Discovery Report

Coastal Flood Study
Westchester County
New York
Report Number 01
1/31/2014

FEMA

Federal Emergency Management Agency
Department of Homeland Security
26 Federal Plaza
New York, NY

Project Area Community List

Westchester County	
Briarclif Manor, Village of	New Castle, Town of
Buchanan, Village of	New Rochelle, City of
Cortlandt, Town of	Ossining, Town of
Croton-on-Hudson, Village of	Ossining, Village of
Dobbs Ferry, Village of	Peekskill, City of
Hastings-on-Hudson, Village of	Pelham, Village of
Irvington, Village of	Pelham Manor, Village of
Larchmont, Village of	Port Chester, Village of
Mamaroneck, Town of	Rye, City of
Mamaroneck, Village of	Sleepy Hollow, Village of
Mount Pleasant, Town of	Tarrytown, Village of
Mount Vernon, City of	Yonkers, City of

This list includes all communities within the study area of project focus in the Coastal Study under consideration for new FEMA Flood Insurance Studies and Flood Insurance Rate Maps. Not all communities will receive new/updated FEMA Flood Insurance Studies or Flood Insurance Rate Maps.

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Acronyms and Abbreviations

AAL	Average Annualized Loss
BRHA	Bluff Recession Hazard Area
CAV	Community Assistance Visit
CBRS	Coastal Barrier Resources System
CID	Community Identification Number
CIS	Community Information System
CNMS	Coordinated Needs Management Strategy
CRS	Community Rating System
DEM	Digital Elevation Model
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIS	Geographic Information System
HAZUS-MH	Multi-Hazard Risk Assessment and Loss Estimation Software Program
LiDAR	Light Detection and Ranging
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision based on Fill
MNUSS	Mapping Needs Update Support System
NDBC	National Data Buoy Center
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NVUE	New, Verified, or Updated Engineering
OFA	Other Federal Agencies
RGB	Red, Green and Blue Imagery
Risk MAP	Risk Mapping, Assessment, and Planning
SFHA	Special Flood Hazard Area
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

I. Discovery Overview

The Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning, or Risk MAP, program helps communities identify, assess, and reduce their flood risk. Through Risk MAP, FEMA provides information to enhance local mitigation plans, improve community outreach, and increase local resilience to floods.

During Discovery, FEMA:

- Gathers information about local flood risk and flood hazards
- Reviews mitigation plans to understand local mitigation capabilities, hazard risk assessments, and current or future mitigation activities
- Supports communities within the watershed to develop a vision for the watershed's future
- Collects information from communities about their flooding history, development plans, daily operations, and stormwater and floodplain management activities
- Uses all information gathered to determine which areas of the watershed require mapping, risk assessment, or mitigation planning assistance through a Risk MAP project

A. Coastal Flood Study

FEMA has initiated a coastal analysis and mapping study to produce updated Flood Insurance Rate Maps (FIRMs) for coastal counties along the Atlantic Coast. The new coastal flood hazard analyses will utilize updated one percent annual chance (100-year) flood elevations obtained from a comprehensive storm surge study.

An updated coastal flood study is needed to obtain a better estimate of coastal flood hazards on the Atlantic Coast. The current, effective FIRMs are outdated primarily due to the age of data and the coastal methodologies used in producing them. Major changes in National Flood Insurance Program (NFIP) policies and methodologies have been implemented since the effective date of many flood insurance studies in the area, creating the need for an update that will reflect a more detailed and complete hazard determination.

The Atlantic Coastal Study includes a system-wide solution that provides a comprehensive analysis of storm and high water events along the coast. This program is funded through the FEMA Risk MAP program. FEMA, the Association of State Floodplain Managers, State partners, and FEMA contractors will collaborate in updating the coastal methodology and flood maps. FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing communities for flood-related disasters.

B. Purpose of Westchester Discovery

The aim is to update NFIP products to increase public awareness of short- and long-term storm events and associated storm surge and waves in order to improve community resiliencies related to flood losses (life, property, and business).

C. Coastal Flood Risk Products

Risk MAP will provide state and community officials with three Flood Risk Products to help them gain a better understanding of flood risk and its potential impact on communities and individuals. These products will also enable communities to take proper mitigation actions to reduce this risk.

- Flood Risk Report
- Flood Risk Map
- Flood Risk Database

These products will summarize information captured through the Flood Risk Datasets during a Flood Risk study. These datasets include:

- Changes Since Last FIRM
- Flood Depth and Analysis Grids
- Flood Risk Assessment Data
- Areas of Mitigation Interest.

II. Westchester County Outreach Strategy

A. Westchester Discovery Stakeholder Coordination

To communicate effectively throughout the life of a possible Risk MAP project in this Westchester County Coastal Flood Study, the use of e-mail, telephone, and letters will be essential. A master or central list of stakeholders in the communities within the Project Area has been established and is included in Appendix A. Several invitations were sent to stakeholders within the Westchester County portion of the Coastal Study project.

Representatives from the local governments, including cities, boroughs, and townships, are considered fundamental stakeholders in this process because they have been elected or appointed to represent the interests of the residents of the Project Area. In addition to local governments, the county officials were invited to participate in the Discovery Meetings. See Appendix D for a complete list of the stakeholders who were invited to the Discovery Meetings.

Table 1: Westchester County Communities Invited to Participate

Community	Municipality Type	Community	Municipality Type
Briarcliff Manor	Village	New Castle	Town
Buchanan	Village	New Rochelle	City
Cortlandt	Town	Ossining	Town
Croton-on-Hudson	Village	Ossining	Village
Dobbs Ferry	Village	Peekskill	City
Hastings-on-Hudson	Village	Pelham	Village
Irvington	Village	Pelham Manor	Village
Larchmont	Village	Port Chester	Village
Mamaroneck	Town	Rye	City
Mamaroneck	Village	Sleepy Hollow	Village
Mount Pleasant	Town	Tarrytown	Village
Mount Vernon	City	Yonkers	City

III. Summary of Data Analysis

A list of the data collected, the deliverable or product in which the data are included, and the sources of the data are shown in the table below. In addition, the discussion Data Analysis is divided into two sections: one section listing the data that can be used for Risk MAP products and the other section listing the information that helped the study team to form a more profound understanding of the study area.

In Westchester County, the communities within the coastal study area were invited to a Project Kickoff Meeting. During that meeting, community officials were presented with the Risk MAP Discovery concept and asked to participate in the months to come.

Table 2: Data Collected for Westchester County

Data Types	Deliverable/Product	Source
Average Annualized Loss Data	Discovery Map Geodatabase	Census 2010 and HAZUS
Boundaries: Community	Discovery Map Geodatabase	FEMA
Boundaries: County and State	Discovery Map Geodatabase	National Atlas of the United States
Boundaries: Watersheds	Discovery Map Geodatabase	USGS
Census Blocks	Discovery Map Geodatabase	U.S. Census Bureau
Coastal Barrier Resources System	Discovery Map Geodatabase	U.S. Fish and Wildlife Service
Contacts	Excel spreadsheet	Local websites, State/FEMA updates
Community Assistance Visits	Community Fact Sheet	Community Information System (CIS)
Community Rating System	Community Fact Sheet	FEMA's "Community Rating System Communities and Their Classes"
Coordinated Needs Management Strategy	Discovery Map Geodatabase	FEMA
Critical Facilities	Community Fact Sheets	Local Mitigation Plans
Dams and/or Levees	Discovery Map Geodatabase	USGS
Declared Disasters	Community Fact Sheets	FEMA's "Disaster Declarations Summary"
Demographics, Industry	Community Fact Sheet	U.S. Census Bureau, Hazard Mitigation Plans

Table 2: Data Collected for Westchester County - continued

Data Types	Deliverable/Product	Source
Effective Floodplains: Modernized SFHAs	Discovery Map Geodatabase	FEMA's Mapping Service Center and Mapping Information Platform
Gage Data	Discovery Map Geodatabase	USGS
Hazards Mitigation Plans and Status	Community Fact Sheets	Community Websites
Hazard Mitigation Assistance Program Grants Received	Community Fact Sheets	FEMA's "Hazard Mitigation Program Summary"
Individual Public Assistance	Community Fact Sheet	FEMA's "Public Assistance Funded Projects Summary"
Insurance Policies	Community Fact Sheet	CIS
Letter of Map Change (LOMCs)	Community Fact Sheet (known clusters on Discovery Map Geodatabase)	FEMA's Mapping Information Platform
Mapping Needs Update Support System (MNUSS)	Community Fact Sheet	FEMA's "MNUSS Search"
Mid-term Levee Inventory	Discovery Map Geodatabase	MLI
Mitigation Projects: Recent, ongoing, planned, desired FEMA/OFA/local projects	Discovery Map Geodatabase	Mitigation Plans
Repetitive Loss	Community Fact Sheet	CIS
Stream Gages	Discovery Map Geodatabase	USGS
Topography	Discovery Map Geodatabase	NOAA, PAMAP

A. Data that can be used for Coastal Flood Risk Products

During the Discovery process, a database of available flood hazard and flood risk assessment data was created. This database is an inventory of available data and helps identify gaps in the flood hazard data. State, county, and government GIS Web sites are a good place to start the data search, but local knowledge of flooding and mitigation projects is critical to help accurately determine flood risks and mapping needs. Therefore, locally and regionally developed data will be used where available.

1. Average Annualized Loss Data

The Average Annualized Loss (AAL) data provides a general understanding of the dollar losses associated with a certain frequency of flood events within a county and is used to get a relative comparison of flood risk. It is determined by using FEMA's Multi-Hazard Risk Assessment and Loss Estimation Program, otherwise known as Hazus-MH. The current Hazus-MH analysis is based on approximate flood boundaries and national datasets.

The countywide results for Westchester County was obtained from the report called FEMA HAZUS AAL Usability Analysis April 2013 and are shown in the table below. AAL data summarized at the census block level are shown in Discovery Maps.

Table 3: HAZUS AAL Data in Westchester County, NY

FIPS	County	Total (in thousands of dollars)	Building (in thousands of dollars)	Content (in thousands of dollars)
36119C	Westchester	$6,505,000	$2,305,000	$3,957,000

Source: FEMA HAZUS AAL Usability Analysis 2012

2. Bathymetry

The LiDAR-derived data were **c**ollection was a joint effort by the NOAA Coastal Services Center (CSC) and the New York State Department of Environmental Conservation. The data were collected to depict the elevations above and below water along the immediate coastal zone.

3. Jurisdictional Boundaries

Jurisdictional boundaries were obtained from FEMA.

4. Shoreline Change Information

Westchester County has approximately 70 miles of shoreline along the Hudson River and Long Island Sound.

5. Stream Lines/Hydrograph

Stream lines were obtained from the effective Westchester County (All Jurisdictions) FIRM database issued September 28, 2007.

6. Topography

Light Detection and Ranging (LiDAR) elevation data is available for all areas within the project area. 2012 LASer (LAS) file format covering the project area in Westchester County is available from NOAA. Each file covers 750 m by 750 m on the ground. Horizontal Datum is UTM, NAD 83, zone 18 N. Vertical Datum is NAVD88. This data will be used to develop 3-d models of the ground or surface, and for engineering and mapping applications.

7. Transportation

Transportation features were obtained from the effective Westchester County (All Jurisdictions) FIRM database September 28, 2007.

8. Watershed Boundaries

Westchester County is within three HUC8 watersheds 1100006 – Saugatuck, 2030101 – Lower Hudson, and 2030102 – Bronx.

B. Other Data and Information

Westchester County is located in the southeastern portion of the State of New York. It is bordered on the north by Putnam County; on the east by Fairfield County, Connecticut; on the south by the City of New York; on the west by the Hudson River. On the southeastern border lies the Long Island Sound.

Geologically, lower Westchester County is part of the Piedmont Zone, which is a transition between the Atlantic Coastal Plain to the southeast and the Hudson Highlands to the northwest. The ridges, valleys, and streams trend north to northeast. The eastern side of Westchester County rests on the upper edge of the unsubmerged portion of the continental shelf of the United States, which was scoured out to form Long Island Sound. The geology of the streams in southern Westchester County is generally similar. Principal structural elements in these various basins are Fordham Gneiss, Inwood Limestone, and Manhattan Schist, overlain by Charlton, Hollis, and Paxton soils. Outcroppings of bedrock are frequent throughout each of the watersheds. The unconsolidated overlying materials are predominantly of glacial origin. Stratified drift and alluvium deposits cover much of the low-lying lands, while till deposits of varying thicknesses cover much of the hillside bedrock.

Coastal Barrier Resources System
Coastal barriers are unique land forms that protect distinct aquatic habitats and serve as the mainland's first line of defense against damage from coastal storms and erosion. The Coastal Barrier Resources System (CBRS) defines a coastal barrier as a landform composed of unconsolidated shifting sand or other sedimentary material that is generally long and narrow and entirely or almost entirely surrounded by water. They are sufficiently above normal tides so that they usually have dunes and terrestrial vegetation. To varying degrees, they enclose and thereby protect other features, such as estuaries, salt marshes, and the mainland, from direct wave influence by the open ocean.

There are no CBRS boundaries within Westchester County.

9. Coastal Zone Protection Structures

USACE's Enterprise Coastal Inventory Database application and database houses information on over 900 coastal structures as well as associated inlet data. The coastal structures protect harbors and shore-based infrastructure, provide shoreline stability control, provide flood protection, protect coastal communities, roadways and bridges, etc. Coastal

structures include seawalls, groins, bulkheads, revetments, dikes, levees, breakwaters, jetties, and piers. In Westchester County, NY information on coastal structure information is not available through USACE's Enterprise Coastal database.

10. Community Assistance Visits

Statewide Community Assistance Visits (CAVs) are part of the evaluation and review process used by FEMA and local officials to ensure that each community adequately enforces local floodplain management regulations to remain in compliance with National Flood Insurance program (NFIP) requirements. Generally, a CAV consists of a tour of the floodplain, an inspection of community permit files, and meetings with local appointed and elected officials. During a CAV, observations and investigations will focus on identifying issues in various areas, such community floodplain management regulations/ordinances, community administration and enforcement procedures, engineering or other issues within the FIRMs, other problems in community floodplain management, and problems with the Biennial report data.

Any administrative problems or potential violations identified during a CAV will be documented in the CAV findings report. The community will be notified and given the opportunity to correct administrative procedures and remedy any violations to the maximum extent possible within established deadlines.

Statewide CAVs serve as an evaluation and review process between FEMA and local officials to ensure that each community adequately enforces local floodplain management regulations to remain in compliance with NFIP requirements. CAVs are also a way to provide technical assistance to communities. Table 4 lists the CAVs performed within the Project Are.

Table 4: CAVs Performed within the Project Area in Westchester County, NY

Community	CID	CAV Date
Village of Larchmont	360915	03/31/2006
Town of Mamaroneck	360917	03/21/2006
Village of Mamaroneck	360916	09/24/2008
City of Peekskill	360924	07/13/1999
City of Rye	360931	07/19/1999
City of Yonkers	360936	04/04/2012

11. Community Rating System

The Community Rating System (CRS) is a voluntary incentive program to provide flood insurance premium discounts to NFIP-participating communities that take extra measures to

manage floodplains above the minimum requirements. A point system is used to determine a CRS rating. The more measures a community takes to minimize or eliminate exposure to floods, the more CRS points are awarded and the higher the discount on flood insurance premiums. The list of CRS communities is available on FEMA's Web site.

As of November 2012, only the Village of Scarsdale is a participating community in Westchester County in the CRS program. Village of Scarsdale is located outside the Westchester County coastal flood study area and will not be affected by upcoming PMR

12. Hazard Mitigation Plans

Westchester County has a countywide hazard mitigation plan (Westchester County Hazard Mitigation Plan for County Owned Property and Infrastructure). This plan will identify potential hazards and threats that face Westchester County. Subsequent to the completion of the plan the county is eligible to receive grants for future mitigation projects through the Hazard Mitigation Grant Program (HMGP). There are numerous advantages of mitigation. By creating a mitigation plan the potential hazards that may arise in the future are identified. Once the threats are identified, this enables the county to take steps to eliminate or minimize the impact a potential hazard would cause. Preventative measures are also cost effective; preventing the impact of a hazard will cost less than cleaning up after a disaster occurs. Mitigation can prevent the loss of lives as well as property damage. This plan focuses primarily on potential hazards that face Westchester County-owned assets and ways to reduce the County's vulnerability to the potential threats. Some of these strategies may take little time to employ while others may take years to implement.

At the local level, each municipal government also adopts a Hazard Mitigation Plan. These municipal plans provide an insight into local issues and initiatives that are of concern to municipal officials. These plans cover the same elements as the County Hazard Mitigation Plan, but from a local perspective. Each municipal hazard mitigation plan in place in Westchester County was reviewed for initiatives and needs affected by the regional transportation system. The status of comprehensive plans is shown in the table below:

Table 5: Comprehensive Plan Status

Participating Jurisdiction	Comprehensive Plan Status	Web Site
Westchester County	October 2005	http://www.westchestergov.com/emergserv/reports/cemp2005.pdf
Village of Briarcliff Manor	August 2008	http://www.briarcliffmanor.org/pages/BriarcliffManorNY_Trustees/HMP/index
Township of Cortlant	October 2009	
Village of Mamaroneck		http://www.village.mamaroneck.ny.us/pages/mamaroneckny_webdocs/Hazard%20Mitigation%20Plan
Town of New Castle	January 2010	

Table 5: Comprehensive Plan Status - continued

Participating Jurisdiction	Comprehensive Plan Status	Web Site
City of New Rochelle	August 2011	http://www.newrochelleny.com/index.aspx?NID=847
City of Peekskill	March 2008	http://www.cityofpeekskill.com/police/peekskill-hazard-mitigation-plan
Village of Pelham	April 2007	http://www.pelhamgov.com/public/Pre-Disaster%20Hazard%20Mitigation%20Plan.htm
Village of Pelham Manor	September 2010	http://www.pelhammanor.org/images/Pelham%20Manor%20MHMP_09.30.10_COMPLETE.pdf
City of Rye	April 2007	http://www.egovlink.com/public_documents300/rye/published_documents/Planning/Hazard%20Mitigation%20Plan%20Adopted%20April%202007.pdf

13. Coordinated Needs Management Strategy and NFIP Mapping Needs

During FEMA's Flood Map Modernization program from 2003 to 2008, FEMA adhered to Procedure Memorandum No. 56 which states that, "Section 575 of the National Flood Insurance Program Reform Act of 1994 mandates that at least once every five years FEMA assess the need to review and update all floodplain areas and flood risk zones identified, delineated, or established under Section 1360 of the National Flood Insurance Act, as amended." This requirement was fulfilled through the Mapping Needs Assessment process. Other mechanisms such as the Mapping Needs Update Support System and scoping reports were used to capture information describing conditions on the FIRMs and the potential for a map update. FEMA's Coordinated Needs Management Strategy (CNMS) was initiated through FEMA's Risk MAP program in 2009.

There are three classifications within the CNMS; "Valid," "Unverified," and "Unknown." New and updated studies (those with new hydrologic and hydraulic models) performed during the Map Modernization program were automatically determined to be "Valid" and the remaining studies went through a 17 element validation process with 7 critical and 10 secondary elements. Validation elements apply Physical, Climatological, and Environmental factors to stream studies to determine validity. A stream study has to pass all of the critical elements and at least 7 secondary elements in order to be classified as "Valid." The remainders of the streams are classified as "Unverified."

CNMS has gone through three phases of assessment. The CNMS Phase 1 (early 2009) created a national map showing approximate new, valid, or updated Special Flood Hazard Area (SFHA) percentage at a county level. The CNMS Phase 2 (August – November 2009) created a CNMS database and performed bulk validation where new and updated studies performed during the Map Modernization program were automatically determined to be valid and digital conversion and pre-Map Modernization approximate studies were automatically invalid. The CNMS Phase 3 (October 2010 – June 2011) confirmed all bulk

validation assignments and put all stream reaches that were not bulk validated through the 17 element process.

There are many elements that are taken into consideration when classifying a study as "Unverified". The age of the study is considered, but it is not the only determining factor. In fact, as many as 70% of the studies thought to be out-of-date, when put through the full 17 validation element process in CNMS Phase 3 process, were determined to be "Valid". Table 5 summarizes draft results of the validation analysis obtained from CNMS.

Table 6: Current Status of CNMS

		Stream Mileage		
County	FIPS	Valid	Unverified	Total
Westchester, NY	36119C	382.16	29.04	411.20

14. Critical Facilities

Critical facilities are those entities that are essential to the health and welfare of the community. The list of critical facilities for the project area was obtained from the Westchester County Hazard Mitigation Plan. It includes 911 and emergency services facilities, airports, colleges and universities, schools, fire departments, police departments, sewage treatment plants, hospitals and nursing homes. The data are shown in the Table 7.

Table 7: Critical Facilities in Westchester County

Municipality	911	Fire	Police	Hospital	Nursing Home	School	Volunteer Ambulance Corp.	College/ University	Correctional Facility	Sewage Treatment Plant	Total
Village of Briarcliff Manor		2	2		2	4	1				11
Village of Buchanan		2	1			1				3	7
Town of Cortlandt		5	1		3	9	2			8	28
Village of Croton-on-Hudson		3	1			3	1			4	12
Village of Dobbs Ferry		2	1	1	1	7	1				13
Village of Hastings-on-Hudson		4	1		1	4	1				11
Village of Irvington		1	1			6	1	1			10
Village of Larchmont		1	1			2					4

Table 7: Critical Facilities in Westchester County - continued

Municipality	911	Fire	Police	Hospital	Nursing Home	School	Volunteer Ambulance Corp.	College/ University	Correctional Facility	Sewage Treatment Plant	Total
Town of Mamaroneck		1				4	1				6
Village of Mamaroneck		5	2		2	5	1			1	16
Town of Mount Pleasant		5	3			13					21
City of Mount Vernon		4	1	1	2	25	1	1			35
Town of New Castle		5	1			7	1			2	16
City of New Rochelle		5	1	1	4	26	2	3		1	43
Town of Ossining						2				1	3
Village of Ossining		7	1		2	8	1		1	1	21
City of Peekskill		5	1	1	1	8	1	1		1	19
Village of Pelham		1	1			4					6
Village of Pelham Manor		1	1			3					5
Village of Port Chester		4	1		1	6	1			1	14
City of Rye		2	1			11				1	15
Village of Sleepy Hollow		3	1			3					7
Village of Tarrytown		4	2	1		5	1	1			14
City of Yonkers		12	5	3	5	69	2	4		1	101

15. Dams

The National Inventory of Dams lists 7 dams within Westchester County, but none are within the Coastal Study project area. The New York State Department of Environment Conversation (NYSDEC) has its own dam safety program which monitors dam and dam like structures through out the state. NYSDEC classifies all dams within the NYSDEC inventory in 3 different groups based on resulting hazard conditions from a potential dam failure.

Class "A" - Low Hazard Dams (No significant impacts on infrastructure and life)
Class "B" - Moderate Hazard Dams (Minor impacts on infrastructure and no threat to life)
Class "C" - High Hazard Dams (Major impacts on infrastructure and potential loss of life)

There are 12 Dam with NYSDEC Hazard Classification "C" located within Coastal Study Project Area.

16. Declared Disasters

The major disaster declarations that have been declared for Westchester County are listed in the Disaster Declaration Table 8. Table 9 lists the Emergency Declarations. FEMA's disaster declarations and emergency declarations Disaster history can be viewed at FEMA's website.

Table 8: Disaster Declarations in Westchester County

Date Declared	Type
October 2012	Severe Winds and Coastal Flooding Resulted from Superstorm Sandy
August 2011	Inland and Coastal Flooding from Hurricane Irene
April 2010	Severe Storms and Flooding
April 2007	Severe Storms and Inland and Coastal Flooding
April 2005	Severe Storms and Flooding
September 2001	World Trade Center Terrorist Attack
September 1999	Hurricane Floyd
November 1996	Severe Storms, Wind and Flooding

Table 9: Emergency Declarations in Westchester County

Date Declared	Type
October 2012	Hurricane Sandy
August 2011	Hurricane Irene
September 2005	Hurricane Katrina Evacuation
August 2003	Power Outage

Table 9: Emergency Declarations in Westchester County - continued

Date Declared	Type
March 2003	Snowstorm
October 2000	Virus Threat

17. Flood Insurance Policies

This Discovery project also gathered data regarding the flood insurance policies in the Watershed through the NFIP. The number of policies, total coverage, and total premium cost are listed in Table 10.

Table 10: Flood Insurance Policy Data in Westchester County

Number of Policies	Total Premium Cost	Total Coverage
4766	$5,902,455.00	$1,320,617,500.00

18. Gage Data

a. Stream Gages

The U.S. Geological Survey (USGS) National Water Information System Web Interface provides real-time data for any given stream gage location. Table 10 below shows the gage identification numbers and locations for the gages in Westchester County. USGS stream gage locations are also shown on the Discovery Maps.

Table 11: Stream Gage Stations in Westchester County

Gage ID	Begin Date	End Date	Gage Location
01300000	09/15/1944	09/16/1999	Blind Brook at Rye, NY
01300500	09/15/1944	05/17/1989	Beaver Swamp Brook at Mamaroneck, NY
01300800	06/19/1972	12/08/2011	Mamaroneck River at Winfield Ave, at Mamaroneck NY
01301000	09/21/1938	12/08/2011	Mamaroneck River at Mamaroneck, NY
01301500	09/14/1944	03/30/2010	Hutchinson River at Pelham NY
01302000	09/12/1944	09/16/1999	Bronx River at Bronxville NY
01375000	03/05/1934	12/08/2011	Croton R @ New Croton Dam NR Croton-on-Hudson NY
01376420	01/21/1979	09/16/1999	Saw Mill River at Elmsford NY
01376500	06/21/1945	12/08/2011	Saw Mill River at Yonkers NY

b. Tidal Gages

National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS) is responsible for recording and disseminating water level data. Table 11 shows the tidal gage station identification number and location for the gages in the Westchester Project area.

Table 12: Tidal Gage Stations in Westchester County

Gage ID	Begin Date	End Date	Gage Location
8516945	10/27/1998	present	Kings Point, NY

c. Wave Gage/Buoy Stations

The National Data Buoy Center (NDBC) is part of the NOAA National Weather Service. The NDBC operates and maintains a large network of data collecting stations. NDBC provides hourly data, including wind speed, direction, and gust; atmospheric pressure; and air temperature. Historical and current data are available at NDBC website.

There are no buoy stations are located in Westchester County.

19. Historical Flooding

According to the effective Westchester County, New York (All Jurisdictions) FIS, dated September 28, 2007:

> Floods may occur during any month of the year in New York.
>
> There have been several major floods in Westchester County dating as far back as 1889. Some have been associated with high stream stages and others with high tidal stages. The most severe riverine floods in the past have been associated with intense rains caused by localized or transcontinental storms, land-falling hurricanes originating in the Caribbean Sea, or heavy rain falling on previously frozen or saturated ground.
>
> A northeaster storm can also produce high tide levels in Long Island Sound and along the coastline of Westchester County. This trend results from storm winds which blow out of the northeast and across the considerable fetch of Long Island Sound. The duration of a northeaster may be several days, and can result in high tidal elevations in the open waters of the sound as well as in the bays and inlets.

Major flooding was observed along the Westchester County coastal communities during Superstrom Sandy (October 2012). Significant flooding and damage reported in Playland Park in City of Rye, Ossining Boat Club in Ossining, City of Yonkers, Village of Port Chester, City of New Rochelle, Mamaroneck Harbor in Village of Mamaroneck, Village of Larchmont and other low lying area. Westchester County was added to the Federal Disaster Declaration area by the President and disaster aid was made available to the affected property and owners.

20. Land Use

According to U.S. Census figures, the total population of Westchester County was 949,113 in 2010. The land in square miles was 430.50 in 2010. According to the U.S.D.A. 2007 Census of Agriculture, there are approximately 106 farms throughout the county, consisting of slightly over 8,521 acres of farmland.

21. Levees

FEMA's Midterm Levee Inventory project compiled a database of structures that were designed to provide at least the minimum level of protection from the base (1-percent-annual-chance) flood level.

There are currently no levees identified within the study area.

22. Letters of Map Change

A Letter of Map Change (LOMC) is a letter that reflects an official revision to an effective NFIP map. LOMCs are issued in place of the physical revision and republication of the effective FIRM. It includes completed cases of Letters of Map Amendment (LOMAs) and Letters of Map Revision (LOMRs), including LOMRs based on fill (LOMR-Fs), and conditional LOMRs.

Each completed LOMA or LOMR-F application results in either a removal or non-removal determination for a structure or property from the SFHA. Removal determinations are evaluated during each new Flood Study and those that that remain valid after the new analyses are complete are officially revalidated once a new FIRM becomes effective.

The lists of LOMC cases within the Westchester County Coastal Study area were obtained from FEMA Mapping Information Platform website. No Conditional LOMAs or Conditional LOMR-F-s was included.

Table 13: LOMCs in Project Area of Westchester County

Community	Number of LOMA/LOMR-Fs	Number of LOMRs
Village of Briarcliff	1	0
Village of Buchanan	1	0
Town of Cortlandt	37	0
Village of Croton-on-Hudson	2	0
Village of Dobbs Ferry	0	0
Village of Hastings-on-Hudson	1	0
Village of Irvington	3	0
Village of Larchmont	2	1

Table 13: LOMCs in Project Area of Westchester County - continued

Community	Number of LOMA/LOMR-Fs	Number of LOMRs
Town of Mamaroneck	7	0
Village of Mamaroneck	26	2
Town of Mount Pleasant	6	0
City of Mount Vernon	1	0
Town of New Castle	15	1
City of New Rochelle	26	3
Town of Ossining	0	0
Village of Ossining	1	1
City of Peekskill	1	1
Village of Pelham	1	0
Village of Pelham Manor	2	0
Village of Port Chester	1	0
City of Rye	19	1
Village of Sleepy Hollow	2	1
Village of Tarrytown	1	1
City of Yonkers	14	3

23. Mitigation Plan Status and Mitigation Projects

A local hazard mitigation plan is a long-term strategic/guidance document used by an entity to reduce future risk to life, property and the economy in a community. The purpose of the Westchester County 2005 Hazard Mitigation Plan is:

- To protect life, safety, and property by reducing the potential for future damages and economic losses that result from natural hazards';
- To qualify for additional grant funding, in both the pre-disaster and the post-disaster environment;
- To speed recovery and redevelopment following future disaster events;
- To demonstrate a firm local commitment to hazard mitigation principles; and
- To comply with both state and federal legislative requirements for local hazard mitigation plans.

The Westchester County 2005 Hazard Mitigation Plan outlines mitigation actions which officials believe are attainable and can be implemented. Some of these activities in the project area include:

- Reduce the number of critical facilities in hazard prone areas including those locations in local jurisdictions. Reduce the future development of County facilities in flood inundation zones
- Reduce the number of critical facilities in hazard prone areas including those locations in local jurisdictions. Map out all critical facilities in 100-year flood zones

- Develop regulations that require zero-increase in runoff
- Raise structures located in flood prone areas
- Require flood proofing building construction methods
- Develop comprehensive plan to relocate critical facilities to safer areas

24. Ordinances

The Project Area's local jurisdictions have a patchwork of regulations regarding development within known flood hazard areas that can range from ordinances with minimum NFIP requirements to strong, pro-active ordinances that not only regulate and protect new and improved development in existing SFHAs but seek to mitigate the growth of SFHAs caused by increased runoff from developed areas and the degradation of natural flood control areas, such as wetlands and forests. The following summarizes the six different ordinance level based on NFIP section 60.3 landuse classification levels.

1. The "a" type should be used when 1-percent-annual-chance floodplains have not yet been identified.

2. The "b" type should be used when 1-percent-annual-chance floodplains without BFEs have been identified.

3. The "c" type should be used only when 1-percent-annual-chance floodplains with BFEs but without floodways have been identified. If the community also has coastal flooding but does not have coastal high-hazard areas (V Zones), it is a "c" type.

4. The "d" type should be used when 1-percent-annual-chance floodplains with BFEs and a floodway have been identified. If the community also has coastal flooding but does not have coastal high-hazard areas (V Zones), it is a "d" type.

5. The "e" type should be used when coastal high-hazard areas (V Zones) have been identified, and there are no floodways designated.

6. The "d&e" type should be used when both floodways and coastal high-hazard areas (V Zones) have been identified.

Table 14 lists the Program Status and Ordinance Level for each community.

Table 14: Program Status and Ordinance Level

Community	Program Status	Ordinance Level
Village of Briarcliff	Participating	D
Village of Buchanan	Participating	D
Town of Cortlandt	Participating	D
Village of Croton-on-Hudson	Participating	D
Village of Dobbs Ferry	Participating	D
Village of Hastings-on-Hudson	Participating	D
Village of Irvington	Participating	D
Village of Larchmont	Participating	D/E
Town of Mamaroneck	Participating	D/E
Village of Mamaroneck	Participating	D/E
Town of Mount Pleasant	Participating	D
City of Mount Vernon	Participating	D
Town of New Castle	Participating	D
City of New Rochelle	Participating	D/E
Town of Ossining	Participating	D
Village of Ossining	Participating	D
City of Peekskill	Participating	D
Village of Pelham	Participating	D
Village of Pelham Manor	Participating	D
Village of Port Chester	Participating	D/E
City of Rye	Participating	D/E
Village of Sleepy Hollow	Participating	D
Village of Tarrytown	Participating	D
City of Yonkers	Participating	D

It is assumed that the NFIP-participating communities within the Project Area have floodplain management regulations in place and have a mechanism for updating their ordinances. Additional information about local ordinances will be requested at the Discovery meeting.

25. Regulatory Mapping

The effective countywide FIS for Westchester County was released on September 28, 2007.

26. Repetitive Loss/Severe Repetitive Loss Properties

This Discovery project also gathered data regarding the flood insurance policies in the Project through the NFIP. The unclaimed repetitive loss information obtained from FEMA suggested 601 repetitive losses within Westchester County. The data is shown in Table 15.

Table 15: Repetitive Losses in Westchester County

Community	CID	Number of Repetitive Losses
Village of Briarcliff	360904	9
Village of Buchanan	361534	1
Town of Cortlandt	360906	4
Village of Croton-on-Hudson	360907	1
Village of Dobbs Ferry	360908	1
Village of Hastings-on-Hudson	360913	3
Village of Irvington	360914	4
Village of Larchmont	360915	26
Town of Mamaroneck	360917	42
Village of Mamaroneck	360916	171
Town of Mount Pleasant	360919	9
City of Mount Vernon	360920	5
Town of New Castle	360921	6
City of New Rochelle	360922	69
Town of Ossining	361241	1
Village of Ossining	361021	2
City of Peekskill	360924	5
Village of Pelham	360925	2
Village of Pelham Manor	360926	3
Village of Port Chester	360928	11
City of Rye	360931	166
Village of Sleepy Hollow	361515	2
Village of Tarrytown	360933	1
City of Yonkers	360936	58

27. Transects

Transect layout for coastal hazards analysis and subsequent floodplain delineation is determined by physical factors such as changes in topography, bathymetry, shoreline orientation, and land cover data, in addition to societal factors such as variations in development and density. The base topography together with aerial photographs will be reviewed to determine the appropriate placement for hazard modeling transects within the Coastal Study area. There are 140 draft transects for 70 miles of shoreline, as shown in Figure 1.

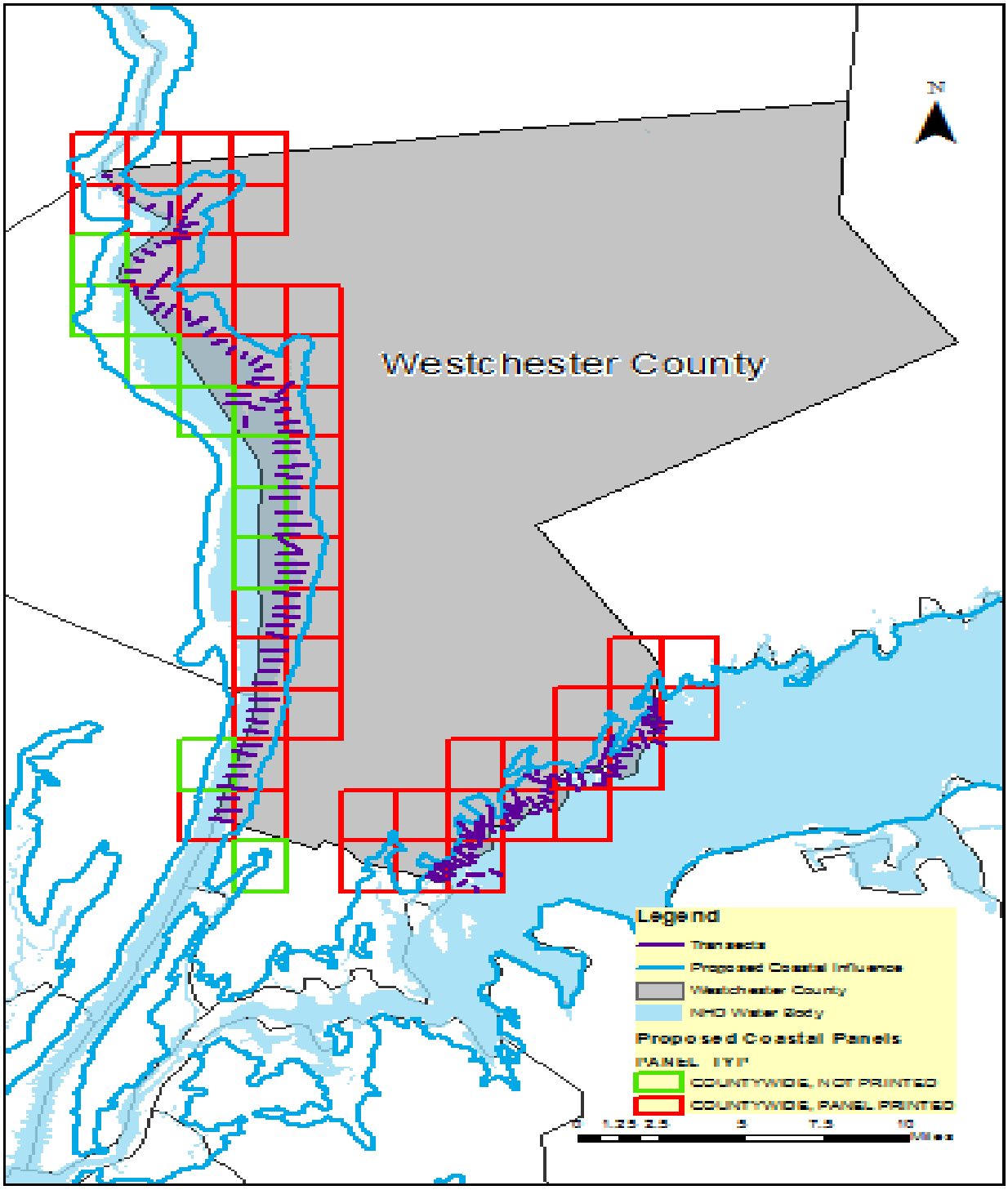

Figure 1: Draft Transects for Westchester County

Discovery Meeting

An initial Discovery Meeting was held on August 1, 2013 via WebEx. A total of three Discovery Meetings were held on August 28-29, 2013 in Westchester County, NY. Westchester County, affected communities and other major stakeholders were invited to the Discovery meetings. The purpose of this meeting is to facilitate discussion about study needs, mitigation project needs, desired compliance support, and local flood risk awareness efforts. The Discovery Maps 1a and 1b will be displayed at the meeting to stimulate the discussion. Attendees, including all affected communities and selected other stakeholders, will be asked to cooperatively identify Areas of Concern within the Coastal Study area.

Discovery Meeting Minutes and other items noted below will be added to the Appendices after the meeting.

- *Meeting Agenda/Minutes*
- *Meeting Sign-In sheet*
- *Meeting Exhibits*
    - *Meeting Presentation*
    - *Handout Material*
- *Community Coastal Data Request Forms*
- *Meeting Evaluation Forms*

IV. Risk MAP Projects and Needs

Risk Map Allows communities to make informed mitigation decisions by providing products and technologies that communicate and visualize risks. Equips communities with the information and tools they need to develop effective mitigation.

A. Coastal Studies

Coastal flood hazard analyses and mapping will be performed for all communities within Westchester County located along the Long Island Sound and Hudson River. Below is a summary of data that will be collected and analysis that will be performed:

1) Creation of Bathymetric and Topographic Map Data Inventory:
Topographic data for the coastal areas to be studied will be used for coastal analysis, floodplain boundary delineation, and/or testing of floodplain boundary standard compliance. The topographic data used will be based on the data collected as part of this Discovery process, and will depend on the date and accuracy of existing topographic data. Only topographic data that is of better quality than that of the original study or effective studies will be used. New topographic and bathymetric LiDAR, RGB imagery, and hyperspectral imagery will be used for the coastal study areas and will replace the existing datasets.

2) Base Map Acquisition
Base map data for all counties, including data collected during this Discovery process as an initial inventory will be collected and organized. The necessary permissions from the map sources will be obtained to allow FEMA to use and distribute hard-copy and digital map products using the digital base map. Base map data must comply with FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners (FEMA, 2003).

3) Coastal Flood Hazard Analysis
Response-based computational approaches outlined in FEMA G&S Appendix D.3 dated May 2012 (FEMA, 2012) will be used to perform coastal flood hazard analysis for the Westchester County shoreline and areas subject to coastal flooding. The coastal flood hazard analyses include the following components:
Wave setup
Erosion
Wave runup
Wave overtopping
Overland wave propagation
Primary frontal dune identification (where applicable)

A transect-based approach for assessing coastal flood risks along Westchester County will be used.

The Westchester County coastal flood study will include Long Island Sound and areas of the Hudson River included within the model domain defined by RAMPP for their Region 2 Coastal Storm Surge Study.

The 1.5-foot breaking wave height will be selected from the Wave Height Analysis for Flood Insurance Studies (WHAFIS) results and used to define the LiMWA as described in FEMA Procedure Memorandum No. 50 updated in 2012.

Coastal flood hazards will be mapped as outlined in FEMA's G&S Appendix D.3 dated May 2012 (FEMA, 2012). Flood hazard mapping will extend to the landward limit of coastal flooding as a result of waves and storm surge.

Coastal flood maps (or workmaps) will be produced for the study area. The workmap will include the 1-percent- and 0.2-percent-annual-chance SFHA, Coastal High Hazard (Zone VE) and Coastal A Zone (Zone AE), base flood elevations (BFEs), and LiMWA. Communities will be provided with an opportunity to review the workmaps after the coastal modeling is complete and before FEMA approves of and adopts the updated coastal flood maps.

B. Mitigation Projects

During the Discovery process, FEMA and RAMPP met with the communities and discussed their recent and current mitigation projects. Based on the results of the Westchester County coastal study, the communities can determine if their existing projects and programs are adequate or if they would benefit from additional mitigation measures.

Technical assistance is available through Risk MAP to help communities identify, select, and implement activities to support mitigation planning and risk reduction. Activities could include (but are not limited to):

- Advising in the creation of initial hazard mitigation plans
- Advising in the update of existing hazard mitigation plans
- Training to improve a community's capabilities for reducing risk
- Assisting in incorporating flood risk datasets and products into potential and effective community legislation, guidance, regulations, procedures, etc.
- Assisting with creating, acquiring, and incorporating GIS data into potential and effective maps, planning mechanisms, emergency management procedures, etc.
- Facilitating the identification of data gaps and interpreting technical data to identify risk reduction deficiencies that should be corrected
- City of Yonkers had shown interest in mitigation area along the old mill buildings along the Hudson River shoreline as there may be a possible waterfront development project in that vicinity. In City of Rye Westchester County is planning to develop portion of Playland park located along the Long Island Sound. The Park has suffered damages during superstorm sandy and other past major flooding events. In City of New Rochelle

area of mitigation interest were identified along the harbor and waterfront as there are proposal of redevelopment of several properties in front of city planning.

C. Compliance

FEMA uses a number of tools to determine a community's compliance with the minimum regulations of the NFIP. Among them are Community Assistance Contacts (CACs) and Community Assistance Visits (CAVs). These tools help assess a community's implementation of its floodplain management regulations and identify any deficiencies and/or violations.

The CAC is a telephone call or brief visit by a FEMA staff member (or staff of a State agency on behalf of FEMA) verifying the community's floodplain management contact. The CAC can be used as a way to screen for potential floodplain management issues in communities that would require a CAV.

The CAV is a visit to a community that serves the dual purpose of providing technical assistance to the community and ensuring that the community is adequately enforcing its floodplain management regulations. Potential violations may be identified during the CAV as a result of touring the floodplain, inspecting community permit files, and meeting with local appointed and elected officials. "Open" CAVs can be indicative of unresolved violations. No open CAVs were found for the coastal communities in Westchester County.

If administrative problems or potential violations are identified, the community will be notified and given the opportunity to correct those administrative procedures and remedy the violations to the maximum extent possible within established deadlines. FEMA or the State will work with the community to help bring the program into compliance with NFIP requirements. In extreme cases where the community does not take action to bring itself into compliance, FEMA may initiate an enforcement action against the community.

During the Discovery process of this study, stakeholders were provided with information regarding NFIP requirements that are associated with coastal hazard zones, as well as information about new FEMA guidance related to moderate wave action. These topics, including coastal SFHAs, building requirements in VE Zones, and LiMWA, are compiled below and discussed in greater detail.

C.1 Coastal Special Flood Hazard Areas

The Westchester County Coastal Flood Hazard study analysis may result in new SFHAs, which are defined as areas that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent-annual-chance flood is also referred to as the base flood or 100-year flood. SFHAs labeled as Zone AE have been studied by detailed methods and show BFEs. SFHAs labeled as Zone VE are along coasts and are subject to additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic analyses are shown within these zones.

The NFIP shows coastal flood hazards in two different zones on its FIRMs:

Zone VE, where the delineated flood hazard includes wave heights equal to or greater than 3 feet; and

Zone AE, where the delineated flood hazard includes wave heights less than 3 feet.

These zones were discussed in greater detail during the Discovery Meetings, as the updated coastal analysis results may show that these flood risks exist along the Hudson River and Long Island Sound shorelines.

C.2 Building Requirements in VE Zones

The zone designation and the BFE are critical factors in determining which requirements apply to a building and, as a result, how the structure must be built. The NFIP minimum requirements for buildings constructed in Zone VE (Coastal High Hazard Areas) are as follows:

1. The building must be elevated on pile, post, pier, or column foundations.
2. The building must be adequately anchored to the foundation.
3. The building must have the bottom of the lowest horizontal structural member at or above the BFE.
4. The building design and method of construction must be certified by a design professional.
5. The area below the BFE must be free of obstructions.
6. Enclosures must be made of lightweight wood lattice, insect screening, or breakaway walls.

Communities participating in the NFIP that have mapped VE Zones must adopt floodplain management regulations that meet or exceed the minimum NFIP requirements described above.

C.3 Limit of Moderate Wave Action

Post-storm field investigations and laboratory tests have confirmed that waves as small as 1.5 feet can cause significant damage to structures that are constructed without consideration of coastal hazards. Additional flood hazards associated with coastal waves include floating debris, high velocity flow, erosion, and scour, which can cause damage to Zone AE-type construction in these coastal areas.

To help community officials and property owners recognize this increased potential for damage due to wave action in the AE Zone, FEMA issued Procedure Memorandum 50 in December 2008, which provides guidance on identifying and mapping the 1.5-foot wave height line, referred to as the Limit of Moderate Wave Action, or LiMWA. The LiMWA alerts property owners on the inland side of this line that although their property is in a Zone AE area, it may also be affected by waves 1.5 feet or higher. Consequently, it is important to be aware of the area between this inland limit and the Zone VE boundary, as the area may face a high risk—though not as high as Zone VE. Figure 2 helps to explain the LiMWA zone location.

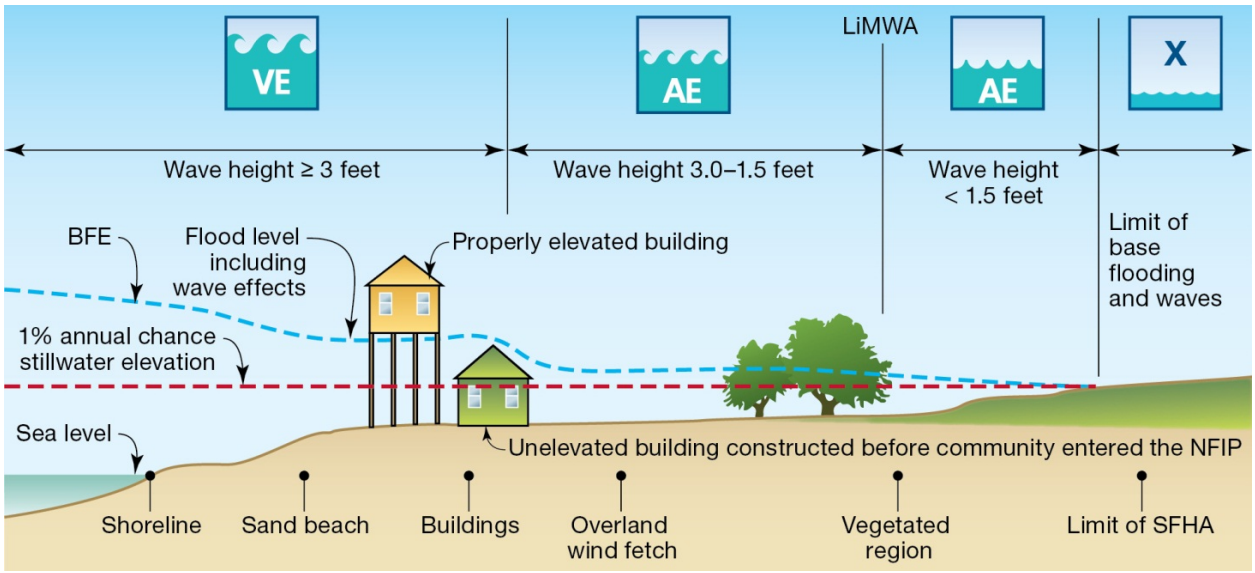

Figure 2: Limit of Moderate Wave Action

A new line layer will be added to the FIRM Database to accommodate the LiMWA features. The new layer will be depicted on updated FIRMs as two black dots and three white dashed lines in a sequential pattern. The LiMWA will be identified in the FIRM legend as "Limit of Moderate Wave Action," and a note will be included in the "Notes to Users" section on the map panel to explain the LiMWA boundary.

Figure 3 is an example FIRM showing the delineated LiMWA. The area in Map A shows the delineation of the LiMWA in an area where the predominant coastal flood hazard is overland wave propagation. Map B shows delineation of the LiMWA in a region where the major coastal flood hazard is wave breaking and runup.

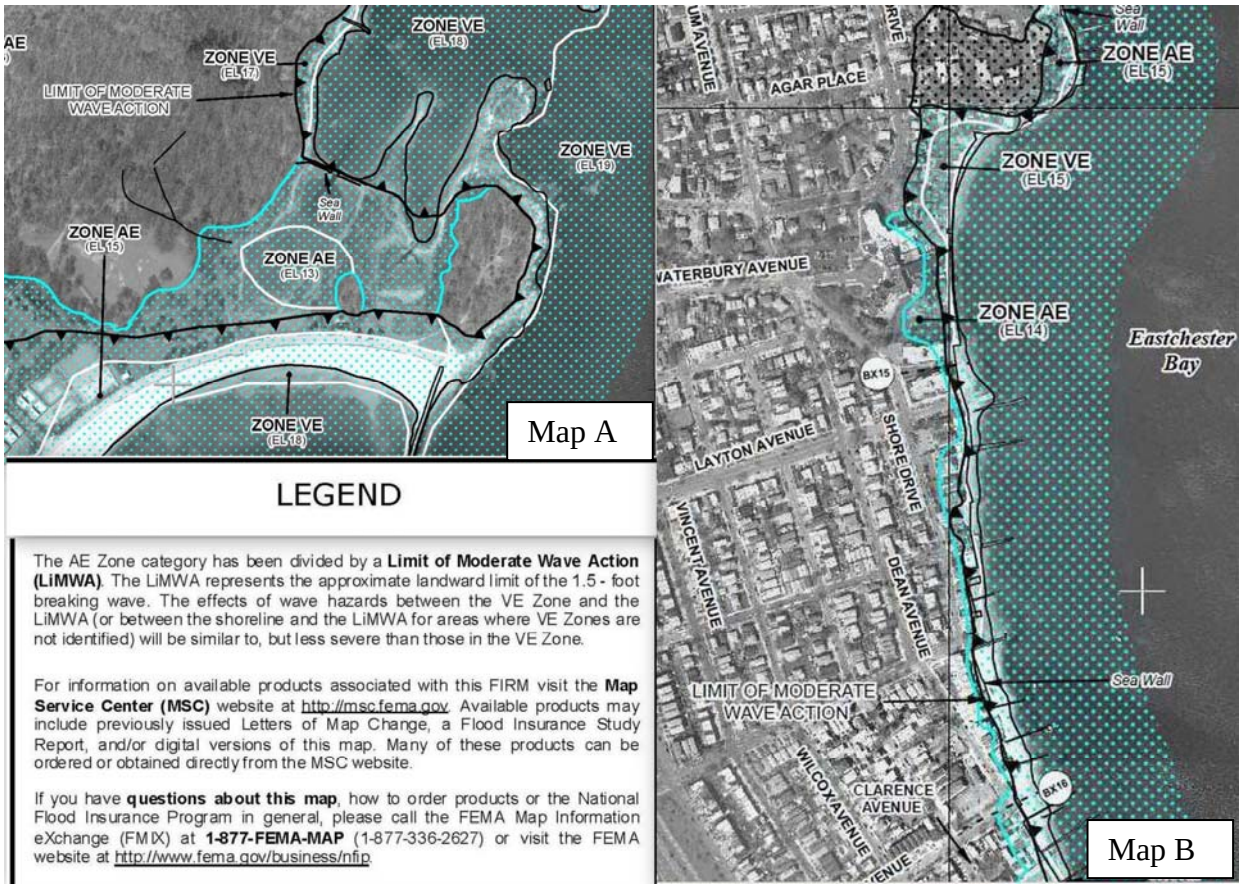

Figure 3: Example FIRM showing LiMWA

While FEMA does not impose floodplain management requirements based on the LiMWA, the LiMWA is provided to help communicate the higher risk that exists in that area. Because the 1.5-foot breaking wave in the LiMWA zone can potentially cause foundation failure, communities are encouraged to adopt building construction standards similar to those in Zone VE in those areas. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. CRS credits can lower insurance premiums for residents and business owners. Additional information on CRS can be found online at http://www.fema.gov/national-flood-insurance-program/community-rating-system.

Mapping the LiMWA will provide community officials and other stakeholders with additional important flood risk details to consider when buying/ developing, mitigating, or enforcing floodplain management regulations in coastal flood hazard areas.

Residents and business owners living or working in the LiMWA zone should be aware of the potential wave action along with floating debris, erosion, and scour that could cause significant damage to their property. They are encouraged to build safer and higher than the minimum local requirements in order to reduce the risk to life and property.

While the risk of damage is higher between the LiMWA line and the Zone VE line than it is in other parts of the coastal AE Zone, the NFIP flood insurance rates currently do not differ from other AE Zone rates.

The Federal mandatory purchase requirement does apply in these zones, and property owners are encouraged to carry coverage equivalent to the replacement cost of their building and to include contents coverage.
For additional background information on the LiMWA, please refer to FEMA Procedure Memorandum No. 50 at www.fema.gov/library/viewRecord.do?id=3481.

D. Communication

Throughout this Discovery process, community representatives and local stakeholders indicated the need to be kept informed about the results of Discovery, the upcoming coastal flood study, and opportunities for public input throughout the study process. As a result of communication to date, several new stakeholders have been identified and added to the master contact database for this study.

E. Unmet Needs

The Westchester County Discovery process did not identify unmet needs during this study. At the conclusion of the Westchester County Coastal Flood Study, communities can examine the results and determine if their existing mitigation projects and floodplain management programs are adequate or if they have needs that have not been met by the new study.

V. Appendices

Communications
- *Contacts*
- *Stakeholders*
- *Notifications/Invitations*
  - *A. Discovery Meeting invites via emails (WebEx) and paper copies (meetings)*
  - *B. Meeting Notes Distributed via email and through RAMPP Website*

Information Exchange
- *Data Questionnaires*

Discovery Meeting
- *Agenda*
- *Presentation*
- *Sign-In Sheet*
- *Discovery Meeting Map and other related Maps*
- *Meeting Minutes*
- *Evaluations*

Discovery Deliverables
- *Report*
- *Project Area Map*
- *Final Discovery Map*
- *Tabular Data, including Data Sources and Mapping Needs*
- *Geodatabase*
- *Database Updates*

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VI. References

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