown, Town of	June 21, 1990	*	September 21, 1995
Gosnold, Town of	August 5, 1977	*	*
Oak Bluffs, Town of	August 11, 1977	July 22, 1983 January 16, 1979 August 15, 1979	March 1, 1984
Tisbury, Town of	August 4, 1977	May 22, 1981	June 27, 1983
West Tisbury, Town of	June 21, 1990	November 9, 1983	September 21, 1995

* Data Not Available

For this coastal revision, initial CCO meeting was held on March 24, 2011. The meetings were attended by representatives of Dukes County, FEMA, Martha's Vineyard Commission (MVC), Massachusetts Department of Conservation and Recreation (MA DCR), STARR, and the communities.

A final CCO meeting for this coastal revision was held on;

For the countywide revision, the initial CCO meeting was held on October 27, 2006. The meeting was attended by representatives from the Towns of Edgartown, Oak Bluffs, Tisbury, and West Tisbury, as well as from FEMA; Ocean and Coastal Consultants, Inc. (OCC); CDM; MA DCR; and MVC.

The results of the study were reviewed at the final CCO meeting held on November 13, 2008, and was attended by representatives from the Towns of Chilmark, Edgartown, Oak Bluffs, and West Tisbury, as well as from FEMA; Ocean and Coastal Consultants, Inc. (OCC); CDM; Massachusetts Department of Conservation and Recreation (MA DCR); and Martha's Vineyard Commission (MVC). All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

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

For the countywide FIS, no new flooding sources were studied by detailed methods.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods in the pre-countywide FISs. Limits of detailed study are indicated on the FIRM. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Flooding Source	Description
Atlantic Ocean	Coastal flooding and its wave action in the Towns of Aquinnah, Chilmark, Edgartown, West Tisbury, and in the Wampanoag Tribe of Gay Head (Aquinnah) and shallow flooding and ponding in the Towns of Chilmark, Oak Bluffs, and West Tisbury.
Buzzards Bay	Coastal flooding including its wave action in Gosnold, Town of.
Lagoon Pond	Coastal flooding including its wave action in Tisbury, Town of.
Squibnocket Pond	Coastal flooding including its wave action in the Towns of Aquinnah and Chilmark and in the Wampanoag Tribe of Gay Head (Aquinnah).
Tiasquam River	Coastal flooding including its wave action in the Towns of Chilmark and West Tisbury.
Tisbury Great Pond	Coastal flooding including its wave action in the Towns of Chilmark and West Tisbury.

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS -continued

Town Cove	Coastal flooding including its wave action in the Towns of Chilmark and West Tisbury.
Vineyard Haven Harbor	Coastal flooding including its wave action in Tisbury, Town of.
Vineyard Sound	Coastal flooding including its wave action in the Towns of Aquinnah, Gosnold, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah); and Tidal flooding in the Towns of Chilmark and Tisbury.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision (LOMR)), as shown in Table 3, "Letters of Map Change."

TABLE 3 – LETTERS OF MAP CHANGE

Community	Case Number	Flooding Source	Letter Date
Oak Bluffs, Town of	95-01-021P	Nantucket Sound	08/21/1995

For the countywide revision, the coastal areas including the Atlantic Ocean, Vineyard Sound, and Nantucket Sound were evaluated for Primary Frontal Dunes (PFD) for the entire coastline along the Towns of Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, and West Tisbury and the Wampanoag Tribe of Gay Head (Aquinnah) using more up to date topographic information, including LiDAR data, which meets the accuracy standards for flood hazard mapping (http://maps.csc.noaa.gov/). No new detailed or approximate studies were performed by detailed methods.

For this coastal revision, the coastal analysis establishes the flood elevations for selected recurrence intervals primarily in the coastal communities of the Towns of Aquinnah, Chilmark, Gosnold, Edgartown, Oak Bluffs, Tisbury, and West Tisbury and the Wampanoag Tribe of Gay Head (Aquinnah). There were no new LOMR determinations that resulted in FIRM revisions. No new riverine or approximate studies were performed as part of this coastal revision.

2.2 Community Description

Dukes County is situated on Martha's Vineyard approximately 70 miles southeast of the City of Boston. In Dukes County there are seven (7) incorporated communities, including the Towns of Aquinnah, Chilmark, Edgartown, Gosnold, Oak Bluffs, Tisbury, and West Tisbury. The Town of Gosnold includes approximately 22 islands known as the Elizabeth Islands.

Dukes County is bordered on the north by Vineyard Sound and Nantucket Sound.

It is bordered on the east by Nantucket Sound. It is bordered on the south and west by the Atlantic Ocean.

According to the U.S. Census, the population estimate of Dukes County was 16,535 in 2010. The land area of Dukes County consists of 490.95 square miles. It should be noted that Martha's Vineyard has a summer seasonal population increase of almost three times the year-round population (Reference 9). All communities in Dukes County included in the FIS, along with their population and total area, are listed in Table 4, "Population and Total Area by Community."

TABLE 4 – POPULATION AND TOTAL AREA BY COMMUNITY

Community	Total Area (Sq. mi)[1]	Population[2]
Aquinnah, Town of	40.77	419[3]
Chilmark, Town of	100.42	843
Edgartown, Town of	122.74	3,779
Gosnold, Town of	140.16	86
Oak Bluffs, Town of	25.96	3,713
Tisbury, Town of	19.16	3,755
West Tisbury, Town of	41.74	2,467

[1] Data obtained from US Census Bureau, 2003
[2] Data obtained from 2010 US Census
[3]Includes Wampanoag Tribe of Gay Head (Aquinnah)
*No data available

In general, Dukes County is a residential community with no manufacturing industry. The economy of the town is based on commercial and service industries geared to the summer visitors and residents.

The climate of Dukes County is characterized by uniform precipitation and wide ranging temperatures. The average yearly rainfall is 43.7 inches. The normal monthly temperature varies from 32.5 degrees Fahrenheit (°F) in January to 67.5°F in July (Reference 9).

The terrain of Dukes County varies from areas of high elevations, reaching a maximum of 308 feet in the Town of Chilmark, to low lying marsh areas along the coastline. The geomorphology of Martha's Vineyard is largely the result of glacial deposition. The three basic landforms on the island are the Western Moraine (from Aquinnah to Makoniky Head), the Eastern Moraine (in the Oak Bluffs area), and the Outwash Plain (the triangular shaped landform between and south of the two moraines). The two moraines are the irregularly shaped and poorly sorted deposits left by the glaciers. Clay is much more prevalent in the Western Moraine, which accounts for the presence of streams and ponds on this part of the island. The abundance of sand and gravel and the scarcity of clay in the Eastern Moraine and the Outwash Plain allow no streams and only a few small ponds in these regions.

Dependable groundwater supplies are relatively abundant in the Outwash Plain and Eastern Moraine, but scarce in the Western Moraine. The Outwash Plain was formed by melt-water streams that carried sand and gravel from the glacier and deposited them downstream. The non-inundated former channels of these streams are the large ponds found on the south shore of the island. The Outwash Plain is very flat and is composed of extensive sand and gravel deposits. Vegetation in the county consists of woodland, scrubland, and heathland. In general, the densest vegetation is found inland and the sparsest is found closest to the shore (Reference 10).

The main flooding sources in Dukes County are along the coastline.

2.3 Principal Flood Problems

Dukes County is subject to coastal flooding caused by northeasters and hurricanes. Northeasters can occur at any time of the year but are more prevalent in the winter months, whereas hurricanes occur in the late summer and early fall months.

The following discussion on hurricanes and northeasters is useful for understanding their relationship to tidal elevations on Dukes County. A hurricane develops as a tropical storm either near the Cape Verde Islands off the African coast or in the western Caribbean Sea. Most hurricanes that reach Dukes County approach from the south after recurving east of Florida and skirting the mid-Atlantic States. These hurricanes begin with a forward speed of approximately 10 miles per hour (mph) and, after recurving towards Long Island, may increase their speed to 20-30 mph and even 60 mph as they approach colder water temperatures (Reference 11).

The most destructive hurricane winds occur east of the eye where the spiral wind movement and forward motion of the storm combine. For this reason, the actual track of a hurricane is very important because of the effect its high wind velocity may have on the community. Tidal levels along the coastline are greatly influenced by the forces, duration, and direction of these winds as well as the distance or fetch across open water over which the winds act.

A northeaster travels in a southwest to northeast direction along the Atlantic coast, collecting moisture over the ocean and sending it inland via northeast winds. The northeaster varies from a hurricane in that it covers a larger area, the winds are not as intense, and it moves much more slowly. While a hurricane may last for several hours, a northeaster may last for several days. For this reason, northeasters often last long enough to be accompanied by at least one high tide, resulting in the most severe flooding conditions. These high levels result from a drop in the barometric pressure and from strong winds that blow out of the northeast across the considerable fetch of the Atlantic Ocean.

Damaging waves may result in areas with sufficient fetch length and water depth. During hurricanes, the coastlines facing southeast to south and southwest are subject to wave action in the Towns of Aquinnah, Chilmark, and West Tisbury; the coastlines facing southeast to south and southwest are subject to wave action. The north-facing coastline may not be subject to peak winds at the time of a peak storm surge during a hurricane, but they are subject to damaging waves during northeasters.

In the Town of Gosnold, tropical storms and hurricanes cause the greatest rise in tide levels in the Elizabeth Islands. This is a result of strong winds following a northerly track across the open ocean. The force of this type of storm is more damaging to the south side of the islands. Northeasters do not create tide levels as high as a tropical storm because the southerly winds have a shorter fetch across Buzzards Bay. The areas of flooding are minimal in the Town of Gosnold, but there are a few buildings near the eastern spit of land that forms the southern side of the entrance to Cuttyhunk Pond and a few near Hadleys Harbor on Naushon Island that are regularly flooded in large storms. Most structures on these islands are built at protected elevations (Reference 11).

Several severe storms have occurred in Dukes County. The hurricanes of 1938, 1944, and 1954 caused serious flooding. A local estimate of damage resulting from the 1938 hurricane fell between $50,000 in Tisbury to $200,000 in Edgartown (References 12 and 13). Storms to strike Dukes County include Hurricane Bob in 1991, and Hurricane Edouard in 1996. Both storms caused damage as a result of high winds (References 14 and 15). Additional storms to strike Dukes County include Hurricane Irene in 2011 and Hurricane Sandy in 2012. Both storms caused significant damage due to wind and flooding.

Several high-water marks for the 1938, 1944, and 1954 storms are listed in Table 5, “High-water Marks by Location” (References 12 and 13).

TABLE 5 -HIGH-WATER MARK ELEVATIONS BY LOCATION

Location	Hurricane Sept. 21, 1938 (feet NAVD88)[1]	Hurricane Sept. 14-15, 1944 (feet NAVD88)[1]	Hurricane Aug. 31, 1954 (feet NAVD88)[1]
ATLANTIC OCEAN			
Aquinnah Cliffs	9.4	*	*
CUTTYHUNK ISLAND (GOSNOLD)			
North Side	10.0	*	*
EDGARTOWN HARBOR			
U.S. Coast and Geodetic Survey Gage: Latitude 41º23.3' N Longitude 70º30.7' W	6.1	6.5	*
Harbor Side Inn	*	*	6.9
Coulger's Garage	*	*	6.8
LAGOON POND			
Howard Avenue, Burt's Boat Yard, Town of Tisbury	*	*	5.8
MENEMSHA POND			
Aquinnah and Chilmark	5.3	4.2	*
U. S. Coast & Geodetic Survey Gage Latitude 41º21' N Longitude 70º46' W (At Mouth of Pond)	*	*	7.8

[1]North American Vertical Datum of 1988
*No data available

TABLE 5 -HIGH-WATER MARK ELEVATIONS BY LOCATION – cont'd

Location	Hurricane Sept. 21, 1938 (feet NAVD88)[1]	Hurricane Sept. 14-15, 1944 (feet NAVD88)[1]	Hurricane Aug. 31, 1954 (feet NAVD88)[1]
NANTUCKET SOUND			
U.S. Coast and Geodetic Survey Gage: Latitude 41º27.5' N Longitude 70º33.3' W	6.3	6.9	*
Our Market Store, Town of Oak Bluffs	*	*	5.7
Greenleaf Avenue, Town of Oak Bluffs	*	*	6.6
NASHAWENA ISLAND (At Robinson's Hole, Town of Gosnold)			
North Side	9.95	*	*
South Side	8.95	*	*
NAUSHON ISLAND			
North Side (center of island)	10.8	*	*
South Side (Tarpaulin Cove	8.15	*	*
Hadleys Harbor	7.91	*	*
VINEYARD HAVEN HARBOR			
Beach Road, Hancock & Sons Woodworkers, Town of Tisbury	4.3	5.6	6.1

[1]North American Vertical Datum of 1988
*No data available

TABLE 5 -HIGH-WATER MARK ELEVATIONS BY LOCATION – cont'd

Location	Hurricane Sept. 21, 1938 (feet NAVD88)[1]	Hurricane Sept. 14-15, 1944 (feet NAVD88)[1]	Hurricane Aug. 31, 1954 (feet NAVD88)[1]
VINEYARD HAVEN HARBOR – cont'd			
Beach Road, Mobil Gas Co., Town of Tisbury	*	5.7	6.3
End of Union Street, Nantucket Steamship Co., Town of Tisbury	*	*	6.3
U.S. Coast and Geodetic Survey Gage: Latitude 41º29' N Longitude 70º36.1' W	6.4	*	*
U.S. Coast and Geodetic Survey Gage: Latitude 41º27' N Longitude 70º36' W	*	5.7	*
VINEYARD SOUND			
A&P Store, Water Street	*	*	6.3
Burt's Boatyard, Howard Avenue (Lagoon Pond), Town of Tisbury	*	*	5.8
Mobil Gas Co., Beach Road, Town of Tisbury	*	5.7	6.3
Nantucket Steamship Authority, Union Street, Town of Tisbury	*	*	6.3

[1]North American Vertical Datum of 1988
*No data available

TABLE 5 -HIGH-WATER MARK ELEVATIONS BY LOCATION – cont'd

Location	Hurricane Sept. 21, 1938 (feet NAVD88)[1]	Hurricane Sept. 14-15, 1944 (feet NAVD88)[1]	Hurricane Aug. 31, 1954 (feet NAVD88)[1]
VINEYARD SOUND cont'd			
Tilton Lumber Co., Water Street, Town of Tisbury	*	*	6.3

[1]North American Vertical Datum of 1988
*No data available

High-water marks taken at the tide gages at Montauk (29 years of record) and at Newport (44 years of record) for various historic storms in the Dukes County area are shown in Table 6, "High-water Mark Elevations At Gages" (References 16 and 17).

TABLE 6 – HIGH-WATER MARK ELEVATIONS AT GAGES

Storm Type and Date	Montauk Gage[1]	Newport Gage[1]
Northeaster April 20-22, 1940	*	3.2
Northeaster November 30, 1944	*	4.4
Hurricane Carol August 31, 1954	*	8.6
Northeaster March 8-9, 1957	*	2.5
Northeaster December 29-30, 1959	3.0	3.9
Northeaster March 3-5, 1960	2.7	2.4
Northeaster January 19-21, 1961	2.9	2.9
Northeaster March 9, 1961	3.4	2.9
Northeaster January 23-24, 1966	1.2	3.1
Northeaster December 3-5, 1967	*	3.2
Northeaster February 8, 1968	2.0	1.4

[1]North American Vertical Datum of 1988
*No data available

TABLE 6 – HIGH-WATER MARK ELEVATIONS AT GAGES – cont'd

Storm Type and Date	Montauk Gage[1]	Newport Gage[1]
Northeaster		
November 10-12, 1968	4.5	3.8
Northeaster		
February 19, 1972	4.3	4.1
Northeaster		
March 16-18, 1976	3.3	3.7
Northeaster		
February 6-7, 1978	4.9	4.3

[1]North American Vertical Datum of 1988

The assignment of recurrence intervals to the surge heights measured during historic storms is of value as a rough comparison between 10-, 2-, 1-, and 0.2-percent-annual-chance tidal floods developed in the pre-countywide Edgartown, Oak Bluffs, and Tisbury FISs and actual tidal floods experienced in Edgartown Harbor, Vineyard Haven Harbor and the open coast of Tisbury. Table 7 shows the surge heights and recurrence intervals for three hurricanes.

TABLE 7 – SURGE HEIGHTS AND RECURRENCE INTERVALS

Location	Surge Height (feet NAVD88)[1]	Recurrence Interval (annual chance)
EDGARTOWN HARBOR (EDGARTOWN, TOWN OF ONLY)		
September 21, 1938	6.0	2.4-percent
September 14-15, 1944	6.4	2-percent
August 31, 1954	6.7	1.9-percent
VINEYARD HAVEN HARBOR (OAK BLUFFS, TOWN OF ONLY)		
September 21, 1938	5.3	2.5-percent
September 14-15, 1944	5.7	2.1-percent

[1]North American Vertical Datum of 1988

TABLE 7 – SURGE HEIGHTS AND RECURRENCE INTERVALS – (cont'd)

Location	Surge Height (feet NAVD88)[1]	Recurrence Interval (annual chance)
VINEYARD HAVEN HARBOR (OAK BLUFFS, TOWN OF ONLY) – cont'd		
August 31, 1954	6.2	1.7-percent
VINEYARD SOUND (TISBURY, TOWN OF ONLY)		
September 1938	5.3	2.5-percent
September 1944	5.7	2.1-percent
August 1954	6.2	1.7-percent

[1]North American Vertical Datum of 1988

The assigned recurrence intervals are applicable only to surge heights and only to the above-mentioned flooding sources and locations. They cannot be accurately applied to other locations or to the other storm components (wind, waves). The recurrence intervals presented above are based on the coastal analysis performed at the time the Towns of Edgartown, Oak Bluffs, and Tisbury, pre-countywide FISs were published in 1997, 1984 and 1983, respectively, and will change as more data become available (References 3, 5, 6).

2.4 Flood Protection Measures

In the Towns of Aquinnah and Chilmark, the only protective structure is a breakwater located at the mouth of Menemsha Creek, which protects the shoreline, piers, and docks from damage due to wave action. The Town of Aquinnah has adopted a flood plain zone within their zoning by-laws (Reference 18). Very limited construction is allowed in the shore zone, which extends from mean low water to 100 feet of the inland edge of any beach or marsh grasses and 100 feet inland of the crest of any bluff exceeding a height of 15 feet. The inland zone is restricted to single-family dwellings and consists of all land below the 10 foot contour, excluding the shore zone (Reference 19).

The Town of Edgartown has zoning by-laws that are applicable to tidal areas, tidal marsh areas, and beach areas. Permits are required for any alteration to these areas (Reference 20). No major structural flood protection measures exist for the town.

In the Town of Gosnold, the only major flood protection measures are found on Cuttyhunk Island, where there are two U.S. Army Corps of Engineers (USACE) projects. The first was completed in 1939, and the second in 1965. The 1939 project included maintenance of existing jetties at the north and south sides of the east-west entrance into Cuttyhunk Pond. The 1965 project consists of two stone dikes and aprons, one 1,300 feet long at the east end of Canapitsit Beach to protect the entrance channel from the south, and the second 600 feet long at the south end of Copicut Neck Beach to protect the inner harbor from the northwest (Reference 11).

The Town of Oak Bluffs currently has zoning regulations that apply to the flood plain overlay district. Included in the zoning by-laws is a detailed definition of the flood plain overlay district and other regulations that pertain to buildings in the district (Reference 21).

In the Town of Tisbury, the main protective structure is the breakwater in Vineyard Haven Harbor. When not accompanied by high storm surge, this breakwater offers protection from large waves to the main mooring basin, harbor facilities, and steamship wharves. In several locations, the headlands of West Chop are protected from wave erosion by riprap embankments. Two small breakwaters form the entrance to Tashmoo Pond and are intended more to alleviate deposition problems than flooding problems, although they may break damaging waves.

The Town of Tisbury has adopted a flood plain overlay district (Reference 22). This zoning by-law assesses a $200 penalty for violators of this by-law.

In the Town of West Tisbury, there are no flood protection structures existing. There is, however, a flood plain ordinance in the zoning regulations of the town. Permits for all proposed construction and uses of land within the designated flood plain districts, which are based on the FIRM, are required for new construction, substantial improvement, addition to existing structures of increased water, electric or sewage, and septage systems, and alterations of the land form. Permits granted to any new residence or substantially improved residence are subject to several provisions, including the lowest floor must be elevated to or above the BFE and there shall be no basement, and additional restrictive requirements are in place for V Zones (Reference 23).

3.0 **ENGINEERING METHODS**

For the flooding sources studied by detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 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 that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the county at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

For each community within Dukes County that has a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below. No new Hydrologic Analyses were performed for the countywide FIS.

In the Towns of Aquinnah, Chilmark, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah), elevation-frequency relationships for Martha's Vineyard, Nantucket Island, the southern coast of Rhode Island, and Block Island have been determined through a Pearson Type III analysis on the tide gages at Montauk (29 years of record) and at Newport (44 years of record). This analysis showed that the August 1954 storm had a recurrence interval of approximately1-percent-annual-chance. High-water marks taken at the gages for various historic storms in the area are shown in Table 6, “High-Water Mark Elevations by Location”, found in the previous section (References 16 and 17).

For various points on the Elizabeth Islands in the Town of Gosnold, high-water mark information obtained from the New England Division of the USACE and the National Ocean Survey (NOS) indicates that historic flood elevations differ significantly from simultaneous observations at Woods Hole and points directly across Buzzards Bay (References 24 and 25) . Therefore, stage-recurrence interval relationships taken from the USACE profiles could not be used in this area, and new relationships had to be developed.

Hypothetical hurricane windfields were developed using standard methods developed by the National Weather Service Hydrometeorological Branch (Reference 26). The 10-, 2-, 1-, and 0.2-percent-annual-chance windfields were used as input to the Coastal Ocean Grid numerical solution of storm surge due to wind setup over the continental shelf (Reference 27). The numerical solution was first tested for validity by application to the Woods Hole area. Results compared well with surge elevations predicted by the Woods Hole tide gage regression analysis (Reference 28). Results for Cuttyhunk Island (south side) compare well with historic high-water marks on the island. Stage-recurrence interval relationships developed for the Vineyard Sound (south) shore of Cuttyhunk Island were transposed to the north side of the island by a method which took into account the higher spring tides encountered in Buzzards Bay (Reference 29). Stage-recurrence interval relationships for the remaining islands of the Elizabeth Island chain were interpolated from profiles determined by straight-lining stage-recurrence interval relationships between Cuttyhunk Island and Woods Hole.

A two-dimensional computer model for coastal storm surge simulation was used to determine the tidal flood elevations for Martha's Vineyard (References 30, 31, 32, 33, and 34) in the Towns of Aquinnah, Chilmark, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah). The model, which was developed by Stone and Webster to simulate northeasters, was a modification of the Tetra Tech surge model. An option was added by the study contractor to model hurricanes because peak flood levels on Martha's Vineyard are caused by both types of storms.

The initial portion of the model is a coastal storm simulation. Both types of storms were modeled based on storm radius, central pressure depression, storm track, and forward speed, the differences being in wind field definition and storm shape.

Fifteen historic storms were modeled from synoptic charts provided by the National Weather Service (Reference 35). Model output consisted of pressure and wind fields for the storm and arrays of wind stress and barometric rise of the water surface.

The wind stress and barometric rise arrays are saved for input to the second portion of the model, which consists of a simulation of the physical characteristics of the study area. For the coastlines of Martha's Vineyard, the entire Nantucket, Rhode Island, and Block Island Sounds were modeled. Input for the second portion of the model consisted of the arrays specified by the northeaster and hurricane models and a two-dimensional grid system to define the basin, where depths are specified for every grid point and land areas are defined. The output is a time series of storm surge elevations for every grid point.

The model was calibrated with the August 1954 storm. Model surge elevations were compared to and showed good correlation with recorded elevations (Reference 36).

The model results for the fourteen other storms were compared to recorded elevations at the Montauk and Newport tide gages. For each storm, ratios were developed to compare the elevation at each coastal point to the elevation at each of the gages. A single ratio for each point was developed based on all storms modeled to relate tidal flooding at the point to tidal flooding at Montauk and Newport. The ratios were applied to the gage curves to develop elevation-frequency relationships for the coastlines of the Towns of Aquinnah, Chilmark, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah).

For Tisbury Great Pond, the Tiasquam River, and Town Cove, a one-dimensional model was used to route the coastal surge hydrograph through all tidal portions (Reference 37). Input consisted of stream depth, stream width, freshwater flows, and stream branching information for a series of grids. Output consisted of a time series of elevations for each grid. Hydrographs for the 10-, 2, 1-, and 0.2-percent-annual-chance storms were routed up the estuary to develop elevation-frequency curves at each point.

In the Towns of Edgartown, Tisbury, and Oak Bluffs, stillwater elevations for the Edgartown Harbor and Nantucket Sound shorelines were taken from the FIS for the Town of Falmouth (Reference 38). These elevations were verified by determining meteorological parameters for hurricanes typical of the latitudes of Cape Cod. The parameters were employed to develop wind fields characteristic of the hurricanes. Finally, storm surge setup was calculated along traverse lines extending from the edge of the continental shelf to points on the Cape's south, east, and north shore. Surge calculation methods were taken from the USACE Shore Protection Manual (Reference 39). The surge elevations resulted from a summation of setup due to wind, atmospheric pressure changes, and astronomical tide levels. The analysis verified the reasonableness of USACE surge elevations on the south shore of Falmouth (References 40, 41, 42, and 43).

The USACE determination of coastal surge profiles for the 10-, 2-, 1-, and 0.2-percent-annual-chance recurrence intervals required a statistical analysis of long-term NOS tide gage records for Woods Hole, Massachusetts (Reference 44). In the USACE gage analysis, records from 1933 were adjusted for the observed gradual rise in sea level (0.1 foot per decade). A plotting position frequency analysis on these adjusted data resulted in the following 10-, 2-, 1-, and 0.2-percent-annual-chance surge elevations, shown in Table 8, “Surge Height on Falmouth’s Southern Shore”.

A comparison of high-water marks for the southern shore of Falmouth and for Martha's Vineyard for historic storms showed that the flood levels on the island were consistently lower. Therefore, the direct use of the Falmouth surge heights are considered inappropriate on Martha's Vineyard.

TABLE 8 – SURGE HEIGHT ON FALMOUTH'S SOUTHERN SHORE

Recurrence Interval (annual chance)	Surge Height on Falmouth's Southern Shore (feet NAVD88)[1]
10-percent	4.5
2-percent	8.1
1-percent	10.9
0.2-percent	14.9

[1]North American Vertical Datum of 1988

The 10-, 2-, 1-, and 0.2-percent-annual-chance storm surge elevations on the open coast of Martha's Vineyard were determined by transposing the elevations developed by the USACE for the southern shore of Falmouth. The transposition was performed by calculating ratios of surge heights for the hurricane of 1954 at locations on Martha's Vineyard and the southern shore of Cape Cod at Falmouth (Reference 45 and 46). A comparison of the 1954 storm was considered appropriate because this storm was closer to a 1-percent-annual-chance event on Martha's Vineyard than the 1938 or 1944 storms and because the 1954 storm was well documented by high-water marks on Martha's Vineyard and at Falmouth.

Lake Tashmoo and Lagoon Pond in the Town of Tisbury were analyzed to determine what, if any, attenuation of open coast surge elevations might occur. A one-dimensional numerical storm surge model was applied to develop the surge elevations in Lake Tashmoo and Lagoon Pond (Reference 43). This model uses a depth-average form of the Navier Stokes Equations with bottom contour information from navigational charts (Reference 47). The results of the model showed reasonable agreement with high-water marks taken at Vineyard Haven Harbor and at Lagoon Pond after the 1954 hurricane.

In the Town of Oak Bluffs, a one-dimensional estuarine storm surge model for tidal rivers and inlets has been applied to calculate the 10-, 2-, 1-, and 0.2-percent-annual-chance stillwater elevations for Lagoon Pond (Reference 17). Tide and depth data and channel cross-section information were taken from several points using National Oceanic and Atmospheric Administration maps, USGS topographic maps, and tide tables (References 30, 31, 32, and 33). Boundary conditions for the model (winds and surge heights) were calculated using a synthetic hurricane model and available data on past major storms. The results of the one-dimensional model demonstrated reasonable agreement with high-water marks taken at Vineyard Haven Harbor and at Lagoon Pond after the 1954 hurricane.

The stillwater elevation is the elevation of the water due solely to the effects of the astronomical tides, storm surge, and wave setup on the water surface. The inclusion of wave heights, which is the distance from the trough to the crest of the wave, increases the water-surface elevations. The height of a wave is dependent upon wind speed and its duration, depth of water, and length of fetch. The wave crest elevation is the sum of the stillwater elevation and the portion of the wave height above the stillwater elevation.

Wave heights and corresponding wave crest elevations were determined using the National Academy of Sciences (NAS) methodology (Reference 48). Stillwater elevations for the Atlantic Ocean were determined using a two-dimensional storm surge model prepared for FEMA by Tetra Tech, Inc. (Reference 49).

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for Nantucket Sound, Vineyard Sound, Tisbury Great Pond, Menemsha Pond, Tiasquam River, Town Cove, Squibnocket Pond, Buzzards Bay, Lagoon Pond, and the Atlantic Ocean and are summarized in Table 9, "Summary of Stillwater Elevations."

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD88[1])			
	10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
ATLANTIC OCEAN				
Entire shoreline within Aquinnah, Town of; Chilmark, Town of; Edgartown, Town of; and West Tisbury, Town of	4.2	5.7	6.8	9.1
BUZZARDS BAY				
At Cuttyhunk Island	5.2	8.3	9.7	12.7
At Kettle Cove, Naushon Island	4.7	8.2	9.9	13.8
At the west end of Naushon Island	4.6	8.1	10.0	14.1
At Nashawena Island	5.0	8.3	9.8	13.2
At Pasque Island	4.8	8.2	9.9	13.6

[1]North American Vertical Datum of 1988

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS – (cont'd)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD88[1]) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BUZZARDS BAY – cont'd				
At Woods Hole	7.0	10.7	12.1	15.7
LAGOON POND				
At Oak Bluffs, Town of	2.3	5.2	6.6	11.1
At Tisbury, Town of	2.3	5.2	6.6/9.3[2]	11.1
LAKE TASHMOO				
At Tisbury, Town of	3.2	6.1	7.6/13.2[2]	11.3
MENEMSHA POND				
Entire shoreline within Aquinnah, Town of and Chilmark, Town of	4.9	6.6	7.8	10.5
NANTUCKET SOUND				
At Oak Bluffs Harbor	3.3	6.1	7.7	11.5
At Oak Bluffs/Edgartown Corporate Limits	3.4	6.3	7.9	11.8
At Edgartown Harbor	3.5	6.5	8.2	12.2
At Cape Poge	3.5	6.5	8.2	12.2
At Vineyard Haven Harbor	3.2	6.1	7.6	11.3

[1]North American Vertical Datum of 1988
[2]Stillwater Elevation/Maximum Wave Crest Elevation

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS – (cont'd)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD88[1]) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
SQUIBNOCKET POND				
Entire shoreline within Aquinnah, Town of and Chilmark, Town of	4.2	5.7	6.8	9.1
TIASQUAM RIVER				
Entire shoreline within Chilmark, Town of and West Tisbury, Town of	4.7	6.3	7.5	9.9
TISBURY GREAT POND				
Entire shoreline within Chilmark, Town of and West Tisbury, Town of	4.4	6	7.1	9.4
TOWN COVE				
Entire shoreline within Chilmark, Town of and West Tisbury, Town of	4.4	6.0	7.1	9.4
VINEYARD HAVEN SOUND				
Entire shoreline within Tisbury, Town of	3.2	6.1	7.6/11.1[2]	11.3
VINEYARD SOUND				
At Cuttyhunk Island	5.2	8.3	9.7	12.7
At Nashawena Island	5.0	8.3	9.8	13.2
At Pasque Island	4.8	8.2	9.9	13.6

[1]North American Vertical Datum of 1988
[2]Stillwater Elevation/Maximum Wave Crest Elevation

TABLE 9 – SUMMARY OF STILLWATER ELEVATIONS – (cont'd)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD88[1]) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
VINEYARD SOUND – cont'd				
At Tarpaulin Cove, Naushon Island	4.6	8.1	10.0	14.1
At the west end of Naushon Island	4.7	8.2	9.9	13.8
At Woods Hole	4.3	8.1	10.1	14.9
Entire shoreline within Aquinnah, Town of and Chilmark, Town of	4.9	6.6	7.8	10.5
Entire shoreline within Tisbury, Town of	3.2	6.1	7.6	11.3
Entire shoreline within West Tisbury, Town of	5.1	6.8	8.1	10.8

[1]North American Vertical Datum of 1988

The analyses reported in this study reflect the stillwater elevations due to tidal and wind setup effects. The effects of wave action were also considered in the determination of flood hazard areas. Coastal structures that are located above still-water flood elevations can still be severely damaged by wave run-up, wave-induced erosion, and wave-borne debris. For example, during the northeasters of January and February 1978, considerable damage along the Massachusetts coast was caused by wave activity, even though most of the damaged structures were above the high-water level. The extent of wave run-up past still-water levels depends greatly on the wave conditions and local topography.

Wave heights and corresponding wave crest elevations were determined using the National Academy of Sciences (NAS) methodology (Reference 50). The wave run-up was determined using the methodology developed by Stone and Webster Engineering Corporation for FEMA (Reference 48).

3.2 Hydraulic Analyses

For each community within Dukes County that has a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below. Primary Frontal Dune mapping was the only analysis performed for this countywide FIS.

Pre-Countywide Analyses

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 51). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures. This criterion has been adopted by FEMA for the determination of V Zones. By definition, all primary frontal dunes are also V Zones. A wave height analysis was performed to determine wave heights and corresponding wave crest elevations for the areas inundated by the tidal flooding. A wave runup analysis was performed to determine the height and extent of run-up beyond the limit of tidal inundation. The results of these analyses were combined into a wave envelope, which was constructed by extending the maximum wave run-up elevation seaward to its intersection with the wave crest profile.

In the Town of Tisbury, wave heights for Lake Tashmoo, Lagoon Pond, and Vineyard Haven Harbor, and their immediate shorelines, were calculated using the Coastal Engineering Research Center's revised method for wave forecasting in shallow water (References 52 and 53) . This methodology predicts significant wave heights based on water depths, distances available for wave generation, and adjusted wind speeds. These procedures supersede those presented in the Shore Protection Manual (Reference 3).

The methodology for analyzing wave heights and corresponding wave crest elevations was developed by the NAS (Reference 50). The NAS methodology is based on three major concepts.

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

$$H_b = 0.78d$$

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

$$Z_w = S_* + 0.7H_* = S_* + 0.55d$$

where Z_w is the wave crest elevation, S_* is the still water elevation at the site, and H_* is the wave height at the site. The 0.7 coefficient is the portion of the wave height which reaches above the still water elevation. H_b is the upper limit for H_*.

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

$$H_t = BH_i$$

where H_t is the transmitted wave height, H_i is the incident wave height, and B is a transmission coefficient ranging from 0.0 to 1.0. The coefficient is a function of the physical characteristics of the obstruction. Equations have been developed by the NAS to determine B for vegetation, buildings, natural barriers such as dunes, and man-made barriers such as breakwaters and seawalls (Reference 50).

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

The methodology for analyzing wave run-up was developed by Stone and Webster Engineering Corporation based on a previous study by the USACE (Reference 48). The wave run-up computer program operates using an ensemble of deepwater wave heights, H_i, the stillwater elevation, S_*, a wave period, T_s, and beach slope, m. For the Town of Chilmark, wave heights range from 2.1 feet up to the significant wave height of 18.1 feet; the wave period ranges from 6.0 to 12.5 seconds. For the Town of Gosnold, wave heights range from 3 feet up to the significant wave height of 23.1 feet; the wave periods range from 3.6 to 9 seconds. For the Town of Oak Bluffs, wave heights range from 1.2 feet up to the significant wave height of 30.9 feet; the wave periods range from 3.8 to 14.4 seconds. For the Town of West Tisbury, wave heights range from 3.1 feet up to the significant wave height of 18.1 feet; the wave period was 12.5 seconds.

These concepts and equations were used to compute wave envelope elevations associated with the 1-percent-annual-chance storm surge. The analysis is based on the assumption that there is a high correlation between the n-year storm surge and the n-year wave heights. This assumption will be met when the wind field that is present during the peak of the surge is used in the computation of the wave heights. Accurate topographic, land-use, and land cover data are required for the coastal analyses. For the Towns of Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah), maps of the study area, at a scale of 1:4,800 with a contour interval of 5 feet, were used for the topographic data (Reference 55). For the areas in the Towns of Aquinnah and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah) that had been revised in precountywide FISs, maps of the study area, at a scale of 1:4,800, with a contour interval of 4 feet were used for the topographic data (Reference 56). For the Town of Gosnold, maps of the study area, at a scale of 1:24,000 enlarged to 1:12,000 with a contour interval of 10 feet, were used for the topographic data (Reference 57). For the Towns of Aquinnah, Chilmark, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah), the land-use and land cover data were obtained from aerial photographs (Reference 58). For the Towns of Gosnold, Edgartown, and Oak Bluffs, the land-use and land cover data were obtained by field surveys. The Town of

Tisbury land-use and land cover data were obtained from both field surveys and aerial photographs (Reference 59). Depths below mean low water were determined from NOS Nautical Charts (References 60 and 61).

In the Towns of Chilmark and Oak Bluffs, areas of shallow flooding have been determined for the lee side of the dunes along the Atlantic Ocean. In these areas, the wave runup elevation exceeded the dune crest elevation. The difference between the runup elevation and the dune crest was used to determine the depth of shallow flooding behind the dune (Reference 62).

Also in the Town of Chilmark, areas of ponding have been determined along the Atlantic Ocean. In these areas, the wave runup elevation exceeded the bluff elevation. The amount of overtopping and flooding behind the bluff were determined based on the bluff elevation and surrounding topography (References 62 and 63).

The revised coastal analyzes performed in the Towns of Aquinnah, Edgartown, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah); determined coastal flood zones and associated elevations following FEMA methodologies, including erosion, wave runup, and wave height analyses (References 64, 65, 66, 67, and 68).

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

Along each transect, wave envelope elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. Between transects, elevations were interpolated using the topographic maps, land-use, and land cover data, and engineering judgment to determine the area extent of flooding. The results of the calculations are accurate until local topography, vegetation, or cultural developments within the community undergo any major changes.

In the Town of Gosnold, a wave runup analysis was performed for only the Vineyard Sound shoreline; a runup analysis was not performed on the north-facing Buzzards Bay coastline due to significant wave shadow effects. A wave height analysis was performed on the Buzzards Bay shoreline, resulting in wave heights of less than 3 feet. Penikese Island and Gull Island are subject to significant wave attack due to their exposure to winds from the south.

The FEMA erosion model, which is a simplified version of the dune retreat model developed by the Delft Hydraulics Laboratory of the Netherlands, was used analyze wave runup (References 44, 48 and 66). The WHAFIS model was used to compute the 1-percent-annual-chance storm wave heights. These data were used to determine flood zones and base 1-percent-annual-chance flood elevations.

For the Towns of Edgartown and West Tisbury, the USACE Shore Protection Manual, Volume 1, was used to estimate wave overtopping rates when necessary (Reference 39).

Areas exist within the Town of Tisbury where greater flood hazards may be expected than are presently indicated on the revised FIRM due to potential wave action. These areas include, but may not be limited to, Vineyard Sound and the south shores of Lake Tashmoo, Lagoon Pond, and Vineyard Haven Harbor. Due to limitations of the data and engineering methodology, including a knowledge of wave generation and propagation mechanisms and wind-surge correlations in time, the magnitude and extent of wave hazard cannot be accurately determined at present and these areas have been omitted from rigorous analysis. As further refinements to existing study methods become available, the FIRM will be revised accordingly.

Countywide Analysis

As part of the countywide update, coastal analyses in the form of Primary Frontal Dune (PFD) delineation were performed for the open water flooding sources in the Towns of Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, and West Tisbury. PFD was not delineated in the Town of Gosnold and in the Wampanoag Tribe of Gay Head (Aquinnah). Provided below is a summary of the analyses performed. All revised coastal analyses were performed in accordance with Appendix D "Guidance for Coastal Flooding Analyses and Mapping," (Reference 69) of the Guidelines and Specifications, as well as, the "Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update", (Reference 70).

In accordance with 44 CFR Section 59.1 of the NFIP the effect of the PFD on coastal high hazard area (V Zone) mapping was evaluated for the Towns of Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, and West Tisbury and in the Wampanoag Tribe of Gay Head (Aquinnah); in Dukes County. Identification of the PFD in the Towns of Oak Bluffs, Edgartown, the south shores of the Towns of West Tisbury and Chilmark; and the west coast of the Town of Aquinnah and the Wampanoag Tribe of Gay Head (Aquinnah) was based upon a FEMA approved numerical approach for analyzing the dune's dimensional characteristics. This approach utilized LiDAR data for the study areas (Reference 71) and assessed change in back slope to determine the landward toe of the PFD. Site visits were then performed to confirm the analysis. Identification of PFD outside areas with detailed topographic data was performed through field verification only. The PFD defined the landward limit of the V Zone along portions of the shoreline within each community.

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3.3 Coastal Hydrologic Analyses

The stillwater elevation is the elevation of the water surface due to storm surge and the astronomical tides coincident with a storm. In 1988, the USACE developed coastal flood frequency curves for the New England coastline, covering the Long Island Sound to the U.S.-Canada border in Maine (Reference 13). The data for this work was derived from high water marks collected after historical storm events and tide gauge records maintained by the USACE and NOAA. A Pearson Type III distribution was fitted to the data, from which inferences about flood recurrence intervals were made. The statistics at the gauge locations were then extrapolated along the coastline based on considerations of tidal hydrodynamics and high water marks from historic storms (Reference 72). This document has historically been the primary source of SWELs for FEMA coastal studies.

Additionally, storm surge modeling studies have been used to supplement the tidal profiles where the profiles do not provide coverage of a coastline segment. All of the stillwater information was taken from the effective FIS and supporting documentation.

3.4 Coastal Hydraulic Analyses

For the purpose of the analysis, the coastline was classified according to the extent of open-ocean exposure. Open-ocean shorelines are exposed to undiminished wind-generated wave action, while sheltered (or restricted-fetch) shoreline segments are mostly subject to locally-generated waves. The other major consideration in sheltered areas is the fact that the peak floods may not be coincident with the peak waves. The full complexity of the physical processes in sheltered areas can only be unearthed through detailed coupled wind-wave-surge modeling. This is beyond the scope of the current work. It is assumed here that the peak flood elevation coincides with the peak onshore winds, which is a reasonable assumption given the small fetches characteristic of the study area.

The coastal flood hazard analyses utilized an event-based approach, where, the 1-percent-annual-chance flood is associated with a 1-percent-annual-chance meteorological event. This event may be a hurricane or a northeaster. The 1-percent-annual-chance flood event is idealized as the joint occurrence of storm surge conditions along with corresponding wind-generated wave conditions. The storm surge and wave conditions, appropriately transformed to the shoreline using hydraulic models where necessary, are used as inputs for the assessment of nearshore and overland flooding.

The severity of storm-induced coastal flooding depends on storm surge elevations, dune erosion or failure of coastal armoring structures, wave setup, wave runup and overtopping, and overland propagation of waves in low-lying areas inundated by storm surge. The analysis of nearshore and overland flooding was conducted along representative transects, placed perpendicular to the mean shoreline. The placement of transects took into account variations in topography, shoreline characteristics, land use, and incident hydraulic conditions.

The storm surge elevations (i.e. the SWELs) for different recurrence intervals were derived by statistical analysis of tide gauge records in New England. The results of the analysis at the tide gauge stations were used to develop flood profiles along the New England coastline. On sections of the coastline not covered by the tidal flood profiles, the SWELs were taken from results of hydraulic modeling studies in the effective FIS (Reference 72).

Wave setup was computed at each transect using the Direct Integration Method (DIM) as described in the Guidelines & Specifications (G&S). On low-lying transects inundated by storm surge, the propagation of waves overland was modeled using the Wave Height Analysis for Flood Insurance Studies (WHAFIS 4.0) tool (Reference 73).

On steep transects where wave runup, rather than storm surge inundation is the dominant source of flooding, wave runup was computed using the RUNUP 2.0 tool or the Technical Advisory Committee for Water Retaining Structures (TAW) method, as described in the G&S. The choice of runup methodology was dictated by the steepness of the nearshore profile. Both WHAFIS 4.0 and RUNUP 2.0 are implemented in the Coastal Hazard Analysis Modeling Program (CHAMP) (Reference 74).

The northern coastline of Martha's Vineyard, from Menemsha Bight to Edgartown Harbor and the islands to the north (excluding Cuttyhunk and Nashawena) are largely sheltered from wind waves generated in the Atlantic Ocean. Wave conditions for transects along these coastlines were derived using the methodology prescribed by the USACE for computing wave growth in fetch-restricted water bodies. The approach is implemented in the Automated Coastal Engineering Analysis (ACES) software package, which was used for this work.

For each transect, the geometry of the basin was defined by specifying wind fetches (at 10 degree offsets) radiating from the normal shoreline. For each specific wind condition, ACES computes the effective significant wave height and the peak wave period using the deepwater wave growth equations which take into account wind fetch and wind duration. As recommended in the Coastal Engineering Manual (CEM) and FEMA guidance, the deepwater wave growth option was used in all cases irrespective of the average depth of the wind basin. The ACES technical report notes that the shallow-water forms of the wave growth equations attempt to incorporate the effects of bottom friction and percolation but that the formulations are still largely experimental and unverified. The CEM instead recommends that the computed wave height be capped by depth-limited wave breaking considerations and

the wave period (T_P) be capped by the limiting wave period:

$$T_P \approx 9.78\left(\frac{d}{g}\right)^{1/2}$$

where d is the average water depth and g is standard gravity.

On transects with significant inland excursion of the 1-percent-annual-chance SWEL, WHAFIS 4.0 was used to compute the propagation of waves inland. Along each transect, WHAFIS takes as input, the 1-percent SWEL and corresponding wave conditions (i.e. the significant wave height and peak wave period), a bathymetric and topographic profile (entered as station-elevation pairs), and input “cards” at each station describing vegetation and land-use characteristics. WHAFIS uses this information to compute wave heights, wave crest elevations, flood insurance risk zone designations, and flood zone boundaries along each transect.

The original basis for the WHAFIS model was the 1977 National Academy of Sciences (NAS) report: Methodology for Calculating Wave Action Effects Associated with Storm Surges (Reference 75). The NAS methodology accounted for varying fetch lengths, barriers to wave transmission, and the regeneration of waves over flooded land areas. Since the incorporation of the NAS methodology into the initial version of WHAFIS, periodic upgrades have been made to WHAFIS to incorporate improved or additional wave physics. Version 4.0 has the additional option to input location specific wind speeds.

The wave action conservation equation used within the model governs both wave regeneration caused by wind and wave dissipation resulting from marsh plants. This equation is supplemented by the conservation of wave equation, which expresses the spatial variation of the wave period at the peak of the wave spectrum. The wave heights and period respond to changes in wind conditions, water depths, and obstructions as a wave propagates. These equations are solved as a function of distance along the wave analysis transects.

To populate the WHAFIS database in CHAMP, transect data was extracted from Geographical Information System (GIS) shapefiles as point features along the defined transects. First, the coordinates of the station corresponding to the point where each transect intersected with the shoreline (zero-foot contour) were extracted. Land and bathymetry elevation, station and source data were also extracted using a custom tool for ArcGIS, developed by STARR. Data was extracted at changes in land use, land cover, extents of buildings, and changes in topography.

All points seaward of the zero-foot contour used the bathymetry elevation. Points seaward of the zero-foot contour with an elevation higher than zero-foot were removed. Points representing the (0.0, 0.0) locations were appended where needed. Detailed information on the physical and cultural features of the study area was obtained from aerial photography and field reconnaissance notes and photographs. Topographic data was derived from LiDAR and survey data.

WHAFIS carding was developed using the WHAFIS Carding Guidance included in the reference materials for CHAMP software in accordance with the Overland Wave Propagation section in the G&S. WHAFIS carding was applied using aerial photographs, field inspection data, and topographic data.

Wave runup was calculated for each coastal transect using methods described in Section D.2.8 of the G&S (Reference 64). Runup estimates were developed for vertical structures using the guidance in Figure D.2.8-3 of the G&S. The Technical Advisory Committee for Water Retaining Structures' (TAW) method was applied for sloped structures with a slope steeper than 1:8. For slopes milder than 1:8, the FEMA Wave Runup Model RUNUP 2.0 was used. Both the runup on vertical structures method and RUNUP 2.0 compute the mean wave runup. The mean runup was scaled to the 2-percent runup height using a factor of 2.2 as recommended in the G&S. The total wave runup elevation is the sum of the runup height and the SWEL.

In areas where wave runup elevations dominate over wave heights, such as areas with steeply sloped beaches bluffs or shore-parallel flood protection structures, there is no evidence of significant damage to residential structures by runup depths less than 3 feet. To simplify the representation, the limit of moderate wave action (LiMWA) was continued immediately landward of the VE/AE boundary in areas where wave runup elevations dominate. Similarly, in areas where the Zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA was also delineated immediately landward of the VE/AE boundary.

Table 10, "Transect Descriptions," provides a listing of the transect locations, stillwater elevations, and maximum wave crest (or wave runup) elevations along the shoreline. Transects have been re-numbered to conform to countywide standard.

Along each transect, WHAFIS computes wave heights and wave crest elevations taking into account the combined effects of changes in ground elevation, vegetation, and other obstructions. Wave heights are calculated to the nearest 0.1 foot, and wave crest elevations are computed at whole-foot intervals. The calculations are carried inland along the transect until the wave crest elevation is permanently less than 0.5 foot above the SWEL or until the coastal flooding meets another flood source (e.g., a riverine flood source). The results of this analysis are summarized in Table 11, "Transect Data."

TABLE 10 - TRANSECT DESCRIPTIONS

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD88[3]) MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
1	The transect is located near Indian Hill Road at a point approximately 2,000 feet north of The intersection of Forest Road and Tisbury Lane East , extending west towards Vineyard Sound	8.1	13.2
2	This transect is located along James Pond at a point approximately 1,500 feet west of Lamberts Cove Road, extending north towards Vineyard Sound.	8.1	13.7
3	The transect is located approximately 300 feet east of the intersection of West Sound Lane and Pilot Hill Farm Road, extending north towards Vineyard Sound.	7.6	*
4	The transect is located in Lake Tashmoo at a point approximately 100 feet northeast of Hvoslef Avenue extending northwest towards Vineyard Sound.	7.6	13.2
5	The transect is located at a point approximately 250 feet southeast of the intersection of Golf Club Road and West Chop Lane Extending Northwest Towards Vineyard Sound.	7.6	13.3
6	The transect is located at a point approximately 200 feet southeast of the intersection of Golf Club Road and Franklin Street, extending northeast towards Vineyard Sound.	7.6	*
7	The transect is located at a point approximately 200 feet east of the intersection of Dolan Avenue and North William Street, extending east towards Vineyard Sound.	7.6	14.6
8	The transect is located at a point approximately 1,000 feet southwest of the intersection of Winyah Circle and Winyah Lane, extending northeast towards Vineyard Haven Harbor.	7.6	13.4

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988
[*]1% annual chance water level governed by wave runup

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
9	The transect is located at a point approximately 1,000 feet northeast of the intersection of Hines Point and Lagoon Pond Road, extending east into Lagoon Pond.	6.6	9.8
10	The transect is located at a point approximately 150 feet north of the intersection of Skiff Avenue and Mount Alderworth Road, extending southeast towards Lagoon Pond.	6.6	9.3
11	The transect is located in upper Lagoon Pond at a point approximately 300 feet northwest of the intersection of Barnes Road and Hudson Avenue, extending north into Vineyard Haven Harbor.	7.6	13.0
12	The transect is located in Crystal Lake at a point approximately 100 feet northwest of the intersection of Clay Avenue and Webster Avenue, extending northwest towards Vineyard Haven Harbor.	7.6	13.6
13	The transect is located at a point approximately 100 feet north of the intersection of Putnam Avenue and Madison Avenue, extending northwest towards Vineyard Haven Harbor.	7.7	12.9
14	The transect is located at a point approximately 100 feet north of the intersection of Simpson Avenue and Pacific Avenue, extending northeast towards Nantucket Sound.	7.7	14.8
15	The transect is located at a point approximately 200 feet south of the intersection of Hitching Circle and Richmond Street, extending northeast towards Nantucket Sound.	7.7	14.9
16	The transect is located at a point approximately 100 feet south of the intersection of Hitching Circle and Richmond Street, extending east towards Nantucket Sound.	7.7	15.0

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
17	The transect is located in Sengekontacket Pond at a point approximately 150 feet north of the intersection of Old Harbor Lane and Waterview Road, extending east towards Nantucket Sound.	7.9	14.4
18	The transect is located at a point approximately 700 feet south of the intersection of West Tisbury Road and Robinson's Road, extending north towards Nantucket Sound.	7.9	10.8
19	The transect is located at a point near the intersection of School Street and High Street, extending northeast towards Nantucket Sound.	8.2	14.3
20	The transect is located in Katama Bay at a point approximately 750 feet northeast of the intersection of Green Hollow Road and Katama Road, extending northeast towards Edgartown Harbor.	8.2	14.0
21	The transect is located at a point approximately 100 feet north of the intersection of Chappaquiddick Road and West Cape Poge Avenue, extending northwest towards Edgartown Harbor.	8.2	*
22	The transect is located along the Cape Pogue shore at a point approximately 200 feet east of the intersection of Main Street and Cooke Street, extending northeast towards Nantucket Sound.	8.2	16.0
23	The transect is located along the Cape Pogue shore at the intersection of Lighthouse Road and the Road to the Gut, extending northeast towards the Nantucket Sound.	8.2	16.5
24	The transect is located in Katama Bay at a point approximately 400 feet southeast of the intersection of Sand Plain Way and Tackanash Avenue, extending southwest towards the Atlantic Ocean.	6.8	14.8

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988
[*]1% annual chance water level governed by wave runup

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD88[3]) MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
25	The transect is located approximately 1,200 feet east of the intersection of Katama Road and Pleasant Avenue, extending south towards the Atlantic Ocean.	6.8	14.8
26	The transect is located approximately 500 feet south of the intersection of Aero Avenue and Mattakesett Way, extending south towards the Atlantic Ocean.	6.8	15.1
27	The transect is located in Edgarton Great Pond at a point approximately 1,500 feet east of the intersection of Jacob's Neck Road and Swan Lake Farm, extending south towards the Atlantic Ocean.	6.8	15.2
28	The transect is located in Oyster Pond at a point approximately 1,300 feet east of Oyster Watcha Road, extending south towards the Atlantic Ocean.	6.8	15.3
29	The transect is located at a point approximately 1,100 feet north of the intersection of Big Homer's Pond Road and Scrubby Neck Road, extending south towards the Atlantic Ocean.	6.8	15.4
30	The transect is located in Tisbury Great Pond at a point approximately 1,600 feet south of the intersection of Bradley Martin Road and Deep Bottom Road, extending southwest towards the Atlantic Ocean.	7.1	13.3
31	The transect is located in Tisbury Great Pond at a point near the intersection of Tiah's Cove Road and Plum Bush Point Road, extending south towards the Atlantic Ocean.	7.1	15.9
32	The transect is located in Tisbury Great Pond at a point near the intersection of Edgartown West Tisbury Road and Old County Road, extending southeast towards the Atlantic Ocean.	7.1	15.9

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

		ELEVATION (feet NAVD88[3])	
TRANSECT	**LOCATION**	**1-PERCENT-ANNUAL-CHANCE STILLWATER[1]**	**MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]**
33	The transect is located at a point approximately 400 feet east of Bartleed Woods Road and South Road, extending south towards the Atlantic Ocean.	6.8	15.5
34	The transect is located at a point near the intersection of South Road and South Abels Hill Road, extending southeast towards the Atlantic Ocean.	6.8	15.5
35	The transect is located at a point approximately 750 feet north of South Road and Stone Ridge, extending southeast towards the Atlantic Ocean.	6.8	15.7
36	The transect is located at a point approximately 1,800 feet southwest of the intersection of South Road and Windy Gates Road, extending south towards the Atlantic Ocean.	6.8	15.8
37	The transect is located in Nashaquitsa Pond, at a point approximately 600 feet north of the intersection of Eliot Avenue and South Road, extending southeast towards the Atlantic Ocean.	6.8	15.8
38	The transect is located in Nashaquitsa Pond, at a point approximately 50 feet east of State Road and Greenhouse Lane, extending southeast towards the Atlantic Ocean.	6.8	15.8
39	The transect is located at a point approximately 250 feet west of the intersection of Austen Pasture and State Road, extending southeast towards the Atlantic Ocean.	6.8	15.7
40	The transect is located at a point approximately 600 feet southwest of the intersection of Spruce Gate Road and Squibnocket Farm Road, extending southwest towards the Atlantic Ocean.	6.8	14.9

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD88[3]) MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
41	The transect is located in Squibnocket Pond at a point approximately 2,00 feet southwest of the intersection of State Road and Austen Pasture, extending southwest towards the Atlantic Ocean.	6.8	14.5
42	The transect is located at a point approximately 4,000 feet southeast of the intersection of Moshup Trail and Red Gate Farm, extending southwest towards the Atlantic Ocean.	6.8	15.1
43	The transect is located at a point approximately 3,000 feet southeast of the intersection of Moshup Trail and Maple Hill Road, extending southwest towards the Atlantic Ocean.	6.8	16.1
44	The transect is located at a point approximately 1,000 feet northeast of the intersection of Moshup Trail and Windy Hill, extending southwest towards the Atlantic Ocean.	6.8	16.3
45	The transect is located at a point approximately 800 feet north of the intersection of Pilot's Landing and Lighthouse Road, extending northwest towards Vineyard Sound.	7.8	*
46	The transect is located at a point approximately 211 feet east of the intersection of Mariner's View Lane and Lighthouse Road, extending north towards Vineyard Sound.	7.8	*
47	The transect is located at a point approximately 1,000 feet southeast of the intersection of Sandcastle Lane and Lighthouse Road, extending north towards Vineyard Sound.	7.8	14.6
48	The transect is located at a point approximately 1,000 feet east of the intersection of Lighthouse Road and Lobsterville Road, extending northeast towards Vineyard Sound.	7.8	14.3

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988
[*]1% annual chance water level governed by wave runup

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

TRANSECT	LOCATION	ELEVATION (feet NAVD88[3]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD88[3]) MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]
49	The transect is located in Menemsha Pond at a point approximately 1,600 feet east of the intersection of State Road and Abel's Neck Road, extending northwest towards Vineyard Sound.	7.8	14.5
50	The transect is located approximately 270 feet northeast of the intersection of Cemetery Road and Rebecca Lane, extending northwest towards Vineyard Sound.	8.0	16.2
51	The transect is located in Menemsha Pond at a point approximately 200 feet east of the intersection of State Road and Herring Run, extending north towards Vineyard Sound.	7.8	11.8
52	The transect is located in Menemsha Pond at a point approximately 500 feet northeast of the intersection of State Road and Clam Point Cove Road, extending northwest.	7.8	10.7
53	The transect is located in Menemsha Pond at a point approximately 650 feet southeast of the intersection of State Road and Gay Mark, extending northwest.	7.8	10.8
54	The transect is located on Nonamesset Island at a point 1,000 feet of the intersection of Minnamesset Road and Lackeys Bay Road, extending southeast towards Vineyard Sound.	10.1	18.4
55	The transect is located on Uncatena Island approximately 700 feet east of Uncatena Road, extending southeast towards Vineyard Sound.	10.1	16.1
56	The transect is located on Naushon Island at a point near the intersection of Main Road and Stonehouse Road, extending southeast towards Vineyard Sound.	10.1	17.5

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988

TABLE 10 - TRANSECT DESCRIPTIONS - (cont'd)

		ELEVATION (feet NAVD88[3])	
TRANSECT	**LOCATION**	**1-PERCENT-ANNUAL-CHANCE STILLWATER[1]**	**MAXIMUM 1-PERCENT-ANNUAL-CHANCE WAVE CREST[2]**
57	The transect is located on Naushon Island at a point approximately 700 feet east of Grapevine Walk and Sunset Path, extending south towards Vineyard Sound.	9.9	16.6
58	The comment said that we didn't use roads in the S_TRNS layer. But it's on an island where we don't have any roads in that layer. Check with Dave and see what's up with that. Not sure there's anything we can do.	10	16.2
59	The transect is located on Pasque Island at a point approximately 4,000 feet southeast of Robinson's Hole, extending south towards Vineyard Sound.	9.9	21.2
60	The transect is located on Nashawena Island at a point approximately 500 feet south of Quicks Hole Pond, extending southeast towards Vineyard Sound.	9.8	20.3
61	The transect is located on Cuttyhunk Island at a point approximately 4,000 feet east of Cemetery Road, extending south towards Vineyard Sound.	9.7	20.5
62	The transect is located on Cuttyhunk Island at Cemetery Road, extending south towards Vineyard Sound.	9.7	20.4
63	The transect is located on Cuttyhunk Island at a point approximately 7,000 feet southeast of the intersection of Cemetery Road and Gosnold County Road, extending southeast towards Vineyard Sound.	9.7	20.7

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, maximum wave elevations may not be shown on the FIRM.
[3]North American Vertical Datum of 1988

TABLE 11 - TRANSECT DATA

STILLWATER ELEVATION[1]

TRANSECT	FLOODING SOURCE	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD88*)[2]
1	Vineyard Sound	5.1	6.8	8.1	10.8	VE	13
						AE	13
2	Vineyard Sound	5.1	6.8	8.1	10.8	VE	12-14
						AE	11
3	Vineyard Sound	3.2	6.1	7.6	11.3	VE	14
4	Vineyard Sound	3.2	6.1	7.6	11.3	VE	11-13
						AE	10
5	Vineyard Sound	3.2	6.1	7.6	11.3	VE	11-13
						AE	9-11
6	Vineyard Sound	3.2	6.1	7.6	11.3	VE	12
7	Vineyard Sound	3.2	6.1	7.6	11.3	VE	15
8	Vineyard Haven Harbor	3.2	6.1	7.6	11.3	VE	12-13
						AE	10
9	Lagoon Pond	2.3	5.2	6.6	11.1	AE	10
10	Lagoon Pond	2.3	5.2	6.6	11.1	VE	9
11	Vineyard Haven Harbor	3.2	6.1	7.6	11.3	VE	11-13
						AE	10-11
12	Vineyard Haven Harbor	3.2	6.1	7.6	11.3	VE	13-14
						AE	10
13	Vineyard Haven Harbor	3.3	6.1	7.7	11.5	VE	13
14	Nantucket Sound	3.3	6.1	7.7	11.5	VE	14-15
						AE	10-12
15	Nantucket Sound	3.3	6.1	7.7	11.5	VE	15
						AE	10
16	Nantucket Sound	3.3	6.1	7.7	11.5	VE	15
						AE	10-11
17	Nantucket Sound	3.4	6.3	7.9	11.8	VE	13-14
						AE	10

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[*]North American Vertical Datum of 1988

TABLE 11 - TRANSECT DATA - (cont'd)

STILLWATER ELEVATION[1]

TRANSECT	FLOODING SOURCE	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD88*)2
18	Nantucket Sound	3.4	6.3	7.9	11.8	AE	11
19	Nantucket Sound	3.5	6.5	8.2	12.2	VE	13-14
						AE	9-11
20	Edgartown Harbor	3.5	6.5	8.2	12.2	VE	12-14
21	Edgartown Harbor	3.5	6.5	8.2	12.2	VE	17
22	Nantucket Sound	3.5	6.5	8.2	12.2	VE	16
23	Nantucket Sound	3.5	6.5	8.2	12.2	VE	14-17
						AE	12
24	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	14-15
						AE	11
25	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-16
						AE	10-12
26	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	13-15
						AE	11
27	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-15
28	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	13-15
						AE	10
29	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-15
30	Atlantic Ocean	4.4	6	7.1	9.4	VE	13-16
						AE	10
31	Atlantic Ocean	4.4	6	7.1	9.4	VE	13-16
32	Atlantic Ocean	4.4	6	7.1	9.4	VE	12-16
33	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-16
34	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	13-16
35	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	14-16

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
*North American Vertical Datum of 1988

TABLE 11 - TRANSECT DATA - (cont'd)

STILLWATER ELEVATION[1]

TRANSECT	FLOODING SOURCE	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD88*)[2]
36	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	16
37	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-16
						AE	11
38	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	16
39	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	16
40	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	15
41	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	12-15
42	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	15
43	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	16
44	Atlantic Ocean	4.2	5.7	6.8	9.1	VE	16
45	Vineyard Sound	4.9	6.6	7.8	10.5	VE	17
46	Vineyard Sound	4.9	6.6	7.8	10.5	VE	18
47	Vineyard Sound	4.9	6.6	7.8	10.5	VE	15
						VE	11
						AE	10
48	Vineyard Sound	4.9	6.6	7.8	10.5	VE	12-14
49	Vineyard Sound	4.9	6.6	7.8	10.5	VE	12-16
						AE	11-12
50	Vineyard Sound	5.0	6.7	8.0	10.7	AE	11
51	Vineyard Sound	4.9	6.6	7.8	10.5	VE	12-14
52	Menemsha Pond	4.9	6.6	7.8	10.5	VE	12
53	Menemsha Pond	4.9	6.6	7.8	10.5	VE	12
54	Vineyard Sound	4.3	8.1	10.1	14.9	VE	16-18
55	Vineyard Sound	4.3	8.1	10.1	14.9	VE	15-16
56	Vineyard Sound	4.3	8.1	10.1	14.9	VE	14-17
						AE	12

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
*North American Vertical Datum of 1988

TABLE 11 - TRANSECT DATA - (cont'd)

STILLWATER ELEVATION[1]

TRANSECT	FLOODING SOURCE	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (feet NAVD88*)[2]
57	Vineyard Sound	4.7	8.2	9.9	13.8	VE	17
58	Vineyard Sound	4.6	8.1	10	14.1	VE	10-17
59	Vineyard Sound	4.8	8.2	9.9	13.6	VE	21
60	Vineyard Sound	5.0	8.3	9.8	13.2	VE	20
61	Vineyard Sound	5.2	8.3	9.7	12.7	VE	20
						AE	17
62	Vineyard Sound	5.2	8.3	9.7	12.7	VE	15-20
						AE	15
63	Vineyard Sound	5.2	8.3	9.7	12.7	VE	20

[1]Including stillwater elevation and effects of wave setup.
[2]Because of map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
*North American Vertical Datum of 1988

Figure 1, "Transect Location Map," illustrates the location of the transects for the county.

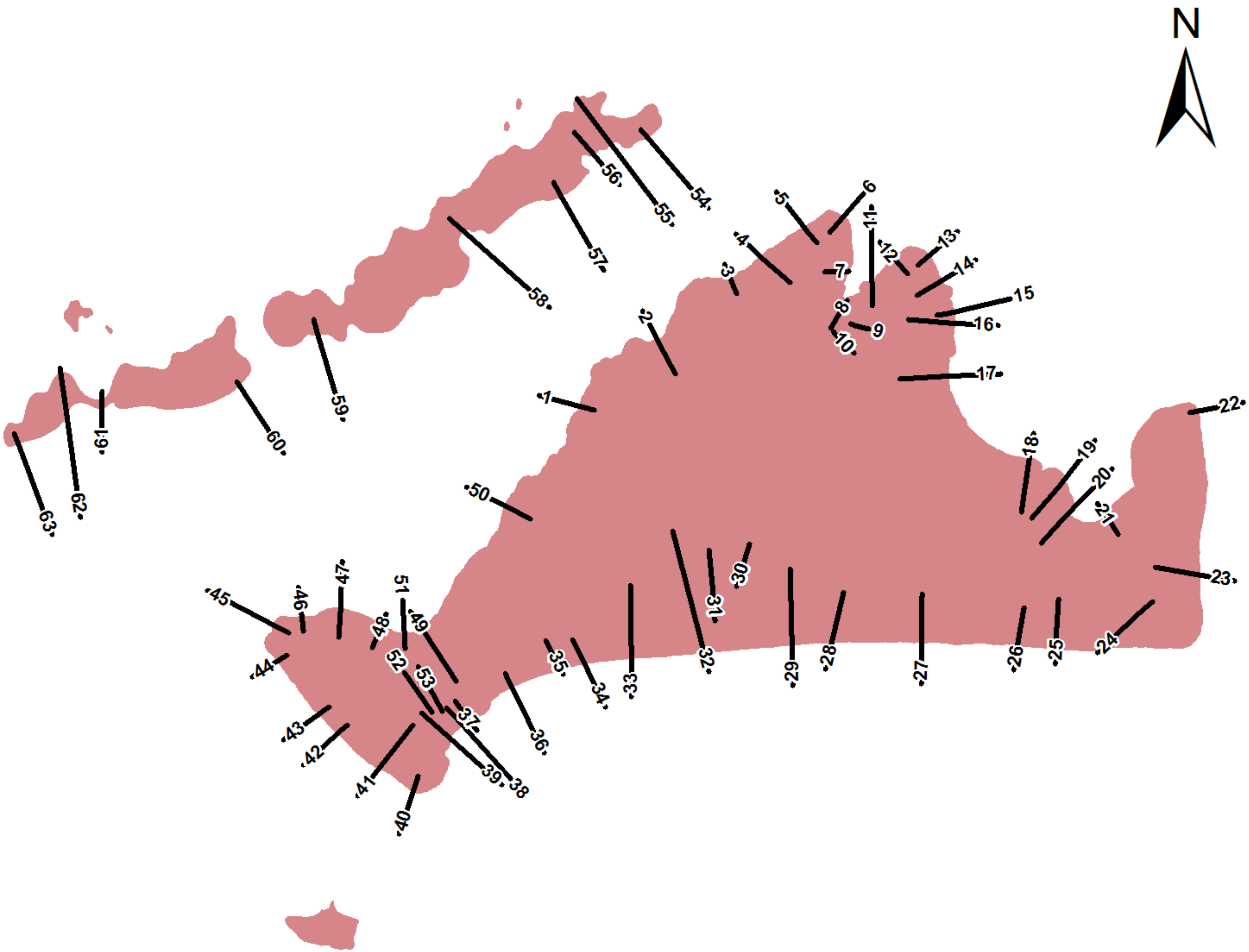

Figure 1-TRANSECT LOCATION MAP

Along each transect, WHAFIS computes wave heights and wave crest elevations taking into account the combined effects of changes in ground elevation, vegetation, and other obstructions. Wave heights are calculated to the nearest 0.1 foot, and wave crest elevations are computed at whole-foot intervals. The calculations are carried inland along the transect until the wave crest elevation is permanently less than 0.5 foot above the SWEL or until the coastal flooding meets another flood source (e.g., a riverine flood source).

Figure 2 shows a typical cross-shore profile and illustrates the effects of energy dissipation and regeneration of waves along the transect. The figure illustrates the attenuating effect of obstructions such as buildings, vegetation, and topography on the wave crest envelope was waves propagate inland. Conversely, the wave crest elevations increase due to wave growth in open, unobstructed fetches.

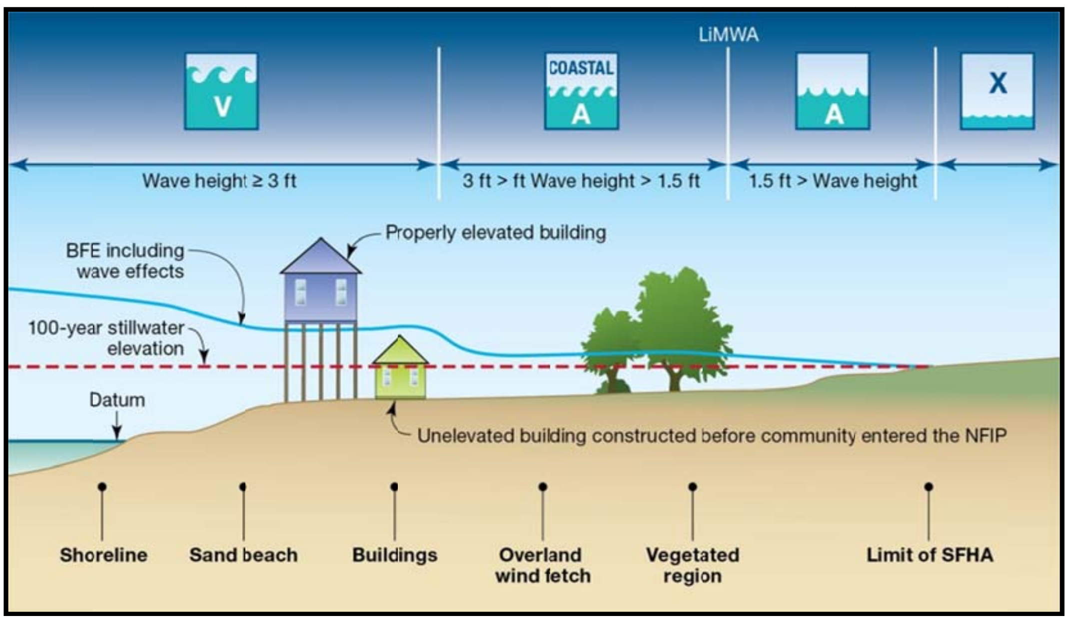

Figure 2 – TRANSECT SCHEMATIC

3.5 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor. **The conversion factor from NGVD29 to NAVD88 is -0.9, and from NAVD88 to NGVD29 is +0.9.**

For information regarding conversion between the NGVD29 and NAVD88, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

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

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

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

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

For Dukes County, data were taken from previously printed FISs for each individual community and are compiled below.

In tidal areas without wave action in Aquinnah, Chilmark, and the Wampanoag Tribe of Gay Head (Aquinnah), the 1- and 0.2- percent-annual-chance boundaries were delineated using topographic maps at a scale of 1: 4,800 with a contour interval of 5 feet (Reference 55, 76). In Gosnold, for tidal areas without wave action, the 1- and 0.2-percent-annual-chance boundaries were delineated using USGS topographic maps at a scale of 1:24,000 enlarged to a scale of 1:12,000 with a contour interval of 10 feet (Reference 50). For the tidal areas with wave action, the flood boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land-cover data, the topographic maps referenced above, and aerial photographs (References 55, 56, 57, 58, and 61). The 1-percent-annual-chance floodplain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

Along the southern coastline of Chilmark, a number of ponds are separated from the Atlantic Ocean by sand dunes. Some of these dunes are shown on the detailed maps rising above the 1-percent-annual-chance. Because the dunes would be overtopped, broken down, or washed away during a 1-percent-annual-chance flood, they have been shown to be within the 1-percent-annual-chance.

For this revision, Strategic Alliance for Risk Reduction (STARR) performed coastal flood hazard analysis for the study area that included the collection of storm surge (coastal hydrology) data and conducting overland wave height analysis (coastal hydraulics). For storm surge or stillwater elevations, the STARR team used the “Tidal Flood Profiles New England Coastline,” prepared by New England Division, USACE, dated September 1988. STARR has reviewed the FEMA HQ report titled, “Updating Tidal Profiles for New England Coastline,” dated December 3, 2008, for the 10-, 2-, 1-, and 0.2- percent-annual-chance flood events. The 1988 profiles also reflect highwater information for multiple areas resulting from the Hurricanes of 1938 and February 1978 extratropical events.

The overland wave height analysis was performed using CHAMP. Results of the overland wave height analysis were transferred to topographic work maps.

After the wave models were reviewed, the model outputs were imported into ArcMap and zone point shapefiles were generated. The zone point shapefiles delineate the change in BFEs along the transect and can be used to map the BFE changes. The BFEs were separated by drawing gutter lines which connect the zone point breaks between transects.

STARR delineated the 1- and 0.2-percent-annual-chance floodplain boundaries for Dukes County using standard GIS utilities. The STARR team manually drew the floodplain boundaries on the on 2-foot topographic contours derived from the terrain model using LiDAR collected in 2011. Aerial imagery and land use data assisted in the development of these features.

Zone VE (high wave velocity action area) was assigned to areas where the wave height is at least 3 feet. Since the wave crest is 70 percent of the controlling wave height above the stillwater plus setup surface, the wave crest in Zone VE is at least 2.1 feet higher than the stillwater plus wave setup elevation. Zone AE was assigned to areas where the total wave height is less than 3 feet and the wave crest is less than 2 feet above the stillwater plus wave setup elevation. Any zone width that is less than 0.2 times the FIRM scale was merged into the adjacent higher elevation zone. In the case of Dukes County, the FIRM scales are 1 inch equals 500 feet, so zone widths of less than 100 feet were usually merged to the adjacent higher zone.

In March 2007, FEMA developed the guidance on the identification and mapping of the LiMWA. For Dukes County, MA this mapping was done by identifying the LiMWA location(s) along each transect using the WHAFIS output and connecting those points between transects using gutter lines. In areas where runup elevations dominate over WHAFIS wave height, such as areas with steeply sloping beaches or high bluffs, there is no need to delineate the LiMWA. To retain continuous LiMWA lines in runup areas, the LiMWA was placed immediately landward of the mapped VE/AE Zone boundary and coincident with the 1-percent-annual-chance floodplain boundary in areas without an AE zone.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 1). On the Aquinnah and the Wampanoag Tribe of Gay Head (Aquinnah) maps, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones AE and VE), 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.

4.2 Base Flood Elevations

Areas within the community studied by detailed engineering methods have BFEs established in A and V Zones. These are the elevations of the base (l-percent-annual - chance) flood relative to NAVD88. In coastal areas affected by wave action, BFEs are generally maximal at the normal open shoreline. These elevations generally decrease in a landward direction at a rate dependent on the presence of obstructions capable of dissipating the wave energy. Where possible, changes in BFEs have been shown in 1-foot increments on the FIRMs. However, where the scale did not permit, 2- or 3-foot increments were sometimes used. BFEs shown in the wave action areas represent the average elevation within the zone. Current program regulations generally require that all new construction be elevated such that the first floor, including basement, is above the BFE in A and V Zones.

4.3 Velocity Zones

The USACE has established the 3-foot wave as the criterion for identifying coastal high hazard zones. This was based on a study of wave action effects on structures. This criterion has been adopted by FEMA for the determination of V Zones. Because of the additional hazards associated with high-energy waves, the NFIP regulations require much more stringent floodplain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in V Zones are higher than those in A Zones with similar numerical designations. The location of the V Zone is determined by the 3-foot wave as discussed previously. The detailed analysis of wave heights performed in this study allowed a much more accurate location of the V Zone to be established. The V Zone generally extends inland to the point where the 1-percent-annual-chance flood depth is insufficient to support a 3-foot wave.

5.0 INSURANCE APPLICATION

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

Flood Insurance Zones

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 report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs 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 BFEs 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, 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 (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

The FIRM for Dukes County includes areas designated by Congress as units of the Coastal Barrier Resources System (CBRS), where federally backed flood insurance is not available.

The Coastal Barrier Resources Act of 1982 and the Coastal Barrier Improvement Act of 1990 define and establish a system of protected coastal areas (including the Great Lakes) known as the CBRS. The Acts define areas within the CBRS as depositional geologic features consisting of unconsolidated sedimentary materials; subject to wave, tidal, and wind energies; and protecting landward aquatic habitats from direct wave attack. The Acts further define coastal barriers as “all associated aquatic habitats, including the adjacent wetlands, marshes, estuaries, inlets and nearshore waters, but only if such features and associated habitats contain few manmade structures and these structures and man’s activities on such features, and within such habitats do not significantly impede geomorphic and ecological processes.” The Acts provide protection to CBRS areas by prohibiting most expenditures of Federal funds within them. These prohibitions refer to “any form of loan, grant, guarantee, insurance, payment, rebate, subsidy or any other form of direct or indirect Federal assistance,” with specific and limited exceptions. The CBRS boundaries depicted on the FIRM for Chatham County were adopted into public law by Acts of Congress and are, therefore, considered final and not subject to appeal.

In addition to the CBRS, the Coastal Barrier Improvement Act of 1990 established Otherwise Protected Areas (OPAs). OPAs are undeveloped coastal barriers within the boundaries of an area established under Federal, State, or local law, or held by a qualifying organization, primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes.

Congress designated the initial CBRS areas in 1982. Subsequent modifications of the CBRS are introduced as legislation to be acted on by Congress, and originate from State and local requests, as well as recommendations made by the U.S. Fish and Wildlife Service. After Congress approves additions to the CBRS, the new areas are assigned a unique effective date, after which Federal assistance prohibitions apply. In cooperation with the U.S. Department of the Interior, FEMA transfers CBRS boundaries to FIRMs using Congressionally adopted source maps titled Coastal Barrier Resources System. FIRMs clearly depict the different CBRS areas and their effective dates with special map notes and symbols. It should be noted that although FEMA shows CBRS areas on FIRMs, only Congress may authorize a revision of CBRS boundaries.

Within CBRS boundaries, Federal flood insurance is not available for structures built or substantially improved on or after the date that the subject area was added to the CBRS. To assist map users in determining the correct insurance prohibition date in CBRS areas, each separate CBRS unit is clearly identified on the FIRM. It is important to note that insurance for structures in OPAs may be obtained if written documentation is provided, which certifies that the structures are used in a manner consistent with the purpose for which the area is protected.

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 BFEs or average depths. Insurance agents use zones and BFEs 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.

The countywide FIRM presents flooding information for the entire geographic area of Dukes County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 12, “Community Map History.”

The FIRM for Dukes County is, for insurance purposes, the principal result of the FIS. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole foot water-surface elevation of the base (1-percent-annual-chance) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Aquinnah, Town of	December 6, 1974	October 1, 1983	October 15, 1985	September 4, 1987 July 2, 1992 September 29, 1996
Chilmark, Town of	December 6, 1974	October 1, 1983	October 15, 1985	July 2, 1992 July 20, 1998
Edgartown, Town of	May 31, 1974	October 22, 1976	July 2, 1980	October 1, 1983 March 18, 1985 July 2, 1992 July 16, 1997 July 20, 1998
Gosnold, Town of	December 20, 1974	None	June 4, 1980	October 1, 1983 June 3, 1986 November 4, 1987 July 2, 1992 July 20, 1998
Oak Bluffs, Town of	March 22, 1974	July 19, 1977	July 2, 1980	March 18, 1985 July 2, 1992
Tisbury, Town of	March 22, 1974	June 11, 1976 October 1, 1983	June 15, 1984	None
West Tisbury, Town	February 14, 1975	October 1, 1983	October 15, 1985	July 2, 1992 September 29, 1996 July 20, 1998

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

DUKES COUNTY, MA

(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies published on flooding sources studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

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

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