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# **SECTION 1. INTRODUCTION**

# 1.1 BACKGROUND

Communities, residents and businesses have been faced with continually increasing costs associated with both natural and man-made hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards. Westchester County and 43 participating jurisdictions located therein, have developed this Westchester County Multi-Jurisdictional Hazard Mitigation Plan (WCHMP, also referred herein as the "Hazard Mitigation Plan" or the "plan"), which is a multi-jurisdictional, multi-hazard mitigation plan. The WCHMP includes countywide analysis and assessment of hazards, risk and capabilities and represents both an update of the 2015 "Westchester County Hazard Mitigation Plan for County Owned Property and Infrastructure" (single jurisdiction plan) as well as an update of single- and multi-jurisdictional hazard mitigation plans (HMPs) developed previously by the participating Westchester municipalities. The plan has been prepared following the requirements of the federal Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by

Hazard Mitigation is any sustained action taken to reduce or eliminate the long term risk and effects that can result from specific hazards.

FEMA defines a *Hazard Mitigation Plan* (HMP) as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for the development of multi-jurisdictional hazard mitigation plans, and the New York State Division of Homeland Security and Emergency Services (DHSES) also supports plan development for jurisdictions in New York State.

Specifically, DMA 2000 requires that states, with support from local governmental agencies, update hazard

Westchester County has been included in 35 FEMA (major and emergency) declarations since 1954. mitigation plans on a five year basis to prepare for and reduce the potential impacts of natural hazards. DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning will better enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

# 1.1.1 DMA 2000 Origins -The Robert T. Stafford Disaster Relief and Emergency Assistance Act

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than simply reacting whenever disasters strike communities, the federal government began encouraging communities to first assess their vulnerability to various disasters and proceed to take actions to reduce or eliminate potential risks. The logic is simply that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost and more quickly. Moreover, other costs associated with disasters, such as the time lost from productive activity by business and industries, are minimized.

The Federal Emergency Management Agency (FEMA) estimates that for every dollar spent on damage prevention (mitigation), twice that amount is saved through avoided postdisaster damage

DMA 2000 provides an opportunity for states, tribes and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the

Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning





provisions (Section 409) and replacing them with a new set of requirements (Section 322). This section sets forth the requirements that communities evaluate natural hazards within their respective jurisdictions and develop an appropriate plan of action to mitigate those hazards, while emphasizing the need for state, tribal and local governments to closely coordinate mitigation planning and implementation efforts.

The amended Stafford Act requires that each local jurisdiction identify potential natural hazards to the health, safety and well-being of its residents and identify and prioritize actions that can be taken by the community to mitigate those hazards—before disaster strikes. For communities to remain eligible for hazard mitigation assistance from the federal government, they must first prepare, and then maintain and update an HMP (this plan).

Responsibility for fulfilling the requirements of Section 322 of the Stafford Act and administering the FEMA Hazard Mitigation Program has been delegated to the State of New York, specifically to NYS DHSES. FEMA also provides support through guidance, resources, and plan reviews.

### 1.1.2 Benefits of Mitigation Planning

Effective mitigation planning will help prepare citizens and government agencies to better prepare for and respond when disasters occur. Also, mitigation planning allows Westchester County as a whole, including the participating Westchester County cities, towns, and villages, to remain eligible for mitigation grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning and implementation include:

- An increased understanding of hazards faced by Westchester County communities
- National Benefit-Cost Ratio (BCR) Per Peril **Beyond Code** Federally BCR numbers in this study have been rounded Requirements Funded \$4:1 **\$6:1 Overall Hazard Benefit-Cost Ratio Riverine Flood** \$5:1 \$7:1 **Hurricane Surge \$7:1** Wind \$5:1 S5:1 **Earthquake** \$4:1 \$3:1 Wildland-Urban \$4:1 \$3:1 **Interface** Fire

- A more sustainable and disasterresistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the community
- Reduced long-term impacts and damages to human health and structures
- Reduced costs associated with response and recovery efforts, including repairs

# 1.1.3 Organizations Involved in the Mitigation Planning Effort

Westchester County and the participating jurisdictions have prepared this hazard mitigation plan with full coordination and participation of county and local government, relevant organizations and groups, as well as state and federal agencies and the general public. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and mitigation actions included in Section 6 and in the jurisdictional annexes in Section 9. Including Westchester County, 43 of the municipal governments in the county have participated in the planning process as indicated in Table 1-1 below. It is noted that the Town of Mount Pleasant and Village of Sleepy Hollow elected not to formally participate in this planning process, having either recently completed or were in an active hazard mitigation planning process.



Source:
 FEMA 2018; Federal Insurance Mitigation Administration 2018

 Note:
 Natural hazard mitigation saves \$6 on average for every \$1 spent on federal mitigation grants.

The format of this plan is such that these communities can readily join in the regulatory 5-year plan update process, as identified in Section 7.

Jurisdictions				
Westchester County	Town of North Salem	Village of Hastings-On-Hudson		
City of Mount Vernon	Town of Ossining	Village of Irvington		
City of New Rochelle	Town of Pelham	Village of Larchmont		
City of Peekskill	Town of Pound Ridge	Village of Mamaroneck		
City of Rye	Town of Rye	Village of Mount Kisco		
City of White Plains	Town of Somers	Village of Ossining		
City of Yonkers	Town of Yorktown	Village of Pelham		
Town of Bedford	Village of Ardsley	Village of Pelham Manor		
Town of Cortlandt	Village of Briarcliff Manor	Village of Pleasantville		
Town of Eastchester	Village of Bronxville	Village of Port Chester		
Town of Greenburgh	Village of Buchanan	Village of Rye Brook		
Town of Lewisboro	Village of Croton-On-Hudson	Village of Scarsdale		
Town of Mamaroneck	Village of Dobbs Ferry	Village of Tarrytown		
Town of New Castle	Village of Elmsford	Village of Tuckahoe		
Town of North Castle	Village of Harrison	-		

#### **Multiple Agency Support for Hazard Mitigation**

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments. However, local governments are not alone; various partners and resources at the regional, state and federal levels are available to assist communities in the development and implementation of mitigation strategies. Within New York State, NYS DHSES is the lead agency providing hazard mitigation planning assistance to local jurisdictions. In addition, FEMA provides grants, tools, guidance and training to support mitigation planning.

Additional input and support for this planning effort was obtained from a range of agencies and through public involvement (as discussed in Section 3). The project is managed by the Westchester County Department of Emergency Services – Office of Emergency Management (WCDES-OEM), with oversight provided by a Steering Committee consisting of representatives from WCDES-OEM, the Westchester County Department of Planning (WCDP), and two municipalities (Town of Ossining, Village of Mamaroneck) to provide both county and local perspectives to guide the planning process. The 43 participating municipalities provided significant input into the preparation of the plan, in particular the preparation of the annexes included in Section 9 for each municipality. Details regarding the roles and responsibilities of the various committees and other participants are further discussed in Section 3.













This hazard mitigation plan was prepared in accordance with the following regulations and guidance:

- FEMA Local Mitigation Planning Handbook, March 2013.
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013.
- FEMA Plan Integration: Linking Local Planning Efforts, July 2015.
- Local Mitigation Plan Review Guide, October 1, 2011.
- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 Code of Federal Regulations (CFR) Parts 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004 Interim Final Rules).
- FEMA *How-To Guide for Using HAZUS-MH for Risk Assessment* FEMA Document No. 433, February 2004.
- FEMA *Mitigation Planning How-to Series* (FEMA 386-1 through 4, 2002), available at: <u>http://www.fema.gov/fima/planhowto.shtm</u>.
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013.
- NYS DHSES Hazard Mitigation Planning Standard, 2017.
- NYS DHSES Hazard Mitigation Plan

Table 1-2 summarizes the requirements outlined in the DMA 2000 Interim Final Rule and where each of these requirements is addressed in this hazard mitigation plan.

#### Table 1-2. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan			
Prerequisites				
Adoption by the Local Governing Body: §201.6(c)(5)	Section 2.0; Appendix A			
Planning Process				
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 3.0			
Risk Assessment				
Identifying Hazards: §201.6(c)(2)(i)	Sections 5.2			
Profiling Hazards: §201.6(c)(2)(i)	Section 5.4			
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 5.4			
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 4.0 Section 5.4			
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 5.4			
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 4.0; Section 9 Annexes			
Mitigation Strategy				
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 6.0; Section 9 Annexes			
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Section 6.0; Section 9 Annexes			
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 6.0; Section 9 Annexes			
Multi-Jurisdictional Mitigation Actions: : §201.6(c)(3)(iv)	Section 6.0; Section 9 Annexes			
Plan Maintenance Process				
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7.0			
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7.0; Section 9 Annexes			





Plan Criteria	Primary Location in Plan
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7.0

#### Organization

The Westchester County Hazard Mitigation Plan has been organized into a two-volume plan to facilitate use of this plan as a resource for each participant. The plan provides a detailed review and analysis of hazards of concern, resources, and relevant statistical information for Westchester County and participating municipalities.

Volume I is intended for use as a resource for on-going mitigation analysis. It includes a description of the county and local municipalities as well as information on mitigation planning and how the risk assessment and capability analysis was performed. Volume II consists of an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; evaluates vulnerabilities to natural hazards; describes the status of past mitigation actions; and provides specific mitigation strategies. The annexes are intended to provide an expedient resource for each jurisdiction for implementation of mitigation projects and maximizing future grant opportunities.

#### Hazard Mitigation Plan Mission Statement, Goals, and Objectives

#### **Mission Statement**

In order to provide a guiding principle to describe the overall duty and purpose of the planning process and in accordance with FEMA guidance (386-1), the Westchester County Hazard Mitigation Plan Steering Committee chose to develop a Mission Statement for this plan. The intent of this statement is to focus the range of goals and objectives identified to support the over-arching purpose of the plan. This is provided as an enhancement to the 2015 plan which did not include a mission statement or guiding principle.

As a result of the committee deliberations, the 2021 Westchester County Hazard Mitigation Mission Statement is as follows:

The mission of the Westchester County Hazard Mitigation Plan is to protect and enhance the health, safety, property, environment, and economy of the communities within Westchester County and to increase resilience by partnering and planning to identify and reduce future vulnerability to natural and other emerging hazards in an equitable, proactive, and efficient manner.

#### Goals and Objectives

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." The mitigation goals have been developed based on the risk assessment results, discussions, research, and input from amongst the committee, existing authorities, polices, programs, resources, stakeholders and the public.



Goal 4: Encourage the development and implementation of long-term, cost-effective, environmentally sound, and resilient mitigation projects to preserve or restore the functions of natural systems.





The Westchester County Hazard Mitigation Plan planning process included a review and update of the prior mitigation goals and the addition of all new objectives as a basis for the planning process and to guide the selection of appropriate mitigation actions addressing all hazards of concern. Further, the goal development process considered the mitigation goals expressed in the New York State HMP, as well as other relevant county and local planning documents, as discussed in Section 6 (Mitigation Strategy).

#### **Hazards of Concern**

Westchester County and participating jurisdictions reviewed the natural hazards that caused measurable impacts based on events, losses and information available since the development of the current Westchester County HMP (2015). Westchester County and participating jurisdictions evaluated the risk and vulnerability due to each of the hazards of concern on the assets of each participating jurisdiction. Although the resulting hazard risk rankings varied for each jurisdiction, the summary risk rankings corresponded with that of Westchester County and are indicated in each jurisdictional annex. The hazard risk ranks were used to focus and prioritize individual jurisdictional mitigation strategies.

#### **Plan Integration into Other Planning Mechanisms**

#### Effective mitigation is achieved when hazard awareness and risk

management approaches and strategies become an integral part of public activities and decision-making. Within the county there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate, complement, and reference those plans and programs to the extent practical in order to be a comprehensive resource for hazard mitigation.

The "Capability Assessment" section of Chapter 6 (Mitigation Strategy) provides a summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (Federal, State, County and local) that support hazard mitigation within the county. Within each jurisdictional annex in Chapter 9, the County and each participating jurisdiction have identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework ("integration capabilities"), and how they intend to continue to promote this integration ("integration actions"). A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7.

### **1.1.4 Implementation of Prior and Existing Local Hazard Mitigation Plans**

The status of the mitigation projects identified in prior or existing local HMPS are provided in Section 6 (Mitigation Strategy) and Section 9 (Jurisdictional Annexes) of the plan. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Those projects not completed have been revaluated, modified as necessary and incorporated into this plan. The County and municipal annexes describe these mitigation activities in more detail, and plan maintenance procedures (Section 7) have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.

### 1.1.5 Implementation of the Planning Process

To support the planning process in developing this plan, Westchester County and the participating jurisdictions have accomplished the following:

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#### Westchester County HMP Hazards of Concern

Earthquake Extreme Temperature Flood Severe Storm Severe Winter Storm Wildfire Chemical, Biological, Radiological, Nuclear (CBRN)



- Developed a Steering Committee and countywide planning partnership with municipalities and stakeholders,
- Reviewed the 2015 "Westchester County Hazard Mitigation Plan,
- Identified/reviewed hazards that are of greatest concern to the community (hazards of concern) to be included in the update,
- Profiled these hazards,
- Estimated the inventory at risk and potential losses associated with these hazards,
- Developed appropriate hazard mitigation goals,
- Reviewed mitigation strategies identified in prior and existing local HMPS to indicate progress,
- Developed new mitigation actions to address reduction of vulnerability of hazards of concern,
- Involved a wide range of stakeholders and the public in the plan update process,
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NYS DHSES and FEMA.

As required by DMA 2000, Westchester County and participating jurisdictions have informed the public and provided opportunities for public comment and input. In addition, numerous agencies and stakeholders have participated as core or support members, providing input and expertise throughout the planning process.

This Hazard Mitigation Plan documents the process and outcomes of Westchester County and the jurisdictions' efforts. Additional information on the plan update process is included in Section 3, Planning Process. Documentation that the prerequisites for plan approval have been met is included in Section 2, Plan Adoption.

# 1.1.6 Organization of This Mitigation Plan

The planning effort followed the four-phase planning process recommended by FEMA and summarized in Figure 1-2.





#### Figure 1-2. Westchester County Hazard Mitigation Planning Process



This plan was organized in accordance with FEMA and NYS DHSES guidance, organized into two volumes: Volume I includes all information that applies to the entire planning area (Westchester County); and Volume II includes specific information for the County as a jurisdiction as well as each participating jurisdiction.

More specifically, Volume I of this plan includes the following sections:

Section 1: Introduction: Overview of participants and planning process

Section 2: Plan Adoption: Information regarding the adoption of the plan by Westchester County and each participating jurisdiction.

**Section 3:** Planning Process: A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the plan will be incorporated into existing programs.

Section 4: County Profile: An overview of Westchester County, including: (1) general information and physical conditions, (2) economy, (3) land use patterns and trends, (4) population and demographics, (5) general building stock inventory and (6) critical facilities.

**Section 5:** Risk Assessment: Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety and health; general building stock; critical facilities and the economy). Description of the status of local data and planned steps to improve local data to support mitigation planning.

**Section 6:** Mitigation Strategies: Information regarding the mitigation goals and objectives identified by the Steering Committee in response to priority hazards of concern, and the process by which County and local mitigation strategies have been developed or updated.

Section 7: Plan Maintenance Procedures: A system to continue to monitor, evaluate, maintain and update the plan.

Volume II of this plan includes the following sections:

Section 8: Planning Partnership: Description of the planning partnership and jurisdictional annexes.

**Section 9:** Jurisdictional Annexes: A jurisdiction-specific annex for Westchester County and each participating jurisdiction containing their hazards of concern, hazard risk ranking, capability assessments, mitigation actions, action prioritization specific only to Westchester County or that jurisdiction, progress on prior mitigation activities (as applicable), and a discussion of prior local hazard mitigation plan integration into local planning processes.

#### Appendices include:

**Appendix A:** Sample Resolution of Plan Adoption: Documentation that supports the plan approval signatures included in Section 2 of this plan.

**Appendix B**: Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

**Appendix C:** Public and Stakeholder Outreach Documentation: Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan update process.





#### Appendix D: Participation Matrix

Appendix E: Action Worksheet Template and Instructions

**Appendix F:** Plan Maintenance Tools: Examples of plan review templates available to support annual plan review and example FEMA Guidance Worksheets (FEMA 386-4).

#### Appendix G: Critical Facility Inventory

- **Appendix H:** County Profile and Risk Assessment Supplementary Data: Details regarding past hazard events since those documented in the 2015 plan.
- Appendix J: NYS DHSES Planning Standards: Includes planning standards and guidelines for hazard mitigation planning.

Appendix K: Linkage Procedures

### **1.2 The Plan Update – What is Different?**

Westchester County's initial HMP was initially approved by FEMA and adopted by participating jurisdictions in 2015. The 2021 update builds on the 2015 plan and specifically includes the following changes or enhancements. This plan differed from its predecessor for a variety of reasons:

- (1) This plan was prepared in accordance with the 2017 NYS DHSES guidance which provided a framework for a more concise and focused mitigation plan.
- (2) Updated data and tools provided for a more detailed and accurate risk assessment. Building footprint data was now available to provide a more accurate flood vulnerability assessment. The risk assessment was prepared to better support future grant applications by providing risk and vulnerability information that would directly support the measurement of "cost-effectiveness" required under FEMA mitigation grant programs.
- (3) There was a strong desire on the part of Westchester County for this plan to be a user-friendly document that is understandable to the general public and not overly technical and provide images and text that can easily be used as tools to better communicate local hazard risk.
- (4) The plan identified implementable actions rather than strategies, with enough information to serve as the basis for policy and funding decisions and represent measurable impacts on resiliency and mitigation progress. Strategies provide direction, but actions are fundable under grant programs.

#### Table 1-3. Plan Changes Crosswalk





2021 Updated Plan



Overall vulnerability assessment.

was convened to provide an additional opportunity for input. A comprehensive review of relevant plans and programs was performed by the planning team. A similar methodology, using new, updated data, was employed for the 2021 plan update. The 2021 risk ranking included the addition of two additional factors to provide a relative risk ranking of the hazards. These included climate change sensitivity and adaptive capacity.

The same format, using new and updated data, was used for the 2021 plan update. Each section of the risk assessment includes the following:

- Hazard profile, including maps of extent and location, previous occurrences, and probability of future events.
- Climate change impacts on future probability using the best available data for New York State.
- Vulnerability assessment includes: impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability.
- The vulnerability assessment also includes changes in vulnerability since the 2015 plan.
- Identified issues have been documented in each hazard profile.

The same methodology was deployed for the 2021 plan update, using new and updated data.

§201.6(c)(2)(ii): [The risk assessment] shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.

Vulnerability was assessed for all hazards of concern. The HAZUS-MH computer model was used for the severe storm, earthquake, and flood hazards. These were Level 2 analyses using county data. Site-specific data on county-identified critical facilities were entered into the HAZUS-MH model. HAZUS-MH outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from HAZUS-MH-MH.





44 CFR Requirement	2015 Plan	2021 Undated Plan
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.	A summary of NFIP insured properties including an analysis of repetitive loss property locations was included in the plan.	The same methodology was deployed for the 2021 plan update using new and updated aggregate data.
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" for the planning area, and these were inventoried by exposure. Each hazard profile provides a discussion on future development trends.	The same methodology was deployed for the 2021 plan update using new and updated data and enhanced with the identification of lifeline facilities.
Requirement $\S201.6(c)(2)(ii)(B)$ : [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern. These were generated by HAZUS-MH for the severe storm, earthquake, and flood hazards. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in HAZUS-MH.	The same methodology was deployed for the 2021 plan update using new and updated data.
Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a summary of anticipated development in the County profile, as well as in each individual annex.	The same methodology was deployed for the 2021 plan update using new and updated data.
§201.6(c)(3):[ The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2015 plan contained a goals, objectives and actions. The mission statement, goals and objectives were regional and covered all planning partners. Each planning partner identified actions that could be implemented within their capabilities. The actions were jurisdiction-specific and strove to meet multiple objectives. All objectives met multiple goals and stand alone as components of the plan. Each planning partner completed an assessment of its planning, regulatory, technical, and financial capabilities.	The 2021 plan includes a mission statement. Regarding goals, the same methodology for setting goals, objectives, and actions was applied to the 2021 plan update. The Steering Committee reviewed and reconfirmed the mission statement, goals, and objectives for the plan. Each planning partner used the progress reporting from the plan maintenance and evaluated the status of actions identified in the 2015 plan. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2021 plan, and in some cases, new actions were added to the action plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Steering Committee identified goals, and objectives targeted specifically for this hazard mitigation plan. These planning components supported the actions identified in the plan.	The same methodology for setting goals, objectives, and actions was applied to the 2021 plan update. The Steering Committee reviewed and updated the mission statement, goals, and objectives for the plan to include a focus on increased resiliency. This resulted in the finalization of four goals and 20 objectives to frame the plan.
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section	Concerted efforts were made to assure that municipalities develop updated	A tocused process was used to provide step-wise review of a



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44 CFR Requirement	2015 Plan	2021 Updated Plan
that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013). Members of the Planning Committee and contract consultants worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).	comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard. Each partner was mentored by the contracted planner and the County to review and enhance carry-over actions from the 2015 plan to provide a better foundation for funding and implementation. In addition, projects in all mitigation categories (Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, and Education and Awareness actions were reviewed and considered when addressing problem statements identified by the partners or via public and stakeholder feedback. <i>Additional data regarding</i> <i>problem areas are included in annex</i> <i>mapping to support identification of</i> <i>effective mitigation actions.</i>
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners that participate in the NFIP identified an action stating their commitment to maintain compliance and good standing under the program.	Ongoing participation in the NFIP for municipalities was included in ongoing capabilities.
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each recommended action was prioritized using a methodology based on the STAPLEE criteria for the 2015 plan.	The same methodology based on the STAPLEE criteria but using new and updated data was used for the 2021 plan update.
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five- year cycle.	The 2015 plan details steps for monitoring, evaluating, and updating the mitigation plan set forth in 44 CFR § 201.6.	The 2021 plan details a plan maintenance strategy enhancing that of the initial plan by use of a web- based proprietary progress reporting tool.
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2015 plan details recommendations for incorporating the plan into other planning mechanisms.	<ul> <li>The 2021 plan details</li> <li>recommendations for incorporating</li> <li>the plan into other planning</li> <li>mechanisms such as the following:</li> <li>Comprehensive Plan.</li> <li>Emergency Response Plan.</li> <li>Capital Improvement Programs.</li> <li>Municipal Code.</li> </ul>
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2015 plan details a strategy for continuing public involvement.	The 2015 plan maintenance strategy was carried over to the 2021 plan. In addition, the County will use a proprietary online tool to support the annual progress reporting of mitigation actions.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include]	42 of 45 planning partners participated in the 2015 planning process.	The 2021 plan achieves DMA compliance for 43 planning partners.



44 CFR Requirement	2015 Plan	2021 Updated Plan
documentation that the plan has been		A list of partners who met the
formally adopted by the governing body of		planning criteria for DMA
the jurisdiction requesting approval of the		compliance are included in Section 8
plan (e.g., City Council, County		(Planning Partnership) of this plan.
Commissioner, Tribal Council).		Resolutions for each partner adopting
		the plan will be in Appendix A of this
		volume.



# **SECTION 2. PLAN ADOPTION**

# 2.1 Overview

This section contains information regarding adoption of the 2015 Westchester County Multi-Jurisdictional Hazard Mitigation Plan by Westchester County and each participating jurisdiction.

# 2.1.1 Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies demonstrates the commitment of Westchester County and each participating jurisdiction to fulfill the mitigation goals [and objectives] and mitigation strategies outlined in the Plan. Adoption legitimizes the Plan and authorizes responsible agencies to execute their responsibilities.

The County and all participating jurisdictions will proceed with formal adoption proceedings when FEMA provides conditional approval of this plan. Following adoption or formal action on the plan, the jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the plan to NYS DHSES. This will then be submitted to FEMA with the resolution in Appendix A of this Plan. The jurisdictions understand that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the plan to the mitigation plan coordinator.

The resolution issued to support adoption of the plan is included as Appendix A, Resolution of Plan Adoption.

In addition to being required by DMA 2000, adoption of the plan is necessary because:

- It lends authority to the plan to serve as a guiding document for all local and state government officials;
- It gives legal status to the plan in the event it is challenged in court;
- It certifies the program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' citizens; and
- It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

Source: FEMA. 2003. "How to Series"-*Bringing the Plan to Life* (FEMA 386-4).



# **SECTION 3. PLANNING PROCESS**

# 3.1 Introduction

This section includes a description of the planning process used to update the Westchester County Hazard Mitigation Plan (WCHMP, also referred herein as the "Hazard Mitigation Plan" or the "plan"), including how it was prepared, who was involved in the process, and how the public was involved.

To ensure that the plan both met the requirements of the DMA 2000, as well as to support the long-term goal of having all jurisdictions in the County covered under a comprehensive and cohesive county-wide DMA 2000 plan, an approach to the planning process and plan documentation was developed to achieve the following:

• The plan will be multi-jurisdictional, with the intention of including all municipalities in the county. Westchester County invited all jurisdictions in the county to join with them in the planning process. To date, 43 of the 45 local municipal governments in the county have participated in the 2015 plan update process as indicated in Table 3-1 below. It is noted that the Town of Mount Pleasant and the Village of Sleepy Hollow elected not to formally participate in this planning process, having either recently completed or were in an active hazard mitigation planning process. The format of this plan is such that these communities can readily join in the regulatory 5-year plan update process, as identified in Section 7.

	Jurisdictions	
Westchester County	Town of North Salem	Village of Hastings-On-Hudson
City of Mount Vernon	Town of Ossining	Village of Irvington
City of New Rochelle	Town of Pelham	Village of Larchmont
City of Peekskill	Town of Pound Ridge	Village of Mamaroneck
City of Rye	Town of Rye	Village of Mount Kisco
City of White Plains	Town of Somers	Village of Ossining
City of Yonkers	Town of Yorktown	Village of Pelham
Town of Bedford	Village of Ardsley	Village of Pelham Manor
Town of Cortlandt	Village of Briarcliff Manor	Village of Pleasantville
Town of Eastchester	Village of Bronxville	Village of Port Chester
Town of Greenburgh	Village of Buchanan	Village of Rye Brook
Town of Lewisboro	Village of Croton-On-Hudson	Village of Scarsdale
Town of Mamaroneck	Village of Dobbs Ferry	Village of Tarrytown
Town of New Castle	Village of Elmsford	Village of Tuckahoe
Town of North Castle	Village of Harrison	-

### Table 3-1. Participating Westchester County Jurisdictions

- The plan considers all-natural hazards facing the area, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000. In addition, non-natural hazards that pose significant risk were considered as well.
- The plan was developed following the process outlined by DMA 2000, FEMA regulations, and prevailing FEMA and NYS DHSES guidance. Following this process ensures that all the requirements are met and support Plan review. In addition, this Plan will meet criteria for the National Flood Insurance Program (NFIP) Community Rating System (CRS) and the Flood Mitigation Assistance (FMA) programs.





The Westchester County HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from municipal and regional agencies and staff as well as stakeholders, federal and state agencies, and the residents of the county. The HMP Steering Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events. In addition, the committees took into consideration planning and zoning codes, ordinances, and recent land use planning decisions. The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, county and regional agencies, residents, and stakeholders.

This section of the plan describes the mitigation planning process, including (1) Organization of Planning Process; (2) Planning Activities; (3) Stakeholder Outreach and Involvement; (4) Public Outreach and Involvement; (4) Integration of Existing Data, Plans, and Information; (5) Integration with Existing Planning Mechanisms and Programs; and (6) Continued Public Outreach.

# 3.2 Organization of Planning Process

This section of the plan identifies how the planning process was organized with the many planning partners involved and outlines the major activities that were conducted in the development of this HMP.

### 3.2.1 Organization of Planning Partnership

Westchester County applied for and was awarded a multi-jurisdictional planning grant under the Pre-Disaster Mitigation Grant Program (PDMC 2018-005), which has supported the development of this HMP.

Project management and grant administration has been the responsibility of the Westchester County Department of Emergency Services – Office of Emergency Management. A contract planning consultant (Tetra Tech) was tasked with:

- Assisting with the organization of a Steering Committee and municipal planning partnership;
- Assisting with the development and implementation of a public and stakeholder outreach program;
- Data collection;
- Facilitation and attendance at meetings (Steering Committee, municipal, stakeholder, public and other);
- Review and update of the hazards of concern, and hazard profiling and risk assessment;
- Assistance with the review and update of mitigation planning goals and objectives;
- Assistance with the review of past mitigation strategies progress;
- Assistance with the screening of mitigation actions and the identification of appropriate actions;
- Assistance with the prioritization of mitigation actions; and
- Authoring of the draft and final plan documents.

In June 2021, the County notified all municipalities within the County of the pending planning process and invited them to formally participate. Jurisdictions were asked to formally notify the county of their intent to participate (via a Letter of Intent) and to identify planning points of contact to facilitate municipal participation and represent the interests of their respective communities.

To facilitate plan development, Westchester County developed a Steering Committee to provide guidance and direction to the HMP update effort, and to ensure the resulting document will be embraced both politically and by the constituency within the planning area. All municipalities participating in the plan update authorized the Steering Committee to perform certain activities on their behalf, via the Letter of Intent to participate (FEMA mitigation planning "combination model"). Specifically, the Steering Committee was charged with:





- Providing guidance and oversight of the planning process on behalf of the general planning partnership;
- Attending and participating in Steering Committee meetings;
- Assisting with the development and completion of certain planning elements, including:
  - $\circ~$  Reviewing and updating the hazards of concern,
  - Developing a public and stakeholder outreach program,
  - Assuring that the data and information used in the plan update process is the best available
  - Reviewing and updating the hazard mitigation goals,
  - $\circ~$  Identification and screening of appropriate mitigation strategies and activities; and
- Reviewing and commenting on plan documents prior to submission to NYS DHSES and FEMA.

The Steering Committee provided guidance and leadership, oversight of the planning process, and acted as the point of contact for all participating jurisdictions and the various interest groups in the planning area.

All municipalities in the County were invited to participate in the planning process, and received a copy of the Planning Partner Expectations, outlining the responsibilities of the participants and the agreement of the partners to authorize the Steering Committee to represent the jurisdiction in the completion of certain planning elements as noted above. Within this plan, the greater universe of County and local departments, agencies and jurisdictions that formally participated in the planning process are referred to as the "planning partnership", while the municipal government participants are referred to as the "municipal planning partnership".

The municipal planning partnership was charged with the following:

- Represent their jurisdiction throughout the planning process;
- Assure participation of all department and functions within their community that have a stake in mitigation (e.g., planning, engineering, code enforcement, police and emergency services, public works, etc.);
- Assist in gathering information for inclusion in the plan update, including the use of previously developed reports and data;
- Support and promote the public involvement process;
- Report on progress of mitigation actions identified in prior or existing HMPs, as applicable;
- Identify, develop and prioritize appropriate mitigation initiatives;
- Report on progress of integration of prior or existing HMPs into other planning processes and municipal operations;
- Develop and author a jurisdictional annex for their jurisdiction;
- Review, amend, and approve all sections of the plan update; and
- Adopt, implement and maintain the plan update.

Table 3-2 shows the current members of the planning partnership as of the time of publication of this plan update.

Organization	Name	Title	Steering Committee Representative	POC	Alternate POC
Westchester County	Dennis Delborgo	Director, Westchester County Department of Emergency Services-OEM; Project Manager	Х	X	
	Daniel Olmoz	Program Administrator, Westchester County	Х	Х	

#### Table 3-2. Westchester County Hazard Mitigation Planning Partnership Members





Organization	Name	Title	Steering Committee Representative	POC	Alternate POC
		Department of Emergency Services-OEM			
	Susan Spear	Deputy Commissioner, Westchester County Department of Emergency Services-OEM	Х	Х	
	Linda Luddy	Westchester County Department of Emergency Services-OEM	Х	Х	
	David Kvinge	Director of Environmental Planning	Х	Х	
	Douglas Wessels	Environmental Planner, Westchester County Department of Planning; Alternate for Robert Doscher and David Kvinge	Х		Х
	Steve Courage	Associate Transportation Planner	Х		Х
	Babara Sabater	WC Department of Social Services	Х	Х	
	Dr. Sherlita Amler, M.D., M.S.	Commissioner of Health	Х	Х	
	Hernane De Almeida	Deputy Commissioner, Department of Public Works and Transportation	Х	Х	
	Xiaobo Cui	GIS, GIS Manager	Х		Х
	Bianca Lopez	Assistant Director of Operations	Х	Х	
	Captain James Luciano	Department of Public Safety	Х	Х	
	Carolyn Fortino	County Public Information	Х	Х	
	Lisa Reyes	Communications Officer, Westchester County Public Information	Х	Х	
	Robert Doscher	District Manager, County Soil and Water Conservation District	Х	Х	
	William Bland	Westchester County Department of Parks, Recreation and Conservation	Х	Х	
	Naomi Klein	Transportation	Х	Х	
Westchester County Association	Jason Chapin	Director of Workforce Development	X		X
	Michael N. Romia	President and CEO	Х	Х	
Business Council of Westchester	Marsha Gordon	President/CEO	Х	Х	
	John Ravitz	Executive Vice President/COO	X		X
City of Mount Vernon	Ali Evans	Director of the City of Mount Vernon OEM		X	
	Deborah Norman	Fire Commissioner			X
City of New Rochelle	Barry Nechis	Captain, Fire Department		X	v
Roonene	Robert rainuder	INISK IVIAIIAGOI		Λ	Λ



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Organization	Name	Title	Steering Committee Representative	POC	Alternate POC
	James Moran, P.E.	DPW Commissioner			Х
City of Peekskill	Leo Dylewski	Lt. of Peekskill Police Department		Х	
	Dave Rambo	Water Superintendent			Х
City of Rye	Christian Miller	City Planner		X	
	Greg Usry	City Manager			Х
City of White Plains	Richard Hope	Commissioner of Public Works		Х	
	Stefania Mignone	Deputy Commissioner of Public Works		Х	
	Ed Calvano	Lieutenant, White Plains Police Department			Х
City of Yonkers	Thomas G. Meier	Commissioner of Public Works	Х	Х	
	Michael Mosiello	Director, Office of			Х
Town of Podford	Vovin Winn	Department of Public Works			v
Town of Bediord	Leff Osterman	Director of Planning		x	Λ
Town of Cortlandt	Michael Preziosi	Director Department of		X	
Town of Cortianat	P.E.	Technical Services		71	
	Rosemary Boyle	Assistant Director,			Х
	Lasher	Department of Technical Services			
Town of Eastchester	Margaret Uhle	Director of Building and Planning		Х	
	Patricia George	Community Liaison			Х
Town of Greenburgh	Brian Simmons	Deputy Commissioner of Public Works			Х
	Rich Fon	Commissioner of Public Works		Х	
Town of Lewisboro	Tony Goncalves	Councilman and Deputy Supervisor			Х
	Adam Ochs	Director, Office of Emergency Management		Х	
Town of	Michael	Deputy Emergency		Х	
Mamaroneck	Liverzani	Manager/Ambulance District			
	Connie Green O'Donnell	Deputy Town Administrator/Administration			Х
Town of New	Kellan Cantrell	Assistant Planner			Х
Castle	Robert Cioli	Town Engineer		Х	
Town of North	Kevin Hay	Town Administrator		Х	
Castle	Adam Kaufman, AICP	Director of Planning			Х
Town of North	Warren Lucas	Supervisor		Х	
Salem	Janine Kourakos	Chief of Staff		37	Х
I own of Ossining	Dana Levenberg	1 own Supervisor		X	v
	vicioria Cafarelli	Administrative Assistant to the Supervisor			А
-	Valerie Monastra	Principal Planner	Х	_	
Town of Pelham	Daniel McLaughlin	Town Supervisor		Х	
	Phil DeSimone	Facility Manager			Х
Town of Pound	David M. Ryan	Chief of Police		Х	
Ridge	Kevin Hansan	Supervisor and OEM Director			Х





Organization	Name	Title	Steering Committee Representative	РОС	Alternate POC
Town of Rye	Debbie Reisner	Town Administrator and Rye		Х	
	Victor Federico	Director of Grounds and Facilities			Х
Town of Somers	Nick DeVito	Highway Superintendent		Х	
	Brian Linkletter	Police Chief			Х
Town of Yorktown	Craig Scatola	Sergeant-Emergency Manager/Police		Х	
	Margaret	HR-Building Maintenance			Х
	Gspurning	Director/Supervisor			
Village of Ardsley	Larry Tomasso	Building Inspector		Х	
	David DiGregorio	Highway Foreman			Х
Village of	David Turiano	Village Engineer		Х	
Briarcliff Manor	Georgina Gualdino	Building Department Assistant			Х
Village of	James M. Palmer	Village Administrator		Х	
Bronxville	Stephen Shallo	Assistant to the Village			Х
		Administrator			
Village of	Marcus Serrano	Administrator		Х	
Buchanan	George Pommer	Village Consulting Engineer			Х
Village of Croton-	Bryan Healy	Village Manager		Х	
On-Hudson	Paula DiSanto	Village Clerk			Х
Village of Dobbs	Alissa Fasman	Assistant to the Village		Х	
Ferry		Administrator			
	Richard Leins	Village Administrator			X
Village of	Antonio	Village Engineer		Х	
Elmsford	Capicotto	<b>X7'11 A 1 ' ' / /</b>			V
Villaga of Hamison	Michael Mills	Village Administrator		v	Å
v mage of marrison	Amodeo, PE, CFM	Town/vinage Engineer		Λ	
	Jackie Greer	Town Clerk			Х
Village of	Mary Beth	Village Manager		Х	
Hastings-On-	Murphy	0 0			
Hudson	David Dosin	Chief of Police			Х
Village of Irvington	Lawrence S. Schopfer	Village Administrator		Х	
C	Francis Pignatelli	Village of Irvington Police Department			Х
Village of	Justin Datino	Justin Datino		Х	
Larchmont	Rick Vetere	Rick Vetere			Х
Village of	Daniel Sarnoff	Assistant Village Manager	Х		Х
Mamaroneck	Jerry Barberio	Village Manager		Х	
Village of Mount	Edward Brancati	Village Manager		Х	
Kisco	Keneth Famulare	Assistant Village Manager			X
Village of Ossining	Maddi Zachacz	Assistant Village Manager			Х
V'11 CD 11	Karen D'Attore	Village Manager		Х	37
village of Pelham	Kobert Benkwitt	Fire Chief			Х
	Christopher Scelza	Village Manager		Х	
Village of Pelham	Thomas Atkins	Police Chief		Х	
Manor	Lt. Gregory Sancho	Village Police			Х



Organization	Name	Title	Steering Committee Representative	РОС	Alternate POC
Village of Pleasantville	Alyssa Hochstein	Secretary to the Village Manager			Х
	Eric Morrissey	Village Administrator		Х	
Village of Port Chester	Kevin Donahue	Building Inspector			Х
	Stuart Rabin	Village Manager		Х	
Village of Rye Brook	Christopher Bradbury	Village Administrator		Х	
	Michal Nowak	Superintendent of Public Works/Engineer			Х
Village of	Gregory Cutler	Village Planner		Х	
Scarsdale	Robert Cole	Deputy Village Manager			Х
Village of Tarrytown	Richard Slingerland	Village Administrator		Х	
	Joshua Ringel	Assistant Village Administrator			Х
Village of	David Burke	Administrator		Х	
Tuckahoe	John Costanzo	Police Chief			X

Notes: POC = Point of Contact; WC = Westchester County \*TBD = To Be Determined

It is noted that the jurisdictional Letter of Intent to Participate identifies the above "Planning Partner Expectations" as serving to identify those activities comprising overall participation by jurisdictions throughout the planning process. The various jurisdictions in Westchester County have differing levels of capabilities and resources available to apply to the plan update process, and further, have differing exposure and vulnerability to the natural hazard risks being considered in this plan. It was Westchester County's intent to encourage participation by all-inclusive jurisdictions, and to accommodate their specific needs and limitations while still meeting the intents and purpose of plan update participation. Such accommodations have included the establishment of a Steering Committee, engaging a contract consultant to assume certain elements of the plan update process on behalf of the jurisdictions, and the provision of additional and alternative mechanisms to meet the purposes and intent of mitigation planning.

Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP wherein jurisdictions have individually identified their planning points of contact, evaluated their risk to the hazards of concern, identified their capabilities to effect mitigation in their community, and identified and prioritized an appropriate suite of mitigation initiatives, actions, and projects to mitigate their hazard risk; and eventually, by the adoption of the updated plan via resolution. Refer to Section 9 of this HMP.

Appendix D identifies those individuals who represented the municipalities during this planning effort and indicates how they contributed to the planning process.

It is noted that all but two Local municipalities (towns of Rye and Pelham) in the county actively participate in the National Flood Insurance Program and have a designated NFIP Floodplain Administrator (FPA). All FPAs have been informed of the planning process, reviewed the plan documents, and provided direct input to the plan update. Local FPAs are identified in the "Administrative and Technical" portion of the local Capability Assessments presented within the jurisdictional annexes in Section 9, as well as in Appendix D.





# 3.2.2 Planning Activities

Members of the planning partnership (individually and as a whole), as well as key stakeholders, convened and/or communicated on an as-needed basis to share information and participate in workshops to identify hazards; assess risks; review existing inventories of and identify new critical facilities; assist in updating and developing new mitigation goals and strategies; and provide continuity through the process to ensure that natural hazards vulnerability information and appropriate mitigation strategies were incorporated. All members of the planning partnership had the opportunity to review the draft plan and supported interaction with other stakeholders, and assisted with public involvement efforts.

A summary of planning partnership activities, including meetings held during the development of the plan, is included in Table 3-3. This summary table identifies only the formal meetings and milestone events held during the plan update process and does not reflect the larger universe of planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between planning partnership members and the consultant through individual local meetings, phone and email.

After completion of the plan, implementation and ongoing maintenance will become a function of the planning partnership as described in Section 7. The planning partnership is responsible for reviewing the draft plan and soliciting public comment as part of an annual review and as part of the five-year mitigation plan updates.

Table 3-3 presents a summary of planning activities and general project planning efforts conducted during the plan development process. It also identifies which DMA 2000 requirements the activities satisfy. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) may be found in Appendix C.

Date	DMA 2000 Requirement	Description of Activity	Participants
-	1b, 2	County approves resolution to apply for FEMA mitigation planning grant	-
-	1b, 2	County conducts procurement process for contract planning support	-
5/27/2021	2	Project Start Up Meeting: Discuss proposed planning process and scope of work including documenting participation, schedule, and public and stakeholder outreach and involvement.	See Appendix D
6/2021	2	All municipalities invited to participate in the planning process.	-
7/13/2021	2, 3c	GIS data collection meeting	See Appendix D
Weekly	-	Weekly project status meeting to discuss action items in support of the expedited planning process	See Appendix D
	1c, 2	Interested jurisdictions submit Letters of Intent to Participate in this planning process, acknowledging municipal participation requirements and identifying planning point(s) of contact.	See Appendix D
7/13/2021	1b, 2, 3a, 3b, 3c, 4a, 5c	SC Meeting #1: Review project schedule; review municipal participation, discuss municipal Kick Off meeting and local data collection; review and discuss sources and availability of county and regional data;	See Appendix D

# Table 3-3. Summary of Mitigation Planning Activities / Efforts



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	DMA 2000			
Date	Requirement	Description of Activity	Participants	
		discuss public and stakeholder outreach efforts.		
7/20/2021	1b, 2, 3a, 3b, 3c, 4a	Municipal Kick-Off Meeting: Complete overview of planning process, plan participant expectations, review of hazards and hazards of concern identification, discussion of data needs and data collection process explaining all provided worksheets (hard copy and on resource CD), discussion of public and stakeholder outreach efforts	County and municipal representatives and stakeholders. See Appendix D	
8/18/2021	2	Media Release	Public and Stakeholders	
8/2021	2	Public project website developed: www.westchesterhmp.com	Core Planning Team, Contract Planner	
9/2021	2	Online Public Hazard Preparedness and Mitigation survey developed	Core Planning Team, Contract Planner	
9/2021	2	Online Stakeholder Hazard Mitigation surveys developed	Core Planning Team, Contract Planner	
9/14/2021	1a, 3a, 3b, 3c, 3d	Steering Committee Risk Assessment Meeting	See Appendix D	
9/22/2021	1a, 3a, 3b, 3c, 3d	Planning Partnership Risk Assessment Meeting	See Appendix D	
10/13/21	1a, 2, 4a, 4b, 4c	Mitigation Strategy Workshop	See Appendix D	
10/20/2021		Stakeholder Workshop	See Appendix D	
11/1/2021	1a, 2, 4a, 4b, 4c	Inland Communities Annex Development Meeting	See Appendix D	
11/1/2021	1a, 2, 4a, 4b, 4c	Hudson River Communities Annex Development Meeting	See Appendix D	
11/1/2021	1a, 2, 4a, 4b, 4c	Long Island Sound Communities Annex Development Meeting	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Yorktown (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Somers (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Mamaroneck (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Mamaroneck (V)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Larchmont (V)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with North Castle (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Harrison (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Port Chester (V)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Rye Brook (V)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with North Salem (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Bedford (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Cortlandt (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Ossining (V)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Peekskill (C)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with New Castle (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with City of New Rochelle	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Village of Scarsdale	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Lewisboro (T)	See Appendix D	
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Rye (T)	See Appendix D	



	DMA 2000		
Date	Requirement	Description of Activity	Participants
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Pelham (T and V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Tuckahoe (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Buchanan (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Croton on Hudson (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Eastchester (T)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Dobbs Ferry (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Hastings on Hudson (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Pound Ridge (T)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Briarcliff Manor (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Tarrytown (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Elmsford (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Pleasantville (V)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Eastchester (T)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Ossining (T)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Mount Vernon (C)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Greenburgh (T)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Rye (C)	See Appendix B
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Bronxville (V)	See Appendix D
10-11/2021	All requirements	Steering Committee Meeting	Steering Committee; Contract Planner See Appendix D
11/9/2021	s	Steering Committee Meeting- Finalize Goals and Objectives, Plan Maintenance, Draft Plan Review	Steering Committee; Contract Planner See Appendix D
	1b, 2, 3a-c, 3e	Local support meeting with Mount Vernon (C)	See Appendix D
10-11/2021	1b, 2, 3a-c, 3e	Local support meeting with Peekskill (C)	See Appendix D
11/15/2021	2	Draft Plan posted to public project website	Public and Stakeholders
11/16- 12/17/2021	1b, 2	Public and stakeholder comments to Draft Plan received and incorporated in to Final Plan.	Public and Stakeholders
11/2021	All requirements	Final plan submitted to NYS DHSES and FEMA Region II	NYS DHSES, FEMA Region II
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating municipalities	All plan participants

Note: TBD = to be determined.

Each number in column 2 identifies specific DMA 2000 requirements, as follows:

1a – Prerequisite – Adoption by the Local Governing Body

1b – Public Participation

2 – Planning Process – Documentation of the Planning Process





- 3a Risk Assessment Identifying Hazards
- 3b Risk Assessment Profiling Hazard Events
- 3c Risk Assessment Assessing Vulnerability: Identifying Assets
- 3d Risk Assessment Assessing Vulnerability: Estimating Potential Losses 3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends
- 4a Mitigation Strategy Local Hazard Mitigation Goals
- 4b Mitigation Strategy Identification and Analysis of Mitigation Measures
- *4c* Mitigation Strategy Implementation of Mitigation Measures
- 5a Plan Maintenance Procedures Monitoring, Evaluating, and Updating the Plan
- 5b Plan Maintenance Procedures Implementation through Existing Programs
- *5c Plan Maintenance Procedures Continued Public Involvement*

# 3.3 Stakeholder Outreach and Involvement

This section details the outreach to, and involvement of, the many agencies, departments, organizations, nonprofits, districts, authorities and other entities that have a stake in managing hazard risk and mitigation, commonly referred to as stakeholders.

Diligent efforts were made to assure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Steering and Planning committees. Stakeholder outreach was performed early and throughout the planning process. In addition to "mass media" notification efforts, identified stakeholders were invited to attend the kick-off meeting, while key stakeholders were requested to participate on the Steering and/or Planning committees. Information and input provided by these stakeholders has been included throughout this plan where appropriate, as identified in the references.

The following is a list of the various stakeholders that were invited to participate in the development of this plan, along with a summary of how these stakeholders participated and contributed to the plan. This summary listing cannot represent the sum total of stakeholders that were aware of and/or contributed to this plan since formal and informal outreach efforts were utilized throughout the process by the many planning partners involved in the overall effort. Complete documentation of such broad-based and often locally-focused efforts is impossible. Instead, this summary is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the planning process.

#### **Federal Agencies**

**FEMA Region II:** Provided updated planning guidance; provided summary and detailed NFIP data for planning area; facilitated a presentation of non-regulatory flood products; attended meetings; conducted a Mitigation Strategy Workshop; conducted plan review.

U.S. Army Corps of Engineers (NY Division): All relevant NY Division projects and activities summarized in plan.

National Weather Service (NWS): Provided data and information, provided subject matter expert review of atmospheric/weather-related hazard profile.

**National Oceanic and Atmospheric Agency (NOAA) – Coastal Resources Center:** Provided data and information through their Digital Coast program.

#### **State Agencies**

**New York State Department of Homeland Security and Emergency Services (NYS DHSES: Headquarters and Region II):** Administered planning grant and facilitated FEMA review; provided updated planning guidance; attended meetings; facilitated workshops (e.g., hazard mitigation planning and RiskMAP, Sandy HMGP, updating mitigation strategies), provided review of Draft and Final Plan.





New York State Department of Environmental Conservation (NYSDEC): Provided data and information.

#### **County and Regional Agencies, Commissions and Non-Profits**

Westchester County Department of Community and Mental Health (WCDCMH): Attended meetings, provided input on vulnerable populations.

Westchester County Department of Emergency Services – Office of Emergency Management (WCDES – OEM): Secured and administered FEMA planning grant, managed project, arranged and attended meetings, served on Steering Committee, provided data and information, facilitated and supported public and stakeholder outreach, identified ongoing and potential mitigation projects and initiatives, reviewed draft and final plan sections.

Westchester County Department of Health (WCDOH): Served on the Steering Committee, attended meetings, and identified vulnerabilities and mitigation actions.

**Westchester County Department of Information Technology (WCDoIT):** Served on the Steering Committee and provided GIS data and GIS support. Provided hazard related information and data mitigation initiatives.

Westchester County Department of Planning (WCDP): Served on Steering Committee, provided critical data and information, reviewed progress on original mitigation strategy, identified new projects/initiatives, reviewed and provided input on draft and final plan sections.

Westchester County Department of Public Safety (WCDPS): Served on the Steering Committee and provided input. Attended meetings, identified vulnerabilities and mitigation initiatives.

Westchester County Department of Public Works and Transportation (WCDPW/T): Served on the Steering Committee, attended meetings, reviewed progress on previous mitigation actions, provided data and information, identified vulnerabilities, updated mitigation strategies.

Westchester County Department of Social Services (WCDSS): Served on the Steering Committee and provided input.

Westchester County Soil and Water Conservation District (WCSWCD): Served on the Steering Committee and provided input.

Westchester County Department of Public Information: Served on the Steering Committee and provided input.

Westchester County Association: Served on the Steering Committee and provided input.

Business Council of Westchester County: Served on the Steering Committee and provided input.

#### **Regional and Local Stakeholders**

U.S. Geological Survey (USGS): Provided data and information.

Academia (School districts and other academic institutions): Many municipalities directly involved school district representatives in the planning process, as identified in Table 3-3. The following school districts, colleges, and academic organizations in the county were invited to complete a stakeholder survey and attend a stakeholder workshop:

• Peekskill City School District (CSD)





- Pelham Union Free School District (UFSD)
- Pleasantville Union Free School District (UFSD)
- Pocanticao Hills Central School District (CSD)
- Port Chester-Rye Union Free School District (UFSD)
- Putnam-Northern Westchester BOCES
- Putnam-Northern Westchester BOCES
- Rye City School District (CSD)
- Rye Neck Union Free School District (UFSD)
- Scarsdale Union Free School District (UFSD)

- Somers Central School District (CSD)
- SUNY Purchase
- Tarrytown Union Free School District (UFSD)
- Tuckahoe Union Free School District (UFSD)
- Valhalla Union Free School District (UFSD)
- Westchester Community College (SUNY-WCC)
- Westchester Torah Academy
- White Plains City School District (CSD)
- Yonkers City School District (CSD)
- Yorktown Central School District (CSD)

**Law Enforcement:** Many municipalities directly involved police and other law enforcement representatives in the planning process, as identified in Table 3-3. Further, the following police departments and law enforcement agencies in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- A.T.F.
- Ardsley Police Department
- Bedford Police Department
- Briarcliff Manor Police Department
- Bronxville Police Department
- Buchanan Police Department
- Carmel Police Department
- Croton Police Department
- Dobbs Ferry Police Department
- E-911

It

- Eastchester Town Police Department
- Elmsford Police Department
- Greenburgh Police Department
- Harrison Police Department
- Hastings Police Department
- Irvington Police Department
- Larchmont Police Department
- Lewisboro Town Police Department
- Mamaroneck Town Police Department
- Mamaroneck Village Police Department
- Mount Pleasant Police Department
- Mount Vernon Police Department
- New Castle Town Police Department

- New Rochelle Police Department
- North Castle Police Department
- North Salem Police Department
- NYC Department Police
- Ossining Village Police Department
- Peekskill Police Department
- Pelham Village Police Department
- Pleasantville Police Department
- Port Chester Police Department
- Pound Ridge Police Department
- Rye Brook Police Department
- Rye Police Department
- Scarsdale Police Department
- Sleepy Hollow Police Department
- Somers Police Department
- SUNY Purchase Police Department
- Tarrytown Police Department
- Tuckahoe Police Department
- West Co. Department of Public Safety
- White Plains Police Department
- Yonkers Police Department
- Yorktown Police Department



**Fire Districts and Fire Departments:** Many municipalities directly involved fire district/department, hazmat teams, and rescue team representatives in the planning process, as identified in Table 3-3. The following fire district/department, haz-mat teams, and rescue team representatives in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- Archville Fire Department (263)
- Ardsley Fire Department (201)
- Armonk Fire Department (202)
- Banksville Fire Department (258)
- Bedford Fire Department (204)
- Bedford Hills Fire Department (203)
- Briarcliff Fire Department (205)
- Buchanan Fire Department (255)
- Chappaqua Fire Department (206)
- Continental Village Fire Department (213)
- Croton Falls Fire Department (207)
- Croton Fire Department (208)
- DES Haz-Mat Team
- DES Tech Rescue
- Dobbs Ferry Fire Department (209)
- Eastchester Fire Department (210)
- Elmsford Fire Department (211)
- Fairview Fire Department (212)
- Goldens Bridge Fire Department (214)
- Grasslands Fire Department (254)
- Greenville Fire Department (215)
- Harrison Fire Department (216)
- Hartsdale Fire Department (217)
- Hastings Fire Department (218)
- Hawthorne Fire Department (219)
- Irvington Fire Department (220)
- Katonah Fire Department (221)
- Larchmont Fire Department (222)
- Mamaroneck Town Fire Department (223)
- Mamaroneck Village Fire Department (224)
- Metro North RR (264)

- Millwood Fire Department (225)
- Mohegan Lake Fire Department (226)
- Montrose Fire Department (227)
- Montrose VA Fire Department (257)
- Mount Kisco Fire Department (228)
- Mount Vernon Fire Department (229)
- North White Plains Fire Department (232)
- Ossining Fire Department (233)
- Peekskill Fire Department (234)
- Pelham Fire Department (235)
- Pelham Manor Fire Department (236)
- Pleasantville Fire Department (237)
- Pocantico Hills Fire Department (238)
- Port Chester Fire Department (239)
- Pound Ridge Fire Department (240)
- Purchase Fire Department (241)
- Rye Brook Fire Department (266)
- Rye Fire Department (242)
- Scarsdale Fire Department (243)Sleepy Hollow Fire Department (231)
- Somers Fire Department (244)
- South Salem Fire Department (245)
- Tarrytown Fire Department (246)
- Thornwood Fire Department (247)
- Valhalla Fire Department (248)
- Verplanck Fire Department (249)
- Vista Fire Department (256)
- West Harrison Fire Department (250)
- Westchester Airport (259)
- White Plains Fire Department (251)
- Yonkers Fire Department (252)
- Yorktown Fire Department (253)

**Hospitals and Health-Care Facilities:** The following hospitals and health-care facilities in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- Northwell Health Phelps Memorial Hospital Center
- Westchester Medical Center
- Northwell Health Northern Westchester Hospital
- Saint John's Riverside Hospital
- New York Presbyterian/Lawrence Hosptial





- White Plains Hospital
- Blythedale Children's Hospital
- St. Vincent's Hopsital Westchester
- Greenwich Hospital (CT.)
- Burke Rehabilitation Hospital
- Montefiore Hospitals (Mt. Vernon, New Rochelle)
- New York Presbyterian/Hudson Valley Hosptial
- Saint Joseph's Medical Center Yonkers

**Ambulance/Emergency Medical Services:** The following ambulance and emergency medical service providers in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- American Medical Response
- Briarcliff/Croton ALS
- Chappaqua EMS
- Cortlandt Medics
- Cortlandt VAC
- Croton EMS
- Dobbs Ferry EMS
- Eastchester EMS
- Elmsford EMS
- Empress EMS
- EMStar Ambulance
- Grasslands EMS
- Greenburgh PD EMS
- Hastings EMS
- Hawthorne EMS
- Irvington EMS
- Katonah/Bedford Hills VAC
- Larchmont/Mamaroneck Town VAC
- Lewisboro VAC
- Mamaroneck Town ALS
- Mamaroneck Village EMS
- Mobile Life Support
- Mohegan EMS
- Montrose VA Hospital
- Mount Kisco VAC
- Mt. Pleasant Medics
- No Westchester Medics
- North Salem VAC
- Ossining EMS
- Ossining VAC
- Peekskill VAC
- Pleasantville VAC
- Port Chester/Rye/Rye Brook EMS

- Pound Ridge VAC
- Scarsdale VAC
- Senior Care EMS
- Sleepy Hollow EMS
- Somers EMS
- Tarrytown VAC
- Valhalla VAC
- Verplanck EMS
- Vista EMS
- Westchester EMS
- White Plains EMS
- Yorktown VAC



**Utilities:** The following utility companies in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- Altice USA
- Charter Communications
- Comprehensive Decommissioning International, LLC (CDI)
- Con Edison Electric & Gas
- Enbridge Spectra Energy
- NYSEG (Brewster Division)
- NYSEG 24-Hour Emergency Line
- Tennessee Gas Pipeline
- Verizon
- North Castle (T/O) Water & Sewer Department
- NYC Department of Environmental Protection Bureau of Water Supply
- Amawalk Shenorock Water District
- Northern Westchester Joint Water Works (NWJWW)
- Greenburgh Water & Sewer Department
- SUEZ Westchester Operations
- Buchanan (V/O) Water Department
- Peekskill (C/O) Water & Sewer Department
- New Castle Consolidated Water District
- Cortlandt Consolidated Water District (CCWD)

**Transportation:** The following transportation companies and organizations in the County were invited to complete a stakeholder survey and attend a stakeholder workshop:

- Liberty Lines Transit
- P.T.L.A. Enterprises
- Westchester County Bee-Line
- Westchester County ParaTransit
- Airport Westchester County (HPN)
- Amtrak (HQ)
- Chappaqua Transportation
- Metropolitan Transportation Authority Metro North Railroad (MTA MNRR)
- NYS Department of Transportation (DOT)
- Royal Coach

#### Adjacent Jurisdictions:

The County has made an effort to keep surrounding jurisdictions appraised of the project, and allowed the opportunity to provide input to this planning process via a stakeholder survey and a request to review the draft plan. Specifically, the following adjoining county and state representatives were contacted in September 2021 to inform them about the availability of the project website, draft plan documents and surveys, and invited to provide input to the planning process:

- Orange County (NY)
  - Division of Emergency Management
  - Department of Planning




- Nassau County (NY)
  - o Office of Emergency Management
  - o Planning Department
- Rockland County (NY)
  - o Department of Fire & Emergency Services
  - o Rockland Planning Agency
- Suffolk County (NY)
  - Fire, Rescue and Emergency Services
  - o Department of Economic Development and Planning
- Putnam County (NY)
  - Bureau of Emergency Services
  - Department of Planning
- New York City Emergency Management
- Bergen County (NJ)
  - Office of Emergency Management
- Connecticut
  - o Department of Emergency Services & Public Protection

Input from neighboring counties which responded to the survey is summarized in the section below.

### 3.3.1 Stakeholder and Neighboring County Survey Summaries

The following provides a summary of the results and feedback received by stakeholders who completed the survey. Feedback was reviewed by the Steering Committee and integrated where appropriate in the plan.

### **Stakeholder Survey**

The stakeholder survey was designed to help identify general needs for hazard mitigation and resiliency within Westchester County from the perspective of stakeholders, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including the various county and municipal departments and agencies in the County. As of October 28, 2021, 30 stakeholders completed the survey, with nearly 54% of respondents coming from the emergency services sector as shown in Figure 3.3-1.









When asked if the organization maintains or manages anything within their designated service area, exactly half of people who answered the question said no they do not manage any facilities. For those that did answer, they indicated the following facilities: buildings, roads, bridges, water/sewar, stormwater infrastructure, neighborhoods, and downtowns. Out of these only 3.8% of the respondents provided county-wide services, and a total of 56% only service a single jurisdiction as shown in Figure 3.3-2.

The Stakeholder Survey was broken down into 4 sections: Hazard and Damage Identification, Community Preparedness, Project Identification, and COVID-19, each detailed below. Survey results were shared with the Steering Committee and Planning Partnerships in scheduled meetings for consideration in the development of mitigation strategies.

### Hazard and Damage Identification

More than half of survey respondents (59%) indicated that buildings, facilities, or structures their organization is involved with have been impacted by a natural hazard. Of these, almost all were impacted by flooding. One respondent noted that inadequate stream culverts caused road flooding, and some floods have impacted septic systems. Respondents also noted power outages are problem, especially since many communities have individual wells.

In addition to asking about whether or not their facilities were damaged, stakeholders were also asked what areas they believe to be the most vulnerable to natural hazards, and the problems they face. The respondents provided hazards and impacts:







#### Figure 3.3-2 Stakeholder Service Area

What areas (in which you provide services to) do you believe to be the most vulnerable to natural hazards?

- Town of Cortlandt Continental Village
- Downtown Ardsley
- Village of Mamaroneck Areas near the Mamaroneck and Sheldrake Revers
- Communities reliant on well water (power outages)
- Village of Ardsley Area of Cross Road and Markwood Place (flooding)
- Village of Pelham 4<sup>th</sup>-7<sup>th</sup> Streets, Highbrook Ave, Marquand Place, Manning Circle, Brookside Ave, Wolfs Lane (flooding)

• Flooding causing water damage and blocking roads

• Flash floods causing the sanitary sewer main to be overwhelmed

• Damage to overhead electric lines

• Tree damage and fall, especially impacting transportation and power supply

• Communication interruptions, heightened by a lack of cell coverage

• Sanitary sewer main gets overwhelmed during flash flooding events

• Power outages causing a halt in internet services

As facilities have been previously impacted by hazard events, most respondents (59%) indicated that their facilities have been impacted by a natural hazard, with most (85%) of these hazards involving

flooding. 19% of respondents indicated they did not know if their facilities are adequately prepared for withstanding natural disasters, and 24% said their facilities are not adequately prepared for withstanding natural disasters. This compares to almost half of respondents that believe their facilities are equipped to withstand natural disasters. However, 72% believe their utility infrastructure and service is not equipped to withstand natural hazards and do not have the ability to provide uninterrupted service.

### **Community Preparedness**

Many of respondents (42.9%) believe local public education and awareness programs are not effective at informing residents about disasters and preparedness and reducing personal risk. 53% of respondents believe the public, particularly vulnerable populations, **Figure 3.3-4 Vulnerable Populations** 

public, particularly vulnerable populations, are not aware of, understand, or take advantage of emergency warning systems, while 32% do not know. Two respondents believe that there is an oversaturation of information during hazard events, causing many people to turn off notifications and alerts. A majority (80.9%) of survey participants indicated that they were aware of the number and location of vulnerable populations in their community, but many (41.1%) of those respondents indicated a desire for additional information about these populations. Awareness by stakeholders of where vulnerable populations are located is shown in Figure 3.3-4.







About a third (35%) of respondents believe Figure 3.3-5 Plan Involvement

the local government understands. supports, and possesses adequate resources for hazard risk reduction efforts in the community. 2 respondents believe that the government only does so in some areas. One respondent noted that there is a need for additional funding in order to address flooding issues. For about half of the respondents (47.6%), private business does not play a direct critical role in daily operations. The vast majority (90.5%) of respondent's organizations have, or are part of, an Emergency Response Plan, and of the ones that do, 71% of the organizations have a defined role or responsibility within the plan, and 57% of their plans cover potential



impacts to their operations, including pandemics. More than two-thirds (70.6%) of responding organizations are part of multiple plans, with 41.7% of total respondents being part of an Emergency Operations Plan, and 28% being part of a Continuity of Operations Plan. More than half (61%) of participants also indicated their organization is resilient with respect to a natural disaster.

### **Project Identification**

Respondents identified the following projects or programs that could reduce their organization's vulnerability to damages, including operation of service:

- Install green infrastructure to reduce flooding
- Implement a tree trimming program •
- Education programs to train employees on hazard mitigation plan details
- Utility pole maintenance: eliminate double poles and replace old poles

The following were identified as recently implemented projects that reduced vulnerabilities to hazard events:

- Updates to online emergency information and resources •
- Established an EOC
- Generator installation
- Stormwater drainage mitigation actions •
- Tree trimming near power lines

### COVID-19

Respondents were also asked to detail how their organization has been involved in response to the ongoing COVID-19 pandemic. Respondents detailed the following:

- Assisting the supply chain to help local hospitals •
- Organizing food distribution to residents in need •
- Providing emergency services (First Responders, EMS response, answering emergency calls, etc.)
- Providing security at testing locations •
- Providing medical care





Respondents also answered with the following about how they believe the COVID-19 pandemic will reshape their organization's practices and business framework:

- Masks, social distancing, partitions when applicable
- Remote work and remote meetings
- Ensuring facilities are kept clean frequent sanitization
- Remote patient screening and remote appointments when possible
- Vaccination mandates

The following services and infrastructure were identified by respondent being built or improved upon within their communities in order to mitigate damages experienced by the pandemic:

- Granting food sales in street and restaurant street scraps
- Recreation Department assisting seniors; schools continuing to provide two meals a day for students, regardless of whether they had previously been identified as in need; local food banks
- Installation of decontamination stations throughout service area
- Telehealth systems
- Extensive changes to the hospital to provide additional negative pressure spaces to accommodate COVID positive patients

Respondents also identified the following challenges and obstacles their organization is facing due to the COVID-19 pandemic:

- Clear messaging
- Finding medical professionals
- Availability of Personal Protective Equipment
- Availability of cleaning supplies
- Contingency/back-up plan for staffing
- Receiving accurate information regarding current situation/resources available
- Connectivity while working remotely
- Lack of volunteers
- Grants and other funding available to their agency
- The open meeting law requirement of a transcript for meetings in addition to a recording of the meeting has made it much more difficult to have videoconference meetings.

### **Neighboring County Survey**

The neighboring county survey was sent to the surrounding counties of Westchester due to their proximity to the county and because the effects of hazard events that impact Westchester County would be similar to that of their neighbors. As of Thursday, October 28<sup>th</sup>, 2021, three counties submitted the survey.

The Neighboring County Survey was broken down into 5 sections: Emergency Operations and Continuity of Operations Planning, Risk and Vulnerability, Evacuation and Sheltering, Information Sharing, and Projects, Grants, Education and Outreach, each detailed below.





### Emergency Operations and Continuity of Operations Planning

One county did not answer survey questions regarding emergency operations and Continuity of Operations Planning. Both (100%) of the remaining counties indicated that they do not know whether Westchester is involved in their comprehensive emergency operations planning. One of the counties indicated that Westchester County is not involved in their own county's continuity of operations planning, nor are they involved in Westchester County's continuity of operations planning. However, one respondent did indicate they would like to be involved in updating Westchester County's comprehensive emergency operations plan.

The survey asked respondents to explain how emergency operations is communicated between the counties. A majority of the respondents indicated that communication is done through state and FEMA meetings during disaster response.

### Risk and Vulnerability

None of the respondents indicated that their county would share risk and vulnerability assessments, including flood mapping, and HAZUS data, with Westchester County.

#### **Evacuation and Sheltering**

None of the respondents indicated there is collaboration with Westchester County on establishing evacuation routes, alternative evacuation routes, shelters, and temporary housing. However, as one of the respondents did not know if this collaboration existed, and two did not answer the relevant questions, it does not exclude the possibility for collaboration.

#### Information Sharing

Respondents indicated they do not know whether they have access to contact information for Westchester County Emergency Operations Centers.

#### Projects, Grants, Education and Outreach

Respondents identified the following projects as requiring cross-collaboration between county boundaries:

- Floodplain projects or planning
- Outreach (education and outreach campaigns, Programs for Public Information, etc.)

Respondents provided comments about their answer to cross-collaboration projects and indicated that Westchester County and Orange County work together on communication concerning the former nuclear power plant.

There were no responses to the question regarding collaboration on grant applications.

Orange County indicated they and Westchester County are both concerned by flooding and potential impacts to power grid or railroad, creating opportunities for collaboration on mitigation projects. Orange County suggested that quarterly meetings between OEM Commissioners are opportunities to optimize cooperation with Westchester County on emergency management operations and hazard mitigation projects.

### 3.3.2 Public Outreach

In order to facilitate better coordination and communication between the Planning Committee and citizens and to involve the public in the planning process, it was determined that draft documents will be made available to the public through a variety of venues including printed and online format. This effort is intended to increase the





likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of Westchester County.

The Steering and Planning committees have made the following efforts toward public participation in the development and review of the Plan:

- The public was informed of the hazard mitigation planning effort commencement at the kick-off meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- Media Release to local news sources.
- To inform the public and county agencies of the ongoing plan update effort, updates regarding the mitigation planning process have been made at county-wide meetings including those of the Local Emergency Preparedness Working Group, and County Department Heads Meeting.
- A public website is being maintained as another way to facilitate communication between the Steering Committee, planning partnership, public and stakeholders (<u>www.westchesterhmp.com</u>). The public website contains a project overview, County and local contact information, access to the citizens survey and various stakeholder surveys, and sections of the HMP for public review and comment.
- All participating municipalities have been encouraged to distribute press releases on the project, including links to the project webpage and citizen and stakeholder surveys. Municipalities posting information and supporting online outreach include:
  - City of New Rochelle
  - Village of Hastings-on-Hudson
  - Town of New Castle
  - Town of Lewisboro
  - Tarrytown-Sleepy Hollow
  - Croton-on -Hudson
  - Village of Larchmont
  - Town and Village of Harrison
- An article was published in the Hudson Independent
- Susan Spear of Deputy Commissioner, Westchester County Department of Emergency Services was a guest on an AM radio show WVOX "Good Morning Westchester" on 8/25/2021 to talk about the Hazard Mitigation Plan and specifically the public survey.
- In order to facilitate coordination and communication between the Planning Committee and citizens and involve the public in the planning process, the Plan Update will be available to the public through a variety of venues. A printed version of the Plan will be maintained at the Westchester County Office of Emergency Management, and Westchester County Department of Planning.
- An on-line natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact Westchester County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. The questionnaire asks quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asks several demographic questions to help analyze trends.
- The questionnaire was posted on the County website on August 18, 2021 and was available through November 5<sup>th</sup> for public input. All participating municipalities have been requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (e.g. Facebook, Twitter, email blasts, etc.) Response rates to date are considered strong as over 1000 responses have been collected.. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan.





- Directed response surveys were distributed to Academia, Fire Departments, EMS, Hospitals and Healthcare Organizations, Business and Commercial interests, Utilities and Law Enforcement stakeholders as detailed in the Stakeholder outreach subsection of this chapter. summary of survey results is provided later in this Section with full results provided in Appendix C of this plan. In addition, an example of the directed stakeholder surveys is presented in Appendix C.
- The Draft Plan was posted to the public website as of November 15, 2021 for public review and comment. All public comments were directed to the Westchester County Planning Department for collection and review by the Steering Committee. All public comments received were forwarded to the appropriate jurisdiction and/or agency and incorporated into the final plan as appropriate.
- Once submitted to NYS DHSES/FEMA, the Final Plan will be available for public review and comment in the same manner and format as the Draft Plan, as well as in hard-copy format at the following as identified in Section 7, "Plan Maintenance".

#### Figure 3-6. Westchester County HMP Webpage and Local On-Line Outreach

Home	About	What is Hazard Mitigation?	Calendar	Meetings	Explore the Plan	Additional Information	Questions?
Westches	ster Co	ounty Hazard Mitig	ation Pl	an Upda	ate		
Welcome to the updates, resour	Westcheste ces, and link	er County Hazard Mitigation Pla ks to hazard mitigation in suppo	an (HMP) Web ort of the HMF	osite. This webs 9 update.	site provides project	WESTCHES	TER COUNTY
The goal of the county. During t	project is to he course o	o save lives and property through of this planning project, county	gh the reducti and local lead	on of hazard v ders and the co	vulnerability for the en ommunity will work in	HAZARD MIT	IGATION PLAN
andem to ident	ify risks, as:	sess capabilities, and formulate	e a strategy to	reduce disast	er vulnerability.	Your input is need losses from na	ded to help reduce atural disasters
Public participat Department of I	ion and fee Planning ha	edback is a vital part of the haz is developed a Mitigation Surve	ard mitigation y to assist in p	planning proc providing the p	cess. Westchester Cou oublic an outlet to	CLICK HERE TO TAKE THE US UPDATE THE WEST	PUBLIC SURVEY AND HELP Chester County HMP
Contribute to the Chank you for p contribution.	articipating	in this important initiative by p	roviding us wi	ith your anony	mous survey	Weste	dester gov.com
Keep checking b	back regula	rly for information on upcomin	g events, to to	ake our public :	survey, and to review	and comment on the draft	t plan.
Upcomin	g Meet	tings					
All planning pro	cess meetin	ngs are open to the public. Upco	oming meetin	gs and informa	ation are provided be	low.	
October 202	1 Go <	> Month Week Day					
					Events in	October 2021-Se	ptember 2022
October 13, 20	21 - Mitigatio	on Strategy Workshop					
October 20, 20	121 <b>-</b> Stakeh	older Workshop					
Contact I	nforma	ation					





Westchester gov.com	WESTCHESTE 2021 UPDATE	R COUI	NTY HA	ZARD MIT	IGATION PLA	N
Home About	What is Hazard Mitigation?	Calendar	Meetings	Explore the Plan	Additional Information	Questions?
Meetings						
Steering Committee Mee	eting #1 - July 13, 2021					
Steering Committee #1	- Agenda					Download
Steering Committee #1	- Minutes					Download
<ul> <li>Steering Committee #1</li> </ul>	- Presentation					Download
Planning Partnership Me	<u>eting #1 - July 20, 2021</u>					
Planning Partnership #	1 - Agenda					Download
• Planning Partnership #	1 – Presentation					Download
Planning Partnership #	1 – Minutes					Download
To view and listen to the p	presentation, follow this link.					
Steering Committee #2 -	- September 14, 2021					
Steering Committee #2	2 – Agenda					Download
Steering Committee #2	2 – Presentation					Download

Westchester George Latimer gOV.COIII Wendcheer Courts Executive	st 🗘 📞 🕑 💌 Layout 💉 🖍 Font 🗢 🖸 T 🖸				
Department of Planning > Hazard	Mitigation Planning				
ENVIRONMENT	Hazard Mitigation Planning				
Soil and Water Conservation	Hazard Mitigation Plans form the foundation of a community's long-term strategy to break the c 🕮 COUNTY NEWS age,				
Watershed Protection	reconstruction and repeated damage. Disasters cause loss of life, damage buildings and infrastructure and have devastating consequences for a community's economic, social, and environmental well-being. The <b>consequences</b> for a community's economic, social, and environmental well-being. The <b>consequences</b> for a community's economic, social, and environmental well-being.				
Water Quality	CFR 201.2) defines hazard mitigation as "sustained action taken to reduce or eliminate long-term recommended and sustained action taken to reduce or eliminate long-term recommended and sustained to from hazards." The purpose of mitigation planning is to identify policies and actions, which can be implemented and sustained to				
Aquatic Restoration	reduce risk and future losses from disasters.				
Stormwater Management	Breaking the Cycle of Destruction				
Flooding         When recurrent disasters such as coastal or riverine flooding take place, and repairs and reconstruction are completed in such a way as to simply restore damaged property to pre-disaster conditions, a cycle of repeated damage and reconstruction can occu           Flood Zones & Maps         Reconstruction becomes more expensive, as the costs accumulate throughout the years. By undertaking a comprehensive haza					

















		Covid 19 - LATEST VACCINATION INFORMATION	
LUISBORD	Lewisba	NEW YORK Community Departments Com	Search amittees and Council Resour
J.			
Supervisar and Tawn Baard The Town of Lewisboro is working al		Westchester County Hazard Mitigation Plan The Town of Lewisboro is working along with the County to develop a hazard mitigation plan so that we are eligible to receive Federal grant funding for projects to reduce our risk to natural hazards such as flooding	Contact Information
	About the Supervisor and Town Board	and severe storms. Available funding can support projects such as drainage improvements, structural elevations, and backup power for schools and critical facilities. Your input is needed. To find out more, review the draft plan and have the opportunity to provide input, please visit our project website at at the draft plan and have the opportunity to provide input.	<b>Hours:</b> 9 a.m. – 5 p.m. Monday – Friday
	Agendas/Minutes	nttp://www.westchesternmp.com/# and take our citizen preparedness and mitigation survey at https://www.surveymonkey.com/r/9L7XFJJ#	Peter Parsons Supervisor
	Members		914-763-3151 Mary Hafter
	Procurement Policy	Supporting Documents	Confidential Secretary Benefits Coordinator
	Sexual Harassment Policy	☑ Hazard Mitigation Section Lewisboro ∞(575 KB)	Phone: 914-763-9035 Fax: 914-763-3398 benefts@lewisborogov.com⊠

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	<u>ዮ</u> አ 63°F		Nearby -		Local News -		Neighbor Posts		Local Marke
	Politics W PL M The draft O Posted	& Government estc ublic itiga survey wi plan for Press Releas Thu, Aug 19, <u>Press</u> Augus Westc	nt hester Count in the ster in the ster	TO TO Ian il Septer n Nover	excloped this p	eek Ha nd resu	ting azard ults will be include overnment:	ed in th	e















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### **Citizen Survey Summary**

Those that live and work in Westchester County were given the opportunity to be involved in the planning process. One opportunity was the citizen survey. As stated above, the survey was developed to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. It asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The County advertised the survey on their website and social media accounts. As of November 2021, the survey received 1250 responses.

Most residents (66.46%) receive information concerning natural hazards through the internet. Demographically, survey respondents were from 42 municipalities within Westchester County, with 46.45% having lived in the county for 20 years or more, and the vast majority (88.29%) in their own home. The most common (35.19%) age of respondents was over the age of 61. The majority (66.46%) of residents receive information concerning a natural hazard

through the internet. Over half (55.24%) receive information through TV news, and slightly under half (49.01%) receive information through Town/Village email.

Survey respondents identified the following as the top 5 most frequently occurring natural hazard events within Westchester County in the past 10 years, as shown in Figure 3-3:

- Severe storms wind, lightning, hail (54.90%)
- Severe winter storms blizzard, heavy snow, ice (54.45%)
- Extreme temperature heat and cold (42.08%)
- Disease outbreak (37.10%)
- Flooding urban flooding / stormwater issues (35.44%)

The highest hazards of concern (respondents reporting somewhat concerned, very concerned, or extremely concerned) include: Extreme Temperatures, Severe Winter Storms, CBNR incidents, and Disease Outbreak.

# Figure 3.4. Most frequently experienced natural hazard events in Westchester County





Respondents identified the following as desired projects to implement to reduce the damages due to natural hazards:

- Improve and strengthen infrastructure, such as elevating roadways and improving drainage systems (83.57%)
- Work on improving the damage resistance of utilities (electricity, communications, water/wastewater facilities, etc.) (77.97%)
- Inform property owners of ways they can mitigate damage to their properties (42.13%)
- Install or improve protective structure, such as bulkheads, floodwalls or levees to protect against flooding (38.99%)
- Assist vulnerable property owners with securing funding to mitigate their properties (38.29%)

Respondents were then given the opportunity to propose their own projects they would like to see implemented in Westchester County

- Better communication, education and disaster response (15%)
- City planning: 8 residents suggested making changes to building permits, including restricting the amount and location of new construction to mitigate property damage and prevent a loss of soil permeability. Residents also suggested placing more restrictions on residential construction projects
- Climate Change: 4 respondents expressed concerns about climate change and suggested passing legislation to restrict carbon emissions and building enhanced flood infrastructure.
- Flooding: 25% of respondents were concerned about flooding and suggesting improving water storage areas, reinforcing retaining walls and river banks, regular dredging of the Mamaroneck River, and building dams and levees.

Please list any additional types of projects you believe local, county, state or federal government agencies could be doing in order to reduce the damage and disruption of natural disasters in Westchester County.

"Rescue operation, better warning systems, possibly a natural disaster unit by town within fire and police departments. Overtime staffed areas of time. Mostly Prevention and infrastructure. Willing to pay higher taxes to do so."

"Teach landscapers to build rain gardens and plant shrubs and trees that can make our yards healthier. Lawns are useless at absorbing and retaining water."

"Environmental restoration projects, lowering carbon footprint incentives, sewage treatment system rain separation-overflow discharge, all power lines underground!"

- Electricity: 23% of respondents expressed concerns over electricity and suggested burying power lines, increasing tree trimming, and installing backup generators in cell phone towers and gas stations
- Improve sewar infrastructure (13%)
- Better stormwater management (23%): Suggestions included more regular drain cleaning, improving culverts and pipes and re-directing water.

Respondents were asked to rank how prepared they and their household are for a natural disaster, on a scale of 1 to 5, with 1 being least prepared and 5 being most prepared. 66.72% indicated their level of preparedness is a 3 and above, with 11.45% feeling least prepared, and only 4.37% feeling most prepared. Respondents also indicated their households have taken the following steps to prepare for hazard events:

- I have used local news or other media to obtain information (73.43%)
- I am prepared to shelter in-place for 3-5 days if that is the best available option (65.72%)





- I have at least two methods for receiving emergency notifications and for information during severe weather or other potential emergency situations (62.89%)
- I have taken precautionary measures to protect my property through improvements or when constructed (44.03%)

Respondents were then asked about protecting their home from natural hazards. 50% said they would consider a "buyout", "elevation", or "relocation" if they lived in a designated high hazard area or had repeated damages from a natural disaster event. Respondents were then asked how much money they would be willing to spend on their current home to help protect it from the impacts of potential future natural disasters. 20% (114 respondents) indicated they would spend between \$5,000 and \$9,999, while 30% (173 respondents) do not know how much they would be willing to spend. However, 98 respondents provided the amount of money they have already spent on hazard mitigation, with an average amount of \$19,655, for items such as improved drainage, sump pumps, and generators. 109 respondents indicated they would be incentivized by grants, tax breaks, funding assistance. insurance discounts. low interest rate loans, waivers, and/or lower insurance rates to protect their home from natural hazard impacts.

Respondents were also asked about their property's location within the floodplain, and if they have flood insurance. Of the 664 respondents who answered this question, only 91 (13.70%) indicated that their property is located in a designated floodplain. However, 120 residents (18.21%) indicated their home is covered by flood insurance.





The amount of money respondents would be willing to spend on their current home to help protect it from the impacts of potential future natural disasters within their community



Figure 3.4-2 Amount willing to spend on mitigation

The most self-selected jurisdictions

respondents indicated that they live in, include the Village of Dobbs Ferry, the Village of Harrison, the Village of Mamaroneck, and the Village of Tarrytown.

Municipality-specific responses can be found in Section 9 (Jurisdictional Annexes).

Refer to Appendix D (Public and Stakeholder Outreach) for the full list of survey questions and responses.



### 3.4 Incorporation of Existing Plans, Studies, Reports and Technical Information

The Westchester County plan strives to use the best available technical information, plans, studies and reports throughout the planning process to support hazard profiling; risk and vulnerability assessment; review and evaluation of mitigation capabilities; and the identification, development and prioritization of County and local mitigation strategies.

The asset and inventory data used for the risk and vulnerability assessments is presented in the County Profile (Section 4). Details of the source of this data, along with technical information on how the data was used to develop the risk and vulnerability assessment, is presented in the Hazard Profiling and Risk Assessment Section (Section 5), specifically within Section 5.3 (Data and Methodology), as well as throughout the hazard profiles in Section 5.4. Further, the source of technical data and information used may be found within the References section.

Plans, reports and other technical information were identified and accessed online or provided directly by the County, participating jurisdictions and numerous stakeholders involved in the planning effort, as well as through independent research by the planning consultant. The County and participating jurisdictions were tasked with updating the inventory of their Planning and Regulatory capabilities (see Capability Assessment section of each jurisdictional annex in Section 9) and providing relevant planning and regulatory documents as applicable. Relevant documents, including plans, reports, and ordinances were reviewed to identify:

- Existing municipal capabilities;
- Needs and opportunities to develop or enhance capabilities, which may be identified within the County or local mitigation strategies;
- Mitigation-related goals or objectives, considered in the review and update of the overall Goals and Objectives (see Section 6);
- Proposed, in-progress, or potential mitigation projects, actions and initiatives to be incorporated into the updated County and local mitigation strategies.

The following local regulations, codes, ordinances and plans were reviewed during this process in an effort to develop mitigation planning goals and objectives and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms; and thus develop complementary and mutually supportive strategies, including:

- Comprehensive/Master Plans
- Building Codes
- Zoning and Subdivision Ordinances
- NFIP Flood Damage Prevention Ordinances
- Site Plan Requirements
- Local Waterfront Revitalization Plans
- Stormwater Management Plans
- Emergency Management and Response Plans
- Land Use and Open Space Plans
- Capital Plans
- Climate Smart Community Program
- Community Rating System
- New York State Standard Multi-Hazard Mitigation Plan, 2019





During the course of this planning process, a concerted effort was made to review all relevant plans contributing to the capability of the county and each municipality to integrate effective mitigation efforts into the daily activities of the county and municipalities. Documentation of this extensive review is reflected in the capability assessment table in each of the municipal annexes wherein the plan types, names, and dates are indicated in the table as well as a summary of how the plan supports mitigation and resilience. The A partial listing of the plans, reports and technical documents reviewed in the preparation of this plan (inclusive of those which provided the basis for capabilities in the previous plan) is included in Table 3-4. Additional plans providing source information are found in the annexes as noted above as well as the References section of this plan.

Table 3-4.	Record Review (Municipalities) ·	• Record of the review of	of existing programs, j	policies, and
technical d	locuments for participating jurisd	lictions		

Existing plan, program or technical documents	Jurisdictional Applicability2
2025 Context for County and Municipal Planning in Westchester County and Policies to Guide County Planning	All
Patterns for Westchester: The Land and the People. Policies and Strategies to Guide Land Use	All
Westchester County Comprehensive Emergency Management Plan	All
Annual Report of the Westchester County Solid Waste Commission For 2008	All
Flooding and Land Use Planning: A Guidance Document for Municipal Officials and Planners, June 2010	All
Initial Earthquake Loss Estimation Analysis for Westchester County, New York, January 2011	All
Hurricane Sandy: Westchester County – Incident Overview, February 2013	All
Mid-Hudson Regional Sustainability Plan, November 2012	All
Village of Ardsley Stormwater Management Plan	Ardsley
Flood Regulations – 2007	Bedford
Comprehensive Plan – Amended 2010 to include Climate Action Plan	Bedford
Comprehensive Master Plan for the Village of Buchanan, March 2005	Buchanan
Downtown Revitalization Initiative Strategic Investment Plan, 11/1/2020	City of Peekskill
Comprehensive Plan	City of White Plains
Transit District Plan	City of White Plains
Recreation and Parks Master Plan	City of White Plains
Public Health Emergency Operations Plan	City of White Plains
Stormwater Management Plan Town of Cortlandt, May 2012	Cortlandt
Town of Cortlandt Comprehensive Master Plan, July 2004	Cortlandt
Comprehensive Plan for Village of Croton-on-Hudson, January 2003	Croton-on-Hudson
Town of Eastchester All Hazard Mitigation Plan, February 2009	Eastchester
Town of Eastchester Comprehensive Plan, February 1997	Eastchester
Comprehensive Plan Town of Greenburgh, New York, October 2000	Greenburgh
Town of Greenburgh Comprehensive Plan Update, February 2011	Greenburgh
Addendum to the Comprehensive Plan, January 2003	Greenburgh
Climate Action Plan for the Town of Greenburgh Municipal Operations, April 2003	Greenburgh
Hazard Mitigation Plan – September 2009	Harrison



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Existing plan, program or technical documents	Jurisdictional Applicability2
Town/Village of Harrison Comprehensive Plan – December 2013	Harrison
Blind Brook Watershed Management Plan – March 2009	Harrison, Rye Brook, City of Rye
Hydrologic and Hydraulic Analysis Report, Blind Brook Watershed Study – August 2014	Harrison, Rye Brook, City of Rye
Blind Brook Watershed Plan and Environmental Impact Statement – July 1979	Harrison, Rye Brook, City of Rye
Village of Hastings-on-Hudson Comprehensive Plan, July 2011	Hastings-on-Hudson
Village of Hastings-on-Hudson Local Waterfront Revitalization Program, April 2007	Hastings-on-Hudson
Village of Irvington 2003 Comprehensive Plan, March 2003	Irvington
Hazard Mitigation Plan – September 2013	Larchmont
Local Waterfront Revitalization Program for Town of Mamaroneck and Village of Larchmont – October 1986	Larchmont
Updated Local Waterfront Revitalization Program for Town of Mamaroneck and Village of Larchmont – 1996	Larchmont
Climate Action Plan – [cannot determine date but it's very recent]	Larchmont
Flood Regulations – 2007	Lewisboro
Resolution to create Lewisboro Emergency Management Committee – Jan. 3, 2008	Lewisboro
Comprehensive Emergency Management Plan – August 2008	Lewisboro
Town Master Plan – May 24, 1985	Lewisboro
MS4 Annual Report – May 5, 2013	Lewisboro
Multi-Hazard Hazard Mitigation Plan – March 2014	Mamaroneck Town
Local Waterfront Revitalization Program for Town of Mamaroneck and Village of Larchmont – October 1986	Mamaroneck Town
Updated Local Waterfront Revitalization Program for Town of Mamaroneck and Village of Larchmont – 1996	Mamaroneck Town
Local Multi-Hazard Mitigation Plan – May 2012	Mamaroneck Village
Local Waterfront Revitalization Program – May 1985	Mamaroneck Village
Update of Local Waterfront Revitalization Program – September 2011 (draft)	Mamaroneck Village
Comprehensive Plan – February 2012	Mamaroneck Village
Multi-Hazard Mitigation Plan – October 2013	Mount Kisco
Flood Regulations	Mount Kisco
Comprehensive Development Plan – August 2000	Mount Kisco
NYSDEC Brownfield Opportunity Areas Program Step 1 Pre-Nomination Study – City of Mount Vernon, December 2009	Mount Vernon
Preparing a New Comprehensive Plan for the Physical Development of the City of Mount Vernon, January 2011	Mount Vernon
Mount Vernon Action Plan, March 2009	Mount Vernon
Westchester Safe Routes to School Workshop – A.B. Davis Middle School, Mount Vernon, NY, October 20, 2009	Mount Vernon
Town Development Plan, November 1989	New Castle
City of New Rochelle 2012 Annual Stormwater Report, 2012	New Rochelle
Armonk Main Street Planning & Design Study – May 2001	North Castle
Flood Regulations	North Castle



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Existing plan, program or technical documents	Jurisdictional Applicability2
Town Comprehensive Plan Update 1996	North Castle
Revised Town Development Plan Map – Dec. 13, 2006	North Castle
Assessment of Hydrogeologic Conditions - March 1990	North Castle
Hamlet Design Guidelines – October 2011	North Castle
North Castle Biodiversity Plan – 2007	North Castle
Official Map – Town of North Castle – Oct. 23, 1997	North Castle
MS4 Annual Report – Mar. 9, 2012	North Castle
Compilation of Flood Problem Areas from Reconnaissance Plans – Jun. 30, 2014	North Castle, Harrison, Larchmont, Mamaroneck Town and Village, Port Chester, Rye Brook, Yorktown, Pound Ridge, Lewisboro, Mount Kisco, North Salem, Somers
Flood Regulations	North Salem
Open Space Report – Oct. 15, 2009	North Salem
North Salem Town Newsletter - Spring 2014	North Salem
Cedar Lane Drainage Study, November 2011	Ossining
Town of Ossining Comprehensive Plan, September 2002	Ossining
Town of Ossining Stormwater management Program, 2012	Ossining
Central Ave & South Water St. Corridor Study, January 2010	Peekskill
City of Peekskill Hazard Mitigation Plan for Property and Infrastructure, December 2007	Peekskill
City of Peekskill Local Waterfront Revitalization Program, January 2005	Peekskill
Peekskill Waterfront Redevelopment Plan – Land Use Plan, December 1989	Peekskill
Incorporated Village of Pelham: Multi-Hazard Mitigation Plan, April 2007	Pelham
Village of Pelham Comprehensive Plan, April 2008	Pelham
Village of Pelham Manor Multi-Hazard Mitigation Plan, September 2010	Pelham Manor
Village of Pleasantville Master Plan Update – Final Adopted Amendments Relating to Marble Avenue Corridor Study, October 2007	Pleasantville
Village of Pleasantville Master Plan Update, 1995	Pleasantville
Local Waterfront Revitalization Program – February 2013 (draft)	Port Chester
Local Waterfront Revitalization Program – 1992	Port Chester
Comprehensive Plan – December 2012	Port Chester
Flood Regulations	Pound Ridge
Emergency Management Plan – December 2013	Pound Ridge
Comprehensive Plan – Nov. 4, 2010	Pound Ridge
New York Rising Community Reconstruction Plan – December 2014	Rye (City)
Hazard Mitigation Plan – April 2007	Rye (City)
Flood Mitigation Plan – November 2001	Rye (City)
Local Waterfront Revitalization Program – June 1991	Rye (City)
Stormwater Management Program [no date]	Rye (City)
City of Rye Development Plan – April 1985	Rye (City)
2014-2018 Capital Improvement Plan – August 2013	Rye (City)



Existing plan, program or technical documents	Jurisdictional Applicability2
Hazard Mitigation Plan – June 2007	Rye Brook
Village of Rye Brook Comprehensive Plan – June 2014	Rye Brook
Stormwater Analysis, East Branch Blind Brook – November 2002	Rye Brook
Project Report, Flood Mitigation Study, Lower Pond Supplemental – Blind Brook at Lower Pond Site – August 2008	Rye Brook, City of Rye
Project Report, Flood Mitigation Study, Bowman Avenue Dam Site - Blind Brook at Bowman Avenue Dam Site - March 2008	Rye Brook, City of Rye
Hydrologic and Hydraulic Analysis, Bowman Avenue Dam Project, Study for Resizing the Upper Pond – September 2012	Rye Brook, City of Rye
Flood Regulations	Somers
Comprehensive Master Plan Update – Interim Draft Dec. 2005	Somers
Comprehensive Master Plan – January 1994	Somers
Sustainable Comprehensive Plan, 3	Town of Cortlandt
Open Space Plan	Town of Cortlandt
Verplanck Waterfront Master Plan	Town of Cortlandt
Survey and Assessment of Historic Roads	Town of Cortlandt
Master Plan	Town of Lewisboro
Bike and Pedestrian plan	Town of Lewisboro
Climate Action Plan	Town of New Castle
Emergency/Disaster Op[erating Procedures Emergency Plan	Town of New Castle
Comprehensive Plan	Town of North Castle
Future Land Use Plan	Town of North Castle
Comprehensive Plan	Town of North Salem
Sustainable Ossining	Town of Ossining
Tree Inventory	Town of Ossining
Community Climate Action Plan	Town of Ossining
Green Ossining Climate Action Plan	Town of Ossining
Comprehensive Plan	Town of Somers
Stormwater Management Plan	Town of Somers
Comprehensive Plan	Town of Yorktown
Croton-to-Highlands Biodiversity Plan	Town of Yorktown
Sustainable Development Study	Town of Yorktown
Comprehensive Plan	Village of Briafcliff Manor
Comprehensive Plan	Village of Buchanan
Bicicle-Pedestrian master Plan	Village of Croton-on-Hudson
Local Waterfront Revitalization Program	Village of Croton-on-Hudson
Comprehensive Plan	Village of Croton-on-Hudson
Municipal Place Gateway and North Riverside Neighborhood Zoning Study	Village of Croton-on-Hudson
Comprehensive Plan Update	Village of Croton-on-Hudson
Comprehensive Plan	Village of Hastings-on-Hudson



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Existing plan, program or technical documents	Jurisdictional Applicability2				
Street Tree Inventory	Village of Irvington				
Village-Wide Flood Study	Village of Irvington				
Main Street Streetscape Master Plan	Village of Irvington				
Comprehensive Plan Update	Village of Ossining				
Community Climate Action Plan	Village of Ossining				
Master Plan Update	Village of Pleasantville				
Comprehensive Plan Update	Village of Scarsdale				
Comprehensive Plan	Village of Tarrytown				
Bronx River Corridor Study and Management Plan for Westchester County, NY	Westchester County				
The Comprehensive Croton Watershed Water Quality Protection Plan	Westchester County				
Indian Brook-Croton Gorge Watershed Conservation Action Plan	Westchester County				
Saw Mill River Coalition 5-year Action Plan	Westchester County				
Agriculture and Farmland Protection Plan	Westchester County				
City of White Plains, New York 2013-14 Community Development Annual Action Plan, September 2013	White Plains				
The City of White Plains, New York Multi-Hazard Mitigation Plan, September 2013	White Plains				
City of Yonkers Multi-Hazard Mitigation Plan, 2013	Yonkers				
Flood Regulations	Yorktown				
Comprehensive Plan – June 15, 2010	Yorktown				
All Hazard Mitigation Plan – Draft Jan. 30, 2006	Yorktown				
MS4 Annual Report – Mar. 9, 2013	Yorktown				
Stormwater Reconnaissance Plan for the Saw Mill River-Pocantico River Watershed	Village of Ardsley, City of Yonkers, Village of Briarcliff Manor, Village of Sleepy Hollow, Town of Greenburgh, Village of Irvington, Mt. Pleasant, Pleasanville, Town of New Castle, Town and Village of Ossining, Village of Tarrytown				
Stormwater Reconnaissance Plan for the Bronx River Watershed	Mt. Vernon, Pelham, Pelham Manor, New Rochelle, Eastchester, Scarsdale, Mamaroneck, Larchmont, Rye, Port Chester, Rye Brok, Harrison, White Plains Village of Bronxville, Tuckahoe				
Stormwater Reconnaissance Plan for the Long Istand Sound Watershed	City of Rye, Village and Town of Mamaroneck, Larchmont, New Rochelle, Pelham Manor, Harrison, Port Chester				
Stormwater Reconnaissance Plan for the Peekskill-Haverstraw Bay Watershed	Peeks, Cortlandt, Buchanan, Croton-on- Hudson				
Stormwater Reconnaissance Plan for the Croton River and Inland Long Istand Sound Watershed	Yorktown, Somers, North Salem, Lewisboro, Bedford, Mt. Kisco, North Castle, Pound Ridge				



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### 3.5 Integration with Existing Planning Mechanisms and Programs

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the county there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those existing plans and programs.

The "Capability Assessment" section of Chapter 6 (Mitigation Strategy) provides a summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (Federal, State, County and local) that support hazard mitigation within the county. Within each jurisdictional annex in Chapter 9, the County and each participating jurisdiction have identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework ("integration capabilities") and how they intend to promote this integration ("integration actions").

A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7.

### 3.6 Continued Public Involvement

Westchester County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This Plan update will be posted on-line (currently at <u>www.westchestercountyhmp.com</u>), and municipalities will be encouraged to maintain links to the plan website. Further, the County will make hard copies of the Plan available for review at public locations as identified on the public plan website.

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the Planning Committee's annual evaluation and posted on the public website (currently www.westchesterhmp.com).

Each jurisdiction's governing body shall be responsible for receiving, tracking, and filing public comments regarding this plan.

The public will have an opportunity to comment on the plan as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. The HMP Coordinator (currently Mr. Dennis Delborgo of WCDES - OEM) is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the 5-year plan update as appropriate; however, members of the Planning Committee will assist the HMP Coordinator. Additional meetings may also be held as deemed necessary by the Planning Committee. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the plan.

Further details regarding continued public involvement are provided in Section 7.

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Planning Committee. The Planning Committee will review the plan and accept public comment as part of an annual review and as part of five-year mitigation plan updates.

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the HMP Committee's annual evaluation and posted on the public web site.





Mr. Daniel Olmoz of WCDES-OEM has been identified as the ongoing County All-Hazard Mitigation Plan Coordinator (see Section 7), and is responsible for receiving, tracking, and filing public comments regarding this Plan Update. Contact information is:

Mailing Address:	WC Department of Emergency Services Office of Emergency Management 200 Bradhurst Avenue Hawthorne, NY
Contact Name:	Mr. Daniel Olmoz
Email Address:	dno1@westchestergov.com
Telephone:	(914) 864-5451



## **SECTION 4. COUNTY PROFILE**

This profile describes the general information of the County (physical setting, population and demographics, general building stock, and land use and population trends) and critical facilities located within Westchester County. In Section 5, specific profile information is presented and analyzed to develop an understanding of the county, including the economic, structural, and population assets at risk and the particular concerns that may be present related to hazards analyzed (for example, a high percentage of vulnerable persons in an area).

### 4.1 GENERAL INFORMATION

Westchester County covers an area of approximately 450 square miles and is home to nearly one million people living in 45 municipalities (six cities, 23 villages, and 16 towns). Bounded by the Long Island Sound to the southeast and the Hudson River to the west, the terrain throughout the county is largely rolling hills with many rivers, streams and waterbodies of various sizes. Located just north of New York City, major transportation networks are located throughout the county.

### 4.1.1 Physical Setting

This section presents location, topography and geology, hydrology and hydrography, climate, land use and land cover.

### Location

Westchester County is located in the southeastern portion of New York State. It is 450 square miles in size and is bordered to the north by Putnam County; to the east by Fairfield County, Connecticut; to the south by New York City, and to the west by the Hudson River. The Long Island Sound makes up the southeastern border of the County (FEMA 2007). See Figure 4-1, on the following page.

### Hydrography and Hydrology

Numerous ponds, lakes, creeks, and rivers make up the waterscape of Westchester County. The major waterways within the County include, but not limited to: West Branch Croton River, East Branch Croton River, Titicus Reservoir, Amawalk Reservoir, Croton River, New Croton Reservoir, Cross River Reservoir, Saw Mill River, Sprain Brook, Pocantico River, Caney Brook, Hutchinson River, Wickers Creek, Knollwood Brook, Troublesome Brook Reach 1, Hartsdale Brook, Blind Brook, Beaver Swamp Brook, Brentwood Brook, Mamaroneck River, East Branch Mamaroneck River, Barney Brook, Sunnyside Brook, Riverview Road Brook, Sheldrake River, Nanny Hagen Brook, Fly Kill Brook, Clove Brook, Laurel Brook, Kisco River, Burling Brook, Stephenson Brook, Bear Gutter Creek, Byran River, Wampus River, Kil Brook, Annsville Creek, Hudson River, Kensico Reservoir, Bronx River and the Long Island Sound (FEMA 2007).

The Long Island Sound shoreline in the county is generally rocky. Tidal mud flats and marshes, as well as several natural and artificially-maintained sand beaches, are interspersed on the coast. Several islands can be found offshore. The islands include: Glen Island which is a County park and used for passive and active recreation; Huckleberry Island which is largely undeveloped and has one of the largest rookeries for some shore bird species in western Long Island Sound; Hen Island which contains a residential community; and David's Island, the former location of the U.S. Army's Fort Slocum, which is undergoing an environmental cleanup and is slated to be used as passive parkland.













The widest section across the Hudson River is 3.6 miles and is found between the Westchester and Rockland County shorelines immediately north of Croton Point in Croton-on-Hudson. The Hudson River is tidal and brackish through the County and contains a small number of estuarine marshes. Two bridges span the River in Westchester County; the Bear Mountain Bridge crosses at Cortlandt and the Tappan Zee Bridge at Tarrytown. Municipal, County and state-owned parks provide access to waterfront landmarks and sites throughout Westchester County.

### Watersheds

A watershed is the area of land that drains into a body of water such as a river, lake, stream, or bay. It is separated from other systems by high points in the area such as hills or slopes. It includes not only the waterway itself but also the entire land area that drains to it. For example, the watershed of a lake would include not only the streams entering the lake but also the land area that drains into those streams and eventually the lake. Drainage basins generally refer to large watersheds that encompass the watersheds of many smaller rivers and streams. Figure 4-2 depicts the hydrologic system of a watershed (NYCDEP 2015).

### Figure 4-2. Watershed



Source: U.S. Environmental Protection Agency (EPA) 2012

Watersheds come in all shapes and sizes and can cross municipal and county boundaries. New York State's waters (lakes, rivers, and streams) fall within one of 17 major watersheds (or drainage basins). Westchester County is divided into six primary drainage basins (watersheds): Coastal Long Island Sound, Inland Long Island Sound, Bronx River, Peekskill and Haverstraw Bays, Saw Mill and Pocantico Rivers, and Croton River. Within these six primary drainage basins, there are approximately 60 smaller basins (subwatersheds). The principal streams draining the southern part of the County include Beaver Swamp Brook, Blind Brook, Bronx River, Hutchinson River, Mamaroneck River, Saw Mill River, Sheldrake River, Stephenson Brook, and Tibbetts Brook. The primary streams draining the central portion of the County include: Byram River, Kisco River, Mianus River, Mill River, Pocantico River, and Silvermine River (Westchester County Department of Planning 2010). The northern part of the County is drained primarily by the following: Dickey Brook, Furnance Brook, Hallocks Mill Brook, Hunter Brook, Muscoot River, Peekskill Hollow Brook, and Titicus River. Figure 4-3 shows the watersheds in Westchester County.







Source: Westchester County





### New York City Watershed

The Croton Watershed makes up a portion of the watershed for the New York City drinking water supply system. The Kensico Reservoir, located in the central portion of Westchester, is a component of the Catskill/Delaware System. The combined New York City Water Supply System – the Croton, Delaware and Catskill components – provides drinking water to 85 percent of Westchester County residents. More detailed information on the New York City water supply system can be obtained from the New York City Department of Environmental Protection at http://www.nyc.gov/html/dep/html/watershed\_protection/reservoirs.shtml and from the *Comprehensive Croton Watershed Water Quality Protection Plan* at www.westchestergov.com/crotonplan. Figure 4-4 illustrates the location of the Croton Watershed (Westchester County 2009).

### Figure 4-4. Croton Watershed



Source: New York City Environmental Protection 2007



### **Topography and Geology**

Westchester County is more hilly north of Interstate 287, which bisects the county. The highest point is Bailey Mountain located in Mountain Lakes County Park in the Town of North Salem. It has an elevation of 976 feet (Westchester County Databook, www.westchestergov.com/databook).

The portion of Westchester County south of I-287 is part of the Piedmont Province, 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 the county rests on the upper edge of the unsubmerged portion of the continental shelf of the U.S. Outcroppings of bedrock are frequent throughout each side of glacial origin (FEMA 2007).

### Climate

The climate of New York State is very similar to most of the Northeast U.S. and is classified as Humid Continental. Differences in latitude, character of topography, and proximity to large bodies of water all have an effect on the climate across New York State. Precipitation during the warm, growing season (April through September) is characterized by convective storms that generally form in advance of an eastward moving cold front or during periods of local atmospheric instability. Occasionally, tropical cyclones will move up from southern coastal areas and produce large quantities of rain. Both types of storms typically are characterized by relatively short periods of intense precipitation that produce large amounts of surface runoff and little recharge (Cornell University Unknown)

The cool season (October through March) is characterized by large, low-pressure systems that move northeastward along the Atlantic coast or the western side of the Appalachian Mountains. Storms that form in these systems are characterized by long periods of steady precipitation in the form of rain, snow, or ice, and tend to produce less surface runoff and more recharge than the summer storms because they have a longer duration and occasionally result in snowmelt (Cornell University Unknown).

Westchester County generally experiences short winters and long summers. Temperature extremes between the seasons are from -34°F to 106°F. The County's received precipitation is consistent throughout the year with no stark variations between months; however, the summer months can be slightly higher. The average amount of precipitation yearly is approximately 45 inches (FEMA 2007).

### Land Use and Land Cover

Total land area in Westchester County is nearly 432 square miles, of which, 46-percent is occupied by urban land use. The densest residential areas include cities and villages in the southern portion of the County, while the northwestern municipalities remain the least dense. According to the County's open space mapping portal, dedicated open space and recreation lands occupy over 92,386 acres (32.1-percent of the County's total land area). The largest portions of protected open space are in the northern areas of Westchester County, but overall, open space areas are spread throughout the County.

The tradition of home rule is well-established in Westchester County. Cities, towns and villages exercise direct control over land use. However, formal and informal arrangements between local governments on land use and infrastructure decisions have evolved and will need to expand, especially with climate change and increasing urban populations (Westchester County Department of Planning 2010). The distribution of land use in Westchester County varies throughout. The County's urban and village centers in the south are dominated by medium- and high-density residential, commercial, and industrial uses, while open space, low-density residential, and some institutional uses are more prominent in the northern section of the County. During the



20<sup>th</sup> Century, the County experienced rapid growth and development, leaving less than one-tenth of the County's total land area vacant or undeveloped.

The southern portion of Westchester County, along the Long Island Sound and the lower portion of the Hudson River, is more densely developed and populated than the northern portion. Development in the northern part is largely comprised of low- to medium-density residential development with small amounts of commercial development located in 12 small hamlets. The southern portion of the county is home to five cities and densely populated villages. The historical development of the county is based on three primary components: centers, corridors, and open space.

### **County Centers**

Westchester County's centers are the focal points in the county's pattern of development. Centers consist of commercial or mixed-use cores and surrounding residential and industrial areas. Centers are likely to have the principal services on which most communities depend. They can be categorized into four types based on their size and function. Hamlets are the smallest centers, mostly found at the crossroads of historic transportation routes, and have basic retail, religious, and government facilities. Local centers are served by major road, train, and transit corridors. Intermediate centers have well-developed infrastructure systems and have a distinct urban character, with mid- and high-rise buildings, large-scale retail, and some industrial uses. Major centers are the county's largest places of economic activity, with high-density development and extensive infrastructure.

### **County Corridors**

The corridors in Westchester County are the historic paths of movement and development, connecting the County's centers to each other and to places outside of the County. These corridors serve an important transportation role but also have important functions beyond transportation. Housing, commercial, and industrial development has occurred along corridors due to the access that they provide to places of employment and markets for goods. Other corridors have developed based on their scenic qualities and the access they provide to major open spaces and recreational opportunities. Table 4-1 provides information on the distribution of land use in Westchester County. Figure 4-5 displays the land use and land cover of the County.

Land Use Type	Acres	Percent of Total Acreage
Agriculture	5,329	1.9%
Barren	376	0.1%
Forest	129,538	45.1%
Urban	132,159	46.0%
Water	10,612	3.7%
Wetland	9,477	3.3%
Westchester County (Total)	287,492	100.0%

### Table 4-1. 2016 NLCD/USGS Land Use Land Cover in Westchester County

Source: NLCD/USGS - 2016











The following sections provides information on the general land use types in Westchester County based upon the property class description assigned to each parcel by the tax assessor within the County. Please note, the information presented below may under or overestimate the area coverage of each land use type and should be used for planning purposes only.

### Residential

Residential land use continues to make up the largest share of land use in Westchester County, occupying approximately 48.5-percent of the County's parcel land area. The Villages of Bronxville and Tuckahoe have the largest percentage of parcel area in residential use. The municipalities with the lowest percentage of urban land use are the Village of Buchanan and the Village of Pelham.

### Non-Residential

Non-residential parcels occupy approximately 26.3-percent of Westchester County's land area, with approximately 12,896 acres dedicated to commercial and retail uses and approximately 28,545 acres devoted to office and research uses. Industrial land use occupies approximately 877 acres (0.4-percent of the total land area). The City of Mount Vernon has the largest percentage of industrial land (5.4-percent equal to 156 acres). Agriculture remains a small presence in Westchester County's economy. It occupies approximately 3,704 acres in the County (1.5-percent of total parcel land area). The Towns of Bedford and North Salem are the County's municipalities with the largest amount of agricultural land. Government, religious, and public services cover approximately 0.3-percent, 3.6-percent, and 0.8-percent of the County's total parcel land area, respectively.

### Open Space

Open space in Westchester County includes public parks, parkway lands, nature preserves, private recreation lands, cemeteries, common land homeowners' association lands, and water supply lands. According to the County's open space mapping portal, dedicated open space and recreation lands occupy over 98,372 acres (35.5-percent of the County's total land area). The largest portions of protected open space are in the northern areas of Westchester County, but overall, open space areas are spread throughout the County.

Westchester County is a major source for the region's drinking water. A substantial amount of protected lands surround the major reservoirs in the County. Water supply lands account for nearly 15,595 acres in the County (3.7-percent); a majority of which are owned by the New York City Department of Environmental Protection (NYCDEP 2015). The NYCDEP maintains a program to purchase lands surrounding the water supply reservoirs for permanent protection.

### Vacant and Undeveloped Land

Approximately 24.9-percent of the County's total parcel land area (61,793 acres) is vacant and undeveloped. The Towns of Cortlandt and Yorktown have the largest amount of parcel area with vacant land. The Villages of Elmsford and Pelham have less than 50 acres of vacant or undeveloped land. The Villages of Port Chester and Rye Brook have less than 7-percent of their total parcel land area remaining as vacant or undeveloped.

### 4.2 **POPULATION AND DEMOGRAPHICS**

According to the 2019 5-year American Community Survey Population Estimates, Westchester County had a population of 968,065 people which represents approximately a 2-percent increase from the 2010 U.S. Census population of 949,113 people. Hazus demographic data will be used in the loss estimation analyses in Section 5 of this plan. All demographic data in Hazus corresponds to the 2010 U.S. Census data. Table 4-2 presents the population statistics for Westchester County based on the 2010 and 2019 5-year American Community Survey Population Estimates data. For the purposes of this plan, the 2019 5-year American Community Survey





Population Estimates were used where the data was available and supplemented with Hazus data (representing 2010 data).

DMA 2000 requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. For the purposes of this study, vulnerable populations shall include (1) the elderly (persons aged 65 and over) and (2) those living in low-income households.





### Table 4-2. Distribution of Population in Westchester County

	2019 American Community Survey 5-Year Population Estimates				U.S. Census 2010						
Municipality	Total Persons	Pop. 65+	Percent of Total	Low Income Pop.	Percent of Total	Total Person S	Pop. 65+	Percen t of Total Person S	Total Families *	Low- Income Families* *	Percent of Total Familie S
Ardsley (V)	4,512	988	21.9%	47	1.0%	4,452	806	18.1%	1,186	18	1.5%
Bedford (T)	17,803	2,605	14.6%	1,086	6.1%	17,335	2,166	12.5%	4,342	100	2.3%
Briarcliff Manor (V)	7,616	1,538	20.2%	232	3.0%	7,867	1,213	15.4%	2,092	84	4.0%
Bronxville (V)	6,409	977	15.2%	356	5.6%	6,323	881	13.9%	1,685	39	2.3%
Buchanan (V)	2,140	311	14.5%	142	6.6%	2,230	331	14.8%	620	0	0.0%
Cortlandt (T)	32,131	5,295	16.5%	1,651	5.1%	31,292	4,836	15.5%	7,737	201	2.6%
Croton-on-Hudson (V)	8,155	1,386	17.0%	187	2.3%	8,070	1,160	14.4%	2,260	38	1.7%
Dobbs Ferry (V)	11,070	1,655	15.0%	343	3.1%	10,875	1,652	15.2%	2,659	120	4.5%
Eastchester (T)	19,990	3,914	19.6%	705	3.5%	19,554	3,656	18.7%	5,380	194	3.6%
Elmsford (V)	5,085	602	11.8%	539	10.6%	4,664	510	10.9%	1,094	30	2.7%
Greenburgh (T)	44,829	8,582	19.1%	1,970	4.4%	42,863	7,466	17.4%	11,409	228	2.0%
Harrison (T)	28,135	4,146	14.7%	1,369	4.9%	27,472	3,525	12.8%	6,589	191	2.9%
Hastings-on-Hudson (V)	7,921	1,480	18.7%	184	2.3%	7,849	1,360	17.3%	2,026	30	1.5%
Irvington (V)	6,529	1,154	17.7%	387	5.9%	6,420	968	15.1%	1,749	31	1.8%
Larchmont (V)	6,096	682	11.2%	163	2.7%	5,864	740	12.6%	1,618	0	0.0%
Lewisboro (T)	12,599	2,029	16.1%	506	4.0%	12,411	1,439	11.6%	3,474	35	1.0%
Mamaroneck (T)	11,298	2,013	17.8%	453	4.0%	11,977	1,819	15.2%	3,018	75	2.5%
Mamaroneck (V)	19,217	3,493	18.2%	1,131	5.9%	18,929	2,867	15.1%	4,596	115	2.5%
Mount Kisco (T)	10,866	1,716	15.8%	641	5.9%	10,877	1,460	13.4%	2,790	114	4.1%
Mount Pleasant (T)	27,000	4,341	16.1%	1,434	5.3%	26,176	3,412	13.0%	6,442	225	3.5%
Mount Vernon (C)	67,896	10,717	15.8%	9,327	13.7%	67,292	9,318	13.8%	16,124	1,516	9.4%
New Castle (T)	17,905	2,466	13.8%	580	3.2%	17,569	1,999	11.4%	4,963	20	0.4%
New Rochelle (C)	79,067	13,916	17.6%	8,142	10.3%	77,062	11,711	15.2%	17,778	1,227	6.9%




	2019 American Community Survey 5-Year Population Estimates				U.S. Census 2010						
Municipality	Total Persons	Pop. 65+	Percent of Total	Low Income Pop.	Percent of Total	Total Person S	Pop. 65+	Percen t of Total Person S	Total Families *	Low- Income Families* *	Percent of Total Familie S
North Castle (T)	12,235	1,665	13.6%	252	2.1%	11,841	1,565	13.2%	3,071	95	3.1%
North Salem (T)	5,167	1,071	20.7%	241	4.7%	5,104	913	17.9%	1,296	0	0.0%
Ossining (T)	5,567	1,372	24.6%	369	6.6%	5,406	1,270	23.5%	1,337	110	8.2%
Ossining (V)	25,086	3,567	14.2%	2,584	10.3%	25,060	2,614	10.4%	5,646	644	11.4%
Peekskill (C)	24,075	3,610	15.0%	2,769	11.5%	23,583	2,786	11.85%	5,539	698	12.6%
Pelham (V)	6,941	946	13.6%	341	4.9%	6,910	797	11.5%	1,820	7	0.4%
Pelham Manor (V)	5,569	741	13.3%	173	3.1%	5,486	769	14.0%	1,376	17	1.2%
Pleasantville (V)	7,221	1,063	14.7%	212	2.9%	7,019	930	13.2%	1,851	31	1.7%
Port Chester (V)	29,342	3,825	13.0%	3,208	10.9%	28,967	3,082	10.6%	6,896	786	11.4%
Pound Ridge (T)	5,177	1,181	22.8%	64	1.2%	5,104	772	15.1%	1,600	37	2.3%
Rye (C)	15,820	2,454	15.5%	619	3.9%	15,720	2,358	15.0%	4,103	0	0.0%
Rye Brook (V)	9,487	1,985	20.9%	332	3.5%	9,347	1,841	19.7%	2,528	114	4.5%
Scarsdale (T)	17,837	2,819	15.8%	370	2.1%	17,166	2,390	13.9%	4,776	38	0.8%
Sleepy Hollow (V)	10,122	1,646	16.3%	1,331	13.1%	9,870	1,263	12.8%	2,361	236	10.0%
Somers (T)	21,487	5,563	25.9%	565	2.6%	20,434	4,581	22.4%	5,692	28	0.5%
Tarrytown (V)	11,436	1,830	16.0%	466	4.1%	11,277	1,642	14.6%	2,358	73	3.1%
Tuckahoe (V)	6,584	1,080	16.4%	427	6.5%	6,486	995	15.3%	1,644	112	6.8%
White Plains (C)	58,137	10,096	17.4%	7,033	12.1%	56,853	8,672	15.3%	13,609	803	5.9%
Yonkers (C)	199,968	33,075	16.5%	29,453	14.7%	195,976	28,776	14.7%	47,799	5,306	11.1%
Yorktown (T)	36,538	6,768	18.5%	1,399	3.8%	36,081	5,831	16.2%	10,194	143	1.4%
Westchester County (TOTAL)	968,065	162,363	16.8%	83,783	8.7%	949,113	139,12 2	14.7%	237,127	13,908	5.9%

Source: ACS 2019; Census 2010

*Note: Pop.* = *population;* % = *Percent* 

\*Total Families is calculated using the 2010 5-Year American Community Survey Estimates.

\*\*Low income families represents the number of families living under the poverty threshold according to the 2010 5-Year American Community Survey Estimates. These numbers are considered best available data, but do not directly correlate to the values presented in the 2019 American Community Survey Estimates and do not reflect the total number of persons within each family that is living below the poverty threshold.





Poverty thresholds were established by the 2019 5-Year American Community Survey Population Estimates U.S. Census Bureau and were used to represent low income persons in the County. This difference is not believed to be significant for the purposes of this planning effort. Figure 4-7 shows the distribution of persons over age 65 in Westchester County, while Figure 4-8 shows the distribution of low income persons.



























# 4.3 General Building Stock

The 2010 U.S. Census data identified 347,232 occupied housing units in Westchester County. The 2020 U.S. Census data 367,296 occupied housing units in Westchester County. The 2010 5-year American Community Survey estimates there were 345,795 households in the County; whereas in 2019, the 5-year population data estimates 349,292 households. The County experienced an increase in both households and housing units from 2010 to 2020. The U.S. Census defines household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, you may have more than one household per housing unit. The median price of an owner-occupied housing unit in Westchester County was estimated at \$540,600 (ACS 2019).

For this update, the default general building stock in Hazus was updated and replaced with a custom building inventory for Westchester County both at the aggregate and structure level. The building stock update was performed using updated 2020 building footprint data from Westchester County's GIS team and updated 2021 tax assessor data and parcels from NYS GIS. The replacement cost value was calculated using the square footage value of each building and RS Means 2021 data.

For the purposes of this plan, there are approximately 269,974 structures identified by the tax data and spatial data available. These structures account for a replacement cost value of approximately \$402.9 billion. Estimated content value was calculated by using 50-percent of the residential replacement cost value, and 50-percent, 100-percent or 150-percent of the non-residential replacement values depending on the assigned specific occupancy class of the non-residential structure. Using this methodology, there is approximately \$178.7 billion in contents within these properties. Approximately 89.5-percent of the total buildings in the County are residential, which make up approximately 30.1-percent of the total replacement cost value of structures in the County. Table 4-3 presents building stock statistics by occupancy class for Westchester County.

	All Occupancies							
Municipality	Count	Estimated Structure Replacement Cost Value	Estimated Contents Replacement Cost Value	Total Replacement Cost Value (Structure + Contents)				
Ardsley (V)	1,600	\$690,147,019	\$494,031,454	\$1,184,178,473				
Bedford (T)	7,842	\$3,604,194,518	\$2,583,095,972	\$6,187,290,490				
Briarcliff Manor (V)	2,821	\$1,661,020,285	\$1,268,330,156	\$2,929,350,441				
Bronxville (V)	1,524	\$1,303,875,894	\$1,118,301,086	\$2,422,176,980				
Buchanan (V)	1,153	\$630,710,839	\$544,128,134	\$1,174,838,972				
Cortlandt (T)	11,740	\$4,608,359,980	\$2,930,940,515	\$7,539,300,494				
Croton-on-Hudson (V)	3,412	\$2,822,551,744	\$2,516,621,538	\$5,339,173,282				
Dobbs Ferry (V)	2,888	\$1,902,779,173	\$1,621,972,243	\$3,524,751,416				
Eastchester (T)	5,861	\$2,486,034,848	\$1,856,594,948	\$4,342,629,796				
Elmsford (V)	1,358	\$1,413,897,425	\$1,305,258,179	\$2,719,155,604				
Greenburgh (T)	14,313	\$22,531,563,429	\$19,477,783,464	\$42,009,346,893				
Harrison (T)	7,813	\$5,738,654,406	\$4,677,279,753	\$10,415,934,158				
Hastings-on-Hudson (V)	2,812	\$6,771,327,685	\$6,496,364,904	\$13,267,692,589				
Irvington (V)	1,736	\$896,086,208	\$679,569,011	\$1,575,655,219				

#### Table 4-3. Number of Buildings and Total Replacement Cost Value of Structures by Municipality





	All Occupancies							
		Estimated Structure Replacement Cost	Estimated Contents Replacement Cost	Total Replacement Cost Value (Structure				
Municipality	Count	Value	Value	+ Contents)				
Larchmont (V)	2,281	\$1,781,695,596	\$1,505,502,822	\$3,287,198,418				
Lewisboro (T)	6,358	\$3,420,663,377	\$1,893,020,453	\$5,313,683,830				
Mamaroneck (T)	4,065	\$1,444,603,147	\$918,847,204	\$2,363,450,350				
Mamaroneck (V)	5,699	\$3,999,122,618	\$3,322,774,742	\$7,321,897,360				
Mount Kisco (T)	3,002	\$3,066,885,930	\$2,846,578,101	\$5,913,464,031				
Mount Pleasant (T)	9,863	\$4,646,186,278	\$3,663,621,553	\$8,309,807,831				
Mount Vernon (C)	12,648	\$8,920,142,825	\$8,101,798,954	\$17,021,941,779				
New Castle (T)	6,759	\$2,963,999,254	\$1,993,955,523	\$4,957,954,777				
New Rochelle (C)	17,044	\$22,496,744,379	\$20,299,119,090	\$42,795,863,468				
North Castle (T)	5,391	\$2,943,236,759	\$2,124,467,298	\$5,067,704,057				
North Salem (T)	2,870	\$1,458,383,687	\$913,743,210	\$2,372,126,897				
Ossining (T)	2,266	\$823,885,012	\$558,602,850	\$1,382,487,862				
Ossining (V)	5,874	\$3,308,083,732	\$2,763,135,834	\$6,071,219,565				
Peekskill (C)	6,001	\$3,428,399,367	\$2,887,222,980	\$6,315,622,346				
Pelham (T)*	4,596	\$2,064,930,900	\$1,583,846,524	\$3,648,777,424				
Pelham (V)	2,377	\$1,308,580,193	\$1,075,663,307	\$2,384,243,499				
Pelham Manor (V)	2,219	\$756,350,707	\$508,183,217	\$1,264,533,925				
Pleasantville (V)	2,919	\$1,690,889,377	\$1,151,709,941	\$2,842,599,318				
Port Chester (V)	6,424	\$4,809,453,551	\$3,059,613,927	\$7,869,067,479				
Pound Ridge (T)	3,025	\$1,033,413,252	\$563,339,692	\$1,596,752,944				
Rye (C)	5,632	\$3,296,228,031	\$2,524,694,229	\$5,820,922,260				
Rye Brook (V)	3,591	\$2,703,971,990	\$2,188,259,031	\$4,892,231,021				
Scarsdale (T)	6,829	\$2,821,235,146	\$1,782,514,247	\$4,603,749,394				
Sleepy Hollow (V)	1,921	\$1,125,662,964	\$865,222,506	\$1,990,885,470				
Somers (T)	11,490	\$3,781,344,288	\$2,310,860,056	\$6,092,204,344				
Tarrytown (V)	3,078	\$3,831,292,018	\$3,452,981,551	\$7,284,273,569				
Tuckahoe (V)	1,655	\$859,475,671	\$670,891,037	\$1,530,366,709				
White Plains (C)	13,986	\$34,680,317,731	\$26,819,380,864	\$61,499,698,595				
Yonkers (C)	33,912	\$27,499,246,243	\$23,145,102,633	\$50,644,348,876				
Yorktown (T)	13,922	\$12,243,182,100	\$7,260,604,696	\$19,503,786,796				
Westchester County (Total)	269,974	\$224,203,878,676	\$178,741,682,905	\$402,945,561,577				

Source: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021

*Notes:* C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor



	Residential		C	ommercial	Industrial		
	Total		Total				
Manada in alita	6t	(Structure +	Coun	(Structure +	Coun	Total (Structure +	
Municipality	Lount	\$502.016.224	t 71	<b>Contents</b>	t	contents	
Ardsley (V)	7,0(0	\$392,010,234	/1	\$430,398,301	17	\$0	
Bedford (T)	7,000	\$3,033,162,249	400	\$2,169,473,791	1/	\$70,903,089	
Briarcliff Manor (V)	2,599	\$1,290,536,318	132	\$1,239,015,543	4	\$26,774,766	
Bronxville (V)	1,326	\$600,335,771	133	\$1,599,893,776	0	\$0	
Buchanan (V)	947	\$249,282,228	189	\$829,366,804	7	\$56,582,957	
Cortlandt (T)	11,046	\$5,081,231,918	516	\$1,752,706,122	17	\$17,685,293	
Croton-on-Hudson (V)	2,972	\$930,722,819	368	\$4,238,464,445	4	\$11,881,438	
Dobbs Ferry (V)	2,453	\$913,657,503	257	\$2,078,362,616	0	\$0	
Eastchester (T)	5,397	\$1,721,466,270	368	\$2,211,948,128	0	\$0	
Elmsford (V)	1,115	\$312,698,558	212	\$2,197,073,970	11	\$119,447,872	
Greenburgh (T)	12,196	\$4,883,944,289	1,419	\$27,857,899,37 3	14	\$395,691,399	
Harrison (T)	7,000	\$3,500,841,733	449	\$5,525,090,834	3	\$2,247,437	
Hastings-on-Hudson (V)	2,383	\$770,456,431	199	\$1,727,391,156	0	\$0	
Irvington (V)	1,583	\$713,951,716	80	\$538,670,296	4	\$17,677,364	
Larchmont (V)	2,093	\$724,984,994	156	\$2,449,574,491	0	\$0	
Lewisboro (T)	6,007	\$4,595,003,775	202	\$261,402,377	5	\$6,065,189	
Mamaroneck (T)	3,506	\$1,417,682,814	509	\$809,651,365	0	\$0	
Mamaroneck (V)	4,637	\$1,684,701,023	946	\$5,043,540,830	18	\$165,870,079	
Mount Kisco (T)	2,454	\$799,156,729	496	\$4,864,634,754	13	\$127,649,181	
Mount Pleasant (T)	8,807	\$3,302,945,339	763	\$3,718,989,389	24	\$83,764,525	
Mount Vernon (C)	10,810	\$3,289,216,287	1,045	\$10,413,590,27 1	548	\$2,358,719,654	
New Castle (T)	6,235	\$2,959,354,338	354	\$1,429,573,834	7	\$91,554,845	
New Rochelle (C)	15,098	\$5,776,906,118	1,567	\$34,981,630,81 1	37	\$318,356,287	
North Castle (T)	4,814	\$2,494,284,757	401	\$1,934,407,549	12	\$43,869,256	
North Salem (T)	2,623	\$1,625,286,693	155	\$512,249,055	0	\$0	
Ossining (T)	2,104	\$812,293,126	118	\$417,877,814	0	\$0	
Ossining (V)	5,299	\$1,511,339,155	417	\$3,785,122,005	15	\$48,487,937	
Peekskill (C)	5,286	\$1,683,532,230	579	\$4,004,929,706	58	\$278,727,398	
Pelham (T)*	4,293	\$1,374,314,313	229	\$1,931,679,195	14	\$86,171,313	
Pelham (V)	2,199	\$623,395,480	158	\$1,581,987,360	6	\$75,477,375	
Pelham Manor (V)	2,094	\$750,918,832	71	\$349,691,835	8	\$10,693,938	
Pleasantville (V)	2,608	\$753,179,402	241	\$1,884,400,084	10	\$63,253,899	
Port Chester (V)	5,521	\$1,883,562,560	832	\$5,704,515,868	4	\$11,925,917	
Pound Ridge (T)	2,909	\$1,412,926,422	71	\$111,536,011	0	\$0	

## Table 4-4. Number of Buildings and Total Replacement Value by Occupancy Class



	Residential		C	ommercial	Industrial		
Municipality	Count	Total (Structure + Contents)	Coun t	Total (Structure + Contents)	Coun t	Total (Structure + Contents)	
Rye (C)	5,126	\$2,325,350,998	429	\$2,967,069,651	4	\$2,794,283	
Rye Brook (V)	3,479	\$1,582,329,531	91	\$2,925,014,679	0	\$0	
Scarsdale (T)	6,604	\$3,035,356,771	112	\$1,051,672,817	0	\$0	
Sleepy Hollow (V)	1,707	\$740,501,942	194	\$1,157,873,891	2	\$25,596,675	
Somers (T)	10,958	\$4,409,030,182	292	\$1,000,033,509	0	\$0	
Tarrytown (V)	2,584	\$1,045,934,401	345	\$5,198,963,984	2	\$3,983,718	
Tuckahoe (V)	1,519	\$538,960,127	108	\$897,363,532	12	\$51,852,090	
White Plains (C)	11,994	\$19,754,651,94 3	1,657	\$36,527,147,21 3	20	\$140,038,815	
Yonkers (C)	30,124	\$9,840,473,311	2,970	\$35,296,906,56 9	158	\$1,418,820,386	
Vorletown (T)	12,817	\$15,238,710,72	785	\$2,695,099,783	13	\$41,192,222	
Westchester County	241,60	\$121,226,274,0	20,85	\$228,398,206,2	1,057	\$6,087,587,282	
(Total)	5	41	7	52			

Source: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021

Notes: C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

The 2019 American Community Survey data identified that the majority of housing units (44 percent or 164,836 units) in Westchester County are single-family detached units. The 2019 U.S. Census Bureau's County Business Patterns data identified 31,580 business establishments employing 392,824 people in Westchester County. The professional, scientific, and technical services industry has the greatest number of establishments in the County, with 4,031 establishments. This is followed by the construction industry with 3,697 establishments and the retail industry with 3,591 establishments (US Census n.d.).

Figure 4-8 through Figure 4-10 show the distribution and exposure density of residential, commercial and industrial buildings in Westchester County based on the New York State Department of Taxation and Finance Property Class Code. Exposure density is the dollar value of structures per unit area, including building content value. Generally, contents for residential structures are valued at about 50 percent of the building's value. For commercial facilities, the value of the content is generally about equal to the building's structural value. Actual content value various widely depending on the usage of the structure. The densities are shown in units of \$1,000 (\$K) per square mile.

Viewing exposure distribution maps, such as Figure 4-9 through Figure 4-11 can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.



























# 4.4 Land Use and Population Trends

In New York State, land use regulatory authority is vested in towns, villages, and cities. However, many development and preservation issues transcend local political boundaries. DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use trends can also significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

This plan provides a general overview of population and land use and types of development occurring within the county. An understanding of these development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

# 4.4.1 Land Use Trends

A report prepared by the Westchester County Department of Planning titled Land Use in Westchester dated 2010, is a comprehensive resource for land use planners, policymakers, researchers, business communities, and residents. The report presents data and information on the present state of land use in Westchester County. Following is a summary of land use trends as presented in the report. For more information regarding land use trends Use Westchester found in the County. see Land in here: http://planning.westchestergov.com/images/stories/reports/LandUseReport1.pdf or visit the Westchester 2025 Web site at http://westchester2025.westchestergov.com/ (Westchester County Department of Planning 2010).

Over the past ten years, land use trends in Westchester County have had both positive and negative impacts on the county. New development and redevelopment have strengthened the county's municipal centers, as well as waterfront areas. Open space protection has preserved important natural resources and scenic features in the county as well. Major subdivisions, big box stores, and generic retail developments have been constructed on previously vacant lands and have changed the character of some Westchester County communities.

Eight major land trends over the past 14 years have been identified in the county. Their effect on the county's communities has been apparent in recent years. Some of these trends have had positive effects on a community's function and character, while others have had a more negative impact. Communities lacking the necessary zoning and land use regulations to avoid low-quality development were more negatively affected by these trends than those that planned comprehensively and produced zoning frameworks protective of community character and focused on efficient growth and development.

These eight trends are as follows:

- Redevelopment in central cities
- Development and redevelopment in small centers
- Riverfront redevelopment
- Preservation of open space
- Build-out of large subdivisions
- Growth of generic retail developments
- Development of big box stores
- Reuse of corporate campuses and office parks

The cities of White Plains, New Rochelle, and Yonkers are three of the largest cities in Westchester County. The downtown areas of these cities benefited from the real estate and construction boom that occurred between 1995 and the early 2000s. The urban environments and transit accessibility of these three cities made them





particularly attractive to commuters and residents desiring an urban lifestyle without the costs associated with living in New York City.

Many of the County's smaller municipalities are rediscovering historic strengths as convenient and walkable community centers near transit. The central business districts of communities, such as Tuckahoe, Pelham, and Scarsdale, have seen infill development on under-utilized or vacant properties and adaptive reuse of former industrial and commercial buildings. These communities have increased their mix of uses, from residential apartments to offices, stores, and restaurants.

The communities along the Hudson River have encouraged the construction of industrial and commercial buildings along large portions of the waterfront during the 19<sup>th</sup> and early 20<sup>th</sup> centuries. As the region's economy shifted from manufacturing and transportation shifted to cars and trucks, the need for large industrial sites and shipping of goods was reduced. This left many of the old waterfront industrial buildings empty, leaving many communities large underutilized buildings and polluted sites along the waterfront. Many communities have recognized the economic, environmental, and aesthetic value of their waterfront areas and been involved in finding new uses for these properties.

Westchester County has a history of preserving open space for its environmental, scenic, and recreational quality. Since the late 1990s, the County has worked to fund and acquire over 1,900 acres of open space (Westchester County Department of Planning 2010). This includes privately-held open spaces. Westchester County has over 51,000 acres of open space, occupying 18% of the total land area. Some of the areas include: Taxter Ridge Park Preserve in the Town of Greenburgh (199 acre site), Leon Levy Preserve in the Town of Lewisboro (383 acre site), and Angle Fly Preserve in the Town of Somers (654 acre site).

The growth of the County's suburbs occurred after World War II in single-family subdivisions. By the end of the 20<sup>th</sup> century, the area of single-family subdivision development moved north of Westchester County as land available for large subdivisions became scarcer. Developers in the County realized that they must turn to other means to continue to build housing and to do business in the County. In the 1990s, the County started experiencing a trend toward tearing down old homes and replacing with new, larger residences. Today, many municipalities have passed ordinances banning the teardown practice, and others have used site layout and design regulations to make certain that new homes positively impact neighborhood character.

Westchester County communities have experienced a large growth in the number of generic commercial developments, especially banks, retail pharmacies, and convenience stores. The presence of these businesses provides convenient access to import services; however, the rapid increase in the number of chain businesses has garnered community opposition in many places since these businesses hurt small, local ones that provide the same services.

Big box stores are large chain retail businesses that provide a variety of goods and services. With the convenience of these stores, many smaller, independent businesses that have less diverse product offerings have been replaced. The development of the big box stores requires large tracts of land, but the presence of available land for commercial development in the County has been limited by commercial areas that are more restricted and confined than in many other areas. In order to develop in Westchester County, many big box stores have readapted previously developed commercial sites or have changed their standard architectural and site design approaches.

Many corporate office parks and corporate campuses are found in Westchester County. Corporate campuses are large tracts of land owned and occupied by single corporate tenants and which often include substantial reservations of open space and park-like landscape design. Office parks typically include one or more buildings, sometimes with multiple tenants, on large landscaped properties. Today, the region's economy has shifted





toward smaller firms, reducing the demand for these facilities; thus, creating redevelopment challenges to corporate campuses and office parks. Many of these office areas were approved with the understanding that large areas of their sites would be maintained or protected as permanent open space. Identifying the best opportunities for reusing corporate campuses and office parks will ensure that communities have a vision in place should these businesses relocate and require reuse of the properties.

# 4.4.2 Population Trends

This section discusses population trends to use as a basis for estimating future changes of the population and significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

According to the U.S. Census Bureau Westchester County's 2019 5-year estimated population was reported to be 968,065, which is 2-percent increase from the 2010 population of 949,113 persons. From 1900 to 1970, the County experienced a constant growth. The only decrease in population was seen between 1970 and 1980, when the County had a 3.1% decrease in population. The largest increase was seen between 1900 and 1910 when the population of the County grew by 53.6 percent (98,798 persons). The smallest increase was seen between 1980 and 1990 when the County only had a 1 percent increase in population (8,267 persons). Table 4-5 displays the population and change in population from 1900 to 2013 in Westchester County.

Year	Population	Change in Population	Percent (%) Population Change
1900	184,257	N/A	N/A
1910	283,055	98,798	53.6
1920	344,436	61,381	21.7
1930	520,947	176,511	51.2
1940	573,558	52,611	10.1
1950	625,816	52,258	9.1
1960	808,891	183,075	29.3
1970	894,104	85,213	10.5
1980	866,599	-27,505	-3.1
1990	874,866	8,267	1.0
2000	923,459	48,593	5.6
2010	949,113	25,654	2.8
2019	968,065	18,949	2.0

## Table 4-5. Westchester County Population Trends, 1900 to 2020

Source: U.S. Census Bureau, 2010, 2021

Note: Change in population and percent in population change was calculated from available data

Over the next 25 years, from 2020 to 2030, Westchester County has a projected population growth of 1% percent, and a 0.4% decline between 2030 and 2040. Based on projections from the Cornell University Program on Applied Demographics, the County population is expected to reach 970,773 by 2030 and 967,355 by 2040 (Table 4-6 (Cornell University 2017).





Year	Projected Population	Change in Population	Percent (%) Population Change
2020*	1,004,457	55,344	5.5
2025	967,407	6,381	0.66
2030	970,773	3,366	0.35
2035	970,393	-380	-0.04
2040	967,355	-3,038	-0.31

#### Table 4-6. Westchester County Population Projections, 2025 to 2040

Source:

: U.S. Census 2020; Cornell University 2017

\* Actual population from 2020 Census

## 4.4.3 Future Growth and Development

An understanding of population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use and development trends significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard (FEMA 2004).

Local zoning and planning authority is provided for under the New York State General Municipal Law, which gives municipalities zoning and planning authority. Refer to Sections 6 and 9 for further details on the planning and regulatory capabilities for the County and each municipality.

New development that has occurred in the last five years within the County, and potential future development in the next five years as identified by the county and each municipality, is included in the jurisdictional annexes in Section 9, along with an indication of proximity to known hazard zones. Recent, ongoing, and known/anticipated future development identified by the municipalities has been cross-checked and augmented with a county-level development inventory (2021) provided by the Westchester County Department of Planning, illustrated in Figure 4-13. The county-level inventory includes major development projects referred to the County as part of the mandatory site plan review referral process and does not include all development in the County.











# 4.5 LIFELINES AND CRITICAL FACILITIES

Critical infrastructure and facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. Critical facilities are those that maintain essential and emergency functions and are typically defined to include police and fire stations, schools, and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, electricity, and communication services to the community. Also included are Tier II facilities (hazardous materials) and rail yards; rail lines hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event (FEMA 1997).

*Critical Facilities* are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities, and essential facilities

*Essential facilities* are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the county risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

*Lifelines* enable the continuous operation of critical business and government functions and are essential to human health and safety or economic security.

Beginning in 2017, FEMA developed a new construct to increase effectiveness for disaster operations and position response to catastrophic incidents. This construct, known as "community lifelines", represents the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into seven categories which include:

- Safety and Security
- Food, Water, Shelter
- Health and Medical
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

To facilitate consistency with the National Response Framework, FEMA Strategic Plan, and guidance for the Building Resilient Infrastructure and Communities grant program, critical facilities in Westchester County are discussed in terms of lifelines.

A comprehensive inventory of critical facilities and lifelines in Westchester County was developed from various sources including input from the Planning Committees. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the HMP and was used for the risk assessment in Section 5 (Risk Assessment). Figure 4-14 shows the location of Westchester County lifelines and critical facilities.

# 4.5.1 Safety and Security

This section provides information on Safety and Security lifelines. Components of this lifeline category include law enforcement/security, fire services, search and rescue services, government services, and community safety (e.g. dams) (Figure 4-14).







Westchester gov.com





## **Emergency Facilities**

The Westchester County Department of Emergency Services is composed of five separate divisions, the Emergency Communications Division, the Fire Services Coordination-Training Division, the Emergency Medical Services Coordination-Training Division, and the Office of Emergency Management. The Department is responsible for aiding communities in emergency planning and response, as well as providing the training and equipment for the County's first responders and volunteers. Additionally, the Department operates a mission-critical radio systems that presently serve the Department of Emergency Services, Department of Public Safety, and Department of Public Works and Transportation that is intended to provided emergency guidance in times of need.

Almost all of the County's municipalities are serviced by their own fire department, with the exception of Rye Brook, which is primarily serviced by departments located in Port Chester. Police enforcement and public safety is maintained by the New York State Police Department, Westchester County Police and local departments. There are 259 fire stations, 39 EMS facilities, six Emergency Communications Centers, and Office of Emergency Management (Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021).

#### Military

There is one military installation, Camp Smith in the Town of Cortlandt.

#### Schools

There are 205 primary educational facilities (elementary and middle school), 52 secondary educational establishments (high schools), and 71 post-secondary educational establishments (colleges and universities) located in Westchester County. In times of need, schools can function as shelters and are an important resource to the community. For information regarding shelters, see the Shelters subsection of this document.

#### **Dams and Levees**

According to the NYSDEC Division of Water Bureau and Flood Protection and Dam Safety, there are three hazard classifications of dams in New York State (NYSDEC n.d.). The dams are classified in terms of potential for downstream damage if the dam were to fail. The hazard classifications are as follows:

*Low Hazard (Class A)* is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property

*Intermediate Hazard (Class B)* is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

*High Hazard (Class C)* is a dam located in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure.



According to the U.S. Army Corps of Engineers National Inventory of Dams (NID), there are 90 dams located within Westchester County which indicate 34 high hazard, 43 significant hazard and 13 low hazard dams. According to NYSDEC however, there are additional dams that are not listed in the ACOE. According to the GIS data, there are 223 dams located in Westchester County (128 Class A, 42 Class B, 35 Class C, eight Class D and 11 unclassified). Refer to Appendix G for the names and locations of the dams found in the County.

# 4.5.2 Food, Water, and Shelter Lifelines

Food, Water, and Shelter lifelines include facilities pertaining to food supply (distribution facilities, programs, and supply chain), water supply (including both potable and wastewater systems), shelter (housing and hotels), and agricultural facilities (Figure 4-15).













### **Potable Water**

In Westchester County, water is provided from various facilities as a public service or through private supplies, such as wells (Westchester County 2009). Community water suppliers serve 94 percent of the county's land area while the remaining area of the county is served by on-site wells. Municipal suppliers are the local governments which have service areas corresponding to the boundaries of the municipality.

The principal water source for both municipal and private suppliers is the New York City water supply system which serves approximately 85 percent of the county's total population. Details regarding the New York City reservoir and aqueduct system are described earlier in this section.

There are two inter-municipal water suppliers, the Westchester Joint Water Works (WJWW) and the Northern Westchester Joint Water Works (NWJWW), established under inter-municipal agreements. The WJWW serves the Town of Mamaroneck, the villages of Mamaroneck and Larchmont, and portions of Harrison and the City of Rye. The NWJWW serves the towns of Yorktown and Cortlandt and the Montrose Improvement District. Private suppliers vary greatly in size, from homeowner associations serving a small area to the larger private water companies serving several municipalities.

Four County water districts, each covering several municipalities or portions thereof, have been established to distribute water and/or to provide benefits (treatment, maintenances, or administration of the water supply).

- 1. County Water District (CWD) 1 serves the cities of White Plains, Yonkers, Mount Vernon, and the Village of Scarsdale
- 2. CWD 2 serves portions of the towns of Yorktown, Cortlandt, and Somers
- 3. CWD 3 serves the Westchester Medical Center
- 4. CWD 4 serves the City of Rye, and the villages of Rye Brook and Port Chester, which are currently serviced by United Water of New Rochelle

There are 194 potable water treatment facilities, 148 potable water tanks, 384 potable wells, and 58 potable pumps in Westchester County.

#### **Wastewater Facilities**

Municipal wastewater collection systems connect with Westchester County trunk sewers which serve 13 separate sewer districts. However, not all areas within districts are served by public sewers. The southern and central portions of Westchester County are served by the County's seven wastewater treatment plants: Blind Brook, Mamaroneck, Port Chester, and New Rochelle plants on the Long Island Sound shore and Yonkers, Ossining, and Peekskill plants on the Hudson River shore. These plants are located where 90 percent of the County's population resides. The plants are fed by 194 miles of trunk sewers and 40 pump stations.

Most areas in northern Westchester County are dependent on subsurface sewage disposal systems (septic systems) located on each lot or are served by a few locally-based central sewage collection and treatment districts. By land area, approximately one-third of the county is dependent on septic systems. Most of this land is located within the Croton watershed which encompasses five reservoirs that are part of the New York City water supply systems (discussed earlier in this profile). There are also 28 privately and municipally-owned wastewater collection, treatment and disposal systems located in the Croton watershed. These facilities discharge four million gallons of treated effluent daily. There is one wastewater tank, two wastewater wet wells, 21 wastewater lift stations, 134 wastewater pump stations, and 101 wastewater treatment facilities located in the County.





## Shelters

With support and cooperation of the American Red Cross and local jurisdictions, the County references an inventory of suitable shelter locations and can assist with the coordination and communication of shelter availability as necessitated by the execution of local municipal emergency operation plans. There are 21 shelter facilities in the County. County-wide sheltering policies and procedures are documented in the following plans:

- Westchester County Comprehensive Emergency Management Plan, Coastal Storm Emergency Response Annex (Evacuation Centers/Shelters) June, 2009
- Westchester County Comprehensive Emergency Management Plan, Hazardous Materials Emergency Response Annex (In-Place Sheltering/Evacuation) September, 2014
- Westchester County Radiological Emergency Response Plan (Reception/Congregate Care Centers) August, 2014

## Temporary Housing

During the planning process, each municipality was asked to identify potential locations for temporary housing in the event of an emergency. The locations identified by the municipalities are documented in Section 9 (Jurisdictional Annexes). Communities discussed and documented a wide range of temporary housing locations. Those that could identify temporary housing locations agreed that those areas should be located well outside of high hazard areas, namely outside mapped Special Flood Hazard Areas. Several of the Villages had very little safe, vacant land outside of these areas, and as such would need to coordinate with the surrounding Town for a good location for temporary housing. Westchester County has a wide variety of options that would vary based on the situation and need. Communities discussed a range of locations for potential temporary housing. While a range of safe locations were identified by municipalities in the annexes in Section 9, they would certainly need to be further investigated and formalized in a given hazard situation.

As evidenced by the recent flood emergency, and regarding the use of vacant rental properties, the County recognizes challenges in successfully transitioning the remaining residents, primarily renters, displaced by the storm are significant, including:

- Uncertainty of their landlords' ability to repair and provide safe and affordable units in the short-term;
- An overall shortage of affordable and appropriate housing for both individuals and families in Westchester; and,
- Limited income and resources of remaining residents to secure affordable permanent housing.

As a result, the County is actively utilizing the following resources and supports to assist in transitioning these residents:

- Westchester County Department of Social Services has met with residents to assess status, gather information regarding their housing situation, document income and resources and obtain applications for other DSS administered assistance including Medicaid, SNAP, and other temporary assistance through a dedicated Department of Social Services staff member;
- The County has encouraged residents to apply for and continue pursuing FEMA IA and any other related benefits to assist in their successful transition;
- The County has contracted with a community nonprofit, to assist with identifying and providing affordable housing options to residents. This partnership has resulted in opportunities to seek longer term affordable housing units at a nearby College (pending);
- The County has provided guarantee letters to use a broker in locating another apartment, as well as moving packets in order to guarantee moving costs;



• When necessary, it assists individuals and families in transitioning into permanent housing.

## Long-Term Housing

A buildable block analysis was conducted to support identification of potential sites suitable for relocating houses out of hazard areas (i.e., the floodplain) or building new homes in the event structures are destroyed by a natural hazard event. The analysis identified potential areas for post-disaster development in accordance with the 2017 NYS DHSES Hazard Mitigation Planning Standards Guide requirement "to identify long-term housing options for relocating displaced residents to maintain post-disaster social and economic stability". The analysis provides an indication of vacant land suitable for development. In this case, vacant land is defined as a block that is classified as vacant and is located outside the following hazard areas:

- 1. FEMA floodplain (1- and 0.2-percent annual chance flood)
- 2. Wetlands (National Wetlands Inventory; National Land Cover Database)
- 3. Land that has steep slopes (>15% gradient) without consideration of ownership or availability

Figure 4-17 provides potential long-term housing locations in Westchester County. Developable land displayed on the figure represents the portion of each identified vacant block with greater than 50 percent of their land area outside the three above hazard areas.













## **Evacuation Routes**

The County has identified evacuation zones for hurricanes, maintains specific evacuation plans for radiological emergencies associated with the recently closed Indian Point Energy Center, and can assist with the coordination and communication of evacuation routing as necessitated by the execution of local municipal emergency operation plans.

Hurricane Emergency Evacuation Zones are identified at: http://giswww.westchestergov.com/gismap/default.aspx?ovmap=hurricane

Specific evacuation routes are identified in the Westchester County Radiological Emergency Response Plan – August, 2014

Westchester County Evacuation Bus Routes are also posted for residents who lack their own transportation, and can be found at: https://emergencyservices.westchestergov.com/images/stories/pdfs/2021ipeg.pdf

The County has identified a number of mitigation actions within their County annex (Section 9.1) that will improve county-wide emergency management capabilities, including evacuation and sheltering, as follows:

- 2021-Westchester County-003: County-Wide Evacuation Route and Sheltering Plan Initiative
- 2021-Westchester County-004: County-Wide Disaster Housing Location/Relocation Planning Initiative
- 2021-Westchester County-005: Develop Comprehensive County-Wide Critical Facility Database

# 4.5.3 Health and Medical Lifelines

Health and medical lifelines include facilities pertaining to medical care, patient transportation, public health, fatality management, and medical chain supply (Figure 4-18).











## **Hospitals and Medical Facilities**

The County also has multiple hospitals and health care facilities; these facilities range in size and primary function that include smaller psychiatric and children's hospitals and the larger, regional Westchester Medical Center. There are 68 healthcare facilities in the County.

## **Senior Care and Living Facilities**

The County has an extensive system of programs and services for the senior population. This includes 44 nursing homes and seven senior centers. These facilities are highly vulnerable to potential impacts from disasters, and knowing the location and numbers of these types of facilities will be effective in managing a response plan preand post-disaster.

# 4.5.4 Energy (Power and Fuel) Lifelines

Energy lifelines include facilities and infrastructure relating to the power grid and fuel (Figure 4-19). Due to heightened security concerns, local utility lifeline data sufficient to complete the analysis have only partially been obtained. Westchester County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular provided by multiple companies, such as Verizon, Direct TV, and Cablevision and Optimum Online. There is one communication facility in Westchester County identified as a critical facility. Each carrier has individual plans for emergency situations during hazard events and post disaster recovery efforts. In addition to land line, fiber optic and cellular communications systems, Westchester County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation and other supporting organizations.





### Figure 4-17. Energy Facilities in Westchester County





## **Energy Resources**

Power in Westchester County is transmitted and distributed by two companies: Consolidated Edison Company of New York (Con Ed) and New York State Electric and Gas (NYSEG) (Sustainable Westchester n.d.). Homes in the county are heated by many different sources, with a majority using utility gas or fuel oil. There are 24 electric power facilities, 11 energy facilities, and 19 electric substations in Westchester County.

## **Nuclear Power**

There is one nuclear power plant, Indian Point located in the Village of Buchanan, which closed as of April 2021.

## 4.5.5 Communication Lifelines

Communication lifelines include communication infrastructure; alerts, warnings, and message systems; 911 and dispatch; responder communications; and finance (Figure 4-20).













#### Communications

Westchester County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular provided by multiple companies, such as Verizon, Direct TV, and Cablevision and Optimum Online. There is one communication facility in Westchester County identified as a critical facility. Each carrier has individual plans for emergency situations during hazard events and post disaster recovery efforts. In addition to land line, fiber optic and cellular communications systems, Westchester County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation and other supporting organizations.

# 4.5.6 Transportation Lifelines

Transportation lifelines include highways, roadways, mass transit, railway, aviation, and maritime. Westchester County's location and extensive transportation network offer residents and employees various options for transportation throughout the County and the region. The County's location within the New York City metropolitan region is one of its most important assets. Westchester County's transportation system includes an extensive network of roads, access to national and commuter rail, countywide bus service, an airport providing domestic services, regional ferry service, and a pedestrian and bicycle network. Figure 4-21 shows the regional transportation systems found in Westchester County.

The County has over 3,200 miles of public roadways. County roads total 154 miles and State road make up approximately 760 miles of Westchester County's road network. Interstate (I)-95 is the east coast's major interstate highway. It is known as the New England Thruway in New York State and runs through southern Westchester County parallel to the Long Island Sound and gives residents and commuters access to New York City and New England. I-87 (New York State Thruway) runs north-south on the western side of the County and links Westchester with New York City and upstate New York and Canada. The Cross Westchester Expressway, I-287, runs east-west across the center of the County and connects I-87, the Tappan Zee Bridge, and I-95. It also passes through the City of White Plains. I-684 runs north from White Plains into Putnam County through the central and northern suburbs and provides a connection to I-84.

In addition to the major interstates found in Westchester County, there is a network of six scenic parkways that facilitate travel within the County and beyond. These parkways include the following: Bronx River, Hutchinson River, Cross County, Saw Mill River, Taconic State, and the Sprain Brook (Westchester County Department of Planning 2010).

Residents of Westchester County have the highest rate of public transportation usage for commuting to work among all suburban counties in the New York City metropolitan area. Over 20 percent of County resident workers use railroad, subway or bus travel to work. Metro-North Railroad riders are a large portion of the public transportation users, with over 55,000 County residents reporting travel via railroad as their primary mode of transportation to work. The different modes of transportation provided in the County are discussed below (Westchester County n.d.).













## **Bus and Other Transit Facilities**

Numerous bus services are available in Westchester County. The Bee-Line System is run by the County's Department of Public Works and Transportation and provides an extensive network of local, express, and railroad feeder bus services to customers throughout the county. It is one of the 40 largest bus systems in North America. The Bee-Line operates between Westchester County and Manhattan, the Bronx and Putnam County with 89 routes in the system (Westchester County n.d.). The Bee-Line also provides express routes for White Plains, an express service to Manhattan and an Airlink service between White Plains and the Westchester County Airport. Many of the System's routes are designed to provide connecting service to Metro-North trains, New York City transit bus and subway lines, and other transit systems. In addition to the Bee-Line system, other bus services are available between Westchester and surrounding areas. There are 47 bus facilities, two transportation facilities, and 55 bridges located in Westchester County, including: Transportation of Rockland, I-Bus Transit (CT), The Leprechaun Connection, Orange-Westchester Line, Putnam Area Rapid Transit, and Greyhound and Trailways.

#### **Railroad Facilities**

There are two types of rail systems in Westchester County: interstate rail and commuter rail. Amtrak connects three stations in Westchester County with points throughout the national rail system. The New Rochelle station is located along Amtrak's Northeast Corridor and provides regional service to Boston, Springfield, New York City, and Washington D.C. The Croton-Harmon and Yonkers stations are served daily by five Amtrak lines: the Lakeshore Limited, the Adirondack, the Ethan Allen Express, the Maple Leaf, and Empire Service. Connecting rail service is available to many other points throughout the U.S. and Canada (Westchester County n.d.).

The Metropolitan Transportation Authority (MTA) Metro-North Railroad (Metro-North) provides commuter rail service to 44 stations and to 75 percent of all communities in Westchester County. Three branches, the Hudson, Harlem, and New Haven Lines, connect County communities to New York City's Grand Central Terminal. The Hudson Lines serves the portion of Westchester County along the Hudson River. The Harlem Line serves the central part of the County and the New Haven Line serves areas along Long Island Sound. There is one rail facility and 45 train stations located in Westchester County.

#### Airports

The Westchester County Airport is located five miles northeast of the City of White Plains' downtown area. This central location serves as the gateway to Westchester County and puts in close proximity to one of the largest concentrations of company headquarters in the U.S. It has been cited that the Airport's accessibility and its ability to accommodate both corporate and commercial aircraft are benefits to many businesses in the County. Additionally, New York-Kennedy, New York-LaGuardia, Newark-Liberty, Hartford-Bradley, and Newburgh-Stewart Airports are within 100 miles of most points in Westchester County. The Westchester County Airport handles all types of aircraft ranging from single engine aircraft to large corporate jets and commercial airliners.

#### **Ferry Service and Ports**

Passenger ferries connecting Westchester County locations with Rockland County and New York City are available for commuters, residents, and visitors. The major ferry service providers include: NY Waterway and New York Water Taxi with the ferry terminal located in the Village of Ossining. There are 37 port facilities, 64 marinas and two ferry facilities in Westchester County (MTA 2020).





# 4.5.7 Hazardous Material Lifelines

Hazardous material (HAZMAT) lifelines include HAZMAT facilities; and HAZMAT, pollutants, and contaminants (Figure 4-22).

A Superfund site consists of land in the United States that has been contaminated by hazardous waste and identified by the U.S. Environmental Protection Agency (EPA) as a candidate for cleanup because it poses a risk to human health and/or the environment. These sites are placed on the National Priorities List (NPL). The NPL is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

Abandoned hazardous waste sites placed on the federal NPL include those that the EPA has determined present "a significant risk to human health or the environment," with the sites being eligible for remediation under the Superfund Trust Fund Program. As of November 2021, Westchester County has two hazardous sites in the federal Superfund Program that are listed on the NPL (CERCLIS 2021).

Superfund sites are contaminated locations requiring a long-term response to clean up hazardous materials; NPL sites are included. The EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (Superfund) Public Access Database (CPAD) reports that there are currently 21 archived Superfund sites located in Westchester County (CERCLIS 2021). An archived Superfund site is one that has no further interest under the federal Superfund Program based on available information and is no longer part of the CERCLIS inventory but can be found on the Superfund Enterprise Management System database in EPA's Envirofacts webtool.

In addition to the hazardous waste sites, there are approximately 109 active hazardous facilities in Westchester County cataloged by the NYSDEC's Bulk Storage Program Database. The Bulk Storage Program includes three types of facilities: Petroleum Bulk Storage (PBS), Major Oil Storage Facilities (MOSF), and Chemical Bulk Storage (CBS). Registration with NYSDEC is mandatory for all PBS facilities with a total storage capacity of 1,100 gallons or more; all CBS underground tanks and all stationary aboveground tanks with a capacity of 185 gallons or more; and all MOSF sites storing more than 400,000 gallons of petroleum products (NYSDEC 2021).

The Environmental Protection Agency (EPA) identifies 61 facilities under the Toxic Release Inventory (TRI). These facilities are required to annually report how much of each chemical is recycled, combusted for energy recovery, treated for destruction, and disposed of or otherwise released on and off site (EPA 2021).












## 4.5.8 Additional Facilities

The Planning Partnership has also identified additional facilities (user-defined facilities) as critical facilities. Some of these facilities fall under categories previously defined above as well as under other critical categories. These facilities were included in the risk assessment conducted for the County. Figure 4-23 shows the locations and types of these facilities in the County.











# 5.1 Methodology and Tools

A risk assessment is the process of measuring the potential loss of life, personal injury, and economic and property damage resulting from identified hazards. Identifying potential hazards and vulnerable assets allows planning personnel to address and reduce hazard impacts and emergency management personnel to establish early response priorities. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions that reduce each jurisdiction's risk to a specified hazard. Past, present, and future conditions must be evaluated to assess risk most accurately for the county and each jurisdiction. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction.
- Profile each hazard—Understand each hazard in terms of:
  - Extent—Severity of each hazard.
  - Location—Geographic area most affected by the hazard.
  - Previous occurrences and losses
- Assess Vulnerability
  - Exposure identification—Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
  - Vulnerability identification and loss estimation—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.
  - Future changes that may impact vulnerability—Analyze how demographic changes, projected development and climate change impacts can alter current exposure and vulnerability.

The Westchester County risk assessment was updated using best available information.

- An updated building stock inventory was created using Westchester County's 2020 building footprint data using 2021 RS Means values and supplemented with 2021 NYS Tax assessor data.
- 2015-2019 American Community Survey 5-year Population Estimates were utilized.
- A critical facility was generated and reviewed by the Planning Partnership and County jurisdictions.
- Lifelines were identified in the critical facility inventory to align with FEMA's lifeline definition.
- Hazus was used to estimate potential impacts to the flood, wind, and seismic hazards.
- Best available hazard data was used as described in this section.

The following summarizes the asset inventories, methodology and tools used to support the risk assessment process.



## 5.1.1 Asset Inventories

Westchester County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Westchester County assessed exposure and vulnerability of the following types of assets: population, buildings and critical facilities/infrastructure, new development, and the environment. Some assets may be more vulnerable of their physical characteristics because or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

## Population

Total population statistics from the 2015-2019 American Community Survey (ACS) 5-year estimate were used to estimate the exposure and potential impacts to the County's population in place of the 2010 U.S. Census block estimates. To determine population statistics for village and towns, the population of villages was





subtracted from the total town population. Please note two distinct population features for this updated HMP:

- 1. Any results reported for the Town of Pelham are the aggregate of results for the Village of Pelham and the Village of Pelham Manor.
- 2. Furthermore, population statistics for the 5-year ACS estimates indicated an excess of 825 persons not accounted for in the villages within the Town of Rye. These 825 persons were not distributed throughout the villages that are contained by the Town of Rye to maintain the accuracy of the reported statistical population of the Town of Rye's associated villages; thus, 825 persons are not considered in the general population exposure analysis for this updated HMP.

Population counts at the jurisdictional level were averaged among the residential structures in the County to estimate the population at the structure level. This estimate is a more precise distribution of population across the County compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

As discussed in Section 4 (County Profile), research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in Westchester County included in the risk assessment are children, elderly, population below the poverty level, limited English speaking individuals, and persons non-institutionalized with a disability.

## Buildings

The building stock inventory developed for the 2021 HMP was updated using Westchester County's 2020 building footprint data, 2021 RS Means values, and supplemented with 2021 NYS Tax assessor data. The occupancy classes available in Hazus were condensed into the following categories (residential, commercial, industrial, agricultural, religious, governmental, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single-family dwellings. Replacement cost value (RCV) is the current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials. Total replacement cost value consists of both the structural cost to replace a building and



the estimate value of contents of a building. Structural and content RCV were calculated for each building utilizing RS Means 2021 values. A regional location factor for Westchester County was applied based on the individual building stock's zip code location:

- 104: Residential 1.32/Non-Residential 1.28
- 105: Residential 1.14/Non-Residential 1.17
- 106: Residential 1.2/Non-Residential 1.19
- 107: Residential 1.21/Non-Residential 1.21
- 108: Residential 1.17/Non-Residential 1.15

### **Critical Facilities and Lifelines**

The 2015 HMP critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities was updated by the Planning Partnership and County jurisdictions. The update involved a review for accuracy, additions or deletions of new/moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition; refer to Appendix E (Risk Assessment Supplement). To protect individual privacy and

A lifeline provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security (FEMA).

the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

### **Environment and Land Use Area**

National land use land cover data created by the U.S. Geological Survey (USGS) in 2016 was used to assess land use characteristics of the County. This dataset was converted from a raster to a vector polygon, which informed spatial areas of agriculture, barren land, forested land, urban areas, water, and wetlands.

### **New Development**

In addition to assessing the vulnerability of the built environment, Westchester County examined recent development over the last 5 years and anticipated new development in the next 5 years. Each jurisdiction was asked to provide a list by parcel ID or address of major development that has taken place within these timeframes.

New development was identified as 1) anticipated in the next five years and 2) recently developed over the last five years. An exposure analysis was conducted in Geographic Information System (GIS) to determine hazard exposure to these development sites. Projects built on multiple parcels were assessed as one unit. If one parcel identified within the project boundary intersected a spatial hazard layer, the entire project was considered 'exposed' to the hazard area of concern.

Identifying these changes and integrating new development into the risk assessment provides communities information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future (one tool in the Mitigation Toolbox discussed in Section 6 – Mitigation Strategy). The new development is mapped in Section 4 (County Profile) and hazard exposure analysis results are presented in Section 9 (Jurisdictional Annexes) as a table in each annex.

## 5.1.2 Methodology

To address the requirements of the DMA 2000 and to better understand potential vulnerability and losses associated with hazards of concern, Westchester County used standardized tools, combined with local, state, and



federal data and expertise to conduct the risk assessment. Three different levels of analysis were used depending upon the data available for each hazard as described below. Table 5.1-1 summarizes the type of analysis conducted by hazard of concern.

- 1. **Historic Occurrences and Qualitative Analysis** This analysis includes an examination of historic impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using best available data and professional judgement.
- 2. **Exposure Assessment** This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets are located in the hazard area and may incur future impacts.
- 3. Loss estimation The FEMA Hazus modeling software was used to estimate potential losses for the following hazards: flood, earthquake, hurricane. In addition, an examination of historic impacts and an exposure assessment was conducted for these spatially-delineated hazards.

Hazard	Population	General Building Stock	Critical Facilities	New Development
Disease Outbreak	Q	Q	Q	Q
Earthquake	E, H	E, H	E, H	Е
Extreme Temperature	Q	Q	Q	Q
Flood	E, H	E, H	E, H	Е
Severe Storm	Н	Н	Н	Q
Severe Winter Storm	Q	Q	Q	Q
Wildfire	E	E	Е	E
CBRN	Q	Q	Q	Q

### Table 5.1-1. Summary of Risk Assessment Analyses

E – Exposure analysis; H – Hazus analysis; Q – Qualitative analysis

## Hazards U.S. - Multi-Hazard (Hazus)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or Hazus. Hazus was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. Hazus was expanded into a multi-hazard methodology, Hazus with new models for estimating potential losses from wind (hurricanes) and flood (riverine) hazards. Hazus is a GIS-based software tool that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

Hazus uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, Hazus uses default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. More information on Hazus is available at <a href="http://www.fema.gov/hazus">http://www.fema.gov/hazus</a>.



In general, modeled losses were estimated in the program using depth grids for the flood analysis and probabilistic analyses were performed to develop expected/estimated distribution of losses (mean return period losses) for hurricane wind and seismic hazards. The probabilistic model generates estimated damages and losses for specified return periods (e.g., 100- and 500-year). Table 5.1-2 displays the various levels of analyses that can be conducted using the Hazus software.

	Hazus Analysis Levels				
Level 1	Hazus provides hazard and inventory data with minimal outside data collection or				
	mapping.				
Level 2	Analysis involves augmenting the Hazus provided hazard and inventory data with more				
	recent or detailed data for the study region, referred to as "local data"				
Level 3	Analysis involves adjusting the built-in loss estimation models used for the hazard loss				
	analyses. This Level is typical done in conjunction with the use of local data.				

Table 5.1-2. Summary of Hazus Analysis Levels

## Disease Outbreak

Disease outbreak is a new hazard of concern for the Westchester County HMP. All of Westchester County is exposed to disease outbreak events. A qualitative assessment was conducted. Research from the Centers for Disease Control and Prevention was utilized to qualitatively assess the most recent COVID-19 outbreak.

## Earthquake

Probabilistic assessment was conducted for Westchester County for the 500-year and 2,500-year mean return periods (MRPs) through a Level 2 analysis in Hazus v5.0 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations, and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

As noted in the Hazus Earthquake User Manual, "Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance." (FEMA 2020). However, Hazus' potential loss estimates are acceptable for the purposes of this HMP.

Ground shaking is the primary cause of earthquake damage to man-made structures and soft soils amplify ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake.

An exposure analysis was conducted for the County's assets (population, building stock, critical facilities, and new development) using NEHRP soil data provided by New York State and the national landslide susceptibility data where landslide susceptibility was listed as high susceptibility. The exposure analysis focused on soil types



that would experience amplified ground motion during an earthquake (i.e., Class D and E). Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to these soil types.

Data from New York State was used in Hazus to replace default NEHRP soils. Groundwater was set at a depth of five (5) feet (default setting). The default assumption is a magnitude 7.0 earthquake for all return periods. Although damages are estimated at the census tract level, results were presented at the municipal level. Since there are multiple census tracts that contain more than one jurisdiction, an area analysis was used to extract the percent of each tract that falls within individual jurisdictions. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boils, etc.

## **Extreme Temperatures**

All of Westchester County is exposed to extreme temperature events. A qualitative assessment was conducted for the extreme temperatures hazard. Information from the National Weather Service (NWS), Centers for Disease Control and Prevention, stakeholder plans/reports, the 2019 New York City Hazard Mitigation Plan, and the Planning Partnership were used to assess the potential impacts to the County's assets.

## Flood

The 1- and 0.2-percent annual chance flood events were examined to evaluate the County's risk from the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as NFIP.

The following data was used to evaluate exposure and determine potential future losses for this plan update:

- The Westchester County FEMA Digital Flood Insurance Rate Map (DFIRM) dated September 28, 2007.
- The depth grid developed for the 2014 Westchester County HMP using data from the State of New York's 2-meter Resolution Digital Elevation Model, and the coastal flood depth grid modeled by FEMA in January 2015 for the County.

The effective Westchester County FEMA DFIRM published in 2007 was used to evaluate exposure and determine potential future losses. The depth grid generated for the 2014 HMP was integrated into the Hazus riverine flood model used to estimate potential losses for the 1-percent annual chance flood event.

To estimate exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development). Centroids that intersected the flood boundaries were totaled to estimate the building replacement cost value and population vulnerable to the flood inundation areas. A Level 2 Hazus riverine flood analysis was performed in Hazus v5.0. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in Westchester County for the 1-percent annual chance flood events. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2010 U.S. Census data across dasymetric blocks), potential damages to the general building stock, and potential damages to critical



facility inventories based on the depth grids generated and the default Hazus damage functions in the flood model.

#### **Severe Storm**

A Hazus probabilistic analysis was performed in Hazus v5.0 to analyze the wind hazard losses for Westchester County for the 100- and 500-year MRP events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Westchester County. Hazus contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damages are estimated at the census tract level, results were presented at the municipal level. Since there are multiple census tracts that contain more than one jurisdiction, a density analysis was used to extract the percent of building structures that fall within each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

#### **Severe Winter Storm**

All of Westchester County is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A percentage of the custom-building stock structural replacement cost value was utilized to estimate damages that could result from winter storm conditions (i.e., 1-percent, 5-percent, and 10-percent of total replacement cost value). Given professional knowledge and currently available information, the potential losses for this hazard are considered to be overestimated; hence, providing a conservative estimate for losses associated with winter storm events.

#### Wildfire

The Wildland-Urban Interface (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For this risk assessment, the high-, medium-, and low-density interface areas were combined and used as the "Interface" hazard areas, and the high-, medium-, and low-density intermix areas were combined and used as the "Intermix" hazard areas.

To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to a wildfire event.

### Chemical, Radiological, and Nuclear Incidents

All of Westchester County is exposed and vulnerable to chemical, radiological, and nuclear incidents (CBRN) incidents. Resources from Westchester County's Local Emergency Planning Committee, Westchester's Comprehensive Emergency Management Plan, and the U.S. Department of Transportation were referenced to assess the County's overall risk to this hazard of concern.

### **Considerations for Mitigation and Next Steps**

The following items are to be discussed for considerations for the next plan update to enhance the vulnerability assessment:



- All Hazards
  - Create an updated user-defined general building stock dataset
  - Utilize updated and current demographic data. If 2020 U.S. Census demographic data is available at the U.S. Census block level during the next plan update, use the census block estimates and residential structures for a more precise distribution of population, or the current American Community Survey 5-Year Estimate populations counts at the Census tract level.
- Flood
  - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10 and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Continue to expand and update urban flood areas to further inform mitigation.
  - As more current FEMA floodplain data become available (i.e., DFIRMs), update the exposure analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts at these properties can be developed.
- Extreme Temperatures
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at risk areas.
- Severe Storm
  - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
  - Integrate evacuation route data that is currently being developed.
- Wildfire
  - General building stock inventory can be updated to include attributes such as roofing material or fire detection equipment or integrate distance to fuels as another measure of vulnerability.

## 5.1.3 Data Source Summary

Table 5.1-3 summarizes the data sources used for the risk assessment for this plan.

#### Table 5.1-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American	2010; 2019	Digital (GIS) format
	Community Survey 5-Year		
	Estimates		
Building Inventory	Westchester County GIS; NY GIS;	2021; 2021; 2021	Digital (GIS) format
	RS Means		
Wildfire Fuel Hazard	University of Wisconsin - Madison	2010	Digital (GIS) format
Critical facilities	Westchester County GIS; HIFLD;	2019/2020/2021;	Digital (GIS) format
	EPA; Westchester County HMP;	2014/2017/2019/2020/2021;	
	Westchester Planning Partners	2021;2014;2021	
Digitized Effective FIRM	FEMA	2007/2014	Digital (GIS) format
maps (2007)			
NEHRP Soil	NYS	n.d.	Digital (GIS) format



Data	Source	Date	Format
2-meter Resolution Digital Elevation Model	New York State	2014	Digital (GIS) format
New Development Data	Westchester Planning Partnership and County Jurisdictions	2021	Digital (GIS) Format
Sea Level Rise (1-foot, 3- feet, 6-feet)	Westchester County GIS	2021	Digital (GIS) Format
SLOSH (Categories 1 through 4)	NYS GIS	2013	Digital (GIS) Format
Coastal Risk Areas (Moderate, High, Extreme)	NYSDOS	2013	Digital (GIS) Format

### Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- 1) Approximations and simplifications necessary to conduct such a study
- 2) Incomplete or dated inventory, demographic, or economic parameter data
- 3) The unique nature, geographic extent, and severity of each hazard
- 4) Mitigation measures already employed by the participating municipalities
- 5) The amount of advance notice residents have to prepare for a specific hazard event
- 6) Uncertainty of climate change projections

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Westchester County will collect additional data to collect additional data, update and refine existing inventories, to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock utilizing best available data. The County acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.





## 5.2 Identification of Hazards of Concern

To provide a strong foundation for mitigation strategies considered in Section 6, Westchester County considered a full range of natural hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The natural hazard of concern identification process incorporated input from the County and participating jurisdictions; review of the New York State Hazard Mitigation Plan (NYSHMP) and previous hazard identification efforts; research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them. Table 5.2-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation.

For the purposes of this planning effort, the Planning Committee chose to group some natural hazards together, based on the similarity of hazard events, their typical concurrence or their impacts, consideration of how hazards have been grouped in Federal Emergency Management Agency (FEMA) guidance documents (FEMA 386-1, "Understanding Your Risks, Identifying Hazards and Estimating Losses; FEMA's "Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy"), and consideration of hazard grouping in the NYSHMP.

The "Flood" hazard includes riverine (inland) flooding, dam failure flooding, coastal, and stormwater/urban flooding. Inclusion of the various forms of flooding under a general "Flood" hazard is consistent with that used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

The "Severe Storm" hazard includes windstorms that often entail a variety of other influencing weather conditions including thunderstorms, hail, lightning, and tornadoes. Tropical and extra-tropical cyclones, sometimes grouped together under a coastal storms hazard (FEMA 386-2), are being grouped in this hazard category.

The "Severe Winter Storm" hazard includes heavy snowfall, blizzards, freezing rain/sleet, Nor'Easters, and ice storms.

Please note that technological (e.g. Chemical, Biological, Radiological and Nuclear [CBRN]) are being addressed in this planning process. However, the DMA 2000 regulations do not require consideration of such hazards. The County and Planning Committee chose to include these hazards in the 2021 Plan Update. Cyber attack, a human caused hazard, while it has not been addressed as a hazard of concern in this HMP, is recognized as a threat and a profile is included in Appendix H Supplementary Data for awareness. Critical Infrastructure Failure has been included in hazard profiles as a cascading hazard of hazards of concern and has been included in Section 4, County Profile as well as in Section 5.4 Hazard Profiles as applicable.





## Table 5.2-1- Identification of Hazards of Concern for Westchester County

Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Avalanche	No	No	<ul> <li>The NYSHMP does identify avalanche as a hazard of concern for New York State, with occurrences in the back country of the Adirondack Mountains. There have been no occurrences in Westchester County.</li> <li>The topography and climate of Westchester County does not support the occurrence of an avalanche event.</li> <li>New York State in general has a very low occurrence of avalanche events based on statistics provided by the American Avalanche Association (AAA) between 1950 and 2020.</li> <li>The Planning Committee did not identify Avalanche has a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>Review of NAC-AAA database between 1998 and 2020.</li> <li>Planning Committee Input</li> </ul>
Coastal Erosion	Yes	No	<ul> <li>The NYSHMP identifies coastal erosion has a hazard of concern for New York State. Erosion can impact all of the State's coastal counties along: Lake Erie and the Niagara River, Lake Ontario and the St. Lawrence River, Atlantic Ocean and Long Island Sound, Hudson River south of the federal dam in Troy, the East River, the Harlem River, the Kill van Kull and Arthur Kill, and all connecting waterbodies, bays, harbors, shallows and wetlands.</li> <li>Westchester County is bordered to the east by the Long Island Sound which is vulnerable to erosion.</li> <li>The NYSHMP indicated that the County was impacted by one to three coastal erosion events.</li> <li>The Planning Committee did not identify Coastal Erosion has a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>Planning Committee Input</li> </ul>
Dam Failure	Yes	Yes	<ul> <li>The 2019 NYSHMP identifies dam failure as a hazard of concern for New York State and includes it in the flood hazard profiles.</li> <li>According to the NYS DEC there are 223 dams in Westchester County: 127 low hazard, 43 intermediate hazard, 34 high hazard, and 19 negligible or no hazard classification.</li> <li>Dam failure is included in the flood profile.</li> </ul>	<ul> <li>NYS DHSES</li> <li>Input from Steering Committee and Planning Partnership</li> <li>NYSDEC</li> <li>NYS GIS</li> </ul>
Drought	Yes	No	<ul> <li>The NYSHMP identifies drought as a hazard of concern for New York State.</li> <li>Between 2014 and 2021, the County has experienced 1 drought events.</li> <li>Westchester County is located in the Hudson Valley Climate Division. According to the NRCC, this climate division has been impacted by the following periods of severe and extreme drought: <ul> <li>November – December 1908</li> <li>May – July 1911</li> <li>October 1930 – April 1931</li> </ul> </li> </ul>	<ul> <li>NYSHMP</li> <li>NRCC</li> <li>NOAA-NCDC Storm Database</li> <li>Planning Committee Input</li> </ul>





Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
			<ul> <li>December 1939 – January 1940</li> <li>November 1941 – February 1942</li> <li>November – December 1949</li> <li>September – November 1957</li> <li>June 1964 – August 1966</li> <li>April – May 1985</li> <li>August – September 1995</li> <li>July – August 1999</li> <li>November 2001 – April 2002</li> <li>While the Planning Committee recognizes that drought is a general concern for Westchester County, the County and planning partners have been actively working to address the concern and have not included this as a stand-alone mitigation HOC for this plan update. Drought is included as a cascading hazard in the Extreme Temperature profile.</li> </ul>	
Earthquake	Yes	Yes	<ul> <li>The NYSHMP identifies earthquake as a hazard of concern for New York State.</li> <li>Westchester County has a PGA between 3 and 5% based on peak ground acceleration (%g) with 10% probability of exceedance in 50 years.</li> <li>Westchester County is primarily comprised of NEHRP soil classes B through D. The majority of the County is soil class B.</li> <li>Between 1979 and 2019, Westchester County has had 13 earthquakes events.</li> <li>Numerous fault lines are located in or near Westchester County, including the Ramapo Fault. Indian Point Nuclear Power Plant is located within the vicinity of this fault line.</li> <li>The Planning Committee identified earthquake has a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>USGS</li> <li>Planning Committee Input</li> </ul>
Expansive Soils	No	No	<ul> <li>The NYSHMP identifies expansive soils as a hazard of concern for New York State; however, the Planning Committee did not identify this as a hazard of concern for Westchester County.</li> <li>USGS indicated that less than 50% of Westchester County is underlain by soils with abundant clays of slight to moderate swelling potential or areas of the County are underlain by soils with little to no clays with swelling potential.</li> </ul>	<ul> <li>NYSHMP</li> <li>USGS 1989 Swelling Clays Map of the Conterminous U.S.</li> <li>Planning Committee Input</li> </ul>
Extreme Temperature (cold and heat)	Yes	Yes	<ul> <li>They NYSHMP identifies extreme temperature as a hazard of concern for New York State.</li> <li>The coldest temperatures recorded in Westchester County included: <ul> <li>Westchester County Airport10°F in 1961 and 1979</li> <li>Dobbs Ferry-Ardsley10°F in 1994</li> <li>Yorktown Heiphs15°F in 1994</li> </ul> </li> </ul>	<ul> <li>NYSHMP</li> <li>NOAA – NCDC Storm Event Database</li> <li>Midwestern Regional Climate Center</li> </ul>





Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	<ul> <li>Why was this determination made?</li> <li>The highest temperatures recorded in Westchester County included: <ul> <li>Westchester County Airport -102°F in 1966 and 2010</li> <li>Dobbs Ferry-Ardsley -104°F in 1980</li> <li>Yorktown Heights -100°F in 1995 and 2010</li> </ul> </li> <li>The NOAA-NCDC storm event database indicated that between 1990 and 2021, Westchester County had 25 extreme temperature events reported. Those events resulted in two fatalities.</li> </ul>	Source(s) • Input from Planning Committee
Flood	Yes	Yes	<ul> <li>The NYSHMP identifies flooding as a hazard of concern for New York State.</li> <li>There are numerous floodprone areas throughout the County, especially along the major waterways in the County.</li> <li>Approximately 1.9 percent of the County's population lives within the 1% Annual Chance Floodplain. Over 26,000 acres (9.2%) of the County's total land area is located in the A-Zone. Over 29,000 acres (10.42%) is located in the 0.2% flood hazard area.</li> <li>Westchester County is bordered to the west by the Hudson River and prone to flooding events from the River.</li> <li>The County has 6,551 NFIP policies with total loss payments equaling over \$11.6 million. There are 1227 repetitive loss policies.</li> <li>Between 1954 and 2021, Westchester County was included in 10 FEMA declarations related to flooding:</li> <li>FEMA-DR-311 – September 13, 1971 – Severe Storms &amp; Flooding</li> <li>FEMA-DR-311 – September 13, 1971 – Severe Storms and Flooding</li> <li>FEMA-DR-487 – October 2, 1975 – Storms, Rains, Landslides &amp; Flooding</li> <li>FEMA-DR-702 – March 28-April 8, 1984 – Coastal Storm, High Tides, Heavy Rain &amp; Flooding</li> <li>FEMA-DR-1146 – October 19-20, 1996 – Severe Storms and Flooding</li> <li>FEMA-DR-1145 – October 19-20, 1996 – Severe Storms and Flooding</li> <li>FEMA-DR-1534 – May 13 – June 17, 2004 - Severe Storms and Flooding</li> <li>FEMA-DR-1650 – June 26-July 10, 2006 – Severe Storms and Flooding</li> <li>FEMA-DR-1692 – April 14-18, 2007 – Severe Storms and Flooding</li> <li>FEMA-DR-1699 – March 13-31, 2010 – Severe Storms and Flooding</li> <li>FEMA-DR-1899 – March 13-31, 2010 – Severe Storms and Flooding</li> <li>FEMA-DR-1899 – March 13-31, 2010 – Severe Storms and Flooding</li> <li>The A-cording to NOAA NCDC storm events database, Westchester County had 191 flood events reported between 1990 and 2021. These events resulted in three deaths, two injuries, and over \$6.6 million property damage.</li> <li>The Planning Committee identified flooding as a hazard of concern for Westchester County.&lt;</li></ul>	<ul> <li>NYSHMP</li> <li>FEMA</li> <li>NFIP</li> <li>NOAA-NCDC Storm Events Database</li> <li>Input from Planning Committee</li> </ul>



	Is this a hazard that may occur in Westshaatar	If yes, does this hazard		
Hazard	County?	threat to the County?	Why was this determination made?	Source(s)
Hail	Yes	Yes	Please See Severe Storm	
Hurricane	Yes	Yes	Please See Severe Storm	
Ice Storm	Yes	Yes	Please See Severe Winter Storm	
Land Subsidence	Yes	No	<ul> <li>The NYSHMP identifies land subsidence as a hazard of concern for New York State; however, the Planning Committee did not identify this as a hazard of concern for Westchester County.</li> <li>A majority of Westchester County is not underlain by carbonate rock; however, there is a small band running northeast to southwest in the County.</li> </ul>	<ul> <li>NYSHMP</li> <li>Input from Planning Committee</li> </ul>
Landslide	Yes	No	<ul> <li>The NYSHMP identifies landslide as a hazard of concern for New York State.</li> <li>According to the NYSHMP, over 36,000 people in Westchester County live within a high incidence of landslides; while the remainder of the County is considered to have a low incidence of landslides.</li> <li>Between 1960 and 2012, the County has experienced only one landslide event that caused \$833 in property damage.</li> <li>According to FEMA, between 1954 and 2014, Westchester County was included in one declaration associated with landslide events:</li> <li>FEMA-DR-487 – October 2, 1975 – Severe Storms, Heavy Rain, Landslides, Flooding</li> <li>The Planning Committee did not identify landslide as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>Input from Planning Committee</li> </ul>
Invasive Species	Yes	No	<ul> <li>The NYSHMP does not identify invasive species as a hazard of concern for New York State.</li> <li>According to the New York Invasive Species Map, there have been reported infestations of invasive insects in Westchester County</li> <li>Based on input from the Steering Committee and Planning Partnership, infestation and invasive species is not identified as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYS DHSES</li> <li>Input from Steering and Planning Committees</li> <li>NYSDEC</li> <li>USDA</li> </ul>
Nor'easter	Yes	Yes	Please see Severe Winter Storm	
Severe Storm (Windstorms, Thunderstorms, Hail, Hurricanes /Tropical Storms, Lightning, and Tornados)	Yes	Yes	<ul> <li>The NYSHMP identifies hail, high winds, tornadoes, and hurricane as hazards of concern for New York State.</li> <li>According to FEMA, between 1954 and 2021, Westchester County was included in 14 declarations associated with severe storm events.</li> <li>FEMA-DR-311 – September 13, 1971 – Severe Storms and Flooding</li> <li>FEMA-DR-338 – June 23, 1972 – Tropical Storm Agnes</li> <li>FEMA-DR-487 – October 2, 1975 – Storms, Rains, Landslides &amp; Flooding</li> <li>FEMA-DR-974 – December 10-14, 1992 – Coastal Storm, High Tides, Heavy Rain &amp; Flooding</li> </ul>	<ul> <li>NYSHMP</li> <li>FEMA</li> <li>NOAA-NCDC Storm Events Database</li> <li>FEMA</li> <li>SPC</li> <li>Input from Planning Committee</li> </ul>





	Is this a hazard that may occur in	If yes, does this hazard		
Hazard	County?	threat to the County?	Why was this determination made?	Source(s)
			<ul> <li>FEMA-DR-1146 – October 19-20, 1996 – Severe Storms, Flooding, Heavy Rains, High Winds</li> <li>FEMA-DR-1296 – September 16-19, 1999 – Hurricane Floyd</li> <li>FEMA-DR-1534 – May 13-June 17, 2004 – Severe Storms and Flooding</li> <li>FEMA-DR-1589 – April 2-4, 2005 – Severe Storms and Flooding</li> <li>FEMA-DR-1650 – June 26-July 10, 2006 – Severe Storms and Flooding</li> <li>FEMA-DR-1692 – April 14-18, 2007 – Severe Storms and Flooding</li> <li>FEMA-DR-1899 –March 13-31, 2010 – Severe Storms and Flooding</li> <li>FEMA-DR-1899 –March 13-31, 2010 – Severe Storms and Flooding</li> <li>FEMA-DR-4020 – August 26-September 5, 2011 – Hurricane Irene</li> <li>FEMA-DR-4085 – October 27-November 8, 2012 – Hurricane Sandy</li> <li>FEMA DR-4567 – August 4, 2020 – Tropical Storm Isaias</li> <li>NOAA-NCDC storm events database indicates that Westchester County was impacted by approximately 454 severe storm events between 1990 and 2021 causing a total of 26 injuries, 14 fatalities, approximately \$17.1 million in property damages, and \$250 in crop damages.</li> <li>Between 1970 and 2019, Westchester County has been impacted by eight tornadoes.</li> <li>The Planning Committee identified severe storms as a hazard of concern for Westchester County.</li> </ul>	
Severe Winter Storm (Heavy Snow, Blizzards, Nor Easters, Freezing Rain/Sleet, Ice Storms)	Yes	Yes	<ul> <li>The NYSHMP identifies severe winter storm as a hazard of concern for New York State.</li> <li>Annual average snowfall in Westchester County is less than 60 inches.</li> <li>According to FEMA, between 1954 and 2021, Westchester County was included in five declarations associated with severe winter storm events.</li> <li>FEMA-DR-702 – March 28-April 8, 1984 – Coastal Storms and Flooding</li> <li>FEMA-DR-974 – December 10-14, 1992 – Coastal Storm, High Tides, Heavy Rain and Flooding</li> <li>FEMA-EM-3107 – January 6-12, 1996 – Severe Snowstorm (Blizzard of '96)</li> <li>FEMA-EM-3184 – February 17-18, 2003 – Snow</li> <li>NOAA-NCDC has indicated that Westchester County has experienced the impacts of 78 winter storm events between 1990 and 2021.</li> <li>The Planning Committee identified severe winter storm as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>FEMA</li> <li>NOAA – NCDC Storm Event Database</li> <li>Input from Planning Committee</li> </ul>
Tornado	Yes	Yes	Please See Severe Storm	





Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Tsunami	No	No	<ul> <li>The NYSHMP does identify tsunami as a hazard of concern for the State of New York. All low-lying coastal areas in the State have the potential to be struck by a tsunami.</li> <li>There is no recent history of tsunamis impacting the State.</li> <li>The Long Island Sound makes up the eastern border of Westchester County. Even though there are coastal areas in the County, there is no history of tsunami occurrences.</li> <li>Tsunami is included in the earthquake profile.</li> </ul>	<ul> <li>NYSHMP</li> <li>Input from Planning Committee</li> </ul>
Volcano	No	No	<ul> <li>The NYSHMP does not identify volcano as a hazard of concern for New York State.</li> <li>The Planning Committee did not identify volcanoes as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>Input from Planning Committee</li> </ul>
Wildfire	Yes	Yes	<ul> <li>The NYSHMP identifies wildfire as a hazard of concern for the State of New York.</li> <li>In Westchester County, approximately 11.6 percent of the County is located in the WUI. A majority of the WUI is located in the northern half of the County.</li> <li>Approximately 2.6% of general building stock is located in the WUI.</li> <li>Numerous brush fires have historically impacted the County</li> <li>According to FEMA, between 1954 and 2021, Westchester County was included in one declaration associated with wildfire events.</li> <li>FM-2115-NY – August 21-25, 1995 – Rocky Point/Cranberry Bog Fire</li> <li>The Planning Committee identified wildfire as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYSHMP</li> <li>NOAA-NCDC Storm Events Database</li> <li>FEMA</li> <li>Input from Planning Committee</li> </ul>
Windstorm	Yes	Yes	Please see Severe Storm	

Notes:

DR Presidential Disaster Declaration Number EMPresidential Disaster Emergency Number FEMA Federal Emergency Management Agency Hazard Mitigation Plan HMPK Thousands (\$) MMillions (\$) NCDC National Oceanic and Atmospheric Administration National Climatic Data Center National Oceanic and Atmospheric Administration NOAA NRCC Northeast Regional Climate Center National Weather Service NWS NYSHMP New York State Hazard Mitigation Plan SPC Storm Prediction Center USGS U.S. Geologic Survey





### WUI Wildland-Urban Interface

## Table 5.2-2. Identification of Non-Natural Hazards of Concern for Westchester County

Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Chemical, Biological, Radiological, or Nuclear (CBRN) Incidents	Yes	Yes	<ul> <li>The NYSHMP does not identify CBRN incidents as a hazard of concern for New York State. However, the Steering and Planning Committees felt it was important to include as a hazard of concern for Westchester County.</li> <li>Any area of Westchester County can experience a CBRN incident; however, the most vulnerable areas are the major roadways, facilities that contain hazardous materials, and facilities that have or transport radioactive materials.</li> <li>While there have been no major CBRN incidents in the County, there is the potential. Therefore, the Planning and Steering Committees identified CBRN as a hazard of concern for Westchester County.</li> </ul>	<ul> <li>NYS DHSES</li> <li>Westchester County</li> <li>Steering and Planning Committee Input</li> </ul>
Critical Infrastructure Failure	Yes	Yes, to be included as a cascading hazard in the plan.	<ul> <li>The NYSHMP does not identify critical infrastructure failure as a hazard of concern for New York State. However, based on recent events that led to power outages and fuel shortages, the Planning and Steering Committees felt it was important to include as a hazard of concern for Westchester County.</li> <li>Power outages and fuel shortages can occur anywhere in the County and can impact those that live, work, or visit the County.</li> <li>There are have been numerous events that led to critical infrastructure failure. See Table 5.2-1 for details regarding those events.</li> <li>Based on previous events, critical infrastructure failure will continue to impact Westchester County. Therefore, the Planning and Steering Committees identified this as a hazard of concern for the County.</li> </ul>	<ul> <li>NYS DHSES</li> <li>Westchester County</li> <li>Steering and Planning Committee Input</li> </ul>
Cyber Attack	Yes	Yes, to be included as an appendix in the plan to acknowledge county-wide issues.	<ul> <li>The NYSHMP does not identify cyber-attack as a hazard of concern for New York State. However, the Steering and Planning Committees felt this hazard could have adverse impacts on the County and should be identified as a hazard of concern for Westchester County.</li> <li>Although there are have been no major direct attacks impacted Westchester County, the Steering and Planning Committees identified cyber-attack as a hazard of concern for the County due to its vulnerability and impact on the County and the previous occurrences.</li> <li>Westchester County is a vulnerable target to cyber-attacks due to its location, critical information infrastructures, and home to several Fortune 500 companies. Any disruption to these businesses could have an impact on the County's economy.</li> </ul>	<ul> <li>NYS DHSES</li> <li>Westchester County</li> <li>Steering and Planning Committee Input</li> </ul>
Disease Outbreak	Yes	Yes	• The NYSHMP does not identify disease outbreak as a hazard of concern for New York State; however, there have been numerous incidents in the State and in Westchester County.	<ul><li>NYS DHSES</li><li>Westchester County</li><li>USGS</li></ul>





Hazard	Is this a hazard that may occur in Westchester County?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
			<ul> <li>Infestations of ticks, mosquitoes, and/or other types of pest may be present in the county. Therefore, the Steering and Planning Committees identified disease outbreak as a hazard of concern.</li> <li>In addition to tick- and mosquito-borne illnesses, the county has been impacted by influenza and has participated in Ebola awareness/preparedness programs due to recent incidents, as well as the coronavirus pandemic.</li> </ul>	<ul> <li>NYS DOH</li> <li>Steering and Planning Committee Input</li> </ul>





According to input from the County, and review of all available resources, a total of seven hazards of concern, including six natural hazards and one non-natural hazard (Disease Outbreak) were identified as significant hazards affecting the entire planning area, to be addressed at the county level in this plan:

- Disease Outbreak
- Earthquake
- Extreme Temperatures
- Flooding (coastal, dam failure, stormwater, riverine/flash)
- Severe Storm (High Winds, Tornadoes, Thunderstorms, Hail, Hurricane/Tropical Storm)
- Severe Winter Storm (Heavy Snow, Blizzards, Ice Storms, Nor'easter)
- Wildfire

Additionally, certain non-natural hazards of concern were reviewed to determine the effect and applicability of inclusion in this hazard mitigation plan. Ultimately, the Steering Committee determined that due to the existence of the defunct Indian Point Nuclear Power Plant which houses spent radiological fuel, that Chemical, Biological, Radiological, or Nuclear (CBRN) Incidents pose a significant hazard to the planning area and should be addressed in this plan. The Steering Committee also re-evaluated the inclusion of Cyber Attack Incidents and Critical Infrastructure Failure in the plan as stand-alone hazards as per the 2015 plan. However, based on the inherent random aspect of cyber-attack and the alignment of this with preparedness rather than mitigation planning, it was determined to include this hazard as an appendix to the plan to acknowledge its potential for disrupting county and local operations and to cause economic and life safely issues. Regarding Critical Infrastructure Failure, as this is a cascading hazard associated with severe weather, this has been included by reference in the Flood, Severe Storm, Severe Winter Storm, and Extreme Temperature hazards.

Other natural and technological hazards of concern have occurred within Westchester County, but have a low potential to occur, are addressed by other planning mechanisms, and/or do not result in significant impacts within the County. Therefore, these hazards will not be further addressed within this version of the Plan. However, if deemed necessary by the County, these hazards may be considered in future versions of the Plan.





# 5.3 Hazard Ranking

As discussed in Section 5.2 (Identification of Hazards of Concern), a comprehensive range of natural hazards that pose a significant risk to Westchester County were selected and considered during development of this plan; however, each community in Westchester County has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the county and each participating jurisdiction can be found in their jurisdictional annexes in Volume II, Section 9 of this plan.

To this end, a hazard risk ranking process was conducted for Westchester County and its municipalities using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and changing future conditions (climate change). Each were assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

## 5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Westchester County is described below. Estimates of risk for the county were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's HAZUS-MH risk assessment tool, and input from Westchester County and participating jurisdictions. The ranking includes a factor to evaluate capacity of the participating jurisdiction regarding ability to address the hazard through plans, policies, and mitigation strategies. For example, a community participating in the CRS has a high capacity to address and mitigation flooding issues, which will be reflected in the ranking benchmark. In addition, a factor addressing the degree of climate change impact is included in the methodology to adjust rankings for hazards expected to be significantly impacted by climate change. Table 5.3-1 shows the four risk assessment categories' values for each of Westchester County's hazards. Details for each category are further described below.

Cate	egory	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value	
Probability of Occurrence		Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.		30%	
		Rare	Between 1 and 10% annual probability of a hazard event occurring.	1		
		Occasional	Between 10 and 100% annual probability of a hazard event occurring.	2		
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3		
Impact (Sum of	Population (Numeric	Low	14% or less of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	1	30%	
all 3)	Value x 3)	Value x 3)	Medium	15% to 29% of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	2	
		High	30% or more of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	3		
Property (Numeric Value x 2) Economy (Numeric		Low	Property exposure is 14% or less of the total number of structures for community.	1		
		Medium	Property exposure is 15% to 29% of the total number of structures for community.	2		
		High	Property exposure is 30% or more of the total number of structures for community.	3		
		Low	Loss estimate is 9% or less of the total replacement cost for community.	1		
	Value x 1)	Medium	Loss estimate is 10% to 19% of the total replacement cost for community.	2		

## Table 5.3-1. Summary of Hazard Ranking Approach



Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		High	Loss estimate is 20% or more of the total replacement cost for community.	3	
Capability		Weak	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	-1	30%
		Moderate	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	0	
Strong         Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.		1			
Climate	Change	Low	No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well-documented and acceptable methods).	3	

## **Probability of Occurrence**

The probability of occurrence is the likelihood of a hazard event occurring in any given year. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions described in Table 5.3-2. The probability of occurrence is given a weighted value of 30%.

Numeric Value	Probability Category	Definition
0	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.
1	Rare	Between 1 and 10% annual probability of a hazard event occurring.
2	Occasional	Between 10 and 100% annual probability of a hazard event occurring.
3	Frequent	100% annual probability; a hazard event may occur multiple times per year.

### Impact

The impact of each hazard is considered in three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and individual assessments by each participating municipality, an impact rating of high, medium, or low is assigned with a corresponding numeric value for each hazard of concern. In addition, a weighting factor is assigned to each impact category: 3 for population, 2 for property, and 1 for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard. The total of each category is assigned a weighted value of 30%. Table 5.3-3 presents the numerical rating, weighted factor, and description for each impact category.



Category	Weighted Value	Low Impact* (1)	Medium Impact (2)	High Impact (3)
Population	3	14% or less of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	15% to 29% of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	30% or more of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.
Property	2	Property exposure is 14% or less of the total number of structures for community.	Property exposure is 15% to 29% of the total number of structures for community.	Property exposure is 30% or more of the total number of structures for community.
Economy	1	Loss estimate is 9% or less of the total replacement cost for community.	Loss estimate is 10% to 19% of the total replacement cost for community.	Loss estimate is 20% or more of the total replacement cost for community.

#### Table 5.3-3. Numerical Values and Definitions for Impacts on Population, Property and Economy

Note: A numerical value of zero is assigned if there is no impact.

\* For the purposes of this exercise, "impacted" means exposed for population and property and loss for economy.

### Additional Impacts

Along with impacts on population, property, and economy, the overall risk ranking looks at two additional impacts that impact the county's vulnerability: capability and climate change. Table 5.3-4 presents the numerical rating and description for each category.

#### Capability

Capability refers to a jurisdiction's ability to protect the community from or withstand a hazard event. Mitigation measures are already in place, including codes/ordinances, plans, and procedures to withstand hazards due to design or location, deployable resources, or plans and procedures in place to respond to an event. The capability category has a weighted factor of 30%.

#### Table 5.3-4. Numerical Values and Definitions for Adaptive Capability and Changing Future Conditions

Category	Weak	Moderate	Strong
Capability	Weak/outdated/inconsistent plans, policies, codes/ ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.
		jurisdiction capabilities.	. 0

### **Climate Change**

Climate change refers to the impact that climate change projections have on increasing or decreasing the severity and frequency of a hazard. The climate change category has a weighted factor of 10%.

Table 5.3-5, Nume	erical Values and	d Definitions for	Changing Future	Conditions
Tuble 5.5 5. Mullic	fical values and		changing ruture	conditions

Category	Low Impact	Medium Impact	High Impact
Climate Change	No local data is available; modeling projects are uncertain on whether there is increased future risk;	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change;	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence



Category	Low Impact	Medium Impact	High Impact		
	confidence level is low	confidence level is medium to high	level (strong evidence, well-		
	(inconclusive evidence).	(suggestive to moderate evidence).	documented and acceptable methods).		

#### **Risk Ranking Value**

Each impact was then weighted and the risk ranking for each hazard is then calculated using the following formula:

#### **Example Risk Ranking Equation**

Risk Ranking = [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x .30] + [Capability x 30%] + [Climate Impact x 10%] + [Probability of Occurrence x 30%]

Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = values less than 3.9; Medium = values between 3.9 and 4.9; High = values greater than 4.9.

## 5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Westchester County. The hazard ranking for Westchester County is detailed in the subsequent tables that present the step-wise process for the ranking. The countywide risk ranking includes the entire planning area and might not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each municipality indicate the differing degrees of risk exposure and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. Both the county and the participating jurisdictions have applied the same methodology to develop the countywide risk and local rankings to ensure consistency in the overall ranking of risk; jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves four purposes: 1) to describe the probability of occurrence for each hazard; 2) to describe the impact each would have on the people, property, and economy; 3) evaluate the capabilities a community has with regards to natural hazards; and 4) to consider changing future conditions (i.e., climate change) in Westchester County. Estimates of risk for Westchester County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's HAZUS-MH risk assessment tool and input from the county and participating municipalities.

Table 5.3-6 shows the county-wide probability ranking assigned for likelihood of occurrence for each hazard.

Table 5.3-6. Probability of Occurrence Ranking for Hazards of Concern for Westchester Coun
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Hazard of Concern	Probability	Numeric Value
Disease Outbreak	Occasional	2
Earthquake	Unlikely	0
Extreme Temperature	Occasional	2
Flood	Frequent	3
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Wildfire	Rare	1
CBRN	Rare	1

Table 5.3-7 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the county level. It is noted that several hazards that have a high impact on the





local jurisdictional level can have a lower impact when analyzed countywide. Jurisdictional ranking results are presented in each local annex in Section 9 (Jurisdictional Annexes) of this plan. The weighting factor results and a total impact for each hazard also are summarized. Values in red indicate values that were altered by the county based on local knowledge and experience with each hazard.





	Population			Property		Economy			Total Impact	
Hazard of Concern	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	(Population + Property + Economy)
Disease Outbreak	Medium	2	6	Low	1	2	Medium	2	2	10
Earthquake	Low	1	3	Low	1	2	Low	1	1	6
Extreme Temperature	Medium	2	6	Low	1	2	Low	1	1	9
Flood	Medium	3	6	High	3	6	Low	1	1	13
Severe Storm	High	3	9	Medium	2	4	Low	1	1	14
Severe Winter Storm	High	3	9	Low	1	2	Low	1	1	12
Wildfire	Low	1	3	Medium	2	4	Medium	2	2	9
CBRN	Medium	3	6	Low	1	2	Medium	2	2	10

## Table 5.3-7. Impact Ranking for Hazards of Concern for Westchester County





Table 5.3-8 shows the additional impact rankings for the hazards of concern. This includes the overall capabilities of the county and municipalities and the consideration of changing future conditions, such as climate change.

Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Disease Outbreak	Moderate	0	Medium	2
Earthquake	Moderate	0	Low	1
Extreme Temperature	Moderate	0	High	3
Flood	Moderate	0	High	3
Severe Storm	Moderate	0	High	3
Severe Winter Storm	Strong	1	Medium	2
Wildfire	Moderate	0	High	3
CBRN	Moderate	0	Low	1

Table 5.3-8. Additional Impact Ranking for Hazards of Concern for Westchester County

Table 5.3-9 presents the total calculations for each hazard ranking value for the hazards of concern.

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Risk Ranking Value
Disease Outbreak	0.6	3	0	0.2	3.8
Earthquake	0	1.8	0	0.1	1.9
Extreme Temperature	0.6	2.7	0	0.3	3.6
Flood	0.9	3.9	0	0.3	5.1
Severe Storm	0.9	4.2	0	0.3	5.4
Severe Winter Storm	0.9	3.6	0.3	0.2	5
Wildfire	0.3	2.7	0	0.3	3.3
CBRN	0.3	3	0	0.1	3.4

Table 5.3-9. Total Hazard Ranking Values for the Hazards of Concern for Westchester Coun
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Low = values less than 3.9 (yellow); Medium = values between 3.9 and 4.9 (orange); High = values greater than 4.9 (red).

Table 5.3-10 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories, low, medium, and high. It also includes input by the municipalities. The rankings were categorized as follows: Low = values less than 3.9 colored yellow; Medium = values between 3.9 and 4.9 colored orange; High = values greater than 4.9 colored red.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Section 9 (Jurisdictional Annexes) of this plan. The summary rankings for the county reflect the results of the vulnerability analysis for each hazard of concern and can vary from the specific results of each jurisdiction. For example, the severe storm hazard may be ranked low in one jurisdiction, but due to the exposure and impact countywide, it is ranked as a high hazard and is addressed in the county mitigation strategy accordingly. The table below represents the initial calculated rankings presented to each jurisdiction. Each jurisdiction was able to review the rankings and adjust as necessary. Refer to Section 9 (Jurisdictional Annexes) for the adjusted rankings.



Westchester County Municipalities	Disease Outbreak	Earthquake	Extreme Temperature	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN
Ardsley (V)	Low	Medium	Low	High	High	Medium	Low	Low
Bedford (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Briarcliff Manor (V)	Low	Low	Low	High	High	Medium	Low	Low
Bronxville (V)	Low	Low	Low	High	High	Medium	Low	Low
Buchanan (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Cortlandt (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Croton-On-Hudson (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Dobbs Ferry (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Eastchester (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Elmsford (V)	Low	Low	Low	High	High	Medium	Low	Low
Greenburgh (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Harrison (V)	Low	Low	Low	High	High	Medium	Low	Low
Hastings-On-Hudson (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Irvington (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Larchmont (V)	Low	Low	Low	High	High	Medium	Low	Low
Lewisboro (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Mamaroneck (T)	Low	Low	Low	High	High	Medium	Low	Low
Mamaroneck (V)	Low	Low	Low	High	High	Medium	Low	Low
Mount Kisco (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Mount Pleasant (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Mount Vernon (C)	Low	Low	Low	Medium	High	Medium	Low	Low
New Castle (T)	High	Low	Medium	High	High	High	Low	Low
New Rochelle (C)	Low	Low	Low	High	High	Medium	Low	Low
North Castle (T)	Low	Low	Low	Medium	High	Medium	Low	Low
North Salem (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Ossining (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Ossining (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Peekskill (C)	Low	Low	Low	Medium	High	Medium	Low	Low
Pelham (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Pelham (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Pelham Manor (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Pleasantville (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Port Chester (V)	Low	Low	Low	High	High	Medium	Low	Low
Pound Ridge (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Rye (C)	Low	Low	Low	High	High	Medium	Low	Low
Rye (T)	Low	Low	Low	Low	High	Medium	Low	Low
Rye Brook (V)	Low	Low	Low	High	High	Medium	Low	Low
Scarsdale (V)	Low	Low	Low	High	High	Medium	Low	Low
Sleepy Hollow (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Somers (T)	Low	Low	Low	Medium	High	Medium	Low	Low

## Table 5.3-10. Summary of Overall Ranking of Natural Hazards by Jurisdiction





Westchester County Municipalities	Disease Outbreak	Earthquake	Extreme Temperature	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN
Tarrytown (V)	Low	Low	Low	Medium	High	Medium	Low	Low
Tuckahoe (V)	Low	Low	Low	Medium	High	Medium	Low	Low
White Plains (C)	Low	Low	Low	Medium	High	Medium	Low	Low
Yonkers (C)	Low	Low	Low	High	High	Medium	Low	Low
Yorktown (T)	Low	Low	Low	Medium	High	Medium	Low	Low
Westchester County	Low	Low	Low	High	High	Medium	Low	Low

Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9.





# 5.4.1 Earthquake

This section provides a profile and vulnerability assessment for the earthquake hazard.

## 5.1.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

## Description

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or by a manmade explosion (FEMA 2013) Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. New York State is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1997)

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities (FEMA 2001). This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches. A description of each of these is provided below.

- *Surface faulting*: Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- *Ground motion (shaking):* The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- Landslide: A movement of surface material down a slope.
- *Liquefaction*: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
- *Tectonic Deformation*: A change in the original shape of a material due to stress and strain.
- *Tsunami*: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
- *Seiche*: The sloshing of a closed body of water from earthquake shaking (USGS 2012).

#### Extent

An earthquake's magnitude and intensity are used to describe the severity and size of the event. intensity describes the overall felt severity of shaking during the event and magnitude describes the size at the focus of an





earthquake. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale. Currently, it is now most commonly expressed using the moment magnitude (Mw) scale. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows:

- Great  $M_W > 8$
- Major Mw = 7.0 7.9
- Strong Mw = 6.0 6.9
- Moderate Mw = 5.0 5.9
- Light Mw = 4.0 4.9
- Minor Mw = 3.0 3.9
- Micro Mw = 3.0 3.9

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 5.4.1-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region. This shaking depends on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 5.4.1-2 displays the MMI scale and its relationship to the areas peak ground acceleration.

Mercalli Intensity	Shaking	Description
Ι	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Table 5.4.1-1.	Modified	Mercalli	Intensity	Scale

Source: USGS 2014



Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
Ι	<.17	Not Felt	None
II	.17 - 1.4	Weak	None
III	.17 - 1.4	Weak	None
IV	1.4 - 3.9	Light	None
V	3.9 - 9.2	Moderate	Very Light
VI	9.2 - 18	Strong	Light
VII	18 - 34	Very Strong	Moderate
VIII	34 - 65	Severe	Moderate to Heavy
IX	65-124	Violent	Heavy
Х	>124	Extreme	Very Heavy

Table 5.4.1-2.	Modified Mercalli Intensity and PGA Equivalents
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Source: Freeman et al. (Purdue University) 2004 Note: PGA Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (percent g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a period of interest. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Figure 5.4.1-3 through Figure 5.4.1-5.

PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes, or accelerates, in a given geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 1.0%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. 10%g PGA means that the ground acceleration is 10% that of gravity (NJOEM 2013). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5.4.1-3.

Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20 - 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.
Source: NJOE	М 2011

Table 5.4.1-3.	Damage Levels	Experienced	in Earthquakes
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Note: %g Peak Ground Acceleration

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown 2001) The USGS updated the



National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map represents the best available data, as determined by the USGS.



#### Figure 5.4.1-1. 2018 Long-Term National Seismic Hazard Map

The New York State Geological Survey conducted seismic shear-wave tests of the state's surficial geology (glacial deposits). Based on these test results, the surficial geologic materials of New York State were categorized according to the National Earthquake Hazard Reduction Program's (NEHRP) Soil Site Classifications (Table 5.4.1-4). The NEHRP developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from Class A to Class E, as noted in Figure 5.4.1-2, where Class A represents hard rock that reduces ground motions from an earthquake and Class E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class E soils include water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type. Seismic waves travel faster through hard rock than through softer rock and sediments. As the waves pass from harder to softer rocks, the waves slow down, and their amplitude increases. Shaking tends to be stronger at locations with softer surface layers where seismic waves move more slowly. Ground motion above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock for small ground motions (FEMA 2013)

#### Table 5.4.1-4. NEHRP Soil Classifications

Soil Classification	Description
А	Hard rock
В	Rock
С	Very dense soil and soft rock



Nestchester



Description
Stiff soils
Soft soils

Source: FEMA 2013

As illustrated in Figure 5.4.1-2, soils in Westchester County are primarily NEHRP Soil Classes B and C. There are small areas of Class D and E soils located throughout as well.








Figure 5.4.1-3. Peak Ground Acceleration Modified Mercalli Scale for a 100-Year MRP Earthquake Event





Figure 5.4.1-4. Peak Ground Acceleration Modified Mercalli Scale for a 500-Year MRP Earthquake Event





Figure 5.4.1-5. Peak Ground Acceleration Modified Mercalli Scale for a 2,500-Year MRP Earthquake Event





#### Location

As noted in the NYS HMP, the importance of the earthquake hazard in New York State is often underestimated because other natural hazards (for example, hurricanes and floods) occur more frequently and while the New York Metro Area is often considered more vulnerable to sea level rise and flooding, earthquakes are still a possibility (NYS DHSES 2019). While the probability of a strong earthquake occurring is moderate, the risk is heightened because of the interdependencies of critical infrastructure systems, and the age of New York's built environment. In addition to this, the New York City Area Consortium for Earthquake Loss Mitigation (NYCOEM 2013) ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala 2003). The New York City metropolitan area, including small parts of Westchester County, has been classified by the USGS as a moderate level for potential earthquakes (USGS 2018)

The closest plate boundary to the East Coast is the Mid-Atlantic Ridge, which is approximately 2,000 miles east of Westchester County. Over 200 million years ago, when the continent Pangaea rifted apart forming the Atlantic Ocean, the Northeast coast of America was a plate boundary. Being at the plate boundary, many faults were formed in the region. Although these faults are geologically old and are contained in a passive margin, they act as pre-existing planes of weakness and concentrated strain. When a strain exceeds the strength of the ancient fault, it ruptures causing an earthquake (Lehigh Earth Observatory 2006).

There are numerous faults throughout New York State. Figure 5.4.1-6 illustrates the faults relative to Westchester County (New York State Museum 2012). According to this figure, there are numerous fault lines that run throughout and surrounding the County.

There are three general regions in New York State that have a higher seismic risk compared to other parts of the State. These regions are: 1) the north and northeast third of the State, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region; 2) the southeast corner, which includes the greater New York City area (including Westchester County) and western Long Island; and 3) the northwest corner, which includes Buffalo and its surrounding area. Overall, these three regions are the most seismically active areas of the State, with the north-northeast portion having the higher seismic risk and the northwest corner of the State has the lower seismic risk (NYS DHSES 2019).

The Ramapo Fault (Figure 5.4.1-7) is part of a system of northeast striking, southeast-dipping faults, which runs from southeastern New York to the Hudson River at Stony Point, through eastern Pennsylvania and beyond. The fault is a hairline fracture, 50 miles long, and is located 35 miles from New York City. Seismographic stations, part of the Advanced National Seismic System, are used to monitor earthquakes and ground motion near important buildings and critical infrastructure along this fault (Lamont-Doherty 2014). Numerous minor earthquakes have been recorded in the Ramapo Fault zone, a 10 to 20-mile-wide area lying adjacent to and west of the actual fault.















Source: Rasmusson, 2003

According to a study conducted by the Lamont-Doherty Earth Observatory, research has found evidence of an active seismic zone running at least 25 miles from Stamford, Connecticut to the Hudson Valley's Town of Peekskill (Westchester County), known as the Stamford-Peekskill line. Small clusters of earthquake events are found along the length of the line and to its immediate southwest. Just north of the line, there are no recorded earthquakes. The Stamford-Peekskill line runs parallel to the other faults beginning at 125<sup>th</sup> Street and researchers believe this fault is in the same family capable of producing at least a magnitude 6.0 earthquake. This fault also intersects the Ramapo seismic zone (NYCOEM 2013).

Information was compiled from 383 earthquakes within a 15,000 square mile area around New York City since 1677 and analyzed 34 years of new data on tremors recorded by modern technology. Based on this research, magnitude 5 earthquakes should be expected in the region about every 100 years, with the most recent one in





1884 (Gardner, 2008; Neroulias, 2008; Environmental News Service, 2008. Figure 5.4.1-9 depicts the Stamford-Peekskill seismic zone, along with earthquakes between 1974 and 2007.





Source: Sykes et al., 2008 Note: Quakes located by instruments 1974-2007. Arrows indicate the Peekskill-Stamford fault line and Ramapo seismic zone (RSZ), which intersect near Indian Point. Purple numerals indicate distance in kilometers.

In the 1970s and 1980s, earthquake risk along the Ramapo Fault became more known due to its proximity to the Indian Point Nuclear Power Generating Station, operated by Entergy Nuclear and located in the Village of Buchanan, New York. The Stamford-Peekskill seismic zone passes less than one mile north of the Indian Point nuclear power plant. Seismic evidence confirms that Indian Point is situated at the intersection of both the Ramapo and Stamford-Peekskill seismic zones (Sykes, Armbruster and Kim 2008) Approximately 20 million people live within 50 miles of Indian Point, which includes all of New York City. According to the New York Governor's Office, as of April 2021, the power plant has been closed and all reactors and storage facilities decommissioned (New York State 2021). While the site is no longer active, there are still various threats and hazards that are associated with the facility, if an earthquake were to occur, and precautions and monitoring will need to continue to mitigate the possibility for nuclear disasters.





The combination of New York State's geology and human footprint may increase the problem with earthquakes. Many New York earthquakes occur near the surface, within the upper mile of the extremely hard, rigid rocks underlying Manhattan and much of the lower Hudson Valley. These rocks can build large stresses, and then suddenly transmit energy over long distances. The region's major highways, commuter and long-distance rail lines, and the main gas, oil and power transmission lines all run parallel with active faults (Sykes et al., 2008).

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goal of the project is to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 52 seismographic stations in seven states, including New York. (Lamont-Doherty 2014). In addition to the Lamont-Doherty Seismic Stations, the USGS operates a global network of seismic stations (GSN) to monitor seismic activity. While no seismic stations are located in New York State, nearby stations are positioned in State College, Pennsylvania and Oak Ridge, Massachusetts.

The Advanced National Seismic System (ANSS) is run by USGS. When earthquakes strike, ANSS delivers realtime information, providing situational awareness for emergency-response personnel. In regions with sufficient seismic stations, that information includes –within minutes–a ShakeMap showing the distribution of potentially damaging ground shaking, information used to target post-earthquake response efforts. ANSS stations are operated within the state at Lake Ozonia (St. Lawrence County) and the City of Binghamton (Broome County) (USGS 2018).

# **Previous Occurrences and Losses**

Earthquakes are not uncommon in the New York City metropolitan area and up to MMI VII have been observed in the past (Westchester County GIS 2001). Many sources provided historical information regarding previous occurrences and losses associated with earthquakes throughout New York State. Therefore, with so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the sources. According to the New York State 2019 HMP, since the first earthquake that probably took place on December 19, 1737, New York has had over 550 earthquakes centered within its state boundaries through 2016 (NYSDHES 2019). Figure 5.4.1-12 illustrates earthquake epicenters record in and around Westchester County from 1950 to 2021.

# FEMA Major Disasters and Emergency Declarations

Between 1954 and 2021, New York State was included in one earthquake-related major disaster (DR) or emergency (EM) declaration. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declaration. Westchester County was not included in any DRs or EMs related to earthquakes (FEMA 2021).

#### **USDA** Declarations

Between 2012 and 2021, there have been no USDA disaster declarations made for Westchester County related to earthquake events (USDA 2021).





# **Previous Events**

For this HMP, known earthquakes events that have impacted New York State and Westchester County between 2014 and 2021 are identified in Table 5.4.1-5. Many sources were researched for historical information regarding earthquake events in Westchester County; therefore, Table 5.4.1-5 may not include all earthquake events that have impacted the County.









Dates of Event	Event Type	Location	FEMA Declaration Number <b>(if</b> <b>applicable)</b>	County Designated?	Event Details*
October 29, 2019	Earthquake	Mamaroneck, NY	NA	NA	A 1.3 magnitude earthquake was recorded at 9AM on October 29 <sup>th</sup> 1 kilometer west of Mamaroneck NY with a 4 km depth. No damage was recorded.
July 23, 2018	Earthquake	Elmsford, NY	NA	NA	A 1.5 magnitude earthquake was recorded at 3PM on July 23rd 1 kilometer northwest of Elmsford NY with a 10.1 km depth. No damage was recorded.
May 31, 2018	Earthquake	Mamaroneck, NY	NA	NA	A 0.8 magnitude earthquake was recorded at 10AM on May 31 <sup>st</sup> 2 kilometer northwest of Mamaroneck NY with a 2 km depth. No damage was recorded.
January 12, 2016	Earthquake	Byram, CT	NA	NA	A 0.8 magnitude earthquake was recorded at 5AM on January 12 <sup>th</sup> near Byram CT, with a 2.4 km depth. No damage was recorded.
November 20, 2014	Earthquake	Byram, CT	NA	NA	A 1.5 magnitude earthquake was recorded at 7AM on November 20 <sup>th</sup> near Byram CT, with a 2 km depth. No damage was recorded.
May 12, 2014	Earthquake	Lincolndale, NY	NA	NA	A 1.5 magnitude earthquake was recorded around 4AM on May 12 <sup>th</sup> near Lincolndale NY, with a 3 km depth. No damage was recorded.
February 1, 2014	Earthquake	Rye Brook, NY	NA	NA	A 1.4 magnitude earthquake was recorded around 12:30PM on February 1 <sup>st</sup> near Rye Brook NY, with a 12 km depth. No damage was recorded.

#### Table 5.4.1-5. Earthquake Events Impacting Westchester County, 2014 to 2021

*Source(s):* NYS DHSES 2019; FEMA 2021; USGS 2021

\*Many sources were consumed to provide an update of previous occurrences and losses; event details and loss/impact information may very and has been summarized in the above table.

CTConnecticutDRMajor Disaster Declaration (FEMA)FEMAFederal Emergency Management Agency

Km Kilometer

N/A Not Applicable

NY New York

USGS U.S. Geological Survey





#### **Probability of Future Events**

The New York City Area Consortium for Earthquake Loss Mitigation (NYCOEM) ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala et al. 2003). The New York State Disaster Preparedness Commission (NYS DPC) and probabilistic maps for Westchester County indicate that the potential for earthquakes does exist in the County (NYS DHSES 2019). The location of Westchester County and past events indicate that earthquakes will continue to occur. However, impacts to Westchester County may be limited. The probability of occurrence for earthquakes in the county is considered *unlikely* (less than 1% annual chance of occurring). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

### **Climate Change Impacts**

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA 2004)

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

# 5.1.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 100-year, 500-year, and 2,500-year Mean Return Period (MRP) events through a Level 2 analysis in Hazus v5.0 to analyze the earthquake hazard and provide a range of loss estimates. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

# Impact on Life, Health, and Safety

The entire County may experience an earthquake. However, the degree of impact is dependent on many factors including the age and type of construction people live in, the soil types their homes are located on, and the intensity of the earthquake. Whether directly or indirectly impacted, residents could be faced with business closures, road closures that could isolate populations, and loss of function of critical facilities and utilities.

According to the 2015-2019 ACS 5-year population estimate, Westchester County had a population of 968,065 people. Overall, risk to public safety and loss of life from an earthquake in the County is minimal for low magnitude events. However, there is a higher risk to public safety for those inside buildings due to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake.

Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry construction. Of these most vulnerable populations, socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the poverty threshold, are most susceptible. Factors leadings to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. According to the 2015 –





2019 5-year ACS estimates, there are approximately 83,783 total persons living below the poverty level and 162,363 persons over the age of 65 years in Westchester County.

As noted earlier, NEHRP Soil Classes D and E can amplify ground shaking to damaging levels even during a moderate earthquake, and thus increase risk to the population. Populations within municipalities located on NEHRP Class D and E soils were estimated and are listed in Table 5.4.1-6. Approximately 45,798 residents (4.7-percent of the County's population) are located on NEHRP Class D and E soils. The Village of Ardsley has the greatest proportion of its population residing on NEHRP Class D and E soils (i.e., 28.1-percent).

	Total Population	Estimated Population Located in the Class D and F NFHRP Soil Hazard A		
	(American	Number of	IIII JUII HAZAI U AI CA	
Jurisdiction	2015-2019)	People	Percent of Total	
Ardsley (V)	4,512	1,268	28.1%	
Bedford (T)	17,803	240	1.3%	
Briarcliff Manor (V)	7,616	111	1.5%	
Bronxville (V)	6,409	0	0.0%	
Buchanan (V)	2,140	34	1.6%	
Cortlandt (T)	32,131	2,854	8.9%	
Croton-on-Hudson (V)	8,155	510	6.3%	
Dobbs Ferry (V)	11,070	596	5.4%	
Eastchester (T)	19,990	0	0.0%	
Elmsford (V)	5,085	547	10.8%	
Greenburgh (T)	44,829	6,730	15.0%	
Harrison (T)	28,135	993	3.5%	
Hastings-on-Hudson (V)	7,921	708	8.9%	
Irvington (V)	6,529	136	2.1%	
Larchmont (V)	6,096	0	0.0%	
Lewisboro (T)	12,599	268	2.1%	
Mamroneck (T)	11,298	0	0.0%	
Mamaroneck (V)	19,217	0	0.0%	
Mount Kisco (T)	10,866	894	8.2%	
Mount Pleasant (T)	27,000	3,179	11.8%	
Mount Vernon (C)	67,896	3,159	4.7%	
New Castle (T)	17,905	6	0.0%	
New Rochelle (C)	79,067	0	0.0%	
North Castle (T)	12,235	546	4.5%	
North Salem (T)	5,167	6	0.1%	
Ossining (T)	5,567	0	0.0%	
Ossining (V)	25,086	0	0.0%	
Peekskill (C)	24,075	141	0.6%	
Pelham (T)*	12,510	0	0.0%	
Pelham (V)	6,941	0	0.0%	
Pelham Manor (V)	5,569	0	0.0%	
Pleasantville (V)	7,221	864	12.0%	
Port Chester (V)	29,342	0	0.0%	
Pound Ridge (T)	5,177	82	1.6%	
Rye (C)	15,820	0	0.0%	
Rye Brook (V)	9,487	455	4.8%	
Scarsdale (T)	17,837	22	0.1%	
Sleepy Hollow (V)	10,122	1,251	12.4%	
Somers (T)	21,487	157	0.7%	
Tarrytown (V)	11,436	1,226	10.7%	
Tuckahoe (V)	6,584	0	0.0%	
White Plains (C)	58,137	7,576	13.0%	
Yonkers (C)	199,968	9,897	4.9%	

### Table 5.4.1-6. Estimated Population Located on NEHRP Class D or Class E Soil Types





	Total Population (American	Estimated Population Located in the Class D and E NEHRP Soil Hazard Area		
Jurisdiction	Community Survey 2015-2019)	Number of People	Percent of Total	
Yorktown (T)	36,538	1,340	3.7%	
Westchester County (Total)	968,065	45,798	4.7%	

Sources: American Community Survey 2015-2019; NYS n.d.

Notes: NEHRP = National Earthquake Hazard Reduction Program; C = City; T = Town; V = Village; % = Percent \*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

As a result of a significant earthquake event, residents may be displaced or require temporary to long-term sheltering. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. Hazus estimates that there will be zero displaced households and zero persons seeking short-term sheltering caused by the 100-year MRP event. Table 5.4.1-7 summarizes the estimated number of displaced households and persons seeking short-term sheltering caused by the 500-year and 2,500-year MRP events.

able bill / Estimated Displaced Households and Mainber of Fersons Requiring billetering
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	500	-Year MRP	2,500-Year MRP		
Jurisdiction	Displaced Households	People Requiring Short-Term Shelter	Displaced Households	People Requiring Short-Term Shelter	
Ardsley (V)	0	0	0	0	
Bedford (T)	0	0	0	0	
Briarcliff Manor (V)	0	0	0	0	
Bronxville (V)	0	0	0	0	
Buchanan (V)	0	0	0	0	
Cortlandt (T)	0	0	2	1	
Croton-on-Hudson (V)	0	0	1	0	
Dobbs Ferry (V)	0	0	1	1	
Eastchester (T)	0	0	1	0	
Elmsford (V)	0	0	0	0	
Greenburgh (T)	0	0	5	3	
Harrison (T)	0	0	1	1	
Hastings-on-Hudson (V)	0	0	2	1	
Irvington (V)	0	0	0	0	
Larchmont (V)	0	0	0	0	
Lewisboro (T)	0	0	0	0	
Mamroneck (T)	0	0	1	0	
Mamaroneck (V)	0	0	1	1	
Mount Kisco (T)	0	0	2	1	
Mount Pleasant (T)	0	0	1	0	
Mount Vernon (C)	0	0	8	6	
New Castle (T)	0	0	0	0	
New Rochelle (C)	0	0	4	3	
North Castle (T)	0	0	0	0	
North Salem (T)	0	0	0	0	
Ossining (T)	0	0	0	0	
Ossining (V)	0	0	2	1	
Peekskill (C)	0	0	3	2	
Pelham (T)*	0	0	0	0	
Pelham (V)	0	0	0	0	
Pelham Manor (V)	0	0	0	0	
Pleasantville (V)	0	0	0	0	
Port Chester (V)	0	0	1	1	
Pound Ridge (T)	0	0	0	0	
Rye (C)	0	0	0	0	





	500	-Year MRP	2,500-Year MRP			
Jurisdiction	Displaced Households	People Requiring Short-Term Shelter	Displaced Households	People Requiring Short-Term Shelter		
Rye Brook (V)	0	0	0	0		
Scarsdale (T)	0	0	0	0		
Sleepy Hollow (V)	0	0	2	2		
Somers (T)	0	0	0	0		
Tarrytown (V)	0	0	2	1		
Tuckahoe (V)	0	0	0	0		
White Plains (C)	0	0	12	7		
Yonkers (C)	1	0	34	25		
Yorktown (T)	0	0	1	1		
Westchester County (Total)	1	1	91	60		

Sources: Hazus v5.0

*Notes: C* = *City; T* = *Town; V* = *Village; MRP* = *Mean Return Period* 

\*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

According to the 1999-2003 NYCEM Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), a strong correlation exists between structural building damage and number of injuries and casualties from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, Hazus considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial, and industrial sectors are at their maximum at 2:00 p.m., with peak commute time at 5:00 p.m. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself. Overall, Hazus estimates that there are no injuries or casualties caused by the 100-year MRP event. Table 5.4.1-8 and Table 5.4.1-9 summarize the estimated number of injuries or casualties caused by the 500-year and 2,500-year MRP events.

# Table 5.4.1-8. Estimated Number of Injuries and Casualties Caused by the 500-Year MRP EarthquakeEvent

	Time of Day					
Level of Severity	2:00 AM	2:00 PM	5:00 PM			
Injuries	3	11	4			
Hospitalization	0	1	0			
Casualties	0	0	0			

Sources: Hazus v5.0 Notes: MRP = Mean Return Period

# Table 5.4.1-9. Estimated Number of Injuries and Casualties Caused by the 2,500-Year MRP Earthquake Event

	Time of Day						
Level of Severity	2:00 AM	2:00 PM	5:00 PM				
Injuries	51	121	51				
Hospitalization	4	19	6				
Casualties	0	3	1				

Sources: Hazus v5.0

Notes: MRP = Mean Return Period

# **Impact on General Building Stock**

The entire County's general building stock is considered at risk and exposed to this hazard. As stated earlier, soft soils (NEHRP Soil Classes D and E) can amplify ground shaking to damaging levels even during a moderate





earthquake (NYCEM 2003). Therefore, buildings located on NEHRP Classes D and E soils are at increased risk of damage from an earthquake. Table 5.4.1-10 summarizes the number and replacement cost value of buildings in Westchester located on NEHRP Class D and E soils. Overall, approximately 5.3-percent of Westchester County's buildings are built on NEHRP Class D and E soils.

			Estimated Building Stock Located in the Class D or				
			Class	s E NEHRP	Soil Hazard Area		
	Total	Total			Replacement		
	Number of	Replacement	Number of	Percent	Cost Value	Percent	
Jurisdiction	Buildings	Cost Value (RCV)	Buildings	of Total	(RCV)	of Total	
Ardsley (V)	1,600	\$1,184,178,473	493	30.8%	\$686,627,721	58.0%	
Bedford (T)	7,842	\$6,187,290,490	122	1.6%	\$77,032,631	1.2%	
Briarcliff Manor (V)	2,821	\$2,929,350,441	44	1.6%	\$217,427,410	7.4%	
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%	
Buchanan (V)	1,153	\$1,174,838,972	71	6.2%	\$209,471,960	17.8%	
Cortlandt (T)	11,740	\$7,539,300,494	1,048	8.9%	\$559,136,026	7.4%	
Croton-on-Hudson (V)	3,412	\$5,339,173,282	216	6.3%	\$225,828,280	4.2%	
Dobbs Ferry (V)	2,888	\$3,524,751,416	156	5.4%	\$140,971,096	4.0%	
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%	
Elmsford (V)	1,358	\$2,719,155,604	254	18.7%	\$1,596,147,421	58.7%	
Greenburgh (T)	14,313	\$42,009,346,893	2,226	15.6%	\$7,595,550,693	18.1%	
Harrison (T)	7,813	\$10,415,934,158	291	3.7%	\$581,989,322	5.6%	
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	258	9.2%	\$264,564,018	2.0%	
Irvington (V)	1,736	\$1,575,655,219	39	2.2%	\$22,772,322	1.4%	
Larchmont (V)	2,281	\$3,287,198,418	0	0.0%	\$0	0.0%	
Lewisboro (T)	6,358	\$5,313,683,830	156	2.5%	\$228,731,204	4.3%	
Mamroneck (T)	4,065	\$2,363,450,350	0	0.0%	\$0	0.0%	
Mamaroneck (V)	5,699	\$7,321,897,360	0	0.0%	\$0	0.0%	
Mount Kisco (T)	3,002	\$5,913,464,031	353	11.8%	\$1,311,312,466	22.2%	
Mount Pleasant (T)	9,863	\$8,309,807,831	1,352	13.7%	\$2,230,037,898	26.8%	
Mount Vernon (C)	12,648	\$17,021,941,779	701	5.5%	\$1,788,355,018	10.5%	
New Castle (T)	6,759	\$4,957,954,777	2	0.0%	\$1,345,124	0.0%	
New Rochelle (C)	17,044	\$42,795,863,468	0	0.0%	\$0	0.0%	
North Castle (T)	5,391	\$5,067,704,057	312	5.8%	\$513,327,733	10.1%	
North Salem (T)	2,870	\$2,372,126,897	9	0.3%	\$5,558,243	0.2%	
Ossining (T)	2,266	\$1,382,487,862	0	0.0%	\$0	0.0%	
Ossining (V)	5,874	\$6,071,219,565	0	0.0%	\$0	0.0%	
Peekskill (C)	6,001	\$6,315,622,346	69	1.1%	\$86,802,261	1.4%	
Pelham (T)*	4,596	\$3,648,777,424	0	0.0%	\$0	0.0%	
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%	
Pelham Manor (V)	2,219	\$1,264,533,925	0	0.0%	\$0	0.0%	
Pleasantville (V)	2,919	\$2,842,599,318	394	13.5%	\$597,331,641	21.0%	
Port Chester (V)	6,424	\$7,869,067,479	0	0.0%	\$0	0.0%	
Pound Ridge (T)	3,025	\$1,596,752,944	46	1.5%	\$24,013,934	1.5%	
Rye (C)	5,632	\$5,820,922,260	0	0.0%	\$0	0.0%	
Kye Brook (V)	3,591	\$4,892,231,021	167	4./%	\$66,515,367	1.4%	
Scarsdale (1)	6,829	\$4,603,749,394	8	0.1%	\$3,039,940	0.1%	
Sleepy Hollow (V)	1,921	\$1,990,885,470	256	13.3%	\$390,871,736	19.6%	
Somers (1)	11,490	\$6,092,204,344	125	1.1%	\$95,935,122	1.5%	
Translasha a (V)	3,0/8	\$1,284,273,369	305	9.9%	\$197,131,653	2./%	
Tuckanoe (V)	1,000	\$1,530,366,709	0	0.0%	\$U \$10,172,000,975	0.0%	
White Plains (C)	13,986	\$61,499,698,595	2,55/	10./%	\$19,1/3,990,8/5	51.2%	
TONKETS (C)	33,912	\$30,044,348,876 \$10,502,786,706	1,990	5.9%	\$0,730,949,762 \$1,210,062,615	13.3%	
I Officient (1) Westehoston County (Total)	15,922	\$19,303,780,790 \$402 045 561 579	14 356	4.0%	\$1,510,002,015	0./%	
westenester County (10tal)	207,7/4	QTU4,7TJ,JU1,J/0	14,330	3.370	\$t0,730,031,492	11.//0	

# Table 5.4.1-10. Estimated Building Stock Located on NEHRP Class D or Class E Soil Types

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NYS n.d.



Notes: NEHRP = National Earthquake Hazard Reduction Program; C = City; T = Town; V = Village; % = Percent \*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

There is a strong correlation between PGA and damage a building might undergo (NYCEM 2019). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Westchester County. See Figure 5.4.1-3 through Figure 5.4.1-5 earlier in this profile which illustrates the geographic distribution of PGA (g) across the County for the 100-year, 500-year, and 2,500-year MRP events at the Census-tract level.

A building's construction determines how well it can withstand the force of an earthquake. The NYCEM Hazard Mitigation Plan indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this Hazus analysis, the building ages and building types from the inventory were incorporated into the Hazus model.

Potential building damage was evaluated by Hazus across the following damage categories: none, slight, moderate, extensive, and complete. Table 5.4.1-11 provides definitions of these five categories of damage for a light wood-framed building. Definitions for other building types are included in the Hazus technical manual documentation. The results of potential damage states for buildings in Westchester County categorized by general occupancy classes (i.e., residential, commercial, industrial, etc.) from Hazus are summarized in Table 5.4.1-11 for the 500-year and 2,500-year MRP events. Hazus estimates that there are zero damages to structures caused by the 100-year MRP event.

Table 5.4.1-11. Examp	able 5.1.1 11. Example of 5ti actural Damage State Definitions for a light wood 11amed Dahamg					
Damage Category	Description					
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.					
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.					
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.					
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of					

collapse due to cripple-wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

 Table 5.4.1-11. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Source: Hazus Technical Manual

# Table 5.4.1-12. Estimated Buildings Damaged by General Occupancy for the 500-Year and 2,500-Year MRP Earthquake Events

			Earthqı	ıake 500-Year	Earthquake 2,500-Year	
Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
Residential Exposure	241,605	None	240,617	99.6%	228,552	94.6%
(Single and Multi-		Slight	916	0.4%	11,398	4.7%
Family Dwellings)		Moderate	72	0.0%	1,564	0.6%
		Extensive	0	0.0%	91	0.0%



			Earthqu	uake 500-Year	Earthquake 2,500-Year	
Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Building Count	Percent Buildings in Occupancy Class	Building Count	Percent Buildings in Occupancy Class
		Complete Destruction	0	0.0%	1	0.0%
Commercial	20,857	None	20,757	99.5%	19,868	95.3%
Buildings		Slight	86	0.4%	788	3.8%
		Moderate	12	0.1%	182	0.9%
		Extensive	1	0.0%	16	0.1%
		Complete	0	0.0%	3	0.0%
		Destruction				
Industrial Buildings	1,059	None	1,033	97.5%	899	84.9%
		Slight	19	1.8%	101	9.5%
		Moderate	6	0.6%	49	4.6%
		Extensive	1	0.1%	10	0.9%
		Complete Destruction	0	0.0%	1	0.1%
Government,	6,453	None	6,372	98.7%	5,866	90.9%
Religion,		Slight	63	1.0%	420	6.5%
Agricultural, and		Moderate	16	0.2%	142	2.2%
Education Buildings		Extensive	2	0.0%	23	0.4%
		Complete	0	0.0%	3	0.0%
		Destruction				

Sources: Hazus v5.0

Nestchester

Notes: MRP = Mean Return Period; % = Percent

Building damage as a result of the 100-year, 500-year, and 2,500-year MRP earthquakes were estimated for each municipality using Hazus. Hazus estimates that zero damages will occur to buildings or contents during the 100-year MRP event. Table 5.4.1-13 and Table 5.4.1-14 summarize estimated total building and content losses caused by the 500-year and 2,500-year MRP events by jurisdiction, respectively. These tables also summarize losses for structures categorized as residential, commercial, and all other occupancy classes. Less than 0.1-percent of the County's structures are impacted by the 500-year MRP event (i.e., approximately \$96.8 million in replacement cost value) and approximately 0.6-percent of the County's structures are estimated to occur in the City of White Plains.





# Table 5.4.1-13. Estimated Building Damages (Structure and Contents) from the 500-year MRP Earthquake Event

			500-	Year MRP		
			Percent of Total			Estimated
		Estimated	Building and Contents	Estimated	Estimated	Damages for
	Replacement Cost	Total	Replacement Cost	Residential	Commercial	All Other
Jurisdiction	Value (RCV)	Damage	Value	Damage	Damage	Occupancies
Ardsley (V)	\$1,184,178,473	\$357,423	<0.1%	\$176,199	\$108,692	\$72,533
Bedford (T)	\$6,187,290,490	\$754,139	<0.1%	\$415,974	\$157,106	\$181,059
Briarcliff Manor (V)	\$2,929,350,441	\$365,622	<0.1%	\$183,354	\$121,086	\$61,183
Bronxville (V)	\$2,422,176,980	\$262,128	<0.1%	\$68,153	\$119,349	\$74,626
Buchanan (V)	\$1,174,838,972	\$268,897	<0.1%	\$61,152	\$169,516	\$38,229
Cortlandt (T)	\$7,539,300,494	\$1,319,749	<0.1%	\$918,148	\$246,560	\$155,041
Croton-on-Hudson (V)	\$5,339,173,282	\$859,831	<0.1%	\$157,386	\$660,728	\$41,717
Dobbs Ferry (V)	\$3,524,751,416	\$721,316	<0.1%	\$170,333	\$344,432	\$206,551
Eastchester (T)	\$4,342,629,796	\$442,120	<0.1%	\$205,829	\$144,251	\$92,040
Elmsford (V)	\$2,719,155,604	\$481,138	<0.1%	\$68,291	\$283,745	\$129,102
Greenburgh (T)	\$42,009,346,893	\$9,705,094	<0.1%	\$1,136,231	\$5,166,559	\$3,402,305
Harrison (T)	\$10,415,934,158	\$1,245,463	<0.1%	\$479,103	\$457,336	\$309,025
Hastings-on-Hudson (V)	\$13,267,692,589	\$11,237,323	0.1%	\$188,853	\$799,399	\$10,249,071
Irvington (V)	\$1,575,655,219	\$235,259	<0.1%	\$109,215	\$42,993	\$83,051
Larchmont (V)	\$3,287,198,418	\$318,577	<0.1%	\$97,131	\$194,594	\$26,852
Lewisboro (T)	\$5,313,683,830	\$696,635	<0.1%	\$572,258	\$25,358	\$99,018
Mamroneck (T)	\$2,363,450,350	\$290,176	<0.1%	\$181,541	\$81,234	\$27,401
Mamaroneck (V)	\$7,321,897,360	\$801,568	<0.1%	\$243,537	\$386,841	\$171,190
Mount Kisco (T)	\$5,913,464,031	\$1,282,439	<0.1%	\$177,482	\$977,751	\$127,207
Mount Pleasant (T)	\$8,309,807,831	\$1,979,196	<0.1%	\$721,251	\$741,352	\$516,593
Mount Vernon (C)	\$17,021,941,779	\$3,714,037	<0.1%	\$578,320	\$2,028,507	\$1,107,211
New Castle (T)	\$4,957,954,777	\$576,220	<0.1%	\$367,047	\$100,744	\$108,430
New Rochelle (C)	\$42,795,863,468	\$4,178,328	<0.1%	\$775,272	\$2,803,321	\$599,735
North Castle (T)	\$5,067,704,057	\$819,298	<0.1%	\$375,577	\$260,720	\$183,001
North Salem (T)	\$2,372,126,897	\$298,612	<0.1%	\$192,383	\$36,520	\$69,710
Ossining (T)	\$1,382,487,862	\$172,365	<0.1%	\$103,555	\$40,473	\$28,337
Ossining (V)	\$6,071,219,565	\$813,674	<0.1%	\$206,331	\$311,316	\$296,027
Peekskill (C)	\$6,315,622,346	\$946,564	<0.1%	\$302,043	\$456,564	\$187,956
Pelham (T)*	\$3,648,777,424	\$384,668	<0.1%	\$163,374	\$132,621	\$88,673
Pelham (V)	\$2,384,243,499	\$233,487	<0.1%	\$74,863	\$112,212	\$46,412
Pelham Manor (V)	\$1,264,533,925	\$151,181	<0.1%	\$88,511	\$20,409	\$42,261
Pleasantville (V)	\$2,842,599,318	\$421,173	<0.1%	\$140,683	\$200,813	\$79,677
Port Chester (V)	\$7,869,067,479	\$735,794	<0.1%	\$231,144	\$441,341	\$63,309
Pound Ridge (T)	\$1,596,752,944	\$194,634	<0.1%	\$170,025	\$9,289	\$15,319





			500-	Year MRP		
Jurisdiction	Replacement Cost Value (RCV)	Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Rye (C)	\$5,820,922,260	\$698,626	<0.1%	\$321,987	\$200,563	\$176,075
Rye Brook (V)	\$4,892,231,021	\$559,268	<0.1%	\$227,737	\$256,584	\$74,946
Scarsdale (T)	\$4,603,749,394	\$539,855	<0.1%	\$367,307	\$71,669	\$100,880
Sleepy Hollow (V)	\$1,990,885,470	\$552,622	<0.1%	\$127,271	\$371,301	\$54,050
Somers (T)	\$6,092,204,344	\$797,378	<0.1%	\$532,979	\$68,239	\$196,160
Tarrytown (V)	\$7,284,273,569	\$1,288,494	<0.1%	\$185,381	\$835,452	\$267,662
Tuckahoe (V)	\$1,530,366,709	\$138,903	<0.1%	\$67,388	\$56,134	\$15,381
White Plains (C)	\$61,499,698,595	\$29,217,447	<0.1%	\$10,076,267	\$17,188,976	\$1,952,205
Yonkers (C)	\$50,644,348,876	\$13,271,419	<0.1%	\$1,771,092	\$8,348,016	\$3,152,312
Yorktown (T)	\$19,503,786,796	\$2,835,275	<0.1%	\$2,154,473	\$233,824	\$446,978
Westchester County (Total)	\$402,945,561,578	\$96,778,747	<0.1%	\$25,769,055	\$45,681,868	\$25,327,824

Sources: Hazus v5.0; Westchester County GIS 2020; NYS GIS 2021; RS Means 2021

Notes: C = City; T = Town; V = Village; % = Percent; MRP = Mean Return Period; < = Less Than\*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

#### Table 5.4.1-14. Estimated Building Damages (Structure and Contents) from the 2,500-year MRP Earthquake Event

		2,500-Year MRP								
Jurisdiction	Replacement Cost Value (RCV)	Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies				
Ardsley (V)	\$1,184,178,473	\$9,110,158	0.8%	\$4,556,266	\$3,157,232	\$1,396,660				
Bedford (T)	\$6,187,290,490	\$22,932,919	0.4%	\$11,267,054	\$7,351,736	\$4,314,129				
Briarcliff Manor (V)	\$2,929,350,441	\$12,417,353	0.4%	\$5,161,921	\$5,785,419	\$1,470,014				
Bronxville (V)	\$2,422,176,980	\$9,373,542	0.4%	\$2,016,220	\$6,161,693	\$1,195,629				
Buchanan (V)	\$1,174,838,972	\$7,493,900	0.6%	\$1,733,413	\$4,819,655	\$940,831				
Cortlandt (T)	\$7,539,300,494	\$38,736,114	0.5%	\$26,136,947	\$8,723,309	\$3,875,858				
Croton-on-Hudson (V)	\$5,339,173,282	\$29,848,620	0.6%	\$4,685,837	\$24,147,193	\$1,015,590				
Dobbs Ferry (V)	\$3,524,751,416	\$19,999,912	0.6%	\$4,718,263	\$11,111,938	\$4,169,711				
Eastchester (T)	\$4,342,629,796	\$16,106,221	0.4%	\$6,178,428	\$7,911,722	\$2,016,071				
Elmsford (V)	\$2,719,155,604	\$14,590,839	0.5%	\$1,873,301	\$10,017,316	\$2,700,222				





				2.50	0-Year MRP	
			Percent of	,		
			Total			
			<b>Building and</b>			
	Replacement	Estimated	Contents	Estimated	Estimated	
	Cost Value	Total	Replacement	Residential	Commercial	Estimated Damages for All Other
Jurisdiction	(RCV)	Damage	Cost Value	Damage	Damage	Occupancies
Greenburgh (T)	\$42,009,346,893	\$247,644,144	0.6%	\$29,247,967	\$153,034,525	\$65,361,652
Harrison (T)	\$10,415,934,158	\$41,426,939	0.4%	\$13,644,684	\$21,092,734	\$6,689,521
Hastings-on-Hudson (V)	\$13,267,692,589	\$194,487,865	1.5%	\$4,833,575	\$15,421,887	\$174,232,404
Irvington (V)	\$1,575,655,219	\$7,047,869	0.4%	\$2,986,001	\$2,261,075	\$1,800,793
Larchmont (V)	\$3,287,198,418	\$12,434,032	0.4%	\$2,686,461	\$9,186,038	\$561,534
Lewisboro (T)	\$5,313,683,830	\$18,309,457	0.3%	\$15,560,300	\$833,443	\$1,915,714
Mamroneck (T)	\$2,363,450,350	\$9,506,776	0.4%	\$5,161,462	\$3,741,424	\$603,891
Mamaroneck (V)	\$7,321,897,360	\$28,443,136	0.4%	\$6,784,720	\$18,318,556	\$3,339,860
Mount Kisco (T)	\$5,913,464,031	\$35,268,604	0.6%	\$4,863,589	\$27,924,425	\$2,480,590
Mount Pleasant (T)	\$8,309,807,831	\$52,591,444	0.6%	\$18,934,092	\$23,509,550	\$10,147,802
Mount Vernon (C)	\$17,021,941,779	\$95,917,894	0.6%	\$15,649,940	\$54,435,847	\$25,832,107
New Castle (T)	\$4,957,954,777	\$18,405,989	0.4%	\$10,520,791	\$5,183,311	\$2,701,887
New Rochelle (C)	\$42,795,863,468	\$168,295,743	0.4%	\$22,071,343	\$135,153,991	\$11,070,409
North Castle (T)	\$5,067,704,057	\$24,017,111	0.5%	\$10,411,868	\$9,724,645	\$3,880,598
North Salem (T)	\$2,372,126,897	\$7,454,881	0.3%	\$4,965,356	\$1,475,579	\$1,013,946
Ossining (T)	\$1,382,487,862	\$5,496,062	0.4%	\$2,994,159	\$1,771,418	\$730,485
Ossining (V)	\$6,071,219,565	\$25,348,636	0.4%	\$6,017,993	\$14,615,125	\$4,715,519
Peekskill (C)	\$6,315,622,346	\$27,936,138	0.4%	\$7,758,844	\$15,818,958	\$4,358,336
Pelham (T)*	\$3,648,777,424	\$14,054,709	0.4%	\$4,925,613	\$7,292,482	\$1,836,613
Pelham (V)	\$2,384,243,499	\$9,349,833	0.4%	\$2,277,665	\$6,069,248	\$1,002,920
Pelham Manor (V)	\$1,264,533,925	\$4,704,876	0.4%	\$2,647,948	\$1,223,235	\$833,693
Pleasantville (V)	\$2,842,599,318	\$11,698,448	0.4%	\$3,708,838	\$6,513,810	\$1,475,800
Port Chester (V)	\$7,869,067,479	\$25,076,711	0.3%	\$6,811,128	\$16,953,824	\$1,311,760
Pound Ridge (T)	\$1,596,752,944	\$5,178,080	0.3%	\$4,486,122	\$388,946	\$303,012
Rye (C)	\$5,820,922,260	\$21,830,561	0.4%	\$8,548,748	\$10,456,256	\$2,825,558
Rye Brook (V)	\$4,892,231,021	\$20,295,422	0.4%	\$6,171,838	\$12,252,467	\$1,871,117
Scarsdale (T)	\$4,603,749,394	\$17,425,194	0.4%	\$10,958,369	\$3,987,876	\$2,478,949
Sleepy Hollow (V)	\$1,990,885,470	\$12,833,209	0.6%	\$3,647,370	\$8,100,023	\$1,085,816
Somers (T)	\$6,092,204,344	\$20,392,542	0.3%	\$13,863,211	\$3,280,902	\$3,248,429
Tarrytown (V)	\$7,284,273,569	\$40,185,947	0.6%	\$5,370,502	\$27,157,323	\$7,658,122
Tuckahoe (V)	\$1,530,366,709	\$5,623,658	0.4%	\$2,082,702	\$3,073,718	\$467,238
White Plains (C)	\$61,499,698,595	\$605,461,047	1.0%	\$218,762,406	\$350,666,640	\$36,032,001
Yonkers (C)	\$50,644,348,876	\$310,085,884	0.6%	\$48,085,688	\$208,009,172	\$53,991,023
Yorktown (T)	\$19,503,786,796	\$81,852,362	0.4%	\$61,976,949	\$10,613,918	\$9,261,495





		2,500-Year MRP							
			Percent of Total Building and						
	Replacement	Estimated	Contents	Estimated	Estimated				
	Cost Value	Total	Replacement	Residential	Commercial	Estimated Damages for All Other			
Jurisdiction	(RCV)	Damage	Cost Value	Damage	Damage	Occupancies			
Westchester County (Total)	\$402,945,561,578	\$2,392,636,077	0.6%	\$652,820,279	\$1,271,437,102	\$468,378,696			

Sources: Hazus v5.0; Westchester County GIS 2020; NYS GIS 2021; RS Means 2021 Notes: C = City; T = Town; V = Village; % = Percent; MRP = Mean Return Period\*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor





Historically, Building Officials Code Administration (BOCA) regulations in the northeast states were developed to address local concerns, including heavy snow loads and wind. Seismic requirements for design criteria are not as stringent as those of the west coast of the United States, which rely on the more seismically focused Uniform Building Code. As such, a smaller earthquake in the northeast can cause more structural damage than if it would occur in the west.

# **Impact on Critical Facilities and Lifelines**

All critical facilities and lifelines in Westchester County are considered exposed to the earthquake hazard. Refer to subsection "Critical Facilities and Lifelines" in Section 4 (County Profile) of this HMP for a complete inventory of critical facilities in Westchester County.

The number of critical facilities and lifelines built on NEHRP Class D and Class E soil types was assessed. Overall, there are 505 critical facilities located on soils prone to ground shaking during an earthquake event. Of these critical facilities, 443 are considered lifelines for the County. Refer to Table 5.4.1-15 and Table 5.4.1-16 which summarize the number of facilities by jurisdiction and the number of lifelines categorized by FEMA lifeline categories located on NEHRP Class D and Class E soil types, respectively. Appendix F provides a table summarizing the distribution of critical facilities by critical facility type within each jurisdiction located on these soil types.

# Table 5.4.1-15. Estimated Number of Critical Facilities and Lifelines Located on NEHRP Class D and Class E Soil Types

	Total		Number of Critical Facilities and Lifeline Facilities Located in the NEHRP Soil Class D or Soil Class E Earthquake Hazard Area						
Jurisdiction	Number of Critical Facilities	Total Number of Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines			
Ardsley (V)	21	21	12	57.1%	12	57.1%			
Bedford (T)	173	160	4	2.3%	4	2.5%			
Briarcliff Manor (V)	43	38	0	0.0%	0	0.0%			
Bronxville (V)	19	19	0	0.0%	0	0.0%			
Buchanan (V)	21	18	5	23.8%	4	22.2%			
Cortlandt (T)	165	143	20	12.1%	19	13.3%			
Croton-on-Hudson (V)	57	51	5	8.8%	5	9.8%			
Dobbs Ferry (V)	43	34	7	16.3%	7	20.6%			
Eastchester (T)	51	43	0	0.0%	0	0.0%			
Elmsford (V)	22	16	10	45.5%	8	50.0%			
Greenburgh (T)	245	217	48	19.6%	41	18.9%			
Harrison (T)	139	117	7	5.0%	5	4.3%			
Hastings-on-Hudson (V)	37	27	14	37.8%	11	40.7%			
Irvington (V)	37	35	4	10.8%	4	11.4%			
Larchmont (V)	31	26	0	0.0%	0	0.0%			
Lewisboro (T)	174	169	23	13.2%	23	13.6%			
Mamroneck (T)	27	25	0	0.0%	0	0.0%			
Mamaroneck (V)	98	83	0	0.0%	0	0.0%			
Mount Kisco (T)	83	78	18	21.7%	18	23.1%			
Mount Pleasant (T)	355	340	47	13.2%	45	13.2%			
Mount Vernon (C)	251	165	15	6.0%	11	6.7%			
New Castle (T)	75	67	0	0.0%	0	0.0%			
New Rochelle (C)	238	182	0	0.0%	0	0.0%			
North Castle (T)	174	169	10	5.7%	10	5.9%			
North Salem (T)	116	114	0	0.0%	0	0.0%			
Ossining (T)	24	18	0	0.0%	0	0.0%			
Ossining (V)	94	83	0	0.0%	0	0.0%			





	Total		Number of Critical Facilities and Lifeline Facilities Located in the NEHRP Soil Class D or Soil Class E Earthquake Hazard Area						
Jurisdiction	Number of Critical Facilities	Total Number of Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines			
Peekskill (C)	141	106	15	10.6%	15	14.2%			
Pelham (T)*	36	30	0	0.0%	0	0.0%			
Pelham (V)	16	13	0	0.0%	0	0.0%			
Pelham Manor (V)	20	17	0	0.0%	0	0.0%			
Pleasantville (V)	47	45	14	29.8%	14	31.1%			
Port Chester (V)	110	93	0	0.0%	0	0.0%			
Pound Ridge (T)	42	41	0	0.0%	0	0.0%			
Rye (C)	77	72	0	0.0%	0	0.0%			
Rye Brook (V)	61	53	1	1.6%	1	1.9%			
Scarsdale (T)	39	34	0	0.0%	0	0.0%			
Sleepy Hollow (V)	51	36	14	27.5%	7	19.4%			
Somers (T)	194	182	12	6.2%	11	6.0%			
Tarrytown (V)	67	60	14	20.9%	13	21.7%			
Tuckahoe (V)	19	16	0	0.0%	0	0.0%			
White Plains (C)	227	175	71	31.3%	63	36.0%			
Yonkers (C)	590	436	101	17.1%	83	19.0%			
Yorktown (T)	145	114	14	9.7%	9	7.9%			
Westchester County (Total)	4,659	3,951	505	10.8%	443	11.2%			

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; NYS GIS n.d.

Notes: NEHRP = National Earthquake Hazard Reduction Program; C = City; T = Town; V = Village; % = Percent\*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

# Table 5.4.1-16. Estimated Number of Lifelines Categorized by FEMA Lifeline Category Located onNEHRP Class D or Class E Soil Types

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Class D or Class E NEHRP Soil Hazard Area
Communications	36	4
Energy	240	34
Food, Water, Shelter	1,495	166
Hazardous Materials	61	21
Health and Medical	102	15
Safety and Security	1,363	156
Transportation	211	47
Westchester County (Total)	3,508	443

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; NYS GIS n.d.; FEMA 2021 Notes: NEHRP = National Earthquake Hazard Reduction Program

The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities in Westchester County for the 100-year, 500-year, and 2,500-year MRP events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example, Hazus might estimate that a facility has 5% chance of being fully functional at Day 3, and a 95% chance of being fully functional at Day 90. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

As a result of a 100-year MRP event, Hazus estimates that critical facilities will be nearly 100-percent functional with negligible damages. Therefore, the impact to critical facilities is not significant for the 100-year event.





Whereas, for the 500-year and 2,500-year MRP events, functionality can approximately decrease as low as 13.2-percent and 54.9-percent. Table 5.4.1-17 through Table 5.4.1-19 summarizes the damage state probabilities for critical facilities during the 100-year, 500-year, and 2,500-year MRP events, respectively.





# Table 5.4.1-17. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Westchester County for the 100-Year MRPEarthquake Event

	Pe	ercent Probabi	lity of Sustain	ing Damage		Percent Functionality				
Name	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90	
<b>Essential Facilities</b>	l									
EOC	98.9% - 99.9%	<0.1% - 0.9%	<0.1% - 0.2%	0.0% - <0.1%	0.0%	98.8% - 99.9%	99.7% - 99.9%	99.9%	99.9%	
Medical Facilities	99.9% - 100.0%	0.0% - <0.1%	0.0%	0.0%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Police Stations	98.9% - 99.9%	<0.1% - 0.9%	<0.1% - 0.2%	0.0% - <0.1%	0.0%	98.8% - 99.9%	99.7% - 99.9%	99.9%	99.9%	
Fire Stations/EMS	99.7% - 99.9%	<0.1% - 0.3%	<0.1%	0.0% - <0.1%	0.0%	99.6% - 99.9%	99.9%	99.9%	99.9%	
Schools	99.7% - 99.9%	<0.1% - 0.3%	<0.1%	0.0% - <0.1%	0.0%	99.6% - 99.9%	99.9%	99.9%	99.9%	
Utilities										
Communication	99.5% - 100.0%	0.0% - 0.4%	0.0% - <0.1%	0.0% - <0.1%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Electric Power	99.8% - 99.9%	<0.1% - 0.1%	0.0% - <0.1%	0.0% - <0.1%	0.0%	99.8% - 99.9%	99.9%	99.9%	99.9%	
Potable Water	99.2% - 99.9%	<0.1% - 0.5%	<0.1% - 0.3%	0.0% - <0.1%	0.0%	99.5% - 99.9%	99.9%	99.9%	99.9%	
Wastewater	99.2% - 100.0%	0.0% - 0.5%	0.0% - 0.3%	0.0% - <0.1%	0.0%	99.3% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Transportation										
Airports	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	
<b>Bus Facilities</b>	99.9% - 100.0%	0.0% - <0.1%	0.0%	0.0%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Ferry Facilities	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	
Highway Bridges	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	
Rail Facilities	99.9% - 100.0%	0.0% - <0.1%	0.0%	0.0%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Port Facilities	99.9% - 100.0%	0.0% - <0.1%	0.0%	0.0%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021 Notes: EOC = Emergency Operation Center; EMS = Emergency Medical Services; < = Less Than; % = Percent

# Table 5.4.1-18. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Westchester County for the 500-Year MRPEarthquake Event

	F	Percent Probał	oility of Sustai	ning Damage		Percent Functionality					
Name	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90		
Essential Facilities											
EOC	86.9% - 98.7%	1.0% - 8.8%	0.3% - 3.7%	<0.1% - 0.6%	0.0% - <0.1%	86.8% - 98.7%	95.4% - 99.6%	99.3% - 99.9%	99.6% - 99.9%		
Medical Facilities	98.7% - 99.9%	<0.1% - 1.0%	0.0% - 0.2%	0.0% - <0.1%	0.0%	98.7% - 99.9%	99.7% - 99.9%	99.9%	99.9%		
Police Stations	86.9% - 98.7%	1.0% - 8.8%	0.2% - 3.7%	<0.1% - 0.6%	0.0% - <0.1%	86.8% - 98.7%	95.4% - 99.6%	99.3% - 99.9%	99.6% - 99.9%		
Fire Stations/EMS	93.3% - 98.7%	1.0% - 4.8%	0.3% - 1.7%	<0.1% - 0.2%	0.0% - <0.1%	93.3% - 98.7%	97.9% - 99.6%	99.7% - 99.9%	99.8% - 99.9%		
Schools	93.3% - 98.7%	1.0% - 4.8%	0.3% - 1.7%	<0.1% - 0.2%	0.0% - <0.1%	93.2% - 98.7%	97.9% - 99.6%	99.7% - 99.9%	99.8% - 99.9%		
Utilities											
Communication	91.7% - 99.8%	0.2% - 5.2%	0.0% - 2.8%	0.0% - 0.3%	0.0%	98.3% - 99.9%	99.8% - 99.9%	99.9%	99.9%		
Electric Power	95.0% - 99.2%	0.5% - 2.8%	0.3% - 1.8%	<0.1% - 0.3%	0.0%	96.5% - 99.4%	99.7% - 99.9%	99.9%	99.9%		
Potable Water	89.5% - 99.2%	0.5% - 5.5%	0.3% - 4.1%	<0.1% - 0.9%	0.0%	93.8% - 99.6%	98.9% - 99.9%	99.7% - 99.9%	99.8% - 99.9%		
Wastewater	89.5% - 100.0%	0.0% - 5.5%	0.0% - 4.1%	0.0% - 0.9%	0.0%	91.7% - 100.0%	98.7% - 100.0%	99.2% - 100.0%	99.9% - 100.0%		





	I	Percent Probal	bility of Sustai	ning Damage	Percent Functionality				
Name	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Transportation	-		-		-			-	
Airports	99.8%	0.2%	0.0%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
<b>Bus Facilities</b>	97.9% - 99.8%	0.2% - 2.0%	0.0% - <0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Ferry Facilities	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Highway Bridges	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Rail Facilities	97.9% - 99.8%	0.2% - 2.0%	0.0% - <0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Port Facilities	98.7% - 99.9%	<0.1% - 1.2%	0.0% - 0.2%	0.0% - <0.1%	0.0%	99.8% - 99.9%	99.9%	99.9%	99.9%

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021 Notes: EOC = Emergency Operation Center; EMS = Emergency Medical Services; < = Less Than; % = Percent

# Table 5.4.1-19. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Westchester County for the 2,500-Year MRP Earthquake Event

Nieme		Percent Proba	bility of Sustain	ing Damage		Percent Functionality				
Name	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90	
<b>Essential Facilities</b>										
EOC	45.1% - 90.2%	6.8% - 25.1%	2.6% - 21.0%	0.4% - 7.2%	<0.1% - 1.6%	45.1% - 90.1%	69.6% - 96.8%	91.2% - 99.5%	94.8% - 99.7%	
Medical Facilities	82.5% - 99.3%	1.0% - 11.2%	0.1% - 5.6%	0.0% - 0.5%	0.0% - 0.2%	82.5% - 99.2%	93.4% - 99.8%	99.3% - 99.9%	99.5% - 99.9%	
Police Stations	45.1% - 90.7%	6.5% - 25.1%	2.5% - 21.0%	0.3% - 7.2%	<0.1% - 1.6%	45.1% - 90.6%	69.6% - 97.0%	91.2% - 99.6%	94.8% - 99.7%	
Fire Stations/EMS	63.7% - 90.8%	6.4% - 20.0%	2.4% - 12.6%	0.3% - 3.2%	<0.1% - 0.5%	63.7% - 90.8%	83.2% - 97.0%	96.3% - 99.6%	97.8% - 99.7%	
Schools	63.4% - 90.8%	6.4% - 20.1%	2.4% - 12.7%	0.3% - 3.2%	<0.1% - 0.5%	63.4% - 90.8%	83.0% - 97.0%	96.2% - 99.6%	97.8% - 99.7%	
Utilities										
Communication	49.4% - 97.5%	2.4% - 34.4%	0.1% - 20.1%	0.0% - 6.2%	0.0% - 0.3%	84.5% - 99.9%	96.6% - 99.9%	99.8% - 99.9%	99.9%	
Electric Power	65.6% - 93.4%	3.7% - 14.3%	2.5% - 14.7%	0.5% - 5.4%	0.0% - <0.1%	74.2% - 95.4%	97.1% - 99.7%	99.9%	99.9%	
Potable Water	38.2% - 93.4%	3.7% - 18.5%	2.5% - 26.8%	0.3% - 15.6%	0.0% - 0.9%	57.3% - 97.3%	85.5% - 99.6%	94.8% - 99.9%	96.5% - 99.9%	
Wastewater	38.2% - 100.0%	0.0% - 18.5%	0.0% - 26.8%	0.0% - 15.6%	0.0% - 0.9%	48.1% - 100.0%	81.5% - 100.0%	85.9% - 100.0%	97.8% - 100.0%	
Transportation										
Airports	97.4% - 97.5%	2.4% - 2.5%	0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%	
<b>Bus Facilities</b>	76.2% - 97.6%	2.3% - 19.9%	0.1% - 3.8%	0.0% - <0.1%	0.0% - <0.1%	97.4% - 99.9%	99.8% - 99.9%	99.9%	99.9%	
Ferry Facilities	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	
Highway Bridges	99.9% - 100.0%	0.0% - <0.1%	0.0% - <0.1%	0.0% - <0.1%	0.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	99.9% - 100.0%	
Rail Facilities	76.2% - 97.6%	2.3% - 19.9%	0.1% - 3.8%	0.0% - <0.1%	0.0% - <0.1%	97.4% - 99.9%	99.8% - 99.9%	99.9%	99.9%	
Port Facilities	82.3% - 99.3%	0.6% - 11.3%	0.1% - 5.7%	0.0% - 0.5%	0.0% - 0.2%	95.8% - 99.9%	99.4% - 99.9%	99.5% - 99.9%	99.7% - 99.9%	

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021 Notes: EOC = Emergency Operation Center; EMS = Emergency Medical Services; < = Less Than; % = Percent





#### **Impact on Economy**

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 5.4.1-20.

### Table 5.4.1-20. Economic Losses for Earthquake Mean Return Period Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Building and Content Losses	Wages Losses	Rental Losses	Capital- Related Loss
500-year MRP	\$353,100	\$4,638,700	\$96,777,800	\$2,200,400	\$2,805,500	\$1,155,100
2,500-year MRP	\$13,505,000	\$65,618,700	\$2,392,635,400	\$26,992,500	\$43,258,000	\$15,652,700

Sources: Hazus v5.0

Notes: MRP = Mean Return Period

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly these features would undergo damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair (FEMA 2012).

Earthquake events can also significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at times of construction.

Hazus also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2020).

For the 100-year MRP event, Hazus estimates that zero tons of debris will be generated. For the 500-year and 2,500-year MRP events, Hazus estimates a total of 17,144 tons and 197,749 tons of debris will be generated county-wide, respectively. Table 5.4.1-21 summarizes the estimated debris generated as a result of these events by municipality.

	500-	-Year	2,500-Year			
Jurisdiction	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)		
Ardsley (V)	52	6	557	138		
Bedford (T)	111	13	1,088	224		
Briarcliff Manor (V)	48	6	474	104		
Bronxville (V)	57	9	397	114		
Buchanan (V)	29	6	326	126		
Cortlandt (T)	127	14	1,528	308		
Croton-on-Hudson (V)	41	4	506	107		
Dobbs Ferry (V)	111	15	1,116	321		
Eastchester (T)	56	8	580	168		
Elmsford (V)	81	12	741	244		

#### Table 5.4.1-21. Estimated Debris Generated by the 500-Year and 2,500-Year MRP Earthquake Events





	500	Year	2,500-Year		
			Brick/Wood	Concrete/Steel	
Jurisdiction	Brick/Wood (tons)	Concrete/Steel (tons)	(tons)	(tons)	
Greenburgh (T)	1,594	240	14,320	4,365	
Harrison (T)	188	31	1,764	566	
Hastings-on-Hudson (V)	3,837	582	37,061	9,342	
Irvington (V)	44	5	436	80	
Larchmont (V)	27	6	245	130	
Lewisboro (T)	85	9	895	139	
Mamroneck (T)	28	5	286	109	
Mamaroneck (V)	154	30	1,215	514	
Mount Kisco (T)	134	30	1,077	640	
Mount Pleasant (T)	366	55	3,342	989	
Mount Vernon (C)	772	151	6,795	2,807	
New Castle (T)	75	8	808	149	
New Rochelle (C)	565	101	4,385	1,558	
North Castle (T)	109	13	1,127	247	
North Salem (T)	56	7	422	85	
Ossining (T)	27	3	260	46	
Ossining (V)	233	42	1,522	567	
Peekskill (C)	130	22	1,300	475	
Pelham (T)*	67	11	582	178	
Pelham (V)	40	7	343	133	
Pelham Manor (V)	27	3	239	45	
Pleasantville (V)	72	30	564	590	
Port Chester (V)	105	43	894	1,023	
Pound Ridge (T)	19	2	226	35	
Rye (C)	148	20	1,171	263	
Rye Brook (V)	43	4	479	72	
Scarsdale (T)	60	6	687	134	
Sleepy Hollow (V)	55	23	504	536	
Somers (T)	153	18	1,298	238	
Tarrytown (V)	94	19	1,128	583	
Tuckahoe (V)	16	2	178	53	
White Plains (C)	1,548	572	16,611	12,628	
Yonkers (C)	1,861	1,239	15,255	28,757	
Yorktown (T)	311	33	3,283	563	
Westchester County (Total)	13,688	3,456	127,433	70,316	

Sources: Hazus v5.0

Notes: MRP = Mean Return Period Notes; C = City; T = Town; V = Village; % = Percent \*The Town of Pelham is the aggregate of the Village of Pelham and Village of Pelham Manor

#### **Impact on Environment**

According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event (USGS 2020). Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles isolating animal species or tear apart plant roots.

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources (USGS 2020). The greater the seismic activity and liquefaction properties of the soil, the more likely drainage of groundwater can occur which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid increasing risk of localized flooding and deposition or accumulation of silt.





# **Cascading Impacts to Other Hazards**

The Global Geoengineering Research Group in USGS has been investigating the relationship earthquakes have with ground deformation, ground failure, and coastal erosion (USGS, Global Geoengineering Research 2020). As mentioned in earlier sections, soft and loose soils are more susceptible to earthquake events. Ground failure can become exacerbated due to earthquake events, causing land sliding and coastal erosion. Areas of steep slopes are at greater risk of ground failure and potential erosion during earthquakes (USGS, Global Geoengineering Research 2020).

Further, residual impacts from earthquakes could alter the floodplain extent for the county if ground failure and erosion occur. Damage could occur at dams or levees as they may become breached as a result of an earthquake event, which could create flooding in the impacted areas. Earthquake loading can lead to several damaging dam performances. Liquefaction can cause sliding, block, or rotational failure, resulting in an overtopping of a dam. A seiche can also overtop and damage dams as well (Everett Taylor 2021).

# Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

# Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during earthquakes because of the loose soil characteristics of these soil classes. However, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards. Refer to Section 4, and Volume II Section 9 for more information about the potential new development in Westchester County.

# Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Persons that move into older buildings may increase their overall vulnerability to earthquakes. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

#### **Climate Change**

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result of the climate change projections discussed above, the County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a higher risk of landslides/mudslides because of seismic activity.





# **Change of Vulnerability Since the 2015 HMP**

Since the 2015 HMP was drafted, updated inventory data has become available to assess the earthquake in Westchester County. This data includes the 5-Year 2015-2019 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Hazus v5.0 was also used to assess the losses in the County to the earthquake 100-year, 500-year and 2500-year mean return period events. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the earthquake hazard.





# **5.4.2 Extreme Temperatures**

This section provides a profile and vulnerability assessment for the extreme temperature hazard.

# 5.2.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

# Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes *extreme cold* or *extreme heat* can vary across different areas of the country, based upon what the population is accustomed. The potential issues identified with extreme temperature events include:

- Prolonged extreme heat events can lead to drought conditions and impact the drinking water supply for residents.
- The aging population of the county may result in an increase of residents vulnerable to extreme temperature events as the senior population is less able to withstand extreme temperatures due to age and health conditions.
- Extreme temperature events can damage aging infrastructure and buildings as highways and roads are damaged by excessive heat as the asphalt softens, and roadways can be damaged from extreme cold temperatures causing frost heaving of road infrastructure.
- In 2019, Housing and Urban Development estimated that there were 1812 individuals experiencing homelessness in Westchester County (Marroquin 2020). Homeless individuals experience an acute vulnerability to extreme temperatures owing to the lack of sheltering and exposure to the elements (Lohud.com 2017)

# Extreme Cold

Extreme cold events occur when temperatures drop significantly below normal in an area for an extended period of time. The 2019 NYS HMP defines extreme cold as temperatures at or below zero degrees for an extended period of time (NYS DHSES 2019).

#### Extreme Heat

Extreme heat is defined as temperatures which hover 10 degrees or more above the average high temperature for a region and that last for several weeks (CDC 2016). An extended period of extreme heat of three or more consecutive days is typically called a heat wave and is often accompanied by high humidity (NWS 2020). Humid or muggy conditions occur when a *dome* of high atmospheric pressure traps hazy, damp air near the ground. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90 °F or at or above 95 °F. Heat waves are defined as three consecutive days with maximum temperatures above 90 °F (NYS DHSES 2019).

# Extent

#### Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures generally are measured through the Wind Chill Temperature (WCT) Index. The WCT Index uses advances in science, technology, and computer modeling to





provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT Index, refer to: http://www.nws.noaa.gov/om/winter/windchill.shtml. The WCT Index is presented in Figure 5.4.2-2.

# Figure 5.4.2-1. WCT Index

							Te	empera	ture (°	'F)								
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98
	Frostbi	teTime	s															
													Where, T	= Air Ten	nperature	(°F) V= \	Nind Spe	ed (mph

Source: NYS DHSES, 2019

The National Weather Service (NWS) provides alerts when Wind Chill indices approach hazardous levels. Table 5.4.2-1 explains these alerts.

# Table 5.4.2-1. National Weather Service Alerts for Extreme Cold

Alert	Criteria
Wind Chill Advisory	NWS issues a wind chill advisory when seasonably cold wind chill values, but not
	extremely cold values are expected or occurring.
Wind Chill Watch	NWS issues a wind chill watch when dangerously cold wind chill values are possible.
Wind Chill Warning	NWS issues a wind chill warning when dangerously cold wind chill values are
	expected or occurring.

Source: NWS 2018b





#### Extreme Heat

The extent of extreme heat temperatures is measured through the Heat Index, identified in Figure 5.4.2-4. The Heat Index was created by the NWS to accurately measure apparent temperature of the air as it increases with the relative humidity. Temperature and relative humidity are needed to determine the Heat Index. Once each value is acquired, the Heat Index is the corresponding number of both the values, as seen in Figure 5.4.2-4. This provides a measure of how temperatures feel; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the index by up to 15 degrees (NYS DHSES 2019).

The NWS provides alerts when Heat Indices approach hazardous levels. Table 5.4.2-2 explains these alerts.

# Figure 5.4.2-2. Relative Humidity at a Glance

#### Relative Humidity at a Glance

Relative humidity is the amount of moisture in the air at a certain temperature compared to what the air can "hold" at that temperature...it is measured as a percentage or ratio of the amount of water vapor in a volume of air RELATIVE to a given temperature and the amount it can hold at that given temperature. Warm air can hold more moisture than cold air.

Source: Molekule.com, 2018

Alert	Criteria
Heat Advisory	Criteria for a Heat Advisory in Pennsylvania is a heat index of 100-104 °F and in New York 95-104 °F. The heat index has to remain at or above criteria for a minimum of 2 hours. Heat advisories are issued by county when any location within that county is expected to reach criteria.
Excessive Heat Watch	Issued when Heat Warning criteria is possible (50-79%) 1 to 2 days in advance
Excessive Heat Warning	Criteria for an Excessive Heat Warning is a heat index of 105 °F or greater that will last for 2 hours or more. Excessive Heat Warnings are issued by county when any location within that county is expected to reach criteria.

#### Table 5.4.2-2. National Weather Service Alerts

Source: NWS 2020

#### Figure 5.4.2-3. Heat Index Chart



Source: NYS DHSES, 2019





#### Location

According to the New York State Hazard Mitigation Plan (2019), excessive heat can occur anywhere within the State of New York. Excessive heat incidents are widespread, even if there are localized cooler areas. The State has varied summers. Warmer conditions are experienced in the south, whereas more mild conditions experienced elsewhere in the State.

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau, Northern Plateau, Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and central Lakes. Westchester County is located in the Hudson valley climate division.

#### Extreme Cold

Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the state. When atmospheric pressures are higher than normal and Arctic air masses enter the area, extreme cold temperatures impact Westchester County, flowing southward from central Canada or the Hudson Bay (MRCC 2020)

#### Extreme Heat Temperatures

Extreme heat temperatures degrees occur throughout the county for most of the summer season, except for areas with high altitudes. High-pressure systems can move off the Atlantic coast and become stagnant for several days. A persistent airflow from the southwest or south affects the weather in the state. This circulation brings the very warm, often humid weather of the summer season and the mild, more pleasant temperatures during the fall, winter, and spring seasons (MRCC 2020). Areas of dense urban development are prone to the urban heat island effect phenomenon that can further raise temperatures.



#### **Previous Occurrences and Losses**

Extreme temperature events occur annually in Westchester County. To identify the events in Westchester County, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Events database were examined. The database records and defines extreme temperature events as follows:

Source: weatherquestions.com, 2019

- Cold/Wind Chill is reported in the NOAA-NCEI database when a period of low temperatures or wind chill temperatures reach or exceed locally or regionally defined advisory conditions (typical value is negative 18 °F or colder).
- Excessive Heat is reported in the NOAA-NCEI database whenever heat index values meet or exceed locally or regionally established excessive heat warning thresholds.
- Extreme Cold/Wind Chill is reported in the NOAA-NCEI database when a period of extremely low temperatures or wind chill temperatures reaches or exceeds locally or regionally defined warning criteria (typical value around negative 35 °F or colder).
- Heat is reported in the NOAA-NCEI database whenever heat index values meet or exceed locally or regionally established advisory thresholds.





#### FEMA Major Disasters and Emergency Declarations

Between 1954 and August 2021, New York State was not included in any major disaster (DR) or emergency (EM) declarations due to extreme temperatures (heat or cold). However, during the same time period, the FEMA included Westchester County in three winter storm-related DR or EM declarations classified as one or a combination of the following disaster types: severe winter storm, snowstorm, snow, ice storm, winter storm, and blizzard (Table 5.4.2-3.). Extreme cold temperatures are often associated with these disaster types.

# Table 5.4.2-3. Winter Storm Related Disaster (DR) and Emergency (EM) Declarations 1954-2021

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-1083	January 12, 1996	January 6, 1996 January 12, 1996	Snow	Blizzard of '96 (Severe Snow Storm)
EM-3107	March 17, 1993	March 13, 1993 March 17, 1993	Snow	Severe Blizzard

Source: FEMA 2021

DR Major Disaster Declaration (FEMA)

EM Emergency Declaration (FEMA)

FEMA Federal Emergency Management Agency

#### **USDA** Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2014 and 2021, Westchester County was not included in the any USDA declarations involving extreme temperatures.

#### Previous Events

Information regarding specific details of temperature extremes in Westchester County is limited. Previous occurrences and losses associated with extreme temperature events are limited as a result. For this 2021 HMP update, extreme temperature events were summarized from 2014 to 2021 and are identified in Table 5.4.2-4. For events prior to 2014, refer to Appendix E (Supplementary Data).





Dates of Event	Event Type	Location	FEMA Declaration Number	Westchester County Designated?	Description
July 21, 2019	Excessive Heat	Southern Westchester County	NA	NA	The KHPN ASOS recorded a heat index of 105 to 106 from 3PM to 5PM across the entire region. No property damage or deaths were reported.
July 21, 2019	Heat	Southern Westchester County	NA	NA	The KHPN ASOS recorded a heat index between 100 and 105 from 1PM to 5PM across the entire region. No property damage or deaths were reported.
July 19, 2019	Heat	Southern Westchester County	NA	NA	The KHPN ASOS recorded a heat index between 95 and 100 at 4PM and again from 6PM to 7PM across the entire region. No property damage or deaths were reported.
August 13, 2016	Excessive Heat	Southern Westchester County	NA	NA	The combination of hot temperatures in the 90s, and high humidity resulted in a heat index up to 105 degrees in White Plains at Westchester Airport. No property damage or deaths were reported.

Table 5.4.2-4. Extreme Temperature Events Impacting Westchester County, 2014 to 2021

Source(s): NOAA-NCEI 2021; FEMA 2021




## **Probability of Future Events**

The frequency and duration of heat waves (three or more consecutive days with maximum temperatures at or above 90 °F) is expected to increase (Table 5.4.2-5) in the coming decades due to climate change. Overall warmer temperatures will cause extreme cold events (defined both as the number of days per year with minimum temperature at or below 32 °F and those at or below 0 °F) to decrease in frequency as average temperatures rise (NYSERDA 2011/2014). With the increase in temperatures, heat waves will become more frequent and intense, increasing heat-related illness and death, and posing new challenges to the energy system, air quality and agriculture. Table 5.4.2-5 displays the projected changes in these events and includes the minimum, central range, and maximum days per year.

Event Type (2050s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 degrees Fahrenheit (°F) (10 days)	22	27 to 41	50
# of Heat Waves (1 heat waves)	3	4 to 6	7
Duration of Heat Waves (4 days)	5	5 to 6	6
Days below 32°F (155 days)	98	104 to 119	125

### Table 5.4.2-5. Changes in Extreme Events in Region 5 - Heat Waves and Drought Conditions

Source: NYSERDA 2014

Westchester County is expected to continue experiencing direct and indirect impacts of extreme temperature events each year. These events can also induce secondary hazards such as utility failure. The identified hazards of concern for Westchester County were ranked in Section 5.3 (Hazard Ranking). The probability of occurrence, or likelihood of the event, is among the parameters used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for severe storms in the county is considered *occasional* (event has between a 10 and 100 percent annual probability).

### **Climate Change Impacts**

The frequency and duration of heat waves (three or more consecutive days with maximum temperatures at or above 90 °F) is expected to increase (Table 5.4.2-5) in the coming decades due to climate change. Overall warmer temperatures will cause extreme cold events (defined both as the number of days per year with minimum temperature at or below 32 °F and those at or below 0 °F) to decrease in frequency as average temperatures rise (NYSERDA 2011/2014). With the increase in temperatures, heat waves will become more frequent and intense, increasing heat-related illness and death, and posing new challenges to the energy system, air quality and agriculture. Table 5.4.2-5 displays the projected changes in these events and includes the minimum, central range, and maximum days per year.

## 5.2.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Westchester County's vulnerability, in a qualitative nature, to the extreme temperature hazard.





## Impact on Life, Health, and Safety

The entire population of Westchester County is exposed to extreme temperature events (i.e., 968,065 people, 2019 American Community Survey 5-year population estimates). Extreme temperature events have potential health impacts including injury and death. Exposure to excessive heat and extreme cold can pose a number of health risks to individuals (refer to Table 5.4.2-6 and Table 5.4.2-7)

## Table 5.4.2-6 Health Effects of Extreme Heat

Health Hazard	Symptoms
Sunburn	Redness and pain. In severe cases: swelling of skin, blisters, fevers, and headaches
Dehydration	Excessive thirst, dry lips, and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting
Heat Stroke	High body temperature (104 °F or higher), hot and dry skin, rapid and strong pulse, and loss of consciousness

Source: CDC 2020

## Table 5.4.2-7 Health Effects of Extreme Cold

Health Hazard	Symptoms
Wind Chill	Wind chill is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body
	temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not.
Frostbite	Frostbite is damage to body tissue caused by extreme cold. A wind chill of -20 degrees Fahrenheit (F) will cause frostbite in just 30 minutes. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes or the tip of the nose. If symptoms are detected, get medical help immediately! If you must wait for help, slowly re-warm affected areas. However, if the person is also showing signs of hypothermia, warm the body core before the extremities.
Hypothermia	Hypothermia is a condition brought on when the body temperature drops to less than 95 degrees Fahrenheit (F). It can kill. For those who survive, there are likely to be lasting kidney, liver and pancreas problems. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and apparent exhaustion. Take the person's temperature. If below 95 degrees F, seek medical care immediately!

Source: NYS DHSES 2014

According to the Centers for Disease Control and Prevention (CDC), populations most at risk to extreme cold and heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions, and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure), 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2021).

Persons that are most vulnerable to extreme temperature events make up 16.8 percent and 8.7 percent of the total population in Westchester County for persons over 65-years old, and persons below the poverty level, respectively. The City of Yonkers has the greatest number of persons over the age of 65 (i.e., 33,075 persons total). The Town of Somers has the greatest concentration of persons over the age of 65 (i.e., 25.9-percent of its total population).

Furthermore, the homeless and residents below the poverty level might not have access to housing or their housing could be less able to withstand extreme temperatures (e.g., homes with poor insulation and heating supply). There is a total of 83,783 persons living in poverty in the County (US Census, 2020). In Westchester County, areas with the highest concentration of population below the poverty level, thus most vulnerable





communities due to potentially fewer resources to protect against extreme temperatures, are located in the City of Yonkers (i.e., 14.7-percent of its total population). The City of Yonkers has the greatest number of persons living below the poverty level (i.e., 29,453 persons total).

Overall, the CDC 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Westchester County's overall score is 0.5516, indicating that its communities have moderate vulnerability (CDC 2016). This score indicates that while some residents would have adequate resources to respond to extreme temperatures, a large portion would not. Refer to Section 4 (County Profile) that displays the densities of all the vulnerable populations in Westchester County.

In addition to vulnerable populations, 30-percent of all deaths caused by fire occur in the winter months. Cooking and heat sources too close to combustible materials are leading factors in winter home fires (U.S. Fire Administration 2018). Furthermore, power outages occur more frequently during extreme cold events. Individuals powering their homes with generators are subjected to carbon monoxide poisoning if proper ventilation procedures are not followed (NYS DHSES 2019). Improperly connected portable generators are capable of 'back feeding' power lines which may cause injury or death to utility workers attempting to restore power and may damage house wiring and/or generators.

Meteorologists can accurately forecast extreme heat and cold event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

## **Impact on General Building Stock**

All buildings are exposed to the extreme temperature hazard. Refer to Section 4 (County Profile), which summarizes the building inventory in Westchester County. Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage through freezing/bursting pipes and freeze/thaw cycles, as well as increasing vulnerability to home fires. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme temperatures.

The 2019 New York City Hazard Mitigation Plan states that older buildings following less stringent building codes are more vulnerable to drafts during extreme cold events due to cracks and leaks in the walls (NYC 2019). Roof damage can also occur due to excessive snow fall and extreme temperature change. Extreme heat may also be damaging to older structures. Further, structures with glass exposed to sunlight and structures exposed to heat on all four sides are more susceptible to damages, including interior damages from overheating.

## **Impact on Critical Facilities and Lifelines**

All critical facilities in the County are exposed to the extreme temperature hazard. Impacts to critical facilities that are buildings will experience similar issues as described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as *brown-outs*, due to increased usage from air conditioners and other energy-intensive appliances. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption. Backup power is recommended for critical facilities and infrastructure.



The 2019 New York City Hazard Mitigation Plan indicates that transportation infrastructure may experience damages from extreme temperature events. This is particularly the case with ground transportation systems at risk of cracking, buckling, or sagging due to high temperatures (NYC 2019). This can cause disruptions to essential services that travel along these routes to provide services to the community.

### **Impact on Economy**

Extreme temperature events also impact the economy, including loss of business function and damage to and/or loss of business inventory. Business-owners can be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills, or business interruption due to power failure (i.e., loss of electricity or telecommunications). Disruptions in public transportation service will also impact the economy for both commuters and customers alike.

### **Impact on Environment**

Extreme temperature events can have a major impact on the environment. For example, freezing and warming weather patterns create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Likewise, rain-on-snow events also exacerbate runoff rates with warming winter weather. Extreme heat events can have particularly negative impacts on aquatic systems, contributing to fish kills, aquatic plant die offs, and increased likelihood of harmful algal blooms.

## **Cascading Impacts on Other Hazards**

Extreme temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe storm and severe winter weather events for the County. For example, extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial species, making them more susceptible to catching fire. Extreme variation in temperatures could create ideal atmospheric conditions for severe storms or worsen the outcome of severe winter weather during freezing and thawing periods. Refer to Section 5.4.4 (Severe Storm), Section 5.4.5 (Severe Winter Storm), and Section 5.4.6 (Wildfire) for more information about these hazards of concern.

## Future Changes that may Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

## **Projected Development**

The ability of new development to withstand extreme temperature impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Transformation of pervious surfaces (including vegetation) to impervious surfaces causes an island of higher temperatures. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.





### Projected Changes in Population

According to the U.S. Census Bureau, the population in Westchester County has increased by approximately 2percent between 2010 and 2020 (US Census Bureau 2020). However, estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the County's population will increase slowly into 2030, increasing the total population to approximately 970,773 persons and then start decreasing into 2040 to a population of 967,355, which is still higher than the 2020 population (Cornell University 2017). An increase in the population throughout Westchester County will increase the County's risk to extreme temperature events. Refer to Section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

### Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

### **Change of Vulnerability Since the 2015 HMP**

Overall, the entire County remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age they can be at increased risk to failed utility systems (e.g., HVAC) if they are not properly maintained. Similarly, an increase in the elderly population remaining in the County increases the vulnerable population.





# **5.4.3 Flood**

The following section provides the hazard profile and vulnerability assessment for the flood hazard in Westchester County.

## 5.3.1 Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the flood hazard.

## **Hazard Description**

Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2007). As defined in the NYS HMP (NYS DHSES 2019), flooding is a general and temporary condition of partial or complete inundation on normally dry land as a result of the following:

- Riverine overbank flooding
- Flash floods
- Alluvial fan floods
- Mudflows or debris floods
- Dam-break floods
- Local draining or high groundwater levels
- Fluctuating lake levels
- Ice-jams
- Coastal flooding
- Urban flooding

For the purpose of this HMP and as deemed appropriate by the Westchester County Steering Committee, the main flood types of concern discussed in this section include: riverine, flash, stormwater/urban, coastal, storm surge, ice jam, and dam failure flooding. In addition, coastal erosion is considered as a cascading hazard in the coastal areas. These types of flood are further discussed below.

## Riverine (Inland) Flooding

Riverine floods are the most common flood type. They occur along a channel and include overbank and flash flooding. Channels are defined, ground features that carry water through and out of a watershed. They may be called rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (The Illinois Association for Floodplain and Stormwater Management 2006).

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Westchester County, floodplains line the rivers and streams of the County and the coastal areas. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques. Figure 5.4.3-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.





## Figure 5.4.3-1. Illustration of a Floodplain



Source: New Jersey Department of Environmental Protection (NJDEP), Date Unknown

### Flash Flooding

Flash floods are defined by the National Weather Service as "a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam." (NWS 2009).

### Stormwater and Urban Flooding

Stormwater flooding described below is due to local drainage issues and high groundwater levels. Locally, heavy precipitation may produce flooding in areas other than delineated floodplains or along recognizable channels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Flooding issues of this nature generally occur in areas with flat gradients and generally increase with urbanization which speeds the accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 1997).

High groundwater levels can be a concern and cause problems even where there is no surface flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation (FEMA 1997).

Heavy rainfall that overwhelms a developed area's stormwater infrastructure causing flooding is commonly referred to as urban flooding. Urban flooding can be worsened by aging and inadequate infrastructure and over development of land. The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (Center for Disaster Resilience 2016). While riverine and coastal flooding is mapped and studied by FEMA, urban flooding is not.

NOAA defines urban flooding as the flooding of streets, underpasses, low lying areas, or storm drains. (NOAA 2009). Urban drainage flooding is caused by increased water runoff due to urban development and inadequate drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and other urban areas. The systems make use of a closed





conveyance system that channels water away from an urban area to surrounding streams. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area (Harris 2008).

## **Coastal Flooding**

Coastal flooding occurs along the coasts of oceans, bays, estuaries, coastal rivers and large lakes. Coastal floods are the submersion of land areas along the ocean coast and other inland waters caused by seawater over and above normal tide action. Hurricanes, tropical storms and other storm events cause most of the coastal flooding in New York State. Coastal flooding may cause beach erosion; loss or submergence of wetlands and other coastal ecosystems; saltwater intrusion; high water tables; loss of coastal recreation areas, beaches, protective sand dunes, parks, and open space; and loss of coastal structures. Coastal structures can include sea walls, piers, bulkheads, bridges, or buildings (FEMA 2011).

Coastal flooding conditions are defined by sea level relative to land. In tidally influenced bodies of water such as the Hudson River, sea level rise due to thermal expansion, glaciostatic adjustments, and other geological and climatological factors has been recorded and is anticipated to increase in the future. According to the New York State Energy Research and Development Authority (NYSERDA) estimates, as of 2014 sea level is anticipated to rise by three to eight inches on the Hudson River by the 2020s, nine to twenty-one inches by 2050s, and by fourteen to thirty-nine inches by the 2080s (NYSERDA 2014).

There are several forces that occur with coastal flooding:

- *Hydrostatic forces* against a structure are created by standing or slowly moving water. Flooding can cause vertical hydrostatic forces, or flotation. These types of forces are one of the main causes of flood damage.
- *Hydrodynamic forces* on buildings are created when coastal floodwaters move at high velocities. These high-velocity flows are capable of destroying solid walls and dislodging buildings with inadequate foundations. High-velocity flows can also move large quantities of sediment and debris that can cause additional damage. In coastal areas, high-velocity flows are typically associated with one or more of the following:
  - $\circ~$  Storm surge and wave run-up flowing landward through breaks in sand dunes or across low-lying areas
  - o Tsunamis
  - Outflow of floodwaters driven into bay or upland areas
  - Strong currents parallel to the shoreline, driven by waves produced from a storm
  - High-velocity flows

High-velocity flows can be created or exacerbated by the presence of manmade or natural obstructions along the shoreline and by weak points formed by roads and access paths that cross dunes, bridges or canals, channels, or drainage features.

- *Waves* can affect coastal buildings from breaking waves, wave run-up, wave reflection and deflection, and wave uplift. The most severe damage is caused by breaking waves. The force created by these types of waves breaking against a vertical surface is often at least 10 times higher than the force created by high winds during a coastal storm.
- *Flood-borne debris* produced by coastal flooding events and storms typically includes decks, steps, ramps, breakaway wall panels, portions of or entire houses, heating oil and propane tanks, cars, boats, decks and pilings from piers, fences, erosion control structures, and many other types of smaller objects.





Debris from floods are capable of destroying unreinforced masonry walls, light wood-frame construction, and small-diameter posts and piles (FEMA 2011).

### Storm Surge

Hurricanes and tropical storms are the major types of storm events generally impact the New York State coastline and adjacent inland areas. These storms typically impact the State from June to November, which is the official eastern U.S. hurricane season. Late July to early October is the period of time that a hurricane or tropical storm is most likely to impact New York State (NYS DHSES 2019).

Extra-tropical storms (Nor'Easters) typically occur during winter months. These storms are usually less intense but can have localized wind velocities that generally reach hurricane strength (NYS DHSES 2019). Nor'Easters are discussed in Section 5.4.5 (Severe Winter Weather) of this HMP.

Storm surges inundate coastal floodplains by dune overwash, tidal elevation rise in inland bays and harbors, and backwater flooding through coastal river mouths. Strong winds can increase in tide levels and water-surface elevations. Storm systems generate large waves that run up and flood coastal beaches. The combined effects create storm surges that affect the beach, dunes, and adjacent low-lying floodplains. Shallow, offshore depths can cause storm-driven waves and tides to pile up against the shoreline and inside bays.

### Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NOAA 2013). The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely to occur where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can occur during at different times of the year: fall

#### Ice Jams At a Glance

- ✓ Freeze-up jams occur when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement.
- Breakup jams occur during periods of thaw, generally in late winter and early spring.

freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (NYS DHSES 2019).

### Dam Failure Flooding

A dam is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (FEMA 2007). Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water (FEMA 2007). Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity due to uncontrolled release or exceedance of design);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;





- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;
- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance and upkeep;
- Failure of upstream dams on the same waterway; or
- Earthquake (liquefaction / landslides) (FEMA 2010).

A break in a dam can produce extremely dangerous flood situations because of the high velocities and large volumes of water released by such a break. Sometimes they can occur with little to no warning. Breaching of dams often occurs within hours after the first visible sign of dam failure, leaving little or no time for evacuation (FEMA 2006).

## **Cascading Impacts**

The following includes discussion on the cascading impacts related to flowing: sea level rise and coastal erosion.

## **Coastal Erosion**

Along with flooding, coastal erosion is one of the primary coastal hazards leading to loss of lives or damage to property and infrastructure in coastal areas. Many natural factors affect erosion of the shoreline, including shore and near-shore morphology, shoreline orientation, and the response of these factors to storm frequency and sea level rise. Coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system.

Coastal erosion is a natural phenomenon that is an endless sediment redistribution process that continually changes beaches, dunes, and bluffs. Waves, currents, wind-driven water, ice, rainwater runoff, and groundwater seepage all move sand, sediment, and water along the coastline. Other contributing factors that can increase coastal erosion of a natural protective feature include length of fetch; wind direction and speed; wavelength, height, and period; nearshore water depth; tidal influence; and overall strength of a storm (NYS DEC 2020).

Coastal erosion can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitats. Damage often results from an episodic event with the combination of severe storm waves and dune or bluff erosion.

## Sea Level Rise

Sea level rise associated with climate change will have significant effects on coastal areas, including Westchester County. Long-term sea level records show changes in global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity. Sea levels provide a key to understanding the impact of climate change.

There are two ways sea level rise is discussed: global and relative. Global sea level rise refers to the increase currently observed in the average global sea level trend (primarily attributed to changes in ocean volume due to ice melt and

## Figure 5.4.3-2. Causes of Sea Level Change



Source: U.S. Climate Resilience Toolkit 2019





thermal expansion). The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, a steady increase in global atmospheric temperature creates an expansion of saltwater molecules, increasing ocean volume.

Local sea level refers to the height of the water as measured along the coast relative to a specific point on land. Water level measurements at tide stations are referenced to stable vertical points on the land and a known relationship is established. Measurements at any given tide station include both global sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). The heights of both the land and water are changing; therefore, the land-water interface can vary spatially and temporally and must be defined over time. Relative sea level trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications (coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration) (U.S. Climate Resilience Toolkit 2019).

Short-term variations in sea level typically occur on a daily basis and include waves, tides, or specific flood events. Long-term variations in sea level occur over various time scales, from monthly to several years and may be repeatable cycles, gradual trends, or intermittent differences. Seasonal weather patterns (changes in the earth's declination), changes in coastal and ocean circulation, anthropogenic influences, vertical land motion, etc. may influence changes in sea level over time. When estimating sea level trends, a minimum of 30 years of data are used in order to account for long-term sea level variations and reduce errors in computing sea level trends based on monthly mean sea level (U.S. Climate Resilience Toolkit 2019).

Sea level rise projections for East Hudson and Mohawk River Valleys suggest four to eight inches of rise by the 2020s; 11 to 21 inches by the 2050s; and 18 to 39 inches by the 2080s (based on the 2000-2004 baseline). Scenarios in the high estimate suggest 10 inches by the 2020s; 30 inches by the 2050s; and 58 inches by the 2080s. As decades progress, the expansion of the range is driven by uncertainty in land-based ice mass change, ocean thermal expansion, and regional ocean dynamics (NYSERDA 2014).

According to NOAA, sea level rise can amplify factors that currently contribute to coastal flooding: high tides, storm surge, high waves, and high runoff from rivers and creeks. All of these factors change during extreme weather and climate events (NOAA 2012). Other secondary hazards that could occur along the mid-Atlantic coast in response to sea level rise:

- Bluff and upland erosion shorelines composed of older geologic units that form headland regions of the coast will retreat landward with rising sea level. As sea level rises, the uplands are eroded and sandy materials are incorporated into the beach and dune systems along the shore and adjacent compartments (Gutierrez et al. 2007).
- Overwash, inlet processes, shoreline retreat, and barrier island narrowing as sea level rise occurs, storm overwash will become more likely. Tidal inlet formation and migration will become important components of future shoreline changes. Barrier islands are subject to inlet formation by storms. If the storm surge produces channels that extend below sea level, an inlet may persist after the storm. The combination of rising sea level and stronger storms can create the potential to accelerate shoreline retreat in many locations. Assessments of shoreline change on barrier islands have shown that barrier island narrowing has been observed on some islands over the last 100 years (Gutierrez et al. 2007).
- Threshold behavior changes in sea level can lead to conditions where a barrier system becomes less stable and crosses a geomorphic threshold; making the potential for rapid barrier-island migration or segmentation/disintegration high. Unstable barriers may be defined by rapid landward recession of the ocean shoreline, decrease in barrier width and height, increased overwashing during storms, increased barrier breaching and inlet formation, or chronic loss of beach and dune sand volume. With the rates of





- Loss of critical habitat natural ecosystems may be impacted by warmer temperatures and associated changes in the water cycle. The changes could lead to loss of critical habitat and further stresses on some threatened and endangered species (Rutgers 2013).
- An increase in sea level will cause further issues as stormwater recharge is challenged as sea-levels submerge discharge points, resulting in increases in flooding (Kopp et al. 2019).

## Location

Vestchester

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Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects Westchester County is described in the subsections below.

### Floodplains

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Westchester County,





floodplains line the rivers and streams of the County. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques (NJAFM 2015).

### **Flood Map Terms**

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.
- 1-percent annual chance flood = the base flood or 100year flood.
- SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled

Source: FEMA, 2018

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1 percent chance of being equaled to or exceeded in any given year. The 1 percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year (FEMA 2020). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements.

Locations of flood zones in Westchester County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are



illustrated in, Figure 5.4.3-3 and the total land area in the floodplain, inclusive of waterbodies, is summarized in Table 5.3.1-3. Refer to Section 9 for a map of each jurisdiction depicting the floodplains. Flood hazard zones occur throughout the County. The 1% annual chance of flood hazard zones (both A and V-zones) and 0.2% annual chance flood hazard zones throughout Westchester County are identified in Table 5.3.1-1. The eastern and western coasts of Westchester County are located in the 1% annual chance flood hazard zones (both A and V). Several areas along the coastline are located within the 0.2% annual chance zone, while the majority of the 0.2% annual chance zone is located inland. Principal sources of flooding in Westchester County include both the Hudson River and various tributaries, and the Long Island Sound. The Hudson River produces tidal flooding in low-lying shore areas.

Community	Flood Zone(s)		
Ardsley (V)	AE, X		
Bedford (T)	A, AE, AO, X		
Briarcliff Manor (V)	A, AE, VE, X		
Bronxville (V)	AE, X		
Buchanan (V)	AE, VE, X		
Cortlandt (T)	A, AE, VE, X		
Croton-on-Hudson (V)	A, AE, AO, VE, X		
Dobbs Ferry (V)	AE, VE, X		
Eastchester (T)	AE, X		
Elmsford (V)	AE, X		
Greenburgh (T)	A, AE, AO, X		
Harrison (T)	A, AE, X		
Hastings-on-Hudson (V)	AE, VE, X		
Irvington (V)	AE, VE, X		
Larchmont (V)	AE, VE, X		
Lewisboro (T)	Α, Χ		
Mamaroneck (T)	A, AE, VE, X		
Mamaroneck (V)	A, AE, AO, VE, X		
Mount Kisco (T)	A, AE, X		
Mount Pleasant (T)	A, AE, VE, X		
Mount Vernon (C)	AE, X		
New Castle (T)	A, AE, X		
New Rochelle (C)	A, AE, AO, VE, X		
North Castle (T)	A, AE, X		
North Salem (T)	A, AE, X		
Ossining (T)	A, AE, VE, X		
Ossining (V)	A, AE, VE, X		
Peekskill (C)	A, AE, VE, X		
Pelham (V)	AE, X		
Pelham Manor (V)	AE, VE, X		
Pleasantville (V)	AE, X		
Port Chester (V)	AE, VE, X		
Pound Ridge (T)	A, AE, X		
Rye (C)	AE, AO, VE, X		

## Table 5.3.1-1. Flood Zone Designations by Community





Community	Flood Zone(s)
Rye Brook (V)	A, AE, X
Scarsdale (T)	A, AE, X
Sleepy Hollow (V)	A, AE, VE, X
Somers (T)	A, AE, X
Tarrytown (V)	A, AE, VE, X
Tuckahoe (V)	AE, X
White Plains (C)	A, AE, X
Yonkers (C)	A, AE, AH, VE, X
Yorktown (T)	A, AE, X

Source: FEMA 2014

### Table 5.3.1-2. Total Land Area in the Floodplain (inclusive of waterbodies)

				0.2-Percent Annual	
		1-Percent Annual Chance Flood Event		Chance Flood Event	
Jurisdiction	Total Area (acres)	Area (acres)	Percent of Total	Area (acres)	Percent of Total
Ardsley (V)	831	57	6.8%	75	9.1%
Bedford (T)	25,405	2,191	8.6%	2,240	8.8%
Briarcliff Manor (V)	3,815	172	4.5%	190	5.0%
Bronxville (V)	622	25	4.1%	41	6.5%
Buchanan (V)	932	79	8.5%	79	8.5%
Cortlandt (T)	22,149	1,470	6.6%	1,559	7.0%
Croton-on-Hudson (V)	3,067	503	16.4%	603	19.1%
Dobbs Ferry (V)	1,550	61	3.9%	127	8.1%
Eastchester (T)	2,187	157	7.2%	229	10.5%
Elmsford (V)	659	51	7.8%	83	12.5%
Greenburgh (T)	11,469	352	3.1%	515	4.5%
Harrison (T)	11,152	913	8.2%	971	8.7%
Hastings-on-Hudson (V)	1,265	120	9.5%	161	12.5%
Irvington (V)	1,816	148	8.1%	207	11.2%
Larchmont (V)	689	148	21.5%	168	23.8%
Lewisboro (T)	18,659	1,260	6.8%	1,260	6.8%
Mamaroneck (T)	2,267	218	9.6%	236	10.4%
Mamaroneck (V)	2,011	703	34.9%	803	39.2%
Mount Kisco (T)	1,970	329	16.7%	354	18.0%
Mount Pleasant (T)	15,402	1,069	6.9%	1,245	8.1%
Mount Vernon (C)	2,816	127	4.5%	179	6.3%
New Castle (T)	14,999	418	2.8%	1,142	7.6%
New Rochelle (C)	6,638	826	12.4%	963	14.3%
North Castle (T)	16,857	2,886	17.1%	2,896	17.2%
North Salem (T)	14,858	1,537	10.3%	1,556	10.5%
Ossining (T)	1,925	24	1.3%	51	2.7%
Ossining (V)	2,016	142	7.0%	170	8.3%
Peekskill (C)	2,790	159	5.7%	171	6.1%
Pelham (T)*	1,399	128	9.2%	159	11.2%
Pelham (V)	531	36	6.8%	44	8.3%
Pelham Manor (V)	869	92	10.6%	115	13.0%





		1-Percent Annual Chance Flood Event		0.2-Percent Annual Chance Flood Event	
Jurisdiction	Total Area (acres)	Area (acres)	Percent of Total	Area (acres)	Percent of Total
Pleasantville (V)	1,148	54	4.7%	107	9.4%
Port Chester (V)	1,498	83	5.5%	120	8.0%
Pound Ridge (T)	14,771	1,306	8.8%	1,366	9.2%
Rye (C)	3,741	1,011	27.0%	1,296	34.2%
Rye Brook (V)	2,221	146	6.6%	172	7.7%
Scarsdale (T)	4,279	190	4.4%	206	4.8%
Sleepy Hollow (V)	1,446	209	14.4%	244	16.6%
Somers (T)	20,640	2,328	11.3%	2,399	11.6%
Tarrytown (V)	1,974	166	8.4%	249	12.2%
Tuckahoe (V)	383	33	8.7%	42	10.9%
White Plains (C)	6,320	164	2.6%	202	3.2%
Yonkers (C)	11,772	670	5.7%	838	7.1%
Yorktown (T)	25,183	3,808	15.1%	3,868	15.4%
Westchester County (Total)	287,592	26,442	9.2%	29,544	10.3%

Source: Westchester GIS 2021; FEMA 2007

*Notes: C* = *City; T* = *Town; V* = *Village;* % = *Percent* 

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor











### Flood Gages

The USGS National Water Information System (NWIS) collects surface water data from more than 850,000 stations across the country. The time-series data describes stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The data is collected by automatic recorders and manual field measurements at the gage locations. USGS uses stream gages to determine the severity of flood at different points along a body of water. There are several gages in Westchester County, in addition to others just outside of the County's boundary, that provide critical flood data for waterways affecting the County. Though these gages actively record and display information about flooding, they do not have flood stage data calculated by the National Weather Service.

There are seven stream gages in the County, none of which have defined flood and action stages. Table 5.3.1 3 and Figure 5.4.3 4 show the gages in the County and details about each gage. The USGS of the website provides details about each gages (https://waterwatch.usgs.gov/index.php) and the gage heights of flooding events. The NWS provides the different flood stages for the gages (https://water.weather.gov/ahps/).

Gage Site Number	Site Name	Flood Stage Data	Record Flood
01375000	Croton River at New Croton Dam near Croton-On-Hudson, NY	No flood stage data available.	18.44 ft on October 16, 1955
01374930	Muscoot River at Baldwin Place, NY	No flood stage data available.	9.42 ft on September 16, 1999
01374941	Muscoot River Below Dam at Amawalk, NY	No flood stage data available.	12.64 ft on April 17, 2007
01374890	Cross River near Cross River, NY	No flood stage data available.	6.96 ft on March 7, 2011
01374901	Cross River at Katonah, NY	No flood stage data available.	7.71 ft on March 7, 2011
01374781	Titicus River below June Road at Salem Center, NY	No flood stage data available.	6.6 ft on August 28, 2011
01374821	Titicus River at Purdy's Station, NY	No flood stage data available.	8.75 ft on August 28, 2011

### Table 5.3.1-3. Gages in Westchester County

Source: USGS 2021







## Figure 5.4.3-4. U.S. Stream Gages in Westchester County





## **Coastal Flooding**

Westchester County's shoreline along the Hudson River and Long Island Sound are vulnerable to coastal flooding. Both areas are tidally influenced, and low-lying areas along the shoreline can be impacted during high-water events such as nor'easters and coastal storms. Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas. Refer to Figure 5.4.3 3 for the flood hazard areas in the County, including the Coastal High Hazard Areas.

- Coastal High Hazard Area (CHHA) is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood. They are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM (FEMA 2014).
- Primary Frontal Dune (PFD) is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

According to the 2011 Coastal Construction Manual, FEMA P-55, Zone V (including Zones VE, V1-30, and V) identifies the Coastal High Hazard Area. This is the portion of the special flood hazard area (SFHA) that extends from offshore to the inland limit of a primary frontal dune along an open coast and any other portion of the SFHA that is subject to high-velocity wave action from storms or seismic sources. The boundary of Zone V is generally based on wave heights (3 feet or greater) or wave run-up depths (3 feet or greater). Zone V can also be mapped based on the wave overtopping rate (when waves run up and over a dune or barrier). Zone A or AE, identify portions of the SFHA that are not within the Coastal High Hazard Area. These zones are used to designate both coastal and non-coastal SFHAs. Regulatory requirements of the NFIP for buildings located in Zone A are the same for both coastal and riverine flooding hazards. Zone AE in coastal areas is divided by the limit of moderate wave action (LiMWA). The LiMWA represents the landward limit of the 1.5-foot wave (FEMA 2011).

The area between the LiMWA and the Zone V limit is known as the Coastal A-zone (for building codes and standard purposes) and as the Moderate Wave Action area (by FEMA flood mappers). This area is subject to wave heights between 1.5 and 3 feet during the base flood. The area between the LiMWA and the landward limit of Zone A is known as the Minimal Wave Action area, and is subject to wave heights less than 1.5 feet during the base flood (FEMA 2011).

## Storm Surge

According to computer projections based on Sea, Lake, and Overland Surges from Hurricanes (SLOSH), areas of coastal Westchester County along the Long island Sound, and the Hudson River could be inundated by a storm surge from a major hurricane striking at high tide. The entire County is likely to be impacted by heavy rainfall and high winds associated by hurricane and tropical storm events.

## Ice Jam Flooding

There have been no instances of reported ice jams in Westchester County, according to the US Army Corps of Engineers CRREL database.





## Dam Failure Flooding

Flooding as a result of a dam failure occurs wherever dams are located in Westchester County.

Figure 5.4.3-5 illustrates the location of dams in the County along with their hazard classification. High hazard dams are located throughout the County and can pose a threat to the population and building stock located in the dam's inundation area.

### Figure 5.4.3-5 Inventory of Dams in Westchester County







## Dams and Flood Control Measures

NYSDEC maintains an inventory of dam failure data. Hazard classification, location, volume, elevation, and condition information for each dam in Westchester County that has a federal identification number is included in the inventory. Currently, there are 229 dams in Westchester County, as shown in Section 4 (County Profile). Of these 229 dams, 132 are low hazard, 41 are intermediate hazard, 36 are high hazard, and 20 are negligible or no hazard classification (NYSDEC 2020). Table 5.3.1-4 below contains information about flood protection measures within Westchester County.

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Blind Brook	N/A	Dam	Just upstream from the confluence of East Branch Blind Brook	Constructed in 1992, addects the small portion of the Town of Harrison and for the Village of Rye Brook along Blind Brook
Long Island Sound	N/A	Seawall	Along the coast	Protects beaches, marinas against wave action but overtop during tidal storms
Manhattan Ppark Brook	Kensico Aqueduct	1% Annual Chance flood discharge contained in structure	From Kensico Aqueduct to County Center Road	Constructed by Daniel Frankfurt, Inc.
Saw Mill River	N/A	Channel	Along Saw Mill River	Construction of rectangular and trapexoidal channels, channel widening, and channel dredging

## Table 5.3.1-4. Non-Levee Flood Protection Measures

Source: FEMA 2014

## **Coastal Erosion**

Long-term erosion rates throughout the jurisdictions of Westchester County vary significantly because of geology and the physical nature of different locations along the shoreline. Although structural and other measures can be taken to reduce the impact or frequency of this hazard, all shorelines in Westchester County are vulnerable to coastal erosion. The properties most at risk to coastal erosion will be those located within 200 feet of the erodible shoreline and beaches.

Barrier islands are notably prone to large impacts from erosion. Erosion is responsible for the position and shape of most barrier islands, outside of human influence. Longshore transport of eroded sediment can result in the migration of a barrier island or barrier spit, typically with one end of the island or spit lengthening due to accretion.

Five communities within Westchester County have been designated by NYS DEC as areas that are at risk to coastal erosion from natural and human activities and is therefore regulated. NYS DEC has two programs focused on the protection of coastal erosion: Coastal Erosion Hazard Area (CEHA) permit program and the United States Army Corps of Engineers (USACE) Civil Works Program. The CEHA program regulates, and issues permits for activities within a coastal erosion hazard area. NYS DEC works with USACE to study coastal erosion problems along coastlines and to develop coastal erosion solutions. These are usually large-scale projects that impact entire communities (NYS DEC 2020). CEHA communities in Westchester County include: Village of Larchmont, Town of Mamaroneck, Village of Mamaroneck, City of New Rochelle, and City of Rye. The City of New Rochelle is a Certified CEHA Community, meaning that the City administers their own CHEA program (NYSDEC 2020). New York State prevents and reduces coastal erosion by:





- Restricting or prohibiting activities or development in natural protective feature areas;
- Ensuring new construction or structures are a safe distance from areas of active coastal erosion and the impact of coastal storms;
- Regulating the placement and construction of coastal erosion protection structures, when justified, to minimize damage to property, natural protective features, and other natural resources;
- Restricting development involving public investment in services, facilities, or activities (for example, extending public water supply and sewer services) which are likely to encourage new permanent development in coastal erosion hazard areas;
- Requiring publicly financed coastal erosion protection structures intended to minimize coastal erosion damage to be used only where necessary to protect human life or where the public benefits of such structures clearly outweigh the public expenditures;
- Encouraging administration of coastal erosion management programs by coastal municipalities and establishing procedural standards for local program implementation and establishing standards for the issuance of coastal erosion management permits (NYS DEC 2020).

Figure 5.4.3-6 through Figure 5.4.3-9 show the coastal risk hazard areas in Westchester County. Municipalities in these areas may be more susceptible to coastal erosion and the impacts caused by such events.



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## Figure 5.4.3-8. Coastal Risk Hazard Areas - Southwest Westchester County











## Sea Level Rise

Rising sea levels may have a negative impact on the process that leads to coastal erosion. Studies have shown that an increased sea level attributed to climate change can speed up the natural coastal processes that remove sand and vegetation from protective beaches, dunes, and bluffs. Erosion resulting from sea level rise will lead to more intensive coastal impacts from future storm events (NYS DHSES 2014).

During the past 100 years, the rate of global mean sea level rise was approximately 1.7 millimeters per year (0.7 inches per decade) and observations show that the rate of global sea level rise is accelerating. In New York State, tide gauge observations indicate that rates of relative sea level rise in New York State were greater than the global mean, ranging from 2.41 to 2.77 millimeters per year (0.9 to 1.1 inches per decade) over the last 100 years. Sea level in East Hudson and Mohawk River Valleys is projected to rise one to four inches by the 2020s, five to nine inches by the 2050s, and eight to 18 inches by the 2080s (NYSERDA 2011). Sea level rise will affect the State's coastal communities and natural resources. Areas beyond the immediate coastline will experience flooding and erosion associated with the increase in storm occurrences. It is projected that coastal erosion will be accelerated by rising sea levels.









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### Extent

The severity of a flood event is typically determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Severity depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris 2001).

## Riverine and Flash Flooding

The frequency and severity of riverine flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels.

In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- *Minor Flooding* minimal or no property damage, but possibly some public threat or inconvenience.
- *Moderate Flooding* some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- *Major Flooding* extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS 2011).

Wildfires, particular large-scale, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Lands impacted by wildfire increase the risk of flooding and mudflow in those areas impacted by wildfire. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water; thus, creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remain significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2013).

Flooding after a wildfire is often more severe, as debris and ash left from the fire can form mudflows. During and after a rain event, as water moves across charred and denuded ground, it can also pick up soil and sediment and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2013).

## Stormwater and Urban Flooding

Currently, there is no measurement used to further define the frequency and severity of stormwater/urban flooding.

### **Coastal Flooding**

The extent of coastal flooding due to coastal storms (hurricanes, tropical storms and Nor'Easters) is determined by three factors: 1) the nature of the storm with respect to intensity, duration, and path; 2) astronomical tide conditions at the time the storm surge wave reaches the shore; and 3) the physical geometry and bathymetry of a particular area, which affects the time and passage of the surge wave.





Coastal flooding levels, categorized as minor, moderate, or major, are calculated based on the amount of water as it rises above the normal tide in a particular area. Minor flooding represents nuisance coastal flooding of locations adjacent to the shoreline. Minor beach erosion can be expected. Minor coastal flooding is not expected to close roads or do any major structural damage to homes and other buildings. Moderate coastal flooding is when more substantial coastal flooding occurs, threatening life and Some roads will likely become impassable and property. moderate beach erosion will occur. Some homes, businesses and other facilities will experience damage. Major coastal flooding represents a serious threat to both life and property. Many roads will likely become flooded and numerous homes and businesses along the coast will receive major damage. Major beach erosion is also expected (NWS n.d.).

The NWS uses coastal flood watches, warnings and advisories to ensure that people know what to expect in the coming hours and days. Advisories are issued when minor tidal flooding is expected. Minor tidal flooding often results in some road closures and the usually the most vulnerable roadways will flood. Coastal flood watches are issued to inform the public and cooperating agencies that coastal flooding is possible approximately 12 to 36 hours after issuance time. They are issued when flooding with significant impact is possible. Coastal flood warnings are issued to warn the public and cooperating agencies that coastal flooding, posing a serious threat to life and property, is occurring, imminent, or highly likely to occur within the next 12 hours (NWS 2020).

As stated by the NWS, other important factors affecting the local severity, extent, and duration of coastal flooding include: (1) the various tidal cycles, (2) the persistence and behavior of the storm generating the flooding, (3) the topography, shoreline orientation, and bathymetry of the area, (4) the river stage or stream runoff in estuaries, and (5) the presence or absence of offshore reefs or other barriers. Coastal flooding intensities range from minor tidal overflow with little or no damage to a combination of the aforementioned causative factors resulting in extensive inundation and beach erosion (NWS 2020).

### Storm Surge

Typically, storm surge is estimated by subtracting the regular/astrological tide level from the observed storm tide. Typical storm surge heights range from several feet to more than 25 feet. The exact height of the storm surge and which coastal areas will be flooded depends on many factors: strength, intensity, and speed of the hurricane or storm; the direction it is moving relative to the shoreline; how rapidly the sea floor is sloping along the shore; the shape of the shoreline; and the astronomical tide. Storm surge is the most damaging when it occurs along a shallow sloped shoreline, during high tide, in a highly populated, and developed area with little or no natural buffers (for example, barrier islands, coral reefs, and coastal vegetation).

The most common reference to a return period for storm surges has been the elevation of the coastal flood having a 1-percent chance of being equaled or exceeded in any given year, also known as the 100-year flood. Detailed hydraulic analyses include establishing the relationship of tide levels with wave heights and wave run-up. The storm surge inundation limits for the 1-percent annual chance coastal flood event are a function of the combined influence of the water surface elevation rise and accompanying wave heights and wave run-up along the coastline.

A storm surge associated with storms of longer recurrence intervals may result in more storm surge flooding, higher water levels, larger waves, and an increased likelihood of dune overwash, wave damage, and possible breaching of barrier islands.

Storm surge modeling, known as SLOSH (Sea, Lake, and Overland Surges from Hurricanes), computes storm surges based on storm movement in different directions and strengths in combination with topography and bathymetry. SLOSH models analyze storms movement (moving northeast, northwest), changing in strength (from Category 1 to Category 4), and striking during different tidal cycles (NYS DHSES 2019).





SLOSH calculations are based on storm surges reaching above average tides and strong potential winds for each category storm. The error of this model ranges between plus or minus three feet. Figure 5.4.3-14 illustrates the SLOSH map for Westchester County.







Figure 5.4.3-14. Sea Lake Overland Surge from Hurricanes (SLOSH Model) – Northwest Westchester County

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Figure 5.4.3-15. Sea Lake Overland Surge from Hurricanes (SLOSH Model) – West-Central Westchester County

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Figure 5.4.3-16. Sea Lake Overland Surge from Hurricanes (SLOSH Model) – Southwest Westchester County





Figure 5.4.3-17. Sea Lake Overland Surge from Hurricanes (SLOSH Model) – Southeast Westchester County





#### Ice Jam

Ice jam flooding events often occur suddenly and difficult to predict, allowing for little time to prepare for and warn of an event. The size of the snowpack and the rate of snowmelt controls the extent of an ice jam (Rokaya 2018).

# Dam Failure

According to the NYSDEC Division of Water Bureau of Flood Protection and Dam Safety, the hazard classification of a dam is assigned according to the potential impacts of a dam failure pursuant to 6 New York Codes, Rules, and Regulations (NYCRR) Part 673.3 (NYSDEC 2009). Dams are classified in terms of potential for downstream damage if the dam were to fail. These hazard classifications are identified and defined below:

- Low Hazard (Class A) is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property
- Intermediate Hazard (Class B) is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- *High Hazard (Class C)* is a dam located in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure.
- *Negligible or No Hazard (Class D)* is (1) a dam that has been breached or removed, or has failed or otherwise no longer materially impounds waters, or (2) a dam that was planned but never constructed. Class "D" dams are considered to be defunct dams posing negligible or no hazard. The department may retain pertinent records regarding such dams (NYSDEC 2009).

# **Cascading Impacts**

# Coastal Erosion

Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Geologists measure the severity of erosion in two ways -- as a rate of linear retreat (feet of shoreline recession per year) and volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year) (NYC Emergency Management 2019).

Coastal erosion can be rapid or can occur gradually. However, measuring erosion is often difficult, because the extent of natural erosion in a specific shoreline varies significantly from year to year. If choices are made to dredge or nourish beaches along particular parts of the coast, it can be difficult to determine how much beach is being lost or gained through natural processes and how much is being affected by human activities (NYC Emergency Management 2019). Coastal erosion may also be exacerbated by human activities, such as boat wakes, shoreline hardening, and dredging (FEMA 1996). In barrier islands and barrier spits, severe erosion can result in the formation of tidal inlets.





The USGS Coastal Change Hazards Portal hosts a short-term (30 years) change mapper, which displays the rate of average shoreline change on coastal shorelines. The Portal indicates that, over the past 30 years, Suffolk County had various rates shoreline change ranging from -1 meter to 2 meters per year. Figure 5.4.1-1 displays short-term shoreline change rates for Suffolk County's south shore.

Coastal erosion is measured at a rate of either linear retreat (feet of shoreline recession per year) or volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year). A number of factors determine whether a community exhibits greater long-term erosion or accretion:

- Exposure to high-energy storm waves,
- Sediment size and composition of eroding coastal landforms feeding adjacent beaches,
- Near-shore bathymetric variations which direct wave approach,
- Alongshore variations in wave energy and sediment transport rates,
- Relative sea level rise,
- Frequency and severity of storm events, and
- Human interference with sediment supply (e.g. revetments, seawalls, jetties) (Woods Hole Sea Grant 2003).

# Sea Level Rise

The global sea level trend has been recorded by satellite altimeters since 1992 and the latest calculation can be obtained from NOAA's Laboratory for Satellite Altimetry. The University of Colorado's Sea Level Research Group compares global sea level rates calculated by different research organizations and provides detailed explanations about the issues involved (NOAA 2020). A map of regional MSL in the United States can be found here: <a href="http://tidesandcurrents.noaa.gov/sltrends/slrmap.htm">http://tidesandcurrents.noaa.gov/sltrends/slrmap.htm</a>. The map provides an overview of variations in the rates of relative local MSL at long-term tide stations. The variations in sea level trends primarily reflect differences in rates and sources of vertical land motion. Areas that experienced little-to-no change in MSL are shown in green, including stations consistent with average global sea level rise rate of 1.7 to 1.8 mm/year. These stations do not experience both global sea level rise and lowering or sinking of the local land, causing an apparent exaggerated rate of relative sea level rise. Stations that are blue to brown have experienced global sea level rise and a greater vertical rise in local land, causing an apparent decrease in relative sea level. The rates of relative sea level rise reflect actual observations and must be accounted for in any coastal planning or engineering applications (NOAA 2020).

There are three tide stations located near Westchester County. This is where tide gauge measurements are made with respect to a local fixed reference level on land. Figure 5.4.3-18 shows these changes for Kings Point, Port Jefferson, and The Battery. Table 5.3.1-5 presents the history and MSL trends for the stations near Westchester County, which show the result of a combination of the global sea level rate and local vertical land motion.







#### Figure 5.4.3-18. Sea Level Trends near Westchester County

NOAA, 2021 Source: Note: The red oval indicates the approximate location of Westchester County.

# Table 5.3.1-5. Linear MSL Trends and 95% Confidence Intervals

			For all da	ta to 2020			
Station Name	First Year	Year Range	MSL Trend (mm/year)	+/- 95% Confidence Interval			
Kings Point, NY	1931	89	2.3	0.2			
Port Jefferson, NY	1957	36	2.44	0.76			
The Battery, NY	1856	164	2.88	0.09			
Source: NOA	4, 2021						
mm/year milli	meter per year						
MSL Mean	Mean Sea Level						

#### **Previous Occurrences and Losses**

Table 5.3.1-6 documents historical flood events from 1950 to May 2021 in Westchester County based on data collected from the NCEI, National Performance of Dams Program (NPDP), and Cold Regions Research and Engineering Laboratory (CRREL) databases.

# Table 5.3.1-6. Flood Events 1950-2021

Hazard Type	Number of Occurrences Between 1950 and 2021	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Flood	54	1	1	\$0	\$0
Coastal Flood	17	2	1	\$0	\$0
Flash Flood	121	0	0	\$6.67 Million	\$0
Storm Surge/Tide	1	0	0	\$0	\$0





Hazard Type	Number of Occurrences Between 1950 and 2021	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Ice Jams	0	0	0	\$0	\$0
Dam Failure	0	0	0	\$0	\$0
TOTAL	193	3	2	\$6.67 Million	<b>\$0</b>

Source: NOAA-NCEI 2021

Notes: CRELL data does not include information on total fatalities, injuries, property damages, or crop damages

#### FEMA Disaster Declarations

Between 1954 and 2021, FEMA included New York State in 53 flood-related major disaster (DR) or emergency (EM) declarations classified as one or a combination of the following disaster types: severe storms, flooding, storms, rain, landslides, severe storms, hurricane, and inland/coastal flooding. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Westchester County was included in 20 of these flood-related declarations; refer to Table 5.3.1-7.

#### Table 5.3.1-7. Flood-Related FEMA Declarations for Westchester County, 1954 to 2021

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-4615 EM-3572	September 5, 2021	September 1-3, 2021	Hurricane	Remnants of Hurricane Ida
EM-3565	August 22, 2021	August 21-24, 2021	Hurricane	Hurricane Henri
DR-4567	October 2, 2020	August 4, 2020	Hurricane	Tropical Storm Isaias
DR-4085 EM-3351	October 30, 2012	October 27, 2012 – November 8, 2012	Hurricane	Hurricane Sandy
DR-4020 EM-3328	August 31, 2011	August 26, 2011 – September 5, 2011	Hurricane	Hurricane Irene
DR-1899	April 16, 2010	March 13, 2010 – March 31, 2010	Severe Storm(s)	Severe Storms and Flooding
DR-1692	April 24, 2007 April 14, 2007 – April 18, 2007 Severe Storm(s) Severe St		Severe Storms and Inland Coastal Flooding	
DR-1650	July 1, 2006	June 26, 2006 – July 10, 2006	Severe Storm(s)	Severe Storms and Flooding
DR-1589	April 19, 2005	April 2, 2005 – April 4, 2005	Severe Storm(s)	Severe Storms and Flooding
DR-1534	August 3, 2004	May 13, 2004 – June 17, 2004	Severe Storm(s)	Severe Storms and Flooding
DR-1296 EM-3149	September 19, 1999	September 16, 1999 – September 18, 1999	Hurricane	Hurricane Floyd Major Disaster Declaration
DR-1146	November 19, 1996	October 19, 1996 – October 20, 1996	Severe Storm(s)	Severe Storms, Flooding, Heavy Rains, High Winds
DR-974	December 21, 1992	December 10, 1992 – December 14, 1992	Flood	Coastal Storm, High Tides, Heavy Rain, Flooding
DR-702	April 17, 1984	March 28, 1984 – April 8, 1984	Flood	Coastal Storms, Flooding
DR-487	October 2, 1975	October 2, 1975	Flood	Storms, Rains, Landslides, and Flooding
DR-338	June 23, 1972	June 23, 1972	Flood	Tropical Storm Agnes
DR-311	September 13, 1971	September 13, 1971	Flood	Severe Storms & Flooding

Source: FEMA 2021





# **USDA** Declarations

Between 2014 and 2021, Westchester County was included in 3 flood-related USDA Disaster Designations; refer to Table 5.3.1-8 below for more information.

Disaster Number	Approval Date	Event Date	Description of Disaster
S3747	September 24, 2014	April 1, 2014 – July 8, 2014	Excessive Rain, Flash Flooding, Flooding, High Winds, and Hail
S4478	March 20, 2019	August 1, 2018 – November 30, 2018	Excessive Rainfall
S4479	April 10, 2019	July 23, 2018 – Continuing	Excessive Precipitation
Source: USDA 202	21		-

# Table 5.3.1-8. USDA Flood Disaster Designations for Westchester County, 2014 – 2021

#### Previous Events

For this update, flood events were summarized from 2014 to 2021. Known flood events, including FEMA disaster declarations, which have impacted Westchester County between 2014 and 2021 are identified in Table 5.3.1-9. Appendix E (Supplemental Data) contains details on flood events that occurred prior to 2014.





# Table 5.3.1-9. Flood Events in Westchester County, 2014 - 2021

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
April 30, 2014	Flood/ Heavy Rain	N/A	N/A	A mudslide occurred near the Glenwood Metro North Train Station in Yonkers as a result of the heavy rain. Storm total rainfall amounts reported across the county ranged from 2.85 inches in Peekskill to 5.28 inches in Bronxville. In White Plains, the Bronx River Parkway and Hutchinson River Parkway were closed due to flooding.
May 1, 2014	Flood/ Heavy Rain	N/A	N/A	A frontal system associated with a large cutoff low pressure system over the Midwest and Lower Great Lakes region caused periods of heavy rain, which resulted in continued flooding across Westchester and Rockland Counties as well as the Bronx in New York City. The northbound Hutchinson River Parkway was closed between exit 7 and exit 12. Additionally, the Saw Mill River Parkway was closed southbound from exit 16 to Farragut Parkway and northbound between exits 20 and 21 in Elmsford due to flooding. The southbound Bronx River Parkway was closed between Route 100/119 and the Sprain Brook Parkway due to flooding.
July 3, 2014	Flash Flood/ Heavy Rain/ Tropical System	N/A	N/A	As a cold front slowly moved across the area, moisture from Tropical Cyclone Arthur passing to the south and east converged along the boundary resulting in severe thunderstorms, heavy rain and flash flooding in portions of southeast New York. The Bronx River Parkway was closed between the Sprain Brook Parkway in Yonkers and Exit 21, Main St. in White Plains, in both directions due to flooding. Additionally, the Saw Mill River Parkway was closed between exit 27 Marble Ave. and exit 29 Manville Rd. in Pleasantville due to flooding.
July 14 – 15, 2014	Flash Flood/ Heavy Rain	N/A	N/A	A very moist and unstable airmass triggered showers and thunderstorms on multiple surface boundaries. Several rounds of storms produced heavy rain that resulted in flash flooding in portions of Southeast New York. North Greeley Ave. was closed in Chappaqua due to flooding. Several cars were stranded in flood waters up to their doors near Brandurst Ave. in Mt. Pleasant. Water rescues were performed on the Taconic State Parkway near Stevens Avenue. The Bronx River Parkway was closed southbound in White Plains due to flooding. Bloomingdale Rd. was closed in White Plains due to flooding. The Hutchinson River Parkway was closed between exits 10 and 12 in Mt. Vernon due to flooding.
December 9, 2014	Flood/ Heavy Rain	N/A	N/A	A coastal storm passed just south and east of the area causing strong winds and heavy rain with flooding in portions of Southeast New York. The Bronx River Parkway was closed between exit 21 and the Sprain Brook Parkway in Scarsdale due to flooding. The Taconic State Parkway was closed at Stevens Ave. in Mount Pleasant due to flooding. The northbound Hutchinson River Parkway was closed at Lincoln Ave. in Mount Vernon due to flooding. Hayes and Lemont St. in Elmsford was closed due to the Saw Mill River overflowing its banks.
January 23, 2016	Coastal Flood	N/A	N/A	The NOS tidal gauge at Kings Point New York recorded a peak water level of 11.4 ft. MLLW at 11:06 am EST. The moderate coastal flood threshold of 10.5 ft MLLW was exceeded from 9:36 am to 12:42 pm EST. In Rye, NY, law enforcement reported that Milton Road near Rye Marina was flooded and impassable from Fairlawn Avenue to Hewlett Avenue, and Kirby Lane at Tide Mill was flooded and impassable from 11 am to 1 pm EST.





Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
October 21, 2016	Flood/ Heavy Rain	N/A	N/A	The Hutchinson River Parkway was closed southbound in Pelham due to flooding. The Bronx River Parkway was closed due to flooding from the Sprain Brook Parkway to the County Center in White Plains.
March 14, 2017	Coastal Flood	N/A	N/A	The USACE tidal gauge at Stamford recorded a peak water level of 10.9 ft. MLLW at 12 pm EST. This is 2 tenths of a foot under the moderate coastal flood threshold of 11.1 ft MLLW. The NOS tidal gauge at Kings Point recorded a peak water level of 10.8 ft MLLW at 1:12 pm EST. This is 3 tenths of a foot over the moderate coastal flood threshold of 10.5 ft MLLW, which was exceeded between 1206pm and 2:42pm EST. These water levels resulted in impassable roads in the City of Rye, specifically Milton Rd. at Hewlett Ave., Kirby Lane at Tide Mill, Pine Island Drive, and Stuyvesant Ave. near near the entrance to the American Yacht Club. These roads were impassable starting one hour prior to high tide, taking 3 hours to open roads.
July 7, 2017	Flash Flood/ Heavy Rain	N/A	N/A	Rainfall amounts ranged from 1-2.5 across the area, with reports of 2.16 of rain in Nanuet from an IFLOWS gauge and 1.96 in Armonk from CoCoRaHS. This resulted in isolated flash flooding in Westchester County and the Mahwah River near Suffern, NY rising above its flood stage of 4.0 feet for several hours. The Saw Mill Parkway was closed northbound at Marble Avenue in Pleasantville.
October 29, 2017	Flood/ Heavy Rain	N/A	N/A	Rainfall totals across southeastern New York ranged from 2-6 inches. Broadway was closed due to flooding between Prospect Avenue and Benedict Avenue in Tarrytown.
April 16, 2018	Flash Flood/ Heavy Rain	N/A	N/A	Rainfall totals generally ranged from 1.5 to 3.5 inches across much of New York City and the Lower Hudson Valley, with the majority of the rain falling in a 3-4 hour period. This resulted in flash flooding across the region. Flooding closed both lanes of the Bronx River Parkway at Exit 21 and NY119/Main Street in White Plains.
December 21, 2018	Flash Flood/ Heavy Rain	N/A	N/A	The Bronx River Parkway was closed in both directions between the Sprain Brook Parkway and Exit 21 (Main Street) in White Plains due to flooding. State Route 6/202 was closed due to flooding in Annsville between the Bear Mountain Bridge and the Annsville Circle.
January 20, 2019	Coastal Flood	N/A	N/A	A peak water level of 10.6 ft MLLW occurred at the NOS tidal gauge at Kings Point from 2019-01- 20 10:12 to 2019-01-20 10:36. The moderate coastal flood threshold of 10.5 ft MLLW was exceeded from 2019-01-20 09:00 to 2019-01-20 10:48.
July 22 – 23, 2019	Flash Flood/ Heavy Rain	N/A	N/A	Y 128 (Armonk Road) was closed in both directions due to flooding south of Main Street in Mount Kisco. Bumper high water flooded the intersection of Weaver Street and Boston Post Road (Route 1) in Mamaroneck. All northbound lanes closed due to flooding on the Saw Mill River Parkway between Marble Avenue (Exit 27) and Bedford Road in Mount Pleasant. Il southbound lanes closed on the Saw Mill River Parkway due to flooding south of Grant Street (Exit 30) in the vicinity of Pleasantville Road (CR 106) in Mount Pleasant. The Saw Mill River Parkway was closed northbound at Marble Avenue (Exit 27) and southbound at Manville Road in Pleasantville due to flooding.
October 17, 2019	Coastal Flood	N/A	N/A	A peak water level of 10.4 ft MLLW occurred at the nearby USGS tidal gauge at Stamford CT at 2019-10-17 02:30 EDT. The moderate coastal flood threshold of 10.0 ft MLLW was exceeded from 2019-10-17 02:00 EDT to 2019-10-17 03:00 EDT.
October 27, 2019	Coastal Flood	N/A	N/A	A peak water level of 10.6 ft MLLW occurred at the nearby USGS tidal gauge at Stamford CT from 2019-10-27 11:00 EDT to 2019-10-27 11:30 EDT. The moderate coastal flood threshold of 10.0 ft MLLW was exceeded from 2019-10-27 10:00 EDT to 2019-10-27 12:30 EDT.





Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
July 10, 2020	Flash Flood/ Heavy Rain	N/A	N/A	Tropical Storm Fay tracked northward along the New Jersey coast before passing west of New York
2020	Tiedvy Rain			approached. This rain developed in a tropical airmass, with precipitable water values over 2 inches.
				All lanes blocked southbound between exits 15 and 4 on the Bronx River Parkway southbound due to
				flooding in Scarsdale. All lanes were blocked southbound due to flooding on the Bronx River
4	<b>T</b> 1.10.	DD 45/5		Parkway between Scarsdale Road and the Sprain Brook Parkway in Cedar Knoils.
August 3,	Tropical Storm	DR-4567	Yes	I ropical Storm Isaias passed through the region. In Westchester Valley, downed trees left the Town
2020	Isaias			Hall without power and cable for two days. Damages to Town roads exceeded \$122,000. Nearly all
				of the County, including 90% of NYSEG customers, was left without power, and the County was in a
				Declared State of Emergency (Patch.com 2020). The National Guard was deployed to distribute
				water to municipalities and the damage was reported to exceed that of Superstorm Sandy
				(Westchester County Online 2020).
August 21-	Hurricane	EM-3565	Yes	Rainfall totals in Westchester County included: 6.43 inches in New Rochelle, 5.29 inches in
24, 2021	Henri			Tarrytown, 5 inches in Rye, 4.8 inches in Elmsford, 4.7 inches in Scarsdale, and 4 inches in Briarcliff
				Manor. Flash flooding was reported throughout the County, closing roadways and impacting
				emergency response.
September	Remnants of	DR-4615	Yes	Remnants of Hurricane Ida from heavy rain and flooding to Westchester County. Numerous
1-3, 2021	Hurricane Ida			roadways were flooded and closed, with several cars become stuck in floodwaters. Downed trees fell
				across roadways and took down power lines.

Source(s): NOAA NCEI 2021; FEMA 2021

Note: Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table.

FEMA Federal Emergency Management Agency

HMP Hazard Mitigation Plan

NCDC National Climatic Data Center

NOAA National Oceanic and Atmospheric Administration

NWS National Weather Service

NYS New York State



# **Climate Change Projections**

Climate change is affecting both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. *ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA], 2011). Observed trends between 1901 and 2012 indicate that the greater Westchester County region has seen temperature increase of 0.22 degrees per decade and increases in precipitation of 0.9 inches per decade (NYSERDA, 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Westchester County is part of Region 5, East Hudson and Mohawk River Valleys. Some of the issues in this region, affected by climate change, include more frequent heat waves and above 90°F days, more heat-related deaths, increased frequency of heavy precipitation and flooding, decline in air quality, etc. (NYSERDA, 2011).

Temperatures and precipitation amounts are expected to increase throughout the State as well as in Region 5.

NYSERDA's middle range estimates for precipitation change increases in the region call for between two and seven percent increases above the 1971-2000 baseline by 2020, and between four and twelve percent increases by 2050. By 2100, middle range estimates call for increases by between five and twenty-one percent above the 1971-2000 baseline (NYSERDA, 2014). Table 5.3.1-10 displays the projected seasonal precipitation change for the East Hudson and Mohawk River Valleys ClimAID Region (NYSERDA, 2011).

#### Table 5.3.1-10. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

	Winter	Spring	Summer	Fall
	+5 to +15	-5 to +10	-5 to +5	-5 to +10
Source:	NYSERDA 2014			

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways and transportation hugs; and increase delays and hazards related to extreme weather events (NYSERDA 2011).

Increasing air temperatures intensify the water cycle by increasing evaporation and precipitation. This can cause an increase in rain totals during events with longer dry periods in between those events. These changes can have a variety of effects on the State's water resources (NYSERDA 2011). Table 5.3.1-11 displays the project rainfall and frequency of extreme storms in New York State. The amount of rain fall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Medium-range sea level rise estimates for the Lower Hudson region relative to the 2000-2004 baseline are six inches by the 2020s, 16 inches by the 2050s, 29 inches by the 2080s, and 36 inches by 2100. Low estimates are 4, 11, 18, and 22 inches respectively whereas high estimates are 10, 30, 58, and 75 inches respectively (NYSDEC 2020).







Table 5.3.1-11. Projected Rainfall and Frequency of Extreme Storms

Source: NYSERDA 2011

Assumptions about a river's flow behavior, expressed as hydrographs are influences for dam design. Changes in weather patterns can significantly affect the hydrograph used for the design of a dam. If the hygrograph changes, the dam conceivably could lose some or all of its designed margin of safety, also known as freeboard. Loss of designed margin of safety increases possibility that floodwaters would overtop the dam or create unintended loads, which could lead to a dam failure.

Increases in sea level rise will impact Westchester County's coastal floodplain. The Hudson River in the vicinity of Westchester County is tidally influenced and subject to changes in global sea level. The table below shows the estimated increase in square miles of floodplain based on the extent of Westchester County's current floodplain (NYSERDA 2016).

			Sea Level Rise (Feet)					
		1	1.5	2	3	4	5	6
IS	10%	57.6	70.4	83.2	102.4	128	153.6	179.2
uual ince ood itior	2%	25.6	38.4	51.2	76.8	102.4	121.6	140.8
Ant Cha Fld	1%	25.6	38.4	51.2	76.8	96	115.2	128
E	0.2%	25.6	32	38.4	57.6	70.4	89.6	102.4

Table 5.3.1-12. Increase in Acreage of Floodplain Due to Sea Level Rise in Westchester Count
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Source: NYSERDA 2016

# **Probability of Future Occurrences**

Based on the historic and more recent flood events in Westchester County, and the future climate projections for this region, the County has a moderate probability of future flooding. It is anticipated that Westchester County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences. Additionally, climate change is expected to increase the severity and frequency of heavy rain events in Westchester County. This is likely to lead to an increase in flooding events and dam failure events.

As defined by FEMA, Westchester County's 1-percent annual chance flood area is estimated to have a onepercent chance of flooding in any given year. A structure located within a 1-percent annual chance flood area





has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage. Similarly, the 0.2-percent annual chance flood has a 6-percent chance of occurring during a 30-year time period.

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. However, the risk of such an event increases for each dam as the dam's age increases and/or frequency of maintenance decreases.

According to the NOAA NCEI, Westchester County experienced 193 flood events between 1954 and May 2021, including 54 floods, 121 flash floods, 0 dam failures, and 0 ice jams. The table below shows these statistics, as well as the annual average number of events and the percent chance of these individual flood hazards occurring in Westchester County in future years based on the historic record (NOAA NCEI 2020).

Hazard Type	Number of Occurrences Between 1954 and 2021	% chance of occurrence in any given year
Flood	54	80.5%
Coastal Flood	17	25.4%
Flash Flood	121	100%
Storm Surge/Tide	1	1.5%
Ice Jams	0	0%
Dam Failure	0	0%
TOTAL	193	100%

Table 5.3.1-13. Probability of Future Occurrence of Flooding Events

Source: NOAA-NCEI 2020; CRELL 2020; NPDP 2020; FEMA 2020

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act (Public Law 81-875), and selected flood events since 1996. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 5.3, the identified hazards of concern for Westchester County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records, the probability of occurrence for flood in the County is considered 'frequent' (100% annual probability of occurring; occurs multiple times a year).

# 5.3.2 Vulnerability Assessment

To assess Westchester County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map products dated September 2007, NOAA's storm surge SLOSH Categories 1 through 4, sea level rise 1-foot, 3-feet, and 6 feet scenarios provided by the County, and the NYDOS moderate, high, and extreme coastal risk hazard areas. The 1-percent annual chance flood event was further examined to estimate potential loss using the FEMA Hazus model. These results are summarized below. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess flood risk.

# Impact on Life, Health and Safety

The impact of flooding on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable. The impacts from each flood hazard of concern is described below.





# **Riverine and Coastal Flooding**

To estimate population exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 18,696 residents living in the 1-percent annual chance floodplain, or 1.9-percent of the County's total population. There are an estimated 25,411 residents living in the 0.2-percent annual chance floodplain, or 2.6-percent of the County's total population. The City of New Rochelle has the greatest number of residents living in the 1-percent annual chance flood event hazard area with approximately 3,079 residents and the Village of Mamaroneck has the greatest number of residents living in the 0.2-percent annual chance flood event with approximately 3,581 residents. Table 5.3.2-1 summarizes the population exposed to the flood hazard by jurisdiction.

	Total Population	Estimated Population Located in the Flood Hazard Areas							
Jurisdiction	(American Community Survey 2015-2019)	1-percent Annual Chance Flood	Percent of Total	0.2-percent Annual Chance Flood	Percent of Total				
Ardsley (V)	4,512	21	0.5%	39	0.9%				
Bedford (T)	17,803	73	0.4%	101	0.6%				
Briarcliff Manor (V)	7,616	62	0.8%	79	1.0%				
Bronxville (V)	6,409	92	1.4%	155	2.4%				
Buchanan (V)	2,140	5	0.2%	5	0.2%				
Cortlandt (T)	32,131	253	0.8%	303	0.9%				
Croton-on-Hudson (V)	8,155	30	0.4%	60	0.7%				
Dobbs Ferry (V)	11,070	0	0.0%	275	2.5%				
Eastchester (T)	19,990	59	0.3%	419	2.1%				
Elmsford (V)	5,085	64	1.3%	223	4.4%				
Greenburgh (T)	44,829	265	0.6%	412	0.9%				
Harrison (T)	28,135	1,720	6.1%	2,195	7.8%				
Hastings-on-Hudson (V)	7,921	13	0.2%	73	0.9%				
Irvington (V)	6,529	186	2.8%	219	3.3%				
Larchmont (V)	6,096	763	12.5%	824	13.5%				
Lewisboro (T)	12,599	122	1.0%	122	1.0%				
Mamaroneck (T)	11,298	590	5.2%	667	5.9%				
Mamaroneck (V)	19,217	3,025	15.7%	3,581	18.6%				
Mount Kisco (T)	10,866	27	0.2%	40	0.4%				
Mount Pleasant (T)	27,000	169	0.6%	319	1.2%				
Mount Vernon (C)	67,896	100	0.1%	214	0.3%				
New Castle (T)	17,905	135	0.8%	454	2.5%				
New Rochelle (C)	79,067	3,079	3.9%	3,388	4.3%				
North Castle (T)	12,235	341	2.8%	341	2.8%				
North Salem (T)	5,167	167	3.2%	179	3.5%				
Ossining (T)	5,567	8	0.1%	56	1.0%				
Ossining (V)	25,086	85	0.3%	114	0.5%				
Peekskill (C)	24,075	77	0.3%	77	0.3%				
Pelham (T)*	12,510	353	2.8%	456	3.6%				
Pelham (V)	6,941	145	2.1%	246	3.5%				
Pelham Manor (V)	5,569	207	3.7%	210	3.8%				
Pleasantville (V)	7,221	72	1.0%	136	1.9%				
Port Chester (V)	29,342	186	0.6%	415	1.4%				
Pound Ridge (T)	5,177	62	1.2%	112	2.2%				
Rye (C)	15,820	1,839	11.6%	3,318	21.0%				

# Table 5.3.2-1. Estimated Number of Persons in Westchester County Living in the 1-percent and 0.2-percent Annual Chance Flood Event Hazard Areas



	Total Population	Estimated	Population Locate	ed in the Flood Ha	zard Areas
Jurisdiction	(American Community Survey 2015-2019)	1-percent Annual Chance Flood	Percent of Total	0.2-percent Annual Chance Flood	Percent of Total
Rye Brook (V)	9,487	466	4.9%	646	6.8%
Scarsdale (T)	17,837	381	2.1%	427	2.4%
Sleepy Hollow (V)	10,122	457	4.5%	486	4.8%
Somers (T)	21,487	24	0.1%	31	0.1%
Tarrytown (V)	11,436	49	0.4%	62	0.5%
Tuckahoe (V)	6,584	113	1.7%	290	4.4%
White Plains (C)	58,137	19	0.0%	68	0.1%
Yonkers (C)	199,968	2,104	1.1%	2,927	1.5%
Yorktown (T)	36,538	1,041	2.8%	1,106	3.0%
Westchester County (Total)	968,065	18,696	1.9%	25,411	2.6%

Sources: American Community Survey 2019 5-year estimates; FEMA 2007

Note: C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. There are 83,793 persons below the poverty level and 162,363 persons that are over 65 years old in the County. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact to their family. The population over the age of 65 is more vulnerable because they are more likely to seek or need medical attention which may not be available to due isolation during a flood event and they may have more difficulty evacuating. Special consideration should be taken when planning for disaster preparation, response, and recovery for these vulnerable groups.

In addition, displaced populations were estimated for the 1-percent annual chance flood event. It is important to note that the impacts to the households in the FEMA flood hazard area are assessed using the riverine flood model in Hazus. This underestimates any additional damage that may be caused by coastal flooding for persons living in the VE zones. Using 2010 U.S. Census data, Hazus estimates 8,460 people may seek short-term sheltering. These statistics, by jurisdiction, are presented in Table 5.3.2-2

Table 5.3.2-2. Estimated Population Seeking Short-Term Shelter from the 1-percent Annual Chance
Flood Event

Jurisdiction	Persons Seeking Short-Term Sheltering
Ardsley (V)	12
Bedford (T)	139
Briarcliff Manor (V)	79
Bronxville (V)	54
Buchanan (V)	14
Cortlandt (T)	427
Croton-on-Hudson (V)	41
Dobbs Ferry (V)	68
Eastchester (T)	115
Elmsford (V)	45
Greenburgh (T)	171
Harrison (T)	467
Hastings-on-Hudson (V)	31
Irvington (V)	179
Larchmont (V)	98
Lewisboro (T)	96
Mamaroneck (T)	175
Mamaroneck (V)	501



Jurisdiction	Persons Seeking Short-Term Sheltering
Mount Kisco (T)	319
Mount Pleasant (T)	137
Mount Vernon (C)	86
New Castle (T)	70
New Rochelle (C)	1,015
North Castle (T)	257
North Salem (T)	58
Ossining (T)	13
Ossining (V)	213
Peekskill (C)	133
Pelham (T)*	49
Pelham (V)	28
Pelham Manor (V)	21
Pleasantville (V)	50
Port Chester (V)	160
Pound Ridge (T)	126
Rye (C)	409
Rye Brook (V)	270
Scarsdale (T)	94
Sleepy Hollow (V)	150
Somers (T)	119
Tarrytown (V)	180
Tuckahoe (V)	76
White Plains (C)	44
Yonkers (C)	721
Yorktown (T)	999
Westchester County (Total)	8,460

Sources: Hazus v5.0

Nestchester

Note: C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood.

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2020).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning





- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

# Flash Flooding

Flash flooding events can displace populations along steep topography particularly in cases when flood waters surge into residential properties or alter the terrain into unsafe conditions requiring evacuation. According to Table 5.3.1-6, zero injuries have been reported from historical flash flood events that have occurred in Westchester County.

# Stormwater and Urban Flooding

Urban and stormwater flooding has been reported at various locations in the County. Impacts are generally limited to roadways with underlying culverts. In various communities, poor drainage and rainstorms lead to localized flooding on various streets and in residential developments. This type of flooding could cause persons to become isolated or displaced from their homes.

#### Storm Surge

The impact of a coastal storm surge on life, health and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. Approximately 2.3-percent of Westchester County's residents (or 22,377 people) live in Category 4 hurricane storm surge inundation area (2015-2019 ACS 5-year Estimate). Further, approximately 0.3-percent of the population is exposed to Category 1 storm surge impacts. The coastal storm events can displace population and/or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Please refer to Section 4 (County Profile) for more information about Westchester County's demographics to gain more insight about persons vulnerable to this hazard.

The loss associated with coastal storms can vary across the County. Secondary flooding associated with the torrential downpours during hurricanes/tropical storms are also a concern. The estimated population living in the Category 1 through 4 SLOSH inundation zones is summarized in Table 5.3.2-3 by jurisdiction. Overall, the Village of Mamaroneck and the City of Rye have the greatest number of residents in the SLOSH inundation areas. Figure 5.4.3-14 through Figure 5.4.3-17 illustrates the SLOSH zones for Westchester County.





	Estimated Population Located in the Storm Surge Hazard Area								
Jurisdiction	Total Population (American Community Survey 2015- 2019)	Number of Persons Located in the SLOSH Category 1 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 2 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 3 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 4 Hazard Area	Percent of Total
Ardsley (V)	4,512	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bedford (T)	17,803	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Briarcliff Manor (V)	7,616	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bronxville (V)	6,409	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Buchanan (V)	2,140	0	0.0%	0	0.0%	5	0.2%	36	1.7%
Cortlandt (T)	32,131	49	0.2%	96	0.3%	183	0.6%	285	0.9%
Croton-on-Hudson (V)	8,155	3	< 0.1%	3	<0.1%	69	0.8%	327	4.0%
Dobbs Ferry (V)	11,070	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Eastchester (T)	19,990	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Elmsford (V)	5,085	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Greenburgh (T)	44,829	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Harrison (T)	28,135	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hastings-on-Hudson (V)	7,921	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Irvington (V)	6,529	0	0.0%	0	0.0%	4	0.1%	4	0.1%
Larchmont (V)	6,096	513	8.4%	1,002	16.4%	1,686	27.7%	2,557	41.9%
Lewisboro (T)	12,599	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mamaroneck (T)	11,298	113	1.0%	242	2.1%	371	3.3%	538	4.8%
Mamaroneck (V)	19,217	1,061	5.5%	1,998	10.4%	3,183	16.6%	4,981	25.9%
Mount Kisco (T)	10,866	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mount Pleasant (T)	27,000	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mount Vernon (C)	67,896	6	0.0%	94	0.1%	258	0.4%	477	0.7%
New Castle (T)	17,905	0	0.0%	0	0.0%	0	0.0%	0	0.0%
New Rochelle (C)	79,067	262	0.3%	953	1.2%	2,540	3.2%	4,582	5.8%
North Castle (T)	12,235	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Salem (T)	5,167	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Ossining (T)	5,567	3	<0.1%	3	< 0.1%	5	0.1%	8	0.1%
Ossining (V)	25,086	24	0.1%	24	0.1%	33	0.1%	52	0.2%
Peekskill (C)	24,075	23	0.1%	23	0.1%	23	0.1%	36	0.2%
Pelham (T)*	12,510	87	0.7%	338	2.7%	588	4.7%	963	7.7%
Pelham (V)	6,941	13	0.2%	85	1.2%	202	2.9%	271	3.9%
Pelham Manor (V)	5,569	74	1.3%	253	4.5%	386	6.9%	691	12.4%
Pleasantville (V)	7,221	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Port Chester (V)	29,342	101	0.3%	229	0.8%	1,233	4.2%	2,174	7.4%
Pound Ridge (T)	5,177	0	0.0%	0	0.0%	0	0.0%	0	0.0%

# Table 5.3.2-3. Estimated Number of Persons in Westchester County Living in the Category 1 through Category 4 Storm Surge Hazard Areas





			Estimated Population Located in the Storm Surge Hazard Area							
Jurisdiction	Total Population (American Community Survey 2015- 2019)	Number of Persons Located in the SLOSH Category 1 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 2 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 3 Hazard Area	Percent of Total	Number of Persons Located in the SLOSH Category 4 Hazard Area	Percent of Total	
Rye (C)	15,820	719	4.5%	2,200	13.9%	3,509	22.2%	4,382	27.7%	
Rye Brook (V)	9,487	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Scarsdale (T)	17,837	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Sleepy Hollow (V)	10,122	89	0.9%	415	4.1%	433	4.3%	451	4.5%	
Somers (T)	21,487	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Tarrytown (V)	11,436	0	0.0%	0	0.0%	4	0.0%	4	0.0%	
Tuckahoe (V)	6,584	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
White Plains (C)	58,137	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Yonkers (C)	199,968	179	0.1%	478	0.2%	478	0.2%	518	0.3%	
Yorktown (T)	36,538	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Westchester County (Total)	968,065	3,231	0.3%	8,096	0.8%	14,604	1.5%	22,377	2.3%	

Sources: American Community Survey 2019 5-year estimates; NOAA 2014

Note: C = City; T = Town; V = Village; % = Percent; < = Less Than





#### Ice Jam Flooding

According to the historical records in Westchester County, there have been no instances of ice jam flooding events. Therefore, impacts to persons within the County are limited.

### Dam Failure Flooding

Dam failure will have similar impacts to flood events on persons within the County. Refer to the Riverine and Coastal Flooding section for more information.

#### **Coastal Erosion**

Coastal erosion is a residual hazard caused by coastal storm surge, which can lead to changes in the flood hazard extent. To estimate population exposed and vulnerable to the coastal erosion hazard areas, a spatial analysis was conducted. Table 5.3.2-4 lists the estimated population located in the moderate, high, and extreme coastal risk area boundaries by jurisdiction. Overall, 8,471 people live within the moderate coastal risk hazard area, 3,550 people live within the high coastal risk hazard area, and 1,145 people live within the extreme coastal risk hazard area. The City of Rye has the greatest number of persons living within the moderate coastal risk area and the Village of Mamaroneck has the greatest number of persons living within the high and extreme coastal risk hazard areas. Figure 5.4.3-6 through Figure 5.4.3-9 show the coastal risk hazard areas for the County.

# Table 5.3.2-4. Estimated Number of Persons in Westchester County Living in the Coastal Risk HazardAreas

		Estimated Population Located in the Coastal Risk Hazard Area							
Jurisdiction	Total Population (American Community Survey 2015- 2019)	Number of Persons Located in the Moderate Coastal Risk Hazard Area	Percen t of Total	Number of Persons Located in the High Coastal Risk Hazard Area	Percent of Total	Number of Persons Located in the Extreme Coastal Risk Hazard Area	Percent of Total		
Ardsley (V)	4,512	0	0.0%	0	0.0%	0	0.0%		
Bedford (T)	17,803	0	0.0%	0	0.0%	0	0.0%		
Briarcliff Manor (V)	7,616	0	0.0%	0	0.0%	0	0.0%		
Bronxville (V)	6,409	0	0.0%	0	0.0%	0	0.0%		
Buchanan (V)	2,140	11	0.5%	0	0.0%	0	0.0%		
Cortlandt (T)	32,131	113	0.4%	76	0.2%	29	0.1%		
Croton-on-Hudson (V)	8,155	310	3.8%	0	0.0%	44	0.5%		
Dobbs Ferry (V)	11,070	0	0.0%	0	0.0%	0	0.0%		
Eastchester (T)	19,990	0	0.0%	0	0.0%	0	0.0%		
Elmsford (V)	5,085	0	0.0%	0	0.0%	0	0.0%		
Greenburgh (T)	44,829	0	0.0%	0	0.0%	0	0.0%		
Harrison (T)	28,135	0	0.0%	0	0.0%	0	0.0%		
Hastings-on-Hudson (V)	7,921	0	0.0%	0	0.0%	0	0.0%		
Irvington (V)	6,529	0	0.0%	0	0.0%	0	0.0%		
Larchmont (V)	6,096	1,203	19.7%	507	8.3%	35	0.6%		
Lewisboro (T)	12,599	0	0.0%	0	0.0%	0	0.0%		
Mamaroneck (T)	11,298	148	1.3%	122	1.1%	48	0.4%		
Mamaroneck (V)	19,217	1,455	7.6%	891	4.6%	398	2.1%		
Mount Kisco (T)	10,866	0	0.0%	0	0.0%	0	0.0%		
Mount Pleasant (T)	27,000	0	0.0%	0	0.0%	0	0.0%		
Mount Vernon (C)	67,896	220	0.3%	0	0.0%	0	0.0%		
New Castle (T)	17,905	0	0.0%	0	0.0%	0	0.0%		
New Rochelle (C)	79,067	1,791	2.3%	236	0.3%	335	0.4%		
North Castle (T)	12,235	0	0.0%	0	0.0%	0	0.0%		
North Salem (T)	5,167	0	0.0%	0	0.0%	0	0.0%		





	Estimated Population Located in the Coastal Risk Hazard Area							
Jurisdiction	Total Population (American Community Survey 2015- 2019)	Number of Persons Located in the Moderate Coastal Risk Hazard Area	Percen t of Total	Number of Persons Located in the High Coastal Risk Hazard Area	Percent of Total	Number of Persons Located in the Extreme Coastal Risk Hazard Area	Percent of Total	
Ossining (T)	5,567	5	0.1%	3	0.0%	0	0.0%	
Ossining (V)	25,086	24	0.1%	0	0.0%	19	0.1%	
Peekskill (C)	24,075	14	0.1%	5	0.0%	18	0.1%	
Pelham (T)*	12,510	416	3.3%	156	1.2%	0	0.0%	
Pelham (V)	6,941	174	2.5%	13	0.2%	0	0.0%	
Pelham Manor (V)	5,569	242	4.3%	144	2.6%	0	0.0%	
Pleasantville (V)	7,221	0	0.0%	0	0.0%	0	0.0%	
Port Chester (V)	29,342	611	2.1%	37	0.1%	5	0.0%	
Pound Ridge (T)	5,177	0	0.0%	0	0.0%	0	0.0%	
Rye (C)	15,820	2,083	13.2%	657	4.2%	207	1.3%	
Rye Brook (V)	9,487	0	0.0%	0	0.0%	0	0.0%	
Scarsdale (T)	17,837	0	0.0%	0	0.0%	0	0.0%	
Sleepy Hollow (V)	10,122	36	0.4%	409	4.0%	0	0.0%	
Somers (T)	21,487	0	0.0%	0	0.0%	0	0.0%	
Tarrytown (V)	11,436	4	0.0%	0	0.0%	0	0.0%	
Tuckahoe (V)	6,584	0	0.0%	0	0.0%	0	0.0%	
White Plains (C)	58,137	0	0.0%	0	0.0%	0	0.0%	
Yonkers (C)	199,968	27	0.0%	451	0.2%	7	0.0%	
Yorktown (T)	36,538	0	0.0%	0	0.0%	0	0.0%	
Westchester County (Total)	968,065	8,471	0.9%	3,550	0.4%	1,145	0.1%	

Sources: American Community Survey 2019 5-year estimates; NYSDOS 2013

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

#### Sea Level Rise

Furthermore, to estimate population exposed and vulnerable to sea level rise hazards, a spatial analysis was conducted using the 1-foot, 3-feet, and 6-feet sea level rise inundation areas provided by the County; refer to through . Table 5.3.2-5 breaks down the impact of sea level rise for the three sea level rise scenarios summarized by Westchester County's jurisdictions. Figure 5.4.3-10 through Figure 5.4.3-13 illustrates the sea level rise hazard areas in the County.

Based on the spatial analysis, there is an estimated range of 19 people up to 1,864 people living in the sea level rise hazard areas. Similar to flood risks, persons in these hazard areas may become displaced due to flooding. The Village of Ossining has the greatest number of persons located in the 1-foot sea level rise hazard area (i.e., 14 persons); the Town of Cortlandt has the greatest number of residents located in the 3-feet sea level rise inundation area (i.e., 23 persons); and the City of Yonkers has the greatest number of residents located in the 6-feet sea level rise inundation area (i.e., 431 persons).



# Table 5.3.2-5. Estimated Number of Persons in Westchester County Living in the 1-Foot, 3-Feet, and 6-Feet Sea Level Rise Hazard Areas

		Estima	ted Populat	ion Located in th	1e Sea Level	Rise Hazard Ar	ea
		Number of		Number of		Number of	
	Total	Persons		Persons		Persons	
	Population	Located in		Located in		Located in	
	(American	the 1-Foot		the 3-Feet		the 6-Feet	
	Community Survey 2015	Sea Level	Doncont	Sea Level	Doncont	Sea Level	Doroont
Jurisdiction	2019)	Area	of Total	Area	of Total	Area	of Total
Ardsley (V)	4,512	0	0.0%	0	0.0%	0	0.0%
Bedford (T)	17,803	0	0.0%	0	0.0%	0	0.0%
Briarcliff Manor (V)	7,616	0	0.0%	0	0.0%	0	0.0%
Bronxville (V)	6,409	0	0.0%	0	0.0%	0	0.0%
Buchanan (V)	2,140	0	0.0%	0	0.0%	0	0.0%
Cortlandt (T)	32,131	0	0.0%	23	0.1%	87	0.3%
Croton-on-Hudson (V)	8,155	0	0.0%	0	0.0%	0	0.0%
Dobbs Ferry (V)	11,070	0	0.0%	0	0.0%	0	0.0%
Eastchester (T)	19,990	0	0.0%	0	0.0%	0	0.0%
Elmsford (V)	5,085	0	0.0%	0	0.0%	0	0.0%
Greenburgh (T)	44,829	0	0.0%	0	0.0%	0	0.0%
Harrison (T)	28,135	0	0.0%	0	0.0%	0	0.0%
Hastings-on-Hudson (V)	7,921	0	0.0%	0	0.0%	0	0.0%
Irvington (V)	6,529	0	0.0%	0	0.0%	0	0.0%
Larchmont (V)	6,096	0	0.0%	6	0.1%	157	2.6%
Lewisboro (T)	12,599	0	0.0%	0	0.0%	0	0.0%
Mamroneck (T)	11,298	0	0.0%	0	0.0%	61	0.5%
Mamaroneck (V)	19,217	0	0.0%	8	<0.1%	307	1.6%
Mount Kisco (1)	10,866	0	0.0%	0	0.0%	0	0.0%
Mount Pleasant (1)	27,000	0	0.0%	0	0.0%	0	0.0%
Nount Vernon (C)	07,890	0	0.0%	0	0.0%	0	0.0%
New Castle (1)	70.067	5	0.0%	16	0.0%	72	0.070
North Castle (T)	12 235	0	<u>0.170</u>	10	0.170	0	0.170
North Salem (T)	5 167	0	0.0%	0	0.0%	0	0.0%
Ossining (T)	5,107	0	0.0%	0	0.0%	3	0.0%
Ossining (V)	25.086	14	0.070	19	0.070	24	0.070
Peekskill (C)	24 075	0	0.1%	9	<0.1%	23	0.1%
Pelham (T)*	12,510	0	0.0%	0	0.0%	0	0.0%
Pelham (V)	6.941	0	0.0%	0	0.0%	0	0.0%
Pelham Manor (V)	5,569	0	0.0%	0	0.0%	0	0.0%
Pleasantville (V)	7,221	0	0.0%	0	0.0%	0	0.0%
Port Chester (V)	29,342	0	0.0%	0	0.0%	27	0.1%
Pound Ridge (T)	5,177	0	0.0%	0	0.0%	0	0.0%
Rye (C)	15,820	0	0.0%	15	0.1%	339	2.1%
Rye Brook (V)	9,487	0	0.0%	0	0.0%	0	0.0%
Scarsdale (T)	17,837	0	0.0%	0	0.0%	0	0.0%
Sleepy Hollow (V)	10,122	0	0.0%	0	0.0%	332	3.3%
Somers (T)	21,487	0	0.0%	0	0.0%	0	0.0%
Tarrytown (V)	11,436	0	0.0%	0	0.0%	0	0.0%
Tuckahoe (V)	6,584	0	0.0%	0	0.0%	0	0.0%
White Plains (C)	58,137	0	0.0%	0	0.0%	0	0.0%
Yonkers (C)	199,968	0	0.0%	7	< 0.1%	431	0.2%
Yorktown (T)	36,538	0	0.0%	0	0.0%	0	0.0%
Westchester County (Total)	968,065	19	<0.1%	103	<0.1%	1,864	0.2%

Sources: American Community Survey 2019 5-year estimates; Westchester GIS 2021

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than





# **Impact on General Building Stock**

After considering the population exposed and potentially vulnerable to the flood hazard, the built environment was evaluated. Exposure includes those buildings located in the flood hazard areas. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content replacement cost values.

### Riverine and Coastal Flooding

Table 5.3.2-6 and Table 5.3.2-7 summarize the number of structures located in the 1-percent and 0.2-percent annual chance flood events by jurisdiction. In summary, there are 7,040 buildings located in the 1-percent annual chance flood boundary with an estimated \$23.9 billion of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 2.6-percent of the County's total general building stock inventory. In addition, there are 9,575 buildings located in the 0.2-percent annual chance flood boundary with an estimated \$32.9 billion of building stock and contents exposed. This represents approximately 3.5-percent of the County's total general building stock inventory.

The Hazus flood model estimated potential damages to the buildings in Westchester County at the structure level using the custom structure inventory developed for this HMP and the depth grid generated using the effective DFIRM data. The potential damage estimated by Hazus to the general building stock inventory associated with the 1-percent annual chance flood is approximately \$3 billion or 0.7-percent of the total building stock improvement value. The Village of Mamaroneck has the greatest amount of estimated building loss— approximately \$457.4 million (i.e., 6.2-percent of the total replacement cost value). Refer to Table 5.3.2-8 for the estimated losses by jurisdiction.





# Table 5.3.2-6. Estimated General Building Stock Located in the 1-Percent Annual Chance Flood Event

			Estimated Building Stock Located in the Flood Hazard Area						
Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total			
Ardsley (V)	1,600	\$1,184,178,473	34	2.1%	\$174,599,174	14.7%			
Bedford (T)	7,842	\$6,187,290,490	33	0.4%	\$17,512,282	0.3%			
Briarcliff Manor (V)	2,821	\$2,929,350,441	23	0.8%	\$42,417,074	1.4%			
Bronxville (V)	1,524	\$2,422,176,980	35	2.3%	\$173,546,602	7.2%			
Buchanan (V)	1,153	\$1,174,838,972	15	1.3%	\$68,773,793	5.9%			
Cortlandt (T)	11,740	\$7,539,300,494	153	1.3%	\$88,819,608	1.2%			
Croton-on- Hudson (V)	3,412	\$5,339,173,282	85	2.5%	\$277,257,728	5.2%			
Dobbs Ferry (V)	2,888	\$3,524,751,416	7	0.2%	\$12,514,827	0.4%			
Eastchester (T)	5,861	\$4,342,629,796	16	0.3%	\$5,562,400	0.1%			
Elmsford (V)	1,358	\$2,719,155,604	47	3.5%	\$297,190,508	10.9%			
Greenburgh (T)	14,313	\$42,009,346,893	118	0.8%	\$220,453,780	0.5%			
Harrison (T)	7,813	\$10,415,934,158	450	5.8%	\$328,027,154	3.1%			
Hastings-on- Hudson (V)	2,812	\$13,267,692,589	17	0.6%	\$39,325,555	0.3%			
Irvington (V)	1,736	\$1,575,655,219	60	3.5%	\$125,817,495	8.0%			
Larchmont (V)	2,281	\$3,287,198,418	284	12.5%	\$278,122,186	8.5%			
Lewisboro (T)	6,358	\$5,313,683,830	65	1.0%	\$440,960,552	8.3%			
Mamaroneck (T)	4,065	\$2,363,450,350	206	5.1%	\$188,773,906	8.0%			
Mamaroneck (V)	5,699	\$7,321,897,360	1,035	18.2%	\$2,138,963,351	29.2%			
Mount Kisco (T)	3,002	\$5,913,464,031	49	1.6%	\$363,568,097	6.1%			
Mount Pleasant (T)	9,863	\$8,309,807,831	121	1.2%	\$342,973,605	4.1%			
Mount Vernon (C)	12,648	\$17,021,941,779	92	0.7%	\$166,284,201	1.0%			
New Castle (T)	6,759	\$4,957,954,777	49	0.7%	\$14,326,201	0.3%			
New Rochelle (C)	17,044	\$42,795,863,468	827	4.9%	\$12,096,427,100	28.3%			
North Castle (T)	5,391	\$5,067,704,057	199	3.7%	\$332,968,149	6.6%			





			Estimated Building Stock Located in the Flood Hazard Area						
			Number of Buildings Located		Total Replacement Cost Value of				
	Total		in the 1-percent Annual		Buildings Located in the 1-percent				
	Number of	Total Replacement	Chance Flood Event Hazard	Percent of	Annual Chance Flood Event				
Jurisdiction	Buildings	Cost Value (RCV)	Area	l otal	Hazard Area	Percent of Total			
(T)	2,870	\$2,372,126,897	88	3.1%	\$401,074,480	16.9%			
Ossining (T)	2,266	\$1,382,487,862	4	0.2%	\$878,470	0.1%			
Ossining (V)	5,874	\$6,071,219,565	97	1.7%	\$258,524,693	4.3%			
Peekskill (C)	6,001	\$6,315,622,346	131	2.2%	\$596,653,137	9.4%			
Pelham (T)*	4,596	\$3,648,777,424	158	3.4%	\$150,148,338	4.1%			
Pelham (V)	2,377	\$2,384,243,499	50	2.1%	\$35,436,423	1.5%			
Pelham Manor (V)	2,219	\$1,264,533,925	108	4.9%	\$114,711,915	9.1%			
Pleasantville (V)	2,919	\$2,842,599,318	29	1.0%	\$10,228,377	0.4%			
Port Chester (V)	6,424	\$7,869,067,479	187	2.9%	\$509,671,194	6.5%			
Pound Ridge (T)	3,025	\$1,596,752,944	38	1.3%	\$29,040,144	1.8%			
Rye (C)	5,632	\$5,820,922,260	773	13.7%	\$789,714,632	13.6%			
Rye Brook (V)	3,591	\$4,892,231,021	178	5.0%	\$270,761,453	5.5%			
Scarsdale (T)	6,829	\$4,603,749,394	146	2.1%	\$82,350,430	1.8%			
Sleepy Hollow (V)	1,921	\$1,990,885,470	94	4.9%	\$53,735,368	2.7%			
Somers (T)	11,490	\$6,092,204,344	16	0.1%	\$8,020,594	0.1%			
Tarrytown (V)	3,078	\$7,284,273,569	57	1.9%	\$216,467,212	3.0%			
Tuckahoe (V)	1,655	\$1,530,366,709	26	1.6%	\$5,460,456	0.4%			
White Plains (C)	13,986	\$61,499,698,595	15	0.1%	\$32,508,275	0.1%			
Yonkers (C)	33,912	\$50,644,348,876	544	1.6%	\$1,902,481,757	3.8%			
Yorktown (T)	13,922	\$19,503,786,796	439	3.2%	\$344,600,079	1.8%			
Westchester County (Total)	269,974	\$402,945,561,577	7,040	2.6%	\$23,897,504,416	5.9%			

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; FEMA 2007

*Note:* C = City; T = Town; V = Village; % = Percent





# Table 5.3.2-7. Estimated General Building Stock Located in the 0.2-Percent Annual Chance Flood Event

			Estimated Building Stock Located in the Flood Hazard Area				
Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the 0.2- percent Annual Chance Flood Event Hazard Area	Percent of Total	
Ardsley (V)	1,600	\$1,184,178,473	46	2.9%	\$250,509,415	21.2%	
Bedford (T)	7,842	\$6,187,290,490	44	0.6%	\$20,834,909	0.3%	
Briarcliff Manor (V)	2,821	\$2,929,350,441	29	1.0%	\$44,888,617	1.5%	
Bronxville (V)	1,524	\$2,422,176,980	60	3.9%	\$236,965,943	9.8%	
Buchanan (V)	1,153	\$1,174,838,972	15	1.3%	\$68,773,793	5.9%	
Cortlandt (T)	11,740	\$7,539,300,494	171	1.5%	\$93,395,028	1.2%	
Croton-on-Hudson (V)	3,412	\$5,339,173,282	98	2.9%	\$281,383,861	5.3%	
Dobbs Ferry (V)	2,888	\$3,524,751,416	71	2.5%	\$33,176,725	0.9%	
Eastchester (T)	5,861	\$4,342,629,796	126	2.1%	\$111,717,291	2.6%	
Elmsford (V)	1,358	\$2,719,155,604	118	8.7%	\$657,845,948	24.2%	
Greenburgh (T)	14,313	\$42,009,346,893	420	2.9%	\$5,371,141,844	12.8%	
Harrison (T)	7,813	\$10,415,934,158	573	7.3%	\$406,655,750	3.9%	
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	35	1.2%	\$44,294,371	0.3%	
Irvington (V)	1,736	\$1,575,655,219	68	3.9%	\$129,508,704	8.2%	
Larchmont (V)	2,281	\$3,287,198,418	306	13.4%	\$284,681,822	8.7%	
Lewisboro (T)	6,358	\$5,313,683,830	65	1.0%	\$440,960,552	8.3%	
Mamaroneck (T)	4,065	\$2,363,450,350	230	5.7%	\$195,016,246	8.3%	
Mamaroneck (V)	5,699	\$7,321,897,360	1,212	21.3%	\$2,611,607,136	35.7%	
Mount Kisco (T)	3,002	\$5,913,464,031	58	1.9%	\$392,046,585	6.6%	
Mount Pleasant (T)	9,863	\$8,309,807,831	190	1.9%	\$470,984,622	5.7%	
Mount Vernon (C)	12,648	\$17,021,941,779	127	1.0%	\$298,634,810	1.8%	
New Castle (T)	6,759	\$4,957,954,777	209	3.1%	\$539,823,768	10.9%	
New Rochelle (C)	17,044	\$42,795,863,468	896	5.3%	\$12,218,492,969	28.6%	
North Castle (T)	5,391	\$5,067,704,057	199	3.7%	\$332,968,149	6.6%	
North Salem (T)	2,870	\$2,372,126,897	94	3.3%	\$404,820,780	17.1%	
Ossining (T)	2,266	\$1,382,487,862	22	1.0%	\$7,562,508	0.5%	
Ossining (V)	5,874	\$6,071,219,565	109	1.9%	\$369,888,846	6.1%	
Peekskill (C)	6,001	\$6,315,622,346	133	2.2%	\$597,247,165	9.5%	
Pelham (T)*	4,596	\$3,648,777,424	193	4.2%	\$183,306,045	5.0%	
Pelham (V)	2,377	\$2,384,243,499	82	3.4%	\$43,480,435	1.8%	
Pelham Manor (V)	2,219	\$1,264,533,925	111	5.0%	\$139,825,611	11.1%	
Pleasantville (V)	2,919	\$2,842,599,318	55	1.9%	\$20,751,810	0.7%	
Port Chester (V)	6,424	\$7,869,067,479	265	4.1%	\$632,617,994	8.0%	
Pound Ridge (T)	3,025	\$1,596,752,944	85	2.8%	\$90,841,766	5.7%	





			Estimated Building Stock Located in the Flood Hazard Area						
Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the 0.2- percent Annual Chance Flood Event Hazard Area	Percent of Total			
Rye (C)	5,632	\$5,820,922,260	1,296	23.0%	\$1,167,823,205	20.1%			
Rye Brook (V)	3,591	\$4,892,231,021	244	6.8%	\$293,343,457	6.0%			
Scarsdale (T)	6,829	\$4,603,749,394	165	2.4%	\$94,825,975	2.1%			
Sleepy Hollow (V)	1,921	\$1,990,885,470	105	5.5%	\$62,725,941	3.2%			
Somers (T)	11,490	\$6,092,204,344	22	0.2%	\$16,975,658	0.3%			
Tarrytown (V)	3,078	\$7,284,273,569	60	1.9%	\$217,743,960	3.0%			
Tuckahoe (V)	1,655	\$1,530,366,709	69	4.2%	\$22,452,399	1.5%			
White Plains (C)	13,986	\$61,499,698,595	70	0.5%	\$326,241,231	0.5%			
Yonkers (C)	33,912	\$50,644,348,876	743	2.2%	\$2,427,227,477	4.8%			
Yorktown (T)	13,922	\$19,503,786,796	479	3.4%	\$381,740,477	2.0%			
Westchester County (Total)	269,974	\$402,945,561,577	9,575	3.5%	\$32,854,445,553	8.2%			

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; FEMA 2007

Note: C = City; T = Town; V = Village; % = Percent





# Table 5.3.2-8. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event

		Estimated Building Stock Losses – All Occupancies						
				Total (Building				
Jurisdiction	Lotal Replacement Cost Value (RCV)	<b>Building Loss</b>	Content Loss	+ Content) Estimated Loss	Percent of Total Replacement Cost Value			
Ardsley (V)	\$1,184,178,473	\$27,409,939	\$60,808,040	\$88,217,979	7.4%			
Bedford (T)	\$6,187,290,490	\$3,053,108	\$1,147,145	\$4,200,253	0.1%			
Briarcliff Manor (V)	\$2,929,350,441	\$3,922,301	\$3,868,183	\$7,790,484	0.3%			
Bronxville (V)	\$2,422,176,980	\$21,348,392	\$58,855,448	\$80,203,841	3.3%			
Buchanan (V)	\$1,174,838,972	\$1,907,072	\$2,899,036	\$4,806,109	0.4%			
Cortlandt (T)	\$7,539,300,494	\$9,085,754	\$11,497,820	\$20,583,574	0.3%			
Croton-on-Hudson (V)	\$5,339,173,282	\$2,114,511	\$3,206,536	\$5,321,047	0.1%			
Dobbs Ferry (V)	\$3,524,751,416	\$365,802	\$1,516,638	\$1,882,440	0.1%			
Eastchester (T)	\$4,342,629,796	\$901,416	\$268,477	\$1,169,893	0.0%			
Elmsford (V)	\$2,719,155,604	\$26,543,091	\$56,384,935	\$82,928,026	3.0%			
Greenburgh (T)	\$42,009,346,893	\$17,972,392	\$34,367,057	\$52,339,449	0.1%			
Harrison (T)	\$10,415,934,158	\$42,396,635	\$58,576,758	\$100,973,394	1.0%			
Hastings-on-Hudson (V)	\$13,267,692,589	\$1,357,197	\$4,039,144	\$5,396,341	0.0%			
Irvington (V)	\$1,575,655,219	\$13,554,545	\$18,979,866	\$32,534,411	2.1%			
Larchmont (V)	\$3,287,198,418	\$26,577,179	\$37,263,183	\$63,840,362	1.9%			
Lewisboro (T)	\$5,313,683,830	\$36,011,984	\$51,727,137	\$87,739,121	1.7%			
Mamroneck (T)	\$2,363,450,350	\$15,282,994	\$16,087,212	\$31,370,206	1.3%			
Mamaroneck (V)	\$7,321,897,360	\$150,897,551	\$306,545,494	\$457,443,045	6.2%			
Mount Kisco (T)	\$5,913,464,031	\$15,631,303	\$39,901,290	\$55,532,592	0.9%			
Mount Pleasant (T)	\$8,309,807,831	\$26,645,180	\$76,639,555	\$103,284,735	1.2%			
Mount Vernon (C)	\$17,021,941,779	\$4,536,360	\$9,221,092	\$13,757,452	0.1%			
New Castle (T)	\$4,957,954,777	\$3,687,142	\$1,158,618	\$4,845,760	0.1%			
New Rochelle (C)	\$42,795,863,468	\$193,749,690	\$240,879,174	\$434,628,864	1.0%			
North Castle (T)	\$5,067,704,057	\$37,067,932	\$52,536,150	\$89,604,082	1.8%			
North Salem (T)	\$2,372,126,897	\$13,447,813	\$16,972,040	\$30,419,853	1.3%			
Ossining (T)	\$1,382,487,862	\$281,582	\$80,210	\$361,792	<0.1%			





		Estimated Building Stock Losses – All Occupancies						
Jurisdiction	Total Replacement Cost Value (RCV)	Building Loss	Content Loss	Total (Building + Content) Estimated Loss	Percent of Total Replacement Cost Value			
Ossining (V)	\$6,071,219,565	\$7,764,185	\$18,224,855	\$25,989,040	0.4%			
Peekskill (C)	\$6,315,622,346	\$34,369,547	\$112,517,802	\$146,887,349	2.3%			
Pelham (T)*	\$3,648,777,424	\$11,896,608	\$18,134,502	\$30,031,109	0.8%			
Pelham (V)	\$2,384,243,499	\$8,781,582	\$8,675,923	\$17,457,505	0.7%			
Pelham Manor (V)	\$1,264,533,925	\$3,115,025	\$9,458,579	\$12,573,604	1.0%			
Pleasantville (V)	\$2,842,599,318	\$1,327,729	\$1,355,706	\$2,683,434	0.1%			
Port Chester (V)	\$7,869,067,479	\$21,670,795	\$65,535,029	\$87,205,824	1.1%			
Pound Ridge (T)	\$1,596,752,944	\$3,410,175	\$1,116,478	\$4,526,653	0.3%			
Rye (C)	\$5,820,922,260	\$71,268,852	\$135,028,631	\$206,297,483	3.5%			
Rye Brook (V)	\$4,892,231,021	\$26,988,341	\$93,842,563	\$120,830,905	2.5%			
Scarsdale (T)	\$4,603,749,394	\$12,888,471	\$4,778,351	\$17,666,822	0.4%			
Sleepy Hollow (V)	\$1,990,885,470	\$3,037,391	\$2,750,539	\$5,787,929	0.3%			
Somers (T)	\$6,092,204,344	\$983,329	\$903,637	\$1,886,966	<0.1%			
Tarrytown (V)	\$7,284,273,569	\$3,807,675	\$8,209,212	\$12,016,887	0.2%			
Tuckahoe (V)	\$1,530,366,709	\$610,865	\$239,967	\$850,832	0.1%			
White Plains (C)	\$61,499,698,595	\$1,514,388	\$4,212,926	\$5,727,314	<0.1%			
Yonkers (C)	\$50,644,348,876	\$106,595,607	\$277,988,614	\$384,584,221	0.8%			
Yorktown (T)	\$19,503,786,796	\$47,443,665	\$54,652,820	\$102,096,485	0.5%			
Westchester County (Total)	\$402,945,561,577	\$1,051,326,489	\$1,964,917,868	\$3,016,244,357	0.7%			

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; FEMA 2007; Hazus v5.0

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than



# **NFIP Statistics**

FEMA provided a list of properties with NFIP policies, past claims, and multiple claims. According to FEMA, a repetitive loss (RL) property is a NFIP-insured structure that has had at least two paid flood losses of more than \$1,000 in any 10-year period since 1978. A severe repetitive loss (SRL) property is a NFIP-insured structure that has had four or more separate claim payments made under a standard flood insurance policy, with the amount of each claim exceeding \$5,000 and with the cumulative amount of such claims payments exceed the fair market value of the insured building on the day before each loss (FEMA 2018).

Table 5.3.2-9, Table 5.3.2-10, and Table 5.3.2-11 summarize the NFIP policies, claims, and repetitive loss statistics for Westchester County. The majority of the RL and SRL properties are single-family residences (77.7-percent and 81.8-percent, respectively). This information is current as of October 16, 2021.

#### Table 5.3.2-9. Occupancy Class of Repetitive Loss Structures in Westchester County

Occupancy Class	Total Number of NFIP Repetitive Loss (RL) Properties <b>(excludes SRL)</b>	Total Number of NFIP Severe Repetitive Loss (SRL) Properties (excludes RL)	Total NFIP RL and SRL Properties
Single Family	803	N/A	N/A
2-4 Family	145	N/A	N/A
Non-Residential Business	30	N/A	N/A
Other Residential	51	N/A	N/A
Other Non-Residential	198	N/A	N/A
Westchester County (Total)	1,227	N/A	

Source: FEMA Region 2 2021

Note:Policies, claims, repetitive loss and severe repetitive loss statistics provided by FEMA Region 2, and are current as of October 16, 2021.N/ANot available





	NFIP Repetitive Loss (RL) Properties (excludes SRL)							
			Non-					
Iurisdiction	Single Family	2-4 Family	Residential Business	Other Residential	Other Non- Residential			
Ardsley (V)	4	0	0	2	22			
Bedford (T)	7	0	0	1	0			
Briarcliff Manor (V)	11	0	1	0	0			
Bronxville (V)	7	3	5	0	5			
Buchanan (V)	1	0	0	0	0			
Cortlandt (T)	8	0	1	1	0			
Croton-on-Hudson (V)	0	0	0	0	1			
Dobbs Ferry (V)	1	0	0	0	0			
Eastchester (T)	12	0	0	0	1			
Elmsford (V)	9	3	1	2	8			
Greenburgh (T)	31	2	0	0	13			
Harrison (T)	60	31	0	0	3			
Hastings-on-Hudson (V)	3	0	0	0	1			
Irvington (V)	3	0	3	0	0			
Larchmont (V)	42	1	0	0	1			
Lewisboro (T)	0	1	0	0	0			
Mamroneck (T)	2	1	0	0	0			
Mamaroneck (V)	47	5	0	3	7			
Mount Kisco (T)	104	67	9	12	53			
Mount Pleasant (T)	3	0	1	0	1			
Mount Vernon (C)	8	2	1	1	3			
New Castle (T)	3	0	1	0	3			
New Rochelle (C)	10	0	1	0	4			
North Castle (T)	69	3	0	6	10			
North Salem (T)	3	1	0	0	0			
Ossining (T)	5	0	0	0	1			
Ossining (V)	1	0	0	0	0			
Peekskill (C)	1	0	0	0	0			
Pelham (T)*	1	0	0	0	3			
Pelham (V)	0	2	0	0	3			
Pelham Manor (V)	3	0	0	0	0			
Pleasantville (V)	3	2	0	0	0			
Port Chester (V)	2	0	0	0	0			
Pound Ridge (T)	11	2	2	0	3			
Rye (C)	2	0	0	0	0			
Rye Brook (V)	17	4	0	4	1			
Scarsdale (T)	183	7	3	14	20			
Sleepy Hollow (V)	47	0	0	0	0			
Somers (T)	1	0	0	0	0			
Tarrytown (V)	1	0	0	0	0			
Tuckahoe (V)	3	0	0	0	0			
White Plains (C)	13	0	0	0	3			
Yonkers (C)	50	5	1	5	27			
Yorktown (T)	7	0	0	0	0			
Westchester County (Total)	803	145	30	51	198			

# Table 5.3.2-10 Occupancy Class of Repetitive Loss Structures in Westchester County, by Municipality

Source: FEMA Region 2, 2021



# Table 5.3.2-11. NFIP Policies, Claims, and Repetitive Loss Statistics

Jurisdiction	Number of Active NFIP Policies	Total Premium and Fee	Average Premium and Fee	Number of Losses	Total Net Payment	Average Net Payment
Ardsley (V)	24	\$93,310	\$3,888	283	\$2,196,018	\$7,760
Bedford (T)	0	\$0	\$0	1	\$0	\$0
Briarcliff Manor (V)	0	\$0	\$0	0	\$0	\$0
Bronxville (V)	0	\$0	\$0	1	\$0	\$0
Buchanan (V)	0	\$0	\$0	1	\$620	\$620
Cortlandt (T)	113	\$123,671	\$1,094	65	\$348,498	\$5,362
Croton-on-Hudson (V)	67	\$98,479	\$1,470	100	\$1,652,800	\$16,528
Dobbs Ferry (V)	77	\$135,647	\$1,762	232	\$6,200,599	\$26,727
Eastchester (T)	0	\$0	\$0	4	\$10,488	\$2,622
Elmsford (V)	0	\$0	\$0	2	\$273,919	\$136,959
Greenburgh (T)	0	\$0	\$0	1	\$4,200	\$4,200
Harrison (T)	2	\$668	\$334	1	\$0	\$0
Hastings-on-Hudson (V)	0	\$0	\$0	1	\$1,076	\$1,076
Irvington (V)	0	\$0	\$0	10	\$15,954	\$1,595
Larchmont (V)	0	\$0	\$0	2	\$1,873	\$936
Lewisboro (T)	0	\$0	\$0	1	\$0	\$0
Mamroneck (T)	0	\$0	\$0	4	\$13,516	\$3,379
Mamaroneck (V)	76	\$108,223	\$1,424	88	\$2,012,692	\$22,872
Mount Kisco (T)	54	\$71,386	\$1,741	16	\$66,461	\$4,154
Mount Pleasant (T)	0	\$0	\$0	1	\$0	\$0
Mount Vernon (C)	20	\$12,977	\$649	18	\$556,522	\$30,918
New Castle (T)	0	\$0	\$0	4	\$3,404	\$851
New Rochelle (C)	0	\$0	\$0	3	\$387	\$129
North Castle (T)	0	\$0	\$0	1	\$16,511	\$16,511
North Salem (T)	70	\$71,931	\$1,028	129	\$925,456	\$7,174
Ossining (T)	41	\$90,434	\$2,206	331	\$5,609,704	\$16,948
Ossining (V)	0	\$0	\$0	2	\$663	\$332
Peekskill (C)	0	\$0	\$0	4	\$12,166	\$3,042
Pelham (T)*	0	\$0	\$0	1	\$11,000	\$11,000
Pelham (V)	0	\$0	\$0	1	\$0	\$0
Pelham Manor (V)	0	\$0	\$0	1	\$60,500	\$60,500
Pleasantville (V)	0	\$0	\$0	3	\$1,257	\$419
Port Chester (V)	224	\$242,103	\$1,081	420	\$4,998,462	\$11,901
Pound Ridge (T)	0	\$0	\$0	1	\$23,804	\$23,804
Rye (C)	321	\$467,324	\$1,456	949	\$5,882,727	\$6,199





Jurisdiction	Number of Active NFIP Policies	Total Premium and Fee	Average Premium and Fee	Number of Losses	Total Net Payment	Average Net Payment
Rye Brook (V)	29	\$23,600	\$814	40	\$773,229	\$19,331
Scarsdale (T)	0	\$0	\$0	2	\$0	\$0
Sleepy Hollow (V)	0	\$0	\$0	1	\$9,774	\$9,774
Somers (T)	0	\$0	\$0	1	\$11,204	\$11,204
Tarrytown (V)	98	\$220,757	\$2,453	95	\$2,527,414	\$26,604
Tuckahoe (V)	0	\$0	\$0	1	\$0	\$0
White Plains (C)	0	\$0	\$0	1	\$4,675	\$4,675
Yonkers (C)	246	\$636,861	\$2,589	433	\$5,484,077	\$12,665
Yorktown (T)	0	\$0	\$0	2	\$7,007	\$3,504
Westchester County (Total)	6,551	\$10,817,776	\$1,875	11,902	\$165,570,639	\$13,911

Source: FEMA Region 2 2021; Notes: NFIP - National Flood Insurance Program

# Flash Flooding

Flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam. Flash floods can roll boulders, tear out trees, trigger mud slides, destroy buildings and bridges, and scour out new channels. Because flash floods typically occur along rivers, coastlines, and low-lying, all structures located in and around these are susceptible to damages from flash floods. Secondary impacts of flash floods can also damage buildings and infrastructure outside the floodplain (Wyoming 2021) (NWS 2021) (Melina and Rowan 2010).

# Stormwater and Urban Flooding

The impacts to the general building stock as a result of stormwater and urban flooding is similar to the impacts of other types of flooding as described above. Stormwater flooding can damage public and private properties, destroy stormwater infrastructure, and impact roadways and utilities (NOAA, Understanding Stormwater Inundation 2021). Stormwater and urban flooding can occur in areas outside of the floodplain, so public and private properties not in the floodplain area also vulnerable to stormwater and urban flooding.

# Storm Surge

To estimate potential building exposure to storm surge, the SLOSH inundation zones were used. The estimated total number of buildings and replacement cost value (structure and contents) located in Categories 1 through 4 SLOSH inundation zones are summarized in Table 5.3.2-12 through Table 5.3.2-15. Overall, the City of Rye has the greatest number of buildings in the SLOSH Categories 1 through 3 inundation areas and the Village of Mamaroneck has the greatest number of buildings in the SLOSH Category 4 inundation area. Up to 3.2-percent of the County's total building stock is located in the storm surge hazard areas.



Table 5.3.2-12. Estimated General Building Stock Located in the SLOSH Category 1 Storm Surge Hazar	ď
Area	

Jurisdiction	Total Number of Buildings	Total Replacement	Estimated Building Stock and Replacement Cost V Located in the SLOSH Category 1 Storm Surge Ha			
	of Dunuings	Cost Value	Located III		Area	ge mazaru
		(RCV)	Number	Percent	<b>Total Replacement</b>	Percent
			of	of Total	Cost Value of	of Total
			Buildings		Buildings	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0	0.0%
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%
Buchanan (V)	1,153	\$1,174,838,972	1	0.1%	\$1,481,888	0.1%
Cortlandt (T)	11,740	\$7,539,300,494	38	0.3%	\$20,117,295	0.3%
Croton-on-Hudson (V)	3,412	\$5,339,173,282	26	0.8%	\$48,965,157	0.9%
Dobbs Ferry (V)	2,888	\$3,524,751,416	3	0.1%	\$8,063,729	0.2%
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	10	0.4%	\$14,864,972	0.1%
Irvington (V)	1,736	\$1,575,655,219	1	0.1%	\$3,411,894	0.2%
Larchmont (V)	2,281	\$3,287,198,418	188	8.2%	\$205,153,639	6.2%
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%
Mamaroneck (T)	4,065	\$2,363,450,350	41	1.0%	\$71,012,694	3.0%
Mamaroneck (V)	5,699	\$7,321,897,360	358	6.3%	\$260,775,678	3.6%
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%
Mount Vernon (C)	12,648	\$17,021,941,779	24	0.2%	\$40,893,836	0.2%
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%
New Rochelle (C)	17,044	\$42,795,863,468	124	0.7%	\$496,737,771	1.2%
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%
Ossining (T)	2,266	\$1,382,487,862	1	< 0.1%	\$133,351	< 0.1%
Ossining (V)	5,874	\$6,071,219,565	36	0.6%	\$32,274,097	0.5%
Peekskill (C)	6,001	\$6,315,622,346	11	0.2%	\$24,575,138	0.4%
Pelham (T)*	4,596	\$3,648,777,424	43	0.9%	\$29,503,081	0.8%
Pelham (V)	2,377	\$2,384,243,499	4	0.2%	\$970,745	0.0%
Pelham Manor (V)	2,219	\$1,264,533,925	39	1.8%	\$28,532,336	2.3%
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%
Port Chester (V)	6,424	\$7,869,067,479	106	1.7%	\$385,376,815	4.9%
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%
Rye (C)	5,632	\$5,820,922,260	363	6.4%	\$284,057,681	4.9%
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%
Sleepy Hollow (V)	1,921	\$1,990,885,470	17	0.9%	\$5,186,634	0.3%
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%
Tarrytown (V)	3,078	\$7,284,273,569	14	0.5%	\$21,245,289	0.3%
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%
Yonkers (C)	33,912	\$50,644,348,876	85	0.3%	\$379,731,731	0.7%
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%
Westchester County	269,974	\$402,945,561,577	1,490	0.6%	\$2,333,562,371	0.6%
(lotal)						

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NOAA 2014

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than



# Table 5.3.2-13. Estimated General Building Stock Located in the SLOSH Category 2 Storm Surge Hazard Area

Jurisdiction	Total Number of	Total Replacement Cost Value (RCV)	Estimated Building Sto Value Located in the S Surge H		Stock and Replaceme e SLOSH Category 2 Hazard Area	tock and Replacement Cost SLOSH Category 2 Storm Hazard Area		
	Buildings		Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total		
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%		
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%		
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0	0.0%		
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%		
Buchanan (V)	1,153	\$1,174,838,972	6	0.5%	\$45,526,115	3.9%		
Cortlandt (T)	11,740	\$7,539,300,494	73	0.6%	\$42,454,897	0.6%		
Croton-on-Hudson (V)	3,412	\$5,339,173,282	42	1.2%	\$87,091,683	1.6%		
Dobbs Ferry (V)	2,888	\$3,524,751,416	7	0.2%	\$12,514,827	0.4%		
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%		
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%		
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%		
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%		
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	13	0.5%	\$16,155,422	0.1%		
Irvington (V)	1,736	\$1,575,655,219	5	0.3%	\$61,968,317	3.9%		
Larchmont (V)	2,281	\$3,287,198,418	373	16.4%	\$326,161,585	9.9%		
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%		
Mamaroneck (T)	4,065	\$2,363,450,350	89	2.2%	\$108,468,920	4.6%		
Mamaroneck (V)	5,699	\$7,321,897,360	650	11.4%	\$769,669,850	10.5%		
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%		
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%		
Mount Vernon (C)	12,648	\$17,021,941,779	96	0.8%	\$205,662,020	1.2%		
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%		
New Rochelle (C)	17,044	\$42,795,863,468	387	2.3%	\$11,890,308,259	27.8%		
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%		
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%		
Ossining (T)	2,266	\$1,382,487,862	1	<0.1%	\$133,351	<0.1%		
Ossining (V)	5,874	\$6,071,219,565	49	0.8%	\$75,650,499	1.2%		
Peekskill (C)	6,001	\$6,315,622,346	34	0.6%	\$108,291,473	1.7%		
Pelham (T)*	4,596	\$3,648,777,424	157	3.4%	\$140,781,364	3.9%		
Pelham (V)	2,377	\$2,384,243,499	27	1.1%	\$9,868,442	0.4%		
Pelham Manor (V)	2,219	\$1,264,533,925	130	5.9%	\$130,912,922	10.4%		
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%		
Port Chester (V)	6,424	\$7,869,067,479	229	3.6%	\$721,892,109	9.2%		
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%		
Rye (C)	5,632	\$5,820,922,260	882	15.7%	\$594,436,936	10.2%		
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%		
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%		
Sleepy Hollow (V)	1,921	\$1,990,885,470	72	3.7%	\$26,673,548	1.3%		
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%		
Tarrytown (V)	3,078	\$7,284,273,569	19	0.6%	\$58,020,363	0.8%		
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%		
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%		
Yonkers (C)	33,912	\$50,644,348,876	187	0.6%	\$863,271,843	1.7%		
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%		
Westchester County (Total)	269,974	\$402,945,561,577	3,371	1.2%	\$16,155,133,381	4.0%		

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NOAA 2014

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than



# Table 5.3.2-14 Estimated General Building Stock Located in the SLOSH Category 3 Storm Surge Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement	Estimated Building Stock and Replacement Cost V Located in the SLOSH Category 3 Storm Surge Ha			
		Cost Value			Area	2
		(RCV)	Number	Percent	<b>Total Replacement</b>	Percent
			of	of Total	Cost Value of	of Total
			Buildings		Buildings	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%
Briarcliff Manor (V)	2,821	\$2,929,350,441	1	0.0%	\$33,452,640	1.1%
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%
Buchanan (V)	1,153	\$1,174,838,972	22	1.9%	\$69,311,227	5.9%
Cortlandt (T)	11,740	\$7,539,300,494	121	1.0%	\$72,065,517	1.0%
Croton-on-Hudson (V)	3,412	\$5,339,173,282	133	3.9%	\$1,755,751,265	32.9%
Dobbs Ferry (V)	2,888	\$3,524,751,416	9	0.3%	\$15,693,762	0.4%
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	18	0.6%	\$17,714,593	0.1%
Irvington (V)	1,736	\$1,575,655,219	9	0.5%	\$65,220,893	4.1%
Larchmont (V)	2,281	\$3,287,198,418	623	27.3%	\$510,490,916	15.5%
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%
Mamaroneck (T)	4,065	\$2,363,450,350	139	3.4%	\$174,192,757	7.4%
Mamaroneck (V)	5,699	\$7,321,897,360	1,187	20.8%	\$2,092,098,086	28.6%
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%
Mount Vernon (C)	12,648	\$17,021,941,779	153	1.2%	\$407,533,405	2.4%
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%
New Rochelle (C)	17,044	\$42,795,863,468	733	4.3%	\$12,174,986,897	28.4%
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%
Ossining (T)	2,266	\$1,382,487,862	2	0.1%	\$476,762	<0.1%
Ossining (V)	5,874	\$6,071,219,565	79	1.3%	\$206,978,312	3.4%
Peekskill (C)	6,001	\$6,315,622,346	68	1.1%	\$204,012,280	3.2%
Pelham (T)*	4,596	\$3,648,777,424	265	5.8%	\$351,782,295	9.6%
Pelham (V)	2,377	\$2,384,243,499	69	2.9%	\$82,666,996	3.5%
Pelham Manor (V)	2,219	\$1,264,533,925	196	8.8%	\$269,115,299	21.3%
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%
Port Chester (V)	6,424	\$7,869,067,479	559	8.7%	\$2,395,533,880	30.4%
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%
Rye (C)	5,632	\$5,820,922,260	1,349	24.0%	\$1,037,429,156	17.8%
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%
Sleepy Hollow (V)	1,921	\$1,990,885,470	80	4.2%	\$34,045,204	1.7%
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%
Tarrytown (V)	3,078	\$7,284,273,569	38	1.2%	\$158,019,590	2.2%
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%
Yonkers (C)	33,912	\$50,644,348,876	203	0.6%	\$1,010,875,621	2.0%
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%
Westchester County	269,974	\$402,945,561,577	5,791	2.1%	\$22,787,665,058	5.7%
(Total)						

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NOAA 2014

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than


# Table 5.3.2-15. Estimated General Building Stock Located in the SLOSH Category 4 Storm Surge Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement	Estimated Building Stock and Replacement Cost Valu Located in the SLOSH Category 4 Storm Surge Hazar					
		Cost Value			Area			
		(RCV)	Number	Percent	<b>Total Replacement</b>	Percent		
			of	of Total	Cost Value of	of Total		
			Buildings		Buildings			
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%		
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%		
Briarcliff Manor (V)	2,821	\$2,929,350,441	2	0.1%	\$34,355,458	1.2%		
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%		
Buchanan (V)	1,153	\$1,174,838,972	45	3.9%	\$191,410,613	16.3%		
Cortlandt (T)	11,740	\$7,539,300,494	168	1.4%	\$91,591,728	1.2%		
Croton-on-Hudson (V)	3,412	\$5,339,173,282	336	9.8%	\$3,510,771,950	65.8%		
Dobbs Ferry (V)	2,888	\$3,524,751,416	11	0.4%	\$21,783,526	0.6%		
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%		
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%		
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%		
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%		
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	26	0.9%	\$72,257,847	0.5%		
Irvington (V)	1,736	\$1,575,655,219	15	0.9%	\$80,263,662	5.1%		
Larchmont (V)	2,281	\$3,287,198,418	940	41.2%	\$649,750,402	19.8%		
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%		
Mamaroneck (T)	4,065	\$2,363,450,350	306	7.5%	\$346,245,012	14.6%		
Mamaroneck (V)	5,699	\$7,321,897,360	1,822	32.0%	\$3,596,826,425	49.1%		
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%		
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%		
Mount Vernon (C)	12,648	\$17,021,941,779	200	1.6%	\$448,867,212	2.6%		
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%		
New Rochelle (C)	17,044	\$42,795,863,468	1,183	6.9%	\$12,837,809,308	30.0%		
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%		
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%		
Ossining (T)	2,266	\$1,382,487,862	4	0.2%	\$3,603,766	0.3%		
Ossining (V)	5,874	\$6,071,219,565	93	1.6%	\$226,135,106	3.7%		
Peekskill (C)	6,001	\$6,315,622,346	97	1.6%	\$268,189,329	4.2%		
Pelham (T)*	4,596	\$3,648,777,424	422	9.2%	\$465,642,349	12.8%		
Pelham (V)	2,377	\$2,384,243,499	95	4.0%	\$92,942,155	3.9%		
Pelham Manor (V)	2,219	\$1,264,533,925	327	14.7%	\$372,700,194	29.5%		
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%		
Port Chester (V)	6,424	\$7,869,067,479	821	12.8%	\$3,363,415,190	42.7%		
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%		
Rye (C)	5,632	\$5,820,922,260	1,653	29.4%	\$1,482,101,623	25.5%		
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%		
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%		
Sleepy Hollow (V)	1,921	\$1,990,885,470	95	4.9%	\$54,357,128	2.7%		
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%		
Tarrytown (V)	3,078	\$7,284,273,569	51	1.7%	\$261,281,010	3.6%		
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%		
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%		
Yonkers (C)	33,912	\$50,644,348,876	229	0.7%	\$1,255,069,533	2.5%		
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%		
Westchester County (Total)	269,974	\$402,945,561,577	8,519	3.2%	\$29,261,728,177	7.3%		

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NOAA 2014

*Note:* C = City; T = Town; V = Village; % = Percent





# Ice Jam Flooding

The water ice jams hold back can lead to riverine or flash flooding upstream from the ice jam. If the ice jam breaks, flash flooding can occur downstream (NOAA, Ice Jams & Flooding 2015). Structures located near rivers and streams are most at risk of flooding from ice jams (Consortium 2021).

# Dam Failure Flooding

The dams located in Westchester County can have a varying impact on the general building stock. Communities that contain high hazard dams are more at risk for building stock destruction from flooding. The amount of flooding that these structures can experience depends on many factors including the reservoir size, and the time of day and season the breach occurs. Structures that are at a lower elevation from the reservoir will be most vulnerable to flooding from dam failure.

# **Coastal Erosion**

To understand buildings that may be at risk to coastal erosion, an analysis was conducted to determine buildings located in the coastal risk areas. There are 3,326 buildings (approximately \$8 billion in replacement cost value), 1,545 buildings (approximately \$13.4 billion in replacement cost value), and 536 buildings (approximately \$1.1 billion in replacement cost value) built in the moderate, high, and extreme coastal risk areas, respectively. Refer to Table 5.3.2-16 through Table 5.3.2-18 for a summary of building exposure by jurisdiction. Overall, the City of Rye has the greatest number of structures located in the moderate and high coastal risk hazard areas, and the Village of Mamaroneck has the greatest number of structures located in the extreme coastal risk hazard area.

It is important to note that these estimates are considered high because coastal erosion generally occurs in increments of inches to feet per year along the coastline, with the exception of large-scale events, and may not necessarily occur across the entire coastline at the same time.

Jurisdiction	Total Number of	Total Replacement Cost Value (RCV)	Estimated Building Stock and Replacement Cost Value Located in the Moderate Coastal Risk Hazard Area				
	Buildings		Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%	
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%	
Briarcliff Manor (V)	2,821	\$2,929,350,441	1	< 0.1%	\$902,818	<0.1%	
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%	
Buchanan (V)	1,153	\$1,174,838,972	28	2.4%	\$159,161,105	13.5%	
Cortlandt (T)	11,740	\$7,539,300,494	63	0.5%	\$46,069,715	0.6%	
Croton-on-Hudson (V)	3,412	\$5,339,173,282	297	8.7%	\$3,258,615,280	61.0%	
Dobbs Ferry (V)	2,888	\$3,524,751,416	4	0.1%	\$3,833,500	0.1%	
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%	
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%	
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%	
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%	
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	7	0.2%	\$3,581,366	<0.1%	
Irvington (V)	1,736	\$1,575,655,219	10	0.6%	\$19,583,802	1.2%	
Larchmont (V)	2,281	\$3,287,198,418	441	19.3%	\$348,827,879	10.6%	
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%	
Mamaroneck (T)	4,065	\$2,363,450,350	61	1.5%	\$85,614,428	3.6%	
Mamaroneck (V)	5,699	\$7,321,897,360	537	9.4%	\$1,184,184,392	16.2%	

# Table 5.3.2-16. Estimated General Building Stock Located in the Moderate Coastal Risk Hazard Area





Jurisdiction	Total	Total Replacement	Estimated Building Stock and Replacement Cost Value				
	Number of	Cost Value (RCV)	Located in th	e Moderate (	Coastal Risk Haza	rd Area	
	Buildings		Number of	Percent	Total	Percent	
			Buildings	of Total	Replacement	of Total	
					Cost Value of		
					Buildings		
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%	
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%	
Mount Vernon (C)	12,648	\$17,021,941,779	89	0.7%	\$265,515,963	1.6%	
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%	
New Rochelle (C)	17,044	\$42,795,863,468	411	2.4%	\$419,285,714	1.0%	
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%	
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%	
Ossining (T)	2,266	\$1,382,487,862	2	0.1%	\$476,762	<0.1%	
Ossining (V)	5,874	\$6,071,219,565	27	0.5%	\$90,772,425	1.5%	
Peekskill (C)	6,001	\$6,315,622,346	40	0.7%	\$83,438,009	1.3%	
Pelham (T)*	4,596	\$3,648,777,424	183	4.0%	\$209,903,121	5.8%	
Pelham (V)	2,377	\$2,384,243,499	60	2.5%	\$63,512,670	2.7%	
Pelham Manor (V)	2,219	\$1,264,533,925	123	5.5%	\$146,390,451	11.6%	
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%	
Port Chester (V)	6,424	\$7,869,067,479	299	4.7%	\$723,720,953	9.2%	
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%	
Rye (C)	5,632	\$5,820,922,260	738	13.1%	\$486,217,922	8.4%	
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%	
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%	
Sleepy Hollow (V)	1,921	\$1,990,885,470	18	0.9%	\$21,520,825	1.1%	
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%	
Tarrytown (V)	3,078	\$7,284,273,569	29	0.9%	\$154,003,629	2.1%	
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%	
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%	
Yonkers (C)	33,912	\$50,644,348,876	41	0.1%	\$385,258,635	0.8%	
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%	
Westchester County	269,974	\$402,945,561,577	3,326	1.2%	\$7,950,488,242	2.0%	
(Total)							

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NYSDOS 2013

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### Table 5.3.2-17. Estimated General Building Stock Located in the High Coastal Risk Hazard Area

Jurisdiction	Total Number	Total Replacement Cost	Estimated Building Stock and Replacement Cost t Value Located in the High Coastal Risk Hazard Arc					
	of Buildings	Value (RCV)	Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total		
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%		
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%		
Briarcliff Manor (V)	2,821	\$2,929,350,441	1	<0.1%	\$33,452,640	1.1%		
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%		
Buchanan (V)	1,153	\$1,174,838,972	1	0.1%	\$10,238,670	0.9%		
Cortlandt (T)	11,740	\$7,539,300,494	53	0.5%	\$28,887,290	0.4%		
Croton-on-Hudson (V)	3,412	\$5,339,173,282	25	0.7%	\$7,248,209	0.1%		
Dobbs Ferry (V)	2,888	\$3,524,751,416	5	0.2%	\$6,289,160	0.2%		
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%		
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%		
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%		





Jurisdiction	Total	Total	Estimated Building Stock and Replacement Cost					
	Number	Replacement Cost	Value Loca	ted in the H	igh Coastal Risk Ha	zard Area		
	of	Value (RCV)	Number	Percent	Total	Percent		
	Buildings		of	of Total	Replacement	of Total		
			Buildings		Cost Value of			
					Buildings			
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%		
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	4	0.1%	\$10,102,186	0.1%		
Irvington (V)	1,736	\$1,575,655,219	3	0.2%	\$56,872,213	3.6%		
Larchmont (V)	2,281	\$3,287,198,418	180	7.9%	\$150,990,649	4.6%		
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%		
Mamaroneck (T)	4,065	\$2,363,450,350	44	1.1%	\$72,726,449	3.1%		
Mamaroneck (V)	5,699	\$7,321,897,360	235	4.1%	\$175,636,490	2.4%		
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%		
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%		
Mount Vernon (C)	12,648	\$17,021,941,779	62	0.5%	\$103,687,125	0.6%		
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%		
New Rochelle (C)	17,044	\$42,795,863,468	160	0.9%	\$11,223,887,858	26.2%		
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%		
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%		
Ossining (T)	2,266	\$1,382,487,862	1	0.0%	\$254,755	< 0.1%		
Ossining (V)	5,874	\$6,071,219,565	41	0.7%	\$102,547,825	1.7%		
Peekskill (C)	6,001	\$6,315,622,346	38	0.6%	\$157,373,857	2.5%		
Pelham (T)*	4,596	\$3,648,777,424	79	1.7%	\$64,878,074	1.8%		
Pelham (V)	2,377	\$2,384,243,499	4	0.2%	\$970,745	< 0.1%		
Pelham Manor (V)	2,219	\$1,264,533,925	75	3.4%	\$63,907,329	5.1%		
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%		
Port Chester (V)	6,424	\$7,869,067,479	84	1.3%	\$305,851,037	3.9%		
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%		
Rye (C)	5,632	\$5,820,922,260	296	5.3%	\$205,757,715	3.5%		
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%		
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%		
Sleepy Hollow (V)	1,921	\$1,990,885,470	69	3.6%	\$22,503,443	1.1%		
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%		
Tarrytown (V)	3,078	\$7,284,273,569	14	0.5%	\$56,365,356	0.8%		
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%		
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%		
Yonkers (C)	33,912	\$50,644,348,876	150	0.4%	\$572,862,992	1.1%		
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%		
Westchester County (Total)	269.974	\$402,945,561,577	1.545	0.6%	\$13,368,413,994	3.3%		

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NYSDOS 2013

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### Table 5.3.2-18. Estimated General Building Stock Located in the Extreme Coastal Risk Hazard Area

Jurisdiction	Total Number of	Total Replacement Cost Value (RCV)	nt Estimated Building Stock and Replacement Cost V /) Located in the Extreme Coastal Risk Hazard Ar					
	Buildings		Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total		
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%		
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%		
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0	0.0%		
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%		
Buchanan (V)	1,153	\$1,174,838,972	2	0.2%	\$6,562,571	0.6%		
Cortlandt (T)	11,740	\$7,539,300,494	21	0.2%	\$8,480,142	0.1%		



Jurisdiction	Total Number of	Total Replacement	E Estimated Building Stock and Replacement Cost Va						
	Buildings		Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total			
Croton-on-Hudson (V)	3,412	\$5,339,173,282	23	0.7%	\$153,399,314	2.9%			
Dobbs Ferry (V)	2,888	\$3,524,751,416	1	< 0.1%	\$6,101,027	0.2%			
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%			
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%			
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%			
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%			
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	6	0.2%	\$4,762,786	<0.1%			
Irvington (V)	1,736	\$1,575,655,219	1	0.1%	\$3,411,894	0.2%			
Larchmont (V)	2,281	\$3,287,198,418	25	1.1%	\$29,339,397	0.9%			
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%			
Mamaroneck (T)	4,065	\$2,363,450,350	15	0.4%	\$10,804,488	0.5%			
Mamaroneck (V)	5,699	\$7,321,897,360	134	2.4%	\$141,388,017	1.9%			
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%			
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%			
Mount Vernon (C)	12,648	\$17,021,941,779	0	0.0%	\$0	0.0%			
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%			
New Rochelle (C)	17,044	\$42,795,863,468	131	0.8%	\$463,238,785	1.1%			
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%			
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%			
Ossining (T)	2,266	\$1,382,487,862	0	0.0%	\$0	0.0%			
Ossining (V)	5,874	\$6,071,219,565	25	0.4%	\$24,245,059	0.4%			
Peekskill (C)	6,001	\$6,315,622,346	6	0.1%	\$1,109,286	<0.1%			
Pelham (T)*	4,596	\$3,648,777,424	0	0.0%	\$0	0.0%			
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%			
Pelham Manor (V)	2,219	\$1,264,533,925	0	0.0%	\$0	0.0%			
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%			
Port Chester (V)	6,424	\$7,869,067,479	2	<0.1%	\$957,579	<0.1%			
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%			
Rye (C)	5,632	\$5,820,922,260	120	2.1%	\$115,845,623	2.0%			
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%			
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%			
Sleepy Hollow (V)	1,921	\$1,990,885,470	0	0.0%	\$0	0.0%			
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%			
Tarrytown (V)	3,078	\$7,284,273,569	8	0.3%	\$5,339,455	0.1%			
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%			
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%			
Yonkers (C)	33,912	\$50,644,348,876	16	< 0.1%	\$112,899,269	0.2%			
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%			
Westchester County (Total)	269,974	\$402,945,561,577	536	0.2%	\$1,087,884,691	0.3%			

Sources: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; NYSDOS 2013

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### Sea Level Rise

An analysis was performed to determine the number of structures located in the 1-foot, 3-feet, and 6-feet sea level rise hazard areas. There are an estimated 14 buildings, 86 buildings, and 924 buildings located in the 1-, 3-, and 6-foot sea level rise inundation areas, respectively in Westchester County. The total estimated



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replacement cost value of structures located in the sea level rise inundation areas range from \$73 million to \$1.8 billion. This represents approximately 0.4-percent of the County's total replacement cost value at the greatest inundation extent (i.e., 6-foot inundation area). Refer to Table 5.3.2-19 through Table 5.3.2-21 for a summary of the sea level rise building exposure analysis by jurisdiction.

Table 5.3.2-19 Estimated Building Stock and Replacement Located in the 1-Foot Sea Level Rise Hazard
Area

Jurisdiction	Total Number of	Total	Estimated Building Stock and Replacement				
	Buildings	Replacement Cost Value	Located	in the 1-Fo	ot Sea Level Ris Area	e Hazard	
		(RCV)	Number	Percent	Total	Percent	
			of	of	Replacement	of Total	
			Buildings	Total	Cost Value of Buildings		
Ardsley (V)	1.600	\$1,184,178,473	0	0.0%	\$0	0.0%	
Bedford (T)	7.842	\$6,187,290,490	0	0.0%	\$0	0.0%	
Briarcliff Manor (V)	2.821	\$2,929,350,441	0	0.0%	\$0	0.0%	
Bronxville (V)	1.524	\$2,422,176,980	0	0.0%	\$0	0.0%	
Buchanan (V)	1,153	\$1,174,838,972	1	0.1%	\$638.436	0.1%	
Cortlandt (T)	11,740	\$7.539.300.494	0	0.0%	\$0	0.0%	
Croton-on-Hudson (V)	3.412	\$5.339.173.282	1	< 0.1%	\$185.004	< 0.1%	
Dobbs Ferry (V)	2.888	\$3.524.751.416	0	0.0%	\$0	0.0%	
Eastchester (T)	5,861	\$4.342.629.796	0	0.0%	\$0	0.0%	
Elmsford (V)	1.358	\$2,719,155.604	0	0.0%	\$0	0.0%	
Greenburgh (T)	14.313	\$42,009,346,893	0	0.0%	\$0	0.0%	
Harrison (T)	7.813	\$10,415,934,158	0	0.0%	\$0	0.0%	
Hastings-on-Hudson (V)	2.812	\$13,267,692,589	2	0.1%	\$1,083,120	< 0.1%	
Irvington (V)	1.736	\$1.575.655.219	0	0.0%	\$0	0.0%	
Larchmont (V)	2.281	\$3,287,198,418	0	0.0%	\$0	0.0%	
Lewisboro (T)	6,358	\$5.313.683.830	0	0.0%	\$0	0.0%	
Mamroneck (T)	4.065	\$2,363,450,350	0	0.0%	\$0	0.0%	
Mamaroneck (V)	5,699	\$7.321.897.360	1	< 0.1%	\$323.814	< 0.1%	
Mount Kisco (T)	3.002	\$5,913,464.031	0	0.0%	\$0	0.0%	
Mount Pleasant (T)	9,863	\$8.309.807.831	0	0.0%	\$0	0.0%	
Mount Vernon (C)	12,648	\$17,021,941,779	0	0.0%	\$0	0.0%	
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%	
New Rochelle (C)	17,044	\$42,795,863,468	2	< 0.1%	\$4,299,959	< 0.1%	
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%	
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%	
Ossining (T)	2,266	\$1,382,487,862	0	0.0%	\$0	0.0%	
Ossining (V)	5,874	\$6,071,219,565	3	0.1%	\$855,268	< 0.1%	
Peekskill (C)	6,001	\$6,315,622,346	0	0.0%	\$0	0.0%	
Pelham (T)*	4,596	\$3,648,777,424	0	0.0%	\$0	0.0%	
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%	
Pelham Manor (V)	2,219	\$1,264,533,925	0	0.0%	\$0	0.0%	
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%	
Port Chester (V)	6,424	\$7,869,067,479	0	0.0%	\$0	0.0%	
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%	
Rye (C)	5,632	\$5,820,922,260	1	< 0.1%	\$172,818	< 0.1%	
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%	
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%	
Sleepy Hollow (V)	1,921	\$1,990,885,470	0	0.0%	\$0	0.0%	
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%	
Tarrytown (V)	3,078	\$7,284,273,569	0	0.0%	\$0	0.0%	
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%	
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%	
Yonkers (C)	33,912	\$50,644,348,876	3	<0.1%	\$65,838,272	0.1%	





Jurisdiction	Total Number of Buildings Cost Value (RCV)	Total Replacement Cost Value	Estimated Building Stock and Replacement Located in the 1-Foot Sea Level Rise Hazard Area				
		(RCV)	Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total	
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%	
Westchester County (Total)	269,974	\$402,945,561,577	14	0.0%	\$73,396,692	0.0%	

Sources: Westchester County GIS 2020/2021; NYS GIS 2021; RS Means 2021

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Table 5.3.2-20. Estimated Building Stock and Replacement Cost Value Located in the 3-Feet Sea Level Rise Hazard Area

Jurisdiction	Total	Total	Estimated Building Stock and Replacement			icement
	Number of	Replacement	Cost Valı	ie Located	in the 3-Feet Se	a Level
	Buildings	Cost Value		Rise Ha	azard Area	
		(RCV)	Number	Percent	Total	Percent
			of	of	Replacement	of
			Buildings	lotal	Cost Value	lotal
					of Buildings	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0	0.0%
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%
Buchanan (V)	1,153	\$1,174,838,972	1	0.1%	\$638,436	0.1%
Cortlandt (T)	11,740	\$7,539,300,494	12	0.1%	\$3,731,335	< 0.1%
Croton-on-Hudson (V)	3,412	\$5,339,173,282	3	0.1%	\$2,020,309	< 0.1%
Dobbs Ferry (V)	2,888	\$3,524,751,416	0	0.0%	\$0	0.0%
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	5	0.2%	\$4,600,649	< 0.1%
Irvington (V)	1,736	\$1,575,655,219	0	0.0%	\$0	0.0%
Larchmont (V)	2,281	\$3,287,198,418	2	0.1%	\$243,884	< 0.1%
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%
Mamroneck (T)	4,065	\$2,363,450,350	0	0.0%	\$0	0.0%
Mamaroneck (V)	5,699	\$7,321,897,360	13	0.2%	\$7,746,886	0.1%
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%
Mount Vernon (C)	12,648	\$17,021,941,779	0	0.0%	\$0	0.0%
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%
New Rochelle (C)	17,044	\$42,795,863,468	5	< 0.1%	\$4,973,808	< 0.1%
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%
Ossining (T)	2,266	\$1,382,487,862	0	0.0%	\$0	0.0%
Ossining (V)	5,874	\$6,071,219,565	15	0.3%	\$10,510,584	0.2%
Peekskill (C)	6,001	\$6,315,622,346	2	< 0.1%	\$104,917	< 0.1%
Pelham (T)*	4,596	\$3,648,777,424	0	0.0%	\$0	0.0%
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%
Pelham Manor (V)	2,219	\$1,264,533,925	0	0.0%	\$0	0.0%
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%
Port Chester (V)	6,424	\$7,869,067,479	1	< 0.1%	\$509,922	< 0.1%





Jurisdiction	Total Number of Buildings	Total Replacement Cost Value	Estimated Building Stock and Replacem Cost Value Located in the 3-Feet Sea Le Rise Hazard Area			acement a Level
		(RCV)	Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%
Rye (C)	5,632	\$5,820,922,260	11	0.2%	\$6,933,263	0.1%
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%
Sleepy Hollow (V)	1,921	\$1,990,885,470	0	0.0%	\$0	0.0%
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%
Tarrytown (V)	3,078	\$7,284,273,569	6	0.2%	\$2,142,634	< 0.1%
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%
Yonkers (C)	33,912	\$50,644,348,876	10	< 0.1%	\$71,032,905	0.1%
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%
Westchester County (Total)	269,974	\$402,945,561,577	86	0.0%	\$115,189,533	0.0%

Sources: Westchester County GIS 2020/2021; NYS GIS 2021; RS Means 2021

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Table 5.3.2-21 Estimated Building Stock and Replacement Located in the 6-Feet Sea Level Rise Hazard Area

Jurisdiction	TotalTotalNumberReplacementofCost ValueBuildings(RCV)		Estimated Building Stock and Replacement Located in the 6-Feet Sea Level Rise Hazard Area				
	Buildings	(RCV)	Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%	
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%	
Briarcliff Manor (V)	2,821	\$2,929,350,441	1	< 0.1%	\$33,452,640	1.1%	
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%	
Buchanan (V)	1,153	\$1,174,838,972	2	0.2%	\$10,877,106	0.9%	
Cortlandt (T)	11,740	\$7,539,300,494	62	0.5%	\$30,501,527	0.4%	
Croton-on-Hudson (V)	3,412	\$5,339,173,282	17	0.5%	\$6,104,049	0.1%	
Dobbs Ferry (V)	2,888	\$3,524,751,416	4	0.1%	\$11,316,644	0.3%	
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%	
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%	
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%	
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%	
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	10	0.4%	\$14,864,972	0.1%	
Irvington (V)	1,736	\$1,575,655,219	4	0.2%	\$60,284,107	3.8%	
Larchmont (V)	2,281	\$3,287,198,418	57	2.5%	\$26,870,213	0.8%	
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%	
Mamroneck (T)	4,065	\$2,363,450,350	19	0.5%	\$6,401,731	0.3%	
Mamaroneck (V)	5,699	\$7,321,897,360	132	2.3%	\$134,860,663	1.8%	
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%	
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%	
Mount Vernon (C)	12,648	\$17,021,941,779	18	0.1%	\$13,093,837	0.1%	
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%	
New Rochelle (C)	17,044	\$42,795,863,468	73	0.4%	\$402,903,092	0.9%	





Jurisdiction	Total Number of	Total Replacement Cost Value	Estimated Building Stock and Replacement Located in the 6-Feet Sea Level Rise Hazard Area				
	Buildings	(RCV)	Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total	
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%	
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%	
Ossining (T)	2,266	\$1,382,487,862	1	< 0.1%	\$133,351	<0.1%	
Ossining (V)	5,874	\$6,071,219,565	48	0.8%	\$64,674,470	1.1%	
Peekskill (C)	6,001	\$6,315,622,346	24	0.4%	\$89,089,544	1.4%	
Pelham (T)*	4,596	\$3,648,777,424	6	0.1%	\$10,152,781	0.3%	
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%	
Pelham Manor (V)	2,219	\$1,264,533,925	6	0.3%	\$10,152,781	0.8%	
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%	
Port Chester (V)	6,424	\$7,869,067,479	34	0.5%	\$116,571,304	1.5%	
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%	
Rye (C)	5,632	\$5,820,922,260	189	3.4%	\$119,714,060	2.1%	
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%	
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%	
Sleepy Hollow (V)	1,921	\$1,990,885,470	56	2.9%	\$14,933,112	0.8%	
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%	
Tarrytown (V)	3,078	\$7,284,273,569	21	0.7%	\$61,545,331	0.8%	
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%	
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%	
Yonkers (C)	33,912	\$50,644,348,876	146	0.4%	\$555,648,214	1.1%	
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%	
Westchester County (Total)	269,974	\$402,945,561,577	924	0.3%	\$1,783,992,748	0.4%	

Sources: Westchester County GIS 2020/2021; NYS GIS 2021; RS Means 2021

*Note:* C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# **Impact on Critical Facilities and Lifelines**

It is important to determine the critical facilities and infrastructure that may be at risk to flooding, and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

# **Riverine and Coastal Flooding**

Critical facility exposure to the flood hazard was examined. Table 5.3.2-22 lists the critical facilities and number of lifelines, within the 1-percent and 0.2-percent annual chance flood boundaries. Of the 511 critical facilities located in the 1-percent annual chance flood event boundary, the greatest number are food, water, or shelter facilities. Additionally, there are 599 critical facilities located in the 0.2-percent annual chance flood event boundary, 286 of which are food, water, or shelter facilities. A majority of the critical facilities located in the 1-percent annual chance flood event boundaries are in Larchmont and Rye, shown in Table 5.3.2-23 and Table 5.3.2-24.

In cases where short-term functionality is impacted by flooding, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce flood impacts to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.





# Table 5.3.2-22 Critical Facilities and Lifelines Located in the 1-Percent and 0.2-Percent Annual ChanceEvent Floodplain

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-percent Annual Chance Flood Event Hazard Area	Number of Lifelines Located in the 0.2-percent Annual Chance Flood Event Hazard Area
Communications	40	4	4
Energy	274	18	23
Food, Water, Shelter	1,661	244	286
Hazardous Materials	82	16	20
Health and Medical	117	2	5
Safety and Security	1,519	137	169
Transportation	258	90	92
Westchester County (Total)	3,951	511	599

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; Westchester County HMP 2014; Effective DFIRM FEMA September 28, 2007; Latest LOMR August 24 2021

# 5.3.2-23. Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area by Jurisdiction

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area					
		Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Ardsley (V)	21	21	3	14.3%	3	14.3%		
Bedford (T)	173	160	6	3.5%	5	3.1%		
Briarcliff Manor (V)	43	38	2	4.7%	2	5.3%		
Bronxville (V)	19	19	1	5.3%	1	5.3%		
Buchanan (V)	21	18	1	4.8%	1	5.6%		
Cortlandt (T)	165	143	23	13.9%	22	15.4%		
Croton-on-Hudson (V)	57	51	17	29.8%	17	33.3%		
Dobbs Ferry (V)	43	34	5	11.6%	5	14.7%		
Eastchester (T)	51	43	0	0.0%	0	0.0%		
Elmsford (V)	22	16	2	9.1%	1	6.3%		
Greenburgh (T)	245	217	15	6.1%	13	6.0%		
Harrison (T)	139	117	14	10.1%	13	11.1%		
Hastings-on-Hudson (V)	37	27	8	21.6%	5	18.5%		
Irvington (V)	37	35	11	29.7%	11	31.4%		
Larchmont (V)	31	26	13	41.9%	13	50.0%		
Lewisboro (T)	174	169	7	4.0%	7	4.1%		
Mamaroneck (T)	27	25	3	11.1%	3	12.0%		
Mamaroneck (V)	98	83	38	38.8%	33	39.8%		
Mount Kisco (T)	83	78	12	14.5%	10	12.8%		
Mount Pleasant (T)	355	340	17	4.8%	17	5.0%		
Mount Vernon (C)	251	165	20	8.0%	20	12.1%		
New Castle (T)	75	67	1	1.3%	1	1.5%		
New Rochelle (C)	238	182	37	15.5%	37	20.3%		
North Castle (T)	174	169	21	12.1%	21	12.4%		
North Salem (T)	116	114	8	6.9%	8	7.0%		
Ossining (T)	24	18	0	0.0%	0	0.0%		
Ossining (V)	94	83	17	18.1%	17	20.5%		
Peekskill (C)	141	106	32	22.7%	31	29.2%		
Pelham (T)*	36	30	4	11.1%	4	13.3%		
Pelham (V)	16	13	0	0.0%	0	0.0%		





Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area					
		Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Pelham Manor (V)	20	17	4	20.0%	4	23.5%		
Pleasantville (V)	47	45	3	6.4%	3	6.7%		
Port Chester (V)	110	93	32	29.1%	32	34.4%		
Pound Ridge (T)	42	41	5	11.9%	5	12.2%		
Rye (C)	77	72	31	40.3%	30	41.7%		
Rye Brook (V)	61	53	4	6.6%	4	7.5%		
Scarsdale (T)	39	34	1	2.6%	1	2.9%		
Sleepy Hollow (V)	51	36	6	11.8%	6	16.7%		
Somers (T)	194	182	8	4.1%	8	4.4%		
Tarrytown (V)	67	60	15	22.4%	15	25.0%		
Tuckahoe (V)	19	16	1	5.3%	0	0.0%		
White Plains (C)	227	175	2	0.9%	2	1.1%		
Yonkers (C)	590	436	73	12.4%	72	16.5%		
Yorktown (T)	145	114	12	8.3%	12	10.5%		
Westchester County (Total)	4,659	3,951	531	11.4%	511	12.9%		

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

*Note:* C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor Table

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area					
		Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Ardsley (V)	21	21	4	19.0%	4	19.0%		
Bedford (T)	173	160	6	3.5%	5	3.1%		
Briarcliff Manor (V)	43	38	2	4.7%	2	5.3%		
Bronxville (V)	19	19	5	26.3%	5	26.3%		
Buchanan (V)	21	18	1	4.8%	1	5.6%		
Cortlandt (T)	165	143	26	15.8%	25	17.5%		
Croton-on-Hudson (V)	57	51	17	29.8%	17	33.3%		
Dobbs Ferry (V)	43	34	5	11.6%	5	14.7%		
Eastchester (T)	51	43	1	2.0%	1	2.3%		
Elmsford (V)	22	16	4	18.2%	3	18.8%		
Greenburgh (T)	245	217	31	12.7%	29	13.4%		
Harrison (T)	139	117	15	10.8%	13	11.1%		
Hastings-on-Hudson (V)	37	27	8	21.6%	5	18.5%		
Irvington (V)	37	35	12	32.4%	12	34.3%		
Larchmont (V)	31	26	13	41.9%	13	50.0%		
Lewisboro (T)	174	169	7	4.0%	7	4.1%		
Mamroneck (T)	27	25	3	11.1%	3	12.0%		
Mamaroneck (V)	98	83	42	42.9%	37	44.6%		
Mount Kisco (T)	83	78	14	16.9%	12	15.4%		

# Table 5.3.2-24 Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area by Jurisdiction





Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area					
		Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Mount Pleasant (T)	355	340	21	5.9%	20	5.9%		
Mount Vernon (C)	251	165	23	9.2%	23	13.9%		
New Castle (T)	75	67	1	1.3%	1	1.5%		
New Rochelle (C)	238	182	41	17.2%	40	22.0%		
North Castle (T)	174	169	21	12.1%	21	12.4%		
North Salem (T)	116	114	8	6.9%	8	7.0%		
Ossining (T)	24	18	0	0.0%	0	0.0%		
Ossining (V)	94	83	19	20.2%	19	22.9%		
Peekskill (C)	141	106	32	22.7%	31	29.2%		
Pelham (T)*	36	30	4	11.1%	4	13.3%		
Pelham (V)	16	13	0	0.0%	0	0.0%		
Pelham Manor (V)	20	17	4	20.0%	4	23.5%		
Pleasantville (V)	47	45	3	6.4%	3	6.7%		
Port Chester (V)	110	93	34	30.9%	34	36.6%		
Pound Ridge (T)	42	41	9	21.4%	9	22.0%		
Rye (C)	77	72	43	55.8%	42	58.3%		
Rye Brook (V)	61	53	4	6.6%	4	7.5%		
Scarsdale (T)	39	34	2	5.1%	2	5.9%		
Sleepy Hollow (V)	51	36	6	11.8%	6	16.7%		
Somers (T)	194	182	15	7.7%	15	8.2%		
Tarrytown (V)	67	60	15	22.4%	15	25.0%		
Tuckahoe (V)	19	16	1	5.3%	0	0.0%		
White Plains (C)	227	175	6	2.6%	6	3.4%		
Yonkers (C)	590	436	86	14.6%	85	19.5%		
Yorktown (T)	145	114	12	8.3%	12	10.5%		
Westchester County (Total)	4,659	3,951	622	13.4%	599	15.2%		

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

Note: C = City; T = Town; V = Village; % = Percent

### Flash Flooding

Information regarding the vulnerability to flash flooding is not available at this time.

# Stormwater and Urban Flooding

Information regarding the vulnerability to stormwater and urban flooding is not available at this time.

### Storm Surge

The critical facilities located in the Category 1 through 4 inundation zones are summarized in Table 5.3.2-26 through Table 5.3.2-29 by jurisdiction. These critical facilities were also categorized by FEMA's lifeline categories. The number of critical facilities labeled as a lifeline facility for the County that are exposed to the Category 1 through 4 SLOSH inundation areas is also summarized by Table 5.3.2-30. The County has the greatest number of buildings located in SLOSH Category 3 and 4 inundation areas.



			Estimated Building Stock Located in the			in the
			Catego	ory I Stori	n Surge Hazard	Area
		Total			Total	
	Tatal Namban of	Replacement	Number	Damaant	Replacement	Percent
Invisdiction	I OTAL NUMBER OF	(PCV)	0I Ruildings	of Total	Cost value of Buildings	01 Totol
	1 (00	$(\mathbf{KCV})$	Buildings		Buildings	1 0tal
Ardsley $(V)$	1,600	\$1,184,178,473	0	0.0%	\$0 \$0	0.0%
Bedford (1)	7,842	\$6,187,290,490	0	0.0%	\$0 \$0	0.0%
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0 \$0	0.0%
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%
Buchanan (V)	1,155	\$1,1/4,838,9/2	20	0.1%	\$1,481,888	0.1%
Contandi (1)	2 412	\$7,539,300,494	38	0.3%	\$20,117,293	0.3%
Croton-on-Hudson $(V)$	3,412	\$3,339,173,282	20	0.8%	\$48,905,157	0.9%
Dobbs Ferry (V)	2,888	\$5,524,751,416	3	0.1%	\$8,063,729	0.2%
Eastchester (1)	2,801	\$4,542,029,790	0	0.0%	\$0 \$0	0.0%
Crearburgh (T)	1,338	\$2,719,155,604	0	0.0%	\$0 \$0	0.0%
Greenburgh (1)	7 912	\$42,009,340,893	0	0.0%	\$0 \$0	0.0%
Harrison (1)	7,815	\$10,415,934,158	0	0.0%	\$U \$14.964.072	0.0%
Hastings-on-Hudson (V)	2,812	\$15,207,092,389	10	0.4%	\$14,804,972	0.1%
Lorohmont (V)	1,/30	\$1,575,055,219	100	0.170	\$3,411,094	6.2%
Larchmont (V)	2,201	\$5,207,190,410	100	0.00/	\$203,133,039	0.2%
Lewisboro (1)	0,538	\$3,515,065,650	41	0.070	\$U \$71.012.604	2.00/
Mamaranaals (V)	4,003	\$2,303,430,330	41	1.070 6.20/	\$71,012,094	2.60/
Maunt Visco (T)	2,002	\$7,521,697,500	338	0.5%	\$200,773,078	0.0%
Mount Pleasant (T)	0.863	\$3,913,404,031	0	0.076	\$0	0.0%
Mount Vernon (C)	9,803	\$17,021,041,770	24	0.076	\$0	0.0%
New Costle (T)	6 750	\$17,021,941,779	24	0.270	\$0	0.270
New Rochelle (C)	17.044	\$12 795 863 168	124	0.07%	\$496 737 771	1.2%
North Castle (T)	5 391	\$5,067,704,057	0	0.770	\$0	0.0%
North Salem (T)	2 870	\$2 372 126 897	0	0.0%	\$0	0.0%
Ossining (T)	2,070	\$1 382 487 862	1	<0.070	\$133 351	<0.070
Ossining (V)	5 874	\$6,071,219,565	36	0.170	\$32 274 097	0.1%
Peekskill (C)	6 001	\$6 315 622 346	11	0.070	\$24 575 138	0.3%
Pelham (T)*	4,596	\$3.648.777.424	43	0.9%	\$29,503,081	0.8%
Pelham (V)	2.377	\$2,384,243,499	4	0.2%	\$970.745	0.0%
Pelham Manor (V)	2.219	\$1.264.533.925	39	1.8%	\$28.532.336	2.3%
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%
Port Chester (V)	6.424	\$7.869.067.479	106	1.7%	\$385.376.815	4.9%
Pound Ridge (T)	3.025	\$1,596,752,944	0	0.0%	\$0	0.0%
Rve (C)	5.632	\$5,820,922,260	363	6.4%	\$284.057.681	4.9%
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%
Sleepy Hollow (V)	1,921	\$1,990,885,470	17	0.9%	\$5,186,634	0.3%
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%
Tarrytown (V)	3,078	\$7,284,273,569	14	0.5%	\$21,245,289	0.3%
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%
Yonkers (C)	33,912	\$50,644,348,876	85	0.3%	\$379,731,731	0.7%
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%
Westchester County		\$402,945,561,57	1,490	0.6%	\$2,333,562,37	0.6%
(Total)	269,974	7			1	

# Table 5.3.2-25 Critical Facilities and Lifelines Located in the Category 1 SLOSH Inundation Zones

Source: Westchester County GIS 2019/2020/2021; NYS GIS 2013

Notes: V = Village, T = Town, SLOSH = Sea, Lake and Overland Surge from Hurricanes; % = Percent; < = Less Than



Jurisdiction	Total Number	Total	Estimated Building Stock Located in the Sto			e Storm
	of Buildings	Replacement	C	ategory 2	Surge Hazard Area	
		Cost Value	Number	Percent	Total	Percent
		(KCV)	of	of	Replacement	of Total
			Buildings	l otal	Cost Value of Buildings	
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%
Bedford (T)	7,842	\$6,187,290,490	0	0.0%	\$0	0.0%
Briarcliff Manor (V)	2,821	\$2,929,350,441	0	0.0%	\$0	0.0%
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%
Buchanan (V)	1,153	\$1,174,838,972	6	0.5%	\$45,526,115	3.9%
Cortlandt (T)	11,740	\$7,539,300,494	73	0.6%	\$42,454,897	0.6%
Croton-on-Hudson (V)	3,412	\$5,339,173,282	42	1.2%	\$87,091,683	1.6%
Dobbs Ferry (V)	2,888	\$3,524,751,416	7	0.2%	\$12,514,827	0.4%
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%
Hastings-on-Hudson (V)	2,812	\$13,267,692,589	13	0.5%	\$16,155,422	0.1%
Irvington (V)	1,736	\$1,575,655,219	5	0.3%	\$61,968,317	3.9%
Larchmont (V)	2,281	\$3,287,198,418	373	16.4%	\$326,161,585	9.9%
Lewisboro (T)	6,358	\$5,313,683,830	0	0.0%	\$0	0.0%
Mamroneck (T)	4,065	\$2,363,450,350	89	2.2%	\$108,468,920	4.6%
Mamaroneck (V)	5,699	\$7,321,897,360	650	11.4%	\$769,669,850	10.5%
Mount Kisco (T)	3,002	\$5,913,464,031	0	0.0%	\$0	0.0%
Mount Pleasant (T)	9,863	\$8,309,807,831	0	0.0%	\$0	0.0%
Mount Vernon (C)	12,648	\$17,021,941,779	96	0.8%	\$205,662,020	1.2%
New Castle (T)	6,759	\$4,957,954,777	0	0.0%	\$0	0.0%
New Rochelle (C)	17,044	\$42,795,863,468	387	2.3%	\$11,890,308,259	27.8%
North Castle (T)	5,391	\$5,067,704,057	0	0.0%	\$0	0.0%
North Salem (T)	2,870	\$2,372,126,897	0	0.0%	\$0	0.0%
Ossining (T)	2,266	\$1,382,487,862	1	<0.1%	\$133,351	<0.1%
Ossining (V)	5,874	\$6,071,219,565	49	0.8%	\$75,650,499	1.2%
Peekskill (C)	6,001	\$6,315,622,346	34	0.6%	\$108,291,473	1.7%
Pelham (T)*	4,596	\$3,648,777,424	157	3.4%	\$140,781,364	3.9%
Pelham (V)	2,377	\$2,384,243,499	27	1.1%	\$9,868,442	0.4%
Pelham Manor (V)	2,219	\$1,264,533,925	130	5.9%	\$130,912,922	10.4%
Pleasantville (V)	2,919	\$2,842,599,318	0	0.0%	\$0	0.0%
Port Chester (V)	6,424	\$7,869,067,479	229	3.6%	\$721,892,109	9.2%
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%
Rye (C)	5,632	\$5,820,922,260	882	15.7%	\$594,436,936	10.2%
Rye Brook (V)	3,591	\$4,892,231,021	0	0.0%	\$0	0.0%
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%
Sleepy Hollow (V)	1,921	\$1,990,885,470	72	3.7%	\$26,673,548	1.3%
Somers (T)	11,490	\$6,092,204,344	0	0.0%	\$0	0.0%
Tarrytown (V)	3,078	\$7,284,273,569	19	0.6%	\$58,020,363	0.8%
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%
Yonkers (C)	33,912	\$50,644,348,876	187	0.6%	\$863,271,843	1.7%
Yorktown (T)	13,922	\$19,503,786,796	0	0.0%	\$0	0.0%
Westchester County (Total)	269,974	\$402,945,561,577	3,371	1.2%	\$16,155,133,381	4.0%

# Table 5.3.2-26 Critical Facilities and Lifelines Located in the Category 2 SLOSH Inundation Zones

Source: Westchester County GIS 2019/2020/2021; NYS GIS 2013

Notes: V = Village, T = Town, SLOSH = Sea, Lake and Overland Surge from Hurricanes; % = Percent; < = Less Than



#### Jurisdiction Total Total Estimated Building Stock Located in the Storm Number Replacement Category 3 Surge Hazard Area of **Cost Value** Percent Total Percent Number Buildings (RCV) Replacement of of of Total **Buildings** Cost Value of Total Buildings 0.0% Ardsley (V) 1,600 \$1,184,178,473 0 0.0% \$0 Bedford (T) 7,842 \$6,187,290,490 0 0.0% \$0 0.0% 0.0% Briarcliff Manor (V) 2,821 \$2,929,350,441 \$33,452,640 1.1% 1 0.0% 0.0% Bronxville (V) 1,524 \$2,422,176,980 0 \$0 1,153 22 1.9% \$69,311,227 5.9% Buchanan (V) \$1,174,838,972 Cortlandt (T) 11,740 \$7,539,300,494 121 1.0% \$72,065,517 1.0% Croton-on-Hudson (V) 3,412 \$5,339,173,282 133 3.9% \$1,755,751,265 32.9% Dobbs Ferry (V) 2,888 \$3,524,751,416 9 0.3% \$15,693,762 0.4% Eastchester (T) \$4.342.629.796 0 0.0% 0.0% 5.861 \$0 Elmsford (V) 1.358 \$2,719,155,604 0 0.0% \$0 0.0% Greenburgh (T) 14,313 \$42,009,346,893 0 0.0% \$0 0.0% 7,813 0 \$0 0.0% Harrison (T) \$10,415,934,158 0.0% 2,812 Hastings-on-Hudson (V) 18 0.6% \$17,714,593 0.1% \$13,267,692,589 9 1,736 \$1,575,655,219 0.5% \$65,220,893 4.1% Irvington (V) \$510,490,916 15.5% 2,281 \$3,287,198,418 623 27.3% Larchmont (V) Lewisboro (T) 6,358 \$5,313,683,830 0 0.0% \$0 0.0% Mamroneck (T) 4,065 \$2,363,450,350 139 3.4% \$174,192,757 7.4% Mamaroneck (V) 5.699 \$7.321.897.360 1.187 20.8% \$2.092.098.086 28.6% Mount Kisco (T) 3,002 \$5,913,464,031 0 0.0% \$0 0.0% Mount Pleasant (T) 9.863 \$8,309,807,831 0 0.0% \$0 0.0% Mount Vernon (C) 12,648 \$17,021,941,779 153 1.2% \$407,533,405 2.4% 0.0% 0.0% New Castle (T) 6,759 \$4,957,954,777 0 \$0 17,044 \$42,795,863,468 733 4.3% \$12,174,986,897 28.4% New Rochelle (C) 0.0% North Castle (T) 5,391 \$5,067,704,057 0 0.0% \$0 North Salem (T) 2,870 \$2,372,126,897 0 0.0% \$0 0.0% Ossining (T) 2,266 \$1,382,487,862 2 0.1% \$476,762 0.0% 79 1.3% \$206,978,312 3.4% Ossining (V) 5,874 \$6,071,219,565 Peekskill (C) 6.001 \$6,315,622,346 68 1.1% \$204,012,280 3.2% \$3,648,777,424 9.6% Pelham (T)\* 4,596 265 5.8% \$351,782,295 Pelham (V) 2,377 \$2,384,243,499 69 2.9% \$82,666,996 3.5% 2,219 \$1,264,533,925 196 8.8% \$269,115,299 21.3% Pelham Manor (V) 2,919 0.0% \$2,842,599,318 0.0% \$0 Pleasantville (V) 0 8.7% 559 \$2,395,533,880 30.4% Port Chester (V) 6,424 \$7,869,067,479 Pound Ridge (T) 3,025 \$1,596,752,944 0 0.0% 0.0% \$0 \$1,037,429,156 Rye (C) 5,632 \$5,820,922,260 1.349 24.0% 17.8% Rye Brook (V) 3,591 0.0% 0.0% \$4,892,231,021 0 \$0 Scarsdale (T) 6,829 \$4,603,749,394 0 0.0% \$0 0.0% \$34,045,204 Sleepy Hollow (V) 1,921 \$1,990,885,470 80 4.2% 1.7% 11,490 \$6,092,204,344 0.0% 0.0% Somers (T) 0 \$0 1.2% \$158,019,590 2.2% Tarrytown (V) 3,078 \$7,284,273,569 38 Tuckahoe (V) 1,655 \$1,530,366,709 0.0% 0.0% 0 \$0 White Plains (C) 0.0% 0.0% 13,986 \$61,499,698,595 0 \$0 Yonkers (C) 33,912 \$50,644,348,876 203 0.6% \$1,010,875,621 2.0% Yorktown (T) 13.922 \$19,503,786,796 0 0.0% \$0 0.0% Westchester County (Total) 269,974 \$402,945,561,577 5,791 2.1% \$22,787,665,058 5.7%

# Table 5.3.2-27 Critical Facilities and Lifelines Located in the Category 3 SLOSH Inundation Zones

Source: Westchester County GIS 2019/2020/2021; NYS GIS 2013

Notes: V = Village, T = Town, SLOSH = Sea, Lake and Overland Surge from Hurricanes; % = Percent; < = Less Than



#### Jurisdiction Total Total Estimated Building Stock Located in the Storm Number Replacement Category 4 Surge Hazard Area of **Cost Value** Percent Total Percent Number Buildings (RCV) Replacement of of of Total **Buildings** Cost Value of Total Buildings 0.0% Ardsley (V) 1,600 \$1,184,178,473 0 0.0% \$0 Bedford (T) 7,842 \$6,187,290,490 0 0.0% \$0 0.0% 0.1% Briarcliff Manor (V) 2,821 \$2,929,350,441 2 \$34,355,458 1.2% 0.0% 0.0% Bronxville (V) 1,524 \$2,422,176,980 0 \$0 1,153 45 3.9% \$191,410,613 16.3% Buchanan (V) \$1,174,838,972 Cortlandt (T) 11,740 \$7,539,300,494 168 1.4% \$91,591,728 1.2% Croton-on-Hudson (V) 3,412 \$5,339,173,282 336 9.8% \$3,510,771,950 65.8% Dobbs Ferry (V) 2,888 \$3,524,751,416 11 0.4% \$21,783,526 0.6% Eastchester (T) \$4.342.629.796 0.0% 0.0% 5.861 0 \$0 Elmsford (V) 1,358 \$2,719,155,604 0 0.0% \$0 0.0% Greenburgh (T) 14,313 \$42,009,346,893 0 0.0% \$0 0.0% 7,813 0 \$0 0.0% Harrison (T) \$10,415,934,158 0.0% 2,812 0.9% 0.5% Hastings-on-Hudson (V) 26 \$72,257,847 \$13,267,692,589 0.9% 5.1% 1,736 \$1,575,655,219 15 \$80,263,662 Irvington (V) 940 2,281 \$3,287,198,418 41.2% \$649,750,402 19.8% Larchmont (V) Lewisboro (T) 6,358 \$5,313,683,830 0 0.0% \$0 0.0% Mamroneck (T) 4,065 \$2,363,450,350 306 7.5% \$346,245,012 14.6% Mamaroneck (V) 5.699 \$7.321.897.360 1.822 32.0% \$3.596.826.425 49.1% Mount Kisco (T) 3,002 \$5,913,464,031 0 0.0% \$0 0.0% Mount Pleasant (T) 9.863 \$8,309,807,831 0 0.0% \$0 0.0% Mount Vernon (C) 12,648 \$17,021,941,779 200 1.6% \$448,867,212 2.6% 0.0% 0.0% New Castle (T) 6,759 \$4,957,954,777 0 \$0 17,044 \$42,795,863,468 1,183 6.9% \$12,837,809,308 30.0% New Rochelle (C) 0.0% North Castle (T) 5,391 \$5,067,704,057 0 0.0% \$0 North Salem (T) 2,870 \$2,372,126,897 0 0.0% \$0 0.0% Ossining (T) 2,266 \$1,382,487,862 0.2% \$3,603,766 0.3% 4 93 1.6% 3.7% Ossining (V) 5,874 \$6,071,219,565 \$226,135,106 Peekskill (C) 6.001 \$6,315,622,346 97 1.6% \$268,189,329 4.2% \$3,648,777,424 422 9.2% 12.8% Pelham (T)\* 4,596 \$465,642,349 Pelham (V) 2,377 \$2,384,243,499 95 4.0% \$92,942,155 3.9% 2,219 \$1,264,533,925 327 14.7% \$372,700,194 29.5% Pelham Manor (V) 2,919 0.0% \$2,842,599,318 0.0% \$0 Pleasantville (V) 0 821 12.8% \$3,363,415,190 42.7% Port Chester (V) 6,424 \$7,869,067,479 Pound Ridge (T) 3,025 \$1,596,752,944 0 0.0% 0.0% \$0 29.4% \$1,482,101,623 Rye (C) 5,632 \$5,820,922,260 1,653 25.5% Rye Brook (V) 3,591 0.0% 0.0% \$4,892,231,021 0 \$0 Scarsdale (T) 6,829 \$4,603,749,394 0 0.0% \$0 0.0% Sleepy Hollow (V) 1,921 \$1,990,885,470 95 4.9% \$54,357,128 2.7% 11,490 \$6,092,204,344 0 0.0% 0.0% Somers (T) \$0 1.7% \$261,281,010 3.6% Tarrytown (V) 3,078 \$7,284,273,569 51 Tuckahoe (V) 1,655 \$1,530,366,709 0.0% 0.0% 0 \$0 White Plains (C) 0.0% 0.0% 13,986 \$61,499,698,595 0 \$0 Yonkers (C) 33,912 \$50,644,348,876 229 0.7% \$1,255,069,533 2.5% Yorktown (T) 13.922 \$19,503,786,796 0 0.0% \$0 0.0% Westchester County (Total) 269,974 \$402,945,561,577 8,519 3.2% \$29,261,728,177 7.3%

# Table 5.3.2-28 Critical Facilities and Lifelines Located in the Category 4 SLOSH Inundation Zones

Source: Westchester County GIS 2019/2020/2021; NYS GIS 2013

Notes: V = Village, T = Town, SLOSH = Sea, Lake and Overland Surge from Hurricanes; % = Percent; < = Less Than





# Table 5.3.2-29 Critical Facilities and Lifelines Located in the Category 1 through 4 SLOSH Inundation Zones

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the SLOSH Category 1 Hazard Area	Number of Lifelines Located in the SLOSH Category 2 Hazard Area	Number of Lifelines Located in the SLOSH Category 3 Hazard Area	Number of Lifelines Located in the SLOSH Category 4 Hazard Area
Communications	40	2	2	3	3
Energy	274	1	4	6	15
Food, Water, Shelter	1,661	88	138	174	204
Hazardous Materials	82	4	12	13	19
Health and Medical	117	0	1	3	4
Safety and Security	1,519	13	30	44	63
Transportation	258	40	62	71	75
Westchester County (Total)	3,951	148	249	314	383

Source: Westchester County GIS 2019/2020/2021; NYS GIS 2013 Notes: SLOSH = Sea, Lake and Overland Surge from Hurricanes

### Ice Jam Flooding

Similar to the impacts on general building stock, damage to critical facilities will vary for communities depending on the location of the ice jam and proximity of critical facilities to the ice jams. Major roadways can also be impacted because of inundation or debris carried by flooding, leading to road closures and disruption in services provided by or to critical facilities. Because ice jams occur in the colder months, recovery and repairs to damaged areas can take longer due to colder conditions.

### Dam Failure Flooding

Similar to the impacts on the general building stock, damage to critical facilities will vary for communities depending on the distribution of their dams and proximity of critical facilities to these dams and their downstream inundation area. Major roadways within Westchester County may also be impacted by dam failure because of standing floodwaters or debris carried by the flooding. Roadblocks in transportation corridors can create disruption in the services provided to or by critical facilities. This puts communities in the County at greater risk if proper warning time is not provided to the community if a dam failure were to occur.

### **Coastal Erosion**

It is important to determine the critical facilities and infrastructure that may be at risk to coastal erosion impacts, and who may be impacted should damage occur. Coastal erosion can degrade the surrounding infrastructure and utility lines, depending on their location on the property. Critical services may be interrupted due to direct damage or if transportation corridors that connect these facilities to the community are damaged. Roads that are damaged may even isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations.

Table 5.3.2-31 displays the critical facilities and lifelines in moderate to extreme coastal risk areas for Westchester County. A majority of the facilities are located in high and moderate risk areas with the greatest numbers in food, water, or shelter locations.

Critical facility and lifeline exposure to the coastal erosion hazard areas was examined. If the critical facility is located in the coastal erosion hazard area, it is considered exposed.





# Table 5.3.2-30 Critical Facilities and Lifelines Located in Moderate, High, and Extreme Coastal Risk Hazard Area

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Moderate Coastal Risk Hazard Area	Number of Lifelines Located in the High Coastal Risk Hazard Area	Number of Lifelines Located in the Extreme Coastal Risk Hazard Area
Communications	40	1	1	1
Energy	274	7	1	0
Food, Water, Shelter	1,661	69	80	36
Hazardous Materials	82	8	8	0
Health and Medical	117	4	0	0
Safety and Security	1,519	26	16	6
Transportation	258	22	33	20
Westchester County (Total)	3,951	137	139	63

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; NYSDOS 2013

### Sea Level Rise

It is important to determine the critical facilities, infrastructure and lifelines that may be at risk to flooding due to changes in sea level rise, and who may be impacted should damage occur and land be permanently lost. Similar to flood risks, critical services could become disrupted if sea level rise breaches the area a structure or major transportation route is built on. Roads that become blocked or damaged from residual impacts from sea level rise can isolate residents and may prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

Critical facility and lifeline exposure to the sea level rise hazard was examined. Table 5.3.2-31 through Table 5.3.2-33 summarize the number of critical facilities and lifelines exposed to the 1-, 3-, and 6-foot sea level rise inundation areas by jurisdiction, respectively. Table 5.3.2-34 displays the distribution of critical facilities in the most extreme sea level rise inundation area (i.e., 6-foot inundation area). Up to 133 critical facilities may become exposed to the most extreme sea level rise inundation area (i.e., 6-foot sea level rise). In all three scenarios, food, water, and shelter facilities are at the greatest risk of becoming exposed to these hazard areas.

	Total		Number of Critical Facilities and Lifeline Facilities Located in the 1-Foot Sea Level Rise Hazard Area					
Jurisdiction	Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Ardsley (V)	21	21	0	0.0%	0	0.0%		
Bedford (T)	173	160	0	0.0%	0	0.0%		
Briarcliff Manor (V)	43	38	0	0.0%	0	0.0%		
Bronxville (V)	19	19	0	0.0%	0	0.0%		
Buchanan (V)	21	18	0	0.0%	0	0.0%		
Cortlandt (T)	165	143	1	0.6%	1	0.7%		
Croton-on-Hudson (V)	57	51	0	0.0%	0	0.0%		
Dobbs Ferry (V)	43	34	0	0.0%	0	0.0%		
Eastchester (T)	51	43	0	0.0%	0	0.0%		

# Table 5.3.2-31 Number of Critical Facilities and Lifeline Facilities Located in the 1-Foot Sea Level Rise Hazard Area





	T. ( . 1		Number of Critical Facilities and Lifeline Facilities					
Jurisdiction	Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Elmsford (V)	22	16	0	0.0%	0	0.0%		
Greenburgh (T)	245	217	0	0.0%	0	0.0%		
Harrison (T)	139	117	0	0.0%	0	0.0%		
Hastings-on-Hudson (V)	37	27	0	0.0%	0	0.0%		
Irvington (V)	37	35	0	0.0%	0	0.0%		
Larchmont (V)	31	26	0	0.0%	0	0.0%		
Lewisboro (T)	174	169	0	0.0%	0	0.0%		
Mamroneck (T)	27	25	0	0.0%	0	0.0%		
Mamaroneck (V)	98	83	0	0.0%	0	0.0%		
Mount Kisco (T)	83	78	0	0.0%	0	0.0%		
Mount Pleasant (T)	355	340	0	0.0%	0	0.0%		
Mount Vernon (C)	251	165	0	0.0%	0	0.0%		
New Castle (T)	75	67	0	0.0%	0	0.0%		
New Rochelle (C)	238	182	0	0.0%	0	0.0%		
North Castle (T)	174	169	0	0.0%	0	0.0%		
North Salem (T)	116	114	0	0.0%	0	0.0%		
Ossining (T)	24	18	0	0.0%	0	0.0%		
Ossining (V)	94	83	1	1.1%	1	1.2%		
Peekskill (C)	141	106	1	0.7%	1	0.9%		
Pelham (T)*	36	30	0	0.0%	0	0.0%		
Pelham (V)	16	13	0	0.0%	0	0.0%		
Pelham Manor (V)	20	17	0	0.0%	0	0.0%		
Pleasantville (V)	47	45	0	0.0%	0	0.0%		
Port Chester (V)	110	93	1	0.9%	1	1.1%		
Pound Ridge (T)	42	41	0	0.0%	0	0.0%		
Rye (C)	77	72	0	0.0%	0	0.0%		
Rye Brook (V)	61	53	0	0.0%	0	0.0%		
Scarsdale (T)	39	34	0	0.0%	0	0.0%		
Sleepy Hollow (V)	51	36	0	0.0%	0	0.0%		
Somers (T)	194	182	0	0.0%	0	0.0%		
Tarrytown (V)	67	60	0	0.0%	0	0.0%		
Tuckahoe (V)	19	16	0	0.0%	0	0.0%		
White Plains (C)	227	175	0	0.0%	0	0.0%		
Yonkers (C)	590	436	2	0.3%	2	0.5%		
Yorktown (T)	145	114	0	0.0%	0	0.0%		
Westchester County (Total)	4,659	3,951	6	0.1%	6	0.2%		

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021



*Note:* C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Table 5.3.2-32 Number of Critical Facilities and Lifeline Facilities Located in the 3-Feet Sea Level Rise Hazard Area

			Number of Critical Facilities and Lifeline Facilities Located						
	Total		in th	e 3-Feet Sea Lev	vel Rise Hazard	Area			
	Critical	Total		Percent of					
	Facilities	Lifelines		Total		Percent of			
	Located in	Located in	Critical	Critical		Total			
Jurisdiction	Jurisdiction	Jurisdiction	Facilities	Facilities	Lifelines	Lifelines			
Ardsley (V)	21	21	0	0.0%	0	0.0%			
Bedford (T)	173	160	0	0.0%	0	0.0%			
Briarcliff Manor (V)	43	38	0	0.0%	0	0.0%			
Bronxville (V)	19	19	0	0.0%	0	0.0%			
Buchanan (V)	21	18	1	4.8%	1	5.6%			
Cortlandt (T)	165	143	2	1.2%	2	1.4%			
Croton-on-Hudson (V)	57	51	0	0.0%	0	0.0%			
Dobbs Ferry (V)	43	34	0	0.0%	0	0.0%			
Eastchester (T)	51	43	0	0.0%	0	0.0%			
Elmsford (V)	22	16	0	0.0%	0	0.0%			
Greenburgh (T)	245	217	0	0.0%	0	0.0%			
Harrison (T)	139	117	0	0.0%	0	0.0%			
Hastings-on-Hudson (V)	37	27	2	5.4%	0	0.0%			
Irvington (V)	37	35	0	0.0%	0	0.0%			
Larchmont (V)	31	26	0	0.0%	0	0.0%			
Lewisboro (T)	174	169	0	0.0%	0	0.0%			
Mamroneck (T)	27	25	0	0.0%	0	0.0%			
Mamaroneck (V)	98	83	2	2.0%	2	2.4%			
Mount Kisco (T)	83	78	0	0.0%	0	0.0%			
Mount Pleasant (T)	355	340	0	0.0%	0	0.0%			
Mount Vernon (C)	251	165	0	0.0%	0	0.0%			
New Castle (T)	75	67	0	0.0%	0	0.0%			
New Rochelle (C)	238	182	0	0.0%	0	0.0%			
North Castle (T)	174	169	0	0.0%	0	0.0%			
North Salem (T)	116	114	0	0.0%	0	0.0%			
Ossining (T)	24	18	0	0.0%	0	0.0%			
Ossining (V)	94	83	4	4.3%	4	4.8%			
Peekskill (C)	141	106	3	2.1%	3	2.8%			
Pelham (T)*	36	30	1	2.8%	1	3.3%			
Pelham (V)	16	13	0	0.0%	0	0.0%			
Pelham Manor (V)	20	17	1	5.0%	1	5.9%			
Pleasantville (V)	47	45	0	0.0%	0	0.0%			
Port Chester (V)	110	93	1	0.9%	1	1.1%			
Pound Ridge (T)	42	41	0	0.0%	0	0.0%			
Rye (C)	77	72	1	1.3%	1	1.4%			
Rye Brook (V)	61	53	0	0.0%	0	0.0%			
Scarsdale (T)	39	34	0	0.0%	0	0.0%			
Sleepy Hollow (V)	51	36	0	0.0%	0	0.0%			
Somers (T)	194	182	0	0.0%	0	0.0%			
Tarrytown (V)	67	60	0	0.0%	0	0.0%			
Tuckahoe (V)	19	16	0	0.0%	0	0.0%			
White Plains (C)	227	175	0	0.0%	0	0.0%			
Yonkers (C)	590	436	4	0.7%	4	0.9%			



	Total		Number of Ci in th	ritical Facilities a e 3-Feet Sea Lev	and Lifeline Fac vel Rise Hazard	ilities Located Area
	Critical	Total		Percent of		
	Facilities	Lifelines		Total		Percent of
	Located in	Located in	Critical	Critical		Total
Jurisdiction	Jurisdiction	Jurisdiction	Facilities	Facilities	Lifelines	Lifelines
Yorktown (T)	145	114	0	0.0%	0	0.0%
Westchester County (Total)	4,659	3,951	21	0.5%	19	0.5%

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

*Note:* C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Table 5.3.2-33 Number of Critical Facilities and Lifeline Facilities Located in the 6-Feet Sea Level Rise Hazard Area

Jurisdiction	Total Number	Total Number of Lifelines	Number of Critical Facilities and Lifeline Facilities Located in the 6-Feet Sea Level Rise Hazard Area					
	of		Critical	Percent of Total	Lifelines	Percent		
	Critical		Facilities	Critical		of Total		
	Facilities	-	-	Facilities		Lifelines		
Ardsley (V)	21	21	0	0.0%	0	0.0%		
Bedford (T)	173	160	0	0.0%	0	0.0%		
Briarcliff Manor (V)	43	38	1	2.3%	1	2.6%		
Bronxville (V)	19	19	0	0.0%	0	0.0%		
Buchanan (V)	21	18	1	4.8%	1	5.6%		
Cortlandt (T)	165	143	7	4.2%	7	4.9%		
Croton-on-Hudson (V)	57	51	2	3.5%	2	3.9%		
Dobbs Ferry (V)	43	34	0	0.0%	0	0.0%		
Eastchester (T)	51	43	0	0.0%	0	0.0%		
Elmsford (V)	22	16	0	0.0%	0	0.0%		
Greenburgh (T)	245	217	0	0.0%	0	0.0%		
Harrison (T)	139	117	0	0.0%	0	0.0%		
Hastings-on-Hudson (V)	37	27	4	10.8%	1	3.7%		
Irvington (V)	37	35	4	10.8%	4	11.4%		
Larchmont (V)	31	26	1	3.2%	1	3.8%		
Lewisboro (T)	174	169	0	0.0%	0	0.0%		
Mamroneck (T)	27	25	0	0.0%	0	0.0%		
Mamaroneck (V)	98	83	8	8.2%	8	9.6%		
Mount Kisco (T)	83	78	0	0.0%	0	0.0%		
Mount Pleasant (T)	355	340	0	0.0%	0	0.0%		
Mount Vernon (C)	251	165	11	4.4%	11	6.7%		
New Castle (T)	75	67	0	0.0%	0	0.0%		
New Rochelle (C)	238	182	7	2.9%	7	3.8%		
North Castle (T)	174	169	0	0.0%	0	0.0%		
North Salem (T)	116	114	0	0.0%	0	0.0%		
Ossining (T)	24	18	0	0.0%	0	0.0%		
Ossining (V)	94	83	10	10.6%	10	12.0%		
Peekskill (C)	141	106	11	7.8%	11	10.4%		
Pelham (T)*	36	30	3	8.3%	3	10.0%		
Pelham (V)	16	13	0	0.0%	0	0.0%		
Pelham Manor (V)	20	17	3	15.0%	3	17.6%		
Pleasantville (V)	47	45	0	0.0%	0	0.0%		
Port Chester (V)	110	93	7	6.4%	7	7.5%		
Pound Ridge (T)	42	41	0	0.0%	0	0.0%		





Jurisdiction	Total Number	Total Number of Lifelines	Number of Critical Facilities and Lifeline Facilities Located in the 6-Feet Sea Level Rise Hazard Area				
	of		Critical	Percent of Total	Lifelines	Percent	
	Critical		Facilities	Critical		of Total	
	Facilities			Facilities		Lifelines	
Rye (C)	77	72	14	18.2%	14	19.4%	
Rye Brook (V)	61	53	0	0.0%	0	0.0%	
Scarsdale (T)	39	34	0	0.0%	0	0.0%	
Sleepy Hollow (V)	51	36	2	3.9%	2	5.6%	
Somers (T)	194	182	0	0.0%	0	0.0%	
Tarrytown (V)	67	60	5	7.5%	5	8.3%	
Tuckahoe (V)	19	16	0	0.0%	0	0.0%	
White Plains (C)	227	175	0	0.0%	0	0.0%	
Yonkers (C)	590	436	38	6.4%	38	8.7%	
Yorktown (T)	145	114	0	0.0%	0	0.0%	
Westchester County (Total)	4,659	3,951	136	2.9%	133	3.4%	

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

*Note:* C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

#### Table 5.3.2-34 Critical Facilities and Lifelines Located in 1-, 3-, and 6-Feet Sea Level Rise Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-Foot Sea Level Rise Hazard Area	Number of Lifelines Located in the 3- Feet Sea Level Rise Hazard Area	Number of Lifelines Located in the 6-Feet Sea Level Rise Hazard Area
Communications	40	0	0	1
Energy	274	0	0	1
Food, Water, Shelter	1,661	2	7	66
Hazardous Materials	82	0	0	7
Health and Medical	117	0	0	0
Safety and Security	1,519	1	3	17
Transportation	258	3	9	41
Westchester County (Total)	3,951	6	19	133

Sources: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

#### **Impact on the Economy**

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, impacts on tourism, and impacts on the tax base to Westchester County. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the 'Impact on General Building Stock' subsection earlier which discusses direct impacts to buildings in Westchester County. Other economic components such as loss of facility use, functional downtime and socio-economic factors are less measurable with a high degree of certainty.

### **Riverine and Coastal Flooding**

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation.



Debris management may also be a large expense after a flood event. Hazus estimates the amount of debris generated from the 1-percent annual chance event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.) and (3) foundations (concrete slab and block, rebar, etc.). The distinction is made because of the different types of equipment needed to handle the debris. Table 5.3.2-35 summarizes the debris Hazus estimates for these events. As a result of the 1-percent annual chance event, Hazus estimates approximately 214,778 tons of debris will be generated in total.

Jurisdiction	1-Percent Annual Chance Flood Event						
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)			
Ardsley (V)	11,311	1,317	6,467	3,526			
Bedford (T)	1,569	835	425	308			
Briarcliff Manor (V)	692	426	137	129			
Bronxville (V)	491	302	96	93			
Buchanan (V)	41	32	5	4			
Cortlandt (T)	4,958	1,984	1,707	1,268			
Croton-on-Hudson (V)	404	222	102	80			
Dobbs Ferry (V)	1,497	146	775	576			
Eastchester (T)	603	429	104	69			
Elmsford (V)	1,269	606	397	266			
Greenburgh (T)	1,676	774	527	376			
Harrison (T)	4,069	2,501	907	662			
Hastings-on-Hudson (V)	260	133	70	57			
Irvington (V)	1,699	600	646	453			
Larchmont (V)	5,389	1,918	2,175	1,296			
Lewisboro (T)	4,086	2,329	1,123	633			
Mamroneck (T)	3,923	1,973	1,183	767			
Mamaroneck (V)	19,843	8,818	6,907	4,118			
Mount Kisco (T)	2,251	911	848	492			
Mount Pleasant (T)	1,809	1,219	354	236			
Mount Vernon (C)	495	281	97	118			
New Castle (T)	1,012	591	247	174			
New Rochelle (C)	58,164	31,218	20,236	6,711			
North Castle (T)	8,406	2,682	3,348	2,376			
North Salem (T)	1,728	1,392	204	132			
Ossining (T)	151	65	50	36			
Ossining (V)	6,445	873	3,462	2,111			
Peekskill (C)	5,557	2,059	2,142	1,355			
Pelham (T)*	3,105	658	1,469	978			
Pelham (V)	2,917	547	1,420	950			
Pelham Manor (V)	189	112	49	28			
Pleasantville (V)	254	192	36	25			
Port Chester (V)	3,435	827	1,856	752			
Pound Ridge (T)	2,631	919	991	721			
Rye (C)	16,563	7,042	5,832	3,689			
Rye Brook (V)	3,674	1,463	1,307	904			
Scarsdale (T)	1,887	1,640	144	102			
Sleepy Hollow (V)	1,016	808	105	103			
Somers (T)	1,343	466	506	371			
Tarrytown (V)	534	295	130	109			
Tuckahoe (V)	556	554	1	2			
White Plains (C)	450	198	144	108			

### Table 5.3.2-35 Estimated Debris Generated from the 1-percent Annual Chance Flood Event





Jurisdiction	1-Percent Annual Chance Flood Event							
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)				
Yonkers (C)	7,505	3,974	2,104	1,428				
Yorktown (T)	22,027	8,107	8,458	5,461				
Westchester County (Total)	214,778	93,780	77,827	43,171				

Sources: Westchester County HMP 2014; Effective DFIRM FEMA September 28, 2007; Latest LOMR August 24 2021 Note: C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### Flash Flooding

The economic impacts of flash floods are similar to the impacts of riverine and coastal floods; however, flash floods occur with little to no warning which prevents businesses and homeowners to prepare for flooding. Impacts of a flash flood can include damaged or closed roadways, utility failures, and structural damages. Overall economic impacts include loss of business function; damaged roads, bridges, buildings, and cars; utility interruptions; and expended resources to assist with recovery efforts (Wyoming 2021) (eSchoolToday 2021).

### Stormwater and Urban Flooding

The economic impacts of stormwater and urban floods are similar to the impacts of riverine and coastal floods. In addition to damaging businesses and homes, this type of flooding can also lead to drinking water contamination, destroy septic system drainfields, impair tourism and recreational businesses, and disrupt critical infrastructure systems (Council 1999) (Environment 2021).

### Storm Surge

Damage to structures from flooding and wind can be the most immediate result of coastal storm events; however, this damage can have long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. As evidenced by Hurricane Sandy, the State of New York, including Westchester County, lost millions of dollars in wages and economic activity.

# Ice Jam Flooding

Flooding from ice jams can have detrimental impacts on property and infrastructure, including damages to homes, bridges, roads, and businesses. Similar to other types of flooding, ice jam flooding can close roadways and cause power outages, limiting operations of businesses in the impacted areas. A significant ice jam flood event could cause millions of dollars in damages (Das, Reed and Lindenschmidt 2018).

# Dam Failure Flooding

Dam failures have historically occurred in Westchester County and can impact the local and regional economy. A failure of one of the 36 high hazard dams in the County could cause significant impacts. When Hurricane Floyd passed through Westchester County in 1999, the Cortlandt Lake Dam failed due to the amount of rain and erosion (NPDP 2021). An event like Hurricane Floyd could lead to more failures, leaving the County or dam owners responsible for repairing damages and cleanup.

### **Coastal Erosion**

Rapid coastal erosion, in association with harsh coastal storms, has the potential for financial loss in the local and regional economy. Gradual coastal erosion may also pose a financial risk. These financial risks include but are not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, and impacts on tourism. In areas that are directly experiencing coastal erosion, renovations





of commercial and industrial buildings may be necessary, disrupting associated services. If businesses and residents relocate from waterfront property, the low availability and high cost of housing in coastal areas may present a challenge. However, if residents with waterfront property remain, to protect their property, they may be required to make structural changes or construct bulkheads or riprap. The cost of these interventions may financially stress lower- or middle-income residents (New York City Emergency Management 2019). Refer to the 'Impact on Buildings' subsection earlier which discusses direct impacts to buildings in Westchester County.

# Sea Level Rise

Vulnerability to sea level rise is assessed as the potential permanent loss of land and assets. This permanent loss will severely impact the economy given the presence of major infrastructure and residential and commercial properties associated with the tourism industry along the coast in Westchester County. In addition, the densely developed coast has high property values and contributes to the tax base, as well as local and regional economies. The total replacement cost value of structures located in the 1-, 3-, and 6-foot sea level rise inundation areas are \$73 million, \$115 million, and \$1.8 billion, respectively.

Additionally, disruption to business operations can occur in cases where infrastructure is breached by erosion caused by sea level rise. Loss of income may occur as a secondary impact if businesses are closed under repairs due to this breaching. To prevent these potential business losses, public expenditures may need to be spent to implement shoreline stabilizers and to protect key infrastructure like highways and interstates that follow along the coastline.

For discussion on the impacts of climate change influenced extreme temperature and severe weather events on the economy, refer to the Extreme Temperature profile (Section 5.4.2) and the Severe Storm profile (Section 5.4.4).

# **Impact on the Environment**

Flood extents for the 1- and 0.2-percent annual flood events will continue to evolve alongside natural occurrences such as sea level rise, climate change, and/or severity of storms. Further, residents living in and around areas of wildfire may be at increased risk of flooding in the future due to changes in the natural landscape.

# Riverine and Coastal Flooding

Flood events will inevitably impact Westchester County's natural and local environment. Severe flooding not only influences the habitat of these natural land areas, but it can also be disruptive to species that reside in these natural habitats. Table 5.3.2-37 lists the number of acres exposed to the 1- and 0.2-percent annual chance flood extents by land use type.

Land Use Type	Total Acres for County	1-percent Annual Chance Flood Event Hazard Area		0.2-percent A Flood Event	nnual Chance Hazard Area
		Acres	Percent of Total	Acres	Percent of Total
Agriculture	5,329	118	2.2%	126	2.4%
Barren Land	376	82	21.7%	83	22.0%
Forest	129,538	5,184	4.0%	5,722	4.4%
Urban Area	132,159	7,880	6.0%	9,390	7.1%
Water	10,612	9,187	86.6%	9,218	86.9%
Wetlands	9,477	3,899	41.1%	4,276	45.1%
Westchester County (Total)	287,492	26,348	9.2%	28,814	10.0%

Source: NLCD/USGS 2016

Note: % = Percent





### Flash Flooding

Like riverine and coastal flooding, flash floods impact the natural and local environment. The surrounding environment may not be able to withstand and recover from flash flood events. Flash floods can destroy wildlife habitats, pollute rivers and streams, carry sediment and silt that can impact water quality, destroy crops and farms, uproot trees, and cause erosion of streambanks and other areas (Wyoming 2021), (eSchoolToday 2021) (New York City 2019).

### Stormwater and Urban Flooding

Stormwater and urban flooding events can also impact the natural environment. Stormwater picks up and carries pollutants and other hazardous materials into waterways causing poor water quality, contaminated waters, and impacting fish and plants. Stormwater can also erode stream channels, increase sediment and debris in waterbodies, and destroy fish and wildlife habitats (Environment 2021).

Storm Surge

Coastal storms can cause beach and dune erosion, wetland loss, and barrier island breaching that disrupts coastal habitats and migration patterns of species (New York City 2019). Flooding caused by coastal storms may breach structures containing hazardous wastes, which can contaminate water resources and soil resources. Debris caused by coastal storms may also be hazardous to aquatic habitats and species. Table 5.3.2-38 lists the number of acres exposed to SLOSH Category 1 through 4 hazard areas land use type.

Land Use Type	Total Acres for County	SLOSH Category 1 Hazard Area		SLOSH Category 2 Hazard Area		SLOSH Category 3 Hazard Area		SLOSH Category 4 Hazard Area	
		Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Agriculture	5,329	7	0.1%	16	0.3%	23	0.4%	26	0.5%
Barren Land	376	25	6.7%	40	10.8%	46	12.1%	49	13.1%
Forest	129,538	158	0.1%	259	0.2%	393	0.3%	513	0.4%
Urban Area	132,159	1,649	1.2%	2,659	2.0%	3,800	2.9%	4,897	3.7%
Water	10,612	200	1.9%	236	2.2%	312	2.9%	323	3.0%
Wetlands	9,477	335	3.5%	384	4.1%	427	4.5%	443	4.7%
Westchester County (Total)	287,492	2,374	0.8%	3,596	1.3%	5,001	1.7%	6,252	2.2%

# Table 5.3.2-37 Land Use Types in Westchester County Located in SLOSH Category 1 through 4 Hazard Areas

Source: NLCD/USGS 2016

*Note:* % = *Percent* 

### Ice Jam Flooding

Like other types of flood, the environmental impacts of ice jams can include water quality issues, destroy wildlife habitats, pollution, uproot trees and vegetation, and cause erosion along streambanks and other areas.

### Dam Failure Flooding

The environmental impacts of a dam failure can include significant water-quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and





contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

# Coastal Erosion

The loss of natural resources is difficult to quantify; however, their loss would deeply cost the County and communities. Parks and beaches play a critical role in recreation, employment, and the local economy. In addition, wetland areas and coastal habitats are important ecosystems for many species and provide other environmental benefits such as flood mitigation and may be altered through chronic coastal flood conditions, erosion and sea level rise. Table 5.3.2-39 lists the number of acres exposed to moderate, high, and extreme coastal risk hazard areas land use type.

# Table 5.3.2-38 Land Use Types in Westchester County Located in Moderate, High, and Extreme CoastalRisk Hazard Areas

Land Use Type	Total Acres	Moderate Coastal Risk Hazard Area		High Coa Hazar	astal Risk d Area	Extreme Coastal Risk Hazard Area		
	for County	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Agriculture	5,329	8	0.1%	13	0.2%	4	0.1%	
Barren Land	376	15	3.9%	13	3.4%	21	5.6%	
Forest	129,538	233	0.2%	101	0.1%	114	0.1%	
Urban Area	132,159	1,867	1.4%	1,313	1.0%	813	0.6%	
Water	10,612	68	0.6%	85	0.8%	89	0.8%	
Wetlands	9,477	44	0.5%	82	0.9%	262	2.8%	
Westchester County (Total)	287,492	2,233	0.8%	1,606	0.6%	1,303	0.5%	

Source: NLCD/USGS 2016

*Note:* % = *Percent* 

### Sea Level Rise

Sea level rise increases the risks coastal communities face from coastal hazards (floods, storm surges, and chronic erosion). It may also lead to the loss of important coastal habitats and public-access areas. Because of existing shoreline development and protective structures, wetlands, beaches, and other intertidal areas may not be able to migrate inland progressively as sea level rises. These areas could become completely inundated by the rising ocean. Table 5.3.2-40 lists the number of acres exposed to 1-, 3-, and 6-foot sea level rise hazard areas land use type.

# Table 5.3.2-39 Land Use Types in Westchester County Located in 1-, 3-, and 6-Foot Sea Level RiseHazard Areas

Land Use Type	Total Acres	1-Foot Sea Hazar	Level Rise d Area	3-Feet Sea Level Rise Hazard Area		6-Feet Sea Level Rise Hazard Area	
	for County	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Agriculture	5,329	1	0.0%	3	0.1%	14	0.3%
Barren Land	376	8	2.1%	13	3.6%	33	8.7%
Forest	129,538	27	0.0%	54	0.0%	165	0.1%
Urban Area	132,159	115	0.1%	321	0.2%	1,441	1.1%
Water	10,612	66	0.6%	101	1.0%	289	2.7%
Wetlands	9,477	88	0.9%	235	2.5%	350	3.7%
Westchester County (Total)	287,492	304	0.1%	729	0.3%	2,293	0.8%

Source: NLCD/USGS 2016

*Note:* % = *Percent* 





### **Cascading Impacts on Other Hazards**

### Riverine, Coastal, Flash, and Stormwater/Urban Flooding

Flood events can exacerbate the impacts of disease outbreak and landslides. After a flooding event, runoff can pick up and transport pollutants from wildlife and soils. Such organisms can then appear in water drinking facilities and transmit illnesses water-borne and vector diseases to the population (World Health Organization (WHO) 2020). Flooding can also put additional strain on dams, which may lead to dam failure. More information about these hazards of concern can be found in Section 5.4.3 (Dam Failure) and Section 5.4.8 (Disease Outbreak).

### Storm Surge

Hurricanes can escalate the impacts of flooding and coastal erosion. Storm surge may increase erosion along the shoreline, which alters the extent of flooding. The structures most at risk of coastal erosion and flooding can be reviewed in Section 5.4.1 and Section 5.4.3, respectively.

#### Ice Jam and Dam Failure Flooding

Dam failures and ice jams can cause severe downstream flooding, depending on the magnitude of the failure. Other potential impacts are landslides and erosion. They can also cause environmental impacts if floodwaters flow through hazardous material facilities and bring those materials to other areas.

#### **Coastal Erosion**

Since altering beach shape and coastal erosion along the County's shorelines could cause changes in land elevation in the County, the impacts of sea level rise may become enhanced. Additionally, receding shorelines make coastal properties more susceptible to flooding. FEMA discusses the relationship between flooding and erosion for coastal communities in the 2018 Coastal Erosion Guidance Document (Federal Emergency Management Agency (FEMA) 2018). For example, flood map projects for coastal communities are evaluated based on erosion assessments. Estimated flood extents may change based upon the level of erosion that has occurred.

#### Sea Level Rise

Sea level rise and climate change can exacerbate the impacts of coastal erosion, drought, flooding, hurricanes, tropical storms, Nor'Easters, severe weather, severe winter weather, tsunamis, and wildfires. However, truly understanding the future impacts sea level rise and climate change will have on other hazards is challenging. As discussed in earlier sections, sea level rise projections show that coastal areas will become inundated. This inundation may cause a loss in protective shoreline dunes and stabilizing plant material. Further, the level of inundation will vary along the shoreline, which will change the flood dynamics of the coastal communities. Climate change will have an effect on all natural hazards of concern for the County and are discussed in Section 5.4.2 (Extreme Temperature), Section 5.4.3 (Flood), Section 5.4.4 (Severe Storm), Section 5.4.5 (Severe Winter Weather), and Section 5.4.6 (Wildfire).

### **Future Changes That May Impact Vulnerability**

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

Potential or projected development





- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

# **Projected Development**

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. New development that has occurred in the last five years within the County, and potential future development in the next five years as identified by the county and each municipality, is included in the jurisdictional annexes in Section 9, along with an indication of proximity to known hazard zones. Recent, ongoing, and known/anticipated future development inventory (2021) provided by the Westchester County Department of Planning, illustrated in Figure 4-13. The county-level inventory includes major development projects referred to the County as part of the mandatory site plan review referral process and does not include all development in the County. Figure 5.4.3-19 indicates new development with new development; however it does not inform unmapped areas of localized or flash flooding. Refer to Section 4, and Volume II Section 9 for more information about the potential new development in Westchester County.





Figure 5.4.3-19. Recent and Anticipated New Development and Flood Boundaries in Westchester County



Westchester gov.com



### Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Increased population trends along the coastline will change the County's overall risk to severe hurricane wind events. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

### Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. It is anticipated that Westchester County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

Understanding trends in sea level, along with the relationship between global and local sea level, provides information about the impacts of the earth's climate on the oceans and atmosphere. Changes in global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity are known effects of climate change. All of these changes are directly related to and captured in long-term sea level records. Sea levels provide a key to understanding the impact of climate change (NOAA 2013).

Sea level rise increases the risks coastal communities face from coastal hazards (floods, storm surges, and chronic erosion). It may also lead to the loss of important coastal habitats and public-access areas. Because of existing shoreline development and protective structures, wetlands, beaches, and other intertidal areas may not be able to migrate inland progressively as sea level rises. These areas could become completely inundated by the rising ocean. Higher mean sea levels increase the frequency, magnitude, and duration of flooding associated with any given storm (NOAA 2013).

### **Change of Vulnerability Since 2015 HMP**

Since the 2015 HMP was drafted, updated inventory data has become available to assess additional flood hazard areas in Westchester County. This data includes the 5-Year 2015-2019 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Hazus v5.0 was also used to assess the losses in the County to the overall risk from 100-year and 500-year flood risk. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the flood hazard.





# 5.4.4 Severe Storm

The following section provides the hazard profile and vulnerability assessment for the severe storm hazard in Westchester County.

# 5.4.4.1 Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, climate change projections and probability of future occurrences for the severe storm hazard.

### **Hazard Description**

Severe storm events are a common occurrence in Westchester County. A variety of severe storm types, such as thunderstorms, lightning, hail, tornadoes, high winds, and hurricanes/tropical storms, have damaged property and infrastructure, disrupt power, downing trees and power lines, and causing injuries and fatalities. The following section describes the different severe storm types that impact Westchester County.



Thunderstorms

Thunderstorms can lead to flooding, landslides, strong winds, and lightning. Roads could become impassable from flooding, downed trees or power lines, or a landslide. Downed utility poles can lead to utility losses, such as electricity, phone, and water (from loss of pumping and filtering capabilities). A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS, National Weather Service Glossary 2021). A thunderstorm forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong

winds, flash flooding, and lightning. The NWS considers a thunderstorm *severe* only if it produces damaging wind gusts of 58 mph or higher or large hail one inch (quarter size) in diameter or larger or tornadoes (NWS, National Weather Service Glossary 2021).

### Lightning

Lighting is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm. Lightning can be cloud to air, cloud to cloud, and cloud to ground.

Lightning can damage homes and injure people. In the United States, an average of 300 people are injured and 80 people are killed by lightning each year. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. An estimated 100,000 thunderstorms occur each year in the United States, with approximately 10 percent of them classified as severe. During the warm season, thunderstorms are responsible for most of the rainfall.





### Hailstorms

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 °F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail (NSSL 2021).

### High Winds

Wind begins with differences in air pressures. It is rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS, Air Pressure and Wind 2012).

### Tornadoes

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground with an average forward speed of 30 miles per hour (mph). Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NWS, Thunderstorms, Tornadoes, Lightning...Nature's Most Violent Storms 2010).

### Hurricanes/Tropical Storms

A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds of 39 to 73 mph and heavy rain. A hurricane is a tropical storm that attains hurricane status when its wind speed reaches 74 mph or higher. Tropical systems can develop in the Atlantic between the Lesser Antilles and the African coast or in the warm tropical waters of the Caribbean Sea and Gulf of Mexico. These storms can move up the Atlantic coast of the United States, impacting the eastern seaboard, or move into the United States through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving eastward offshore (NWS, Tropical Definitions 2021).

Though Westchester County is at some distance from open waters, the Hudson River is tidally influenced and coastal storms, such as hurricanes and tropical storms, can impact the County (DHSES 2019). Hurricanes and tropical storms can impact Westchester County from June to November, the official eastern U.S. hurricane season; however, late July to early October is the most likely period for hurricanes and tropical storms to impact Westchester County, due to the cooling of the North Atlantic Ocean waters (NYS DHSES 2014).

### Location

All of Westchester County is exposed to high wind, lightning, windstorms, thunderstorms, hail, tornadoes, hurricanes, and tropical storms. Additionally, all of the county is subject to high winds from severe weather events. According to the FEMA Winds Zones of the United States map, Westchester County is located in Wind Zone II. In this zone, wind speeds can reach up to 160 mph. Additionally, the County is located within a "Hurricane Susceptible Region", meaning Westchester County is susceptible to hurricanes and other tropical cyclone events.





### Extent

The extent (severity or magnitude) of a severe storm is largely dependent upon the most damaging aspects of each type of severe weather. This section describes the extent of thunderstorms, lighting, hail, windstorms, tornadoes, hurricanes, and tropical storms in Westchester County.

# Thunderstorms

Severe thunderstorm watches and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. Figure 5.4.4-2 illustrates the warnings and watches NWS issues for thunderstorms. Figure 5.4.4-3 presents the severe thunderstorm risk categories, as provided by the SPC.

# Figure 5.4.4-2. NWS Warnings and Watches for Thunderstorms

#### Severe Thunderstorm Warning

Issued when there is evidence based on radar or a reliable spotter report that a thunderstorm is producing, or forecast to produce, wind gusts of 58 mph or greater, structural wind damage, or hail one inch in diameter or greater.

#### Severe Thunderstorm Watch

Issued by the SPC when conditions are favorable for the development of severe thunderstorms over a larger-scale region for a duration of at least three hours. Tornadoes are not expected in such situations, but isolated tornado development can also occur. Watches are normally issued well in advance of the actual occurrence of severe weather.

#### Special Weather Statement

Issued by the SPC when conditions are favorable for the development of severe thunderstorms over a larger-scale region for a duration of at least three hours. Tornadoes are not expected in such situations, but isolated tornado development can also occur. Watches are normally issued well in advance of the actual occurrence of severe weather.

# Figure 5.4.4-3. Severe Thunderstorm Risk Categories



*Source.* NOAA *SI* C 20

### Lightning

Lightning is associated with moderate to severe thunderstorms. Lightning severity is determined by the frequency of lightning strikes during a storm. The New York City Office of Emergency Management notes that lightning strikes occur with moderate frequency in the State of New York, with 3.8 strikes occurring per square





mile each year. Multiple devices are available to track and monitor the frequency of lightning (NYC Emergency Management 2020). Figure 5.4.4-4. Hail Size Chart

### Hailstorms

The severity of hail is measured by duration, hail size, and geographic extent. Hail can exhibit a variety of sizes, though only the very largest hail stones pose serious risk to people, if exposed (DHSES 2019). The size of hail is estimated by comparing it to a known object. The Tornado and Storm Research Organization (TORRO) Hailstorm Intensity Scale (H0 to H10) relates typical damage and hail sizes. Refer to Appendix E (Supplementary Data) for a table that outlines the TORRO scale.

### High Winds

The following table provides the descriptions of winds and their associated sustained wind speed used by the NWS during windproducing events. The Beaufort wind scale, developed in 1805, is also used toda (Su

### Tal

ed today to classify wind conditions, and is pro- applementary Data).	vided in Appendix E weather.gov				
ble 5.4.4-1. NWS Wind Descriptions					
Descriptive Term	Sustained Wind Speed (mph)				
rong, dangerous, or damaging	≥40				
ery Windy	30-40				
indy	20-30				
reezy, brisk, or blustery	15-25				
one	5-15 or 10-20				
ght or light and variable wind	0-5				

Light or light and variable wind NWS 2010 Source:

mph miles per hour

St V W B:

Ν

The NWS issues advisories and warnings for winds that are typically site-specific. The NWS issues high wind advisories, watches, and warnings when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS (2020), wind warnings and advisories for New York State are as follows:

- High Wind Warnings are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for winds of 58 mph or greater for any duration or widespread damage are possible.
- Wind Advisories are issues when sustained winds of 30 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration.

#### Tornadoes

The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. Figure 5.4.4-5 illustrates the relationship between EF ratings, wind speed, and expected tornado damage.





# Figure 5.4.4-5 Explanation of EF-Scale Ratings

EF Rating	Wind Speeds	Expected Damage				
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.				
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.				
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.				
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.				
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.				
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.				

Source: NOAA 2020

Tornado watches and warning are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly, that little, if any, advance warning is possible (NOAA SPC 2018).

# Hurricanes/Tropical Storms

The extent of a hurricane or tropical storm is commonly categorized in accordance with the Saffir-Simpson Hurricane Wind Scale, which assigns a designation of tropical storm for storms with sustained wind speeds below 74 mph and a hurricane category rating of 1–5 based on a hurricane's increasing sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered *major hurricanes* because of their potential for significant loss of life and damage. Tropical Storms and Category 1 and 2 storms are still dangerous and require preventative measures (NOAA 2020). Figure 5.4.4-6 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall.

Peak wind speed projections were generated using HAZUS-MH v5.0. HAZUS-MH v5.0 estimated the maximum 3-second gust wind speeds for Westchester County to be between 39 and 73 mph for the 100-year MRP event (tropical storm-force winds). The maximum 3-second gust wind speeds for Westchester County range from 74




to 95 mph for the 500-year MRP event (Category 1-force winds). The associated impacts and losses from these 100-year and 500-year MRP hurricane event model runs are reported in the Vulnerability Assessment.

## Figure 5.4.4-6 The Saffir-Simpson Scale























# Previous Occurrences and Losses

Several sources have provided historical information regarding previous occurrences and losses associated with severe storm events in Westchester County. According to NOAA-NCEI Storm Events Database, Westchester County has been impacted by 203 severe storm events that caused no fatalities, 12 injuries, \$26.5 million in property damage, and \$0 in crop damage. However, these numbers only include events that were reported to NOAA-NCEI and may not represent all severe storms that impacted the County.

Hazard Type	Number of Occurrences Between 1950 and 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Funnel Cloud	5	-	-	-	-
Hail	68	-	-	\$250	\$250
Heavy Rain	37	-	-	-	-
High Wind	52	8	2	\$3.98 M	-
Hurricane	12	-	-	-	-
Lightning	17	1	4	\$301,750	-
Strong Wind	33	2	4	\$818,000	-
Thunderstorm Wind	273	2	8	\$1.83 M	-
Tornado	9	1	8	\$10.475 M	-
Tropical Depression	0	-	-	-	-
Tropical Storm	5	-	-	\$8,000	-
TOTAL	511	14	26	\$17.4 M	\$250.00

# Table 5.4.4-2. Severe Storm Events 1950 - June 2021

Source: NOAA-NCEI 2020; NHC 2020

\* Includes Hurricane Sandy event

\*\* Number of events were collected from NOAA-NCEI.

\*\*\* Tropical Storm includes one extra-tropical storm.

M: Million, K: Thousand

# FEMA Major Disasters and Emergency Declarations

Between 1954 and September 2021, New York State was included in 61 FEMA declared severe storm-related major disaster declarations (DR) or emergencies (EM) classified as one or a combination of the following hazards: coastal storm, high tides, heavy rain, flooding, hurricane, ice storm, severe storms, thunderstorms, tornadoes, tropical storm, straight-line winds, and landslides. Of those declarations, Westchester County was included in 16 declarations (FEMA 2020). Table 5.4.4-3 lists FEMA DR and EM declarations for Westchester County.

# Table 5.4.4-3. Severe Storm-Related FEMA Declarations for Westchester County, 1954 to September2021

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-4615	September 5, 2021	September 1, 2021 – September 3, 2021	Hurricane	Remnants of Hurricane Ida
EM-3572	September 2, 2021	September 1, 2021 – September 3, 2021	Hurricane	Remnants of Hurricane Ida
EM-3565	August 22, 2021	August 21, 2021 – August 24, 2021	Hurricane	Hurricane Henri



Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-4567	October 2, 2020	August 4, 2020	Hurricane	Tropical Storm Isaias
DR-4085	October 30, 2012	October 27, 2012 November 8, 2012	Hurricane	Hurricane Sandy
EM-3351	October 28, 2012	October 27, 2012 November 8, 2012	Hurricane	Hurricane Sandy
DR-4020	August 31, 2011	August 26, 2011 September 5, 2011	Hurricane	Hurricane Irene
EM-3328	August 26, 2011	August 25, 2011 September 5, 2011	Hurricane	Hurricane Irene
DR-1692	April 24, 2007	April 14, 2007 April 18, 2007	Severe Storm(s)	Severe Storms and Inland Coastal Flooding
DR-1589	April 19, 2005	April 2, 2005 April 4, 2005	Severe Storm(s)	Severe Storms and Flooding
DR-1534	August 3, 2004	May 13, 2004 June 17, 2004	Severe Storm(s)	Severe Storms and Flooding
DR-1296	September 19, 1999	September 16, 1999 September 18, 1999	Hurricane	Hurricane Floyd Major Disaster Declaration
EM-3149	September 18, 1999	September 16, 1999 September 18, 1999	Hurricane	Hurricane Floyd Disaster Declaration
DR-1095	January 24, 1996	January 19, 1996 January 30, 1996	Flood	Severe Storms and Flooding
DR-487	October 2, 1975	October 2, 1975	Flood	Storms, Rains, Landslides, and Flooding
DR-311	September 13, 1971	September 13, 1971	Flood	Severe Storms & Flooding

Source: FEMA 2020

estchester

## USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2014 and 2021, Westchester County was included in four USDA declarations involving severe storm weather:

- S3593 Excessive rain and related flooding, high winds, and hail May 2013
- S3747 Excessive Rain, Flash Flooding, Flooding, High Winds, and Hail April-July 2014
- S4478 Excessive rainfall August-November 2018
- S4479 Excessive precipitation July 2018

# Previous Events

Figure 5.4.4-9 from the NOAA Historical Hurricane Tracker illustrates the tracks of storms between 1842 and 2018 within 65 miles of Westchester County. Westchester County is occasionally impacted by hurricanes, tropical storms, or tropical depressions.





# Figure 5.4.4-9 Historical Hurricane Tracks within 60 nautical miles of Westchester County, 1861 to 2020

 Source:
 NOAA Historical Hurricane Tracks 2020 (names of storms will be added when available)

 Note:
 Category refers to tropical cyclone strength. TS: Tropical Storm, TD: Tropical Depression, ET: Extra-tropical Storm, H1: Category 1

 Hurricane, H2: Category 2 Hurricane, H3: Category 3 Hurricane, H4: Category 4 Hurricane.

The NOAA National Centers for Environmental Information (NCEI) Storm Events database records severe storm events. For this HMP update, known severe storm events that have impacted Westchester County between 2015 and 2020 are identified in Table 5.4.4-4. With documentation of severe storms for New York State and Westchester County being extensive, not all sources have been identified or researched. Therefore, Table 5.4.4-4 may not include all events that have occurred in the county. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).



Nestchester



# Table 5.4.4-4. Severe Storm Events in Westchester County, 2015 to April 2020

		FEMA Declaration	-	
Dates of Event	Event Type**	Number (if applicable)	County Designated?	Event Details*
February 15, 2015	Strong Wind	N/A	N/A	An area of low pressure deepened as it tracked to the northeast of the local region resulting in strong winds. A mesonet station around 1 mile west northwest of Sparta measured sustained winds of 37 mph at 7:02 am. The ASOS at White Plains Airport measured sustained winds of 38 mph at 10:03 am. \$20,000 in property damage was reported
March 17, 2015	Strong Wind	N/A	N/A	Strong winds were observed behind a cold front. A wind gust of 56 mph was observed at White Plains Airport at 4:00 pm. \$10,000 in property damage was reported.
May 28, 2015	Thunderstorm Wind	N/A	N/A	A passing cold front triggered some isolated severe thunderstorms, bringing damaging wind gusts and large hail to Westchester County. Trees were reported down in South Salem and Lewisboro.
June 23, 2015	Thunderstorm Wind	N/A	N/A	A passing cold front triggered widespread severe thunderstorms across Long Island and isolated severe thunderstorms across the lower Hudson Valley and Queens.
February 16, 2016	Strong Wind	N/A	N/A	Strong to isolated high winds occurred ahead of an area of low pressure and associated frontal boundary. A mesonet reported a wind gust to 53 mph at 248 pm. \$20,000 in property damage was reported.
February 24, 2016	Thunderstorm Wind	N/A	N/A	A passing cold front triggered severe thunderstorms across Southeastern New York. A gust of 67 mph was measured at the Larchmont Harbor mesonet location.
March 28, 2016	Strong Wind	N/A	N/A	Strong Winds occurred behind deepening low pressure. The ASOS at Westchester County Airport measured a wind gust up to 51 mph at 839 pm. \$10,000 in property damage was reported.
June 5, 2016	Thunderstorm Wind	N/A	N/A	A passing cold front triggered isolated severe thunderstorms over the Bronx and Westchester Counties.
July 14, 2016	Thunderstorm Wind	N/A	N/A	An approaching trough of low pressure triggered a line of strong to severe storms that impacted Queens, Nassau and Westchester counties. Trees, large tree branches and power lines were reported down at the intersection of Upland and Woodcrest Avenues just northeast of White Plains. \$2,500 in property damage was reported.
August 13, 2016	Thunderstorm Wind	N/A	N/A	A trough of low pressure and passing upper level disturbance triggered an isolated severe thunderstorm that impacted Westchester County. A tree was reported down at the intersection of Croton Dam Road and Route 129 just northwest of Croton Gorge Park in the Village of Croton on Hudson.
December 15, 2016	Strong Wind	N/A	N/A	Strong winds occurred behind a deep area of low pressure. Near Mamaroneck, a wind gust up to 50 mph was observed at 1227 pm. \$50,000 in property damage was reported.
March 2, 2017	Strong Wind	N/A	N/A	Gusty northwest winds occurred behind a strong cold front. At 749 am in the town of Bedford, Springhurst Road was closed due to a downed tree per social media reports. A gust up to 55 mph was measured at nearby White Plains Airport at 911 am. \$50,000 in property damage was reported.
July 13, 2017	Thunderstorm Wind	N/A	N/A	A cold front pushing south through the Lower Hudson Valley triggered a severe thunderstorm in Westchester County. Trees were reported down on wires on Stoney Street, south of East Main Street near Shrub Oak. \$2,500 in property damage was reported.





Dates of Event	Event Type**	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
August 2, 2017	Hail	N/A	N/A	A passing upper level disturbance triggered multiple severe storms, impacting Orange and Westchester counties. Nickel sized hail was reported in the City of Yonkers by a trained spotter. Golfball size hail was reported in Thornwood by a trained spotter.
October 29, 2017	Strong Wind	N/A	N/A	A low pressure system rapidly intensified as it moved north, passing west of the local area. A mesonet station near Mamaroneck reported a wind gust up to 57 mph at 1236 am on the 30th. A mesonet station near Ossining measured a wind gust up to 53 mph at 1243 am on the 30th.
November 19, 2017	Strong Wind	N/A	N/A	Strong gusty northwest winds occurred behind a strong cold front. A trained spotter reported two trees down on Feniminore Road with multiple tree limbs down. This was due to the winds and occurred around 1015 am in the Town of Mamaroneck. \$2,000 in property damage was reported.
April 16, 2018	Strong Wind	N/A	N/A	Strong winds occurred ahead of deep low pressure and associated warm front. The media reported a large tree down on a home on Nuber Avenue in the City of Mount Vernon. This occurred around 715 am, and the home was uninhabitable. A mesonet station in Larchmong Harbor measure a 61 mph wind gust at 556 am. The instrument is elevated at a height of 40 ft. In the Village of Tarrytown, route 119 was closed in both directions at the junction with I-287 due to downed wires around 9 am per media. \$100,000 in property damage was reported.
May 3, 2018	Thunderstorm Wind	N/A	N/A	Severe thunderstorms moved across Westchester County ahead of a cold front. A sixty seven mile per hour gust was reported at the Tappan Zee Light mesonet location. Trees were reported down in Pleasantville, Thronwood, Armonk, Bedford, and Quarry Heights. \$20,500 in property damage was reported.
May 15, 2018	Thunderstorm Wind	N/A	N/A	An approaching cold front triggered numerous severe thunderstorms over southeastern New York. These storms produced 3 tornadoes in the Lower Hudson Valley, as well as microbursts and macroburts. A 67 mile per hour gust was reported at Tappan Zee Light mesonet. In North Salem, a microburst resulted in a track of downed trees of 250 yards along Route 22. \$75,000 in property damage was reported. On Broadway Road in Irvington near Route 9, large tree limbs and branches down. \$2,000 in property damage was reported. In the Town of Somers, Route 116 was closed due to downed trees. Trees also down on Route 202. \$7,000 in property damage was reported.
June 18, 2018	Thunderstorm Wind	N/A	N/A	A prefrontal trough ahead of a cold front approaching from the west brought severe weather to Southeastern New York. In Jefferson Valley, a 25 foot tree split at top of tree along with numerous large branches down on Adrea Road. \$4,000 in property damage was reported.
June 24, 2018	Thunderstorm Wind	N/A	N/A	A cold front from the northwest approached the region bringing strong to severe thunderstorms across Southeast New York. Tappan Zee Light 14 Station measured a 62 mph gust. Trees were reported down in the Village of Croton on Hudson, Scarborough, the Village of Pleasantive, and Quarry Heights. \$7,000 in property damage was reported.
July 17, 2018	Thunderstorm Wind	N/A	N/A	A cold front approached from the west and brought a line with isolated severe thunderstorms across Westchester County. In Scarborough, trees were down in Law Park and a tree was down on power lines near the Taconic overpass to Dogwood Lane. Other branches were





Dates of Event	Event Type**	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
				also reported down. \$3,000 in property damage was reported. In Hawthorne, a downed tree was reported on Taconic State Parkway northbound ramp to Exit 6. \$4,000 in property damage was reported.
August 3, 2018	Thunderstorm Wind	N/A	N/A	A weak surface trough of low pressure along with an upper level trough approaches from the west to bring severe thunderstorms to the region. In the Village of Croton on Hudson, a tree branch was down blocking Teatown Road. \$1,000 in property damage was reported.
August 7, 2018	Thunderstorm Wind	N/A	N/A	A hot and humid airmass with a weak surface trough, in association with an upper level trough triggered thunderstorms across the region. In Harrison, power lines were down on North Street and \$2,000 in property damage was reported.
August 17, 2018	Thunderstorm Wind	N/A	N/A	A pre-frontal trough and mid level disturbance triggered severe thunderstorms across the region. Trees were reported down in Hawthorne, Banksville, and the Town of Bedford. \$14,000 in property damage was reported.
October 2, 2018	Tornado, Thunderstorm Wind	N/A	N/A	An approaching cold front triggered severe thunderstorms across southeastern New York, they produced 3 tornadoes across Rockland, Westchester and Suffolk Counties. A National Weather Service (NWS) Storm Survey of damage in the town of New Castle New York was conducted in conjunction with the Westchester County Office of Emergency Management, and New Castle Police. Based on the results of this survey and NWS Doppler Radar the following results were determined. The tornado began just west of the Taconic State Parkway, near the Hamlet of Millwood, and ended near Taylor Road south of the Hamlet of Mount Kisco. Many trees were uprooted or snapped along the path. There was also some roof damage to a few homes along the tornado's path. The strongest damage occurred along route 100 in Millwood, with many large hardwood trees uprooted and snapped. This damage is consistent with maximum wind speeds of around 110 mph, making this an EF-1 tornado. The tornado had a maximum path width of around 300 yards and was on the ground continuously for around three and three-quarter miles. Trees and wires were reported down in Croton Heights and the Village of Mount Kisco. \$59,000 in property damages were reported.
October 27, 2018	Strong Wind	N/A	N/A	A coastal storm moved to the east of the area. A mesonet station in Larchmont Harbor reported a wind gust up to 55 mph at 551 am. \$10,000 in property damage was reported.
November 15, 2018	Strong Wind	N/A	N/A	Strong east to northeast winds developed across the region Thursday Night into early Friday morning, as an intensifying coastal storm tracked across the area. The elevated mesonet station in Larchmont Harbor reported winds in excess of 50 mph shortly after midnight on the 16th of November. \$10,000 in property damage was reported.
November 26, 2018	Strong Wind	N/A	N/A	A coastal storm passed east of Long Island on the 26th on November. The mesonet station in Larchmont Harbor measured a wind gust up to 50 mph around 801 pm. \$10,000 in property damage was reported.
January 21, 2019	Strong Wind	N/A	N/A	Deep low pressure tracked to the northeast of the area. The ASOS at Westchester Airport reported a 52 mph wind gust at 455 pm. \$10,000 in property damage was reported.
January 30, 2019	Strong Wind	N/A	N/A	Strong winds occurred behind low pressure and cold front. Two mesonet station reported a 50 mph gust. Larchmont Harbor reported this around 449 pm, and the station along the





Dates of Event	Event Tyne**	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
		(in approace)	2 congriation.	Tappan Zee Light reported the gust around 553 pm. The ASOS at Westchester Airport
July 17, 2019	Thunderstorm Wind	N/A	N/A	An approaching cold front and mid level shortwave triggered severe thunderstorms that
				impacted Southeastern New York. Trees and wires were reported down in the Village of Tuckahoe and Dunwoodie. \$17,000 in property damage was reported.
July 22, 2019	Thunderstorm Wind	N/A	N/A	A cold front stalled as a stationary boundary triggering severe thunderstorms that impacted Southeastern New York. Trees were reported in the City of Peekskill and Purdy Station. \$4,000 in property damage was reported.
August 3, 2019	Thunderstorm Wind	N/A	N/A	A cold front and an upper level low north of the region triggered severe thunderstorms across Southeastern New York. A tree down near Croton Falls caused damage to the third rail on the Metro North Harlem line resulting in delays. \$1,000 in property damage was reported. In the Town of Somers, tree limbs were down and yard furniture was tossed and damaged due to thunderstorm wind gusts. \$2,000 in property damage was reported.
August 7, 2019	Thunderstorm Wind	N/A	N/A	A cold front and an upper level disturbance triggered strong to severe thunderstorms across Southeastern New York. Trees were reported down onto the roadway near the Rye Metro North station resulting in hundreds with power. \$3,000 in property damage was reported.
October 16, 2019	Strong Wind	N/A	N/A	Strong winds occurred behind a deep low pressure. A 55 mph wind gust was reported at White Plains, Westchester County Airport at 1154 pm. A 54 mph wind gust was measured by a mesonet station along Tappan Zee Light 14 at 1141 pm. \$50,000 in property damage was reported.
October 31, 2019	Strong Wind	N/A	N/A	Strong winds occurred behind low pressure and strong cold front. The broadcast media reported one injury from a tree down in the town of New Rochelle around 6 pm. This occurred on Mountain Avenue and Maywood Road. At 1155 pm, the mesonet station on Larchmont Harbor measured a 56 mph gust. \$50,000 in property damage was reported.
November 1, 2019	Strong Wind	N/A	N/A	Strong winds occurred behind low pressure and strong cold front. The mesonet station at Tappan Zee Light measured a 54 mph wind gust at 121 am. \$50,000 in property damage was reported.
January 16, 2020	Strong Wind	N/A	N/A	Strong winds occurred behind a cold front and deepening low pressure. The ASOS at White Plains Westchester Airport measured a 52 mph wind gust at 253 pm. A sustained wind of 37 mph was measured at White Plains Westchester Airport at 419 pm. At 251 pm, the elevated mesonet station Tappan Zee Light measured a 61 mph wind gust. \$50,000 in property damage was reported.
August 3, 2020	Tropical Storm Isaias	DR-4567	Yes	Tropical Storm Isaias passed through the region. In Westchester Valley, downed trees left the Town Hall without power and cable for two days. Damages to Town roads exceeded \$122,000. Nearly all of the County, including 90% of NYSEG customers, was left without power, and the County was in a Declared State of Emergency (Patch.com 2020). The National Guard was deployed to distribute water to municipalities and the damage was reported to exceed that of Superstorm Sandy (Westchester County Online 2020).
August 21-24, 2021	Hurricane Henri	EM-3565	Yes	Rainfall totals in Westchester County included: 6.43 inches in the City of New Rochelle, 5.29 inches in Tarrytown, 5 inches in Rye, 4.8 inches in Elmsford, 4.7 inches in the Village



Dates of Event	Event Type**	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
				of Scarsdale, and 4 inches in Briarcliff Manor. Flash flooding was reported throughout the County, closing roadways and impacting emergency response.
September 1-3, 2021	Remnants of Hurricane Ida	DR-4615	Yes	Remnants of Hurricane Ida from heavy rain and flooding to Westchester County. Numerous roadways were flooded and closed, with several cars become stuck in floodwaters. Downed trees fell across roadways and took down power lines.

Source(s): FEMA 2020; NOAA-NCEI 2020; NYS HMP 2019

\* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

\*\* Only thunderstorm wind events with property damages of \$10K or greater are listed. There were 26 days of thunderstorm winds with 59 individual reports and a total of \$359,000 in property damages.

FEMA Federal Emergency Management Agency

HMP Hazard Mitigation Plan

NCDC National Climatic Data Center

NOAA National Oceanic and Atmospheric Administration

NWS National Weather Service

NYS New York State





# **Probability of Future Occurrences**

Table 5.4.4-5 summarizes data regarding the probability of occurrences of severe storm events in Westchester County based on the historic record. Of severe storm hazards, thunderstorm events are the most commonly occurring in Westchester County, followed by hail events. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Hazard Type	Number of Occurrences Between 1954 and May 2021	% Chance of Occurring in Any Given Year
Funnel Cloud	5	2.8%
Hail	68	95.7%
Heavy Rain	37	52.1%
High Wind	52	73.2%
Hurricane	12	16.9%
Lightning	17	23.9%
Strong Wind	33	46.5%
Thunderstorm Wind	272	100%
Tornado	9	12.7%
Tropical Depression	0	0%
Tropical Storm	5	2.8%
TOTAL	510	100.0%

#### Table 5.4.4-5. Probability of Future Occurrence of Severe Storm Events

Source: NOAA-NCEI 2021; NHC 2021

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected storm events since 1968. Due to limitations in data, not all severe storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Westchester County is expected to continue experiencing direct and indirect impacts of severe storms annually. These storms may induce secondary hazards such as flooding and utility failure. The identified hazards of concern for Westchester County were ranked in Section 5.3 (Hazard Ranking). The probability of occurrence, or likelihood of the event, is among the parameters used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for severe storms in the county is considered *frequent* (event has 100 percent annual probability and might occur multiple times per year).

# **Climate Change Projections**

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011). Westchester County is located in ClimAID Region 5, which includes the East Hudson and Mohawk River Valleys. Table 5.4.4-6 provides the projected seasonal precipitation changes for Region 5 (NYSERDA 2014).





Table 5.4.4-6. Proje	ected Seasonal Precipitat	tion Change in Region	5, 2050s (% change)
----------------------	---------------------------	-----------------------	---------------------

Winter	Spring	Summer	Fall
+5 to +15	-5 to +10	-5 to +5	-5 to +10
Source: NYSERDA 2011			

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The distribution of precipitation is expected to become less even with climate change. Increased precipitation will likely be experienced in the winter months as rain, with potentially less precipitation in the summer and fall. Downpours will likely increase in intensity and frequency. This may impact drinking water through flooding contaminating wells; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011, 2014). Less frequent rainfall during the summer months may hamper water supply provision during these months. Furthermore. increased water temperatures in rivers and streams will have impacts upon aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants and industrial discharges (NYSERDA 2011).

Figure 5.4.4-10 displays the projected rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase. However, the return period (or number of years between storms) is projected to decrease. Rainstorms are anticipated to be more severe and more frequent (NYSERDA 2011).



Figure 5.4.4-10 Projected Rainfall and Frequency of Extreme Storms

NYSERDA 2011 Source.

# 5.4.2 Vulnerability Assessment

All assets in Westchester County are at risk to hurricane and tropical storm events. Potential losses associated with high-wind events were calculated for two probabilistic hurricane events: the 100-year and 500-year MRP hurricane events. The impacts on population, existing structures, critical facilities, lifelines and the economy are presented below.

# Impact on Life, Health, and Safety

The impact of a hurricane wind event on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time was provided to residents. All Westchester





County residents are at risk to the impacts caused by hurricane wind events (968,065 persons; 2015-2019 ACS 5-year Estimate).

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors including their physical and financial ability to react or respond during a hazard. Economically disadvantaged populations are vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate. The population over the age of 65 is also vulnerable and, physically, they may have more difficulty evacuating. Additionally, the elderly are considered vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention which may not be available due to isolation during a storm event. Please refer to Section 4 (County Profile) for the statistics of these populations.

Residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Hazus estimates there will be zero displaced households and no people will require temporary shelter due to a 100-year MRP event and approximately 525 households will become displaced, and 343 persons will seek short-term sheltering caused by the 500-year MRP event. Refer to Table 5.4.4-7 for the number of persons impacted by the 500-year MRP hurricane wind event summarized by jurisdiction. Please note that estimates are only based on wind speed and do not account for sheltering needs associated with flooding and storm surge that may accompany coastal storm events.

Jurisdiction	500-Year Mean Return Period Hurricane		
	Displaced Households	Persons Seeking Short- Term Sheltering	
Ardsley (V)	0	0	
Bedford (T)	3	2	
Briarcliff Manor (V)	0	0	
Bronxville (V)	3	2	
Buchanan (V)	0	0	
Cortlandt (T)	0	0	
Croton-on-Hudson (V)	0	0	
Dobbs Ferry (V)	4	2	
Eastchester (T)	7	3	
Elmsford (V)	1	1	
Greenburgh (T)	13	8	
Harrison (T)	17	10	
Hastings-on-Hudson (V)	1	0	
Irvington (V)	3	1	
Larchmont (V)	6	3	
Lewisboro (T)	1	0	
Mamroneck (T)	18	9	
Mamaroneck (V)	27	15	
Mount Kisco (T)	4	2	
Mount Pleasant (T)	1	1	
Mount Vernon (C)	60	41	
New Castle (T)	2	1	
New Rochelle (C)	71	48	
North Castle (T)	0	0	

# Table 5.4.4-7. Estimated Number of Households and Number of Persons Seeking Short-Term Sheltering During a 500-Year Mean Return Period Hurricane Wind Event





Jurisdiction	500-Year Mean Return Period Hurricane			
	Displaced Households	Persons Seeking Short- Term Sheltering		
North Salem (T)	0	0		
Ossining (T)	1	0		
Ossining (V)	8	6		
Peekskill (C)	1	1		
Pelham (T)*	5	3		
Pelham (V)	3	2		
Pelham Manor (V)	2	1		
Pleasantville (V)	2	1		
Port Chester (V)	44	38		
Pound Ridge (T)	0	0		
Rye (C)	21	12		
Rye Brook (V)	7	4		
Scarsdale (T)	6	4		
Sleepy Hollow (V)	4	3		
Somers (T)	3	1		
Tarrytown (V)	4	2		
Tuckahoe (V)	8	4		
White Plains (C)	53	32		
Yonkers (C)	114	82		
Yorktown (T)	2	1		
Westchester County (Total)	525	343		

Source: Hazus v5.0

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# **Impact on General Building Stock**

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a coastal storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Mobile/manufactured homes, and structures constructed of wood and masonry buildings, in general, tend to experience more damage than concrete or steel buildings.

To better understand these risks, Hazus was used to estimate the expected wind-related building damages. Specific types of wind damages are also summarized in Hazus at the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 5.4.4-8 summarizes the definition of the damage categories. Table 5.4.4-9 summarizes the number and type of buildings and their estimated severity of expected damage.

### Table 5.4.4-8. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No



Notes: C = City; T = Town; V = Village



Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
dents on walls requiring painting or patching for repair.						
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: Hazus Hurricane Technical Manual

# Table 5.4.4-9. Expected Severity of Damages from the 100-Year and 500-Year Mean Return Period Hurricane Wind Events

	Total		100-Year M Period H	Aean Return Iurricane	500-Year M Period H	lean Return Iurricane
Occupancy Class	Number of Buildings in Occupancy	Severity of Expected Damage	Building Count	Percent of Buildings in Occupancy Class	Building Count	Percent of Buildings in Occupancy Class
Residential	241,605	None	240,794	99.7%	223,508	92.5%
Exposure		Minor	790	0.3%	16,860	7.0%
(Single and		Moderate	21	<0.1%	1,182	0.5%
Multi-		Severe	1	<0.1%	43	<0.1%
Family Dwellings)		Complete Destruction	0	0.0%	12	<0.1%
Commercial	20,857	None	20,711	99.3%	19,442	93.2%
Buildings		Minor	142	0.7%	1,231	5.9%
		Moderate	4	<0.1%	169	0.8%
		Severe	0	0.0%	15	0.1%
		Complete Destruction	0	0.0%	0	0.0%
Industrial	1,059	None	1,053	99.4%	1,012	95.6%
Buildings		Minor	6	0.6%	42	3.9%
		Moderate	0	0.0%	4	0.4%
		Severe	0	0.0%	1	0.1%
		Complete Destruction	0	0.0%	0	0.0%
Government,	6,453	None	6,426	99.6%	6,121	94.8%
Religion,		Minor	27	0.4%	315	4.9%
Agricultural,		Moderate	1	<0.1%	16	0.2%
and		Severe	0	0.0%	1	<0.1%
Education Buildings		Complete Destruction	0	0.0%	0	0.0%

Source: Hazus v5.0; Westchester County GIS 2020; NYS GIS 2021; Notes: % = Percent; < = Less Than

Table 5.4.4-10 summarizes the replacement cost value damage for all occupancies estimated for the 100-year and 500-year MRP wind-only events. Damage estimates are reported for the County's probabilistic Hazus model scenarios. The data shown indicates total losses associated with wind damage to the building only.





The total damage to buildings for all occupancy types across Westchester County is estimated to be approximately \$137.6 million and \$982.3 million for the 100- and 500-year MRP wind-only events, respectively. The majority of these losses are to residential buildings (refer to Table 5.4.4-11). Due to differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. The damage counts include buildings damaged at all severity levels from minor damage to destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level. The City of White Plains is estimated to experience the greatest damage, approximately \$18.4 million in a 100-year MRP event and \$176 million in a 500-year MRP event.

# Table 5.4.4-10. Estimated Building Losses Caused by the 100-Year and 500-Year Mean Return PeriodHurricane Wind Events – All Occupancies

		Total Estimated		Total Estimated Duilding	
	Puilding	Caucad by the 100		Lossos Causad by the 500	
	Duiluilig Poplacomont Cost	Voar Moan Poturn	Porcont	Voar Moan Poturn Poriod	Dorcont
Iurisdiction	Value	Period Hurricane	of Total	Hurricane	of Total
Ardsley (V)	\$1,184,178,473	\$382.669	<0.1%	\$2,474,364	0.2%
Bedford (T)	\$6,187,290,490	\$2,841,844	< 0.1%	\$16,166,886	0.3%
Briarcliff Manor (V)	\$2,929,350,441	\$1.665.746	0.1%	\$8,136,288	0.3%
Bronxville (V)	\$2,422,176,980	\$1,486,429	0.1%	\$9,146,950	0.4%
Buchanan (V)	\$1.174.838.972	\$277.163	< 0.1%	\$1,176,853	0.1%
Cortlandt (T)	\$7,539,300,494	\$2,243,687	< 0.1%	\$11,309,164	0.2%
Croton-on-Hudson (V)	\$5.339.173.282	\$1.029.670	< 0.1%	\$7.029.513	0.1%
Dobbs Ferry (V)	\$3.524.751.416	\$776.312	< 0.1%	\$5.044.658	0.1%
Eastchester (T)	\$4.342.629.796	\$2,370.016	0.1%	\$14.077.552	0.3%
Elmsford (V)	\$2,719,155,604	\$511.243	< 0.1%	\$3.419.232	0.1%
Greenburgh (T)	\$42,009,346,893	\$8,808,144	< 0.1%	\$61.038.457	0.1%
Harrison (T)	\$10,415,934,158	\$5,181,247	< 0.1%	\$32,106,919	0.3%
Hastings-on-Hudson (V)	\$13.267.692.589	\$1,163,285	< 0.1%	\$10,090,002	0.1%
Irvington (V)	\$1.575.655.219	\$993.504	0.1%	\$5.351.341	0.3%
Larchmont (V)	\$3,287,198,418	\$1.665.497	0.1%	\$14,980,905	0.5%
Lewisboro (T)	\$5.313.683.830	\$3.034.484	0.1%	\$18,739,863	0.4%
Mamroneck (T)	\$2,363,450,350	\$1,779,218	0.1%	\$12,440,120	0.5%
Mamaroneck (V)	\$7.321.897.360	\$3,258,915	< 0.1%	\$25,329,969	0.3%
Mount Kisco (T)	\$5,913,464,031	\$1.653.251	< 0.1%	\$9.257.902	0.2%
Mount Pleasant (T)	\$8,309,807,831	\$3.063.839	< 0.1%	\$17,980,695	0.2%
Mount Vernon (C)	\$17.021.941.779	\$3.614.443	< 0.1%	\$30,514,719	0.2%
New Castle (T)	\$4.957.954.777	\$3.001.158	0.1%	\$15,347.593	0.3%
New Rochelle (C)	\$42,795,863,468	\$17,709,306	< 0.1%	\$157.010.220	0.4%
North Castle (T)	\$5.067.704.057	\$2,216,193	< 0.1%	\$14,526,818	0.3%
North Salem (T)	\$2,372,126,897	\$1,102,457	< 0.1%	\$6,729,834	0.3%
Ossining (T)	\$1,382,487,862	\$1,134,921	0.1%	\$4,835,050	0.3%
Ossining (V)	\$6,071,219,565	\$1,706,753	< 0.1%	\$8,536,886	0.1%
Peekskill (C)	\$6,315,622,346	\$948,864	< 0.1%	\$5,038,921	0.1%
Pelham (T)*	\$3,648,777,424	\$1,618,231	< 0.1%	\$10,846,939	0.3%
Pelham (V)	\$2,384,243,499	\$964,908	< 0.1%	\$6,589,466	0.3%
Pelham Manor (V)	\$1,264,533,925	\$653,324	0.1%	\$4,257,473	0.3%
Pleasantville (V)	\$2,842,599,318	\$647,183	< 0.1%	\$3,846,894	0.1%
Port Chester (V)	\$7,869,067,479	\$3,647,118	< 0.1%	\$26,161,437	0.3%
Pound Ridge (T)	\$1,596,752,944	\$1,444,211	0.1%	\$7,269,930	0.5%
Rye (C)	\$5,820,922,260	\$6,220,833	0.1%	\$39,005,457	0.7%
Rye Brook (V)	\$4,892,231,021	\$3,407,522	0.1%	\$22,491,220	0.5%
Scarsdale (T)	\$4,603,749,394	\$4,544,128	0.1%	\$24,780,647	0.5%
Sleepy Hollow (V)	\$1,990,885,470	\$671,473	< 0.1%	\$3,749,230	0.2%
Somers (T)	\$6,092,204,344	\$3,078,547	0.1%	\$16,163,042	0.3%
Tarrytown (V)	\$7,284,273,569	\$1,613,970	< 0.1%	\$9,183,194	0.1%
Tuckahoe (V)	\$1,530,366,709	\$721,705	< 0.1%	\$4,964,673	0.3%
White Plains (C)	\$61,499,698,595	\$18,446,993	< 0.1%	\$175,968,006	0.3%
Yonkers (C)	\$50,644,348,876	\$10,276,178	< 0.1%	\$76,739,564	0.2%
Yorktown (T)	\$19,503,786,796	\$5,592,430	< 0.1%	\$33,291,301	0.2%
Westchester County (Total)	\$402,945,561,577	\$137,550,777	<0.1%	\$982,299,206	0.2%

Source: Hazus v5.0; Westchester County GIS 2020; NYS GIS 2021; RS Means 2021 Notes: C = City; T = Town; V = Village; % = Percent; < = Less Than





\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

			Total		Total
			Fetimated		Fetimated
			Duilding		Duilding
		Total Estimated	Loccos to		Loccos to
		Duilding Loccoc	LUSSES IU	Total Estimated	LUSSES IU
		to Decidential	Structuros	Puilding Lossos to	Structures
		Structures Only	Only Coursed	Dulluing Losses to	Only Coursed
		Coursed by the	butho 100	Only Caused by the	butho 500
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Iuricdiction	Value	Hurricano	Hurricano	Hurricano	Hurricano
	¢1 104 170 472			fiul licalle	fullicalle
Ardsley (V)	\$1,184,178,475	\$333,003	\$38,130	\$2,043,850	\$357,254
Bedford (1)	\$6,187,290,490	\$2,441,276	\$319,084	\$12,912,646	\$2,557,877
Briarcliff Manor (V)	\$2,929,350,441	\$1,424,847	\$215,497	\$6,191,747	\$1,746,046
Bronxville (V)	\$2,422,176,980	\$1,238,221	\$230,008	\$6,281,532	\$2,642,679
Buchanan (V)	\$1,174,838,972	\$198,604	\$73,859	\$811,389	\$344,737
Cortlandt (T)	\$7,539,300,494	\$2,079,121	\$125,155	\$10,417,442	\$696,537
Croton-on-Hudson (V)	\$5,339,173,282	\$454,382	\$564,329	\$2,402,521	\$4,546,642
Dobbs Ferry (V)	\$3,524,751,416	\$622,292	\$123,831	\$3,532,508	\$1,219,353
Eastchester (T)	\$4,342,629,796	\$2,104,875	\$235,260	\$11,079,479	\$2,574,217
Elmsford (V)	\$2,719,155,604	\$305,803	\$187,004	\$1,630,985	\$1,590,434
Greenburgh (T)	\$42,009,346,893	\$4,939,743	\$3,207,923	\$25,279,631	\$28,524,877
Harrison (T)	\$10,415,934,158	\$4,192,416	\$862,083	\$23,009,308	\$7,636,292
Hastings-on-Hudson (V)	\$13,267,692,589	\$491,285	\$125,894	\$3,070,768	\$1,015,796
Irvington (V)	\$1,575,655,219	\$911,804	\$62,073	\$4,564,637	\$592,362
Larchmont (V)	\$3,287,198,418	\$917,856	\$724,069	\$6,005,518	\$8,605,314
Lewisboro (T)	\$5,313,683,830	\$2,947,716	\$38,853	\$18,030,910	\$310,206
Mamroneck (T)	\$2,363,450,350	\$1,500,290	\$259,197	\$9,182,927	\$3,007,230
Mamaroneck (V)	\$7,321,897,360	\$2,400,924	\$755,504	\$14,347,167	\$9,636,674
Mount Kisco (T)	\$5,913,464,031	\$1,169,535	\$463,033	\$5,267,666	\$3,762,118
Mount Pleasant (T)	\$8,309,807,831	\$2,504,101	\$492,192	\$13,331,241	\$4,006,336
Mount Vernon (C)	\$17,021,941,779	\$2,544,337	\$882,543	\$19,495,362	\$8,466,484
New Castle (T)	\$4.957.954.777	\$2,774,733	\$180,127	\$13,328,176	\$1,565,022
New Rochelle (C)	\$42,795,863,468	\$7,191,533	\$10,312,736	\$41,583,238	\$112,837,694
North Castle (T)	\$5.067,704.057	\$1.843.989	\$313.258	\$10,979,210	\$2,920,454
North Salem (T)	\$2,372,126,897	\$996,797	\$82,454	\$5,781,964	\$756.137
Ossining (T)	\$1,382,487,862	\$1.069.215	\$50,530	\$4,335,290	\$375.324
Ossining (V)	\$6,071,219,565	\$1,382,723	\$275.865	\$6,551,022	\$1.638.696
Peekskill (C)	\$6 315 622 346	\$615 728	\$298,250	\$3,402,396	\$1,468,864
Pelham (T)*	\$3,648,777,424	\$1.407.567	\$184,186	\$8 362 832	\$2,099,574
Pelham (V)	\$2 384 243 499	\$799.841	\$154 769	\$4 672 053	\$1,754,666
Pelham Manor (V)	\$1 264 533 925	\$607,726	\$29.417	\$3,690,779	\$344 907
Pleasantville (V)	\$2 842 599 318	\$502,926	\$130.361	\$2,813,191	\$887.369
Port Chester (V)	\$7,869,067,479	\$2 540 405	\$1.058.246	\$16 325 706	\$9.246.510
Pound Ridge (T)	\$1,596,752,944	\$1,409,065	\$24.958	\$6,955,553	\$217 563
$P_{\text{Ve}}(C)$	\$5,820,922,260	\$5,427,447	\$24,938	\$30,608,184	\$7 321 548
Ryc (C) Pue Proof: (V)	\$3,820,922,200	\$2,402,022	\$952 729	\$12,057,126	\$0,627,712
Soorsdala (T)	\$4,692,231,021	\$2,493,033	\$108.278	\$12,057,120	\$1,142,214
Sleepy Hollow (V)	\$1,005,749,594	\$574.624	\$89.515	\$2,700,430	\$507 126
Somers (T)	\$6,002,204,244	\$2,007,205	\$124.962	\$14 789 002	\$040 722
Tometown (V)	\$0,092,204,544	\$2,907,205	\$124,802	\$14,788,093	\$940,722
Tarrytown (V)	\$1,284,273,309	\$1,114,900	\$3/3,991	\$2,200,831	\$2,004,701
Tuckanoe (V)	\$1,330,366,709	\$019,000	\$95,875	\$3,932,244	\$950,112
White Plains (C)	501,499,098,595	\$11,505,397	\$0,031,492	\$98,997,154	\$72,934,252
Y onkers (C)	\$30,644,348,876	\$6,900,937	\$2,995,801	\$47,760,131	\$25,076,287
rorktown (1)	\$19,505,786,796	\$3,219,163	\$282,293	\$50,780,901	\$1,891,078
westchester County (10tal)	\$402,945,501,577	\$98,012,903	\$35,109,052	3389,823,035	\$350,979,193

# Table 5.4.4-11. Estimated Building Damages Caused by the 100-Year and 500-Year Mean Return Period Hurricane Wind Events – Residential and Commercial Structures

Source: Hazus v5.0; Westchester County GIS 2020; NYS GIS 2021; RS Means 2021

Notes: C = City; T = Town; V = Village; % = Percent; < = Less Than

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor





# **Impact on Critical Facilities and Lifelines**

Critical facilities may experience structural damage directly from high winds or falling tree limbs/flying debris, which can also result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. The elderly population may be more vulnerable if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. Emergency personnel such as police, fire, and EMS may not be able to effectively respond and maintain the safety of its residents.

Hazus estimates the probability that critical facilities (i.e., medical facilities, fire/EMS, police, EOC, schools, and user-defined facilities such as shelters and municipal buildings) could sustain damage as a result of 100-year and 500-year MRP wind events. Additionally, Hazus estimates the loss of use for each facility in number of days. Due to the sensitive nature of the critical facility dataset, individual facility estimated loss is not provided.

Table 5.4.4-12 and Table 5.4.4-13 summarize the percent probability that each facility type may experience damage as a result of the 100-year and 500-year mean return period hurricane wind events, respectively.

# Table 5.4.4-12. Estimated Impacts to Critical Facilities and Lifelines from the 100-Year Mean ReturnPeriod Hurricane Wind Event

	100-Year Event						
		Perc	Percent-Probability of Sustaining Damage				
Facility Type	Loss of Days	Minor	Moderate	Severe	Complete		
EOC	0	0.5% - 0.8%	0.0%	0.0%	0.0%		
Medical	0	0.2% - 0.3%	0.0%	0.0%	0.0%		
Police	0	0.5% - 1.3%	0.0% - <0.1%	0.0%	0.0%		
Fire	0	0.3% - 0.6%	0.0% - <0.1%	0.0%	0.0%		
Schools	0	0.3% - 0.9%	0.0% - <0.1%	0.0%	0.0%		

Source: Hazus v5.0; Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

*Notes: EOC = Emergency Operations Center; % = Percent; < = Less Than* 

# Table 5.4.4-13. Estimated Impacts to Critical Facilities and Lifelines from the 500-Year Mean Return Period Hurricane Wind Event

	500-Year Event							
		Pei	rcent-Probability of	Sustaining Damage				
Facility Type	Loss of Days	Minor	Moderate	Severe	Complete			
EOC	0	1.5% - 5.4%	<0.1% - 0.4%	0.0%	0.0%			
Medical	0	0.6% - 3.5%	<0.1% - 0.4%	0.0%	0.0%			
Police	0	1.5% - 11.6%	<0.1% - 2.4%	0.0% - 0.1%	0.0%			
Fire	0	0.6% - 6.3%	<0.1% - 2.0%	0.0% - <0.1%	0.0%			
Schools	0 - 1	1.1% - 10.1%	<0.1% - 9.2%	0.0% - 0.1%	0.0%			

Source: Hazus v5.0; Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021

*Notes: EOC* = *Emergency Operations Center;* % = *Percent;* < = *Less Than* 

At this time, Hazus does not estimate losses to transportation lifelines and utilities as part of the hurricane model. Transportation lifelines are not considered particularly vulnerable to the wind hazard; they are more vulnerable to cascading effects such as flooding, falling debris etc. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs.





# **Impact on Economy**

Damage to structures from flooding and wind occur immediately; however, this damage can have long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. As evidenced by Hurricane Sandy, the State of New York, including Westchester County, lost millions of dollars in wages and economic activity.

Hazus estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" subsection discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event. Refer to Table 5.4.4-14 for a summary of Hazus estimated economic losses for Westchester County caused by the 100-year and the 500-year mean return period hurricane wind events.

# Table 5.4.4-14. Estimated Economic Losses for the 100-Year and 500-Year Mean Return PeriodHurricane Wind Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Building Loss	Wage Loss	Rental Loss	Income Loss
100-Year MRP	\$0	\$1,692,360	\$137,550,780	\$986,950	\$1,959,380	\$2,315,880
500-Year MRP	\$245,220	\$56,612,840	\$982,299,210	\$26,834,410	\$55,966,560	\$48,911,820

Source: Hazus v5.0

Debris management can be costly. Hazus estimates the amount of debris that might be produced as result of the 100-year and 500-year mean return period hurricane wind events. Because the estimated debris production does not include debris generated by flooding, this is likely a conservative estimate and could be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Refer to the User Manual for additional details regarding these estimates. Table 5.4.4-15 and Table 5.4.4-16 summarize the estimated debris by municipality for the 100-year and 500-year mean return period hurricane wind events, respectively, which should be considered a lower-bound analysis.

### Table 5.4.4-15. Debris Production for the 100-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Ardsley (V)	31	0	2	9
Bedford (T)	223	0	5	8
Briarcliff Manor (V)	87	0	395	1,621
Bronxville (V)	66	0	194	1,800
Buchanan (V)	16	0	92	356
Cortlandt (T)	113	0	277	1,323
Croton-on-Hudson (V)	128	0	0	0
Dobbs Ferry (V)	72	0	86	649
Eastchester (T)	109	0	364	2,552
Elmsford (V)	55	0	120	945
Greenburgh (T)	816	0	829	5,523
Harrison (T)	378	0	932	4,200
Hastings-on-Hudson (V)	179	0	61	484
Irvington (V)	44	0	271	1,753
Larchmont (V)	173	0	35	338
Lewisboro (T)	291	0	717	1,341





	Brick and	Concrete and Steel		Eligible Tree Volume
Jurisdiction	Wood (Tons)	(Tons)	Tree (Tons)	(Cubic Yards)
Mamroneck (T)	142	0	31	292
Mamaroneck (V)	311	0	485	4,082
Mount Kisco (T)	146	0	313	1,925
Mount Pleasant (T)	212	0	219	1,465
Mount Vernon (C)	521	0	418	3,933
New Castle (T)	143	0	758	2,365
New Rochelle (C)	2,137	0	1,028	8,826
North Castle (T)	172	0	3	11
North Salem (T)	88	0	0	0
Ossining (T)	38	0	285	1,781
Ossining (V)	148	0	290	2,462
Peekskill (C)	109	0	9	86
Pelham (T)*	110	0	82	774
Pelham (V)	66	0	82	774
Pelham Manor (V)	44	0	0	0
Pleasantville (V)	52	0	1	2
Port Chester (V)	487	0	452	4,048
Pound Ridge (T)	97	0	747	790
Rye (C)	336	0	1,239	8,222
Rye Brook (V)	234	0	569	4,040
Scarsdale (T)	142	0	460	3,625
Sleepy Hollow (V)	54	0	278	1,144
Somers (T)	195	0	0	0
Tarrytown (V)	154	0	331	2,233
Tuckahoe (V)	61	0	153	1,396
White Plains (C)	2,524	0	635	4,464
Yonkers (C)	1,168	0	1,081	8,826
Yorktown (T)	488	0	589	3,000
Westchester County (Total)	13,048	0	14,834	92,694

Source: Hazus v5.0

Notes: C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### Table 5.4.4-16. Debris Production for the 500-Year Mean Return Period Hurricane Wind Event

Iurisdiction	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Vards)
			427	2.474
Ardsley (V)	247	0	427	3,4/4
Bedford (T)	1,813	0	15,678	29,172
Briarcliff Manor (V)	660	0	2,890	11,923
Bronxville (V)	665	0	808	7,488
Buchanan (V)	105	0	459	1,780
Cortlandt (T)	978	0	11,089	34,674
Croton-on-Hudson (V)	982	0	1,216	5,851
Dobbs Ferry (V)	534	0	903	6,732
Eastchester (T)	1,199	0	2,022	14,597
Elmsford (V)	412	0	563	4,348
Greenburgh (T)	7,189	0	7,728	44,735
Harrison (T)	3,526	0	8,726	33,149
Hastings-on-Hudson (V)	1,123	0	773	6,248
Irvington (V)	388	0	1,442	9,352
Larchmont (V)	1,937	0	595	5,749
Lewisboro (T)	2,166	0	12,591	24,139
Mamroneck (T)	1,456	0	1,528	10,333
Mamaroneck (V)	3,181	0	2,727	23,014
Mount Kisco (T)	1,036	0	1,854	10,972





				Eligible Tree Volume (Cubic
Jurisdiction	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Yards)
Mount Pleasant (T)	1,891	0	7,858	29,961
Mount Vernon (C)	4,690	0	2,592	24,256
New Castle (T)	1,181	0	10,768	34,552
New Rochelle (C)	21,048	0	6,505	55,968
North Castle (T)	1,633	0	10,464	21,505
North Salem (T)	768	0	8,771	10,340
Ossining (T)	269	0	1,352	8,378
Ossining (V)	888	0	1,299	11,164
Peekskill (C)	629	0	881	6,292
Pelham (T)*	1,128	0	1,031	9,046
Pelham (V)	682	0	514	4,918
Pelham Manor (V)	446	0	516	4,128
Pleasantville (V)	454	0	647	4,991
Port Chester (V)	4,058	0	1,852	16,490
Pound Ridge (T)	732	0	11,200	11,852
Rye (C)	3,726	0	6,002	39,845
Rye Brook (V)	2,454	0	2,566	18,132
Scarsdale (T)	1,672	0	3,609	25,204
Sleepy Hollow (V)	380	0	1,330	5,175
Somers (T)	1,569	0	10,687	29,874
Tarrytown (V)	941	0	1,396	9,090
Tuckahoe (V)	581	0	573	5,248
White Plains (C)	24,056	0	5,371	36,040
Yonkers (C)	10,060	0	8,252	66,109
Yorktown (T)	3,684	0	12,814	42,488
Westchester County (Total)	118,090	0	191,836	809,729

Source: Hazus v5.0

Notes: C = City; T = Town; V = Village

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

### **Impact on Environment**

Coastal storms can impact various natural land resources that can be easily uprooted by major wind events and storm surge (USGS n.d.). Extreme winds from hurricanes or tropical storms may create several tons of debris because the wind tears apart foliage and trees. Plants along waterways may be uprooted from surge causing even further instability and alterations of the shoreline. Consequentially, natural habitat that shelters the County from wind and storm surge can be destroyed, impacting future mitigation.

### **Cascading Impacts on Other Hazards**

The impacts of hurricane related windstorms on the environment typically take place over a larger area. Where these events occur, widespread, severe damage to plant species is likely. This includes uprooting or destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Section 5.4.3 (Flood) provides additional environmental impacts due to flooding from heavy rainfalls.

# Future Changes that may Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population





• Other identified conditions as relevant and appropriate, including the impacts of climate change

# **Projected Development**

Understanding future changes that impact vulnerability in the Westchester County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. It is anticipated that any new development and new residents will be exposed to the hurricane and tropical storm hazard. However, due to increased standards and codes, new development might be less vulnerable to wind-related hazards compared to the aging building stock. The tables and hazard maps included in the jurisdictional annexes contain additional information regarding the specific areas of development that would increase County vulnerability to a wind event.

# Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Increased population trends along the coastline will change the County's overall risk to severe hurricane wind events. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

## Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. An increase in temperatures may also lead to an increase in the frequency and intensity of severe storm events. More frequent and severe storms will increase the County's vulnerability to both wind-related and storm surge impacts.

The northeast region of the United States has experienced a greater increase in extreme precipitation than any other region in the U.S. between 1958 and 2010, the Northeast experienced more than 70 percent increase in the amount of precipitation falling in rain events (Global Change 2014). Refer to Section 5.4.3 (Flood) for a discussion related to the impact of climate change due to increases in rainfall. With an increased likelihood of more frequent storm events and associated strong winds and tornado events, the County's assets continue to be at risk.

# **Change of Vulnerability Since the 2015 HMP**

Since the 2015 HMP was drafted, updated inventory data has become available to assess the severe storm hazard in Westchester County. This data includes the 5-Year 2015-2019 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Additionally, Hazus version 5.0 was recently published by FEMA and was used to assess the County's overall risk to the 100-year and 500-year mean return period hurricane wind events. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the severe storm hazard.





# **5.4.5 Severe Winter Storm**

The following section provides the hazard profile and vulnerability assessment for the severe winter storm hazard in Westchester County.

# 5.4.5.1 **Profile**

This section presents information regarding the description, extent, location, previous occurrences and losses, climate change projections and probability of future occurrences for the severe winter storm hazard.

# **Hazard Description**

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Severe Storms Laboratory (n.d.), the three basic components needed to make a winter storm include the following:

- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (oliographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean.

Some winter storms can immobilize an entire region, while others might only affect a single community. Winter storms typically are accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. Westchester County's winter storms include blizzards, snowstorms, Nor'Easters, and ice storms. Extreme cold temperatures and wind chills are associated with winter storms.

# Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into snow crystals or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Figure 5.4.5-1 depicts snow creation.

# Figure 5.4.5-1. Snow Creation



Source: NOAA-NSSL, 2015



Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals. Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inches in diameter (NSSL 2021)

## Figure 5.4.5-2. Sleet Creation



Source: NOAA-NSSL 2020

### Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile, as the predominant conditions over a 3-hour period. Extremely cold temperatures often are associated with blizzard conditions but are not a formal part of the definition. The hazard, created by the combination of snow, wind, and low visibility, significantly increases when temperatures are below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm, moister air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (Lam 2019).

### Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25-inches or greater (NWS 2013). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (Dolce 2012).





# Figure 5.4.5-3. Freezing Rain Creation



Source: NOAA-NSSL 2020

# Location

## Snow and Blizzards

Snowfall in New York State is highly variable. The inland regions of the State see an average seasonal amount of 40 inches or more, whereas the coastal regions typically see 25 to 35 inches. More than half of New York State's land area sees more than 70 inches of snow each season (NDC 2016). According to data from Cornell University, snowfall in Westchester averages between 25 and 50 inches a year. In terms of snowfall totals across the state, this is on the lower end of the spectrum. Much of the lower Hudson Valley experiences similar snowfall totals, whereas New York City and Long Island see approximately 10-25 inches/year. Much of the northern and western parts of the State (particularly those in higher elevations and near the lakes) can see at least 75 to 100 inches per year (NYS DHSES 2019).

# Figure 5.4.5-4. New York Annual Average Snowfall, 1960-2012



Source: Cornell University, NYSkiBlog.com Note: The red circle indicates the location of Westchester County.





### Ice Storms

The Midwest and Northeast United States are prime areas for freezing rain and ice storm events. These events can occur anytime between November and April, with most events occurring during December and January. Based on data from 1948 to 2000, the average annual number of days with freezing rain for Westchester County is five to six days, and the average annual number of hours is nine to fifteen hours (MRCC 2020).

#### Extent

The magnitude or severity of a severe winter storm depends on several factors, including snowfall rates, regional climatological susceptibility to snowstorms, snowfall amounts, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified both by meteorological measurements and by evaluating societal impacts. The National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA 2021) Table 5.4.5-1 presents the five RSI ranking categories.

#### Table 5.4.5-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: NOAA 2020

Note: RSI = Regional Snowfall Index

The NWS operates a widespread network of observing systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts. According to NWS (NWS 2021), the magnitude of a severe winter storm can be qualified into five main categories by event type:

## Table 5.4.5-2. Winter Storm Category Thresholds

Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6 hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10 °F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.



Additionally, the NWS uses winter weather watches, warnings, and advisories to help people anticipate what to expect in the days and hours prior to an approaching storm (NWS 2021). Refer to Figure 5.4.5.1-5 for the warning thresholds.

# Figure 5.4.5.1-5. Winter Storm Warning Thresholds

Vestchester



# **Previous Occurrences and Losses**

Based on a review of historic weather events and losses, Westchester County was found to have frequent winter storm occurrences. According to the NOAA-NCEI storm events database, Westchester County has been impacted by 174 winter weather events between 1954 and August 2021, including 7 blizzard events, 85 heavy snow events, 4 ice storms, 49 winter storms, and 29 winter weather events (NOAA 2021).

# FEMA Major Disaster and Emergency Declarations

Between 1954 and October 2021, FEMA included New York State in 26 winter storm-related major disaster (DR) or emergency (EM) declarations classified as one or a combination of the following disaster types: severe winter storm, snowstorm, snow, ice storm, winter storm, blizzard, and flooding. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Westchester County was included in three of these declarations.

Disaster Number	Declaration Date	Event Date	Incident Type	Title
EM-3184	March 27, 2003	February 17, 2003 February 18, 2003	Snow	Snow
DR-1083	January 12, 1996	January 6, 1996 January 12, 1996	Snow	Blizzard of '96 (Severe Snow Storm)
EM-3107	March 17, 1993	March 13, 1993 March 17, 1993	Snow	Severe Blizzard

### Table 5.4.5-3 FEMA Major Disasters and Emergency Declarations in Westchester County

Source: FEMA 2021





DRMajor Disaster Declaration (FEMA)EMEmergency Declaration (FEMA)FEMAFederal Emergency Management Agency

# USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2014 and 2021, Westchester County was included in one USDA declarations involving severe winter weather which was categorized as a frost, freeze, and excessive snow event and occurred between January 1 and May 24, 2015 with USDA designation code S3886.

#### **Previous Events**

Table 5.4.5-4 identifies the known severe winter storm events that impacted Westchester County between 2014 and 2021. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
January 2, 2014	Heavy Snow	NA	NA	The public and trained spotters reported widespread snowfall of 6 to 8 inches.
January 21, 2014	Heavy Snow	NA	NA	The public and trained spotters reported widespread snowfall totals of 10 to 13 inches.
February 3, 2014	Heavy Snow	NA	NA	The public and a trained spotter reported widespread 6 to 9 inches snowfall.
February 5, 2014	Heavy Snow	NA	NA	Trained spotters, the public, and an NWS cooperative observer reported widespread 7 to 12 inches snowfall.
February 13, 2014	Winter Storm	NA	NA	Trained spotters and the public reported widespread snowfall of 15 to 16 inches, plus freezing rain accretion of 2 tenths of an inch in Peekskill.
November 26, 2014	Heavy Snow	NA	NA	Snowfall ranged from 3 to 5 inches along and north/west of the heavily traveled Interstate 287 and 684 corridors per a combination of cooperative observer, trained spotter, and public reports.
January 18, 2015	Winter Weather	NA	NA	Freezing rain accumulated 0.1 inch in Somers. The freezing rain led to widespread motor vehicle accidents and injuries, including 5 injuries in a vehicle rollover on the northbound Taconic State Parkway at the Route 202 exit.
January 24, 2015	Heavy Snow	NA	NA	A cooperative observer in Shrub Oak, trained spotters, and the public reported snowfall of 6 to 7 inches.
January 26, 2015	Winter Storm	NA	NA	Trained spotters and the public reported snowfall of 10 to 11 inches. North winds gusted to 43 mph at the Westchester County Airport, with blowing and drifting of snow.
February 1, 2015	Heavy Snow	NA	NA	Snowfall ranged from 6 to 11 inches across the county. The highest amount of 10.7 inches was reported in Armonk, NY.
February 21, 2015	Winter Weather	NA	NA	The public reported snowfall of 6 inches in Cross River, and 5.5 inches in Armonk.
March 1, 2015	Heavy Snow	NA	NA	A trained spotter in Somers and public reports from elsewhere indicated around 6 inches of snowfall.
March 5, 2015	Heavy Snow	NA	NA	Trained spotters and the public measured 6 to 8 inches of snow.
January 17, 2016	Winter Weather	NA	NA	Icy conditions led to a massive 14-car pileup in Yonkers at about 8:45 PM Sunday January 17th, injuring 10 people and closing down a mile-long, southbound stretch of the Bronx River Parkway where the highway merges with the Sprain Brook Parkway for more than 12 hours.
January 23, 2016	Winter Storm	NA	NA	The public and trained spotters reported snowfall of 13 to 25 inches. Also, north winds at Larchmont Harbor were sustained at 38 mph with gusts up to 49 mph between 9 AM and 10 AM on Saturday January 23rd. Southern Westchester likely experienced blizzard conditions during the late morning and early afternoon on Saturday January 23rd, as nearby LaGuardia and Bridgeport ASOS observations showed visibility less than one quarter mile in heavy snow and frequent wind gusts over 35 mph during that time

# Table 5.4.5-4. Severe Winter Weather Events in Westchester County, 2014 to August 2021





Table 5.4.5-4. Severe	Winter Weather	<b>Events</b> in V	Westchester	County, 2014 to	August 2021
					0

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
December 17, 2016	Winter Weather	NA	NA	Trained spotters, the public, and social media reported snowfall of 3.5 to 5 inches.
January 7, 2017	Winter Weather	NA	NA	Trained spotters, the public, and social media reported 4 to 6 inches of snowfall.
February 9, 2017	Winter Storm	NA	NA	Trained spotters, amateur radio, and the public reported 9 to 12 inches of snowfall. Winds gusted to 43 mph at White Plains Airport at 12:46 pm.
March 14, 2017	Winter Storm	NA	NA	Trained spotters, a cooperative observer, and the public reported 11 to 15 inches of snowfall. Some sleet also mixed in with the heavy snow. A 49 mph wind gust was also reported at a WeatherFlow mesonet station in Mamaroneck at 2:17 pm.
January 4, 2018	Blizzard	NA	NA	Westchester County Airport (White Plains, NY) ASOS observations showed blizzard conditions, with visibility less than one quarter mile in heavy snow and frequent wind gusts over 35 mph during the morning and early afternoon on January 4th.
February 17, 2018	Heavy Snow	NA	NA	CoCoRaHS observers, trained spotters, and the public reported 6 to 8 inches of snowfall.
March 7, 2018	Winter Storm	NA	NA	Fire department/rescue reported 13.5 inches of snow in Armonk. 9 to 14 inches was reported across northern Westchester from CoCoRaHS observers, a COOP observer, and the public. The heavy wet snow combined with strong winds to bring down tree limbs and a few power lines.
March 21, 2018	Winter Weather	NA	NA	Trained spotters, social media, and the public reported 2 to 8 inches of snow. These totals were reached in more than 12 hours and did not meet NWS criteria for warning level snow.
April 2, 2018	Heavy Snow	NA	NA	Trained spotters and the public reported 6 to 8 inches of snowfall.
November 15, 2018	Winter Storm	NA	NA	Social Media, trained spotters, CoCoRaHS, and the public reported 6 to 9 inches of snow.
January 19, 2019	Winter Storm	NA	NA	The nearby Danbury, CT ASOS reported 0.37 inches of ice accretion. The broadcast media reported significant impacts due to ice accretion. Power companies were working on many downed trees on power lines in Southeast and in North Salem. A large tree branch came down on Route 121 in North Salem causing the live wires to catch fire. Significant impacts were also observed in nearby northern Fairfield county Connecticut.
March 3, 2019	Heavy Snow	NA	NA	CoCoRaHS and the public reported 6 to 10 inches of snow.
December 1, 2019	Winter Weather	NA	NA	An NWS COOP Observer in Shrub Oak reported 4.5 inches of snow. CoCoRaHS observers, social media, trained spotters, and the public reported 2 to 6 inches of snow.
December 16, 2020	Winter Storm	NA	NA	A CoCoRaHS observer 2 miles east of Yorktown Heights measured 11 inches of snow and a CoCORaHS observer 2 miles south of Peach Lake measured 10.9 inches of snow. Amateur radio and trained spotters measured 10 to 12 inches of snow. Winds gusted to 40 mph at the Westchester County Airport at 6:56 am on December 17, 2020.
February 1, 2021	Winter Storm	NA	Yes	Trained spotters and amateur radio reported 14 to 20 inches of snow. A 46 mph wind gust was recorded by the White Plains Airport ASOS at 4:56 pm February 1, 2021.





## Table 5.4.5-4. Severe Winter Weather Events in Westchester County, 2014 to August 2021

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
February 7, 2021	Heavy Snow	NA	Yes	Amateur radio in New Rochelle and White Plains reported 6.5 inches of snow and 6.0 inches of snow respectively. A trained spotter 2 miles south of Yonkers reported 6.1 inches of snow.

*Sources: FEMA 2021; NOAA-NCEI 2021; SPC 2021* 

\* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table DR Major Disaster Declaration (FEMA)

FEMA Federal Emergency Management Agency

Mph Miles per Hour

NCEI National Centers for Environmental Information

NOAA National Oceanic and Atmospheric Administration

N/A Not Applicable





# **Climate Change Projections**

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of  $0.25^{\circ}$  F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Westchester County is part of Region 5 (Hudson River and Mohawk River Valleys), where temperatures are estimated to increase by 4.5 to 6.2°F by the 2050s and 5.6 to 9.7°F by the 2080s (baseline of 47.6°F, middle range projection). Precipitation totals are estimated to increase between four to twelve percent by the 2050s and five to fifteen percent by the 2080s (baseline of 38.6 inches, middle range projection). Table 5.4.5-5 displays the projected seasonal precipitation change for the region (NYSERDA 2011/2014).

## Table 5.4.5-5. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

	Winter	Spring	Summer	Fall
	+5 to +15	-5 to +10	-5 to +5	-5 to +10
Source:	NYSERDA 2014	•	•	

New York State already is experiencing the effects of climate change during the winter season. Winter snow cover is decreasing, and spring comes, on average, about a week earlier than it did a few years ago. Nighttime temperatures are measurably warmer, even during the colder months. Overall winter temperatures in New York State are almost 5 degrees warmer than in 1970 (NYSERDA 2011/2014). The state has experienced a decrease in the number of cold winter days (below 32 °F) and can expect to see a decrease in snow cover by as much as 25–50 percent by end of the next century. The lack of snow cover may jeopardize opportunities for skiing, snowmobiling, and other types of winter recreation; and natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences 2011). As the century progresses, snowfall is likely to become less frequent, with the snow season decreasing in length. It is uncertain if there will be changes in the intensity of snowfall during each storm; however, it is possible that higher temperatures in colder parts of New York State could support higher snowfall totals during snowstorm events (NYSERDA 2011/2014).

Some climatologists believe that climate change could play a role in the frequency and intensity of Nor'Easters. Two ingredients are needed to produce strong Nor'Easters and intense snowfall: (1) temperatures which are just below freezing and (2) massive moisture coming from the Gulf of Mexico. When temperatures are far below freezing, snow is less likely. As temperatures increase in the winter months, they will be closer to freezing rather than frigidly cold. Climate change is expected to produce more moisture, thus increasing the likelihood that these two ingredients (temperatures just below freezing and intense moisture) will cause more intense snow events.

# **Probability of Future Occurrences**

Table 5.4.5-6 summarizes data regarding the probability of occurrences of severe winter storm events in Westchester County based on the historic record. Heavy snow events and winter storms are the first and second



most common in Westchester County, respectively. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 5.4.5-6. Probability of Future Occurrence of Severe Winter Weather Events in Westcheste	r
County	

Hazard Type	Number of Occurrences Between 1954 and 2021	% Chance of Occurring in Any Given Year
Blizzard	7	10.3%
Heavy Snow	85	100%
Ice Storm	4	5.9%
Winter Storm	49	72%
Winter Weather	29	42.7%
TOTAL	174	100%

Source: NOAA-NCEI 2021

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act (Public Law 81-875), and selected winter storm events since 1996. Due to limitations in data, not all winter storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated

Based on historical data from NYSERDA (2014), it is expected that the following will occur at least once per 100 years:

- Up to four inches of freezing rain in the ice band near central New York State of which between 1–2 inches of accumulated ice will occur over a 24-hour period.
- Up to two feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period.

Based on geography, location, past event history, and climate projections, Westchester County will continue to experience winter storm events. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings; refer to Section 5.3 (Hazard Ranking) for additional information on the hazard ranking methodology and probability criteria. The probability of occurrence for severe winter storms in the County is considered frequent (event has a 100 percent annual probability and might occur multiple times in the same year).

# 5.4.5.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the severe winter storm hazard, all of Westchester County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are vulnerable to a winter storm event.

# Impact on Life, Health and Safety

The entire population of Westchester County (968,065) is exposed to severe winter storm events (US Census n.d.). According to the NOAA National Severe Storms Laboratory (NSSL); every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NSSL 2021).





The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2019 American Community Survey 5-Year population estimate, there are 162,363 persons over 65 years old that reside in the County that are considered vulnerable to severe winter weather. In addition, severe winter storm events can reduce the ability of these populations to access emergency services.

Additionally, the homeless and residents below the poverty level may not have access to housing or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Residents with low incomes might not have access to housing or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). In Westchester County, the City of Yonkers has the highest concentration of population below the poverty level (14.7% total population). Refer to Section 4 (County Profile) that displays the distribution of low-income populations in Westchester County.

# **Impact on General Building Stock**

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percent damages that could result from severe winter storm conditions. This allows planners and emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Table 5.4.5-7 below summarizes the estimated loss based on 1-, 5-, and 10-percent losses. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Jurisdiction	Total Replacement Cost Value (RCV)	1-Percent Exposure/Loss	5-Percent Exposure/Loss	10-Percent Exposure/Loss
Ardsley (V)	\$1,184,178,473	\$11,841,785	\$59,208,924	\$118,417,847
Bedford (T)	\$6,187,290,490	\$61,872,905	\$309,364,525	\$618,729,049
Briarcliff Manor (V)	\$2,929,350,441	\$29,293,504	\$146,467,522	\$292,935,044
Bronxville (V)	\$2,422,176,980	\$24,221,770	\$121,108,849	\$242,217,698
Buchanan (V)	\$1,174,838,972	\$11,748,390	\$58,741,949	\$117,483,897
Cortlandt (T)	\$7,539,300,494	\$75,393,005	\$376,965,025	\$753,930,049
Croton-on-Hudson (V)	\$5,339,173,282	\$53,391,733	\$266,958,664	\$533,917,328
Dobbs Ferry (V)	\$3,524,751,416	\$35,247,514	\$176,237,571	\$352,475,142
Eastchester (T)	\$4,342,629,796	\$43,426,298	\$217,131,490	\$434,262,980
Elmsford (V)	\$2,719,155,604	\$27,191,556	\$135,957,780	\$271,915,560
Greenburgh (T)	\$42,009,346,893	\$420,093,469	\$2,100,467,345	\$4,200,934,689
Harrison (T)	\$10,415,934,158	\$104,159,342	\$520,796,708	\$1,041,593,416
Hastings-on-Hudson (V)	\$13,267,692,589	\$132,676,926	\$663,384,629	\$1,326,769,259

# Table 5.4.5-7. General Building Stock Exposure and Estimated Losses from Severe Winter StormEvents





Jurisdiction	Total Replacement Cost Value (RCV)	1-Percent Exposure/Loss	5-Percent Exposure/Loss	10-Percent Exposure/Loss
Irvington (V)	\$1,575,655,219	\$15,756,552	\$78,782,761	\$157,565,522
Larchmont (V)	\$3,287,198,418	\$32,871,984	\$164,359,921	\$328,719,842
Lewisboro (T)	\$5,313,683,830	\$53,136,838	\$265,684,192	\$531,368,383
Mamroneck (T)	\$2,363,450,350	\$23,634,504	\$118,172,518	\$236,345,035
Mamaroneck (V)	\$7,321,897,360	\$73,218,974	\$366,094,868	\$732,189,736
Mount Kisco (T)	\$5,913,464,031	\$59,134,640	\$295,673,202	\$591,346,403
Mount Pleasant (T)	\$8,309,807,831	\$83,098,078	\$415,490,392	\$830,980,783
Mount Vernon (C)	\$17,021,941,779	\$170,219,418	\$851,097,089	\$1,702,194,178
New Castle (T)	\$4,957,954,777	\$49,579,548	\$247,897,739	\$495,795,478
New Rochelle (C)	\$42,795,863,468	\$427,958,635	\$2,139,793,173	\$4,279,586,347
North Castle (T)	\$5,067,704,057	\$50,677,041	\$253,385,203	\$506,770,406
North Salem (T)	\$2,372,126,897	\$23,721,269	\$118,606,345	\$237,212,690
Ossining (T)	\$1,382,487,862	\$13,824,879	\$69,124,393	\$138,248,786
Ossining (V)	\$6,071,219,565	\$60,712,196	\$303,560,978	\$607,121,957
Peekskill (C)	\$6,315,622,346	\$63,156,223	\$315,781,117	\$631,562,235
Pelham (T)*	\$3,648,777,424	\$36,487,774	\$182,438,871	\$364,877,742
Pelham (V)	\$2,384,243,499	\$23,842,435	\$119,212,175	\$238,424,350
Pelham Manor (V)	\$1,264,533,925	\$12,645,339	\$63,226,696	\$126,453,393
Pleasantville (V)	\$2,842,599,318	\$28,425,993	\$142,129,966	\$284,259,932
Port Chester (V)	\$7,869,067,479	\$78,690,675	\$393,453,374	\$786,906,748
Pound Ridge (T)	\$1,596,752,944	\$15,967,529	\$79,837,647	\$159,675,294
Rye (C)	\$5,820,922,260	\$58,209,223	\$291,046,113	\$582,092,226
Rye Brook (V)	\$4,892,231,021	\$48,922,310	\$244,611,551	\$489,223,102
Scarsdale (T)	\$4,603,749,394	\$46,037,494	\$230,187,470	\$460,374,939
Sleepy Hollow (V)	\$1,990,885,470	\$19,908,855	\$99,544,274	\$199,088,547
Somers (T)	\$6,092,204,344	\$60,922,043	\$304,610,217	\$609,220,434
Tarrytown (V)	\$7,284,273,569	\$72,842,736	\$364,213,678	\$728,427,357
Tuckahoe (V)	\$1,530,366,709	\$15,303,667	\$76,518,335	\$153,036,671
White Plains (C)	\$61,499,698,595	\$614,996,986	\$3,074,984,930	\$6,149,969,860
Yonkers (C)	\$50,644,348,876	\$506,443,489	\$2,532,217,444	\$5,064,434,888
Yorktown (T)	\$19,503,786,796	\$195,037,868	\$975,189,340	\$1,950,378,680
Westchester County (Total)	\$402,945,561,577	\$4,029,455,616	\$20,147,278,079	\$40,294,556,158

Source: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021 \*aggregate Pelham V and Pelham Manor V = Pelham T

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. At-risk residential infrastructures are presented in the flood hazard profile (Section 5.4.3 Flood). Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with the 1-percent annual chance flood.




#### **Impact on Critical Facilities**

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2020). Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming

conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required (NSSL 2021).

Further, heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2020).

#### **Impact on Economy**

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. In addition to snow removal costs, severe winter weather affects the ability of persons to commute into and out of the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County and may cause a loss in economic productivity.

#### **Impact on the Environment**

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Rain-on-snow events can also exacerbate runoff rates with warming winter

Chemically based winter maintenance practices have its own effect on the natural environment. Melting snow and ice that carry de-icing chemicals onto vegetation and into soils can contaminate the local waterways. Elevated salt levels may hinder vegetation from absorbing nutrients, slowing plant growth.

weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

#### Cascading Impacts on Other Hazards

Severe winter weather events may exacerbate flooding. As discussed, the freezing and thawing of snow and ice associated with winter weather events can create major flooding issues in the County. Maintaining winter weather hazards through snow and ice removal could minimize the potential risk of flooding during a warming period. Refer to 5.4.3 (Flood) for more information about the flood hazard of concern.





# Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

# **Projected Development**

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located could be potentially impacted by severe winter weather events. Current New York State land use and building codes incorporate standards that address and mitigate snow accumulation. Some local municipalities in the State have implemented the following activities to eliminate loss of life and property and infrastructure damages during winter storm events:

- Removal of snow from roadways
- Removal of dead trees and trim trees/brush from roadways to lessen falling limbs and trees
- Ensure proper road signs are visible and installed properly
- Bury electrical and telephone utility lines to minimize downed lines
- Removal of debris/obstructions in waterways and develop routine inspections/maintenance plans to reduce potential flooding
- Replace substandard roofs of critical facilities to reduce exposure to airborne germs resulting from leakage
- Purchase and install backup generators in evacuation facilities and critical facilities to essential services to residents
- Install cell towers in areas where limited telecommunication is available to increase emergency response and cell phone coverage (NYS DHSES 2019).

# Projected Changes in Population

According to the U.S. Census Bureau, the population in Westchester County has increased by approximately 2percent between 2010 and 2019 (US Census n.d.). Additionally, estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the County's population will continue to increase in 2030, increasing the total population to approximately 1,037,234 and then increasing again into 2040 to a population of 1,064,958 (Cornell University 2017). Any growth can create changes in density throughout the County, which may impact the ability of persons in the County to mobilize or receive essential services during severe winter storm events. Historically, winter weather events with associated snowfall and ice accumulation have severely impacted transportation corridors as well as infrastructure. Refer to Section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

# **Climate Change**

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access.





#### **Change of Vulnerability Since 2015 HMP**

Since the 2015 analysis, population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates. Additionally, this updated analysis estimated exposure and losses at the structure level with updated building stock data. The general building stock was updated using building stock data provided by the County to update the user-defined facility inventory and critical facility inventory dataset. The replacement cost value of these structures was updated using RS Means 2019 building valuations.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Westchester County.





# 5.4.6 Wildfire

This section provides a profile and vulnerability assessment of the wildfire hazard for Westchester County.

# 5.4.6.1 Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, and the probability of future occurrences for the wildfire hazard.

# **Hazard Description**

Wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfires are commonly termed forest fires, brush fires, grass fires, wildlandurban interface fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS DHSES 2019). Although destructive fires do not occur annually, the State's fire history shows a cycle of outbreaks that have caused human death, property loss, forest destruction, and air pollution (NYS DHSES 2019).

# Location

In Westchester County, areas that are heavily forested or contain large tracts of brush and shrubs, are prone to

fires (NYSDEC 2020). In NYS, NYSDEC's Division of Forest Protection (Forest Ranger Division) is designated as the State's lead agency for wildfire mitigation. It has fought fires and retained records for more than 125 years. Over the past 25 years (1993-2017), Division records indicate that rangers suppressed 5,423 wildfires that burned a total of 52,580 acres (NYSDEC 2020). Currently, more than 1,700 fire departments respond to an average of 4,500 wildfires each year. Forest Rangers respond to approximately 3% of all wildfires. However, they help contain 33% of all wildfire acres (NYSDEC 2020). The Forest Ranger Division (different than the Fire Danger Rating Area) for Westchester County is Region 3. Also included in Region 3 are Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster Counties. The Forest Ranger Division boundaries are displayed in Figure 5.4.6-1. The boundaries of the Fire Danger Rating Areas are displayed below in Figure 5.4.6-3.







Westchester County has significant areas of forest cover. The Westchester County Parks system spans nearly 18,000 acres across 50 parks and recreational areas (Parks 2021). Some of these forest covered areas are in the form of State-owned lands, including Montrose Point State Forest, and Croton Gorge Park.

The wildland-urban interface (WUI) is the area where houses and wildland vegetation meet or intermingle, and where wildfire problems are most pronounced (Radeloff et al 2018). A detailed WUI, divided into Interface and Intermix areas, defines the wildfire hazard area for Westchester County. Intermix WUI are areas where housing and vegetation intermingle; interface WUI are areas with housing in the vicinity of contiguous wildland vegetation. This data was obtained through the SILVIS Laboratory, Department of Forest Ecology and





Management, University of Wisconsin – Madison. Figure 5.4.6-2 illustrates the distribution of WUI areas in Westchester County.









# Extent

Wildfire events can range in size and intensity. A wildfire's intensity depends significantly on both meteorological conditions and human activity.

# Wildfire Behavior and Fire Ecology

Fire behavior is defined as the way fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. Fire behavior is one of the most important aspects of wildfires because almost all actions in response to a fire depend on how it behaves. The extent to which fire manages can understand and predict fire behavior relies on success in pre-suppression planning and actual suppression of wildfires.

Potential for wildfire and its subsequent development (growth) and severity are controlled by the three principal factors of topography, fuel, and weather, described as follows:

**Topography** – Topography can powerfully influence wildfire behavior. Movement of air over the terrain tends to direct a fire's course. A gulch or canyon can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread. Saddles on ridgetops tend to offer lower resistance to passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior. Slope is an important factor. If the percentage of uphill slope doubles, the rate the wildfire spreads will most likely double as well. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of a wildfire's rapid spread (FEMA 1997).

*Fuel* – Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading is used to describe the amount of vegetative material available. If this amount doubles, energy released can also double. Each fuel type is given a burn index—an estimate of amount of potential energy that may be released, effort required to ignite a fire in a given fuel and expected flame length. Different fuels have different burn qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread (FEMA 1997). According to the U.S. Forest Service (USFS), a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels):

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses; and any other combustible biomass between the top of surface fuels and bottom of overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consist mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies constitute the primary fuel layer in a forest crown fire (USFS 2003).

Fire behavior is strongly influenced by these fuels.

*Weather / Air Mass* – Weather is the most important factor influencing fire behavior, but it is always changing. Air mass, defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can affect wildfire through climatic factors that include temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere at the time of the fire (NWS 2009). Extreme weather leads to extreme events, and often a subsidence of severe weather marks the end of a wildfire's growth and the beginning of successful





containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that radically and suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA 1997).

Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

The Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived "greenness" maps (USFS n.d.).

The Fire Potential Index (FPI) is derived by combining information on daily weather and vegetation condition and can identify areas most susceptible to fire ignition (Burgan et al. 2000).

Fuel Moisture (FM) content is quantity of water in a fuel particle expressed as a percent of oven-dry weight of the fuel particle and is an expression of cumulative effects of past and present weather events, to help evaluate the effects of current or future weather on fire potential (Burgan et al. 2000).

The Keetch-Byram Drought Index (KBDI) is designed for fire potential assessment and is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.).

The Haines Index, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures potential for existing fires to become large fires (USFS n.d.).

The Buildup Index (BUI) is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant (North Carolina Forest Service 2007).

The Fire Danger Rating in New York is established using information from the National Fire Danger Rating System (NFDRS) and takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS, n.d.) in each of the ten regions of New York State. Figure 5.4.6-3 shows an example of a Fire Danger Rating Areas (FDRA) in NYS and the fire danger risk within each area on a specific date. Westchester County is part of the Hudson Valley FDRA. On this particular day, the Hudson Valley Fire Danger Rating was low, however some parts of the state were experiencing moderate fire danger. Table 5.4.6-1 lists fire danger ratings and color codes, also used by NYSDEC to update its fire danger rating maps, identified later in this section.

# Table 5.4.6-1. Description of Fire Danger Ratings in New York State

Adjective Rating Class and Color Code	Class Description
Red Flag	A short-term, temporary warning, indicating presence of a dangerous combination of temperature, wind, relative humidity, fuel, or drought conditions that can contribute to new fires or rapid spread of existing fires. A Red Flag Warning can be issued at any Fire Danger level.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high- intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.





Adjective Rating Class and Color Code	Class Description
Very High (orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
High (yellow)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Moderate (blue)	Fires can start from most accidental causes, but except for lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
Low (green)	Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.

Source: NYS DEC 2020

# Figure 5.4.6-3. New York State Fire Danger Rating Areas



Source: NYSDEC 2021





#### **Previous Occurrences and Losses**

Determinations of wildfire occurrences in NYS are based on two data sources: the New York State Forest Ranger force, and the New York State Office of Fire Prevention and Control (NYS OFP&C). Figure 5.4.6-4 illustrates occurrences of wildfires in NYS between 2003 and 2017. This figure reveals occurrences of between 0.9 and 18.5 wildfires per square mile from 2003 to 2017 within Westchester County municipalities with the lowest rate of occurrence in the eastern portion of the county and the highest rate of occurrence in the western portion of the county. The majority of these fires are small brush fires. The plurality of fires in the Hudson Valley region is caused by burning debris (35%) followed by arson and campfires (NYSDEC 2018).





Source: NYSDEC 2018

# FEMA Disaster Declarations

Between 1954 and 2020, Westchester County was not included in any wildfire-related major disaster (DR) or emergency (EM) declarations (FEMA 2020).

#### USDA Declarations

Between 2014 and August 2021, Westchester County was not included in any USDA Disaster Designations for wildfire (USDA 2021).





# **Previous Events**

Between 1950 and 2021, Westchester County has not experienced any major wildfire events (NOAA-NCEI 2021).

# **Climate Change Projections**

Climate change directly and indirectly affects growth and productivity of forests: directly as a result of changes in atmospheric carbon dioxide and climate, and indirectly through complex interactions within forest ecosystems. Climate also affects frequency and severity of many forest disturbances, such as infestations, invasive species, wildfires, and storm events. Extreme heat events and heat waves are also projected to increase, as listed in Table 5.4.6-2 below. As temperatures increase, suitability of a habitat for specific types of trees changes. Prolonged heat waves are likely to generate a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. Increases in rain and snow events prime forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2020).

Event Type (2020s)	Low Estimate (10 <sup>th</sup> Percentile)	Middle Range (25th to 75 <sup>th</sup> Percentile)	High Estimate (90 <sup>th</sup> Percentile)	
Days over 90 degrees Fahrenheit (°F) (10 days)	14	17-22	23	
# of Heat Waves (1 heat waves)	2	2 to 3	4	
Duration of Heat Waves (4 days)	4	5 to 5	5	
Days below 32°F (155 days)	123	127 to 136	139	

# Table 5.4.6-2. Extreme Event Projections for Region 5

Source: NYSERDA 2014

Fire potential depends on climate variability, local topography, and human intervention. Climate change can affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create highest fire risk. With temperatures increasing in NYS, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, susceptibility of forest to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

# **Probability of Future Occurrences**

Nationally, wildfire risk is increasing. Wildfire experts point to four reasons why wildfire risks are increasing:

- The way forests were handled in the past allowed fuel in the form of fallen leaves, branches and plant growth, to accumulate. Now this fuel is lying around the forest with potential to "feed" a wildfire.
- Increasingly hot, dry weather has occurred and will occur within the United States.
- Weather patterns across the country are changing.
- More homes are built within areas of WUI, meaning that homes are built closer to wildland areas where wildfires can occur (NYS DHSES 2014).

According to the NYS Forest Ranger Division, between 1993 and 2017 more than half of all fire departmentresponse to wildfires occurred between March and May (NYS DEC n.d.). Beginning in 2010, NYS enacted revised open burning regulations that ban brush burning statewide during this time period. Forest ranger data





indicate that this new statewide ban resulted in 46 percent fewer wildfires caused by debris burning in upstate New York from 2010 to 2017 (NYS DEC 2020).

Fire probability depends on local weather conditions, outdoor activities (such as camping, debris burning, and construction), and degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase likelihood of wildfire events. Lightning can also trigger wildfire. Other natural disasters can increase probability of wildfires by producing fuel in both urban and rural areas. Forest damage from windstorms may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities (Northern Virginia Regional Commission [NVRC] 2006).

In Westchester County, brush fire events will continue to occur. The likelihood of one of those fires attaining significant size and intensity cannot be predicted and is highly dependent on environmental conditions and firefighting response. However, advanced methods of wildfire management and control and better understanding of fire ecosystems should reduce the number of devastating fires in the future (NYSDEC 2020). Invasive forest insects can increase the likelihood of wildfires occurring; insects that attack and kill trees, such as Emerald Ash Borer, increase the total wildfire fuel available in wooded areas. Climate change is also likely to increase the probability of future wildfires. Prolonged periods of drought caused by climate change can potentially increase the length of the wildfire season and provide a more favorable climate for ignition.

In Section 5.3, the ranking of identified hazards of concern for Westchester County is provided. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for wildfire in the county is considered 'rare' (event has between a 1% and 10% annual probability of a hazard event occurring).

# 5.4.6.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable to the identified hazard. A spatial analysis was conducted using the University of Wisconsin 2010 Wildfire Urban Interface/Intermix spatial layer. For the purposes of the assessment, an asset (population, structures, critical facilities, and lifelines) is considered exposed and potentially vulnerable to the wildfire hazard if it is located in the wildfire interface or wildfire intermix hazard areas.

# Impact on Life, Health and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Table 5.4.6-3 summarizes the estimated population exposed to the wildfire hazard by municipality.

Based on the analysis, an estimated 112,473 residents, or approximately 11.6-percent of the County's population, are located in the wildfire urban interface/intermix hazard area. Overall, the Town of Somers has the greatest number of individuals located in the wildfire hazard area (i.e., 14,299 persons).

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. In Westchester County, there are 83,793 persons living below the poverty threshold and 162,363 persons over 65 years old. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating.





		Estimated Population Located in the Wildland-Urban Interface/Intermix Wildfire Hazard Areas							
Jurisdiction	American Community Survey (2015-2019) Population	Wildland- Urban Interface	Percent of Total	Wildland- Urban Intermix	Percent of Total	Total Number of People (Interface and Intermix)			
Ardsley (V)	4,512	0	0.0%	0	0.0%	0			
Bedford (T)	17,803	1,400	7.9%	12,079	67.8%	13,478			
Briarcliff Manor (V)	7,616	85	1.1%	1,574	20.7%	1,659			
Bronxville (V)	6,409	0	0.0%	0	0.0%	0			
Buchanan (V)	2,140	99	4.6%	194	9.1%	294			
Cortlandt (T)	32,131	989	3.1%	10,565	32.9%	11,554			
Croton-on-Hudson (V)	8,155	779	9.6%	1,287	15.8%	2,066			
Dobbs Ferry (V)	11,070	0	0.0%	0	0.0%	0			
Eastchester (T)	19,990	0	0.0%	0	0.0%	0			
Elmsford (V)	5,085	0	0.0%	0	0.0%	0			
Greenburgh (T)	44,829	0	0.0%	1,672	3.7%	1,672			
Harrison (T)	28,135	0	0.0%	4,108	14.6%	4,108			
Hastings-on-Hudson (V)	7,921	0	0.0%	13	0.2%	13			
Irvington (V)	6,529	0	0.0%	536	8.2%	536			
Larchmont (V)	6,096	0	0.0%	0	0.0%	0			
Lewisboro (T)	12,599	608	4.8%	10,458	83.0%	11,066			
Mamroneck (T)	11,298	0	0.0%	26	0.2%	26			
Mamaroneck (V)	19,217	0	0.0%	58	0.3%	58			
Mount Kisco (T)	10,866	2,342	21.6%	660	6.1%	3,002			
Mount Pleasant (T)	27,000	297	1.1%	2,867	10.6%	3,164			
Mount Vernon (C)	67,896	0	0.0%	0	0.0%	0			
New Castle (T)	17,905	457	2.6%	8,796	49.1%	9,253			
New Rochelle (C)	79,067	0	0.0%	152	0.2%	152			
North Castle (T)	12,235	137	1.1%	8,446	69.0%	8,583			
North Salem (T)	5,167	83	1.6%	3,741	72.4%	3,824			
Ossining (T)	5,567	1,154	20.7%	275	4.9%	1,429			
Ossining (V)	25,086	1,690	6.7%	0	0.0%	1,690			
Peekskill (C)	24,075	3,880	16.1%	14	0.1%	3,894			
Pelham (T)*	12,510	0	0.0%	0	0.0%	0			
Pelham (V)	6,941	0	0.0%	0	0.0%	0			
Pelham Manor (V)	5,569	0	0.0%	0	0.0%	0			
Pleasantville (V)	7,221	828	11.5%	14	0.2%	842			
Port Chester (V)	29,342	0	0.0%	0	0.0%	0			
Pound Ridge (T)	5,177	0	0.0%	5,076	98.0%	5,076			
Rye (C)	15,820	0	0.0%	247	1.6%	247			
Rye Brook (V)	9,487	464	4.9%	0	0.0%	464			

# Table 5.4.6-3. Estimated Population Located within the WUI in Westchester County





		Estimated Population Located in the Wildland-Urban Interface/Intermix Wildfire Hazard Areas							
Jurisdiction	American Community Survey (2015-2019) Population	Wildland- Urban Interface	Percent of Total	Wildland- Urban Intermix	Percent of Total	Total Number of People (Interface and Intermix)			
Scarsdale (T)	17,837	0	0.0%	105	0.6%	105			
Sleepy Hollow (V)	10,122	0	0.0%	53	0.5%	53			
Somers (T)	21,487	3,486	16.2%	10,812	50.3%	14,299			
Tarrytown (V)	11,436	0	0.0%	381	3.3%	381			
Tuckahoe (V)	6,584	0	0.0%	0	0.0%	0			
White Plains (C)	58,137	0	0.0%	0	0.0%	0			
Yonkers (C)	199,968	0	0.0%	66	0.0%	66			
Yorktown (T)	36,538	667	1.8%	8,755	24.0%	9,422			
Westchester County (Total)	968,065	19,446	2.0%	93,028	9.6%	112,473			

Source: American Community Survey 201 (ACS 2015-2019); University of Wisconsin, 2010

Notes: C = City; T = Town; V = Village; % = Percent

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Impact on General Building Stock

The most vulnerable structures to wildfire events are those within the wildfire urban interface/intermix hazard area. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. To estimate the buildings exposed to the wildfire hazard, the WUI was overlaid upon the updated building inventory. Approximately 10.5-percent (42.5 million) of the County's building replacement cost value is located in the wildland-urban interface/intermix wildfire hazard area. The Town of Somers has the greatest number of buildings located in the wildfire hazard area (7,500 structures – 65.3-percent of its total), and the Town of Pound Ridge has the greatest proportion of its buildings located in the wildfire hazard area (i.e., 98.1-percent). The replacement cost value of the structures with their center in the WUI were totaled and are summarized by jurisdiction in Table 5.4.6-4.



Table 5.4.6-4. Building Stock Replacement Value Located within the Wildland Urban Interface/Intermix Wildfire Hazard Area in Westchester County

					Estimated Building	Stock Loc	ated in the V	Vildland-U	Jrban Interface/Int	ermix Wile	dfire Hazard Areas	
Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the Wildland- Urban Interface Hazard Area	Percent of Total	RCV of Buildings Located in the Wildland-Urban Interface Hazard Area	Percent of Total	Number of Buildings Located in the Wildland- Urban Intermix Hazard Area	Percent of Total	RCV of Buildings Located in the Wildland-Urban Intermix Hazard Area	Percent of Total	Total Buildings Located in the Wildland-Urban Interface/Intermi x Hazard Areas	Total RCV Located in the Wildland-Urban Interface/Intermi x Hazard Areas
Ardsley (V)	1,600	\$1,184,178,473	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Bedford (T)	7,842	\$6,187,290,490	623	7.9%	\$1,220,099,961	19.7%	5,114	65.2%	\$3,165,458,954	51.2%	5,737	\$4,385,558,915
Briarcliff Manor (V)	2,821	\$2,929,350,441	35	1.2%	\$177,977,791	6.1%	553	19.6%	\$372,901,153	12.7%	588	\$550,878,944
Bronxville (V)	1,524	\$2,422,176,980	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Buchanan (V)	1,153	\$1,174,838,972	51	4.4%	\$136,314,373	11.6%	142	12.3%	\$89,063,799	7.6%	193	\$225,378,172
Cortlandt (T)	11,740	\$7,539,300,494	352	3.0%	\$535,013,258	7.1%	3,786	32.2%	\$2,237,068,932	29.7%	4,138	\$2,772,082,190
Croton-on- Hudson (V)	3,412	\$5,339,173,282	309	9.1%	\$484,693,114	9.1%	506	14.8%	\$336,952,535	6.3%	815	\$821,645,649
Dobbs Ferry (V)	2,888	\$3,524,751,416	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Eastchester (T)	5,861	\$4,342,629,796	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Elmsford (V)	1,358	\$2,719,155,604	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Greenburgh (T)	14,313	\$42,009,346,893	0	0.0%	\$0	0.0%	610	4.3%	\$5,729,763,419	13.6%	610	\$5,729,763,419
Harrison (T)	7,813	\$10,415,934,158	0	0.0%	\$0	0.0%	1,081	13.8%	\$945,231,522	9.1%	1,081	\$945,231,522
Hastings-on- Hudson (V)	2,812	\$13,267,692,589	0	0.0%	\$0	0.0%	13	0.5%	\$21,919,809	0.2%	13	\$21,919,809
Irvington (V)	1,736	\$1,575,655,219	0	0.0%	\$0	0.0%	145	8.4%	\$202,805,760	12.9%	145	\$202,805,760
Larchmont (V)	2,281	\$3,287,198,418	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Lewisboro (T)	6,358	\$5,313,683,830	292	4.6%	\$172,169,893	3.2%	5,205	81.9%	\$4,649,038,524	87.5%	5,497	\$4,821,208,417
Mamroneck (T)	4,065	\$2,363,450,350	0	0.0%	\$0	0.0%	10	0.2%	\$6,097,203	0.3%	10	\$6,097,203
Mamaroneck (V)	5,699	\$7,321,897,360	0	0.0%	\$0	0.0%	28	0.5%	\$33,063,716	0.5%	28	\$33,063,716
Mount Kisco	3,002	\$5,913,464,031	595	19.8%	\$1,523,107,078	25.8%	168	5.6%	\$173,796,811	2.9%	763	\$1,696,903,888



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					Estimated Building	Stock Loc	ated in the V	Vildland-U	Irban Interface/Inte	Estimated Building Stock Located in the Wildland-Urban Interface/Intermix Wildfire Hazard Areas							
Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the Wildland- Urban Interface Hazard Area	Percent of Total	RCV of Buildings Located in the Wildland-Urban Interface Hazard Area	Percent of Total	Number of Buildings Located in the Wildland- Urban Intermix Hazard Area	Percent of Total	RCV of Buildings Located in the Wildland-Urban Intermix Hazard Area	Percent of Total	Total Buildings Located in the Wildland-Urban Interface/Intermi x Hazard Areas	Total RCV Located in the Wildland-Urban Interface/Intermi x Hazard Areas					
Mount Pleasant (T)	9,863	\$8,309,807,831	98	1.0%	\$38,726,858	0.5%	961	9.7%	\$528,216,820	6.4%	1,059	\$566,943,678					
Mount Vernon (C)	12,648	\$17,021,941,779	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0					
New Castle (T)	6,759	\$4,957,954,777	200	3.0%	\$909,243,101	18.3%	3,290	48.7%	\$1,980,378,195	39.9%	3,490	\$2,889,621,296					
New Rochelle (C)	17,044	\$42,795,863,468	0	0.0%	\$0	0.0%	29	0.2%	\$19,645,357	<0.1%	29	\$19,645,357					
North Castle (T)	5,391	\$5,067,704,057	68	1.3%	\$379,500,824	7.5%	3,469	64.3%	\$2,369,640,277	46.8%	3,537	\$2,749,141,101					
North Salem (T)	2,870	\$2,372,126,897	52	1.8%	\$147,060,499	6.2%	2,020	70.4%	\$1,201,648,832	50.7%	2,072	\$1,348,709,331					
Ossining (T)	2,266	\$1,382,487,862	449	19.8%	\$316,246,614	22.9%	113	5.0%	\$79,590,831	5.8%	562	\$395,837,444					
Ossining (V)	5,874	\$6,071,219,565	368	6.3%	\$385,948,751	6.4%	1	<0.1%	\$10,238,670	0.2%	369	\$396,187,421					
Peekskill (C)	6,001	\$6,315,622,346	1,014	16.9%	\$2,763,414,195	43.8%	3	<0.1%	\$758,715	<0.1%	1,017	\$2,764,172,910					
Pelham (T)*	4,596	\$3,648,777,424	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0					
Pelham (V)	2,377	\$2,384,243,499	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0					
Pelham Manor (V)	2,219	\$1,264,533,925	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0					
Pleasantville (V)	2,919	\$2,842,599,318	302	10.3%	\$89,870,480	3.2%	9	0.3%	\$3,589,868	0.1%	311	\$93,460,348					
Port Chester (V)	6,424	\$7,869,067,479	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0					
Pound Ridge (T)	3,025	\$1,596,752,944	0	0.0%	\$0	0.0%	2,968	98.1%	\$1,573,597,335	98.5%	2,968	\$1,573,597,335					
Rye (C)	5,632	\$5,820,922,260	0	0.0%	\$0	0.0%	87	1.5%	\$49,044,713	0.8%	87	\$49,044,713					
Rye Brook (V)	3,591	\$4,892,231,021	171	4.8%	\$372,455,415	7.6%	0	0.0%	\$0	0.0%	171	\$372,455,415					
Scarsdale (T)	6,829	\$4,603,749,394	0	0.0%	\$0	0.0%	41	0.6%	\$24,206,033	0.5%	41	\$24,206,033					
Sleepy Hollow (V)	1,921	\$1,990,885,470	0	0.0%	\$0	0.0%	10	0.5%	\$67,936,543	3.4%	10	\$67,936,543					
Somers (T)	11,490	\$6,092,204,344	1,782	15.5%	\$605,613,506	9.9%	5,718	49.8%	\$2,907,383,787	47.7%	7,500	\$3,512,997,293					
Tarrytown (V)	3,078	\$7,284,273,569	0	0.0%	\$0	0.0%	86	2.8%	\$34,970,129	0.5%	86	\$34,970,129					





				Estimated Building Stock Located in the Wildland-Urban Interface/Intermix Wildfire Hazard Areas								
	Number	Total	Number of Buildings Located in the Wildland- Urban Interface	Derroomt	RCV of Buildings Located in the Wildland-Urban	Derroomt	Number of Buildings Located in the Wildland- Urban Intermix	Derroot	RCV of Buildings Located in the Wildland-Urban	Devreet	Total Buildings Located in the Wildland-Urban	Total RCV Located in the Wildland-Urban
Jurisdiction	or Buildings	Value (RCV)	Area	of Total	Area	of Total	Hazard Area	of Total	Area	of Total	x Hazard Areas	x Hazard Areas
Tuckahoe (V)	1,655	\$1,530,366,709	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
White Plains (C)	13,986	\$61,499,698,595	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	\$0
Yonkers (C)	33,912	\$50,644,348,876	0	0.0%	\$0	0.0%	12	<0.1%	\$3,112,673	<0.1%	12	\$3,112,673
Yorktown (T)	13,922	\$19,503,786,796	256	1.8%	\$828,783,450	4.2%	3,241	23.3%	\$2,600,536,253	13.3%	3,497	\$3,429,319,703
Westchester County (Total)	269,974	\$402,945,561,577	7,017	2.6%	\$11,086,239,160	2.8%	39,419	14.6%	\$31,416,898,452	7.8%	46,436	\$42,503,137,611

Source: Westchester County GIS 2020; NYS GIS 2021; RS Means 2021; University of Wisconsin 2010

Notes: C = City; T = Town; V = Village; % = Percent; < = Less Than; WUI = Wildland-Urban Interface/Intermix; RCV = Replacement Cost Value

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor





# **Impact on Critical Facilities and Lifelines**

It is recognized that a number of critical facilities and lifelines are located in the wildfire hazard area. Many of these facilities located in the wildfire hazard areas provide food, water, or shelter services to persons within the County. The majority of facilities located in the wildland-urban intermix hazard area are potable water wells and the majority of facilities located in the wildland-urban interface hazard area are childcare facilities. Table 5.4.6-5 summarizes critical facilities and lifelines located within the wildfire hazard area by jurisdiction; a total of 1,267 critical facilities. Of this total, 1,142 of the critical facilities are considered lifelines. The Town of Lewisboro has the greatest number of critical facilities built in the wildland-urban interface/intermix hazard areas (155). The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in Table 5.4.6-6.

			Number of Critical Facilities and Lifeline Facilitie Located in the Wildland-Urban Intermix/Interfac Wildfire Hazard Area				
Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	
Ardsley (V)	21	21	0	0.0%	0	0.0%	
Bedford (T)	173	160	129	74.6%	118	73.8%	
Briarcliff Manor (V)	43	38	7	16.3%	6	15.8%	
Bronxville (V)	19	19	0	0.0%	0	0.0%	
Buchanan (V)	21	18	14	66.7%	11	61.1%	
Cortlandt (T)	165	143	122	73.9%	109	76.2%	
Croton-on-Hudson (V)	57	51	40	70.2%	35	68.6%	
Dobbs Ferry (V)	43	34	0	0.0%	0	0.0%	
Eastchester (T)	51	43	0	0.0%	0	0.0%	
Elmsford (V)	22	16	0	0.0%	0	0.0%	
Greenburgh (T)	245	217	39	15.9%	37	17.1%	
Harrison (T)	139	117	16	11.5%	15	12.8%	
Hastings-on-Hudson (V)	37	27	1	2.7%	1	3.7%	
Irvington (V)	37	35	8	21.6%	8	22.9%	
Larchmont (V)	31	26	0	0.0%	0	0.0%	
Lewisboro (T)	174	169	155	89.1%	150	88.8%	
Mamroneck (T)	27	25	0	0.0%	0	0.0%	
Mamaroneck (V)	98	83	0	0.0%	0	0.0%	
Mount Kisco (T)	83	78	64	77.1%	60	76.9%	
Mount Pleasant (T)	355	340	25	7.0%	22	6.5%	
Mount Vernon (C)	251	165	0	0.0%	0	0.0%	
New Castle (T)	75	67	69	92.0%	61	91.0%	
New Rochelle (C)	238	182	0	0.0%	0	0.0%	
North Castle (T)	174	169	70	40.2%	66	39.1%	
North Salem (T)	116	114	86	74.1%	84	73.7%	
Ossining (T)	24	18	23	95.8%	17	94.4%	
Ossining (V)	94	83	26	27.7%	23	27.7%	

# Table 5.4.6-5. Facilities Located in the Wildland-Urban Interface/Intermix Wildfire Hazard Area





			Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix/Interface Wildfire Hazard Area					
Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines		
Peekskill (C)	141	106	102	72.3%	81	76.4%		
Pelham (T)*	36	30	0	0.0%	0	0.0%		
Pelham (V)	16	13	0	0.0%	0	0.0%		
Pelham Manor (V)	20	17	0	0.0%	0	0.0%		
Pleasantville (V)	47	45	9	19.1%	9	20.0%		
Port Chester (V)	110	93	0	0.0%	0	0.0%		
Pound Ridge (T)	42	41	37	88.1%	36	87.8%		
Rye (C)	77	72	1	1.3%	1	1.4%		
Rye Brook (V)	61	53	4	6.6%	3	5.7%		
Scarsdale (T)	39	34	1	2.6%	1	2.9%		
Sleepy Hollow (V)	51	36	0	0.0%	0	0.0%		
Somers (T)	194	182	127	65.5%	118	64.8%		
Tarrytown (V)	67	60	0	0.0%	0	0.0%		
Tuckahoe (V)	19	16	0	0.0%	0	0.0%		
White Plains (C)	227	175	0	0.0%	0	0.0%		
Yonkers (C)	590	436	0	0.0%	0	0.0%		
Yorktown (T)	145	114	92	63.4%	70	61.4%		
Westchester County (Total)	4,659	3,951	1,267	27.2%	1.142	28.9%		

Source: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; University of Wisconsin 2010

*Notes: C* = *City; T* = *Town; V* = *Village;* % = *Percent* 

\*The Town of Pelham is the aggregate of the Village of Pelham and the Village of Pelham Manor

# Table 5.4.6-6. Lifelines Categorized by FEMA Lifeline Category Located in the Wildland-UrbanInterface/Intermix Wildfire Hazard Area

FEMA Lifeline Categories	Total Lifelines in County	Number Located in the Wildfire-Urban Interface	Number Located in the Wildfire-Urban Intermix
Communications	40	4	12
Energy	274	34	19
Food, Water, Shelter	1,661	230	427
Hazardous Materials	82	6	3
Health and Medical	117	28	9
Safety and Security	1,519	170	179
Transportation	258	17	4
Westchester County (Total)	3,951	489	653

Source: Westchester County GIS 2019/2020/2021; HIFLD 2014/2017/2019/2020/2021; EPA 2021; Westchester HMP 2014; Westchester Planning Partners 2021; University of Wisconsin 2010; FEMA 2021





#### Impact on the Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business. These events may cost thousands of taxpayer dollars to suppress and control and may involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires. Due to a lack of data regarding past structural and economic losses specific to Westchester County or its municipalities, it is not possible to estimate future losses due to wildfire events currently.

#### **Cascading Impacts to Other Hazards**

According to the USGS, post-fire runoff polluted with debris and contaminates can be extremely harmful to ecosystem and aquatic life (USGS 2018). Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USGS 2018). The age and density of infrastructure within Westchester County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminates that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the storm water, contaminate nearby streams, and impair aquatic life. Furthermore, any changes to the landscape caused by wildfires may also alter the flood extent within the County.

#### **Future Changes That May Impact Vulnerability**

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan for the future.

#### Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located in the wildland-urban interface/intermix hazard area could be at risk. Therefore, the County should implement wildfire management strategies in existing building code to protect structures against the residual impacts from wildfire such as heat, debris, and char. Furthermore, development should be built with access to transit routes that will enable easier evacuation during a wildfire event.

# Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. New development and changes in population with a mix of additional structures, ornamental vegetation, and wildland fuels will require continued assessment of the hazard and mitigation risk. In addition, as population and development increases, so will the increased capacity if fire-suppression services (i.e., water supply, fire department services/staff/equipment). Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

#### Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. Changes in temperature can have an effect on how fire interacts with the surrounding natural habitat and built environment. Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:





- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species and an increasing wildland-urban interface (USFS 2020).

Fire occurrence and/or area burned could increase across the U.S. due to the increase of lightning activity, the frequency of surface pressure and associated circulation patterns conductive to surface drying, and fire-weather conditions, in general, which is conductive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels and extending fire seasons and areas burned (USFS 2020).

Future changes in fire frequency and severity are difficult to predict. Global and regional climate changes associated with elevated greenhouse gas concentrations could alter large weather patterns, thereby affecting fire-weather conducive to extreme fire behavior (USFS 2020).

# Change of Vulnerability Since the 2015 HMP

Since the 2015 HMP was drafted, updated inventory data has become available to assess the wildfire hazard in Westchester County. This data includes the 5-Year 2015-2019 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the wildfire hazard.





# 5.4.7 Chemical, Biological, Radiological, or Nuclear (CBRN) Incidents

This section provides a profile and vulnerability assessment for the CBRN hazard.

# 5.4.7.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

# Description

A CBRN incident is one that involves a chemical, biological agent, radioactive material, or nuclear explosion. These incidents can be accidental or intentional in nature. Each of these types of incidents has the potential to cause injuries and death, and all but the biological incidents have the potential to damage property as well.

# Chemical

Many chemicals that exist are considered hazardous materials that pose risk to people, structures, and the environment. The U.S. Department of Transportation (DOT) classifies hazardous materials into nine classes based on the chemical characteristics producing the risk. The nine classifications are listed below:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable liquids
- Class 4: Flammable solids
- Class 5: Oxidizers and organic pesticides
- Class 6: Poisons and etiologic materials
- Class 7: Radioactive materials
- Class 8: Corrosives
- Class 9: Miscellaneous (DOT 2013)

Hazardous materials may affect individuals who are exposed to them. Exposure can occur through inhalation, ingestion, injection, and absorption into the skin. The effects of hazardous materials varies by chemical, and to some extent, by individual.

# Biological

Biological agents are toxins or microscopic organisms that can injure or kill people, animals, and crops (Ready 2021). They consist of toxins, bacteria, and viruses, that can be spread through person-to-person contact, contamination of food or water, dispersed in the air as aerosols, or by animals such as mice, fleas, and mosquitos. Biological attacks are usually detected well after the attack occurs, through monitoring the symptoms reported by hospitals and other healthcare facilities.

# Radiological

A radiological incident is one in which radioactive materials contaminate people, structures, or the environment, causing negative health effects. Radiological incidents can range from a transportation accident that damages cargo that contains radioactive sources, to incidents at laboratory or research facilities, to incidents at nuclear power plants (specifically the Indian Point Energy Center within the County), to Radiological Dispersion Devices (RDD). Radioactive cargo may include larger sources, such as radiography sources and ground density meters.



An RDD is a device that spreads radioactive materials using a conventional explosion. While the explosive itself will cause deaths and injuries in the blast area, the radioactive contamination spread by the explosive is usually too low to cause direct health effects unless it is taken into the body. RDDs may not be recognized as such initially if emergency personnel responding to an explosion do not suspect and monitor radiation levels early in the response.

#### Nuclear

Nuclear blasts are immense explosions with destructive pressure waves, intense heat, a blinding flash of light, and radioactive contamination (FEMA 2013). Nuclear blasts release approximately 1 million times the energy of conventional explosives (Services 2010). They are not the same as radiological incidents described above, though both incident types include the release of radioactive contamination. The threat of nuclear blasts is primarily based on the threat of a terrorist organization obtaining and deploying a small nuclear weapon without being intercepted.

#### Programs in Place to Reduce Impacts

# Plans, Training, and Exercises

Westchester County maintains a Comprehensive Emergency Management Plan (CEMP) that includes an annex specific to hazardous materials emergency response. The County is also required to maintain facility-specific off-site emergency response plans for the Indian Point Energy Center and any facility that uses or stores chemicals that have been deemed Extremely Hazardous Substances (EHS) by the US EPA. The Westchester County Department of Health also maintains plans and procedures to guide the response to biological incidents, as well as to address the health effects of all hazards.

Responders identified in these plans train regularly to carry out their responsibilities, and participate in emergency exercises to test their capabilities and the effectiveness of the emergency plans.

# **Response Resources**

The Westchester County Local Emergency Planning Committee (LEPC) maintains a list of all response assets in the County that could respond to a chemical, biological, radiological, or nuclear incident. These include the hazardous materials response teams maintained by the County and by the City of Yonkers; additional teams through a response partnership with Dutchess and Westchester Counties; Weapons of Mass Destruction (WMD) Squads maintained by several of the County's fire departments; the County's bomb squad; and a response unit maintained by the County Department of Health.

Responses to nuclear detonations will be coordinated by federal assets, with County and local assets providing a support role as needed.

# Location

Westchester County is home to over 3,200 miles of public roadways. Interstate (I)-95 runs through southern Westchester County parallel to the Long Island Sound, connecting New York City and New England. I-87 runs north-south on the western side of the County and links Westchester with New York City and upstate New York and Canada. I-287 runs east-west across the center of the County and connects I-87, the Tappan Zee Bridge, and I-95. I-684 runs north from White Plains into Westchester County through the central and northern suburbs and provides a connection to I-84 (Planning 2010). US Route 9 runs along the Hudson River on the western edge of the County. US Route 1 connects Connecticut with New York City in the southeastern part of the County. U.S. Routes 6 and 202 connect Peekskill with the counties to the northeast. CBRN materials can be transported on any of these major roadways, as well as a number of New York State routes, railroads, ferries and





other boats, pipelines, and aircraft, through Westchester County and/or to destinations within the County. Any of these routes may be used to transport CBRN materials. In addition, widespread contamination that deposits on crops, livestock feed, and the livestock itself may result in contamination of the food chain after a release of contamination due to a CBRN incident.

#### Chemical

The Westchester County LEPC maintains a listing of all facilities that report the hazardous materials they store or use. These locations are spread throughout the County. Between the fixed facilities, the transportation routes described above, and the prevalence of gas stations and heating oil deliveries, the entire County can be considered vulnerable to chemical releases.

#### Biological

Biological incidents can affect anywhere from a small portion of the County to the entire County and beyond. The geographic area affected by a biological incident will depend on the biological agent, the mode of transmission, population density, and the degree of interaction among people in the area. Denser urban areas are more conducive to the spread of disease.

#### Radiological

Radiological incidents may occur from radioactive materials in or being transported to or from medical facilities with radiology departments, or from industry utilizing equipment and facilities with radiological sources.

Westchester County is home to the Indian Point Energy Center, a nuclear power plant just south of Peekskill; however, the facility shut down on April 30, 2021. While the plan is no longer operating, the County still utilizes emergency planning zones. A 10-mile Plume Exposure Pathway Emergency Planning Zone (EPZ) is established around the plant. Municipalities and individuals within this EPZ may be vulnerable to the immediate release of radiation from an incident at the plant. A 50-mile Ingestion Exposure Pathway EPZ has also been established around the plant, reflecting the area in which contamination of the food chain may occur. In the event of an emergency, the County utilizes sirens and the public notification system.

#### Nuclear

A nuclear explosion could be detonated anywhere in Westchester County, assuming that a nuclear device could be constructed in or transported into the County without being detected. A nuclear explosion within Westchester County could result in radioactive contamination of the entire County. The impacts of radioactive fallout resulting from a nuclear detonation may be felt from the physical impact zone in the form of radiation burns and radiation sickness. The area affected by the heat and pressure waves generated by the explosion would depend on the strength of the explosion and where it is centered.

# Extent

This section describes the range of incidents that may stem from each of the CBRN types.

#### Chemical

Chemical releases can range from minor petroleum spills to large, facility-based incidents that have the potential to lead to loss of life, property, environment, and economy. Product release into the local environment can be generated from a fixed facility or along any location on a route of travel, and may be the result of carelessness, technical failure, external incidents, or an intentional act against the facility or container. The volatility of products being stored or transported, along with the potential impact on a local community, may increase the





risk of intentional acts against a facility or transport vehicle. The release of certain products considered to be hazardous materials can have an immediate adverse impact on the general population, ranging from the inconvenience of evacuations, to personal injury, and even death. In addition to human impacts, any release can compromise the local environment through the contamination of soil, groundwater, or local flora and fauna.

#### Biological

Biological incidents may affect anywhere from 1 person to the entire population of Westchester County. The degree to which a biological agent can spread throughout the population depends on the nature of the agent involved, transmissibility, at-risk populations (which may vary from agent to agent), incubation period, time before detection, and other factors.

#### Radiological

The severity of a radiological incident depends on the type of incident. Most incidents that involve radiological materials will be relatively small incidents at fixed facilities (such as a hospital's radiology department) or in transport. Terrorist attacks may include the detonation of an RDD, which spreads radioactive contamination using an explosion. RDDs may not be recognized as such initially if emergency personnel responding to an explosion do not suspect and monitor radiation levels early in the response.

For nuclear power plants, the U.S. Nuclear Regulatory Commission (NRC) classifies incidents as follows (NRC 2014):

- "Notification of Unusual Event (NOUE) Events are in progress or have occurred which indicate a
  potential degradation of the level of safety of the plant or indicate a security threat to facility protection
  has been initiated. No releases of radioactive material requiring offsite response or monitoring are
  expected unless further degradation of safety systems occurs. [Note: This term is sometimes shortened
  to Unusual Event (UE). The terms Notification of Unusual Event, NOUE and Unusual Event are used
  interchangeably.]
- Alert Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guides (PAGs).
- Site Area Emergency (SAE) Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or hostile action that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.
- General Emergency Events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity or hostile action that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels offsite for more than the immediate site area."

Incidents classified as an Alert, Site Area Emergency, or General Emergency may result in the release of radiological materials, though the materials may not present a threat to the population (depending on the classification). Regardless of the incident classification, a release of radiological materials may not necessarily present a threat to the population.





Nuclear

The size of a nuclear explosion is expressed in terms of the number of tons of trinitrotoluene (TNT) that it would take to create an explosion of the same magnitude. Nuclear weapons maintained by the military may be able to generate explosions equivalent to millions of tons of TNT; for instance, a 10 megaton nuclear explosion is equivalent to 10 million tons of TNT. Even a nuclear explosion that is only as strong as 10 thousand tons (10 kiloton) of TNT would cause massive damage and numbers of injuries and fatalities.

In addition to injuries and fatalities related to the nuclear blast, radioactive fallout can deposit on wide areas around the blast site, outside of the zone of physical impact. Fallout will contaminate buildings and equipment, and may cause radiation burns and radiation sickness in thousands of people.

# **Previous Occurrences and Losses**

Between 1954 and 2021, the State of New York was not included in any CBRN-related FEMA disaster declarations.

For this HMP, known CBRN events that have impacted New York State and Westchester County between 2015 and 2021 are identified in Table 5.4.7-1. Many sources were researched for historical information regarding CBRN events in Westchester County; therefore, Table 5.4.7-1 may not include all CBRN events that have impacted the County.





Dates of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
April 2, 2015	Magnesium Hydroxide Spill	Town of Ossining	N/A	N/A	Approximately 1,400 gallons magnesium hydroxide was spilled onto Water Street and Snowden Avenue in Ossining
April 17, 2015	Chlorine Spill	City of Peekskill	N/A	N/A	A chlorine spill at Peekskill Middle School Friday led to the early dismissal of students.
October 5, 2015	Oil Spill	City of Yonkers	N/A	N/A	A runaway oil tanker crashed into the side of an apartment building, tipped on its side and spilled 100 gallons of oil in Yonkers.
July 7, 2016	Chlorine and Hydrochloric Acid Spill	Town of Greeenburgh	N/A	N/A	A four car collision resulted in the spill of swimming pool chemicals chlorine and hydrochloric acid.
February 27, 2016	Oil Spill	City of Yonkers	N/A	N/A	A leaking truck spilled as much as 600 gallons of oil into the Bronx River today as hazmat crews scrambled to clean up a large oil spill.
December 11, 2016	Gas Spill	Town of Cortlandt	N/A	N/A	a tractor trailer driver on an icy Route 6 drove head-on into a car traveling in the opposite direction, leading to a gas spill of 20 gallons of diesel fuel.
December 16, 2016	Oil Spill	City of New Rochelle	N/A	N/A	Officials say an oil truck carrying 2,500 gallons of home heating oil was backing up to make a delivery to a college-owned house on Pryer Terrace when the oil started spewing out
December 24, 2016	Gas Leak	Town of Mamaroneck	N/A	N/A	A faulty boiler caused a gas leak at a nursing home, trapping hundreds of residents in their rooms.
January 4, 2017	Gas Leak	Town of Mamaroneck	N/A	N/A	Rye Neck High School was evacuated after a gas leak on a valve was found in the science department and ConEdison was called to repair the problem.
January 5, 2017	Gas Leak	City of Yonkers	N/A	N/A	A resident drilling a hole in a wall for a flat screen TV hit a gas line, leading to an evacuation of residents.
March 6, 2017	Fuel Spill	Village of Mount Kisco	N/A	N/A	Workers responded to clean up 100 gallons of spilled fuel.
September 25, 2017	Fuel Spill	City of Yonkers	N/A	N/A	A tractor-trailer leaking fuel caused one lane of I-87 in Yonkers to shut down during the morning commute.
October 4, 5, 2017	Suspicious Powder	City of Yonkers	N/A	N/A	On October 4, police investigated a suspicious white powder found at a Westchester business. On October 5, Yonkers police responded to 77 Lee Ave., the address for St Paul the Apostle School, to investigate a white powder found in a plastic bag. Both events were found to be false alarms.
December 7, 2017	Gas Leak	Village of Tarrytown	N/A	N/A	A gas leak resulted in the evacuation of Tarrytown Music Hall.

# Table 5.4.7-1. CBRN Events Impacting Westchester County, 2015 to 2021





Dates of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
August 6, 2018	Oil Spill	Town of Somers	N/A	N/A	An oil spill of at least 200 gallons threatened the Somers
					Reservoir.
February 19,	Gasoline Spill	Town of North	N/A	N/A	An overturned tractor-trailer on Route 116 spilled a small amount
2019		Salem			of fuel into the Titicus Reservoir. The Reservoir was lowered by a
					foot or two to prevent water from passing through the spillway
					and allow for containment.

Source: NOAA NCEI 2021, FEMA 2021, North American Hazmat Situations and Deployments Map 2021.





# **Climate Change Projections**

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011). Westchester County is located in ClimAID Region 5, which includes the East Hudson and Mohawk River Valleys. Table 5.4.7-2 provides the projected seasonal precipitation changes for Region 5 (NYSERDA 2014).

# Table 5.4.7-2. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	-5 to +10	-5 to +5	-5 to +10
Source: NYSERDA 2011			

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The distribution of precipitation is expected to become less even with climate change. Increased precipitation will likely be experienced in the winter months as rain, with potentially less precipitation in the summer and fall. Downpours will likely increase in intensity and frequency. This may impact drinking water through flooding contaminating wells; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011, 2014). Less frequent rainfall during the summer months may hamper water supply provision during these months. Furthermore. increased water temperatures in rivers and streams will have impacts upon aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants and industrial discharges (NYSERDA 2011).

As temperatures change, excessive heat on containers that contain CBRN materials may alter the material properties. In addition, materials and facilities located in the floodplain may experience an increase in flood events due to the project changes in increased precipitation events, magnitude, and frequency.

# **Probability of Future Events**

As a whole, CBRN incidents are highly likely to occur in the County. Releases of chemicals, notably gasoline and diesel fuel related to traffic accidents and spills at fueling stations, occur on a daily basis, but are usually so minor that they do not require an emergency response. While the County's proximity to New York City may make it more likely to be affected by a major, intentional CBRN incident from a terrorist attack, a large-scale CBRN incident occurring in Westchester County is unlikely.

Based on the history of occurrence and input from the Planning Partnership, the probability of future occurrences are considered occasional (between 10 and 100% annual probability event may occur).

# 5.4.7.2 Vulnerability Assessment

A qualitative assessment was conducted for CBRN incidents in Westchester County. The following discusses the County's vulnerability to this hazard. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess CBRN risk.





#### Impact on Life, Health, and Safety

CBRN release or incident has the potential to compromise the health and safety of those living and working in the area of the incident. Specific impacts vary according to the type of material released, the area affected, and the population within the affected area.

A chemical incident may also include an explosion, with additional injuries and deaths being caused by the pressure wave from the explosion. Biological incidents effects on the population depend on the nature of the agent involved, transmissibility, at-risk populations, incubation period, time before detection, and other factors. Biological agents may cause disease from which some individuals will recover while others will not. Radioactive materials can cause significant health effects in individuals, especially if the materials are taken into the body. Radiological incidents that result in the release of radioactive materials from a nuclear power plant can contaminate sources of potable water, livestock, and crops, leading to a dramatically reduced local food supply. Large chemical incidents, and radiological incidents that result in the release of radioactive materials can contaminate sources of potable water, crops, and livestock, leading to a reduced local food supply.

#### Impact on General Building Stock, Critical Facilities, and Lifelines

Chemical, radiological, and nuclear incidents could cause significant damages to homes and businesses. Structures could be damaged from an explosion linked to a chemical release or could become contaminated by chemicals that may degrade the structures themselves. Radioactive contamination from a radiological incident would result in the need to decontaminate any affected structures; those that could not be decontaminated may have to be demolished. Nuclear incidents could completely destroy or seriously damage thousands of structures, depending on where the blast occurred and the strength of the detonation. Biological incidents would not affect the structures themselves but could still result in damages to buildings and critical infrastructure. If a structure required regular maintenance, and a biological incident rendered the maintenance staff unavailable for a prolonged period of time, the structure could suffer damages. Likewise, if the operators at a critical piece of infrastructure, such as a power plant, were unavailable, there could be physical damages to the infrastructure itself.

#### **Impact on Economy**

CBRN incidents could impact the local economy in a number of ways. Chemical, radiological, and nuclear incidents could result in significant physical damages to businesses and infrastructure, which would require repair and perhaps remediation to address. Many businesses would never recover from a prolonged closure. Businesses would also suffer from a decreased workforce and lower productivity from any type of CBRN incident. Contamination of the local food and water supply due to radioactive contamination may lead to herd culling and crop destruction that dramatically reduce the economic value of the County's and region's farmlands.

#### **Impact on Environment**

CBRN releases can contaminate soil, water systems, plants, insects, and animals. Certain chemicals and hazardous materials can be toxic to plants and animals, damaging their habitats and food sources. Radioactive materials released into the environment could enter the food chain and ultimately contaminate the human food supply. Nuclear impacts on the environment are similar to that of radioactive materials; however, the extent of impacts can be larger due to the amount of miles it can impact (NYC 2019).

# **Cascading Impacts on Other Hazards**

CBRN incidents can cause utility failure. If an explosion or contamination occurred, water quality and supply could stop or drastically decrease.





## Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

#### **Projected Development**

Understanding future changes that impact vulnerability in the Westchester County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. An increase in development and population can increase the likelihood of a CBRN incident. Future migration to larger jurisdictions may also increase the likelihood of an incident. The tables and hazard maps included in the jurisdictional annexes contain additional information regarding the specific areas of development that would increase county vulnerability to the CBRN hazard.

#### Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Increased population trends throughout the County can the overall risk to CBRN incidents. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

#### **Climate Change**

As temperatures change, excessive heat on containers that contain CBRN materials may alter the material properties. In addition, materials and facilities located in the floodplain may experience an increase in flood events due to the project changes in increased precipitation events, magnitude, and frequency.

#### **Change of Vulnerability Since the 2015 HMP**

This vulnerability assessment uses updated data where applicable to provide a better understanding of the potential impacts caused by CBRN.





# 5.4.8 Disease Outbreak

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Westchester County.

# 5.4.8.1 **Profile**

# **Hazard Description**

An outbreak or an epidemic occurs when new cases of a certain disease, in a given population, substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic. Pandemic is defined as a disease occurring over a wide geographic area and affecting a high proportion of the population. A pandemic can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person-to-person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and Federal government (NJOEM 2019).

Most disease outbreaks occur due to respiratory viruses. A respiratory virus with pandemic potential is a highly contagious respiratory virus that spreads easily from person to person and for which there is little human immunity. This hazard includes pandemic influenza. This hazard strains the healthcare system, requires school closures, causes high rates of illness and absenteeism that undermine critical infrastructure across the city, and decreases community trust due to social distancing measures interfering with personal movement and being perceived as being ineffectual. Previous events that exemplify this hazard include the 1918 ("Spanish flu") and 2009 ("Swine flu") influenza pandemics and the 2003 SARS outbreak, which had pandemic potential (NYC Emergency Management 2019).

In addition to respiratory viruses, diseases with new or emerging features can challenge control. Emerging diseases are difficult to contain or treat and present significant challenges to risk communication since mechanics of transmission, laboratory identification, and effective treatment protocols may be unknown (NYC Emergency Management 2019).

Of particular concern in Westchester County are arthropod-borne viruses (arboviruses), which are viruses that are maintained in nature through biological transmission between susceptible hosts (mammals) and blood-feeding arthropods (mosquitos and ticks). These infections usually occur during warm weather months, when mosquitoes and ticks are active (NYS Department of Health 2017a).

Mosquito-borne diseases are diseases that are spread through the bite of an infected female mosquito. West Nile Virus (WNV) is the most common mosquito-borne disease recently impacting Westchester County. These diseases rely on mosquitos to spread. They become infected by feeding on birds carrying the virus; and then spread to humans and other animals when the mosquito bites them (NYS Department of Health 2017a).

Tick-borne diseases are bacterial illnesses that spread to humans through infected ticks. These types of diseases rely on ticks for transmission. Ticks become infected by micro-organisms when feeding on small infected mammals (mice and voles). Different tick-borne diseases are caused by different micro-organisms, and it is possible to be infected with more than one tick-borne disease at a time. Anyone who is bitten by an infected tick may get a tick-borne disease. People who spend a lot of time outdoors have a greater risk of becoming infected. The three types of ticks in New York that may carry disease-causing micro-organisms are the Blacklegged Tick (Ixodes scapularis) (also known as Deer Tick), Lone Star Tick (*Amblyomma americanum*), and the American dog tick (*Dermacentor variabilis*) (NYS Department of Health 2019a).





For the purpose of this HMP update, the following diseases will be discussed in further detail: West Nile Virus, Lyme Disease, Influenza, and Coronavirus.

#### West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne disease in the United States. It is most commonly spread to people who are bitten by an infected mosquito. WNV is usually diagnosed during mosquito season, starting in the summer months and continues through the fall (CDC, West Nile Virus 2021). WNV was first found in New York State in 1999. Since 2000, 490 human cases and 37 deaths of WNV have been reported statewide (NYSDOH, West Nile Virus (WNV) Disease 2017). The symptoms of severe infection (West Nile encephalitis or meningitis) can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (NYSDOH, West Nile Virus (WNV) Disease 2017).

#### Lyme Disease

Lyme disease is the most common vector-borne disease in the United States. It is an illness caused by infection with the bacterium *Borrelia burgdorferi*, which is carried by ticks. Typical symptoms include fever, headache, fatigue, and skin rash. If left untreated, symptoms can be severe. Lyme disease is spread to people by the bite of an infected tick (CDC, Lyme Disease 2021). In New York, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (NYSDOH, Lyme Disease and Other Diseases Carried by Ticks 2019).

#### Influenza

Influenza (the flu) is a contagious virus that affects the nose, throat, lunches, and other parts of the body. It can quickly spread from one person to another, causing mile to severe illness and can lead to death. Symptoms include: fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (NYSDOH, What You Should Know About the Flu 2021).

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability. Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (Barry-Eaton District Health Department 2013).

#### Coronavirus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (WHO 2020). With the virus being relatively new, information regarding transmission and symptoms of the virus is still new. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Reported illnesses have ranged from mild symptoms to severe illness





and death. Reported symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion or inability to wake or stay awake, and bluish lips or face. Symptoms may appear 2-14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC, COVID-19 2021).

As of October 30, 2021, Westchester County has 144,409 positive cases of COVID-19 (GIS 2021).

#### Extent

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

The extent and location of disease outbreaks depends on the preferred habitat of the species, as well as the species' ease of movement and establishment. The magnitude of disease outbreaks species ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted to an infestation. The presence of disease-carrying mosquitoes and ticks has been reported throughout most of New York and Westchester County.

#### West Nile Virus

Since it was discovered in the western hemisphere, WNV has spread rapidly across North America, affecting thousands of birds, horses and humans. WNV swept from the New York City region in 1999 to almost all of the continental U.S., seven Canadian provinces and throughout Mexico and parts of the Caribbean by 2004. illustrates WNV activity in the U.S. from 1999-2019. Figure 5.4.8-1 shows the average annual WNV incidence in the United States. The figure shows that Westchester County has between 0.01 and 0.49 incidence per 100,000 (CDC, Final Cumulative Maps & Data for 1999–2019 2021).

#### Lyme Disease

Lyme disease is the most commonly reported vector borne illness in the U.S. Between 2000 and 2018, there were 4,697 confirmed cases of Lyme disease in Westchester County, including 746 cases in 2004 alone (Check 2021). Figure 5.4.8-2 shows the risk of Lyme disease in New York State. The figure indicates that Westchester County has some of the lowest incidence of the disease, with a rate of 31.5 persons per 100,000 people between 2014-2016.





Figure 5.4.8-1. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2019





# Figure 5.4.8-2. Lyme Disease Incidence Rate per 100,000 people, 2014-2016





The red circle indicates the approximate location of Westchester County.





#### Influenza and Coronavirus

As noted above, the exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness. The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe.

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2005 to redefine these phases. This schema is designed to provide guidance to the international community and to national governments on preparedness and response for pandemic threats and pandemic disease. Compared with the 1999 phases, the new definitions place more emphasis on pre-pandemic phases when pandemic threats may exist in animals or when new influenza virus subtypes infect people but do not spread efficiently. Because recognizing that distinctions between the two interpandemic phases and the three pandemic alert phases may be unclear, the WHO Secretariat proposes that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2009). The WHO pandemic phases are outlined in Table 5.4.8-1.

Phase	Description				
Preparedness					
Phase 1	No viruses circulating among animals have been reported to cause infections in humans.				
Phase 2	An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.				
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.				
	Response and Mitigation Efforts				
Phase 4	Human infection(s) are reported with a new subtype, but no human-to-human spread or at most rare instances of spread to a close contact.				
Phase 5	is characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.				
Phase 6	the pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.				

#### Table 5.4.8-1. WHO Global Pandemic Phases

Source: WHO 2009

In New York, activities to be undertaken by pandemic period, use the World Health Organization's classification system. The Pandemic Influenza Plan describes activities which are designated as to whether they are the role of the state health department, local health department and/or providers and public health partners (NYS Department of Health 2006).

Between 2017 and 2021, there were 22,142 laboratory confirmed cases on influenza in Westchester County (NYSDOH, NYS Health Connector 2021). Those most vulnerable to influenza include young children and the elderly, although anyone can become infected.





#### Location

Westchester County's geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. In terms of pandemic influenza, all counties may experience pandemic influenza outbreak caused by factors such as population density and the nature of public meeting areas. Densely populated areas will spread diseases quicker than less densely populated areas. There are some densely populated municipalities in the County, leading to the spread of influenza and mumps more quickly than less densely populated communities.

#### **Previous Occurrences and Losses**

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout New York and Westchester County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

#### FEMA Major Disasters and Emergency Declarations

Between 1954 and 2021, the State of New York was included in two disease outbreak-related emergency (EM) declarations; one for West Nile Virus and one for the coronavirus pandemic. The State was also included in a disaster (DR) declaration for the coronavirus pandemic. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Westchester County was included in both of these declarations (FEMA 2021).

Date(s) of Event	FEMA Declaration Number (if applicable)	Westchester County Designated?	Incident Type	Declaration Title
May 22-November 1, 2000	EM-3155	Yes	Other	West Nile Virus
January 20, 2020 – ongoing	DR-4480	Yes	Biological	COVID-19 Pandemic

#### Table 5.4.8-2. Disease Outbreak-Related FEMA Declarations for Westchester County, 1954 to 2021

Source: FEMA 2021

#### USDA Declarations

Between 2012 and 2021, Westchester County has not been included in any disease-related disaster events, as declared by the USDA.

#### Previous Events

For this 2021 HMP update, known disease outbreak events that have impacted Westchester County between 2014 and 2021 are identified in Table 5.4.8-3, below.

#### Table 5.4.8-3. Major Disease Outbreaks in Westchester County, NY, 2014 - 2021

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Westchester County Designated?	Description
2014	Influenza	N/A	N/A	2,781 confirmed cases of influenza in Westchester County
2014	Lyme	N/A	N/A	88 confirmed cases of Lyme disease in Westchester County
	Disease			




Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Westchester County Designated?	Description
2014	West Nile Virus	N/A	N/A	Two confirmed cases of WNV in Westchester County
2015	Influenza	N/A	N/A	2,215 confirmed cases of influenza in Westchester County
2015	Lyme Disease	N/A	N/A	153 confirmed cases of Lyme disease in Westchester County
2015	West Nile Virus	N/A	N/A	Three confirmed cases of WNV in Westchester County
2016	Influenza	N/A	N/A	4,049 confirmed cases of influenza in Westchester County
2016	Lyme Disease	N/A	N/A	97 confirmed cases of Lyme disease in Westchester County
2017	Influenza	N/A	N/A	4,972 confirmed cases of influenza in Westchester County
2017	Lyme Disease	N/A	N/A	108 confirmed cases of Lyme disease in Westchester County
2017	West Nile Virus	N/A	N/A	Three confirmed cases of WNV in Westchester County
2018	Influenza	N/A	N/A	8,172 confirmed cases of influenza in Westchester County
2018	Lyme Disease	N/A	N/A	119 confirmed cases of Lyme disease in Westchester County
2018	West Nile Virus	N/A	N/A	Four confirmed cases of WNV in Westchester County
2019	Influenza	N/A	N/A	7,451 confirmed cases of influenza in Westchester County
2020	Influenza	N/A	N/A	180 confirmed cases of influenza in Westchester County
2020- 2021	Coronavirus	DR-4480	Yes	As of October 31, 2021, Westchester County had 144,477 confirmed cases of COVID-19. Of which, 2,349 fatalities resulted. The City of Yonkers has the highest number of confirmed cases, 32,637.

Source: Westchester County Department of Health 2021; Westchester County GIS 2021; NYS Health Connector 2021

## **Probability of Future Occurrences**

It is difficult to predict when the next disease outbreak will occur and how severe it will be because viruses are always changing. The United States and other countries are constantly preparing to respond to pandemics. The Department of Health and Human Services and others are developing supplies of vaccines and medicines. In addition, the United States has been working with the WHO and other countries to strengthen detection of disease and response to outbreaks. Preparedness efforts are ongoing via the New York State Department of Health, and local health departments through Community Preparedness programs to empower local health departments and their community partners to promote local readiness, foster community resilience and to ensure comprehensive, coordinated, and effective responses (NYS Department of Health 2010).

In Westchester County, the probability for a future disease outbreak event is dependent on several factors. One factor that influences the spread of disease is population density. Populations that live close to one another are more likely to spread diseases. As population density increases in the County, so too will the probability of a disease outbreak event occurring. When there is a significant change in a circulating strain of a virus, more of the population is susceptible and the strain has the ability to rapidly spread from person to person (Management 2019).

As for mosquito-borne and tick-borne diseases, as long as mosquitoes and ticks are found in Westchester County, the risk of contracting WNV, Lyme disease, or other diseases carried by these insects exists. Instances of WNV have been generally decreasing throughout the northeast United States due to planning and eradication efforts. However, some scientists anticipate an increase in WNV and other mosquito-borne diseases due to changing climate conditions creating suitable habitats for mosquitoes (CDC, West Nile Virus in the United States 2013). Disease-carrying ticks will continue to inhabit Westchester County and the threat





of Lyme disease and other tick-borne diseases will continue. Similar to mosquitoes, there are eradication efforts in place to control the tick population and new methods of control are being developed (Steere, Coburn and Glickstein 2004). Therefore, based on all available information and available data regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Westchester County.

In Section 5.3, the identified hazards of concern for Westchester County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for disease outbreaks in the County is considered 'frequent' (100-percent annual probability; a hazard event may occur multiple times per year, as presented in Section 5.3 [Hazard Ranking]).

# **Climate Change Impacts**

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Westchester County is part of Region 5, East Hudson and Mohawk River Valleys. Some of the issues in this region, affected by climate change, include: more frequent heat waves and above 90°F days, more heat-related deaths, increased frequency of heavy precipitation and flooding, decline in air quality, etc. (NYSERDA 2011).

Temperatures in New York State are warming, with an average rate of warming over the past century of  $0.25^{\circ}$  F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA, Climate Change in New York State 2014).

Regional precipitation across New York State is projected to increase by approximately one to eight-percent by the 2020s, three to 12-percent by the 2050s, and four to 15-percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State (NYSERDA, Climate Change in New York State 2014).

In Region 5, it is estimated that temperatures will increase by 3.5°F to 7.1°F by the 2050s and 4.1°F to 11.4°F by the 2080s (baseline of 47.6°F). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 17% by the 2080s (baseline of 38.6 inches). Table 5.4.8-5 displays the projected seasonal precipitation change for the East Hudson and Mohawk River Valleys ClimAID Region (NYSERDA, 2014).

Table 5.4.8-4	. Projected Seasonal	Precipitation C	Change in I	Region 5, 2050s (	(% change)
---------------	----------------------	-----------------	-------------	-------------------	------------

	Winter	Spring	Summer	Fall
	+5 to +15	-5 to +10	-5 to +5	-5 to +10
Source:	NYSERDA 2011			

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The changes in





climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resources Defense Council 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Spross 2013).

# 5.4.8.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Westchester County's vulnerability, in a qualitative nature, to the disease outbreak hazard.

# Impact on Life, Health and Safety

The entire population of Westchester County is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020). Population data from the 2019 5-year American Community Survey indicates that there are 162,363 persons over 65 years old in Westchester County. This age group would be considered at risk for getting severely ill from the COVID-19 virus. While the statistics of this virus are subject to change during the publication of this HMP, the New York Department of Health dashboard shows that there is a higher percent of illnesses within the mentioned age group and that Westchester County is among the harder hit counties in the State in terms of total COVID-19 cases (New York State Department of Health 2020). The City of Yonkers has the highest number of positive cases, 32,637 cases, since the start of the pandemic (GIS 2021).

## **Impact on General Building Stock**

No structures are anticipated to be directly affected by disease outbreaks.

## Impact on Critical Facilities and Lifelines

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients which may cause interruption of services, but it is unlikely that there will be damages to the facilities. Large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020-2021 coronavirus pandemic has led to overwhelmed hospitals in numerous locations across New York State, including Westchester County.

## Impact on Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs





implemented by the County to address this hazard are described below, all of which could impact the local economy.

Within New York State, the Mid-Hudson Region, which includes Westchester County, was one of the hardest hit by the COVID-19 pandemic. The pandemic put closed businesses, strained the healthcare systems, stressed nonprofits and educational institutions, and stretched public budgets (Association 2020). This resulted in significant impacts and disruption to the County's economy including loss of jobs, decrease in home sales, and disruption in tourism (Council 2020). Though the full scale of the economic fallout is yet to be quantified, the economic impact from disease outbreak was clearly felt in Westchester County.

Smaller-scale disease outbreaks can also cause negative economic impacts, though the extent of impact is variable. For example, an outbreak in mosquito or tick-borne diseases can impact Westchester County's local economies associated with tourism and the use of parks and waterbodies.

## **Impact on Environment**

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and the New York Department of Environmental Conservation. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. As a result, pesticides must be registered before they can be sold, distributed, or used in the state (New York Department of Environmental Conservation 2020).

#### **Cascading Impacts on Other Hazards**

There are no known cascading impacts that disease outbreaks can cause to other hazards of concern for Westchester County.

## Future Changes that May Impact Vulnerability

Understanding future changes that may impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

## **Projected Development**

As discussed in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed and vulnerable. Additional development of structures in areas with high population density are at an increased risk. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

## Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Changes in the density of population when households





move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

## **Climate Change**

As discussed earlier in this section, the relationship between climate change and increase in infectious diseases is difficult to predict with certainty, however there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease.

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

## Change of Vulnerability Since the 2015 HMP

This vulnerability assessment has been expanded on the 2015 plan to include the additional diseases in the profile. In addition the Ebola virus and pandemic influenzas, tick-borne diseases including Lyme and West Nile Virus as well as coronavirus are included in this section. Updated data regarding the extent of these diseases is included to provide a better understanding of the potential impacts caused by the disease outbreak hazard.



# SECTION 6. CAPABILITY ASSESSMENT AND MITIGATION STRATEGIES

This section presents mitigation strategies for Westchester County to reduce potential exposure and losses identified as concerns in the Risk Assessment portion of this plan. The Steering Committee reviewed the Risk Assessment to identify and develop these mitigation actions, which are presented herein.

This section includes:

- 1. Background and Past Mitigation Accomplishments
- 2. General Mitigation Planning Approach
- 3. Review and Update of Mitigation Goals and Objectives
- 4. Capability Assessment
- 5. Mitigation Strategy Development and Update

#### Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

# 6.1 Background and Past Mitigation Accomplishments

In accordance with the requirements of the Disaster Mitigation Act of 2000, detailed on Page 1-1 in Section 1 (Introduction), a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this plan update. Westchester County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- Mamaroneck River Restoration Project Phase II: Removed invasive vegetation, embankment stabilization, and re-planting in the area of Saxon Woods Park along the Mamaroneck River in the Town of Mamaroneck.
- Flood Mitigation Project South of Harney Road, BRP Reservation: Remove substantial amount of coarse sediment from Bronx River channel, stabilize riverbanks, and construct river channel low improvement structures in the Bronx River south of Harney Road in Eastchester and Yonkers. Design has been completed and bonding authorized.
- Bronx River and Sprain Brook: Project will remove the large sediment deposit at the confluence and stabilize the stream banks at the confluence of the Bronx River and Grassy Sprain Brook within the Bronx River Reservation.
- Flood Mitigation Project at Anita Lane/Valley Place on Mamaroneck River: Replace existing bridge carrying county sewer pipe over Mamaroneck River with a new bridge that will enable improved flow in river channel during severe storms in the Village of Mamaroneck at Anita Lane.
- Stormwater management along Fulton Brook: Stormwater management practices and embankment stabilization in the area Bronx River Reservation near County Center and White Plains.
- The County facilitated the development of the original 2015 "Westchester County All Hazards Mitigation Plan Update". The current planning process represents the regulatory five-year plan update process, which includes participation of all municipal governments in the County, along with key county and regional stakeholders.





- All municipalities with the exception of the Towns of Rye and Pelham participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.
- The County and municipalities have implemented mitigation actions to protect critical facilities and infrastructure throughout the planning area. As an example, the Highway Department maintains a multi-year, rotating program of roadway and culvert (drainage) maintenance and improvements to help mitigate stormwater damage to county roads.
- Numerous studies have been conducted by Federal, State, County, and local agencies/entities to examine natural hazards affecting Westchester County, and have been reviewed and incorporated into this plan update as appropriate (see Section 3 and References).
- Municipalities in Westchester County have adopted regulatory standards regarding land-use and zoning that exceed minimum requirements and provide the communities with greater capability to manage development without increasing hazard risk and vulnerability. Examples of these standards are presented in the Capability Assessment subsection later in this chapter.
- The County has been incorporating flood risk reduction through stormwater management into its infrastructure and building improvement projects. All projects, especially in areas adjacent to waterways, are oversized to accommodate the potential of future flooding.

# 6.2 General Mitigation Planning Approach

The overall approach used to update the County and local hazard mitigation strategies are based on FEMA and NYS regulations and guidance regarding local mitigation plan development, including the following:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA Local Mitigation Planning Handbook, March 2013.
- FEMA Local Mitigation Plan Review Guide, October 1, 2011.
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013.
- FEMA Plan Integration: Linking Local Planning Efforts, July 2015.
- FEMA Mitigation Planning How-To Guide #3, Identifying Mitigation Actions, and Implementing Strategies (FEMA 386-3), DATE.
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013.
- NYS DHSES New York State Hazard Mitigation Planning Standards, 2017.
- NYS DHSES New York State Hazard Mitigation Planning Standards Guide, 2017.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections:

- 6.3 Review and update mitigation goals and objectives.
- 6.4 Identify mitigation capabilities and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- 6.5 Prepare an implementation strategy, including:
  - Identify progress on previous county and local mitigation strategies.
  - o Develop updated county and local mitigation strategies.
  - Prioritize projects and initiatives in the updated mitigation strategy.

# 6.3 Review and Update of Mitigation Goals and Objectives

This section documents the County's efforts to develop hazard mitigation goals and objectives that are established to reduce or avoid long-term vulnerabilities to the identified hazards.





# 6.3.1 Mission Statement

In order to provide a guiding principle to describe the overall duty and purpose of the planning process and in accordance with FEMA guidance (386-1), the Westchester County Hazard Mitigation Plan Steering Committee chose to develop a Mission Statement for this plan. The intent of this statement is to focus the range of goals and objectives identified to support the over-arching purpose of the plan. This is provided as an enhancement to the 2015 plan which did not include a mission statement or guiding principle.

As a result of the committee deliberations, the 2021 Westchester County Hazard Mitigation Mission Statement is as follows:

The mission of the Westchester County Hazard Mitigation Plan is to protect and enhance the health, safety, property, environment, and economy of the communities within Westchester County and to increase resilience by partnering and planning to identify and reduce future vulnerability to natural and other emerging hazards in an equitable, proactive, and efficient manner.

# 6.3.2 Goals and Objectives

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." The mitigation goals have been developed based on the risk assessment results, discussions, research, and input from amongst the committee, existing authorities, polices, programs, resources, stakeholders, and the public.

For the purposes of this plan, goals and objectives are defined as follows:

*Goals* are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

FEMA defines *Goals* as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines *Objectives* as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines *Mitigation Actions* as specific actions that help to achieve the mitigation goals and objectives.

**Objectives** are short-term aims, which when combined form a strategy or course of

action to meet a goal. Unlike goals, objectives are a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset for a goal. The objectives also are used to help establish priorities.

The goals and associated objectives for Westchester County and municipalities included in the plan were developed based in part on a review of the hazard mitigation goals and objectives established in the 2019 NYS HMP, the 2005 Westchester County HMP, as well as the current or expired municipal hazard mitigation plans within the county. Further, these goals were selected to be compatible with the needs and goals expressed in other available County and local community planning documents. Achievement of these goals helps to define the effectiveness of a mitigation strategy.

Table 6-1 presents the updated hazard mitigation planning goals and objectives established for this plan update.

## Table 6-1. Westchester County Hazard Mitigation Plan Goals and Objectives

Goal	Objective
Goal 1: Protect Public Health and Safety.	1.1: Identify and reduce the impacts of hazards on vulnerable populations and critical natural resources and infrastructure.





Goal	Objective		
	1.2: Improve and promote systems that provide early warning and emergency communications.		
	1.3: Reduce public health impacts from natural and non-natural hazards by identifying associated risks and protective measures.		
	1.4: Build regional, county, and local mitigation and related emergency management capabilities and support continuity of operations.		
	1.5: Promote post-disaster mitigation as part of restoration and recovery.		
Goal 2: Protect property, including public and	2.1: Reduce repetitive and severe repetitive losses through mitigation or adaptation.		
facilities, and infrastructure.	2.2: Implement mitigation programs that protect critical facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, maintain operations, and expedite recovery from an emergency.		
	2.3: Create redundancies for critical networks such as water, sewer, digital data, power, and communications.		
	2.4: Improve availability of hazard data and information for inclusion into locally developed plans and procedures.		
	2.5: Integrate new hazard and risk information into building codes and land use planning mechanisms.		
	2.6: Address long-term vulnerabilities from High Hazard Dams		
Goal 3: Increase education and awareness and promote relationships among stakeholders	3.1: Improve public knowledge of hazards and protective measures so individuals are able to appropriately respond during hazard events.		
officials, and property owners to develop	3.2: Promote partnerships for improving integration of hazard mitigation into comprehensive emergency planning efforts.		
opportunities for mitigation of natural hazards and to increase resilience.	3.3: Educate public officials, developers, realtors, contractors, building owners, and the general public about hazard risks and building requirements.		
	3.4: Increase social resiliency by improving knowledge about natural hazards along with corresponding adaptive mitigation strategies.		
	3.5: Partner with the private sector to promote hazard mitigation as part of standard business practices.		
Goal 4: Encourage the development and	4.1: Identify and promote the beneficial functions of natural systems as mitigation against natural hazards and climate change.		
implementation of long- term, cost-effective, environmentally sound,	4.2: Adopt and enforce public policies and ordinances that protect existing beneficial natural systems and minimize negative impacts of development on natural systems.		
and resilient mitigation projects to preserve or	4.3: Encourage use of nature-based solutions for development and mitigation strategies that reduce impacts to the environment and enhance mitigation effectiveness.		



Goal	Objective	
restore the functions of	4.4: Promote climate change mitigation and adaption strategies that protect against	
natural systems.	long-term effects on the population and the environment.	

# 6.4 Capability Assessment

According to FEMA's *Mitigation Planning How-To Guide #3*, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation (FEMA 2013).

During the original planning process, the County and participating municipalities identified and assessed their capabilities in the areas of existing programs, policies, and technical documents. By completing this assessment, each jurisdiction learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions;
- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions;
- Action is currently outside the scope of capabilities;
- Types of mitigation actions that may be technically, legally (regulatory) administratively, politically, or fiscally challenging or infeasible;
- Opportunities to enhance local capabilities to support long term mitigation and risk reduction.

During the plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation, and identifying opportunities to enhance local capabilities.

County and municipal capabilities in the Planning and Regulatory, Administrative and Technical, and Fiscal arenas can be found in the Capability Assessment section of each jurisdictional annex in Section 9 (Jurisdictional Annexes). Within each annex, participating jurisdictions identified integration of hazard risk management into their existing planning, regulatory, and operational/administrative framework ("integration capabilities") and intended integration promotion (*integration actions*). A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 (Plan Maintenance).

A summary of the various federal, state, county, and local planning, and regulatory, administrative, and technical, and fiscal programs available to promote and support mitigation and risk reduction in Broome County are presented below.

# 6.4.1 Planning and Regulatory Capabilities - County and Local

# Municipal Land Use Planning and Regulatory Authority

The County and municipalities have various land use planning mechanisms that can be leveraged to mitigate flooding and support natural hazard risk reduction. The Westchester County Department of Planning, using FEMA grant funding, developed *Flooding and Land Use Planning: A Guidance Document for Municipal Officials and Planners* (June 2010). This manual was created for elected officials, planning and zoning board





members, planners, and development professionals to improve land use decisions with respect to flooding and flood damage. The manual covers the following topics as they relate to flooding:

- Flooding causes and the relationship to development
- Regulations for government agencies associated with flood control and flood hazard mitigation
- Comprehensive and watershed planning
- Stormwater management
- Successful floodplain management tools
- Local ordinances
- Site plan review tools
- Stormwater management design

The manual also includes an extensive appendix with a glossary and references, including a summary of federal and state programs that support the items addressed. The manual can be found here: <a href="http://planning.westchestergov.com/images/stories/reports/FLOODGUIDE.pdf">http://planning.westchestergov.com/images/stories/reports/FLOODGUIDE.pdf</a>.

Westchester 2025: A Partnership for Westchester's Future: To further support municipal land use planning, Westchester County has created a new tool for municipalities to be used in the development of local comprehensive plans. In cooperation with local municipal governments an initial set of "planning base studies" have been developed, assembling maps, charts, figures and analysis, in the form of Web-based data sets. This is information planners have always used to draft a comprehensive plan. By tapping into existing resources, local communities will expedite the comprehensive plan process. Westchester County began this collaborative effort with the Village of Rye Brook and has since completed its latest planning base studies for the Town of New Castle.

The Westchester County Department of Planning launched Westchester 2025 - a Web-based format of its county-wide planning policies - with the intent of showing residents and municipalities the importance of working together as they shape and grow the county's infrastructure (roads, trains, sewers, etc.) and communications capabilities (wider bandwidths, GIS technology, etc.). Further information about this program may be accessed on the Westchester Government website (<u>http://westchester2025.westchestergov.com/</u>).

## National Flood Insurance Program (NFIP)

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (FEMA's 2002 National Flood Insurance Program (NFIP): Program Description). The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages.

There are three components to the NFIP: flood insurance, floodplain management and flood hazard mapping. Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage in the U.S. is reduced by nearly \$1 billion each year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance (FEMA, 2008).





The majority of municipalities in Westchester County actively participate in the NFIP. As of October 16, 2021, there were 6,551 NFIP policyholders in Westchester County. There have been 11,902 claims made to date, totaling approximately \$165 million for damages to structures and contents. There are 1,227 NFIP Repetitive Loss (RL) properties, properties in the county. Further details on the flood vulnerability within the County may be found in the flood hazard profile (Section 5.4.3).

Municipal participation in and compliance with the NFIP is supported at the federal level by FEMA Region II and the Insurance Services Organization (ISO), at the state-level by the New York State Department of Environmental Conservation (NYSDEC) and New York State Office of Emergency Management (NYS DHSES). Additional information on the NFIP program and its implementation throughout the county may be found in the flood hazard profile (Section 5).

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

**Freeboard:** By law, NYS requires Base Flood Elevation plus 2 feet (BFE+2) for all single- and two-family residential construction, and BFE+1 for all other types of construction. Communities may go beyond this requirement, providing for additional freeboard or requiring BFE+2 for all types of construction. A number of Westchester municipalities have supported property owners meeting and exceeding freeboard requirements through the site plan review and zoning board of approvals process; for instance, allowing overall structure heights to be determined from BFE+2 rather than grade within NFIP floodplains.

**Cumulative Substantial Improvements/Damages:** The NFIP allows improvements valued at up to 50% of the building's pre-improvement value to be permitted without meeting the flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

Limit of Moderate Wave Action (LiMWA): LiMWA depicts the Limit of the Area of Moderate Wave Action (MOWA), the portion of the 1% annual chance coastal flood hazard area referenced by building codes and standards, where base flood wave heights are between 1.5 and 3 feet, and where wave characteristics are deemed sufficient to damage many National Flood Insurance Program (NFIP)-compliant structures on shallow or solid wall foundations. Coastal communities may adopt what is commonly referred to as the "LiMWA standard" where they enforce "V zone" construction standards within coastal LiMWA "A zones".

# NFIP Community Rating System (CRS)

As an additional component of the NFIP, the Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance (FEMA, 2012). Municipalities and the county as a whole could expect significant cost savings on premiums if enrolled in the CRS program.

Currently the Village of Scarsdale is the only community in Westchester County participating in the CRS program. The Village holds a Class 8 rating, resulting in a 10 percent discount on flood insurance.





#### Stormwater Management Law - Stormwater Reconnaissance Plans

The County enacted a Stormwater Management Law in 2011 requiring the preparation of "reconnaissance" plans that assess current conditions and identify cost-effective projects to directly address flooding and flood damage and impacts throughout Westchester. The law creates a program whereby the County may provide funding assistance to municipalities proposing projects that address flooding problems listed in the plans. A Stormwater Advisory Board created under the law began meeting in 2012 to provide advice and recommendations on projects proposed by municipalities under the program. To date, reconnaissance plans for the entire county have been prepared and approved by the County Board of Legislators, and municipalities may submit petitions through the County Department of Planning to fund potential projects. The plans also include a number of recommendations for both the County and local municipalities to reduce flooding and flood damage. The Westchester County Stormwater Management Law semi-annual status report was released on January 12, 2015 and provided updates as to what stormwater projects are being done across the county and which ones have been completed.

#### Westchester County Stormwater Management Planning Manual

The Westchester County Stormwater Management Planning Manual (Planning Manual) is the result of a project commissioned by the Westchester County Department of Planning. The Planning Manual's intent is to provide a planning framework for municipalities with which to manage stormwater on a watershed basis. In this way, stormwater management planning will occur within the parameters that hydrology and watersheds impose. By developing a watershed-wide planning approach, it will become easier to develop land use plans and zoning ordinances that encourage proper stormwater management, and that protect the natural hydrologic cycle and stream habitat from being degraded by improper development. The Planning Manual is intended as a complement to the New York State Stormwater Management Design Manual, which can be downloaded from the NYSDEC website (http://www.dec.state.ny.us).

The Planning Manual is written as a *guidance* document for local officials on the municipal level, not as a set of required procedures. It reflects many of the recent developments in improved stormwater management that are being encouraged in many neighboring states. New York State's Stormwater Management Design Manual focuses on site specific stormwater management practices (SMPs) for new developments and presents very specific design criteria that will be required as part of a permit application. The Planning Manual has a broader focus: to help local officials understand the watershed management planning process. It guides them through the data collection, data analysis, and stormwater modeling steps that are vital to developing a watershed-based stormwater management plan. It presents an approach to assessing the current and future condition of the watershed, and provides guidance on selecting SMPs to meet two watersheds goals:

- the prevention of deterioration of surface water quality and damage to the streams and riparian habitats, and
- the restoration or repair of already impacted stream systems.

As part of the development of the Planning Manual, one sub watershed was singled out to demonstrate how the planning approach can be applied. The County selected Hallocks Mill Brook as the demonstration sub watershed. Thus, in addition to a description of the overall planning process, various elements of the planning process, as carried out in the demonstration project, are included in the Planning Manual. For example, a stormwater model was developed for Hallocks Mill Brook to simulate stormwater runoff and runoff related pollutant loading to the stream.

#### Local Waterfront Revitalization Program

The Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) on a voluntary basis by preparing





and adopting a Local Waterfront Revitalization Program (LWRP), providing more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review. A number of Westchester County communities have LWRPs, as identified within the Capability Assessment section of the municipal annexes (Section 9).

When an LWRP is approved by the New York State Secretary of State, State agency actions are required to be consistent with the approved LWRP to the maximum extent practicable. When the federal government concurs with the incorporation of an LWRP into the CMP, federal agency actions must be consistent with the approved addition to the CMP. Title 19 of NYCRR Part 600, 601, 602, and 603 provide the rules and regulations that implement each of the provisions of the Waterfront Revitalization of Coastal Areas and Inland Waterways Act including but not limited to the required content of an LWRP, the processes of review and approval of an LWRP, and LWRP amendments.

The Local Waterfront Revitalization Program (LWRP) serves as the Office of Planning and Development's primary program for working in partnership with waterfront communities across the State to address local and regional (coastal or inland) waterway issues, improve water quality and natural areas, guide development to areas with adequate infrastructure and services away from sensitive resources, promote public waterfront access, and provide for redevelopment of underutilized waterfronts.

A Local Waterfront Revitalization Program consists of a planning document prepared by a community, and the program established to implement the plan. An LWRP may be comprehensive and address all issues that affect a community's entire waterfront, or it may address the most critical issues facing a significant portion of its waterfront.

An LWRP follows a step-by-step process by which a community can advance community planning from a vision to implementation, which is described in the Making the Most of Your Waterfront Guidebook developed by the Department of State. Additionally, the Opportunities Waiting to Happen Guidebook, developed by the Department of State, provides help to assist all New Yorkers to redevelop abandoned buildings as part of the overall vision for their community.

In addition to landward development, water uses are subject to an ever-increasing array of use conflicts. These include conflicts between passive and active types of recreation, between commercial and recreational uses, and between all uses and the natural resources of a harbor. Increases in recreational boating, changes in waterfront uses, coastal hazards what to do with dredged materials, competition for space, climate change, and multiple regulating authorities, all make effective harbor management complex. These conflicts and a lack of clear authority to solve them have resulted in degraded natural and cultural characteristics of many harbors, and their ability to support a range of appropriate uses. As part of an LWRP, a harbor management plan can be used to analyze and resolve these conflicts and issues.

An approved LWRP reflects community consensus and provides a clear direction for appropriate future development. It establishes a long-term partnership among local government, community-based organizations, and the State. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State Environmental Protection Fund Local Waterfront Revitalization Program (EPF LWRP) among other sources.

In addition, State permitting, funding, and direct actions must be consistent, to the maximum extent practicable, with an approved LWRP. Within the federally defined coastal area, federal agency activities are also required to be consistent with an approved LWRP. This "consistency" provision is a strong tool that helps ensure all government levels work in unison to build a stronger economy and a healthier environment.





## Saw Mill River Coalition 5-Year Action Plan 2020

The Saw Mill River Coalition, a program of Groundwork Hudson Valley, was established in 2001 with a vision of revitalizing and protecting the Saw Mill River. Throughout the last two decades, the coalition has worked to promote the health of the river through community-based initiatives, such as organizing vine cutting and river cleanup events and supporting government led projects like the Saw Mill River Daylighting in Downtown Yonkers. However, there are still great challenges the river faces, as it runs entirely through highly developed suburban and urban areas. To face these challenges, it is important to develop a process which can ensure continuity of coalition work. In the past few years, the coalition chose to follow the path of other successful watershed alliances in the United States. A State of the Watershed Report was published in 2019, which along with municipal and community input, led to the development of this 5-Year Action Plan. Looking forward, the coalition aims to focus its efforts on developing, together with Westchester County, a comprehensive watershed management plan.

Just like every watershed has its unique characteristics, so does every watershed alliance. Therefore, this action plan not only outlines what we wish to see in the future, but also identifies existing assets and past achievements of our coalition. Such assets include active stewardship program, led by Groundwork Hudson Valley, a successful water sampling program, led by the Sarah Lawrence College Center for the Urban River at Beczak, a county supported advisory board as well as past plans and reports, municipal surveys, community input sessions and a renowned river daylighting project. This plan draws upon those assets and sets clear goals and objectives for further strengthening them.

The plan consists of six sections, focusing on the fields of stormwater management, water quality, habitat restoration, community engagement and stewardship, access and recreation and stakeholder coordination. It is important to note that the success of achieving the objectives of this plan is highly dependent on the ability to ensure continuous funding for the work of the coalition towards the planning and implementation of projects. The strategies, tasks and measurable outcomes detailed in the plan should be viewed as guidelines for efforts to be made by members of the coalition, local municipalities, and the county government to support the restoration of the Saw Mill River.

#### The Groton Plan for Westchester

The concept of preparing a plan for the Croton Water- shed in conjunction with enactment of new Rules and Regulations by the New York City Department of Environmental Protection (DEP), originated among the Northern Westchester watershed towns during negotiations of the MOA. The local governments were un- sure of the potential impact the new Rules and Regulations would have on the economic viability of their communities and on individual homeowners. The towns, with the support of Westchester County, argued that the City of New York should provide funding for such a planning program as part of the MOA. This position of the local communities led to the pro- visions for a Croton planning process in the MOA.

Ten of the 12 Westchester municipalities that are parties to the MOA have land within the Croton Watershed. (The towns of Harrison and Mount Pleasant have land in the Kensico Watershed only.) In January 1998, all ten Croton Watershed municipalities and the County of Westchester agreed by resolution to participate in the development of the Croton Plan. (Although a full partner in this project, data on the Town of North Castle is not included in all aspects of the Croton Plan program due to the fact that only 219 acres of the town are in the Croton Watershed, less than 0.1% of the total watershed area.) The local governments requested that the County lead the planning process.





#### **Climate Action Plan**

For the first time in 11 years, Westchester County is assembling a comprehensive climate action plan to address the threat climate change poses to our communities and create a roadmap for sustainable, environmentally conscious solutions. Multiple programs, actions, and initiatives have already been completed while the plan is being written.

With a \$100K grant from the NYS Department of Environmental Conservation, Westchester County Climate Action Planning Institute (Westchester CAPI) will complete individualized local government operations Greenhouse Gas Inventories (GHGI) and Climate Action Plans (CAP) for each of the nine participating local governments: Westchester County; Villages of Hastings-on-Hudson, Irvington, Ossining, Pelham, Tarrytown; Town of Ossining; and Cities of Peekskill and White Plains. As lead applicant and project participant, Westchester County's project team will include County staff and appointed members of its Climate Smart Communities Task Force. Each partner municipality will contribute a similar team. Upon Westchester CAPI's completion, the County and partner municipalities will present their GHGIs and CAPs at a final working group meeting and to their respective environmental committees and elected officials. The Hudson Valley Regional Council as primary project partner, in conjunction with ICLEI staff, will guide participants in the development of their GHGIs and CAPs.

#### Bronx River Corridor Study and Management Plan for Westchester County, NY - Volume I

The Westchester County Soil and Water Conservation District and Department of Planning have contracted with Field Geology Services, LLC and Tau Engineering to develop a Bronx River Corridor Study and Management Plan (BRCSMP) with the goal of identifying and prioritizing opportunities for reducing flooding and erosion along the Bronx River while simultaneously improving channel stability, aquatic habitat, and recreational use within the river corridor. The term river "corridor" is defined here as the valley bottom area across which the river flows and includes the floodplain as well as areas of artificial fill on the valley bottom that have raised the floodplain surface above the level of floods. The area covered by the BRCSMP covers the 14.1-mile length of the Bronx River and adjacent floodplain corridor in Westchester County from Kensico Dam in Valhalla, NY to the Bronx border in Yonkers, NY (Figure 1). Two tributaries, Grassy Sprain Brook and Laurel Brook, were also investigated given their close association with known areas of concern on the Bronx River itself. (Some figures and tables in this report are embedded within the narrative while most are appended to the end of the report to provide a full-page display with figures and tables numbered sequentially from their first mention in the text.)

Volume I of the two-volume plan, presented herein, provides the results of a geomorphic and hazard assessment that have been used to identify the locations where human modifications of the corridor and watershed at large have exacerbated flooding and erosion, degraded aquatic habitat, destabilized the channel, and constrained recreational opportunities. This information was used to prioritize the "need" of various sections of the river for restoration, or other form of intervention, to realize hazard reductions, habitat improvements, and increases in recreational use. The subsequent completion of Volume II of the Plan will provide a prioritized list of various projects of varying magnitude that address specific "needs" (i.e., increased floodplain access, hazard reduction, habitat improvement). Conceptual project designs will be developed for four mainstem sites and one tributary location with the highest needs.

The vision for the BRCSMP is to highlight and develop non-regulatory opportunities to maintain, enhance, protect, and restore channel stability, water quality, and habitat within the Bronx River Corridor. These opportunities focus on interventions which ensure public safety, mitigate flooding, conserve, and enhance ecosystems, protect public infrastructure, enhance local economies, and increase recreational and tourism opportunities. The BRCSMP was developed with support from Westchester County, will be integrated and consistent with existing local programs and civic organizations' missions associated with watershed management activities, and will promote economically sustainable and vibrant communities throughout the watershed by improving conditions on the river.





## Westchester County Agriculture and Farmland Protection Plan

The purpose of this Agriculture and Farmland Protection Plan is to provide Westchester County with a blueprint for action to protect the remaining agricultural lands in the County. This includes improving awareness of the needs of agriculture as an industry and of farmland itself as valuable component of the County's quality of life. It follows the establishment by the County and approval by the State of an Agricultural District in 2001. Westchester County's District properties comprise 11,856 acres in 19 municipalities. The District establishment is the result of efforts by the Agricultural and Farmland Protection Board (AFPB), whose sole purpose is to focus attention on the role of agriculture in Westchester County.

The State of New York operates the Agriculture and Farmland Protection Program authorized by Article 25-AAA. This program provides counties with grants for planning assistance for coordinated local and state initiatives to protect agriculture and farmland. These plans are intended to identify lands proposed to be protected, to analyze them in terms of their value to the agricultural economy, their open space value, and their level of conversion pressure. Typically, the plans then describe the activities, programs, and strategies that municipalities can use to promote continued agricultural use. This formalized strategy is a prerequisite for eligibility to apply to the NYS Agriculture and Farmland Protection Program for funds for permanent protection of land with purchase of development rights (PDR), also known as conservation easements.

This Plan examines both the land use policies associated with agriculture in Westchester County as well as the state of the industry. It analyses the appropriateness of existing tools to protect land and to support the agricultural enterprises as positive economic contributors to the local economy. Background information was assembled from published sources and from data collected from farm landowners during the creation of the Agricultural District. Information that served as the basis for analysis regarding applicability of farmland protection tools to Westchester County was garnered from both existing maps and documents, as well as from interviews with local and county officials. Economic conditions were gleaned from public data sources and corroborated and expanded upon by the advice and experience of individuals familiar with local dynamics. Since most of the farmland in the County is in the northern towns, much of the land use research for this Plan focused on that area.

## Westchester County Comprehensive Emergency Management Plan

This Plan results from the recognition on the part of Westchester County government and New York State officials that a comprehensive plan is needed to enhance this County's ability to manage the range of emergency/disaster situations to which we are exposed. It was prepared by County officials working as a team in a planning process recommended by the New York State Office of Emergency Management (NYSOEM). This Plan constitutes an integral part of a statewide emergency management program and contributes to its effectiveness. Authority to undertake this effort is provided by both Article 2-B of State Executive Law and the New York State Defense Emergency Act.

The development process of this Plan included an analysis of potential hazards that could affect the County and an assessment of the capabilities existing in the County to manage potential hazards.

Preparing for and responding to disasters is an ongoing and complex undertaking. Through implementation of Risk Reduction measures before a disaster or emergency occurs; Preparedness efforts to include planning, training and exercises; timely and effective Response during an actual occurrence; and provision of both short and long term Recovery assistance after the occurrence of a disaster, lives can be saved and property damage minimized. This process is called Comprehensive Emergency Management to emphasize the interrelationship of activities, functions, and expertise necessary to deal with emergencies.

This comprehensive plan is organized according to the recognized methodology of emergency management. It is organized according to the necessary "all hazard" response functions needed to respond to any disaster.





Accordingly, this plan addresses the four basic principles which include: mitigation, preparedness, response, and recovery operations.

# 6.4.2 Planning and Regulatory Capabilities – State and Federal

#### New York State Floodplain Management

There are two departments that have statutory authorities and programs that affect floodplain management at the local jurisdiction level in New York State: the New York State Department of Environmental Conservation (NYSDEC) and the Department of State's Division of Code Enforcement and Administration (DCEA).

In 1992, the New York State Legislature amended an existing law, finding that "it is in the interests of the people of this state to provide for participation" in the NFIP (New York Laws, Environmental Conservation, Article 36). Although the Legislature recognized that "land use regulation is principally a matter of local concern" and that local governments "have the principal responsibility for enacting appropriate land use regulations," the law requires all local governments with land use restrictions over SFHAs to comply with all NFIP requirements. The law clearly advises local governments that failure to qualify for the NFIP may result in sanctions under Federal law and specifies that the State "will cooperate with the federal government in the enforcement of these sanctions."

The 1992 law that provides for local government participation in the NFIP also requires state agencies to "take affirmative action to minimize flood hazards and losses in connection with state-owned and state-financed buildings, roads and other facilities, the disposition of state land and properties, the administration of state and state-assisted planning programs, and the preparation and administration of state building, sanitary and other pertinent codes." In particular, the commissioner of the NYSDEC is to assist state agencies in several respects, including reviewing potential flood hazards at proposed construction sites.

The NYSDEC is charged with conserving, improving, and protecting the state's natural resources and environment, and preventing, abating, and controlling water, land, and air pollution. Programs that have bearing on floodplain management are managed by the Bureau of Flood Protection and Dam Safety, which cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion, and dam failures. These objectives are accomplished through floodplain management and both structural and nonstructural means.

The Coastal Management Section works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and nonstructural means. The Dam Safety Section is responsible for "reviewing repairs and modifications to dams and assuring [sic] that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning." The Flood Control Projects Section is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

The Floodplain Management Section is responsible for reducing flood risk to life and property through management of activities, such as development in flood hazard areas, and for reviewing and developing revised flood maps. The Section serves as the NFIP State Coordinating Agency and in this capacity is the liaison between FEMA and New York communities that elect to participate in the NFIP. The Section provides a wide range of technical assistance.





# 6.4.3 Administrative and Technical Capabilities - County and Local

#### Westchester County Department of Emergency Services – Office of Emergency Management

The Westchester County Office of Emergency Management (OEM) is responsible for coordinating Westchester County's response to requests for emergency disaster assistance from municipalities throughout the county. This assistance can include:

- On-scene support to local incident commanders during emergencies
- Use of the county's Emergency Operations Center to manage assets and resources deployed in a largescale disaster
- Serving as a conduit for acquiring assistance and support at the state and federal levels

Additionally, OEM is responsible for Westchester County's preparedness activities. OEM works daily with local, state, federal and private sector partners in emergency management to plan and prepare for large-scale, multi-jurisdictional responses to all natural or man-made disasters.

## Westchester County Department of Planning (WCDP)

The WCDP conducts a comprehensive work program and shapes and influences growth and development in Westchester County in order to improve quality of life and protect the environment, resulting in more livable and sustainable communities.

Three of the five specialized sections of the department – Land Use and Development, Housing and Environmental Planning – focus on the initiatives that carry out this mission. They utilize the technical expertise of the department's two other sections – Design and Administration – to produce quality products and plans in the most cost-effective manner for county residents.

The WCDP provides technical planning and policy services to municipalities, county departments and other governmental agencies and individuals regarding natural resource protection and flood and flood damage mitigation. The Department provides a lead role, including administrative and technical support for watershed planning efforts in the county, including the Flood Task Force. WCDP works with local municipal partners to educate the public about stormwater and also constructs best management practices as demonstrations for controlling stormwater to prevent pollution and mitigate flooding.

## Westchester County Soil & Water Conservation District (SWCD)

The SWCD is a special purpose district created to develop and carry out a program of soil, water, and related natural resources conservation. Environmental planners and other WCDP staff provide support to the sevenmember citizen Board of Directors. The SWCD has developed a program with a distinct urban/suburban conservation orientation and considers a wide range of soil and water resources conservation concerns.

## Westchester County Department of Public Works and Transportation (DPW&T)

The DPWT is charged with designing and constructing an extensive infrastructure system for Westchester County. The department also provides oversight on many capital projects big and small and has a traffic engineering and safety program that works to prevent traffic accidents.

The DPW maintains almost 160 miles of roads, including the Bronx River Parkway, the only parkway the county owns. (Most Westchester roads are maintained by local governments; the other parkways are maintained by the state.) DPW is also responsible for 86 bridges, 71 traffic signals, 29 traffic cameras, and all county government





buildings. Whenever possible, the DPW is available to assist local city, town and village public works departments, and have numerous shared services for local governments, school districts and other districts.

#### Westchester County Department of Information Technology (DoIT)

The DoIT offers its expertise and services to municipalities, schools, and special districts in several areas, including digital printing, network and office systems services, geographic information systems (GIS) and emergency support, to name a few. The county has developed these services with the goal of reducing local costs, increasing efficiency, and reducing duplication of services.

There are a number of GIS-related services, including development of GIS databases, Internet mapping, data warehousing and tax map maintenance. The criminal justice and EMS shared services applications have fast become key resources to police departments and emergency responders throughout the county. Mapping is a key component in preparing flood and flood damage mitigation plans.

DoIT is a critical partner in the county's efforts to promote a sustainable environment of innovation. The department has a long tradition of success and has established itself as one of the premier government IT agencies in the country, routinely ranking among the "Top 10" digital counties in the U.S. by the Center for Digital Government.

# 6.4.4 Administrative and Technical Capabilities - State and Federal

#### New York State Division of Homeland Security and Emergency Services (NYS DHSES)

For more than 50 years, NYS DHSES (formerly New York State Office of Emergency Management – NYS DHSES) and its predecessor agencies have been responsible for coordinating the activities of all State agencies to protect New York's communities, the State's economic well-being, and the environment from natural and manmade disasters and emergencies. NYS DHSES routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance.

NYS DHSES administers the FEMA mitigation grant programs in the state and supports local mitigation planning in addition to developing and routinely updating the State Hazard Mitigation Plan. NYS DHSES prepared the current State Hazard Mitigation Plan working with input from other State agencies, authorities, and organizations. It was approved by FEMA in 2019 and it keeps New York eligible for recovery assistance in all Public Assistance Categories A through G, and Hazard Mitigation assistance in each of the Unified Hazard Mitigation Assistance Program's five grant programs. The 2019 New York State HMP was used as guidance in completing the Westchester County HMP Update.

# New York State Department of Environmental Conservation (NYSDEC) – Division of Water - Bureau of Flood Protection and Dam Safety

Within the NYSDEC – Division of Water, the Bureau of Flood Protection and Dam Safety cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion and dam failures through floodplain management and both structural and non-structural means; and, provides support for information technology needs in the Division. The Bureau consists of the following Sections:

• Coastal Management: Works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and non-structural means.





- Dam Safety: Is responsible for reviewing repairs and modifications to dams and assuring that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning.
- Flood Control Projects: Is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.
- Floodplain Management: Is responsible for reducing flood risk to life and property through proper management of activities including, development in flood hazard areas and review and development of revised flood maps.

<u>Grant funding</u> is available to assist eligible dam owners with infrastructure repair costs. Funding is provided through the Federal Emergency Management Agency's (FEMA) High Hazard Potential Dam grant program. DEC accepts applications for grants to assist with technical, planning, design, and other pre-construction activities associated with the rehabilitation of eligible dams classified as High Hazard dams.

#### Department of State's Division of Building Codes and Standards

#### Technical Bulletins for the 2020 Codes of New York State

The Division of Building Codes and Standards (DBSC) publishes 14 technical bulletins including two recent bulletins with guidance related to flood hazard areas: Electrical Systems and Equipment in Flood-damaged Structures and Accessory Structures. One archived bulletin from October 31, 2017, Flood Venting in Foundations and Enclosures Below Design Flood Elevation, t provides clarification on the requirements for flood vents in foundations and enclosures located below the design flood elevation and in flood hazard areas.

#### Forms and Publications

The Department of State Division of Building Standards and Codes (DBSC) in conjunction with the Division of Homeland Security & Emergency Services – Office of Fire Prevention and Control (OFPC) has implemented a joint outreach program that is intended to guide and educate code users. The program will provide concise, easily digestible information on:

- New topics that code users must be aware of;
- Frequently overlooked or misunderstood code requirements; and
- Concerns relating to the administration and enforcement of the Uniform Code and Energy Code.

The DBSC and OFPC hope the program will continue to foster professional growth and support the efforts of the code enforcement community and provide helpful guidance to all code users.

The Code Outreach Program publications are expected to be distributed at the beginning of every month. If you have ideas for future topics to be addressed by the Code Outreach Program, email Cop.Codes@dos.ny.gov.

The DBSC posts several model reporting forms and related publications on its web page. The Building Permit Application requests the applicant to indicate whether the site is or is not in a floodplain and advises checking with town clerks or NYSDEC. The General Residential Code Plan Review form includes a reminder to "add 2' freeboard." Sample Flood Hazard Area Review Forms, including plan review checklists and inspection





checklists for Zone A and Zone V, are based on the forms in Reducing Flood Losses through the International Code Series published by International Code Council and FEMA (2008).

# 6.4.5 Fiscal Capabilities – County and Local

## **Municipal Fiscal Capabilities**

Westchester County municipalities are able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and through a variety of federal and state loan and grant programs. Many municipalities noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints and tax caps. In an effort to overcome these fiscal challenges, municipalities have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and inter-municipal cooperation are beneficial in obtaining grants.

#### Westchester County Stormwater Management Law

As described above, the Westchester County Stormwater Management Law provides a program where Westchester municipalities may petition the County for funding assistance towards the development of engineering studies and construction of physical projects to reduce flooding and flood damage in flood problem areas identified by local municipalities and included in reconnaissance plans prepared under the program. Plans have been prepared for each of the six major drainage basins within the county, and interested municipalities may review the reconnaissance plans and application materials at <u>www.westchestergov.com/flooding</u> or contact the Westchester County Department of Planning for more information.

# 6.4.6 Fiscal Capabilities – State and Federal

## New York Rising Community Reconstruction Program

The NY Rising Community Reconstruction program was established to provide additional rebuilding and revitalization assistance to communities severely damaged by Hurricanes Sandy and Irene and Tropical Storm Lee. The NY Rising Community Reconstruction program enables communities to identify resilient and innovative reconstruction projects and other needed actions based on community-driven plans that consider current damage, future threats, and the communities' economic opportunities. Communities successfully completing a recovery plan will be eligible to receive funds to support the implementation of projects and activities identified in the plans.

Each NY Rising Community has a Planning Committee that includes, among others, a representative from the County, Town, or Village, elected legislative representatives, local residents, and leaders of other organizations and businesses in the community. The Planning Committee will take the lead in developing the content of the plan. The State has provided each NY Rising Community with a planning team to help prepare a plan. Consultants have been hired through a State process administered by New York State Homes and Community Renewal (NYS HCR) through its Office of Community Renewal (OCR) and the Housing Trust Fund Corporation (HTFC). Planning experts from the Department of State and Department of Transportation have been assigned to each community to provide assistance to the community and help oversee the planning consultants.

Within Westchester County, the City of Rye and the City of Yonkers are designated NY Rising Communities, both with \$3 million allocations for project implementation. Funding can go to economic development, infrastructure, prevention of further damages including construction of protective mitigation measures like dunes





or sea walls, to the development of community planning documents such as comprehensive master plans or economic development plans.

#### **Federal Hazard Mitigation Funding Opportunities**



Source: FEMA, 2018

The *NYS Capabilities* section of the 2019 New York State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to find mitigation actions. A list of funding opportunities can be accessed here:

https://mitigateny.availabs.org/strategies/funding

As noted on the FEMA hazard mitigation assistance website (https://www.fema.gov/hazard-mitigation-assistance), FEMA administers five programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The programs are the Hazard Mitigation Grant Program (HMGP), and the HMGP Post Fire Grant, the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program,

and the new Building Resilient Infrastructure & Communities (BRIC) Program.

HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. PDM provides funds for hazard mitigation planning and projects on an annual basis. FMA provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis. BRIC supports jurisdictions in hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program will replace the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency (FEMA 2020).

HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. PDM and FMA funding depends on the amount congress appropriates each year for those programs. BRIC is funded by a 6% (\$500 million) set-aside from federal post-disaster grant funding.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2020).

Table 6-5 provides an overview of program funding eligibility and cost share.

Table 6-2.	rema mma Grant Cost Share Requirements	

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP	75 / 25
FMA – insured properties and planning grants	75 / 25
FMA – repetitive loss property <sup>(2)</sup>	90 / 10
FMA – severe repetitive loss property <sup>(2)</sup>	100 / 0





	Cost Share		
Programs	(Percent of Federal / Non-Federal Share)		
BRIC <sup>(3)</sup>	75 / 25		
BRIC – subrecipient is small and impoverished community <sup>(3)</sup>	90 / 10		
Construction of the second sec			

Source: FEMA HMA Guidance 2015; Regulations.gov; FEMA 2020

(1) Sub applicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

(2) To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

(3) The proposed BRIC program is in the public comment period as of May 2020 and is expected to have an open grant period and be finalized by the Fall of 2020.

## **Federal Hazard Mitigation Funding Opportunities**

Federal mitigation grant funding is available to all communities with a current HMP (this plan); however most of these grants require a "local share" in the range of 10-25 percent of the total grant amount. Details about grant programs and further descriptions of these opportunities can be found at: <u>https://www.fema.gov/hazard-mitigation-assistance</u>. The FEMA mitigation grant programs are described below.

## Hazard Mitigation Grant Program (HMGP)

The HMGP is a post-disaster mitigation program. FEMA makes these grants available to states by after each federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures and can be used to fund cost-effective projects that will protect public or private property or that will reduce the likely damage from future disasters in an area covered by a federal disaster declaration. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing, or elevation to reduce future

#### Figure 6-1. FEMA HMGP Funding Allocation



Source: FEMA 2018

damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved HMP (this plan).

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to NYS DHSES, placed in rank order for available funding, and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and could be considered as additional HMGP funding becomes available. Additional information regarding the HMGP is available on the FEMA website: <a href="https://www.fema.gov/hazard-mitigation-grant-program">https://www.fema.gov/hazard-mitigation-grant-program</a>.









Source: FEMA 2018

# Flood Mitigation Assistance (FMA) Program

The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. For the nom-federal share, at most 25 percent of the total eligible costs must be provided by a non-federal source; of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. The NYS DHSES serves as the grantee and program administrator for the FMA program.

The FMA program is detailed on the FEMA website: <u>https://www.fema.gov/flood-mitigation-assistance-grant-program</u>

## Building Resilient Infrastructure and Communities (BRIC) Program

Building Resilient Infrastructure and Communities (BRIC) will support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program.

The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

For additional information regarding the BRIC program, please refer to: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities.

# Rehabilitation of High Hazard Potential Dams (HHPD) Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.





The HHPD Grant Program will provide assistance for technical, planning, design, and construction activities toward:

- Repair
- Removal
- Structural/nonstructural rehabilitation of eligible high hazard potential dams

For additional information regarding the HHPD program, please refer to: <u>https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources</u>.

#### Extraordinary Circumstances

For FMA project subawards, the FEMA Region might apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP, BRIC, and FMA, extraordinary circumstances exist when a determination is made by the applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the State (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for BRIC and FMA the region must coordinate and seek concurrence prior to granting an exception. The criteria are as follows:

- The jurisdiction meets the small impoverished community criteria (see Part VIII, B.2 of HMA Unified Guidance).
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federallyrecognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or tribal mitigation plan.

For HMGP, BRIC, and FMA, the applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The recipient must provide a work plan for completing the local or tribal mitigation plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).





#### Federal and State Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance could be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. The following sections detail the general types of assistance that might be provided should the President of the United States declare the event a major disaster.

#### Individual Assistance (IA)

Individual Assistance (IA) provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses could be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals are allowed to borrow up to \$200,000 to repair or replace real estate, \$40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans could be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Non-profit organizations, such as charities, churches, and private universities are eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster but are restricted by law to small businesses only. IA is detailed on the FEMA website: <a href="https://www.fema.gov/individual-disaster-assistance">https://www.fema.gov/individual-disaster-assistance</a>.

#### Public Assistance (PA)

Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required. PA is detailed on the FEMA website: <u>https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit</u>.

#### Small-Business Administration (SBA) Loans

SBA provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Homeowners could apply for up to \$200,000 to replace or repair their primary residence. Renters and homeowners could borrow up to \$40,000 to replace or repair personal property-such as clothing, furniture, cars, and appliances that were damaged or destroyed in a disaster. Physical disaster loans of up to \$2 million are available to qualified businesses or most private nonprofit organizations. Additional information regarding SBA loans is available on the SBA website: <u>https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance</u>.

#### Social Services Block Grant Program (SSBG)

To address the needs of critical health and human service providers and the populations they serve, the State of New York will receive a total of \$235.4 million in federal Superstorm Sandy SSBG funding. The state will distribute \$200,034,600 through a public and transparent solicitation for proposals and allocate \$35.4 million in State Priority Projects, using the SSBG funding. Sandy SSBG resources are dedicated to covering necessary expenses resulting from Superstorm Sandy, including social, health, and mental health services for individuals, and for repair, renovation, and rebuilding of health care facilities, mental hygiene facilities, child care facilities, and other social services facilities. Additional information regarding the SSBG program is available on the website: <a href="https://www.acf.hhs.gov/ocs/programs/ssbg">https://www.acf.hhs.gov/ocs/programs/ssbg</a>.





# Department of Homeland Security Grant Program (HSGP)

The HSGP plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. The FY 2020 HSGP supports efforts to build and sustain core capabilities across the Prevention, Protection, Mitigation, Response, and Recovery mission areas. This includes two priorities: building and sustaining law enforcement terrorism prevention capabilities and maturation and enhancement of state and major urban area fusion centers (HSGP 2020). HSGP is comprised of three interconnected grant programs including the State Homeland Security Program (SHSP), Urban Areas Security Initiative (UASI), and the Operation Stonegarden (OPSG). Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. Additional information regarding HSGP is available on the website: <a href="https://www.fema.gov/homeland-security-grant-program">https://www.fema.gov/homeland-security-grant-program</a>.

## Community Development Block Grants (CDBG)

CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, and planning and administration. Public improvements could include flood and drainage improvements. In limited instances and during the times of "urgent need" (e.g., post disaster) as defined by the CDBG National Objectives, CDBG funding could be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. Additional information regarding CDBG is available on the website: <a href="https://www.hudexchange.info/programs/cdbg-entitlement/">https://www.hudexchange.info/programs/cdbg-entitlement/</a>. In 2018, the Community Development Block Grant Mitigation Program was created to fund resilience projects in qualifying areas struck by disaster in 2015-2017.

## U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States. Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer systems improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities. Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base. Additional information is available on the USEDA website: https://www.eda.gov/.

## Federal Highway Administration - Emergency Relief

The Federal Highway Administration Emergency Relief is a grant program that can be used for repair or reconstruction of Federal-aid highways and roads on Federal lands which have suffered serious damage as a result of a disaster. NYS is serving as the liaison between local municipalities and FHWA. The program is appropriated \$100 million annually. For information regarding the FHWA Emergency Relief Program, please refer to: https://www.fhwa.dot.gov/programadmin/erelief.cfm





## Federal Transit Administration - Emergency Relief

The Federal Transit Authority Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. Department of Transportation and directly allocated to MTA and Port Authority, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of \$5.2 Billion has been allocated to NYS-related entities related to Hurricane Sandy. IN the wake of the COVID-19 outbreak in 2020, the program provided emergency-related capital and operating expenses to transit providers. Additional information regarding the FTA Emergency Relief Program is available on the website: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program.

# State Hazard Mitigation Funding Opportunities

## Empire State Development

Empire State Development offers a wide range of financing, grants, and incentives to promote business and employment growth and real estate development throughout the state. Several programs address infrastructure construction associated with project development, acquisition, and demolition associated with project development and brownfield remediation and redevelopment. Additional information regarding Empire State Development is available on the website: <u>https://esd.ny.gov/</u>.

# New York State Department of Transportation (NYSDOT)

# Damaged Roads and Signals

High winds, storm tidal surge and flooding caused significant damage to NYSDOT facilities, roads and local transportation infrastructure in the Hudson Valley, Long Island and New York City. Repair and replacement will be necessary for these facilities and infrastructure. In some cases, municipalities will be direct applicants; therefore, not all FEMA-eligible costs are included for damaged infrastructure.

## Scour Critical/Floodprone Bridge Program

The Scour Critical/Flood Prone Bridge Program is an initiative developed to harden New York State's at-risk bridges to withstand extreme weather events. In the past three years, the state has suffered 9 presidentially declared disasters due to extreme weather, many involving severe flooding (NYSDOT 2014).

For this initiative, 105 scour critical/flood prone bridges throughout New York State were identified as most atrisk from repeated flooding and are located in the Capital District, Long Island, Mid-Hudson, Mohawk Valley, North Country, Finger Lakes, Central/Western and Southern Tier regions. The locations encompass 78 communities within 30 counties across the State (NYSDOT 2014). Additional information of the list of bridges is available on the website: <u>https://www.dot.ny.gov/main/businesscenter/cbow/repository/CBOW\_list\_2014.pdf.</u>

All the bridges included in this program were built to the codes and standards of their time and remain safe and open for everyday traffic; however, due to a variety of natural severe weather events and the increasing frequency of major storms and floods, they are vulnerable to scour and flooding caused by the intensity and velocity of water from extreme natural events. Bridge scour erodes and carries away foundation materials, such as sand and rocks from around and beneath bridge abutments, piers, foundations, and embankments (NYSDOT 2014).

This program encompasses a variety of bridge improvement work, including upgrading concrete bridge abutments and/or piers by adding steel or concrete pile foundations, increasing the size of waterway openings to meet 100-year flood projections, and reducing or eliminating the number of bridge piers in the water to prevent





debris and ice jams that can flood surrounding areas. Completion of the program will ensure continual access to critical facilities and essential personnel during emergency events. Adverse impacts to travel throughout the state will be greatly reduced during severe weather events, as well (NYSDOT 2014).

This program aims to increase the state's resiliency and mitigate the risks of loss and damage associated with future disasters. The total cost of the program, including all 105 bridges across the state, is \$518 million. It will be paid for with a mix of funding from FEMA and the U.S. Department of Housing and Urban Development. No state funding will be required (NYSDOT 2014).

# Emergency Watershed Protection Program

The purpose of the Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters. The EWP Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) administers the EWP Program, EWP-Recovery, and EWP-Floodplain Easement. Additional information regarding the EWP is detailed below and available on the website:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/.

# EWP - Recovery

The EWP Program is a recovery effort program aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that must be a legal subdivision of the state, such as a city, county, township, or conservation district, and Native American Tribes or Tribal governments. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP work is not limited to any one set of measures. It is designed for installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report, which provides a case-by-case investigation of the work necessary to repair or protect a site.

Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

## EWP - Floodplain Easement (FPE)

Privately-owned lands or lands owned by local and state governments might be eligible for participation in EWP-FPE. To be eligible, lands must meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years.
- Other lands within the floodplain are eligible, provided the lands would contribute to the restoration of the flood storage and flow, provide for control of erosion, or that would improve the practical management of the floodplain easement.
- Lands that would be inundated or adversely impacted as a result of a dam breach.

EWP-FPE easements are restored to the extent practicable to the natural environment and can include both structural and nonstructural practices to restore the flood storage and flow, erosion control, and improve the practical management of the easement.





Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

# New York State Department of Environmental Conservation Climate Smart Communities (CSC) Program

The CSC program is jointly sponsored by the following six New York State agencies: DEC; Energy Research and Development Authority; Public Service Commission; Department of State; NYSDOT; and the Department of Health. The program encourages municipalities to minimize the risks of climate change and reduce long-term costs through actions which reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical support on energy and climate and guidance tailored to New York State communities. As of April 2020, more than 303 communities, representing 8.7 million New Yorkers in every region of the state, have committed to acting on climate through New York State's Climate Smart Communities program.

Benefits of participating in the program include saving taxpayer dollars, improving operations and infrastructure, increasing energy independence and security, demonstrating leadership, and positioning for economic growth. Registered Climate Smart Communities receive notification of state and federal assistance that they can leverage to help adopt low-carbon technologies and of programs and support for efficiency improvements and energy conservation. Further, those communities receive an advantage in accessing some state assistance programs, can call on the help of other local governments that already have adopted climate smart practices and policies, and receive statewide recognition for their climate-smart accomplishments. Key elements of the Climate Smart Communities program are described below.

Additional information regarding the CSC program is available on the website: <u>http://www.dec.ny.gov/energy/50845.html</u>.

## Climate Smart Communities Pledge

Any city, town, village, or county in New York can join the program by adopting the Climate Smart Communities Pledge. To become a registered Climate Smart Community, the municipality's governing body must adopt a resolution that includes all ten elements of the pledge and inform DEC of the passage of the resolution. The required ten elements of the pledge are as follows:

- Pledge to be a Climate Smart Community.
- Set goals, inventory emissions, plan for climate action.
- Decrease community energy use.
- Increase community use of renewable energy.
- Realize benefits of recycling and other climate-smart solid waste management practices.
- Reduce greenhouse gas emissions through use of climate-smart land-use tools.
- Enhance community resilience and prepare for the effects of climate change.
- Support development of a green innovation economy.
- Inform and inspire the public.
- Commit to an evolving process of climate action.

## Climate Smart Communities Certification (CSC) Program

The CSC program enables high-performing registered communities to achieve recognition for their leadership. Designed around the existing ten pledge elements, the certification program recognizes communities achieving any on over 130 total possible actions through a rating system leading to four levels of award: Certified, Bronze, Silver, and Gold. Recertification of completed actions is required every five years. Details of the program and the specific documentation required for each action are described in the CSC Certification Manual at





<u>http://www.dec.ny.gov/docs/administration\_pdf/certman.pdf</u>. At the time of this plan update, no communities in the County have achieved certification.

Climate Smart Communities Grant Program

In April 2016, DEC announced an expansion of the Environmental Protection Fund to support communities ready to reduce greenhouse gas emissions and prepare for the effects of climate change. Climate Smart Community Implementation grants support mitigation and adaptation projects and range from \$100,000 to \$2 million. Competitive grants ranging from \$25,000 to \$100,000 will provide support for local governments to become certified Climate Smart Communities. All counties, cities, towns, and villages of the State of New York are eligible to receive funding. The CSC grant program will provide 50/50 matching grants for eligible projects in the following categories.

Funding is available for **implementation projects** that advance a variety of climate adaptation and mitigation actions, including the following:

- Construction of natural resiliency measures.
- Relocation or retrofit of climate-vulnerable facilities.
- Conservation or restoration of riparian areas and tidal marsh migration area.
- Reduction of flood risk.
- Clean transportation.
- Reduction or recycling of food waste.

Funding is available for **certification projects** that advance several specific actions aligned with Climate Smart Communities Certification requirements, including the following:

- Right-sizing of government fleets.
- Developing natural resource inventories.
- Conducting vulnerability assessments.
- Developing climate adaptation strategies.
- Updating hazard mitigation plans to address changing conditions and reduce climate vulnerability.

In scoring grant applications, increasing points are awarded to communities who have already taken the CSC pledge and to those that have achieved certification status. All grant recipients must take the Climate Smart Communities Pledge within the term of their grant contract. For climate mitigation projects, grant recipients must provide a report of estimates of emissions reduction. Certification actions must adhere to the requirements and standards described in the Climate Smart Communities Certification Manual that is available on the website: <a href="http://www.dec.ny.gov/energy/96511.html">http://www.dec.ny.gov/energy/96511.html</a>. For implementation projects involving property (construction, improvements, restoration, rehabilitation), grant recipients that do not have ownership of the property must obtain a climate change mitigation easement.

The Climate Smart Communities Toolkit was developed to educate New York communities on recommended practices that will help to reduce greenhouse gas emissions and adapt to the effects of climate change, specifically in the areas of land-use, transportation policy, green buildings, infrastructure investment, green infrastructure, housing policy, adaptation, and resilience. The Climate Smart Communities Guide to Local Action contains overviews of possible community actions, how-to's and case studies to help communities implement the CSC pledge. The Climate Smart Communities Land Use Toolkit allows New York communities to find recommended practices that will help to reduce greenhouse gas emissions in the areas of land use, transportation policy, green building, infrastructure investment, green infrastructure, and housing policy.



## New York State Department of Environmental Conservation (NYSDEC)

#### Water Quality Improvement Project (WQIP) Program

The WQIP program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. The competitive, statewide grant program is open to local governments and not-for-profit corporations. Grant recipients can receive up to 75 percent of the project costs for high priority wastewater treatment improvement, non-agricultural nonpoint source abatement and control, land acquisition for source water protection, aquatic habitat restoration, and municipal separate storm sewer system projects; up to 50 percent for salt storage projects; and up to 40 percent for general wastewater infrastructure improvement Additional information regarding this program are available on website: projects. the https://www.dec.ny.gov/pubs/4774.html. Eligible activities for the WQIP Program include the following:

- Wastewater treatment improvement.
- Non-agricultural nonpoint source abatement and control.
- Land acquisition for source water protection.
- Salt storage.
- Aquatic habitat restoration.
- MS4s.

New York State DEC/ Environmental Facilities Corporation (EFC) Wastewater Infrastructure Engineering Planning Grant (EPG)

The DEC, in conjunction with the New York State EFC, offers grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects.

The Wastewater Infrastructure EPG assists municipalities with the engineering and planning costs of CWSRFeligible water quality projects. Eligible municipalities have a median household income (MHI) of \$65,000 or less in the Regional Economic Development Council (REDC) regions of Capital District, Southern Tier, North Country, Mohawk Valley, Central NY, Finger Lakes, or Western NY OR an MHI of \$85,000 or less in REDC regions of Long Island, New York City, or Mid-Hudson. Grants with a 20 percent required local match could finance activities, including engineering and consultant fees for engineering and planning services for the production of an engineering report.

The goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, WQIP program, or other funding entities to further pursue the identified solution. Details regarding this program can be found on the website: https://www.dec.ny.gov/pubs/81196.html. Funding priorities go to projects that have one of the following qualities:

- Required by an executed Order on Consent.
- Required by a draft or final State Pollutant Discharge Elimination System (SPDES) permit.
- Upgrading or replacing an existing wastewater system.
- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems.
- Identified in a Total Maximum Daily Load (TMDL) Implementation Plan.





#### New York State Department of Transportation

#### BRIDGE NY

The BRIDGE NY program, administered by the NYSDOT, is open to all municipal owners of bridges and culverts. Projects are awarded through a competitive process and support all phases of project development. Projects selected for funding under the BRIDGE NY Initiative are evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; the significance and importance of the bridge, including traffic volumes, detour considerations, number and types of businesses served, and impacts on commerce; and the current bridge and culvert structural conditions. Information regarding the program can be found on the website: <a href="https://www.dot.ny.gov/BRIDGENY">https://www.dot.ny.gov/BRIDGENY</a>.

#### **Community Risk and Resiliency Act (CRRA)**

On September 22, 2014, Governor Andrew Cuomo signed bill A06558/S06617-B, the CRRA. The purpose of the bill is to ensure that certain state monies, facility-siting regulations, and permits include consideration of the effects of climate risk and extremeweather events. According to NYSDEC (2018), CRRA's five major provisions include the following:



- Official Sea-level Rise Projections—
   CRRA requires the DEC to adopt science-based sea-level rise projections into regulation.
- Consideration of Sea-Level Rise, Storm Surge and Flooding—CRRA requires applicants for permits or funding in a number of specified programs to demonstrate that future physical climate risk due to sea-level rise, storm surge, and flooding have been considered and that DEC considered incorporating these factors into certain facility-siting regulations.
- Smart Growth Public Infrastructure Policy Act Criteria—CRRA adds mitigation of risk due to sea-level rise, storm surge, and flooding to the list of smart-growth criteria to be considered by state public-infrastructure agencies.
- Guidance on Natural Resiliency Measures—CRRA requires DEC, in consultation with the Department of State, to develop guidance on the use of natural resources and natural processes to enhance community resiliency.
- Model Local Laws Concerning Climate Risk—CRRA requires the Department of State, in cooperation with DEC, to develop model local laws that include consideration of future risk due to sea-level rise, storm surge, and flooding. These model local laws must be based on available data predicting the likelihood of extreme-weather events, including hazard-risk analysis.

CRRA requires NYSDEC, in consultation with the Department of State, to prepare guidance on implementation of the statute. To meet its obligation to develop guidance for the implementation of CRRA, DEC is proposing a new document, State Flood Risk Management Guidance (SFRMG). The SFRMG is intended to inform state agencies as they develop program-specific guidance to require that applicants demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations. The SFRMG incorporates possible future conditions, including the greater risks of coastal flooding presented by sea-level rise and enhanced storm surge and of inland flooding expected to result from increasingly frequent extreme-precipitation events (NYSDEC 2018). Additional details on the CRRA are provided on the website: https://www.dec.ny.gov/energy/102559.html.





#### Homeownership Repair and Rebuilding Fund

The Homeownership Repair and Rebuilding Fund provides grants of up to an additional \$10,000 to eligible homeowners who have already qualified for FEMA housing assistance's maximum grant (\$31,900) and will not receive other assistance from private insurance or government agencies that would duplicate the grant's funding. The HRRF includes \$100 million dedicated to help homeowners affected by Sandy and was provided directly from the State of New York.

# New York State Department of Environmental Conservation Climate Smart Communities (CSC) Program

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- Enhance community resilience and prepare for the effects of climate change.
- Support development of a green innovation economy.
- Inform and inspire the public.
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At the time of this plan update, 37 communities in Westchester County have adopted the Climate Smart Communities Pledge.





# Climate Smart Communities Certification (CSC) Program

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- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems.
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## New York State Department of Transportation

### BRIDGE NY

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- Consideration of Sea-Level Rise, Storm Surge and Flooding—CRRA requires applicants for permits or funding in a number of specified programs to demonstrate that future physical climate risk due to sea-level rise, storm surge, and flooding have been considered and that DEC considered incorporating these factors into certain facility-siting regulations.
- Smart Growth Public Infrastructure Policy Act Criteria—CRRA adds mitigation of risk due to sea-level rise, storm surge, and flooding to the list of smart-growth criteria to be considered by state public-infrastructure agencies.
- Guidance on Natural Resiliency Measures—CRRA requires DEC, in consultation with the Department of State, to develop guidance on the use of natural resources and natural processes to enhance community resiliency.
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CRRA requires NYSDEC, in consultation with the Department of State, to prepare guidance on implementation of the statute. To meet its obligation to develop guidance for the implementation of CRRA, DEC is proposing a new document, State Flood Risk Management Guidance (SFRMG). The SFRMG is intended to inform state agencies as they develop program-specific guidance to require that applicants demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations.





The SFRMG incorporates possible future conditions, including the greater risks of coastal flooding presented by sea-level rise and enhanced storm surge and of inland flooding expected to result from increasingly frequent extreme-precipitation events (NYSDEC 2018). Additional details on the CRRA are provided on the website: https://www.dec.ny.gov/energy/102559.html.

## 6.4.7 Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for each jurisdiction to help achieve the mitigation goals and objectives of the (HMP, it is also important to provide sources for funding to implement these strategies. The table below provides a list of programs, descriptions, and links for those seeking funding sources. Please note that this table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.





## Table 6-2. Mitigation Funding Sources

\_\_\_\_

Program	Description	Lead Agency	Website
Federal			
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, PDM	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program Grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long- term hazard mitigation measures following a major disaster declaration	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Building Resilient Infrastructure and Communities (BRIC)	Replacement program for PDM that will invest in local mitigation projects and promote capacity-building	FEMA	https://www.fema.gov/bric
Public Assistance: Hazard Mitigation Funding Under Section 406	Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster	FEMA	https://www.fema.gov/news-release/2017/05/03/4309/fema-hazard- mitigation-grants-404-and-406
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants (AFG) is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage, and rental assistance	HUD	https://www.hud.gov/program_offices/public_indian_housing/publicati ons/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons)	HUD	https://www.hud.gov/program_offices/comm_planning/affordablehousi ng/programs/home/
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation)	HUD	https://www.hud.gov/info/disasterresources
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas	HUD	https://www.hudexchange.info/programs/section-108/
Smart Growth Implementation Assistance (SGIA) program	The SGIA program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.	EPA	https://www.epa.gov/smartgrowth



Program	Description	Lead Agency	Website
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Better Utilizing Investments to Leverage Development (BUILD)	Investing in critical road, rail, transit, and port projects across the nation	U.S. DOT	https://www.transportation.gov/BUILDgrants/about
Community Facilities Direct Loan & Grant Program	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.	USDA	https://www.rd.usda.gov/programs-services/community-facilities- direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters, or quarantine	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan- programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/land scape/ewpp/
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/fina ncial/
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities	U.S. DHS	https://www.fema.gov/emergency-management-performance-grant- program
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies)	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm
State			
Local Government Records Management Improvement Fund (LGRMIF) Disaster Recovery Grants	Grants for disaster recovery projects related to damage caused by a sudden, unexpected event involving fire, water, man-made or natural phenomena where a timely response is necessary to prevent the irretrievable loss of vital or archival records, or to ensure reasonable, timely access to vital records	New York State Archives / New York State Education Department	http://www.archives.nysed.gov/grants/grants_lgrmif.shtml
The New York State Emergency Services Revolving Loan	Repair of firefighting apparatus, ambulances, or rescue vehicles; Renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment	NYS DHSES	http://www.dhses.ny.gov/ofpc/services/loan/





Program	Description	Lead Agency	Website
Environmental Protection Fund (EPF)	Matching grants for the acquisition, planning, development, and improvement of parks, historic properties	New York State Parks, Recreation & Historic Preservation (NYSOPRHP)	https://www.dec.ny.gov/about/92815.html
Recreational Trails (RTP)	Program Matching grants for the acquisition, development, rehabilitation and maintenance of trails and trail-related projects	NYSOPRHP	https://parks.ny.gov/grants/recreational-trails/default.aspx
Environmental Protection & Improvement Grants	Competitive grants for environmental protection and improvement; available for municipalities, community organizations, not-for-profit organizations, and others	New York State Department of Environmental Conservation	https://www.dec.ny.gov/about/92815.html
Volunteer Fire Assistance Grants	The grant is a 50/50 matching funds program. Its purpose is to make funds available to rural fire companies for the purchase of wildland firefighting equipment such as portable backpack pumps, Nomex protective clothing, hand tools, hard hats, hose, portable radios, and dry hydrants.	NYSDEC	https://www.dec.ny.gov/regulations/2364.html
Clean Water Act Section 604(b) Water Quality Planning Grants	Provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. 604(b) funds are to be used for water quality management planning activities, including tasks to determine the nature, extent and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.	NYSDEC	https://www.dec.ny.gov/lands/53122.html
Water Quality Improvement Project (WQIP) Program	The Water Quality Improvement Project (WQIP) program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. Applications are typically available each spring through the Consolidated Funding Application.	NYSDEC	https://www.dec.ny.gov/pubs/4774.html
New York State DEC/EFC Wastewater Infrastructure Engineering Planning Grant (EPG)	The New York State Department of Environmental Conservation (DEC), in conjunction with the New York State Environmental Facilities Corporation (EFC), will offer grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects. The ultimate goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, Water Quality Improvement Project program, or other funding entities to further pursue the identified solution.	NYSDEC	https://www.dec.ny.gov/pubs/81196.html
Climate Smart Communities Grant Program	The CSC Grant program was established in 2016 to provide 50/50 matching grants to cities, towns, villages, and counties (or boroughs of New York City) of the State of New York for eligible climate adaptation and mitigation projects.	NYSDEC	https://www.dec.ny.gov/energy/109181.html
BRIDGE NY	The State is making funding available for local governments to rehabilitate and replace bridges and culverts statewide.	NYS DOT	https://www.dot.ny.gov/BRIDGENY



## 6.5 Mitigation Strategy Development and Update

## 6.5.1 Update of Municipal Mitigation Strategies

To evaluate progress on local mitigation actions, each jurisdiction with actions in previous DMA2000 or related plans, was provided with a Mitigation Action Plan Review Worksheet. Each worksheet was pre-populated with those actions identified for their jurisdiction in the prior plan. For each action, municipalities were asked to indicate the status of each action ("No Progress/Unknown", "In Progress/Not Yet Complete", "Continuous", "Completed", "Discontinued") and provide review comments on each. Municipalities were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. Each jurisdictional annex provides a table identifying their prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as "Complete", and those actions identified as "Discontinued", have been removed from the updated strategies. Those local actions that municipalities identified as "No Progress/Unknown", "In Progress/Not Yet Complete" as well as certain actions/initiatives identified as "Continuous", have been carried forward in their local updated mitigation strategies. Municipalities were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

Certain continuous or ongoing strategies represent programs that are, or since prior and existing local hazard mitigation plans have become, fully integrated into the normal operational and administrative framework of the community. Such programs and initiatives have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.

At the Kick-Off and subsequent planning meetings, all participating municipalities were provided support in identifying mitigation activities completed, ongoing and potential/proposed. As new additional potential mitigation actions, projects or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process (see Section 3), communities were made aware of these either through direct communication (local meetings, email, phone) or via their draft municipal annexes.

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provides a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives, through review of available county and local plans and reports, and through the hazard profiling and vulnerability assessment process.

Beginning in July 2021, members of the Planning Committee and contract consultants worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Concerted efforts were made to assure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

• <u>Local Plans and Regulations</u> – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.





- <u>Structure and Infrastructure Project</u>- These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- <u>Natural Systems Protection</u> These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- <u>Education and Awareness Programs</u> These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA) and Firewise (NFPA) Communities.

In consideration of federal and state mitigation guidance, the Planning Committee recognized that municipalities would benefit from the inclusion of certain mitigation initiatives. These include initiatives to address vulnerable public and private properties, including RL and SRL properties; initiatives to support continued and enhanced participation in the NFIP; improved public education and awareness programs; and initiatives to support countywide and regional efforts to build greater local mitigation capabilities. Municipalities have included such initiatives as appropriate, typically amended with specific details to best meet the needs and interests of their community and promote implementation.

In October 2021, a mitigation strategy workshop was conducted by Tetra Tech staff with commentary provided FEMA Region II and NYSDHSES representatives for all participating jurisdictions to support the identification, evaluation, and prioritization of local mitigation strategies, as well as how to present and document this process within the plan. Based on FEMA's guidance and recommendations provided at this workshop and otherwise, the following significant modifications to the mitigation strategy identification and update process and documentation was made:

- An overarching effort has been made to better focus local mitigation strategies to clearly defined, readily actionable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation objectives have been eliminated from the updated strategy unless accompanied by discrete actions, projects, or initiatives.
- Certain continuous or ongoing strategies that represent programs that are, or since prior and existing plans have become, fully integrated into the normal operational and administrative framework of the community have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.
- Where applicable, mitigation projects have been documented with an Action Worksheet, based on FEMA's Action Worksheet templates and recent guidance documents.

FEMA Action Worksheets have been included for new physical projects identified by the County and participating municipalities. Physical projects being carried forward from the prior plan strategies are not necessarily documented on Action Worksheets as the project screening, identification and development, and prioritization process was accomplished during the last planning process. Whether or not the projects were new or "carry forward", and documented on Action Worksheets or not, all projects included in the updated County and local mitigation strategies have identified hazards addressed, project description, benefits, costs, responsible party, sources of funding, timeline and priority. Further, non-physical actions (e.g. integration actions, studies, etc.) are typically not documented on Action Worksheets.





As discussed within the hazard profiles in Section 5.4, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including extreme temperatures, flood, severe storm, severe winter storm and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

Municipalities included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. When determined to be feasible and practical, mitigation planning for critical facilities identified as previously sustaining flooding and/or being located in a FEMA floodplain will be developed to achieve protection to the 500-year flood event or the actual worst-damage scenario, whichever is greater.

It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, municipal discretion must be recognized. Further, it must be recognized that the County and municipalities have limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

## 6.5.2 Update of County Mitigation Strategy

The update of the County-level mitigation strategies included a review of progress on the actions/initiatives identified in the 2015 Westchester County Hazard Mitigation Plan, using a process similar to that used to review municipal mitigation strategy progress. The County, through their various department representatives, were provided with a Mitigation Action Plan Review Worksheet identifying all of the county-level actions/initiatives from the 2015 plan. For each action, relevant county representatives were asked to indicate the status of each action ("No Progress/Unknown", "In Progress/Not Yet Complete", "Continuous", "Completed", "Discontinued"), and provide review comments on each.

Projects/initiatives identified as "Complete", as well as though actions identified as "Discontinued", have been removed from this plan update. Those actions the county has identified as "No Progress/Unknown", "In Progress/Not Yet Complete" or "Continuous" have been carried forward in the County's updated mitigation strategy.

Throughout the course of the plan update process, additional regional and county-level mitigation actions have been identified. These were identified through:

- Review of the results and findings of the updated risk assessment;
- Review of available regional and county plans, reports, and studies;
- Direct input from County departments and other county and regional agencies, including:
  - o Department of Emergency Services Office of Emergency Management
  - Department of Planning
  - Department of Public Works and Transportation
  - o Department of Environmental Facilities (Wastewater, Solid Waste)
  - o Department of Parks, Recreation and Conservation
  - o Department of Information Technology





- o Department of Social Services
- Department of Health
- Input received through the public and stakeholder outreach process.

As discussed within the hazard profiles in Section 5.4, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including extreme temperatures, flood, severe storm, severe winter storm and wildfire. As such, the County has included mitigation actions and initiatives, including continuing and long-term planning and emergency management support, to address these long-term implications and potential impacts.

Various County departments and agencies have included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. When determined to be feasible and practical, mitigation planning for critical facilities identified as previously sustaining flooding and/or being located in a FEMA floodplain will be developed to achieve protection to the 500-year flood event or the actual worst-damage scenario, whichever is greater. As an example, the County Department of Environmental Facilities (WC DEF) re-evaluated mitigation projects at their critical wastewater facilities throughout the County to provide 500-year levels of protection.

It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, local government authority must be recognized. Further, it must be recognized that the County has limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

## 6.5.3 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires an action plan describing how the actions identified will be prioritized.

Recent FEMA planning guidance (March 2013) identifies a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology that uses a set of 10 evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action. The October mitigation workshop presented by FEMA representatives further amplified these evaluation criteria and indicated that communities may want to consider other factors.

Based on this guidance, the Steering and Planning Committees have developed and applied an action evaluation and prioritization methodology which includes an expanded set of fourteen (14) criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards.

The fourteen (14) evaluation/prioritization criteria used in the 2014 update process are:

- 1. Life Safety How effective will the action be at protecting lives and preventing injuries?
- 2. Property Protection How significant will the action be at eliminating or reducing damage to structures and infrastructure?
- 3. Cost-Effectiveness Are the costs to implement the project or initiative commensurate with the benefits achieved?





- 4. Technical Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
- 5. Political Is there overall public support for the mitigation action? Is there the political will to support it?
- 6. Legal Does the municipality have the authority to implement the action?
- 7. Fiscal Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- 8. Environmental What are the potential environmental impacts of the action? Will it comply with environmental regulations?
- 9. Social Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
- 10. Administrative Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
- 11. Multi-hazard Does the action reduce the risk to multiple hazards?
- 12. Timeline Can the action be completed in less than 5 years (within our planning horizon)?
- 13. Local Champion Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
- 14. Other Local Objectives Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to assist them in evaluating and prioritizing mitigation actions identified in the 2014 update. Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Further, jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results of this exercise were then used by each jurisdiction to help prioritize the action or strategy as "Low", "Medium," or "High." While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions and initiatives from prior mitigation strategies that were prioritized using different, but not necessarily contrary, approaches. Mitigation actions in a number of the existing and prior Westchester County municipal HMPs were prioritized according to the following criteria:

- **High Priority:** A project that meets multiple plan goals and objectives, benefits exceed cost, has funding secured under existing programs or authorizations, or is grant-eligible, and can be completed in 1 to 5 years (short-term project) once project is funded.
- Medium Priority: A project that meets at least one plan goal and objective, benefits exceed costs, funding has not been secured and would require a special funding authorization under existing programs, grant eligibility is questionable, and can be completed in 1 to 5 years once project is funded.





• Low Priority: A project that will mitigate the risk of a hazard, benefits exceed costs, funding has not been secured, and project is not grant-eligible and/or timeline for completion is considered long-term (5 to 10 years).

It is important to note that certain initiatives from the 2005 Westchester County HMP and other local single- and multi-jurisdictional HMPs within the County are being carried forward in their updated strategies, with or without modification. These initiatives were previously prioritized using approaches that may be different from that used in this update process; however it is reasonable to assume that all evaluation and prioritization approaches included similar considerations (e.g. mitigation effectiveness, technical and administrative feasibility, cost-effectiveness, etc.).

At their discretion, jurisdictions carrying forward prior initiatives were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed. Where communities have determined that their original priority ranking for "carry forward" initiatives remained valid, their earlier priority ranking is indicated on the prioritization table, however the plan update criteria ratings are indicated with a null "-" marking.

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives that have been well-vetted and are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. As such, many of the initiatives in the updated mitigation strategy were ranked as "High" or "Medium" priority, as reflective of the community's clear intent to implement, available resources not-withstanding. In general, initiatives that would have had "low" priority rankings were appropriately screened out during the local action evaluation process.

## 6.5.4 Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied in for the evaluation and prioritization of projects and initiatives in this plan update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action, or initiative.

**Costs** are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.

**Benefits** are the savings from losses avoided attributed to the implementation of the project, and may include life-safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When available, jurisdictions were asked to identify the actual or estimated dollar value for project costs and associated benefits. Having defined costs and benefits allows a direct comparison of benefits versus costs, and a quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified or may be impossible to quantitatively assess.





For the purposes of this planning process, jurisdictions were tasked with evaluating project cost-effectiveness with both costs and benefits assigned to "High", "Medium" and "Low" ratings. Where quantitative estimates of costs and benefits were available, ratings/ranges were defined as:

Low = < \$10,000	Medium = \$10,000 to \$100,000	High = > \$100,000
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Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the following definitions were used:

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will
	provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

### Table 6-2. Qualitative Cost and Benefit Ratings

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the Westchester County initiatives identified, the Planning Committee may seek financial assistance under FEMA's HMGP or Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. The Planning Committee is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Committee reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

	500-	Year MRP	2,500-Year MRP		
Jurisdiction	Displaced Households	People Requiring Short-Term Shelter	Displaced Households	People Requiring Short-Term Shelter	
Ardsley (V)	0	0	0	0	
Bedford (T)	0	0	0	0	
Briarcliff Manor (V)	0	0	0	0	
Bronxville (V)	0	0	0	0	
Buchanan (V)	0	0	0	0	
Cortlandt (T)	0	0	2	1	
Croton-on-Hudson (V)	0	0	1	0	
Dobbs Ferry (V)	0	0	1	1	
Eastchester (T)	0	0	1	0	
Elmsford (V)	0	0	0	0	
Greenburgh (T)	0	0	5	3	
Harrison (T)	0	0	1	1	
Hastings-on-Hudson (V)	0	0	2	1	
Irvington (V)	0	0	0	0	
Larchmont (V)	0	0	0	0	
Lewisboro (T)	0	0	0	0	





	500-	Year MRP	2,500-Year MRP		
Jurisdiction	Displaced Households	People Requiring Short-Term Shelter	Displaced Households	People Requiring Short-Term Shelter	
Mamroneck (T)	0	0	1	0	
Mamaroneck (V)	0	0	1	1	
Mount Kisco (T)	0	0	2	1	
Mount Pleasant (T)	0	0	1	0	
Mount Vernon (C)	0	0	8	6	
New Castle (T)	0	0	0	0	
New Rochelle (C)	0	0	4	3	
North Castle (T)	0	0	0	0	
North Salem (T)	0	0	0	0	
Ossining (T)	0	0	0	0	
Ossining (V)	0	0	2	1	
Peekskill (C)	0	0	3	2	
Pelham (T)*	0	0	0	0	
Pelham (V)	0	0	0	0	
Pelham Manor (V)	0	0	0	0	
Pleasantville (V)	0	0	0	0	
Port Chester (V)	0	0	1	1	
Pound Ridge (T)	0	0	0	0	
Rye (C)	0	0	0	0	
Rye Brook (V)	0	0	0	0	
Scarsdale (T)	0	0	0	0	
Sleepy Hollow (V)	0	0	2	2	
Somers (T)	0	0	0	0	
Tarrytown (V)	0	0	2	1	
Tuckahoe (V)	0	0	0	0	
White Plains (C)	0	0	12	7	
Yonkers (C)	1	0	34	25	
Yorktown (T)	0	0	1	1	
Westchester County (Total)	1	1	91	60	



## **SECTION 7. PLAN MAINTENANCE PROCEDURES**

This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Partnership maintains their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below.

The overarching goal of the plan maintenance procedure is to ensure that all participating jurisdictions remain engaged in not only implementing the plan but in its continuous review and update, to ensure it is a relevant and living document. The county is committed to supporting municipalities in frequent communications regarding the status of mitigation projects and to communicating the mitigation successes amongst the county agencies and municipalities. This maintenance procedure is a springboard for each community to routinely use the plan as a resource and roadmap to fund and implement projects to increase the resiliency of their communities.

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.	January or upon major update to Comprehensive Plan or major disaster	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to become an organic part of the ongoing county and municipal activities, the county will incorporate the distribution of the safe growth worksheet (see 7.1.2 below) for annual review and update by all participating jurisdictions.	January each year with interim email reminders to address integration in county and municipal activities.	HMP Coordinator and jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	HMP Coordinator
Evaluation	Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by January 15 of each year	Steering Committee; Plan Maintenance element	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a	Every 5 years or upon major update to Comprehensive Plan or major disaster	Westchester County HMP Coordinator	Jurisdictional points of contacts identified in Section 9

## Table 7-1. Plan Maintenance Matrix





Task	Approach	Timeline	Lead Responsibility	Support Responsibility
	comprehensive update to review and revise the plan.			(Jurisdictional Annexes)

## 7.1 Monitoring, Evaluating and Updating the Plan

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the Planning Committee and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan.

The Planning Committee shall fulfill the monitoring, evaluation and updating responsibilities identified in this section which is comprised of a representative from each participating jurisdiction. Each jurisdiction is expected to maintain a representative on the Planning Committee throughout the plan performance period (five years from the date of plan adoption). As of the date of this plan, primary and secondary mitigation planning representatives (points-of-contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

Regarding the composition of the committee, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation. The HMP Coordinator will strive to keep the committee makeup as a uniform representation of planning partners and stakeholders within the planning area.

Currently, the Westchester County HMP Coordinator is designated as:

Daniel N. Olmoz | Office of Emergency Management Westchester County Department of Emergency Services 200 Bradhurst Avenue, Hawthorne, NY 10532 Office: 914-864-5451 / Fax: 914-864-5434 e-mail: <u>dno1@westchestergov.com</u>

## 7.1.1 Monitoring

The Planning Committee shall be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, and documenting annual progress. Each year, beginning one year after plan development, Westchester County and local Planning Committee representatives will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system, the BATool<sup>SM</sup> which will enable municipal and county representatives of directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. It is anticipated that all participating partners will be prompted by the tool to update progress on a quarterly basis, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. It is expected that this reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system which facilitates the sorting and prioritization of projects.





In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding; and obstacles or impediments to implementation of actions, the information that Planning Committee representatives shall be expected to document, as needed and appropriate include:

- Any grant applications filed on behalf of any of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction,
- Additional mitigation actions believed to be appropriate and feasible,
- Public and stakeholder input.

Plan monitoring for years 2 through 4 of the plan performance periods will be similarly addressed via the BATool<sup>SM</sup> or manually.

## 7.1.2 Integration Process of the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Westchester County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Refer to Section 9 (Jurisdictional Annexes) for how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Partnership representatives will incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 - Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

- 1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts;
- 2. The Hazard Mitigation Plan, Comprehensive Plans, Emergency Management Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of County residents.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Westchester County HMP into their day-to-day operations and planning and regulatory processes. Additionally, each municipality will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report. The following checklist was adapted from FEMA's Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help municipalities identify areas that integrate hazard mitigation currently and where to make improvements and reduce vulnerability to future development. In this manner, the integration of mitigation into municipal activities will evolve into an ongoing culture within the county and its municipalities.





## Table 7-2. Safe Growth Check List

	Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the
		Ves	No	future?
Operati	ng Municipal and Capital Improvem	ont Pro	grom B	udgate
operati	When constructing uncoming		gram D	
	budgets hazard mitigation actions			
	will be funded as budget allows.			
	Construction projects will be			
	evaluated to see if they meet the			
	hazard mitigation goals.			
•	Annually, during adoption process,			
	the municipality will review			
	mitigation actions when allocating			
	funding.			
•	Do budgets limit expenditures on			
	projects that would encourage			
	development in areas vulnerable to			
	natural hazards?			
•	Do infrastructure policies limit			
	extension of existing facilities and			
	services that would encourage			
	development in areas vulnerable to			
	natural hazards?			
•	Do budgets provide funding for			
	hazard mitigation projects identified			
Human	In the County HMP?			
numan	Do any job descriptions specifically			
•	include identifying and/or			
	implementing mitigation			
	projects/actions or other efforts to			
	reduce natural hazard risk?			
Buildin	g and Zoning Ordinances			
•	Prior to, zoning changes, or			
	development permitting, the			
	municipality will review the hazard			
	mitigation plan and other hazard			
	analyses to ensure consistent and			
	compatible land use.			
•	Does the zoning ordinance			
	discourage development or			
	redevelopment within natural areas			
	including wetlands, floodways, and			
	floodplains?			
•	Does it contain natural overlay			
	zones that set conditions			
•	Does the ordinance require			
	developers to take additional			
	actions to mitigate natural hazard			
•	notice house of the second sec			
	natural nazaru areas as limits on			



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	Planning Mechanisms	Do you Do		Notes:
1		Th	is?	How is it being done or how will this be utilized in the
		Yes	No	
	zoning changes that allow greater intensity or density of use?			
•	Do the ordinances prohibit			
	development within, of filling of,			
	wetlands, floodways, and			
	floodplains?			
Subdivi	ision Regulations			
•	Do the subdivision regulations			
	within or adjacent to natural hazard			
	areas?			
•	Do the subdivision regulations			
	restrict the subdivision of land			
	within or adjacent to natural hazard			
	areas?			
•	Do the regulations provide for			
	conservation subdivisions or cluster			
	subdivisions in order to conserve			
	environmental resources?			
•	Do the regulations allow density			
Compr	transfers where nazard areas exist?			
Compr	Are the goals and policies of the			
·	plan related to those of the County			
	HMP?			
•	Does the future land use map			
	clearly identify natural hazard			
	areas?			
•	Do the land use policies discourage			
	development or redevelopment with			
	natural hazard areas?			
	Does the plan provide adequate			
•	space for expected future growth in			
	areas located outside natural hazard			
	areas?			
Land U	se		• • • • • • • • • • • • • • • • • • • •	
•	Does the future land use map			
	clearly identify natural hazard			
	areas?			
•	Do the land use policies discourage			
	development or redevelopment with			
-	natural nazard areas?			
•	Does the plan provide adequate			
	areas located outside natural hazard			
	areas?			
Transp	ortation Plan		I	
•	Does the transportation plan limit			
	access to hazard areas?			





Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the
	Yes	No	future?
• Is transportation policy used to guide growth to safe locations?			
• Are transportation systems designed to function under disaster conditions (e.g. evacuation)?			
Environmental Management			
• Are environmental systems that protect development from hazards identified and mapped?			
• Do environmental policies maintain and restore protective ecosystems?			
• Do environmental policies provide incentives to development that is located outside protective ecosystems?			
Grant Applications			
<ul> <li>Data and maps will be used as supporting documentation in grant applications.</li> </ul>			
Municipal Ordinances			
<ul> <li>When updating municipal ordinances, hazard mitigation will be a priority</li> </ul>			
Economic Development		•	
• Local economic development group will take into account information regarding identified hazard areas when assisting new businesses in finding a location.			
Public Education and Outreach			
<ul> <li>Does the municipality have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?</li> </ul>			





## 7.1.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Committee, to be held either in person or via teleconference approximately one year from the date of local adoption of this update, and successively thereafter. At least two weeks before the annual plan review meeting, the Westchester County HMP Coordinator will advise Planning Committee members of the meeting date, agenda and expectations of the members.

The Westchester County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and Soliciting input regarding progress toward meeting plan goals and objectives. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available.
- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- Changes in county, city, town or village resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Committee will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Under/over spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Committee will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing





Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Committee should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix G – Plan Review Tools). Further, the Planning Committee should refer to any process and plan review deliverables developed by the county or participating jurisdictions as a part of the plan review processes established for prior or existing local HMPs within the county.

The Westchester County HMP Coordinator shall be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local Planning Committee members, information presented at the annual Planning Committee meeting, and other information as appropriate and relevant. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP on an annual basis, the Planning Committee will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report shall be posted on the Westchester County Department of Planning and Development website to keep the public apprised of the plan's implementation (https://www.westchesterhmp.com/). Additionally, the website provides a general overview of the plan and its purpose and use in the community. For communities who might choose to join the NFIP CRS program, this report will also be provided to each CRS participating community in order to meet annual CRS recertification requirements. To meet this recertification timeline, the Planning Committee will strive to complete the review process and prepare an Annual HMP Progress Report by January 15th of each year.

The HMP will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damages or if data listed in the Section 5.4 (Hazard Profiles) of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

## 7.1.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under DMA 2000. It is the intent of the Westchester County HMP Planning Committee to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the Westchester County HMP Coordinator, with support of the Planning Committee, shall use the second annual Planning Committee meeting to develop and commence the





implementation of a detailed plan update program. The Westchester County HMP Coordinator shall invite representatives from NYS DHSES to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements.

At this meeting, the Planning Committee shall determine what resources will be needed to complete the update. The Westchester County HMP Coordinator shall be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all planning group members and the New York State Hazard Mitigation Officer.

## 7.1.5 Grant Monitoring and Coordination

Westchester County recognizes the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each municipal partner as part of their annual progress reporting.". The Westchester County HMP Coordinator will keep the planning partners apprised of Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Westchester County intends to be a resource to the planning partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during open windows for grant applications. As part of grant monitoring and coordination, Westchester County intends to provide the following:

- Notification to planning partners about impending grant opportunities.
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration.
- Notification about mitigation priorities for the fiscal year to assist the planning partners in the selection of appropriate projects.

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

## 7.2 Implementation of Mitigation Plan through Existing Programs

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the county there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those existing plans and programs.

The "Capability Assessment" section of Section 6 (Mitigation Strategy) provides a summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation within the county. Within each jurisdictional annex in Section 9 (Jurisdictional Annexes), the county and each participating jurisdiction identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework ("existing integration"), and how they intend to promote this integration ("opportunities for future integration").

It is the intention of Planning Committee representatives to incorporate mitigation planning as an integral component of daily government operations. Planning Committee representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general





operations of government and partner organizations. Further, the sample adoption resolution (Section 2 - Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Committee anticipates that:

- 1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
- 2) The Hazard Mitigation Plan, Comprehensive Plans, Emergency Management Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community Wildfire Protection Plans
- Comprehensive Flood Hazard Management Plans
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/education plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Committee representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

## 7.3 Continued Public Involvement

Westchester County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on-line (https://www.westchesterhmp.com/). In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability.
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms. Educate the public via the jurisdictional websites on how these applications can be used in an emergency situation.





• Development of annual articles or workshops on flood hazards to educate the public and keep them aware of the dangers of flooding.

Planning Committee representatives and the Westchester County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The Westchester County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. Additional meetings might also be held as deemed necessary by the planning group. The purpose of these meeting would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The Planning Committee representatives shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the Plan.
- Appropriate links to the Westchester County Hazard Mitigation Plan website are included on municipal websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during Plan update cycles.

The Westchester County HMP Coordinator shall be responsible to assure that:

- Public and stakeholder comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- The Westchester County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities along with instructions to facilitate public input and comment on the plan.

Public notices, including media releases, are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.





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# **ACRONYMS AND ABBREVIATIONS**

%	Percent
AAA	American Avalanche Association
ACS	American Community Survey
ADA	American Disabilities Act
AFG	Assistance to Firefighters Grants
AFPB	Agricultural and Farmland Protection Board
ANSS	Advanced National Seismic System
APA	Approval Pending Adoption
ARC	American Red Cross
BCA	Benefit Cost Analysis
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BOCA	Building Officials Code Administration
BRCSMP	Bronx River Corridor Study and Management Plan
BRIC	Building Resilient Infrastructure and Communities Program
CAC	Community Advisory Committee
CAPI	Westchester County Climate Action Planning Institute
CAV	Community Assistance Visit
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control and Prevention
СЕНА	Coastal Erosion Hazard Areas
CEO	Chief Executive Officer
CFM	Certified Floodplain Manager
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CBRN	Chemical, Biological, Radiological, and Nuclear
CDC	Centers for Disease Control and Prevention
CDMS	Comprehensive Data Management System
СМР	Coastal Management Program
COG	Continuity of Operations/Continuity of Government
CRRA	Community Risk and Resiliency Act
CRREL	Cold Regions Research and Engineering Laboratory



CRS	Community Rating System
CSC	Climate Smart Communities (NYSDEC)
СТ	Connecticut
CWSRF	Clean Water State Revolving Fund
СҮ	Cubic Yards
DBSC	Department of State Division of Building Standards and Codes
DCEA	Division of Code Enforcement and Administration
DHS	Department of Homeland Security
DHSES	Division of Homeland Security and Emergency Services
DMA 2000	Disaster Mitigation Act of 2000
DOT	Department of Transportation
DPW	Department of Public Works
DR	Major Disaster Declaration (FEMA)
EAP	Emergency Action Plan
EF	Enhanced Fujita Scale
EFC	New York State Environmental Facilities Corporation
EHS	Extremely Hazardous Substances
EM	Emergency Declaration (FEMA)
EM	Emergency Management
EMPG	Emergency Management Performance Grants Program
EMS	Emergency Medical Services
EOC	Emergency Operation Center
EOP	Emergency Operation Plan
EPA	Environmental Protection Agency
EPZ	Emergency Planning Zone
EWP	Emergency Watershed Protection Program
FD	Fire Department
FDRA	Fire Danger Rating Areas
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIA	Flood Insurance Administration
FIS	Flood Insurance Study
FM	Fuel Moisture
FMA	Flood Mitigation Assistance



FPA	Floodplain Administrator
FPE	Floodplain Easement
GHGI	Greenhouse Gas Inventories
GIS	Geographic Information System
GSN	Global Seismographic Network
HAZUS	Hazards U.S.
HHPD	Rehabilitation of High Hazard Potential Dams grant program
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HOC	Hazard of Concern
HSGP	Homeland Security Grant Program
HTFC	Housing Trust Fund Corporation
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IA	Individual Assistance
IBC	International Building Code
IPCC	International Panel on Climate Change
ISO	Insurance Service Organization
IT	Information Technology
LCSN	Lamon-Doherty Cooperative Seismographic Network
LEPC	Local Emergency Planning Committee
LOIP	Letter of Intent to Participate
LWRP	Local Waterfront Revitalization Program
MHI	Median Household Income
Mi	Mile
MMI	Modified Mercalli Intensity Scale
MMS	Moment Magnitude Scale
MNRR	Metro North Railroad
MOA	Memorandum of Agreement
Mph	Miles per Hour
MRCC	Midwestern Regional Climate Center
MRP	Mean Return Period
MSL	Mean Sea Level
MTA	Metropolitan Transportation Authority
N/A	Not Applicable

NA	Not Available
NASA	National Aeronautics and Space Administration
NAC-AAA	National Avalanche Center – American Avalanche Association
NAVD	North American Vertical Datum
NCDC	National Climate Data Center
NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NDSP	National Dam Safety Program
NEHRP	National Earthquake Hazard Reductions Program
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NHC	National Hurricane Center
NID	National Inventory of Dams
NJAFM	New Jersey Association of Floodplain Managers
NOAA	National Oceanic and Atmospheric Administration
NPCC	New York City Panel on Climate Change
NPDES	National Pollutant Discharge Elimination System
NPDP	National Performance of Dams Program
NOUE	Notification of Unusual Event
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCC	Northeast Regional Climate Center
NRCS	Natural Resources Conservation Service
NSIDC	National Snow and Ice Data Center
NSSL	National Severe Storms Library
NVRC	Northern Virginia Regional Commission
NWS	National Weather Service
NY	New York
NYC	New York City
NYCEM	New York City Area Consortium for Earthquake Loss Mitigation
NYCDEP	New York City Department of Environmental Protection
NYC OEM	New York City Office of Emergency Management
NYCRR	New York Codes, Rule, and Regulations
NYS	New York State
NYS DHSES	New York State Division of Homeland Security and Emergency Services
NYS DEC	New York State Department of Environmental Conservation





NYSDOS	New York State Department of State
NYSDPC	New York State Disaster Preparedness Commission
NYS GIS	New York State Geographic Information System
NYSGS	New York State Geologic Survey
NYS HCR	New York State Homes and Community Renewal
NYS OFP&C	New York State Office of Fire Prevention and Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYSHMP	New York State Hazard Mitigation Plan
NYSOEM	New York State Office of Emergency Management
NYS OFP&C	New York State Office of Fire Prevention and Control
OCR	Office of Community Renewal
OEM	Office of Emergency Management
PA	Public Assistance
PAG	Protective Action Guides
PCDA	Property Condition Disclosure Act
PD	Police Department
PDM	Pre-Disaster Mitigation Program
PDR	Purchase of Development Rights
PE	Professional Engineer
PGA	Peak Ground Acceleration
PIO	Public Information Officer
POC	Point of Contact
Pop.	Population
PW	Public Works
RCV	Replacement Cost Value
RDD	Radiological Dispersion Devices
RL	Repetitive Loss
RSI	Regional Snowfall Index
RTE	Route
RSZ	Ramapo Seismic Zone
SAE	Site Area Emergency
SBA	Small Business Administration



SC	Steering Committee
SDI	State Drought Index
SEQRA	State Environmental Quality Review Act
SDI	State Drought Index (NYSDEC)
SF	Square Feet
SFHA	Special Flood Hazard Area
SFMRG	State Flood Risk Management Guidance
SHELDUS	Spatial Hazard Events and Losses Database for the United States
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SLR	Sea Level Rise
SPC	Storm Prediction Center
Sq. Mi.	Square mile
SRL	Severe Repetitive Loss
SSBG	Social Services Block Grant Program
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, Environmental
SUNY	State University of New York
SVI	Social Vulnerability Index
SWCD	Soil and Water Conservation District
SWMP	Storm Water Management Plan
SWOO	Strengths, Weaknesses, Obstacles and Opportunities
TBD	To Be Determined
TD	Tropical Depression
TDR	Transfer of Development Rights
THIRA	Threat & Hazard Identification & Risk Assessment
TIGER	Transportation Investment Generating Economic Recovery
TMDL	Total Maximum Daily Load
TNT	Trinitrotoluene
TORRO	The Tornado and Storm Research Organization
TS	Tropical Storm
TV	Television
UE	Unusual Event
USACE	U.S. Army Corps of Engineers
USEDA	U.S. Economic Development Administration
USD	U.S. Dollar
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation



USEDA	U.S. Economic Development Administration
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VA	Vulnerability Assessment
WCDEF	Westchester County Department of Environmental Facilities
WCDES-OEM	Westchester County Department of Emergency Services - Office of Emergency
	Management
WCDP	Westchester County Department of Planning
WCDPS	Westchester County Department of Public Safety
WCDPW/T	Westchester County Department of Public Works and Transportation
WCDSS	Westchester County Department of Social Services
WCHMP	Westchester County Hazard Mitigation Plan
WCSWCD	Westchester County Soil and Water Conservation District
WCT	Wind Chill Temperature
WFAS	Wildland Fire Assessment System
WHO	World Health Organization
WMD	Weapons of Mass Destruction
WNV	West Nile Virus
WQIP	Water Quality Improvement Project
WUI	Wildland Urban Interface



# **APPENDIX A. ADOPTION RESOLUTIONS**

The Westchester County and municipal adoption resolutions will be included in this appendix upon receipt of the Federal Emergency Management Agency (FEMA) Approval Pending Adoption (APA) status. Please refer to Section 8 (Planning Partnership) for additional information on plan adoption procedures.

This appendix also includes an example resolution to be submitted by Westchester County and participating jurisdictions authorizing adoption of the Westchester County Hazard Mitigation Plan Update.





#### **RESOLUTION NO. XXXX-XX**

# A RESOLUTION OF THE <mark>Governing Body</mark> OF THE <mark>Jurisdiction Name</mark> AUTHORIZING THE ADOPTION OF THE 2021 WESTCHESTER COUNTY, NY HAZARD MITIGATION PLAN UPDATE

**WHEREAS**, all jurisdictions within Westchester County have exposure to natural hazards that increase the risk to life, property, environment, and the County and local economy; and

**WHEREAS**; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

**WHEREAS**, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

**WHEREAS**; a coalition of Westchester County municipalities with like planning objectives has been formed to pool resources and create consistent mitigation strategies within Westchester County; and

**WHEREAS**, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

#### NOW, THEREFORE, BE IT RESOLVED that the [jurisdiction name]:

- 1) Adopts in its entirety, the 2021 Westchester County Hazard Mitigation Plan (the "Plan") as the jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
- 2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
- 3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
- 4) Will continue its support of the Mitigation Planning Committee as described within the Plan.
- 5) Will help to promote and support the mitigation successes of all participants in this Plan.





- 6) Will incorporate mitigation planning as an integral component of government and partner operations.
- 7) Will provide an update of the Plan in conjunction with the County no less than every five years.

PASSED AND ADOPTED on this X<sup>st</sup>, X<sup>nd</sup>, X<sup>rd</sup>, X<sup>th</sup> day of MONTH, 202X, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

Mayor, City/Town/Village of \_\_\_\_\_

ATTEST:

Clerk, City/Town/Village of \_\_\_\_\_





# **APPENDIX B. MEETING DOCUMENTATION**

Appendix B includes meeting agendas, sign-in sheets and minutes (where applicable and available) for meetings convened during the development of the Westchester County Hazard Mitigation Plan Update.





# **APPENDIX C. PUBLIC AND STAKEHOLDER OUTREACH**

This appendix provides documentation of public and stakeholder outreach. Stakeholder involvement in this planning process was broad and productive as discussed and further documented in Section 3 (Planning Process). Public and stakeholder input has been incorporated throughout this HMP as appropriate, as identified in Section 3 and the References section, as well as within specific mitigation initiatives identified within the jurisdictional annexes (Section 9). Respondent feedback filtered by jurisdiction is included in each jurisdictional annex as available to provide an indication of community resident concerns related to natural hazards.

#### C.1 Westchester County Citizen Survey Results

This section contains information and results gathered from the Westchester County Citizen Survey. The main objective of this survey was to gather information from citizens regarding their level of knowledge regarding hazard vulnerability and knowledge of hazard mitigation information for their local communities. 1250 respondents completed this survey over a period of six months during the planning process. The available County website survey was on Westchester and the HMP website at www.Westchestercountynyhmp.com. The survey results are provided in the following pages, with personal information redacted.





Q1 Please indicate you	ur age range:
------------------------	---------------

ANSWER CHOICES	RESPONSES	
18 to 30	2.74%	34
31 to 40	15.81%	196
41 to 50	23.15%	287
51 to 60	22.18%	275
60 or over	36.13%	448
TOTAL	1	L,240



# Q2 Please indicate in which municipality you live or work in.

### Ridge Town of Rye Town of Somers Town of Yorktown Village of Ardsley Village of Briarcliff... Village of Bronxville Village of Buchanan Village of Croton-On-Hu... Village of Dobbs Ferry Village of Elmsford Village of Harrison Village of Hastings-On-... Village of Irvington Village of Larchmont Village of Mamoroneck Village of Mount Kisco Village of Ossining Village of Pelham Village of Pelham Manor Village of Pleasantville

#### Westchester County Hazard Mitigation Plan - Citizen Survey

.....



ANSWER CHOICES	RESPONSES	
City of Mount Vernon	0.48%	6
City of New Rochelle	1.05%	13
City of Peekskill	0.16%	2
City of Rye	2.10%	26
City of White Plains	12.66%	157
City of Yonkers	4.84%	60
Town of Bedford	0.08%	1
Town of Cortlandt	0.73%	9
Town of Eastchester	0.24%	3
Town of Greenburgh	1.29%	16
Town of Lewisboro	2.26%	28
Town of Mamaroneck	2.58%	32
Town of Mount Pleasant	1.13%	14
Town of New Castle	0.32%	4
Town of North Castle	0.32%	4
Town of North Salem	0.24%	3
Town of Ossining	0.81%	10
Town of Pelham	0.08%	1
Town of Pound Ridge	0.16%	2
Town of Rye	0.56%	7
Town of Somers	0.24%	3
Town of Yorktown	0.97%	12
Village of Ardsley	0.24%	3
Village of Briarcliff Manor	0.48%	6
Village of Bronxville	0.24%	3
Village of Buchanan	0.00%	0
Village of Croton-On-Hudson	0.48%	6
Village of Dobbs Ferry	16.05%	199
Village of Elmsford	0.00%	0
Village of Harrison	11.45%	142
Village of Hastings-On-Hudson	13.55%	168
Village of Irvington	0.48%	6

Village of Larchmont	0.81%	10
Village of Mamoroneck	5.24%	65
Village of Mount Kisco	0.32%	4
Village of Ossining	0.65%	8
Village of Pelham	0.00%	0
Village of Pelham Manor	0.00%	0
Village of Pleasantville	4.27%	53
Village of Port Chester	0.89%	11
Village of Rye Brook	1.61%	20
Village of Scarsdale	0.65%	8
Village of Sleepy Hollow	0.48%	6
Village of Tarrytown	7.66%	95
Village of Tuckahoe	0.16%	2
Other (please specify)	0.97%	12
TOTAL		1,240



ANSWER CHOICES	RESPONSES	
Less than 1 year	3.97%	49
1 to 5 years	19.61%	242
6 to 9 years	12.88%	159
10 to 19 years	17.99%	222
20 years or more	45.54%	562
TOTAL		1,234

# Q3 How long have you lived here?

# Q4 Do you own or rent your place of residence?



ANSWER CHOICES	RESPONSES
Own	90.28% 1,115
Rent	9.72% 120
TOTAL	1,235

Q5 What is your home address? (optional, will be kept confidential - only used to identify localized hazard areas such as flooding. If you would like to include information on a secondary home, please fill out an additional survey)

Answered: 671 Skipped: 575

## Q6 Please rank how prepared you feel you and your household are for natural disaster events likely to occur within your community. Rank on a scale of 1 to 5, with 5 representing the most prepared.



ANSWER CHOICES	RESPONSES	
1 (least)	10.27%	106
2	23.06%	238
3	41.76%	431
4	20.93%	216
5 (Most)	3.97%	41
TOTAL		1,032

# Q7 In what ways do you believe you are prepared for a natural disaster that may occur within your municipality? (Please check all that apply)



ANSWER CHOICES	RESPON	ISES
I have taken precautionary measures to protect my property though improvements or when constructed	45.78%	456
I have a preparedness kit consisting of basic supplies and materials for my family and myself to support us for 3-5 days during a disaster event	37.15%	370
I am aware of how to determine the nearest open shelter during a disaster event	20.18%	201
I have a personal family emergency preparedness plan, and have discussed it with my family and others for whom I have responsibility	17.67%	176
I am prepared to shelter in-place for 3-5 days if that is the best available option	66.57%	663
I have at least two methods for receiving emergency notifications and for information during severe weather or other potential emergency situations	61.95%	617
I have insurance policies to cover losses from specific risks (e.g. flood insurance)	36.65%	365
I have received emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	27.21%	271
I have used local news or other media to obtain information	74.00%	737
I have received information from schools and other academic institutions	24.40%	243
I have attended meetings that have dealt with disaster preparedness	11.14%	111
Other (please specify)	4.72%	47
Total Respondents: 996		

Q8 In the past 10 years, which of the following types of hazards/natural disasters have you or someone in your household experienced within Westchester County, or sustained damage as a result of, and how concerned are you about the following natural hazards impacting the County? (In the first column indicate if you have experienced the hazard, then indicate your level of concern).









Not Concerned

Extremely Concerned

Somewhat Concerned

Have Experienced

Very Concerned

#### Westchester County Hazard Mitigation Plan - Citizen Survey

HAVE NOT SOMEWHAT VERY EXTREMELY TOTAL **EXPERIENCED** CONCERNED CONCERNED CONCERNED CONCERNED RESPONDENTS Earthquake 10.27% 77.83% 16.69% 1.75% 0.82% 88 667 143 15 7 857 44.28% 21.08% 42.90% 18.22% 5.93% **Extreme Temperatures** (hot and cold) 418 199 405 172 56 944 Flooding - Coastal 15.66% 41.07% 27.38% 15.78% 12.06% 135 354 236 136 104 862 29.42% Flooding - Riverine/flash 31.28% 22.17% 21.41% 20.53% flooding 285 202 268 195 187 911 24.42% Flooding - Urban 39.92% 12.42% 28.87% 24.95% flooding/stormwater 235 230 942 376 117 272 issues Severe Storm (wind, 55.46% 3.60% 30.63% 30.83% 20.82% lightning, hail) 554 36 306 308 208 999 Severe Winter Storms 55.20% 7.10% 35.30% 28.60% 15.00% (Blizzard, Heavy Snow, 552 71 353 286 150 1,000 Ice) 2.21% 21.05% 3.60% 1.98% Wildfire 73.14% 860 19 629 181 31 17 Chemical, Biological, 1.39% 45.38% 36.26% 12.12% 5.77% Radiological, or Nuclear 12 393 314 105 50 866 (CBRN) Incidents 7.10% 17.14% 36.75% 28.97% 15.45% Cyber Attack 63 152 326 257 137 887 **Disease Outbreak** 38.50% 6.04% 25.91% 34.34% 25.91% 370 58 249 330 249 961 Other, indicate in 23.68% 39.47% 14.04% 10.53% 23.68% comment box below 27 45 16 12 27 114 Q9 How do you receive your information concerning a natural disaster? Of the information sources below, please identify the top three (3) that are MOST EFFECTIVE in providing you with information to make your home safer and better able to withstand the impact of natural disaster events.



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ANSWER CHOICES	RESPONSES	
Newspaper	21.09%	216
County Website	16.41%	168
Town/Village Websites	27.05%	277
Town/Village Email	52.93%	542
Police, Fire, EMS, 9-1-1	17.29%	177
Telephone Book	0.10%	1
Informational Brochures	2.54%	26
Public Meetings, Workshops, or Public Awareness Events	6.35%	65
Schools	9.86%	101
TV News	55.37%	567
TV Advertising	1.37%	14
Radio News	29.98%	307
Radio Advertisements	1.37%	14
Outdoor Advertisements	0.88%	9
Internet	67.87%	695
Chamber of Commerce	0.98%	10
Civic Organizations/Homeowner Associations	3.32%	34
Realtors	0.39%	4
Fire Department/EMS Agency	7.62%	78
Academic Institutions	2.93%	30
Non-profits	2.54%	26
Books	1.56%	16
Public Library	1.46%	15
Social Media	33.89%	347
Other (please specify)	8.59%	88
Total Respondents: 1.024		

# Q10 To the best of your knowledge is your property located in a designated floodplain?If you do not know, or are not sure, please check the FEMA website: https://msc.fema.gov/portal/home.



ANSWER CHOICES	RESPONSES
Yes	11.93% 123
No	72.55% 748
Not Sure	15.52% 160
TOTAL	1,031



# Q11 Do you have flood insurance?

ANSWER CHOICES	RESPONSES	
Yes	16.16%	166
No	72.15%	741
Not sure	11.68%	120
TOTAL	:	1,027

# Q12 If you do NOT have flood insurance, what is the primary reason?



ANSWER CHOICES	RESPONSES	
I am not required to purchase it	29.35%	241
My property has never flooded/located on high ground	42.51%	349
It is too expensive	6.58%	54
Not familiar with it/don't know about it	7.80%	64
Insurance company will not provide	6.58%	54
I believe that my homeowners insurance will cover me	7.19%	59
TOTAL		821
### Q13 Do you or did you have problems getting homeowners/renters insurance due to risks from natural hazards?



ANSWER CHOICES	RESPONSES	
Yes	3.23%	33
No	96.77% 98	39
TOTAL	1,02	22

## Q14 If you answered "yes" to the previous question, please identify the natural hazard risk that caused you to have problems obtaining homeowners/renters insurance.

Answered: 24 Skipped: 1,222

Q15 Please identify any specific vulnerabilities that you are aware of in your city/town/village (e.g. floodprone areas or specific properties, critical facilities that lack backup power, etc.). Please list street names and other specific identifiers if possible.

Answered: 572 Skipped: 674

Q16 Please identify any specific vulnerabilities that you are aware of in Westchester County outside of your town/village (e.g. floodprone areas or specific properties, critical facilities that lack backup power, etc.). Please list city/town/village, street names, and other specific identifiers if possible.

Answered: 308 Skipped: 938

# Q17 What types of projects do you believe local, county, state or federal government agencies could be doing in order to reduce the damage and disruption of natural disasters in Westchester County? Select your top three choices



#### Westchester County Hazard Mitigation Plan - Citizen Survey

ANSWER CHOICES	RESPON	ISES
Improve and strengthen critical facilities such as police, schools, hospitals	21.44%	193
Improve and strengthen infrastructure, such as elevating roadways and improving drainage systems	85.11%	766
Work on improving the damage resistance of utilities (electricity, communications, water/wastewater facilities etc.)	77.11%	694
Install or improve protective structures, such as bulkheads, floodwalls or levees to protect against flooding	37.33%	336
Enhance dune restoration and beach nourishment projects/programs	12.56%	113
Replace inadequate or vulnerable bridges and causeways	32.11%	289
Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	33.89%	305
Buy out flood prone properties and maintain as open-space	25.89%	233
Inform property owners of ways they can mitigate damage to their properties	42.56%	383
Provide better information about hazard risks and high-hazard areas	33.67%	303
Assist vulnerable property owners with securing funding to mitigate their properties	37.44%	337
Total Respondents: 900		

Q18 How much money would you be willing to spend on your current home to help protect it from the impacts of potential future natural disasters within our community? Examples are: Elevating a flood-prone home; elevating utilities in flood-prone basements; strengthening your roof, siding, doors or windows to withstand high winds; removing threatening trees or branches.



ANSWER CHOICES	RESPONSES	
Over \$50,000	5.34%	48
Between \$25,000 and \$50,000	8.12%	73
Between \$10,000 and \$24,999	20.24%	182
Between \$5,000 and \$9,999	20.02%	180
Less than \$5,000	12.57%	113
Nothing	5.34%	48
Don't know	28.36%	255
TOTAL		899

## Q19 If you have already had to spend money to mitigate your property, how much have you spent and on what?

Answered: 399 Skipped: 847

Q20 Which, if any incentives would motivate you to spend money on protecting your home from the possible impacts of a natural disaster? (such as lower interest rates, grant funding, waivers, etc.)

Answered: 501 Skipped: 745

Q21 If your property were located in a designated high hazard area (e.g. NFIP flood zone, storm surge zone), or had received repeated damages from a natural disaster event, would you consider a "buyout", "elevation" of the structure, or "relocation"?



ANSWER CHOICES	RESPONSES
Yes	50.44% 399
No	8.22% 65
Not sure	41.34% 327
TOTAL	791

Q22 Please list any additional types of projects you believe local, county, state or federal government agencies could be doing in order to reduce the damage and disruption of natural disasters in Westchester County.

Answered: 328 Skipped: 918

Q23 For additional information about Westchester County Multi-Jurisdictional Hazard Mitigation Plan, please visit:https://planning.westchestergov.com/hazard-mitigationplanning/hazard-mitigation-plan Other Comments:

Answered: 131 Skipped: 1,115

#### C.2 Stakeholder Surveys

In addition to collecting information from residents of Westchester County, surveys were developed for the agencies and stakeholders in the county. Unlike steering committee or planning partnership members, stakeholders may not be involved in all stages of the planning process, but they may have information or input to provide. In order to gather that information, the surveys were sent to the following stakeholders: law enforcement, firefighters, emergency medical services, highway and public works, business and commerce, hospitals and health care providers, and utilities. Results of the surveys are provided in the following pages, with personal information redacted.



#### Q1 Please provide your name.

Answered: 34 Skipped: 1

### Q2 Which organization, department, agency, or municipality do you represent?

Answered: 34 Skipped: 1

#### Q3 Please provide your email address.

Answered: 34 Skipped: 1



#### Q4 What category does your facility operation/service fall under?

ANSWER CHOICES	RESPONSES	
Academic/Research	0.00%	0
Business/Commerce	0.00%	0
Emergency Services (police, fire, EMS)	48.28%	14
Hospitals/Medical Services	13.79%	4
Transportation	0.00%	0
Public Works	10.34%	3
Other (please specify)	27.59%	8
TOTAL		29

Q5 Based on the above category, please provide additional description and information as to what your organization does or offers (please explain).

Answered: 24 Skipped: 11

# Q6 Please identify the location of your facility(ies) and/or primary service area. You may choose more than one if your service area covers multiple communities, or "Westchester County (entire area)" if your service area is county-wide:







ANSWER CHOICES	RESPONSES	
City of Mount Vernon	3.45%	1
City of New Rochelle	3.45%	1
City of Peekskill	6.90%	2
City of Rye	6.90%	2
City of White Plains	0.00%	0
City of Yonkers	6.90%	2
Town of Bedford	6.90%	2
Town of Cortlandt	6.90%	2
Town of Eastchester	0.00%	0
Town of Greenburgh	10.34%	3
Town of Lewisboro	10.34%	3
Town of Mamaroneck	0.00%	0
Town of Mount Pleasant	6.90%	2
Town of New Castle	6.90%	2
Town of North Castle	0.00%	0
Town of North Salem	0.00%	0
Town of Ossining	3.45%	1
Town of Pelham	0.00%	0
Town of Pound Ridge	3.45%	1
Town of Rye	3.45%	1
Town of Somers	3.45%	1
Town of Yorktown	3.45%	1
Village of Ardsley	3.45%	1
Village of Briarcliff Manor	0.00%	0
Village of Bronxville	0.00%	0
Village of Buchanan	3.45%	1
Village of Croton-On-Hudson	3.45%	1
Village of Dobbs Ferry	3.45%	1
Village of Elmsford	3.45%	1
Village of Harrison	6.90%	2
Village of Hastings-On-Hudson	6.90%	2
Village of Irvington	3.45%	1

Village of Larchmont Village of Mamoroneck	0.00% -3.45%	0 1
Village of Mount Kisco	3.45%	1
Village of Ossining	0.00%	0
Village of Pelham	3.45%	1
Village of Pelham Manor	3.45%	1
Village of Pleasantville	0.00%	0
Village of Port Chester	0.00%	0
Village of Rye Brook	0.00%	0
Village of Scarsdale	0.00%	0
Village of Sleepy Hollow	3.45%	1
Village of Tarrytown	3.45%	1
Village of Tuckahoe	0.00%	0
Westchester County	17.24%	5
Other (please specify)	13.79%	4
Total Respondents: 29		

## Q7 Does your organization maintain or manage any of the following within your designated service area? If not, answer "No" at the bottom, otherwise check all that apply.



ANSWER CHOICES	RESPONSES
Buildings	44.83% 13
Roads	17.24% 5
Bridges	13.79% 4
Water/Sewer Plants	13.79% 4
Stormwater Infrastructure	24.14% 7
No	44.83% 13
Other (please specify)	13.79% 4
Total Respondents: 29	

#### Q8 Looking back at previous hazard events, have buildings/facilities/structures you have worked in and/or are responsible for been impacted by a natural hazard (ex. damage/closures/etc.)?



ANSWER CHOICES	RESPONSES	
Yes	62.50%	15
No	25.00%	6
Don't Know	12.50%	3
TOTAL		24

Q9 If you answered "Yes" to the above question, in your own words please describe the type of event that caused or is causing (if recurring) damage and loss of service/property. If quantifiable data is available, please provide that as well (e.g., number of damaged structures, monetary loss, etc.). (please explain)

Answered: 15 Skipped: 20

#### Q10 What areas (in which you provide services to) do you believe to be the most vulnerable to natural hazards? What are these hazards? (please explain)

Answered: 20 Skipped: 15

Q11 Is/are the facility(ies) that you work in or are responsible for adequately prepared for withstanding natural disasters? If your work involves working at multiple facilities, please provide a brief description in the "other" category, describing which facilities are most vulnerable.



ANSWER CHOICES	RESPONSES
Yes	47.83% 11
No	21.74% 5
Don't Know	17.39% 4
Other (please specify)	13.04% 3
TOTAL	23

Q12 Based on experience, do you think the transportation infrastructure serving your facility(ies) is adequately designed and equipped to withstand closures and damage due to natural hazards, and are able to provide long-term support for your community's needs?



ANSWER CHOICES	RESPONSES	
Yes	26.09%	6
No	56.52% 13	3
Don't Know	13.04%	3
Other (please specify)	4.35%	1
TOTAL	23	3

# Q13 Overall, do you think the utility infrastructure and service (specifically electricity and communication) are sufficiently equipped/designed to withstand natural disasters and has/have the ability to continue to provide uninterrupted service to your facility(ies)?



ANSWER CHOICES	RESPONSES	
Yes	8.70%	2
No	69.57%	16
Don't Know	17.39%	4
Other (please specify)	4.35%	1
TOTAL		23

## Q14 Are you aware of the number and location of vulnerable populations in your community/operating area?



ANSWER CHOICES	RESPONSES	
Yes	43.48%	10
No	21.74%	5
Yes, but need better information	34.78%	8
Other (please specify)	0.00%	0
TOTAL		23

#### Q15 Do you think that local public education and awareness programs in Westchester County are effective at informing vulnerable populations on what they should do to prepare for and reduce personal risk to natural disasters?



ANSWER CHOICES	RESPONSES	
Yes	26.09%	6
No	39.13%	9
Don't Know	26.09%	6
Other (please specify)	8.70%	2
TOTAL		23

Q16 Do you think that the public, particularly vulnerable populations, is aware of, understands, and takes advantage of emergency warning and notification systems and service (reverse 911, audible alerts, text services, etc.)?



ANSWER CHOICES	RESPONSES
Yes	13.04% 3
No	43.48% 10
Don't Know	34.78% 8
Other (please specify)	8.70% 2
TOTAL	23

## Q17 To your knowledge, are development and land use decisions made with consideration of natural hazard risk exposure?



ANSWER CHOICES	RESPONSES	
Yes	26.09%	6
No	21.74%	5
Don't Know	34.78%	8
Other (please specify)	17.39%	4
TOTAL		23

## Q18 Do you believe that local government understands, supports, and possesses adequate resources for hazard risk reduction efforts in the community?



ANSWER CHOICES	RESPONSES	
Yes	30.43%	7
No	34.78%	8
Don't Know	21.74%	5
Other (please specify)	13.04%	3
TOTAL	2	23

## Q19 Do you believe private businesses in your community (construction companies, supply companies, etc.) play a direct critical role in your organization's operation and daily function?



ANSWER CHOICES	RESPONSES	
Yes	39.13%	9
No	47.83% 1	1
Don't Know	4.35%	1
Other (please specify)	8.70%	2
TOTAL	2	3
### Q20 Does your organization have/or is part of an emergency response plan?



ANSWER CHOICES	RESPONSES	
Yes	86.96%	20
No	4.35%	1
Don't Know	4.35%	1
Other (please specify)	4.35%	1
TOTAL		23

## Q21 If you answered yes above, does the plan cover potential impacts to your operations, including pandemics?



ANSWER CHOICES	RESPONSES	
Yes	56.52%	13
No, we do not need one	8.70%	2
No, but we will need guidance on how to develop	4.35%	1
Don't Know	17.39%	4
Other (please specify)	13.04%	3
TOTAL	:	23

### Q22 If your organization is part of an emergency response plan, does your organization have a defined role or responsibility within the plan?



ANSWER CHOICES	RESPONSES	
Yes	73.91%	17
No	8.70%	2
Don't Know	8.70%	2
Other (please specify)	8.70%	2
TOTAL		23

### Q23 Is your organization covered by any of the following plans? Check all that apply.



ANSWER CHOICES	RESPONSES	
Continuity of Operations Plan	45.45%	10
Continuity of Government Plan	4.55%	1
Emergency Operations Plan	72.73%	16
Evacuation Plan	40.91%	9
None	4.55%	1
Don't Know	13.64%	3
Other (please specify)	9.09%	2
Total Respondents: 22		

#### Q24 Do you believe your organization is resilient with respect to a natural disaster?



ANSWER CHOICES	RESPONSES	
Yes	65.22% 1	5
No	13.04%	3
Maybe	8.70%	2
Other (please specify)	13.04%	3
TOTAL	2	3

# Q25 Can you identify projects or programs that will reduce your facility/organization's vulnerability to damages and losses, including loss of operation/service, to hazard events? (please explain)

Q26 Can you identify projects or programs that have been recently implemented to reduce your community's vulnerability, damage and losses, including loss of operation/service, to hazard events? (please explain)

## Q27 How has your organization been involved in response to this pandemic? (please explain)

Q28 How were your organization's practices/business framework reshaped due to COVID-19 response (e.g. have employees wear masks during flu season, improve sanitation practices, conduct work remotely whenever possible, etc.)? (please explain)

# Q29 What specific services/infrastructure were built/improved in your community in order to mitigate damages experienced from this pandemic? (please explain)

### Q30 Please share any challenges and obstacles you are facing (you can select more than one).



#### Westchester County, NY - Stakeholder Survey

ANSWER CHOICES	RESPONSES	
Availability of cleaning supplies	23.53%	4
Availability of personal protective equipment (PPE)	47.06%	8
Clear messaging	35.29%	6
Debris management	5.88%	1
Finding medical professionals	11.76%	2
Waste disposal	5.88%	1
Contingency/back-up plan for staffing	41.18%	7
Tracking information	5.88%	1
Access to community officials	5.88%	1
Receiving accurate information regarding current situation/resources available	35.29%	6
Other (please specify)	35.29%	6
Total Respondents: 17		

# Q31 Do you have procedures/protocols in place to return back to standard operations after the pandemic (e.g. cleaning protocols and frequency, occupancy limits, etc.)?



ANSWER CHOICES	RESPONSES	
Yes	71.43%	15
No	4.76%	1
Don't Know	0.00%	0
Other (please specify)	23.81%	5
TOTAL		21

#### Q32 Do you have any other questions or comments?

#### C.3 Neighboring County Survey

A neighboring county survey was sent to the surrounding counties of Westchester due to their proximity to the County and because the effects of hazard events that impact Westchester County would be similar to that of their neighbors. A summary of the results are included on the following pages.



#### Q1 Please indicate the county in which you represent

#### Q2 Name and Title of Respondent

#### Q3 What department do you represent?

#### Q4 Please provide your contact information.

ANSWER CHOICES	RESPONSES	
Name	0.00%	0
Company	0.00%	0
Address	0.00%	0
Address 2	0.00%	0
City/Town	0.00%	0
State/Province	0.00%	0
ZIP/Postal Code	0.00%	0
Country	0.00%	0
Email Address	100.00%	3
Phone Number	100.00%	3

### Q5 Do you have any shared service agreements or mutual aid agreements in place with Westchester County at the county level for the following?

Answered: 0 Skipped: 3

#### ▲ No matching responses.

ANSWER CHOICES	RESPONSES	
Equipment and staff for debris cleanup and snow removal	0.00%	0
Emergency staff for evacuations/disaster response	0.00%	0
Damage assessments	0.00%	0
Sheltering	0.00%	0
Other	0.00%	0
Total Respondents: 0		

#### Q6 Is Westchester County involved in your county's comprehensive emergency operations planning, such as by participating on a planning team, or providing resources during an emergency?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	2
N/A	0.00%	0
TOTAL		2

#### Q7 Is your county involved in Westchester County's comprehensive emergency operations planning, such as by participating on a planning team, or providing resources during an emergency?



ANSWER CHOICES	RESPONSES	
Yes	50.00%	1
No	0.00%	0
Don't Know	50.00%	1
N/A	0.00%	0
TOTAL		2

Q8 Is Westchester County involved in your county's Continuity of Operations planning, such as by participating on a planning team, providing resources during an emergency, or carrying out some of your county's essential functions for a period of time?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	50.00%	1
Don't Know	50.00%	1
N/A	0.00%	0
TOTAL		2

Q9 Is your county involved in Westchester County's Continuity of Operations planning, such as by participating on a planning team, providing resources during an emergency, or carrying out some of Westchester County's essential functions for a period of time?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	50.00%	1
Don't Know	50.00%	1
N/A	0.00%	0
TOTAL		2

## Q10 Thinking about emergency operations and disaster response, please explain how these actions are communicated between counties.

### Q11 Does your county share risk and vulnerability assessments (flood mapping, HAZUS, etc.) with Westchester County?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	2
N/A	0.00%	0
TOTAL		2

### Q12 Do you collaborate with Westchester County on establishing evacuation routes and alternate evacuation routes?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

#### Q13 Do you and Westchester County consult with one another before making evacuation decisions that would impact one another (recommending evacuation routes into neighboring counties)?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

### Q14 Are evacuation routes maintained to the same level of protection across county lines?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
Other (please specify)	0.00%	0
TOTAL		1

#### Q15 Do you collaborate with Westchester County on establishing shelters?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

#### Q16 Do you and Westchester County consult with one another before making sheltering decisions that would impact one another (recommending shelters in neighboring counties)?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

Q17 Do you and Westchester County share any spaces suitable for temporary housing? This includes locations suitable to place temporary housing units to house residents displaced by a disaster.



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

### Q18 Does your county have access to contact information for Westchester County's emergency operation centers at the county and local level?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

Q19 Please describe any situations or hazards that are of a concern to both your and Westchester County. For example, would flooding along a particular waterway impact both counties, or are there any facilities or infrastructure that would affect both counties if it/they failed?

### Q20 Please explain how information is shared between counties regarding mitigation projects.

## Q21 Is information regarding mitigation shared during the planning and implementation phases of the projects?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1
## Q22 Are you aware of any projects for the following that requires crosscollaboration between county boundaries?



ANSWER CHOICES	RESPONSES	
Stormwater projects	0.00%	0
Watershed projects or planning	0.00%	0
Floodplain projects or planning	100.00%	1
Connected roadway improvements	0.00%	0
Natural infrastructure restoration	0.00%	0
Outreach (education and outreach campaigns, programs for public information, etc.)	100.00%	1
Other (please specify)	0.00%	0
Total Respondents: 1		

## Q23 If you selected anything above, please explain.

Answered: 1 Skipped: 2

# Q24 Have your county and Westchester County collaborated on grant applications?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

## Q25 Are you aware of any organizations that carry out education and outreach regarding hazards in both counties?



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Don't Know	100.00%	1
N/A	0.00%	0
TOTAL		1

## Q26 What are opportunities or ideas to optimize cooperation with Westchester County on emergency management operations and hazard mitigation projects?

Answered: 1 Skipped: 2

# Q27 Do you have any relevant questions or comments for Westchester County?

Answered: 0 Skipped: 3



### C.4 Website and Social Media Posts

The following provides screenshots of websites, news articles, and social media posts





Welcome to the Westchester County Hazard Mitigation Plan (HMP) Website. This website provides project updates, resources, and links to hazard mitigation in support of the HMP update.

The goal of the project is to save lives and property through the reduction of hazard vulnerability for the entire county. During the course of this planning project, county and local leaders and the community will work in tandem to identify risks, assess capabilities, and formulate a strategy to reduce disaster vulnerability.

Public participation and feedback is a vital part of the hazard mitigation planning process. Westchester County Department of Planning has developed a Mitigation Survey to assist in providing the public an outlet to contribute to the Westchester County HMP update. This survey will be used to develop portions of the HMP. Thank you for participating in this important initiative by providing us with your anonymous survey contribution.



Questions?

Keep checking back regularly for information on upcoming events, to take our public survey, and to review and comment on the draft plan.

What is Hazard Mitigation? Calendar Meetings Explore the Plan

#### Upcoming Meetings

Home

About

All planning process meetings are open to the public. Upcoming meetings and information are provided below.

October 2021 Go < > Month Week Day

Events in October 2021–September 2022

Additional Information

October 13, 2021 - Mitigation Strategy Workshop

October 20, 2021 - Stakeholder Workshop

#### **Contact Information**

Weste	hester gov.com	WESTCHESTE 2021 UPDATE	RCOUN	TYHA	ZARD MIT	IGATION PLA	N	
Home	About	What is Hazard Mitigation?	Calendar	Meetings	Explore the Plan	Additional Information	Questions?	
Meetir	gs							
Steering Con	nmittee Meet	ing <u>#1 - July 13, 2021</u>						
Steering C	ommittee #1 -	- Agenda					Download	
Steering C	ommittee #1 ·	- Minutes					Download	
Steering C	ommittee #1 -	- Presentation					Download	
Planning Pa	tnership Mee	<u>ting #1 - July 20, 2021</u>						
Planning F	artnership #1	- Agenda					Download	
Planning I	artnership #1	- Presentation					Download	
Planning I	artnership #1	- Minutes					Download	
To view and	isten to the pr	esentation, follow this link.						
Steering Co	nmittee #2 -	September 14, 2021						
Steering C	ommittee #2	- Agenda					Download	
Steering C	ommittee #2	- Presentation					Download	

Westchester George Latimer gov.com Wendenser County Executive	ast 🗘 🔇 🗿 🥥 Layout 💉 🖍 Font 🖨 🗘 T Ď
Department of Planning > Hazard	Mitigation Planning
ENVIRONMENT	Hazard Mitigation Planning
Soil and Water Conservation	Hazard Mitigation Plans form the foundation of a community's long-term strategy to break the dia COUNTY NEWS age,
Watershed Protection	reconstruction and repeated damage. Disasters cause loss of life, damage buildings and infrastructure and have devastating consequences for a community's economic, social, and environmental well-being. The community's economic, social, and environmental well-being.
Water Quality	CFR 201.2) defines hazard mitigation as "sustained action taken to reduce or eliminate long-term in CORONAVIRUS INFO from hazards." The purpose of mitigation planning is to identify policies and actions, which can be implemented and sustained to
Aquatic Restoration	reduce risk and future losses from disasters.
Stormwater Management	Breaking the Cycle of Destruction
Flooding	When recurrent disasters such as coastal or riverine flooding take place, and repairs and reconstruction are completed in such a way as to simply restore damage and reconstruction can occur
Flood Zones & Maps	Reconstruction becomes more expensive, as the costs accumulate throughout the years. By undertaking a comprehensive hazard
Hazard Mitigation Planning	<ul> <li>mitigation study to reduce the risks and costs associated with preparing for, responding to and recovering from disasters the</li> <li>expensive cycle of destruction and reconstruction is broken. The implementation of hazard mitigation actions leads to building</li> </ul>



CITY HALL UPDATE	Read On		
Create an Account - Increase your productivity, customize	your experience, and engage in information you care about.		Sig
Coronavirus Local Updates		Tweets by @NewRochelleNY	(
2021 DPW Guide and Calendar	NEW ROCHELLE	natural disasters: bit.ly/3ohDWUb @westchestergov	
2021 DOZ Amendments	PARTNERSHIP BOARD		,
021 Adopted Budget	LISTENING	HAZARD MITIGATION PLA	AN
020 Draft Annual Stormwater Report	IOUR		
deally New Rochelle	THURSDAY,	If you live or work in the County, please take	
ssessment Roll	@7PM	feedback how YOU have been impacted by natural disasters in Westehester County	
New Owners Register for STAR Credit	Bethesda Baptist Church of New Rochelle 71 Lincoln Ave, New Rochelle, NY	Westchaster	
Bid Opportunities	First community "Listening Tour" of many that will be held across the City of New Rochelle. Join us in conversation	$\bigcirc$ [ $\rightarrow$	17 <u>h</u>
Aunicipal Code	about new kocnelle and Community Policing. *MASKS REQUIRED* Cant make this meeting? Join us for the next event!	New Rochelle, NY @NewRochelleNY	y
Property Portal	First Community Meeting: 10/13/21 @ 6:30 PM at the New Rochelle Council Chambers, 515 North Ave, New Rochelle, NY	The New Rochelle Community-Police Partnership Board will begin a Listening	Tour in







Search

Community Departments Committees and Council Resource

Supervisor and Town Board

The Town of

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#### About the Supervisor and Town Board Agendas/Minutes

Members Procurement Policy Sexual Harassment Policy

### Westchester County Hazard Mitigation Plan

The Town of Lewisboro is working along with the County to develop a hazard mitigation plan so that we are eligible to receive Federal grant funding for projects to reduce our risk to natural hazards such as flooding and severe storms. Available funding can support projects such as drainage improvements, structural elevations, and backup power for schools and critical facilities. Your input is needed. To find out more, review the draft plan and have the opportunity to provide input, please visit our project website at at http://www.westchesterhmp.com # and take our citizen preparedness and mitigation survey at https://www.surveymonkey.com/r/9L7XEJJ#

#### **Supporting Documents**

🕢 Hazard Mitigation Section Lewisboro 🖉 (575 KB)

#### Contact Information

**Hours:** 9 a.m. - 5 p.m. Monday - Friday

Peter Parsons Supervisor 914-763-3151

Mary Hafter Confidential Secretary Benefits Coordinator

Phone: 914-763-9035 Fax: 914-763-3398 benefits@lewisborogov.c











The matrix in Appendix D is intended to give a broad overview of FEMA, New York State, county, municipal and stakeholder personnel that participated in the Westchester County HMP update planning process. Meeting attendees and input provided are also included. All participants were encouraged to attend the kick-off meeting and mitigation workshop. During the planning process the consultant contacted each participant to offer support, explain the process, and facilitate the submittal and review of critical documents.

The participating jurisdictions agreed to abide by the Planning Partner Expectations and Planning Partnership Guidelines which established a Steering Committee. Letters of Intent to Participate indicating municipal planning efforts are included in this appendix. Participation is defined as having input to the hazard analysis (providing critical facility, hazard event, vulnerability data), and as having participated in the mitigation workshop or alternate annex meetings as described in the HMP for the purpose of creating a mitigation strategy to be included in each municipalities annex in Section 9 (Jurisdictional Annexes).





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Westchester County	Barbara Sabater	Program Coordinator, Department of Social Services			Х		Х	X	Х					
Westchester County	Daniel Olmoz	Program Administrator, Department of Emergency Services, Office of Emergency Management	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	X	X
Westchester County	Dennis Delborgo	Director, Department of Emergency Services, Office of Emergency Management; Project Manager	Х		Х	Х	Х	Х	Х					
Westchester County	Dr. Sherlita Amler, M.D., M.S.	Commissioner of Health			Х	Х	Х	X	Х					
Westchester County	Hernane De Almeida	Deputy Commissioner, Department of Public Works and Transportation			Х	Х	Х		Х		Х			
Westchester County	Ilir Tota	GIS, Software Architect		Х	Х		Х		Х					
Westchester County	Katherine O'Connor	Program Administrator, Public Health Emergency Preparedness, Department of Health				X		X	X		X			
Westchester County	Susan Spear	Deputy Commissioner, Department of Emergency Services			x	X			X	X				





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Westchester County	Xiaobo Cui	GIS, GIS Manager			Х	Х	Х	Х	Х					
Westchester County	Bianca Lopez	Assistant Director of Operations				Х								
Westchester County	Captain James Luciano	Department of Public Safety			Х			Х						
Westchester County	Christophe r Gelardo	Capital Program Coordinator, Westchester County Department of Environmental Facilities			Х		Х	Х			Х			
Westchester County	David Kvinge	Director of Environmental Planning	X	Х	Х	Х	Х	Х		X	Х			
Westchester County	Doughlas Wessels	Environmental Planner, Westchester County Department of Planning; Alternate for Robert Doscher and David Kvinge			Х	Х								
Westchester County Board of Legislators	Nancy Barr	Westchester						X						
Westchester County	James Luciano	Police Department						Х						
Westchester County	Linda Luddy	Department of Emergency Services	X		Х			X	Х					







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Westchester County	Lisa Reyes	Communications Officer, Westchester County Public Information			Х									
Westchester County	Andrew Ziegler	Department of Public Works									Х			
Westchester County	Robert Doscher	District Manager, County Soil and Water Conservation District				Х								
Westchester County	William Bland	Program Administrator, Department of Parks, Recreation and Conservation			Х									
Westchester County Association	Jason Chapin	Director of Workforce Development			Х	Х	Х	Х	Х					
Westchester County's Executive Office	Christophe r D. Steers	Director of Countywide Administrative Services and Real Estate						Х	Х					
Westchester Department of Planning	Steve Courage	Associate Transportation Planner, Westchester County Department of Planning			Х			Х						
Westchester Land Trust	Janelle Robbins	Board Member						Х						
City of Mount Vernon	Ali Evans	Director of the City of Mount Vernon OEM; AJEvans@ci.mount- vernon.ny.us				Х		X	Х		X			







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
City of Mount Vernon	Deborah Norman	Fire Commissioner				Х		Х	Х		Х			
City of Mount Vernon	Joan Aracich						Х							
City of Mount Vernon	Curtis Woods	Department of Public Works									Х			
City of New Rochelle	Barry Nechis	Captain, Fire Department				Х		Х	Х		Х			
City of New Rochelle	James Moran, P.E.	DPW Commissioner				Х			Х					
City of New Rochelle	Paul Vacca	Building Inspector				Х			Х					
City of New Rochelle	Robert Yamuder	Risk Manager				Х		Х	Х		Х			
City of New Rochelle	Nicholas Sioufas	Sustainability Coordinator								Х				
City of New Rochelle	Andy Sandor	Chief, Fire Department						Х						
City of Peekskill	Alex Demundo	Sgt., Peekskill Police Department						X	Х		Х			
City of Peekskill	Joseph Ronca	Inspector, Office of Emergency Management						X			Χ			







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
City of Peekskill	Nicholas Cecere	Building Inspector									Х			
City of Peekskill	Leo Dylewski	Lt. of Peekskill Police Department				Х		Х						
City of Rye	Christian Miller	City Planner				Х		Х	Х					
City of Rye	Lt. John McDwyer	City of Rye Police				Х								
City of Rye	Robert J. Falk					Х								
City of White Plains	Nok Siriphonlai	Deputy Commissioner of Public Works				Х		Х	Х		Х			
City of White Plains	Richard Hope	Commissioner of Public Works				Х		Х	Х					
City of White Plains	Ed Calvano	Lietenant, White Plains Police Department				Х								
City of White Plains	Mike Zaino	Senior Engineer									Х			
City of White Plains	Stefanie Mignone	Deputy Commissioner of Public Works				Х								





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
City of Yonkers	Paul Summerfie Id	City Engineer				Х			Х		Х			
City of Yonkers	Sarah Sayegh	Executive Assistant to the Commissioner of Public Works						Х	Х		Х			
City of Yonkers	Thomas G. Meier	Commissioner of Public Works				Х			Х		Х			
City of Yonkers	Bobby Kitson	Yonkers Police Department, OEM				Х								
City of Yonkers	Michael Mosiello	Director, Office of Emergency Management									Х			
Town of Bedford	Kevin Winn	Department of Public Works				Х		Х	Х			Х		
Town of Bedford	Jeff Osterman	Director of Planning				Х		Х						
Town of Cortlandt	Michael Preziosi, PE	Director, Technical Services				Х		X			Х			
Town of Cortlandt	Rosemary Boyle Lasher					X		X			X			
Town of Cortlandt	Stephen Ferreira										Х			





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Torum of Fostahastan	Margaret	Director of Building and							V					
Town of Eastenester	Uhle	Planning							Λ					
Town of Eastchester	Patricia George	Community Liaison				Х		Х						
Town of Greenburgh	Brian Simmons	Deputy Commissioner of Public Works				Х		Х	Х				Х	
Town of Greenburgh	Richard Fon	Commissioner of Public Works						Х	Х				Х	
Town of Greenburgh	Daniel Valentine	Town of Greenburgh Police				Х		Х						
Town of Greenburgh	Traci Baker					Х								
Town of Greenburgh	Chelsey Doyle	Public Works Office Assistant											Х	
Town of Lewisboro	Tony Goncalves	Councilman and Deputy Supervisor				X		X	X			X		
Town of Lewisboro	Adam Ochs	Director, Office of Emergency Management				Х								





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Town of Mamaroneck	Michael Liverzani	Deputy Emergency Manager/Ambulance District				Х			Х					
Town of Mamaroneck	Connie Green O'Donnell	Deputy Town Administrator/Administra tion				Х		Х						
Town of Mamaroneck	Elizabeth Aitchison	Coordinator/Conservation				Х								
Town of Mount Pleasant	Elected to not participate													
Town of New Castle	Kellan Cantrell	Assistant Planner				Х		Х	Х			Х		
Town of North Castle	Kevin Hay	Town Administrator						X	Χ			Х		
Town of North Castle	Adam Kaufman, AICP	Director of Planning				Х		Х						







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Town of North Salem	Warren Lucas	Supervisor				Х			Х					
Town of North Salem	Katherine Daniels	Town Council				Х								
Town of Ossining	Valerie Monastra	Town Planner			Х	Х	Х		Х		Х			
Town of Ossining	Victoria Cafarelli	Administrative Assistant to the Supervisor				Х		Х	Х					
Town of Ossining	Dana Levenberg	Town Supervisor			Х	Х		Х						
Town of Ossining	John Hamilton	Building Inspector									Х			
Town of Ossining	Andrew Tiess	Water Superintendent									Х			
Town of Ossining	Peter Connolly	Highway Superintendent									Х			
Town of Pelham	Daniel McLaughli n	Town Supervisor						Х						Х
Town of Pound Ridge	David M. Ryan	Chief of Police				Х								





Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Town of Rye	Debbie Reisner	Town Administrator and Rye Town Park Commission				Х		X	Х					
Town of Rye	Victor Federico	Director of Grounds and Facilities				Х								
Town of Somers	Steve Robbins	Engineer							Х			Х		
Town of Somers	Bill Faulkner	Councilman				Х								
Town of Somers	David Smith					Х								
Town of Somers	Rick Morrissey					Х								
	a i													
lown of Yorktown	Scatola	Manager/Police							Х		Х			
Town of Yorktown	Dan Ciarcia							Х			Х			
Town of Yorktown	David Paganelli										X			
Town of Yorktown	John Landi										Х			







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Town of Yorktown	John Tegeder										Х			
Town of Yorktown	Margaret Gspurning	HR-Building Maintenance Director/Supervisor				Х					Х			
Town of Yorktown	Dave Pagnelli										Х			
Village of Ardsley	Larry Tomasso	Building Inspector				Х		Х	Х				Х	
Village of Ardsley	David DiGregori o	Highway Foreman				Х								
Village of Ardsley	Carol Sommerfie Id	Conservation and Environment Advisory Committee								Х				
Village of Briarcliff Manor	Vincent Salanitro	Assistant Engineer				Х		Х	Х		Х			
Village of Briarcliff Manor	David Turiano	Village Engineer									Х			
Village of Bronxville	Stephen Shallo	Assistant to the Village Administrator				Х		Х						Х







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Village of Bronxville	Carole Upshur	Bronxville Green Committee								Х				
Village of Buchanan	George Pommer	Village Consulting Engineer						Х						
Village of Buchanan	Marcus Serrano	Administrator				Х		Х						
Village of Croton-On- Hudson	Bryan Healy	Village Manager				Х		Х	Х		Х			
Village of Croton-On- Hudson	Daniel O'Connor, P.E.	Village Engineer/Building Inspector				Х		Х	Х					
Village of Croton-On- Hudson	Frank Balbi	Superintendent of Public Works						Х	Х		Х			
Village of Croton-On- Hudson	Janine King	Retired 8/6				X								
Village of Dobbs Ferry	Alissa Fasman	Assistant to the Village Administrator				X			Х					
Village of Dobbs Ferry	Jennifer Dorman	DPW Senior Assistant									Х			
Village of Dobbs Ferry	Steve Trezza	DPW General Foreman									Х			





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Village of Dobbs Ferry	Dan Romer	Assistant Building Inspector									Х			
Village of Dobbs Ferry	Joe Giuliano	Assistant Fire Chief									Х			
Village of Dobbs Ferry	Manuel Guevara	Chief of Police									Х			
Village of Dobbs Ferry	Valerie Monastra	Village Planner									Х			
Village of Elmsford	Antonio Capicotto	Village Engineer							Х				Х	
Town/Village of Harrison	Michael J. Amodeo, PE, CFM	Town/Village Engineer				Х		Х	Х		Х			
Town/Village of Harrison	Megan Pierroz	Assistant Engineer									Х			
Village of Hastings-On- Hudson	Anthony Costantini	Administrative Assistant							Х				Х	
Village of Hastings-On- Hudson	Mary Beth Murphy	Village Manager				Х		Х	Х	Х			Х	





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Village of Hastings-On- Hudson	Charles V. Minozzi, Jr.	Building Inspector/Floodplain Officer				Х		Х						
Village of Hastings-On- Hudson	David Dosin	Chief of Police				Х		Х						
Village of Irvington	Lawrence S. Schopfer	Village Administrator				Х		Х	Х	Х				
Village of Irvington	Edward P. Marron, Jr.	Building Inspector				Х								
Village of Irvington	Francis Pignatelli	Village of Irvington Police Department				Х								
Village of Larchmont	Frank Blasi					Х			Х					
Village of Larchmont	Justin Datino					Х		Х						
Village of Mamaroneck	Daniel Sarnoff	Assistant Village Manager			X	Х	X	X	Х					Х
Village/Town of Mount Kisco	Edward Brancati	Village Manager							Х		Х			





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Village/Town of Mount Kisco	Keneth L. Famulare	Assistant Village Manager				Х		Х	Х		Х			
Village of Ossining	Maddi Zachacz	Assistant Village Manager				Х			Х					
Village of Ossining	Karen D'Attore	Village Manager						Х						
Village of Ossining	Paul Fraioli													
Village of Pelham	Robert Benkwitt III	Fire Chief							Х					Х
Village of Pelham	Christophe r Scelza	Village Manager				Х		Х						
Village of Pelham	Joseph Senerchia	Building Department						Х						
Village of Pelham Manor	Lt. Gregory Sancho	PMPD				Х								
Village of Pelham Manor	Thomas Atkins	Police Chief				Х								
Village of Pelham Manor	Sgt. Andrew Leal	PMPD				Х								





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Village of Discontrille	Alvero	Secretary to the Village				V		V	V		V			
v mage of Pleasantvine	Hochstein	Manager				А		А	Χ		Λ			
Village of Pleasantville	Eric Morrissey	Village Administrator				Х		Х	Х		Х			
Village of Pleasantville	Robert Hughes	Building Inspector												
Village of Pleasantville	Jeffrey Econom	Superintendent of Public Works									Х			
Village of Port Chester	Kevin Donohue	Building Inspector				Х			Х					Х
Village of Port Chester	Stuart Rabin	Village Manager				Х								
Village of Rye Brook	Christophe r Bradbury	Village Administrator				Х			X		X			
Village of Rye Brook	Alex Marshall	Assistant to Village Administrator				X								
Village of Rye Brook	Michal Nowak	Superintendent of Public Works/Engineer				Х								







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Village of Scarsdale	Gregory	Village Planner				X		X	X		X			
	Cutler													
Village of Scarsdale	Ingrid M. Richards	Assistant Village Manager				Х			Х					
Village of Scarsdale	David Goessl	manager				Х		Х						
Village of Sleepy Hollow	Elected not to participate													
Village of Tarrytown	Donato Pennella, P.E.	Village Engineer				Х		Х	Х		Х			
Village of Tarrytown	Joshua Ringel	Assistant Village Administrator				Х			Х		Х			
Village of Tarrytown	Richard Slingerlan d	Village Administrator				X		X	Х		Х			
Village of Tarrytown	Chief Babelet	Chief of Police									Х			
Village of Tarrytown	Lieutenant Cole	Police Department									X			





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Village of Tuckahoe	David Burke	Administrator						Х	Х			Х		
Village of Tuckahoe	John Costanzo	Police Chief				Х								
NYS DHSES	Kevin Clapp				Х				Х					
NYS Mesonet at the University at Albany	Nick Bassill					Х		Х						
PNW BOECES	Emilio Zullo	Regional Safety Technician				Х		Х	Х					
PNW BOECES	C Sneyd					Х								
Shannon Clarke	Shannon Clarke							Х						
DHSES	Elizabeth O'Reilly								Х					
FEMA	Paul Hoole				Х			Х	Х					
Guide Dog Users of the Empire State and the Westchester Council of the Blind	Ann Chiappetta	President GDUES				X								
MTA New York Metropolitan	Naomi Klein	Director of Transportation Planning				Х								







Jurisdiction	Name	Title	5/27/21 Pre-Kick-Off Meeting	7/8/21 GIS Meeting	7/13/21 Steering Committee	7/20/21 Planning Partnership KO Meeting	9/14/21 Steering Committee Meeting	9/22/21 Planning Partnership Meeting	10/13/21 Mitigation Strategy	10/20/21 Stakeholder	Local Annex Meetings	11/1/2021 Inland Communities Annex	11/1/2021 Hudson River Communities	11/1/2021 Long Island Sound Annex
Transportation Commission														
National Weather Service, NY	Nelson Vaz	Warning Coordination Meteorologist						Х						
NYS DHSES	Kevin Clapp				Х				Х					
NYS Mesonet at the University at Albany	Nick Bassill					Х		Х						
PNW BOECES	Emilio Zullo	Regional Safety Technician				Х		Х	Х					
PNW BOECES	C Sneyd					Х								
NYS DHSES	Shannon Clarke	-						Х						
-	NJ Wilson	-						Х	Х					
-	Noga Ruttenberg	-							Х					
Montefiore Health System	Michael Moculski	Director, EMS & Emergency Management								Χ				
St. John's Riverside Hospital	Mindy Brugger	Director of Environment of Care & Safety								Х				





## **APPENDIX E. ACTION WORKSHEET TEMPLATE**

This appendix includes the instructions and template provided for the development of Mitigation Strategy Action Worksheets. These worksheets are included in each jurisdictional annex of the plan in compliance with NYSDHSES Mitigation Guidance.





	А	ction W	orksheet	t							
Project Name:											
Project Number:											
Risk / Vulnerability											
Hazard(s) of Concern:											
Description of the Problem:											
	Action or Project	ct Intend	ded for In	nplem	entation						
Description of the Solution:											
Is this project related to a Critical Facility or Lifeline?				No							
Is this project related to a Critical Facility located within the 100-year floodplain?				No							
(If yes, this project must intend t	o protect the 500-year flo	od event	or the actu	al wors	e case damage s	cenario, whichever is greater)					
Level of Protection:		Estimat (losses	ed Beı avoide	nefits ed):							
Useful Life:			Goals M	let:							
Estimated Cost:			Mitigation Action Type:								
	Plan	for Imp	lementa	tion							
Prioritization:			Desired Implem	l Time lentati	frame for on:						
Estimated Time Required for Project Implementation:	ted Time Required ject nentation:			al Fun 5:							
Responsible Organization:		Local P Mechan	lannin Iisms t ement	g o be Used ation if anv:							
	Three Alternatives	Consid	ered (inc	luding	No Action)						
	Action	Es	stimate	ed Cost	Evaluation						
Alternatives:	No Action		\$0			Current problem continues					
	Progress Rej	port (for	r plan ma	intena	ance)						
Date of Status Report:											
Report of Progress:											
Update Evaluation of the Problem and/or Solution:											




Action Worksheet				
Project Name:				
Project Number:				
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate		
Life Safety				
Property Protection				
Cost-Effectiveness				
Technical				
Political				
Legal				
Fiscal				
Environmental				
Social				
Administrative				
Multi-Hazard				
Timeline				
Agency Champion				
Other Community Objectives				
Total				
Priority (High/Med/Low)				



# uidance to Complete the Mitigation Action Worksheet

The following provides additional guidance on how to complete the Mitigation Action Worksheet. Please note that NYS DHSES requires a minimum of TWO proposed mitigation activities.

## **Action Worksheet**

Project Name: Each action must have a unique project number referenced here and in the Action Tables.

Project Number: Each action must have a unique project name referenced here and in the Action Tables.

## Assessing the Risk and Vulnerability

**Hazard(s) of Concern:** Please identify the hazard(s) being addressed with this action. The Hazards of Concern included in the Westchester County Hazard Mitigation Plan include:

- ✓ Disease Outbreak
- ✓ Earthquake
- ✓ Extreme Temperatures
- ✓ Flood
- ✓ Severe Storm
- ✓ Severe Winter Storm
- ✓ Wildfire
- ✓ Chemical, Biological, Radiological, or Nuclear (CBRN) Incidents

**Description of the Problem:** Provide a detailed narrative of the problem. Describe the natural hazard you wish to mitigate, its impacts to the jurisdiction, past damages and loss of service, etc. Include the street address of the property/project location (if applicable), adjacent streets, and easily identified landmarks such as water bodies and well-known structures, and end with a brief description of existing conditions (topography, terrain, hydrology) of the site.

# **Action/Project Intended for Implementation**

**Description of the Solution:** Provide a detailed narrative of the solution. Describe the physical area (project limits) to be affected, both by direct work and by the project's effects; how the action would address the existing conditions previously identified; proposed construction methods, including any excavation and earth-moving activities; where you are in the development process (e.g., are studies and/or drawings complete), etc., the extent of any analyses or studies performed (attach any reports or studies).

**Critical Facility:** Please indicate whether or not the identified project is related to a critical facility in your community. If a critical facility, indicate whether or not it is located in the 1% annual chance flood area.

**Level of Protection:** Please identify the level of protection the proposed project will provide. For example, 100-year (1%) flood.

Useful Life: Identify the number of years the project will provide protection against the hazard.

**Estimated Cost:** Provide an estimated cost for implementation; rough dollar figures are preferred, but if unknown, a specified range is acceptable. Consider all costs associated with implementation. (Low <\$10,000, Medium \$10,000-\$100,000, High >\$100,000).





**Estimated Benefits:** Identify the benefits that implementation of this project will provide. If dollar amounts are known, include them. If dollar amounts are unknown or are unquantifiable, describe the losses that will be avoided.

### **Mitigation Action Type:**

- Local Plans and Regulations (LPR) These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- <u>Structure and Infrastructure Project (SIP)</u> These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- <u>Natural Systems Protection (NSP)</u> These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- <u>Education and Awareness Programs (EAP)</u> These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.

### **Goals Met:**

- **Goal 1: Protect Public Health and Safety.**
- Goal 2: Protect property, including public and private property, critical facilities and infrastructure.
- Goal 3: Increase education and awareness, and promote relationships with stakeholders, citizens, government officials, and property owners to develop opportunities for mitigation of natural hazards and to increase resilience.
- Goal 4: Encourage the development and implementation of long-term, cost-effective, environmentally sound, and resilient mitigation projects to preserve or restore the functions of natural systems.
- Goal 5: Promote the integration of comprehensive hazard mitigation and sustainability into regional, county and local mitigation preparedness plans, programs and related emergency management capabilities.
- Goal 6: Build regional, county and local mitigation and related emergency management capabilities.
- > Goal 7: Promote Local and Regional Sustainability

### **Plan for Implementation**

Prioritization: Please enter High/Medium/Low. Refer to the prioritization exercise and table.

**Estimated Time Required for Project Implementation**: Provide the estimated time required to complete the project from start to end. (Short-term, Long-term, or On-going/Continuous)

**Responsible Organization:** Identify the name of a department or agency responsible for implementation, not the jurisdiction.

**Desired Timeline for Implementation:** Identify the desired start time for this project. For example, within six months.





Potential Funding Source(s): Multiple sources of potential funding should be listed when appropriate.

Local Planning Mechanism to be Used in Implementation (if any): Consider the use of local planning mechanisms that will be used to implement the project.

# **Evaluation of Potential Actions/Projects**

Actions/Projects Considered: Please consider three different options to mitigate the problem identified. One alternative is always to accept the current level or risk (tolerate the vulnerability/problem) by deciding to take no action at this time. If you choose to take no action, please complete the worksheet up to and including this section and this will be noted in the Plan.

Please include the name of the action considered and a brief reason as to why the action was not selected. The reasoning documents the consideration of these alternatives.

# **Reporting on Progress (for plan maintenance)**

Date of Status Report: This section should be completed during yearly plan maintenance/evaluation.

**Report of Progress:** Describe what progress, if any, has been made on this project. If it has been determined the jurisdiction no longer wishes to pursue implementation, state that here and indicate why.

**Update Evaluation of the Problem and/or Solution:** Provide an updated description of the problem and solution, and what has happened since initial consideration/development.

Actions which are not complete may be dropped with a rational provided (e.g., project deemed unfeasible...). Other incomplete actions should clearly be indicated as continuing; indicate percent complete, and identify any hurdles/obstacles/reasons for change in schedule. Even actions that have had no progress to date can be identified as continuing. For any action that is not yet complete and will continue, always consider modifying the action to promote implementation.

Please note this report on progress should be done, at minimum, each year prior to the annual Planning Committee update outlined in the plan maintenance procedures in Section 7 (Plan Maintenance).





# **Guidance to Complete the Prioritization Table**

Complete this table to help evaluate and prioritize each mitigation action being considered by your municipality. Please use these 14 criteria to assist in evaluating and prioritizing new mitigation actions identified. Specifically, for each new mitigation action, assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria in the provided table, defined as follows:

1 = Highly effective or feasible

- 0 = Neutral
- -1 = Ineffective or not feasible

Use the numerical results of this exercise to help prioritize your actions as "Low", "Medium" or "High" priority. Your municipality may recognize other factors or considerations that affect your overall prioritization; these should be identified in narrative in the Priority field of the worksheet. The 14 evaluation/prioritization criteria are:

- 1. Life Safety How effective will the action be at protecting lives and preventing injuries?
- 2. **Property Protection** How significant will the action be at eliminating or reducing damage to structures and infrastructure?
- 3. **Cost-Effectiveness** Are the costs to implement the project or initiative commensurate with the benefits achieved?
- 4. **Technical** Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
- 5. **Political** Is there overall public support for the mitigation action? Is there the political will to support it?
- 6. Legal Does the jurisdiction have the authority to implement the action?
- 7. **Fiscal** Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- 8. **Environmental** What are the potential environmental impacts of the action? Will it comply with environmental regulations?
- 9. **Social** Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
- 10. Administrative Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
- 11. Multi-hazard Does the action reduce the risk to multiple hazards?
- 12. Timeline Can the action be completed in less than 5 years (within our planning horizon)?
- 13. Local Champion Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?





**Other Local Objectives** – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?





# **APPENDIX F. PLAN MAINTENANCE TOOLS**

This appendix includes tools and worksheets to facilitate plan maintenance and review by the Westchester County Steering and Planning Committees.

In the first year of the performance period, an online performance progress reporting system, the BATool<sup>SM</sup> will provide municipal and county representatives direct access to their mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. This online program will capture information and roll all input into a report to summarize mitigation strategy progress.



TE TETRA TECH	BATOOI State Hazard M	litigation Plan Revie	ews			
Dashboard	County Plan Management Dast	hboard				
Plan Actions	Washington County Hazard	Mitigation Plan – 201	8	(groc	Primary POC	
🖽 Search				3	John Hobert	
C Reports			Jurisdictional	Progress		Approval De
Durane .	Total		Completed		0	Expiration D Plan Status
	5		In Progress		4	2017 Annua
A About			Not Vet Chaded			2017 Annua
Contact Us			Not the second			
	Click 🖉 to edit the plan detail; Clicking Jurisdiction Name	Municipal name navigates to Annual Review Cycle Open Date 06/01/2017 06/01/2017	Annual Review Cycle Close Date 09/30/2017	Point of Contact John Robert, 800-555- 5000, jr@omail.com Anne Hyde, 800-555-1234,	# Action	Review

Figure G-1. BATool<sup>s™</sup> Screenshot

The FEMA 386-4 guidance worksheets are also available to assist with progress reporting. These worksheets are provided in this section for ease of access to the HMP Coordinator and Planning Partnership to maintain the 2021 HMP throughout its period of performance.





Worksheet #1	Progress	Progress Report		
Progress Report Period:	to	to		
(date)	(date)			
Project Title:		Project ID#:		
Responsible Agency:				
Address:				
City/County:				
Contact Person:		Title:		
Phone #(s):	email address:			

List Supporting Agencies and Contacts:

Total Project Cost:

Anticipated Cost Overrun/Underrun:					

Data (Data the second	01-1	data addition and a de
Date of Project Approval:	Start	date of the project:

Anticipated completion date:

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): \_\_\_\_\_

Milestones	Complete	Projected Date of Completion





Page 2 of 3

#### Plan Goal(s)/Objective(s) Addressed:

Goal: \_\_\_\_\_ Objective:

#### Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed	d or
canceled projects, see Worksheet #2 - to complete a project evaluation):	

Project Status	Project Cost Status
Project on schedule	Cost unchanged
Project completed	Cost overrun*
Project delayed*	*explain:
*explain:	
	Cost underrun*
Project canceled	explain:
A. What was accomplished during this reporting period?	
B. What obstacles, problems, or delays did you encounter	r, if any?
······	
C. How was each problem resolved?	





### Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

Page 3 of 3

Other comments:		

Adapted from the North Carolina HMGP Progress Report Form at http://www.dem.dcc.state.nc.us/mitigation/document\_index.htm.





# Worksheet #2 Evaluate Your Planning Team step 3

When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		
Comments/Proposed Action:		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?		
Comments/Proposed Action:		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?		
Comments/Proposed Action:		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?		
Comments/Proposed Action:		
Are there ways to gain more diverse and widespread cooperation?		
Comments/Proposed Action:		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?		
Comments/Proposed Action:		

If the planning team determines the answer to any of these questions is "yes," some changes may be necessary.





# Worksheet #3 Evaluate Your Project Results step



Project Nan	ne and Number:	-	
Project Bud	lget:	-	
Project Des	scription:	- - Incert	location mat
		Include	before and after
Associated	Goal and Objective(s):	photos	if appropriate.
Indicator of	Success (e.g., losses avoided):	-	
Was the ad	ction implemented? YES NO		
Why	y not?		YES NO
Was	s there political support for the action?		
Wer	e enough funds available?		
Wer	e workloads equitably or realistically distributed?		
Was	s new information discovered about the risks or commun ementation difficult or no longer sensible?	ity that made	
Was	the estimated time of implementation reasonable?		
Wer	e sufficient resources (for example staff and technical as	ssistance) available?	
F YES			
Wha	at were the results of the implemented action?		





page 2 of 2	YES	NO
Were the outcomes as expected? If No, please explain:		
Did the results achieve the goal and objective(s)? Explain how:		
Was the action cost-effective? Explain how or how not:		
What were the losses avoided after having completed the project?		
If it was a structural project, how did it change the hazard profile?		
Additional comments or other outcomes:		

Date:

Prepared by: \_\_\_\_\_





# Worksheet #4 Revisit Your Risk Assessment ste

step 4

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?			
Profile hazard events	Are new historical records available?			
	Are additional maps or new hazard studies available?			
	Have chances of future events (along with their magnitude, extent, etc.) changed?			
	Have recent and future development in the community been checked for their effect on hazard areas?			
Inventory assets	Have inventories of existing structures in hazard areas been updated?			
	Is future land development accounted for in the inventories?			
	Are there any new special high-risk populations?			
Estimate losses	Have loss estimates been updated to account for recent changes?			

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.





# **Revise the Plan**



#### Prepare to update the plan.

Worksheet #5

When preparing to update the plan:

Check the box when addressed:

<ol> <li>Gather information, including project evaluation worksheets, progress reports, studies, related plans, etc.</li> </ol>				
Comments:				
<ol> <li>Reconvene the planning team, making changes to the team composition as necessary (see results from Worksheet #2).</li> </ol>				
Comments:				

Consider the results of the evaluation and new strategies for the future.

When examining the community consider:

Check the box when addressed:

1. The results of the planning and outreach efforts.					
Comments:					
2. The results of the mitigation efforts.					
Comments:					





p	age 2 of 4
3. Shifts in development trends.	
Comments:	
4. Areas affected by recent disasters.	
Comments:	
5 The recent magnitude location and type of the most recent hazard or disaster	<u> </u>
Commente:	L
Comments.	
6. New studies or technologies.	
Comments:	
7. Changes in local, state, or federal laws, policies, plans, priorities, or funding.	
Comments:	





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8.	Changes in the socioeconomic fabric of the community.				
Comments:					
9.	Other changing conditions.				
Con	nments:				

### Incorporate your findings into the plan.

When examining the plan consider:

Check the box when addressed:

1. Revisit the risk assessment. (See Worksheet #4)	
Comments:	
2. Update your goals and strategies.	
Comments:	
3. Recalculate benefit-cost analyses of projects to prioritize action items.	
Comments:	





### Use the following criteria to evaluate the plan:

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Criteria	YES	NO	Solution
Are the goals still applicable?			
Have any changes in the state or community made the goals obsolete or irrelevant?			
Do existing actions need to be reprioritized for implementation?			
Do the plan's priorities correspond with state priorities?			
Can actions be implemented with available resources?			

#### Comments:





# **APPENDIX G. CRITICAL FACILITY INVENTORY**

# **G.1 Overview**

This section contains information and details to support information provided in Section 4 – County Profile which provides the distribution of critical facilities located within Westchester County and its municipalities. Due to the sensitive nature of this information, details have been redacted. Contact the HMP Coordinator, for more information contact Mr. Daniel Olmoz at the Westchester County Department of Emergency Services via this email dno1@westchestergov.com.





This appendix contains information and details to support information provided in Section 5 (Risk Assessment).

# H.1 HISTORY OF HAZARD EVENTS WITHIN THE COUNTY

To supplement the information provided in this plan, events prior to the update of this plan are included below by hazard of concern type. Many sources provided historical information regarding previous occurrences and losses associated with hazards throughout New York and Westchester County. It is noted that, with a number of sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the sources.

For more information on past events and impacts, refer to the 2015 Westchester County Hazard Mitigation Plan.

# H.1.1 Earthquake

Known earthquakes events that have impacted New York State and Westchester County between 1737 and 2014 are identified in Table H.1. Many sources were researched for historical information regarding earthquake events in Westchester County; therefore, Table H.1 may not include all earthquake events that have impacted the County.





# Table H.1. Earthquake History in New York State, 1737-2014

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
December 18, 1737	Earthquake 5.2	New York City	N/A	N/A	Bells rang, several chimneys fell
1783	Earthquake 5.0	Westchester-Putnam County Line	N/A	N/A	Felt as far south as Philadelphia
September 2, 1847	Earthquake 3.5	Offshore New York City	N/A	N/A	No reference and/or no damage reported.
July 11, 1872	Earthquake	Westchester County	N/A	N/A	Houses were shaken to their foundations and crockery and glassware in the closets were disturbed by the shock. Impacted the Villages of East Chester, Mt. Vernon, and Pelhamville.
December 11, 1874	Earthquake 3.4	Tarrytown	N/A	N/A	No reference and/or no damage reported.
August 10, 1884	Earthquake 5.2	New York City	N/A	N/A	Chimneys and bricks fell; walls cracked. This was the largest and probably best documented event in the New York City area. It was a strong shock centered off Rockaway Beach and felt over 70,000 square miles, from Vermont to Maryland.
September 3, 1951	Earthquake 3.6	Rockland County	N/A	N/A	No reference and/or no damage reported.
July 9, 1937	Earthquake 3.5	Brooklyn	N/A	N/A	No reference and/or no damage reported.
May 23, 1971	Earthquake 3.5 – 4.1	Blue Mountain Lake, NY	N/A	N/A	No reference and/or no damage reported.
June 7, 1974	Earthquake 3.0	Wappingers Falls, NY	N/A	N/A	Windows broken
June 9, 1975	Earthquake 3.5	Plattsburgh, NY	N/A	N/A	Chimneys and fireplaces cracked
December 30, 1979	Earthquake 2.5	Armonk, NY	N/A	N/A	No reference and/or no damage reported.
January 17, 1980	Earthquake 2.9	Peekskill, NY	N/A	N/A	No reference and/or no damage reported.
February 2, 1983	Earthquake 3.0	Scarsdale-Lagrangeville	N/A	N/A	Chimneys cracked
August 1984	Earthquake 1.4 and 1.8	Greenburgh, between Ardsley and Yonkers	N/A	N/A	No reference and/or no damage reported.
January 26, 1985	Earthquake 2.2	Greenburgh, between Ardsley and Yonkers	N/A	N/A	No reference and/or no damage reported.
October 1985	Earthquake 4.1	Greenburgh, between Ardsley and Yonkers	N/A	N/A	This was widely felt in the New York City area and was centered near the northern border of the City of Yonkers. Tremors shook the metropolitan area and were felt in Philadelphia, southern Canada, and Long Island.





Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
October 19, 1985	Earthquake 2.0	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
October 19, 1985	Earthquake 3.6	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
October 21, 1985	Earthquake 2.8	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
January 4, 1986	Earthquake 1.8	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
April 22, 1986	Earthquake 2.7	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
December 20, 1986	Earthquake 1.9	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
November 1988	Earthquake 6.0	90 miles north of Quebec, Canada	N/A	N/A	This earthquake was felt in the Lower Hudson Valley and in New York City.
June 1991	Earthquake 4.4	West of Albany	N/A	N/A	Rattled homes throughout the area
April 12, 1991	Earthquake 2.0-2.7	Westchester County, NY and Fairfield, CT	N/A	N/A	Last just five seconds and caused no damage
1994	Earthquake 4.7	Reading, PA	N/A	N/A	This event caused millions of dollars of damage and was found to have been triggered by a rock quarry. The seismicity began in May 1993, six months after the quarry was abandoned and flooded; the main shock occurred in January 1994. No reference and/or no damage reported in the Westchester County area.
August 22, 2000	Earthquake 2.5	Carmel, NY	N/A	N/A	The epicenter was located approximately 2.5 miles northeast of the Town of Carmel in Putnam County.
April 20, 2002	Earthquake 5.2	Au Sable Forks, NY	DR-1415	No	Some roads, bridges, chimneys and water lines damaged in Clinton and Essex Counties. Many buildings in the area had cracked walls and foundations, broken windows and small items knocked from shelves. Maximum intensity (VII) at Au Sable Forks. Felt from New Brunswick and Maine to Ohio and Michigan and from Ontario and Quebec to Maryland.
January 2003	Earthquake 1.2 and 1.4	Hastings-on-Hudson	N/A	N/A	Two small earthquakes struck the area surrounding Hastings-on-Hudson.
March 2006	Earthquake 1.1 and 1.3	Rockland, NY	N/A	N/A	Two earthquakes struck Rockland County. The first, 1.1, struck 3.3 miles southwest of Pearl River and the second, 1.3, was centered in the West Nyack-Blauvelt-Pearl River area.
February 18, 2009	Earthquake 2.3	Greater New York Area	N/A	N/A	In Westchester County, residents in Briarcliff Manor reported having felt the earthquake.
June 23, 2013	Earthquake 2.1	Greater New York Area	N/A	N/A	No reference and/or no damage reported.







Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
February 1, 2014	Earthquake 1.8	Rye Brook, NY	N/A	N/A	No reference and/or no damage reported.
May 11, 2014	Earthquake 1.7	Heritage Hills, NY	N/A	N/A	No reference and/or no damage reported.
July 5, 2014	Earthquake 2.5	5.2 miles from Peekskill	N/A	N/A	No reference and/or no damage reported.

Source(s):

NYS DHSES, 2014; USGS, 2014; Kim, 1999; Stover and Coffman, 1989; Journal News Online 2011; PIX11 News 2014; FEMA 2014; Westchester County GIS 2001

CT Connecticut DR Major Disaster

DR Major Disaster Declaration (FEMA)

FEMA Federal Emergency Management Agency

N/A Not Applicable

NY New York

USGS U.S. Geological Survey





# H.1.2 Extreme Temperature

Information regarding specific details of temperature extremes in Westchester County is scarce; therefore, previous occurrences and losses associated with extreme temperature events are limited. Table H.5 summarizes the extreme temperature events in the County from 1950 through 2014.



## Table H.2. Extreme Temperature Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration	County Designated?	Losses / Impacts
		Number	-	
January 16, 1994	Extreme Cold	N/A	N/A	A homeless man died early Sunday in Mount Vernon. Subzero temperatures were blamed for his death.
July 4-6, 1999	Extreme Heat	N/A	N/A	On July 4th, temperatures soared into the mid and upper 90s. The combination of high temperatures and moderate humidity caused most heat indices to range from 100 to 105 degrees. On July 5th, heat indices peaked from 110 to 115 degrees. "Rolling" electrical blackouts occurred across the Metropolitan Region. On July 6th, heat indices peaked around 110 degrees. Widespread blackouts occurred across the Metro area, including Westchester County's sound shore from Pelham Manor to Port Chester. This heat wave was directly responsible for killing 2 people from Pelham.
January 17-18, 2000	Extreme Wind-chill	N/A	N/A	On January 17, wind chill values ranged from 20 to 30 degrees below 0 across the Lower Hudson Valley. On January 18, wind chills across the Lower Hudson Valley were 30 to 35 degrees below 0.
January 21, 2000	Extreme Cold/Wind Chill	N/A	N/A	The combination of a quickly intensifying low pressure system off the New England Coast and a strong high pressure system west of the Great Lakes caused strong and gusty northwest winds. Wind chill values plummeted to 25 to 35 degrees below zero.
January 27-28, 2000	Extreme Wind-chill	N/A	N/A	At Westchester County Airport in White Plains, the lowest wind chill of 26 degrees below zero occurred around 4 am on the 28th when the temperature was 9 degrees above zero and the wind speed was 21 mph.
August 8-10, 2001	Excessive Heat	N/A	N/A	Heat indices ranged from 105 to 110 degrees. Scattered power outages spread across the suburbs.
July 29-31, 2002	Excessive Heat	N/A	N/A	Heat indices ranged from 100 to 105 degrees on the 29th and from around 95 to 100 on the 30th and 31st
January 15-16, 2004	Extreme Cold/wind Chill	N/A	N/A	The large difference in pressure between a strong low pressure system northeast of New England and a strong arctic high pressure system in Southeast Canada resulted in the combination of extremely low temperatures, high winds, and extremely low wind chill index values. Record low temperatures were set and tied. In Westchester County, the lowest wind chill index temperature was reported at the Westchester Airport (-26°F) and a low of -1°F. Sustained winds of 30 mph were also reported at the airport.
July 4-7, 2010	Heat Wave	N/A	N/A	A hot airmass developed over the central portion of the U.S. and moved eastward. It settled over the New York City region during the second half of the 4 <sup>th</sup> of July weekend. Several records were broken. In Westchester County, temperatures ranged from 95°F to 102°F during this timeframe.
July 22-23, 2011	Excessive Heat	N/A	N/A	Excessive heat between 95 and 105 degrees, along with heat indices in excess of 105 degrees occurred for a couple of days. The heat index was as high as 109 degrees at 1 PM at Westchester County Airport (KHPN) on July 22nd.
July 18, 2012	Excessive Heat	N/A	N/A	The heat index reached or exceeded 107 degrees at Newburgh airport (Stewart Field).





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
July 14-19, 2013	Heat Wave	N/A	N/A	A week-long heat wave struck the New York City metropolitan area. Seven consecutive days with highs in the 90s were recorded. Numerous locations saw 100°F and other locations had daily record highs set. In Westchester County, more than 7,600 customers were without power.

Sources: NOAA-NCDC 2014; NWS 2014

Note (1): Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

NOAA-NCDC National Oceanic Atmospheric Administration – National Climatic Data Center

NWS National Weather Service

NYS New York State





# H.1.3 Flood

Known flooding events that occurred from 1971 to 2014 are identified in Table H.3. With flooding documentation for New York State and Westchester County being so extensive, not all sources have been identified or researched. Therefore, Table H.3 may not include all events that have occurred in the County.



#### Table H.3. Flooding Events in Westchester County Between 1971 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
September 1971	Severe Storms and Flooding (Tropical Storm Doria)	DR-311	Yes	This storm caused seven deaths and \$147.6 million in damage throughout its path. New York State experienced approximately \$7.4 million in total eligible damages. Westchester County experienced approximately \$29,000 in property and crop damages.
June 20-25, 1972	Tropical Storm Agnes (FEMA did not identify this as a flooding declaration)	DR-338	Yes	New York State experienced approximately \$703 million in total eligible damages. Storm either severely damaged or destroyed 5,000 homes and killed 24 people. Westchester County experienced approximately \$806,000 in property and crop damages. Approximately 5.2 inches of rain fell within a 12 hour period.
June 28, 1973	Flood	DR-401	No	The Northeast U.S. was affected by flooding, causing 40 counties in New Hampshire, Vermont, New York and Pennsylvania to be declared major disaster areas by FEMA. In New York State, six counties were declared (FEMA DR-401); however, Westchester County was not included in this declaration. According to SHELDUS, the County experienced approximately \$38 million in property damages from this event. However, no other sources were found that indicated this information.
September 25-27, 1975	Severe Storms, Heavy Rain, Landslides, Flooding (Hurricane Eloise)	DR-487	Yes	New York State experienced approximately \$25 million in property damages and 2 fatalities. Total rain amounts exceeded 10 inches within southeastern New York State (including Westchester County).
November 7, 1977	Flash Flood	N/A	N/A	Westchester County experienced approximately \$833,000 in property damages.
May 23, 1979	Flash Flood	N/A	N/A	Westchester County experienced approximately \$1.3 million in property damages.
December 12, 1983	Flash Flood	N/A	N/A	Westchester County experienced approximately \$227,000 in property damages.
April 5, 1984	Coastal Storms and Flood	DR-702	Yes	New York State experienced approximately \$11.9 million in property damages. Losses in the County are unknown.
May 28, 1984	Flash Flood	N/A	N/A	Westchester County experienced approximately \$2.4 million in property damages.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
March 14, 1986	Flash Flood	N/A	N/A	Westchester County experienced approximately \$238,000 in property damages.
March 31, - April 8, 1987	Flash Flood / Heavy Rain	DR-801	No	Intense rainfall in New York State during April 3 and 5 caused widespread flooding in the State. Five counties in southeastern New York State were declared disaster areas by FEMA (FEMA DR-801). A total of ten deaths resulted from this storm when a New York State Thruway bridge collapsed over the Schoharie Creek. Westchester County was not included in the disaster declaration. The County received between 7 and 8 inches of rain from this storm.
December 11-14, 1992	Coastal Storm, High Tides, Heavy Rain, Flooding	DR-974	Yes	New York State experienced approximately \$31.2 million in property damages, mostly due to flooding. Flooding in New York City and Boston was recorded between four and five feet. In Westchester County, between eight and 11 inches of rain, causing flooding. All public schools were closed. Several major roadways were closed due to flooding. Overall, Westchester County had approximately \$7.1 million in flood damages. Over 20,000 power failures occurred throughout the County.
January 28, 1994	Flooding	N/A	N/A	The combination of warm temperatures melting snow and the arrival of heavy rains caused significant and widespread urban flooding across the area. Many roads were closed for hours during this event. Numerous cars stalled out attempting to cross some of these flooded roads. Several of these motorists had to be rescued from their vehicles.
July 26, 1995	Flash Flood	N/A	N/A	A tropical airmass across the region generated some heavy thunderstorms. One of these storms downed some trees across Westchester County and also caused some significant flooding problems as heavy rains were also generated. Lightning caused a blaze that heavily damaged the roof and top floor of a house in Scarsdale.
October 28, 1995	Flood	N/A	N/A	Several inches of rain caused the Mahwah River at Suffern to rise slightly above flood stage. Flooding occurred along the Saw Mill River at Elmsford. There was also some widespread flooding of roadways throughout the area.
May 11, 1996	Flash Flood	N/A	N/A	Torrential rain flooded the Saw Mill River Parkway in Chappaqua.
June 13, 1996	Flash Flood	N/A	N/A	Rainfall rates of up to 2 inches in less than 1 hour produced significant flooding along the Palisades Parkway (from Exits 12 through 15) in Rockland County and on the Saw Mill Parkway near Bedford.
October 19-20, 1996	Severe Storms / Flooding	DR-1146	Yes	Coastal flooding event that caused over \$16.1 million in property damages throughout Westchester and Suffolk Counties. Approximately \$3.5 million in disaster aid to the two counties. Flooding caused the closures of the Hutchinson River Parkway between Wolfs Lane and East 3 <sup>rd</sup> Street and the Bronx River Parkway between Sprain Brook Parkway and Scarsdale Road. Rainfall totals in Westchester County ranged from 2.37 inches at Ossining to 4.98 inches at Dobbs Ferry.
March 9, 1998	Flood	N/A	N/A	Scattered power outages.





Dates of Event	Event Type	FEMA Declaration	County Designated?	Losses / Impacts
		Number	Designated.	
June 13, 1998	Flash Flood	N/A	N/A	Torrential rains resulted in widespread serious flooding of streets, poor drainage and low-lying areas, home basements, and small streams. Lightning struck many homes and ignited fires that damaged them.
September 14-17, 1999	Hurricane Floyd	DR-1296; EM-3149	Yes	New York State experienced approximately \$62.2 million in eligible damages as a result of property damage and debris accumulation (NYSDPC). The worst damage in the New York metropolitan region occurred in Rockland and Westchester Counties. Orange, Putnam, Rockland and Westchester Counties were declared disaster areas. NOAA-NCDC, SHELDUS and other sources indicated that Westchester County experienced between \$6.6 and \$14.6 million in damages. Many Westchester County officials proclaimed the storm as one of the worst storms ever to hit the area at that time, with the most rain ever recorded dropped on the county in 24 hours. Nearly all of the state-controlled parkways in Westchester County flooded during Floyd, causing about \$2.8 million in damage. As of December 6, 1999, FEMA indicated that the County was approved for over \$1.8 million in public assistance. Other sources indicate that Westchester municipalities were reimbursed about \$14 million by FEMA for damages; local businesses received \$2.3 million, and homeowners received approximately \$1.6 million.
June 17, 2001	Flash Flood	N/A	N/A	Excessive rainfall also led to severe flooding conditions across portions of Westchester County.
August 9-15, 2004	Remnants of Hurricane Charley	N/A	N/A	Significant flooding throughout the County.
September 8, 2004	Flash Flood	N/A	N/A	Flash flooding on the Sawmill River Parkway. Flash flooding filled basements with water. Rowboats and payloaders were used to rescue people from flooded homes and vehicles in Mamaroneck, Rye and Harrison. The White Plains Times Newspaper called the flash flooding in Westchester County the worst in 28 years. The remnants of Hurricane Frances produced torrential rainfall across Southeastern New York on September 8th. Rainfall amounts ranging from an inch to up to 6 inches were common across the area. This caused extensive flash flooding across the region, resulting in rescues of people from homes and cars.
September 13-27, 2004	Remnants of Hurricane Jeanne	N/A	N/A	Nearly a foot of rain fell on Westchester county within a 24-hour period. The result was severe, widespread damage, especially in northern areas of the County, where the landscape was transmogrified by floating cars, downed trees, collapsed railroad embankments and impassable roadways. In Cortlandt, several major roadways were submerged.
April 2-4, 2005	Severe Storms and Flooding	DR-1589	Yes	Widespread heavy rain along with heavy showers and thunderstorms impacted the region bringing rainfall totals of one to four inches. The heavy rain caused widespread urban flooding. Most small streams and rivers overflowed their banks. In addition, high wind gusts from 46 to 57 mph downed trees. New York State experienced approximately \$66.2 million in eligible damages. FEMA approved more than \$5 million in disaster aid to the State to help fund recovery efforts in several counties and jurisdictions.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				In Westchester County, rainfall totals ranged from 2.25 inches in Armonk to 3.52 inches in Yorktown Heights. A 40mph wind gust was recorded at Westchester County Airport. Westchester County experienced approximately \$4.3 million in flood damages.
June 29, 2005	Flooding	N/A	N/A	Heavy rain caused major damage to municipalities in southern Westchester County along the Hudson River. Roads buckled, parks flooded and cars were submerged. More than 70 submerged cars had to be towed along the New York State Thruway from the Villages of Tarrytown to Ardsley.
June 26 – July 12, 2006	Severe Storms and Flooding	DR-1650	Yes	<ul> <li>This event was the largest and most costly natural disaster that New York State encountered since Hurricane Agnes in 1972. Resulted in a Disaster Declaration for 19 New York State counties. New York State experienced approximately \$246.3 million in eligible damages. As of December 29, 2006, more than \$227 million in disaster aid was approved for the State.</li> <li>June 29<sup>th</sup> – slow moving thunderstorms produced a wide array of severe weather to the area. Flash flooding, large hail, and damaging winds struck Westchester County. The storms downed trees and brought penny size hail to the Mount Kisco area of the County.</li> <li>July 12<sup>th</sup> - a weak F1 tornado touched down in Grandview-on-Hudson in Rockland County. The tornado moved east to northeast across the Hudson river. It over turned a boat near the Tappan Zee Bridge then moved across the western shores of Westchester County over the Town of Sleepy Hollow. Houses and businesses along Beekman Avenue, Depyster Street, and Chestnut Street in the Town experienced roof and siding damage associated with a F1 tornado intensity. As the tornado moved towards Pacantico Hills (Sleepy Hollow), it damaged trees and structures which included the destruction of two small barns. As it moved into Mount Pleasant and Hawthorne, it caused extensive tree damage. The tornado moved into the Kensico Reservoir across Routes 22 and 120 in North Castle. The path width was estimated at 2000 to 200 warde and approximately \$10 million in damager.</li> </ul>
April 15-16, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	A Nor'Easter struck the area between the 15 <sup>th</sup> and 16 <sup>th</sup> , bringing heavy rains and high winds that caused widespread and significant river, stream and urban flooding. High winds downed many trees and power lines. The combination of high winds, heavy rain, and high water table produced widespread moderate tidal flooding across parts of New York City and Long Island Sound shores. Rainfall totals from this event ranged from 1.47 inches to 8.41 inches. Wind speed gusts ranged from 35 to 55 mph. New York State experienced millions in eligible damages. FEMA gave out more than \$61 million in assistance to affected counties within the State. In Westchester County, rainfall totals ranged from 5.85 inches in Yorktown Heights to 8.22 inches in East White Plains. State Police reported flooding closures of Exit 7 of I-287, Exits 18A, 18B, and 22 of I-95, and I-95 southbound between exits 19 and 17. Roads were also closed along the Hutchinson River Parkway due to flooding at Linden Avenue in the Town of Harrison. The Bronx River Parkway was also closed in the City of White Plains. Private







Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
-				property losses in Westchester County were estimated at \$83 million and public property losses were estimated at \$2 million. Disaster assistance to the County totaled \$30 million.
April 27, 2007	Flash Flood	N/A	N/A	A band of heavy rain occurred across northeast New Jersey and southern Westchester County. It then moved across southern Fairfield and New Haven Counties in Connecticut. Storm totals ranged from two to three inches, which resulted in flash flooding across parts of the region. In Westchester County, totals of 2.71 inches was measured in the southern portion of the County. Flash flooding was reported along the Cross County Parkway in both directions at the Bronx River Parkway on ramp and the Hutchinson River Parkway in both directions at Lincoln Avenue in the City of Mount Vernon. The Sprain Brook Parkway southbound after Route 100 was also flooded in the City of Yonkers.
March 13-15, 2010	Severe Storms and Flooding (also identified as a Nor'Easter)	DR-1899	Yes	<ul> <li>On April 16, 2010, FEMA announced that federal disaster aid was made available for the State of New York due to the severe storms and flooding that struck between March 13 and 15.</li> <li>Nassau, Orange, Richmond, Rockland, Suffolk and Westchester Counties were all included in this declaration. This storm caused seven deaths in Northeast U.S. and more than 300,000 customers were without power. Hurricane-force winds knocked down trees and power lines. Heavy rain caused flooding across the region. Flood warnings were issued from northern Virginia to southern New Hampshire. Some coastal areas received more than six inches of rain. Con Ed reported that more than 86,000 customers were without power in New York City and Westchester County. In Westchester County, schools were closed.</li> </ul>
October 1, 2010	Flash Flood	N/A	N/A	Fourteen families living in a two-story apartment building in Harrison were evacuated after a ceiling in the hallway collapsed, causing flooding throughout the building. Approximately \$50,000 in damages.
March 6 – 7, 2011	Heavy Rain and Flooding	N/A	N/A	Rainfall totals in Westchester County ranged between 2.15 inches and 4.64 inches. Power outages were reported in several areas of Westchester County. Numerous road closures were reported.
August 28, 2011	Hurricane Irene (FEMA did not identify this as a flooding declaration)	DR-4020; EM- 3328	Yes	As Hurricane Irene moved north along the Atlantic coast, it weakened and made its second landfall as a Tropical Storm near Little Egg Inlet along the southeast New Jersey coast. The storm made its third landfall in New York City on August 28 <sup>th</sup> . This storm brought sustained winds, heavy rain, destructive storm surge and two confirmed tornadoes. Heavy rainfall resulted in widespread moderate flooding across the area. Seven deaths resulted from Irene. At least 600,000 people were ordered to evacuate their homes from storm surge and inland flooding. Widespread power outages of up to one week followed the storm. The strong winds from Irene pushed a three to five foot storm surge of water along western Long Island South, New York Harbor, the southern and eastern bays of Long Island, and southern bays of New York City. This resulted in moderate to major coastal flooding, wave damage and erosion along the coast, with heavy damage to public beaches and other public and private facilities. In Westchester County, a raft carrying five men capsized on the Croton River just south of Silver Lake Park. The men were rescued from the raging river, but not before three of the rescue workers were tossed from their rescue hoat and were swent under a trestle bridge just





Dates of Event	Event Type	FEMA Declaratio <u>n</u>	County Designated?	Losses / Impacts
		Number		
				south of the Croton-Harmon station. Babbitt Court in Elmsford was under several ft. of water from the Saw Mill River rising out of its banks, requiring one family to be rescued from their home by the local fire department. The overflowing river also caused portions of Rt. 119 and several side streets throughout Elmsford to be closed, causing untold damage to homes and businesses. The NOS tidal gauge at Kings Point recorded a maximum water level of 12.36 feet MLLW on August 28 <sup>th</sup> . A peak wind gust of 56 mph was recorded at the County Airport.
September 6-10, 2011	Remnants of Tropical Storm Lee	DR-4031	No	Ten days after Hurricane Irene struck, the remnants of Tropical Storm Lee produced record setting rainfall over the same area and lead to historical flooding in some areas of New York State. In Westchester County, on September 8 <sup>th</sup> , in the City of Mount Vernon, the entire Bronx River Parkway was closed due to flooding. In the Village of Briarcliff Manor, the entire Saw Mill River Parkway was closed due to flooding. In the Town of Mamaroneck, I-95 exit ramps at Mamaroneck were closed due to flooding. In the Village of Pelham, the Hutchinson River Parkway in both directions between the New York City line and the Cross County Parkway was closed due to flooding. In the City of Mount Vernon, all on- and off-ramps were closed due to flooding on the Cross County Parkway in both directions at Bronx River Parkway. Overall rainfall totals from this event ranged from 5.14 inches in Thornwood (Town of Mount Pleasant) to 6.8 inches in the City of White Plains.
October 28, 2012	Hurricane Sandy (FEMA did not identify this as a flooding declaration)	DR-4085; EM-3351	Yes	Hurricane Sandy was the 19th named tropical cyclone of the 2012 Atlantic hurricane season. The track of Hurricane Sandy resulted in a worse-case scenario for storm surge for coastal regions from New Jersey north to Connecticut, including New York City and Long Island. It was the costliest natural disaster in southeast New York State. It caused record breaking tides and wave action, as well as sustained winds of 40 to 60 mph and wind gusts of 80 to 90 mph. These extreme conditions resulted in at least 60 deaths and widespread property damage of at least \$42 billion. Emergency managers recommended mandatory evacuations of more than 500,000 people that lived in low-lying areas. Widespread significant power outages of more than two million people lasted up to two weeks. In Westchester County, Sandy did not result in significant rainfall; however, it still caused extreme coastal flooding from storm surge and high winds. Low lying areas along the Hudson River experienced moderate coastal flooding as storm surge moved north along the River as Sandy made landfall in southern New Jersey. This coincided with widespread record coastal flooding occurring in Lower New York Harbor exceeding the FEMA 100 year BFE. Up to two to feet of inundation occurred in the low lying areas. Coastal communities in Westchester County along the southern portions of the County experienced two successive tidal cycles with
				at least moderate coastal flooding on the 28 <sup>th</sup> . Maximum wind gusts ranged between 80 and 90mph. A wind gust of 64 mph was recorded at the Tappan Zee Bridge. A wind gust of 72 mph was measured at the White Plains Airport. The County at least three fatalities related to Sandy and over \$527 million in damages and recovery needs. Overall, the County experienced power outages, school and business closings, flooding, fuel shortages, downed utility poles and trees. Over 156,000 customers lost power in New York City and Westchester County. FEMA





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				Public Assistance topped \$38 million to fund emergency efforts, remove debris, and rebuild infrastructure.
November 27, 2013	Heavy Rain and Flash Flood	N/A	N/A	Several inches of rain fell in the tristate area, which resulted in isolated flash flooding in Westchester County. In the Village of Elmsford, the intersection of Tarrytown Road and Knollwood Road was closed due to flooding. Total reported rainfall totals ranged from 2.75 inches in Mamaroneck to 3.7 inches at the County Airport.
April 30, 2014	Heavy Rain and Flooding	N/A	N/A	Periods of heavy rain impacted portions of New York City, Nassau, Rockland and Westchester Counties, which resulted in flooding in these areas. In Westchester County, a mudslide occurred near the Glenwood Metro North station in the City of Yonkers due to the heavy rain. Storm totals ranged from 2.85 inches in the City of Peekskill to 5.28 inches in Village of Bronxville. In the City of White Plains, the Bronx River Parkway was closed in both directions from Walworth Crossing to Chatterton Avenue due to flooding. The Hutchinson River Parkway (northbound) was also closed in White Plains due to flooding between Lincoln Avenue and Ridge Street.
May 1, 2014	Heavy Rain and Flooding	N/A	N/A	Heavy rain fell across the area resulting in flooding across Westchester and Rockland Counties, as well as the Bronx in New York City. In Westchester County, the northbound Hutchinson River Parkway was closed between exits 7 and 12. The Saw Mill River Parkway was closed southbound from exit 16 to Farragut Parkway and northbound between exits 20 and 21 in the Village of Elmsford due to flooding. In the Village of Bronxville, the southbound Bronx River Parkway was closed between Route 100/119 and the Sprain Brook Parkway due to flooding.
July 14-15, 2014	Heavy Rain and Flash Flooding	N/A	N/A	<ul> <li>On July 14<sup>th</sup>, Westchester County had rainfall totals exceeding 1.6 inches. In the Town of Mount Pleasant, several cars were stranded in flood waters up to the car doors near Bradhurst Avenue. Sprain Brook Parkway was closed in due to flooding; multiple cars were under water. In Chappaqua, North Greeley Avenue was closed due to flooding. In Thornwood, water rescues were performed along the Taconic Parkway near Stevens Avenue.</li> <li>On July 15<sup>th</sup>, between 1.46 and 1.8 inches of rain fell in the County. In White Plains, Bloomingdale Road and the Bronx River Parkway southbound were closed due to flooding. In Mount Vernon, the Hutchinson River Parkway was closed between exits 10 and 12.</li> </ul>
Source: FEMA 2014;	NOAA-NCDC 2014; SHELD	US 2014; Lohud.con	n 2011; Courson et	al. 2010; MyFox New York 2010; Chas. H. Sells, Inc.2007; SPC 2014
Note (1): Monetary fig monetary los	ures within this table were ses would be considerably	e U.S. Dollar (USD) fi hiaher in USDs as a	gures calculated d result of increased	uring or within the approximate time of the event.  If such an event would occur in the present day, I II.S. Inflation Rates.
DR Federal	Disaster Declaration			NCDC National Climate Data Center
EM Federal	Emergency Declaration	4		NOAA National Oceanic Atmospheric Administration
FEMA Federal	Emergency Management	Agency		NWS National Weather Service
K Thousa	nd (\$)			PA Public Assistance
M Million	(\$)			SHELDUS Spatial Hazard Events and Losses Database for the U.S.
MARFC Middle . N/A Not app	Atlantic River Forecast Ce blicable	nter		USACE U.S. Army Corps of Engineer





# H.1.4 Severe Storm

Known severe storm events that occurred from 1990 to 2014 are identified in Table H.7. With severe storm documentation for New York State and Westchester County being so extensive, not all sources have been identified or researched. Therefore, Table H.7 may not include all events that have occurred in the County.



# Table H.4. Severe Storm Events between 1990 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
June 12, 1991	Tornado (F0)	N/A	N/A	A squall line moving across Rockland and Westchester Counties produced a tornado at Briarcliff Manor. A man was killed when the tornado threw a tree on top of his car. In New Rochelle, a woman was killed and her children were injured by a falling tree. At White Plains Airport, 13 planes and about 12 cars were damaged or destroyed. This tornado event caused approximately \$25,000 in damages to the County.
December 11-14, 1992	Coastal Storm, High Tides, Heavy Rain, Flooding	DR-974	Yes	New York State experienced approximately \$31.2 million in property damages, mostly due to flooding. Flooding in New York City and Boston was recorded between four and five feet. In Westchester County, between eight and 11 inches of rain, causing flooding. All public schools were closed. Several major roadways were closed due to flooding. Overall, Westchester County had approximately \$7.1 million in flood damages. Over 20,000 power failures occurred throughout the County.
July 3, 1996	Lightning	N/A	N/A	A home was struck by lightning in the City of New Rochelle. The roof was damaged, causing approximately \$5,000 in damages.
October 19-20, 1996	Severe Storms / Flooding	DR-1146	Yes	Coastal flooding event that caused over \$16.1 million in property damages throughout Westchester and Suffolk Counties. Approximately \$3.5 million in disaster aid to the two counties. Flooding caused the closures of the Hutchinson River Parkway between Wolfs Lane and East 3rd Street and the Bronx River Parkway between Sprain Brook Parkway and Scarsdale Road. Rainfall totals in Westchester County ranged from 2.37 inches at Ossining to 4.98 inches at Dobbs Ferry.
September 14-17, 1999	Hurricane Floyd	DR-1296; EM-3149	Yes	New York State experienced approximately \$62.2 million in eligible damages as a result of property damage and debris accumulation (NYSDPC). The worst damage in the New York metropolitan region occurred in Rockland and Westchester Counties. Orange, Putnam, Rockland and Westchester Counties were declared disaster areas. NOAA-NCDC, SHELDUS and other sources indicated that Westchester County experienced between \$6.6 and \$14.6 million in damages. Many Westchester County officials proclaimed the storm as one of the worst storms ever to hit the area at that time, with the most rain ever recorded dropped on the county in 24 hours. Nearly all of the state-controlled parkways in Westchester County flooded during Floyd, causing about \$2.8 million in damage. As of December 6, 1999, FEMA indicated that Westchester municipalities were reimbursed about \$14 million by FEMA for damages; local businesses received \$2.3 million, and homeowners received approximately \$1.6 million.
August 9-15, 2004	Remnants of Hurricane Charley	N/A	N/A	Significant flooding throughout the County.
September 13-27, 2004	Remnants of Hurricane Jeanne	N/A	N/A	Nearly a foot of rain fell on Westchester county within a 24-hour period. The result was severe, widespread damage, especially in northern areas of the County, where the landscape




Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				was transmogrified by floating cars, downed trees, collapsed railroad embankments and impassable roadways. In Cortlandt, several major roadways were submerged.
April 2-4, 2005	Severe Storms and Flooding	DR-1589	Yes	<ul> <li>Widespread heavy rain along with heavy showers and thunderstorms impacted the region bringing rainfall totals of one to four inches. The heavy rain caused widespread urban flooding. Most small streams and rivers overflowed their banks. In addition, high wind gusts from 46 to 57 mph downed trees. New York State experienced approximately \$66.2 million in eligible damages. FEMA approved more than \$5 million in disaster aid to the State to help fund recovery efforts in several counties and jurisdictions.</li> <li>In Westchester County, rainfall totals ranged from 2.25 inches in Armonk to 3.52 inches in Yorktown Heights. A 40mph wind gust was recorded at Westchester County Airport.</li> </ul>
June 26 July 12	Correct	DB 1(50	V	Westchester County experienced approximately \$4.3 million in flood damages.
June 26 – July 12, 2006	Severe Storms and Flooding	DR-1650	Yes	<ul> <li>This event was the largest and most costly natural disaster that New York State encountered since Hurricane Agnes in 1972. Resulted in a Disaster Declaration for 19 New York State counties. New York State experienced approximately \$246.3 million in eligible damages. As of December 29, 2006, more than \$227 million in disaster aid was approved for the State.</li> <li>June 29<sup>th</sup> – slow moving thunderstorms produced a wide array of severe weather to the area. Flash flooding, large hail, and damaging winds struck Westchester County. The storms downed trees and brought penny size hail to the Mount Kisco area of the County.</li> <li>July 12<sup>th</sup> - a weak F1 tornado touched down in Grandview-on-Hudson in Rockland County. The tornado moved east to northeast across the Hudson river. It over turned a boat near the Tappan Zee Bridge then moved across the western shores of Westchester County over the Town of Sleepy Hollow. Houses and businesses along Beekman Avenue, Depyster Street, and Chestnut Street in the Town experienced roof and siding damage associated with a F1 tornado intensity. As the tornado moved towards Pacantico Hills (Sleepy Hollow), it damaged trees and structures which included the destruction of two small barns. As it moved into Mount Pleasant and Hawthorne, it caused extensive tree damage. The tornado moved into the Kensico Reservoir across Routes 22 and 120 in North Castle. The path width was estimated at 200 to 300 yards and caused approximately \$10 million in damages.</li> </ul>
September 2, 2006	Remnants of Tropical Storm Ernesto	N/A	N/A	Remnants of Tropical Storm Ernesto brought heavy rain and gusty winds across Long Island and Southeast New York State. This resulted in many trees and power lines down with hundreds of thousands of people without power. Westchester County had between 0.5 and 1
	Ellesto			inches of rain, with wind gusts of up to 49 mph.
April 15-16, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	A Nor'Easter struck the area between the 15 <sup>th</sup> and 16 <sup>th</sup> , bringing heavy rains and high winds that caused widespread and significant river, stream and urban flooding. High winds downed many trees and power lines. The combination of high winds, heavy rain, and high water table produced widespread moderate tidal flooding across parts of New York City and Long Island Sound shores. Rainfall totals from this event ranged from 1.47 inches to 8.41 inches. Wind





Dates of Event	Event Type	FEMA Declaration	County Designated?	Losses / Impacts
		Number		<ul> <li>speed gusts ranged from 35 to 55 mph. New York State experienced millions in eligible damages. FEMA gave out more than \$61 million in assistance to affected counties within the State.</li> <li>In Westchester County, rainfall totals ranged from 5.85 inches in Yorktown Heights to 8.22 inches in East White Plains. State Police reported flooding closures of Exit 7 of I-287, Exits 18A, 18B, and 22 of I-95, and I-95 southbound between exits 19 and 17. Roads were also closed along the Hutchinson River Parkway due to flooding at Linden Avenue in the Town of Harrison. The Bronx River Parkway was also closed in the City of White Plains. Private</li> </ul>
March 20, 2008	Strong Wind	N/A	N/A	property losses in Westchester County were estimated at \$83 million and public property losses were estimated at \$2 million. Disaster assistance to the County totaled \$30 million. Strong winds downed a tree on a car in Westchester County, killing one person and injuring two in the Town of Cortlandt. Wind speeds reached 46 mph
June 10, 2008	Thunderstorm Wind	N/A	N/A	A strong cold front moved across southeast New York State causing multiple severe thunderstorms across the region. In the City of New Rochelle, multiple trees were reported down. In Dunwoodie, two large trees and wires were reported down on Parkhill Avenue. Trees were also reported down on Yonkers Avenue and the Saw Mill Parkway. In Mount Vernon, numerous trees were down with some falling onto three homes and 17 cars. Overall, there was approximately \$37,000 in damages in the County.
June 22, 2008	Lightning; Thunderstorm Wind	N/A	N/A	Thunderstorms produced frequent intense lightning that struck a condo complex in Pleasantville. Lightning blew out windows and ignited a fire that caused eight families to evacuate. In Peekskill, numerous trees were reported down. Overall, there was approximately \$200,000 in damages from this event.
August 15, 2008	Hail; Lightning; Thunderstorm Wind	N/A	N/A	A slow moving cold front that crossed the tri-state area produced severe thunderstorms across portions of New York City, Long Island, and the Lower Hudson Valley. This included a microburst in southern Westchester County. In the City of New Rochelle, lightning struck the high school and caused significant damage. A wind gust of 65 mph was measured just northwest of the City. Hail was also reported as a result of this storm. Overall, the County had over \$30,000 in damages.
September 6, 2008	Tropical Storm Hanna	N/A	N/A	Tropical Storm Hanna impacted southeast New York State, making landfall near the Nassau/Suffolk County border on the 6 <sup>th</sup> . Rainfall totals ranged from 1.66 inches to 5.92 inches. The highest sustained wind of 38 mph and a peak gust of 52 mph was reported at Shinnecock Inlet (Suffolk County). Coastal storm tides of two feet or less above astronomical tide levels were common, with only minor beach erosion reported. Near the coast, as well as inland, only scattered trees were reported down to the wind. In Westchester County, scattered trees were reported down in the County. A wind gust of 37 mph occurred at White Plains Airport. Rainfall totals in the County ranged from 3.32 inches in the City of Rye to 4.42 inches at White Plains Airport. Overall, the County had approximately \$8,000 in damages.
July 7, 2009	Thunderstorm Wind; Hail	N/A	N/A	Straight-line winds impacted southern Westchester County. A large area of very strong downburst winds downed numerous large trees that fell on structures, powerlines, and cars. The worst damage was observed in the area of Trevor Park near the Hudson River Museum.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				<ul> <li>Winds in this area were estimated at 100 mph. Some minor damage to the roof of the museum was observed. Nearly all trees appeared to have fallen to the east or southeast. The damage area extended east to North Broadway and into Grant Park on Park Avenue where numerous large trees were knocked over. Large trees in Oakland Cemetery were also downed. In Mount Vernon and Bronxville, downed trees were also reported. Winds in the area of Eastchester and Tuckahoe were estimated at 80 mph.</li> <li>In addition to wind damage, extensive hail from the storm along with torrential rain impacted the area. The hail accumulated to several inches in Yonkers. Rain swept the hail into some locations to a depth of over a foot. In one location in northern Yonkers, up to four feet of hail accumulated inside a home after the drainage become clogged. One injury was reported as a result of this event. The County had over \$1 million in damages.</li> </ul>
July 17, 2009	Thunderstorm Wind	N/A	N/A	Severe weather impacted Orange and Westchester Counties. In Westchester County, in the Town of Somers, trees and wires were reported down along Route 100. At Sparkle Lake (Town of York Town), State Route 35 was closed between Broad Street and Brookside Avenue due to downed trees and wires. Overall, the County had approximately \$9,000 in damages.
August 10, 2009	Thunderstorm Wind	DR-1857	No	Several severe thunderstorms impacted in the Lower Hudson Valley, including Westchester County. Numerous trees were reported down throughout the County. Some trees took down power lines with them, causing sporadic power outages. Overall, the County had approximately \$16,000 in damages.
August 21, 2009	Thunderstorm Wind	N/A	N/A	Strong winds caused damage throughout Westchester County. In Yorktown Heights (Town of Yorktown), dozens of trees were reported down throughout and a funnel cloud was spotted over the hamlet. This event caused approximately \$10,000 in damages to the County.
January 25, 2010	High Wind	N/A	N/A	A cold front produced strong southerly winds in Westchester County. In the southern part of the County, a 62 mph wind gust was reported at the County Airport. A six car Metro North train ran into a tree that had fallen on power lines near the Pleasantville station. Rainfall totals ranged from 1.27 in the City of Rye to 2.01 inches in the City of White Plains. Peak wind gusts in the County ranged from 52 mph in Tarrytown to 62 mph in White Plains. The County had approximately \$10,000 in damages.
March 13-15, 2010	Severe Storms and Flooding (also identified as a Nor'Easter)	DR-1899	Yes	On April 16, 2010, FEMA announced that federal disaster aid was made available for the State of New York due to the severe storms and flooding that struck between March 13 and 15. Nassau, Orange, Richmond, Rockland, Suffolk and Westchester Counties were all included in this declaration. This storm caused seven deaths in Northeast U.S. and more than 300,000 customers were without power. Hurricane-force winds knocked down trees and power lines. Heavy rain caused flooding across the region. Flood warnings were issued from northern Virginia to southern New Hampshire. Some coastal areas received more than six inches of rain. Con Ed reported that more than 86,000 customers were without power in New York City and Westchester County. In Westchester County, schools were closed.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
July 19, 2010	Thunderstorm Wind; Lightning	N/A	N/A	Lightning struck two trees and then traveled through the roots into wires going into houses. A fire was caused, with an occupant treated for smoke inhalation. Multiple trees and power lines were reported down in Yonkers. Damages of \$43,500 were reported.
July 21, 2010	Thunderstorm Wind	N/A	N/A	Severe thunderstorms impacted the Lower Hudson Valley and Long Island. In Westchester County, numerous trees were reported down, with some falling on top of cars. Multiple power lines were reported down as well. Trees fell into homes in Pound Ridge. The County had approximately \$56,000 in damages.
September 22, 2010	Thunderstorm Wind	N/A	N/A	Severe thunderstorms in Westchester County downed a large tree and power lines on Anderson Hill Road in the City of White Plains. The storm caused approximately \$7,500 in damages.
September 30, 2010	Strong Wind	N/A	N/A	Strong winds were responsible for the loss of power to 1,200 customers in Westchester County due to downed power lines and trees. Approximately \$100,000 in property damage.
October 1-2, 2010	Heavy Rain / Wind	N/A	N/A	Remnants of Tropical Storm Nicole moved up the coast of the U.S. which resulted in heavy rain, strong winds, and flooding in portions of New York City, Nassau, Rockland, and Westchester Counties.
				In Westchester County, in the Town of Somers, the stream off of Route 118 overflowed its banks washing away the front yard of a house and inundating the garage of another home. In other areas of the County, flooding caused portions of major roads to close. Rainfall totals ranged from 3.58 inches in White Plains to 6.25 inches in Yorktown Heights. Peak wind gusts ranged from 41 mph in White Plains to 53 mph in Bronxville. The County had approximately \$30,000 in damages.
February 19, 2011	High Wind	N/A	N/A	Max wind gusts in Westchester County ranged from 51 mph in Hastings-on-Hudson to 60 mph in White Plains. Sustained winds ranged from 46 mph in Croton Falls to 48 mph in White Plains. The strong winds resulted in downed trees and tree limbs across portions of the County. Overall, the County had approximately \$100,000 in damages.
March 6 – 7, 2011	Heavy Rain and Flooding	N/A	N/A	Rainfall totals in Westchester County ranged between 2.15 inches and 4.64 inches. Power outages were reported in several areas of Westchester County. Numerous road closures were reported.
July 29, 2011	Microburst	N/A	N/A	Damage from a downburst began on the Croton River along Route 9 and spread south- southeast towards central Ossining. The damage consisted of snapped trees primarily. A large three to four foot diameter tree fell on Route 9 near Eagle Bay Drive in Ossining. It took down power lines and snapped telephone poles. The estimated maximum wind speed was 80 mph. The microburst had a path wide of 0.4 miles and length of 1.4 mile. The County had approximately \$241,000 in damages from this event.
August 28, 2011	Hurricane Irene	DR-4020; EM-3328	Yes	As Hurricane Irene moved north along the Atlantic coast, it weakened and made its second landfall as a Tropical Storm near Little Egg Inlet along the southeast New Jersey coast. The storm made its third landfall in New York City on August 28 <sup>th</sup> . This storm brought sustained winds, heavy rain, destructive storm surge and two confirmed tornadoes. Heavy rainfall resulted in widespread moderate flooding across the area. Seven deaths resulted from Irene.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				At least 600,000 people were ordered to evacuate their homes from storm surge and inland flooding. Widespread power outages of up to one week followed the storm. The strong winds from Irene pushed a three to five foot storm surge of water along western Long Island South, New York Harbor, the southern and eastern bays of Long Island, and southern bays of New York City. This resulted in moderate to major coastal flooding, wave damage and erosion along the coast, with heavy damage to public beaches and other public and private facilities.
				In Westchester County, a raft carrying five men capsized on the Croton River just south of Silver Lake Park. The men were rescued from the raging river, but not before three of the rescue workers were tossed from their rescue boat and were swept under a trestle bridge just south of the Croton-Harmon station. Babbitt Court in Elmsford was under several ft. of water from the Saw Mill River rising out of its banks, requiring one family to be rescued from their home by the local fire department. The overflowing river also caused portions of Rt. 119 and several side streets throughout Elmsford to be closed, causing untold damage to homes and businesses. The NOS tidal gauge at Kings Point recorded a maximum water level of 12.36 feet MLLW on August 28 <sup>th</sup> . A peak wind gust of 56 mph was recorded at the County Airport.
September 6-10, 2011	Remnants of Tropical Storm Lee	DR-4031	No	Ten days after Hurricane Irene struck, the remnants of Tropical Storm Lee produced record setting rainfall over the same area and lead to historical flooding in some areas of New York State. In Westchester County, on September 8 <sup>th</sup> , in the City of Mount Vernon, the entire Bronx River Parkway was closed due to flooding. In the Village of Briarcliff Manor, the entire Saw Mill River Parkway was closed due to flooding. In the Town of Mamaroneck, I-95 exit ramps at Mamaroneck were closed due to flooding. In the Village of Pelham, the Hutchinson River Parkway in both directions between the New York City line and the Cross County Parkway was closed due to flooding. In the City of Mount Vernon, all on- and off- ramps were closed due to flooding on the Cross County Parkway in both directions at Bronx River Parkway. Overall rainfall totals from this event ranged from 5.14 inches in Thornwood (Town of Mount Pleasant) to 6.8 inches in the City of White Plains.
October 29, 2012	Hurricane Sandy	DR-4085 / EM-3351	Yes	<ul> <li>Hurricane Sandy was the 19th named tropical cyclone of the 2012 Atlantic hurricane season. The track of Hurricane Sandy resulted in a worse-case scenario for storm surge for coastal regions from New Jersey north to Connecticut, including New York City and Long Island. It was the costliest natural disaster in southeast New York State. It caused record breaking tides and wave action, as well as sustained winds of 40 to 60 mph and wind gusts of 80 to 90 mph. These extreme conditions resulted in at least 60 deaths and widespread property damage of at least \$42 billion. Emergency managers recommended mandatory evacuations of more than 500,000 people that lived in low-lying areas. Widespread significant power outages of more than two million people lasted up to two weeks.</li> <li>In Westchester County, Sandy did not result in significant rainfall; however, it still caused extreme coastal flooding from storm surge and high winds. Low lying areas along the Hudson River experienced moderate coastal flooding as storm surge moved north along the</li> </ul>





Dates of Event	Event Type	FEMA Declaration	County Designated?	Losses / Impacts
		Number		
				River as Sandy made landfall in southern New Jersey. This coincided with widespread record coastal flooding occurring in Lower New York Harbor exceeding the FEMA 100 year BFE. Up to two to feet of inundation occurred in the low lying areas. Coastal communities in Westchester County along the southern portions of the County experienced two successive tidal cycles with at least moderate coastal flooding on the 28th. Maximum wind gusts ranged between 80 and 90mph. A wind gust of 64 mph was recorded at the Tappan Zee Bridge. A wind gust of 72 mph was measured at the White Plains Airport. The County had at least three fatalities related to Sandy and over \$527 million in damages and recovery needs. Overall, the County experienced power outages, school and business closings, flooding, fuel shortages, downed utility poles and trees. Over 156,000 customers lost power in New York City and Westchester County. FEMA Public Assistance topped \$38 million to fund emergency efforts, remove debris, and rebuild infrastructure.
November 27, 2013	Heavy Rain and Flash Flood	N/A	N/A	Several inches of rain fell in the tri-state area, which resulted in isolated flash flooding in Westchester County. In the Village of Elmsford, the intersection of Tarrytown Road and Knollwood Road was closed due to flooding. Total reported rainfall totals ranged from 2.75 inches in Mamaroneck to 3.7 inches at the County Airport.
April 30, 2014	Heavy Rain and Flooding	N/A	N/A	Periods of heavy rain impacted portions of New York City, Nassau, Rockland and Westchester Counties, which resulted in flooding in these areas. In Westchester County, a mudslide occurred near the Glenwood Metro North station in the City of Yonkers due to the heavy rain. Storm totals ranged from 2.85 inches in the City of Peekskill to 5.28 inches in Village of Bronxville. In the City of White Plains, the Bronx River Parkway was closed in both directions from Walworth Crossing to Chatterton Avenue due to flooding. The Hutchinson River Parkway (northbound) was also closed in White Plains due to flooding between Lincoln Avenue and Ridge Street.
May 1, 2014	Heavy Rain and Flooding	N/A	N/A	Heavy rain fell across the area resulting in flooding across Westchester and Rockland Counties, as well as the Bronx in New York City. In Westchester County, the northbound Hutchinson River Parkway was closed between exits 7 and 12. The Saw Mill River Parkway was closed southbound from exit 16 to Farragut Parkway and northbound between exits 20 and 21 in the Village of Elmsford due to flooding. In the Village of Bronxville, the southbound Bronx River Parkway was closed between Route 100/119 and the Sprain Brook Parkway due to flooding.
July 14-15, 2014	Heavy Rain and Flash Flooding	N/A	N/A	<ul> <li>On July 14<sup>th</sup>, Westchester County had rainfall totals exceeding 1.6 inches. In the Town of Mount Pleasant, several cars were stranded in flood waters up to the car doors near Bradhurst Avenue. Sprain Brook Parkway was closed in due to flooding; multiple cars were under water. In Chappaqua, North Greeley Avenue was closed due to flooding. In Thornwood, water rescues were performed along the Taconic Parkway near Stevens Avenue.</li> <li>On July 15<sup>th</sup>, between 1.46 and 1.8 inches of rain fell in the County. In White Plains, Bloomingdale Road and the Bronx River Parkway southbound were closed due to flooding. In Mount Vernon, the Hutchinson River Parkway was closed between exits 10 and 12.</li> </ul>

Sources: FEMA, 2014; NOAA-NCDC, 2014; NWS, 2014; SHELDUS, 2014





Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
FEMA	Federal Emergency Management Agency
IA	Individual Assistance
Κ	Thousand (\$)
Μ	Million (\$)
Mph	Miles Per Hour
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NYS	New York State
NWS	National Weather Service
PA	Public Assistance
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.
TSTM	Thunderstorms





# H.1.5 Severe Winter Storm

Known severe winter storm events that occurred in Westchester County between 1990 and 2014 are identified in Table H.5. With severe winter storm documentation for New York State and Westchester County being so extensive, not all sources have been identified or researched. Therefore, Table H.5 may not include all events that have occurred in the County.



# Table H.5. Winter Storm Events Between 1990 and 2014.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
December 11-14, 1992	Coastal Storm, High Tides, Heavy Rain, Flooding	DR-974	Yes	New York State experienced approximately \$31.2 million in property damages, mostly due to flooding. Flooding in New York City and Boston was recorded between four and five feet. In Westchester County, between eight and 11 inches of rain, causing flooding. All public schools were closed. Several major roadways were closed due to flooding. Overall, Westchester County had approximately \$7.1 million in flood damages. Over 20,000 power failures occurred throughout the County.
January 3, 1993	Freezing Rain	N/A	N/A	A combination of a cold surface and warm, moist air caused freezing rain and drizzle. This resulted in over 1,000 traffic accidents around the area. Many roadways were covered with a thin sheet of ice, which caused the traffic accidents. Westchester County was affected by this event and had approximately \$5 million in property damages.
March 13-17, 1993	Blizzard	EM-3107	Yes	This blizzard resulted in total eligible damages of approximately \$8.5 million through New York State. County-specific damage information was not available. Total snowfall accumulations for Westchester County were between 10 and 20 inches.
January 12, 1994	Snow/Ice Storm	N/A	N/A	Snowfall totals ranged between four and eight inches. A dangerous coating of ice followed as the snow changed to sleet and freezing rain before ending. Traffic throughout the area was significantly affected.
January 17, 1994	Heavy Snow	N/A	N/A	Accumulations ranged between six and 12 inches however some isolated amounts of 17 inches were reported. This brought traffic to a standstill throughout the area. In addition, trees and power lines were snapped from the weight of the snow. This closed roads and knocked power off to thousands of residents.
February 8, 1994	Snow/Ice Storm	N/A	N/A	After depositing between six and nine inches, the snow began to mix then change to sleet and freezing rain. This added a dangerous coating of ice which caused major transportation problems.
February 11, 1994	Snow/Ice Storm	N/A	N/A	Between six and 14 inches of snow accumulated before it mixed or changed to sleet and/or freezing rain in some locations. The wintery mix caused major transportation problems throughout the region.
February 23, 1994	Snow/Ice Storm	N/A	N/A	The region saw between three and five inches before a dangerous coating of ice was added as the snow changed to sleet and/or freezing rain. Major transportation problems developed.
March 3, 1994	Snow/Ice Storm	N/A	N/A	Strong northeasterly winds of between 35 and 40 mph prevailed for several hours along coastal sections. Several locations reported gust of around 60 mph. Downed trees and branches left thousands without power. In addition, snow and ice accumulated between five and eight inches. This caused significant transportation problems for trains, planes, and motorists.





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
February 27-28, 1995	Ice Storm	N/A	N/A	Numerous traffic accidents were reported as roadways became extremely hazardous due to ice. The ice also coasted trees and caused numerous branches to break off.
January 6-9, 1996	Blizzard	DR-1083	Yes	19 deaths were attributed to the storm; one in Westchester County (Yorktown). The major effects from this storm in New York State were felt across the southeastern sections of the State, resulting in property damages ranging from \$21.3 to \$70 million. Property damage information for Westchester County was not available.
March 7-8, 1996	Winter Storm	N/A	N/A	Ice accumulated on trees, power lines, and roadways. Total accumulations of sleet and snow caused tree branches to snap off, power lines to fall, and a significant increase in traffic accidents.
March 31, 1997	Winter Storm	N/A	N/A	Strong gusty winds (to at least 40 mph) combined with heavy wet snow caused numerous trees and power lines to fall. Many roads were closed due to fallen trees and power lines. Northern Westchester County, snowfall ranged from nine inches at Croton On Hudson to 16 inches at Yorktown Heights.
January 15, 1999	Winter Storm	N/A	N/A	Significant icing caused widespread disruptions to mass transit and traffic. Rte.22 in Bedford was forced to close due to significant icing. Icing downed scattered tree limbs across the region. Heavy rain showers along with wind gusts from 30 to 40 mph occurred along the Long Island Sound shore of Westchester County. This downed additional scattered ice-laden tree limbs that caused some power outages.
March 14-15, 1999	Heavy Snow	N/A	N/A	Heavy wet snow downed many tree limbs and power lines across the region. In Westchester County, snowfall amounts ranged from 6 inches at White Plains to 10 inches at Yorktown Heights.
January 25, 2000	Winter Storm	N/A	N/A	White-out conditions caused massive traffic interruptions. Light freezing rain fell along the coast with a mixture of freezing rain and sleet inland. Snowfall from 5.5 inches at Yorktown Heights to eight inches at White Plains.
February 18-19, 2000	Winter Storm	N/A	N/A	Snowfall amounts ranged from one to six inches across the Lower Hudson Valley. This first round of heavy precipitation was followed by up to a 1/8th-inch thick ice coating, which caused serious and widespread traffic disruptions. Snowfall amounts ranged from two inches at Yonkers to six inches at White Plains. Significant icing of roads occurred, which forced the closure of many metro roads overnight. Numerous traffic accidents occurred on ice-covered roads. One fatality was reported.
December 14, 2000	Ice Storm	N/A	N/A	A mixture of freezing rain and sleet created treacherous travel for the morning commute. In addition, power outages resulted as tree limbs fell due to significant ice accretion. Ice accumulated at least one quarter inch throughout the area, with some locations receiving up to one half inch of ice.
December 30, 2000	Heavy Snow	N/A	N/A	Snowfall totals ranged from 13 inches at Mount Kisco to 16.5 inches at Mamaroneck.





Dates of Event	Event Type	FEMA Declaration	County Designated?	Losses / Impacts
January 20-21, 2001	Winter Storm	N/A	N/A	<ul> <li>Heavy snow occurred across Orange, Putnam, Rockland, and northern</li> <li>Westchester counties. Sleet and freezing rain produced ice accumulations of up to 0.20 inches. Ice accumulations ranged from 0.25 to 0.50 inches. This accretion of ice on tree limbs caused some tree branches to fall, and led to power outages. Snowfall ranged from 5 inches at Yorktown Heights to 7.3 inches measured at White Plains.</li> </ul>
March 5-6, 2001	Winter Storm	N/A	N/A	The combination of very heavy wet snow and strong winds with this prolonged coastal storm produced scattered power outages across southeast New York. In addition, many schools and businesses were closed for several days due to the hazardous nature of this storm. Snowfall ranged from 5.5 inches at New Rochelle, to 9.5 inches at Yonkers.
December 25-26, 2002	Nor'Easter	N/A	N/A	Snowfall totals in Westchester County ranged from eight inches in Yorktown Heights to 11 inches in Tarrytown.
February 17-18, 2003	Heavy Snow (Presidents Day Snow)	EM-3184	Yes	Periods of light snow developed as northeast winds increased to around 15 mph across the New York City metropolitan area. Snow became widespread and heavy, falling at rates up to two to three inches per hour. Heavy snow blown by northeast winds 20 to 30 mph causing near blizzard conditions throughout the area. Record snowfall totals crippled mass transit. These conditions lead to many local emergency declarations throughout the region. In Westchester County, snowfall totals ranged from 14.5 inches in Croton-on-Hudson to 26 inches in Thornwood.
January 28, 2004	Heavy Snow	EM-3195	No	A light mixture of snow, sleet, and freezing rain spread north across the area. A light coating of ice on area roads made traveling extremely hazardous toward evening. Many traffic accidents occurred across the NYC Metropolitan Area during this time. Snowfall in the county ranged from 8.0 inches at Ossining and Yorktown Heights to 10.0 inches at Thornwood and Hasting-On-Hudson.
February 11-12, 2006	Blizzard	N/A	N/A	The storm rapidly intensified as it moved northeast just off the New England coast. Snow spread north across the area, falling steadily and heavily at times in many areas. During the event, many areas had snowfall rates of up to three and four inches an hour. Reports of thunderstorm were received. The highest totals fell across New York City and Westchester and Putnam Counties. Winds ranged from 10 to 20 mph with gusts of up to 30 mph. This created blizzard conditions with very hazardous driving conditions. In Westchester County, snowfall totals ranged from 16 inches in Croton-on-Hudson to 24.5 inches in New Rochelle.
February 13-14, 2007	Ice Storm	N/A	N/A	A significant accretion of ice, especially across the northern half of the county, where nearly half an inch of ice accumulated on tree limbs, power lines, and roadways. In addition, this was further compounded by one to two inches of accumulated sleet. This resulted in major mass transit problems.







Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
April 15-16, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	A Nor'Easter struck the area between the 15 <sup>th</sup> and 16 <sup>th</sup> , bringing heavy rains and high winds that caused widespread and significant river, stream and urban flooding. High winds downed many trees and power lines. The combination of high winds, heavy rain, and high water table produced widespread moderate tidal flooding across parts of New York City and Long Island Sound shores. Rainfall totals from this event ranged from 1.47 inches to 8.41 inches. Wind speed gusts ranged from 35 to 55 mph. New York State experienced millions in eligible damages. FEMA gave out more than \$61 million in assistance to affected counties within the State. In Westchester County, rainfall totals ranged from 5.85 inches in Yorktown Heights to 8.22 inches in East White Plains. State Police reported flooding closures of Exit 7 of I-287, Exits 18A, 18B, and 22 of I-95, and I-95 southbound between exits 19 and 17. Roads were also closed along the Hutchinson River Parkway due to flooding at Linden Avenue in the Town of Harrison. The Bronx River Parkway was also closed in the City of White Plains. Private property losses in Westchester County were estimated at \$83 million and public property
				losses were estimated at \$2 million. Disaster assistance to the County totaled \$30 million
February 10, 2010	Snowstorm	N/A	N/A	Periods of heavy snow and strong winds impacted the New York City and Long Island area. The high winds caused blowing and drifting snow. Snowfall totals in Westchester County ranged from 8.5 inches in Armonk to 14 inches in Bronxville. A peak wind gust of 38 mph was recorded in White Plains.
February 25-26, 2010	Heavy Snow	N/A	N/A	A combination of heavy snow, heavy rain, coastal flooding and strong winds impacted the region. Up to three feet of snow fell across interior portions of the Lower Hudson Valley, one to two feet across the New York City metropolitan area, and six to 12 inches of snow across eastern Long Island. In Westchester County, snowfall totals ranged from 10 inches in Harrison to 25.4 inches in Ossining.
January 26-27, 2011	Heavy Snow	N/A	N/A	A very heavy snow band developed over the New York City metropolitan area, southern and eastern portions of the Lower Hudson Valley and northern and western Long Island. This band was responsible for snowfall rates of three to four inches per hour over a four to six hour period. In Westchester County, snowfall totals ranged from seven inches in Peekskill to 20 inches in Irvington. A peak wind gust of 43 mph was recorded at White Plains.
October 29-30, 2011	Heavy Snow	N/A	N/A	A historic and unprecedented winter storm impacted the area on October 29 <sup>th</sup> bringing over a foot of heavy, wet snow to portions of northeast New Jersey, the Lower Hudson Valley, and southern Connecticut. Thousands of people lost power during this event as heavy snow accumulated on trees causing the trees and limbs to fall, damaging power lines. Storm totals in Westchester County ranged from 6.5 inches in Hastings-on-Hudson to 12.5 inches in Armonk. A peak wind





Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
			-	gust of 33 mph was recorded at White Plains. In addition to the snow, 1.1 inches of rain fell in the County.
December 26-27, 2011	Blizzard	N/A	N/A	This blizzard brought between 20 and 30 inches of snow to the New York City metropolitan area, northeast New Jersey and the Lower Hudson Valley. Winds from this storm ranged between 25 and 40 mph, with gusts exceeding 60 mph. 18 inches of snow fell in the Village of Hastings-on-Hudson, along with 63 mph wind gusts. This storm was declared a major disaster (DR ) by FEMA: however, Westchester County was not included in this declaration.
February 8, 2013	Winter Storm	DR-4111	No	Spotters reported snowfall ranging from 17.2 inches in Mount Vernon, to 23.3 inches in Port Chester.
March 7, 2013	Heavy Snow	N/A	N/A	Spotters reported snowfall ranging from 7.5 inches in Ardsley and Eastchester to 10 inches in Port Chester and White Plains.
March 18, 2013	Winter Weather	N/A	N/A	Spotters reported between 4.0 and 6.5 inches of snow.
December 14, 2013	Winter Storm	N/A	N/A	Spotters reported widespread snowfall totals of 6 to 7.5 inches, followed by 1/10 to 1/4 inch ice accretion.
January 3-4, 2014	Snow	N/A	N/A	Snowfall totals in Westchester County ranged from 5.4 inches in New Rochelle to over 10 inches in Rye. Maximum wind gusts of 40 mph were recorded at the White Plains Airport.
February 13-14, 2014	Snow (Nor'Easter)	N/A	N/A	Snowfall totals ranged from 12 inches in White Plains to 16.5 inches in Hastings- on-Hudson in Westchester County. In Peekskill, 0.22 inches of ice fell.

Sources: NCDC, 2014; FEMA, 2014; Kocin & Uccellini, 2004; McFadden, 2006; Kennedy, 1996

Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

- DR Disaster Declaration
- EM Emergency Declaration
- FEMA Federal Emergency Management Agency
- HMP Hazard Mitigation Plan
- N/A Not Applicable
- NCDC National Climatic Data Center
- NOAA National Oceanic and Atmospheric Administration
- NWSNational Weather ServicePAPublic Assistance
- TŁ



# H.1.6 Wildfire

Known wildfire events that have impacted Westchester County from 1990 to 2014 are identified in Table H.6. Fire departments throughout the County respond to small brush fires each year. However, many of these fires are so small that little information is available. Therefore, Table H.6 may not include a complete record of all wildfire events that have occurred within the county.



## Table H.6. Wildfire Events in Westchester County, 1990 to 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
1987	Wildfire	N/A	N/A	A large fire burned in Mountain Lakes Park,
				destroying several County-owned storage
				buildings
2000	Wildfire	N/A	N/A	Approximately 20 acres burned in the Saxon
				Woods Park along the Mamaroneck/White
				Plains border
Summer of 2002	Wildfire	N/A	N/A	A 30-acre fire burned in the Pound Ridge Park
February 9, 2012	Brush Fire	N/A	N/A	A small brush fire burned behind Crescent Drive
				in Mohegan Lake
February 23, 2012	Brush Fire	N/A	N/A	3 to 5 acres burned in Anthony's Nose in
				Cortlandt
November 10, 2013	Brush Fire	N/A	N/A	A large brush fire burned in the rear of the
				Greenburgh Multiplex in Elmsford

Sources: FEMA, NYS DHSES, Elmsford Fire Department 2014, Mohegan Volunteer Fire Association 2014, O'Rourke and Corcoran 2012

Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or following the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

FEMA Federal Emergency Management Agency

K Thousand (\$)

M Million (\$)

N/A Not applicable





# **H.1.7 CBRN**

This section provides a brief overview of the CBRN incidents that Westchester County has experienced, followed by a table summarizing specific incidents.

# Chemical

Most chemical incidents in the County are petroleum products released from vehicles involved in transportation accidents. These incidents are generally minor, and fluids are cleaned up by the responding fire department or clean-up contractor. Other incidents may result in the release of a chemical agent from a business or infrastructure.

# Biological

There are no records of biological incidents occurring in Westchester County, but the County's population is constantly infected with and affected by a wide range of biological agents such as influenza, the cold virus, chicken pox, and other diseases that are normally found in communities in the United States. Two of the most notable events in recent years is the Ebola outbreak of 2014, in which one individual was treated in nearby New York City. In 2009, individuals were diagnosed and treated for the Novel Influenza A (H1N1) during the pandemic.

## Radiological

From February of 2000 to 2014, there were two reportable events at the Indian Point Energy Center that had the potential to impact offsite facilities and personnel. Neither event had an actual impact on offsite facilities or personnel. Both events required limited Westchester County Emergency Operations Center (EOC) activation for the purposes of monitoring and support. No County support was required by onsite authorities for either event.

## Nuclear

There is no history of nuclear incidents in Westchester County.

# H.1.8 Disease Outbreak

From 2010-2014, there were 15 reported human cases of WNV in Westchester County. Between 2007 and 2011, there were 792 confirmed cases of Lyme disease in Westchester County.

# H.1.9 Cyber Attack

This section provides a profile and vulnerability assessment for the cyber attack hazard.

## Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

## Description

A cyber attack is a malicious, intentional attempt to breach the information technology (IT) infrastructure of an individual or organization. Westchester County defines a cyber attack incident as an adverse event impacting one or more of the county's information assets. Examples include, but are not limited to, the following:

• Unauthorized use

Denial of Service





- Malicious code
- Network system failures
- Application system failures
- Unauthorized disclosure or loss of information

Incidents can be the result of any of the following:

- Intentional and unintentional acts
- Actions of employees
- Actions of vendors or constituents
- Actions of third parties
- External or internal acts
- Credit card fraud
- Potential policy violations
- Natural disasters and power failures
- Acts related to violence, warfare or terrorism
- Serious wrongdoing
- Other

- Information security breach
- Structured Query Language (SQL) Injection
- Other





The motives behind cyber attacks can vary widely, but according to Verizon (Verizon 2014), with input from over 50 organizations around the world, the top three motives in 2013 were

- 1. Financial
- 2. Espionage
- 3. Ideology/fun

According to Verizon (Verizon 2014), 92% of over 100,000 cyber attacks over the last 10 years can be classified into nine different patterns, which are as shown for 2011-2013 in Figure 5.4.8-1. Figure 5.4.8-2 shows the percentage of all cyber attacks by pattern for several industries over that same time period.

Figure 5.4.8-2 shows that 34 percent of breaches in the public sector are Miscellaneous Errors – mistakes such as sending a sensitive document to the wrong person. Insider Misuse, Crimeware, and Theft/Loss are also significant sources of data breach; these three categories would constitute a cyber attack.

Westchester County's IT infrastructure includes the following components, which are potentially vulnerable to cyber attacks (2014 estimate).

- Nearly 5,900 network devices, including nearly 4,900 personal computers
- Over 600 servers
- Nearly 800 terabytes of data storage
- Over 6,000 phone instruments

# Figure 5.4.8-1. Cyber Attack Patterns



Source: Verizon 2014



INDUSTRY	POS INTRUS- ION	WEB APP ATTACK	INSIDER MISUSE	THEFT/ LOSS	MISC. ERROR	CRIME- WARE	PAYMENT CARD SKIMMER	DENIAL OF SERVICE	CYBER ESPION- AGE	EVERY- THING ELSE
Accommodation [72]	75%	1%	8%	1%	1%	1%	<1%	10%		4%
Administrative [56]		8%	27%	12%		1%		1%	1%	7%
Construction [23]	7%		13%	13%	7%				13%	13%
Education [61]	<1%		8%	15%		6%	<1%	6%	2%	22%
Entertainment [71]	7%	22%	10%	7%	12%	2%	2%	32%		5%
Finance [52]	<1%	27%	7%	3%	5%	4%	22%		<1%	6%
Healthcare [62]	9%	3%	15%		12%	3%	<1%	2%	<1%	10%
Information [51]	<1%	41%	1%	1%	1%		<1%	9%	1%	16%
Management [55]		11%	6%	6%	6%		11%	44%	11%	6%
Manufacturing [31,32,33]		14%	8%	4%	2%	9%				9%
Mining [21]			25%	10%	5%	5%	5%	5%		5%
Professional [54]	<1%	9%	6%	4%	3%	3%		37%	29%	8%
Public [ <u>92]</u>		<1%	24%	19%	34%	21%		<1%	<1%	2%
Real Estate [53]		10%	37%	13%	20%	7%			3%	10%
Retail [ <u>44,45</u> ]	31%	10%	4%	2%	2%	2%	6%		<1%	10%
Trade [42]	6%		6%	6%	9%	9%	3%	3%		27%
Transportation [48,49]		15%	16%	7%	6%	15%	5%	3%	24%	8%
Utilities [22]			3%	1%	2%			14%	7%	3%
Other [ <u>81</u> ]	1%		13%	13%	10%	3%		9%	6%	17%

# Figure 5.4.8-2. Cyber Attack Patterns by Industry

Source: Verizon 2014

# Programs in Place to Reduce Impacts

## Information Technology Systems

Mitigation of risk from cyber attacks is primarily handled by the County's Department of Information Technology with support from the County's security partners. The County's IT infrastructure includes the following components to reduce the impacts of cyber attacks:

- Firewall clusters
- Intrusion Prevention Systems (IPS) that alert on and block suspicious traffic
- Log collection platform that collects and analyzes logs from servers to detect potential threats
- Centrally managed security services that alert to potential threats within the IT environment, as well as emerging threats and vulnerabilities worldwide
- Endpoint protection (anti-virus/malware) on servers and PCs
- Data center security for enhanced monitoring & protection of critical servers
- Web filtering to block users from going to suspicious or known rogue websites
- Network traffic analysis
- NYS monthly Qualys scan report on public facing devices Reporting on identified vulnerabilities
- Data Loss Prevention (DLP) for tracking Personally Identifiable Information (PII) or other sensitive data leaving the County's Network
- Daily and real-time reports from the County's security vendor on malware, viruses, phishing attacks, aggressive Secure Shell, and other intrusions based on the overall log collection apparatus.
- Ongoing security awareness program to educate and train county employees on cyber security best practices and policies





## Response

Once an incident has been identified by the County, it is triaged to begin making decisions about how to address it. The County will then analyze computing devices, logs, and other files to identify the cause of the incident and to analyze and preserve evidence. It will then focus on identifying, removing and repairing the vulnerability that led to the incident, and thoroughly cleaning the system. After the cause of an incident has been removed or eradicated, and data or related information is restored, the County will confirm that all threats and vulnerabilities have been successfully mitigated and that new threats or vulnerabilities have not been introduced. The County will then decide to resume business operations, and will perform an after-action analysis. The analysis may consist of one or more meetings and/or reports. The purpose of the analysis is to give participants an opportunity to share and document details about the incident and to facilitate lessons learned. The meetings are held within one week of closing the incident.

## Tabletop Exercise

In September 2014, Westchester County conducted a tabletop exercise to assess its cyber security capabilities. Participants included County departments, local municipalities, local utilities, and non-governmental organizations (NGO). The objectives of the exercises were as follows:

- 1. Examine government and partner organization capacity to manage the response to and short-term recovery from a non-traditional threat to the Westchester County area.
- 2. Examine government and partner organization continuity requirements and current preparedness posture.
- 3. Discuss multi-agency, multi-jurisdictional, and public-private sector communications and operational coordination structures and processes in the context of a no-notice incident with County-wide impacts and significant continuity implications.
- 4. Discuss key public messaging requirements and processes regarding an incident with widespread regional impacts, including electricity, communications and other lifeline infrastructure outages.
- 5. Identify gaps and challenges regarding the public-private sector response to and short-term recovery from an incident involving significant essential services disruptions/outages.

The exercise revealed strengths and areas for improvement regarding interagency coordination, communications, continuity planning, and cyber security planning.

## Extent

When a cyber security incident occurs, Westchester County uses the following factors to evaluate its severity:

- Nature of the attack
- Criticality of systems that are (or could be) made unavailable
- Value of the information compromised (if any)
- Number of people, agencies, or functions impacted
- Business considerations
- Public relations
- Effects on the County's entire IT enterprise

Cyber attacks may range from the infection of a single machine by a common computer virus to a large-scale, organized incident that cripples an organization or infrastructure.





#### Location

The cyber attack hazard is not geography-based. Attacks can originate from any computer to affect any other computer in the world. If a system is connected to the Internet or operating on a wireless frequency, it is susceptible to exploitation. Targets of cyber attacks can be individual computers, networks, organizations, business sectors, or governments. Financial institutions and retailers are often targeted to extract personal and financial data that can be used to steal money from individuals and banks.

#### Previous Occurrences and Losses

The County's security vendor produces a daily report that summarizes potential threats and intrusion attempts. Actions are taken by the Department of Information Technology to mitigate security risks presented in this report, by, for example, blocking IP address ranges, identifying vulnerable servers, performing scans as necessary, opening Help Desk tickets to scan/check machines, etc.

Losses can include loss of productivity, financial theft, and the exposure of secure information. No specific losses from cyber attacks that affected the County are available.

#### Probability of Future Events

As is the case for any large government organization, Westchester County will continue to be impacted and compelled to respond to cyber attacks in the future. The nature of these attacks is projected to evolve in sophistication over time. The County has taken a proactive position in its cyber security efforts and is expected to remain vigilant in its efforts to prevent attacks from occurring and/or disrupting business operations. The reality remains that many computers and networks in organizations of all sizes and industries around the U.S. will continue to suffer intrusion attempts on a daily basis from viruses and malware that are passed through web sites and emails.





# Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the cyber attack hazard, all of Westchester County is exposed to this hazard. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are exposed and potentially vulnerable to a cyber attack. The following text evaluates and estimates the potential impact of the drought hazard on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, health and safety of residents, (2) general building stock, (3) critical facilities, (4) economy, and (5) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time

# Overview of Vulnerability

The entire County is vulnerable to a cyber attack. Because it is difficult to predict the particular target of cyber terrorism, assessing vulnerability to the hazard is also difficult. All populations who directly use a computer or those receiving services from automated systems are vulnerable to cyber terrorism. Although all individuals in Westchester County are vulnerable to an attack, certain types of attacks would impact specific segments of the population.

If the cyber attack targeted the State's power or utility grid, individuals with medical needs would be impacted the greatest. These populations are most vulnerable because many of the life-saving systems they rely on require power. Also, if an attack occurred during months of extreme hot or cold weather, the County's elderly population (those 65 years of age and older) would be vulnerable to the effects of the lack of climate control. These individuals would require shelter or admission to a hospital. Other populations vulnerable to the secondary effects of cyber terrorism are young children.

If a cyber attack targeted a facility storing or manufacturing hazardous materials, individuals living adjacent to these facilities would be vulnerable to the secondary effects, should the attack successfully cause a critical failure at that facility.

# Data and Methodology

For this hazard, data was obtained from Westchester County and the 2015 HMP Planning Committee.

# Impact on Life, Health and Safety

Any individual in the County could be a victim of a cyber attack. If the attack targets infrastructure (such as the power grid) or individual life support systems in a healthcare facility, the effects of a cyber attack on life, health, and safety could be dire. Likewise, if a cyber attack affects the emergency response system, such as by rendering the 911 Center or the radio network inoperable, emergency services in the County could be hindered, which may result in increased injury or loss of life during emergency situations.

# Impact on General Building Stock and Critical Facilities

Cyber attacks may affect structures if any critical electronic systems suffer service disruption. For instance, a cyber attack may cripple the electronic system that controls a cooling system or pressure system within critical infrastructure. This may result in physical damage to the structure from components overheating, or an explosion if pressure relief systems are rendered inoperable.





# Impact on Economy

Economic impacts of cyber attacks could be severe, depending on the nature of the attack itself. Even simple malware that slows the performance of individual computers could result in lost business productivity. Any prolonged period of down time could significantly affect a business's financial performance. Retailers and financial institutions may be targeted to steal personal information so that the attacks' perpetrators can steal money from their victims, such as by opening credit cards with the stolen information.

# Future Growth and Development

As discussed in Sections 4 and 9 of the 2015 HMP, areas targeted for future growth and development have been identified across Westchester County. Any areas of growth could be potentially impacted by the cyber attack hazard because the entire County is exposed and vulnerable. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.





# **APPENDIX J. PLANNING GUIDANCE**

This appendix includes the 2017 NYS DHSES planning standards and guidelines for hazard mitigation planning, as well as FEMA guidance for classifying Lifelines within a community.





# New York State Hazard Mitigation Planning Standards

Congratulations on taking the first steps to create or update a multi-hazard mitigation plan for your community! Based on New York State's disaster history, the New York State Division of Homeland Security and Emergency Services (NYS DHSES) has developed the following mitigation planning standards. While we recommend incorporation of these standards into <u>all</u> mitigation plans, these are required actions for any mitigation plan developed with funds administered by NYS DHSES.

The goal of both NYS DHSES and FEMA is that all jurisdictions develop robust mitigation plans and tangible mitigation actions that will contribute to long-term risk reduction. These requirements are intended to improve the quality of hazard mitigation plans and encourage the development of the most appropriate and effective mitigation projects for your community. It is recognized that many jurisdictions have inherent constraints and certain information may be difficult to provide. NYS DHSES and FEMA will work with you throughout the entire planning process to ensure the successful development of your community's hazard mitigation plan.

There are a multitude of resources that exist to provide guidance and support throughout the planning process, developed by Federal and State agencies, as well as private and research based groups:

The **NYS Hazard Mitigation Planning Standards Guide** provides supplemental guidance and information to support efforts to meet the NYS Planning Standards. This will be made available online, and is included as an attachment.

The **2013 Local Mitigation Planning Handbook** is the official guide for local governments to develop, update and implement local mitigation plans: <u>https://www.fema.gov/media-library/assets/documents/31598?id=7209</u>

The **2011 Local Mitigation Plan Review Guide** provides an overview of the tool that FEMA and NYS DHSES will use to revise plans: <u>https://www.fema.gov/media-library/assets/documents/23194</u>

**Beyond the Basics: Best Practices in Local Mitigation Planning** is a website developed by the University of North Carolina which expands on FEMA's Handbook and features numerous examples and best practices from resources across the country: <a href="http://mitigationguide.org/">http://mitigationguide.org/</a>

We urge you to utilize the information available and to contact us so that we may direct you to additional resources and provide you with the most comprehensive technical assistance possible.

For questions and comments, please call our offices at 518-292-2304.





Additional contact information will be provided to sub-recipients for more direct assistance

# Please note:

*Jurisdiction* is used to describe all government entities within the boundaries set forth in the Multi-Jurisdictional Plan (typically County-wide), including the County itself, as well as cities, towns, villages and tribal entities.

**Special Flood Hazard Area (SFHA)** is defined as the area that will be inundated by the flood event having a 1-percent change of being equaled or exceeded in a given year (also known as the 100-year flood event).

# 1. Establish Jurisdictional Teams

Plans developed with the participation of the widest range of organizations and stakeholders personally familiar with past damages to local infrastructure are likely to contain valuable, relevant information that will lead to a comprehensive plan and feasible projects.

Jurisdictions must invite key stakeholders at the start of and throughout the planning process.

• The plan must document how stakeholders were invited to participate at each phase of the planning process, and provide a summary of feedback.

# 2. Assess Critical Facilities

Critical facilities must remain accessible and functional before, during and after disasters to meet the jurisdictions Continuity of Government (COG) and Continuity of Operations (COOP) standards, and to support important emergency, government and sheltering functions.

Jurisdictions must identify all critical facilities, assess vulnerabilities and ensure protection to a 500-year flood event. Critical facilities located in an SFHA, or having ever sustained previous flooding, must be protected to the 500-year flood event, or worst case scenario.

- The plan must document the name of facility, type of facility, jurisdictional location, and exposure to a 100- and 500-year event.
- The plan must document that critical facilities are protected to the 500-year flood event, or worst damage scenario. For those that do not meet this level of protection, the plan must include an action to meet this criteria, or explain why it is not feasible to do so. (See State Standard 7 for additional requirements related to project identification.)

# 3. Plan for Displaced Residents

Intermediate and long-term housing options must be available to relocate displaced residents to maintain post-disaster social and economic stability.

Jurisdictions containing an SFHA must identify potential sites that are compliant with the NYS Uniform Fire Prevention and Building Code (with first flood elevation placed no less than 2' above the Base Flood Elevation) for the placement of temporary housing units for residents displaced by disaster; and potential sites within the jurisdiction suitable for relocating houses out of the floodplain, or building new houses once properties in the floodplain are razed.

• The plan must document the location of viable sites, and include a letter from the local floodplain administrator certifying viability or listing any actions required to ensure conformance.





# 4. Plan for Evacuation and Sheltering Needs

*Evacuation and sheltering measures must be in place and available for public awareness to protect residents and mitigate risk, stress and personal hardships during hazard events.* 

Jurisdictions must identify routes and procedures to evacuate citizens prior to and during an event, and identify shelters for evacuated citizens. Provisions must be included for a range of medical needs, accommodation for pets, and compliance with the Americans with Disabilities Act (www.ada.gov).

- The plan must document (or refer back to such components in existing valid plan):
  - Evacuation routes and procedures;
  - Location of shelters (outside of the SFHA);
  - Specific information about how these plans are accessible and available to the public, or include the related narrative from those plans in an appendix.

# 5. Document Past Mitigation Accomplishments

Past mitigation actions provide a context for the jurisdictions' projects, and can help to evaluate accuracy of assumptions to support future mitigation planning.

Jurisdictions must identify mitigation projects completed since the approval of the previous mitigation plan (or within the last five years), regardless of whether the project was included in the previous plan or the project's funding source.

• The plan must document the original problem and estimated annual damages, the solution (project), the cost, the level of protection and its success since implementation.

## 6. Include Jurisdictional Annexes

Jurisdictional annexes provide a unique, stand-alone guide to mitigation planning for each jurisdiction.

The plan must be organized so that there is an annex for every jurisdiction within the county's borders, including the County.

- The plan must include a table in the Introduction section clearly identifying all jurisdictions and their level of participation.
- Each participating jurisdictional annex must include the following (at a minimum) and nonparticipating jurisdictions must include a cover sheet and should include as much information as is available:
  - Contact Information;
  - Jurisdiction Profile;
  - Hazard Identification (specific to the jurisdiction);
  - Hazard Event History;
  - National Flood Insurance Program (NFIP) Summary (to meet Federal Standards);
  - Critical Facilities Information (to meet State Standard 2);
  - Jurisdiction/public identified vulnerabilities;
  - Additional public involvement;
  - Capabilities Assessment;
  - Mitigation Strategy:
    - o All identified previous mitigation activities with current status;
    - Previous mitigation activities completed (to meet State Standard 5);
    - All proposed mitigation activities (both new and carried forward, to meet State Standard 7);
    - Action Worksheets for a minimum of two (2) proposed mitigation activities (to meet State Standard 7).



# 7. Develop Mitigation Actions

Projects that are well developed and documented in one place are more quickly identifiable for selection when grants become available, making implementation that much more likely.

Within each jurisdictional annex, jurisdictions must develop projects to include all information requested in the NYS DHSES Proposed Project Tables and provide a minimum of two (2) worksheets for the jurisdiction's highest priority projects.

- The plan must document all mitigation projects that have reasonable potential to be accomplished within the lifespan of the plan (five years) to include all information requested in the NYS DHSES Proposed Project Tables.
- The plan must include at least two (2) NYS DHSES Action Worksheet for the jurisdiction's highest priority projects. For jurisdictions containing an SFHA, one (1) of these Action Worksheets must be for a project that addresses flooding.

# 8. Identify Funding Sources

Identifying strategic funding sources is integral to successful coordination and implementation of mitigation actions.

• The plan must include a list of potential local, State and Federal funding sources.

# 9. Plan for Climate Change

Acknowledging and planning for climate change protects residents, avoids or reduces damage to property and public infrastructure, and reduces personal hardship.

The county and its municipalities must assess how climate change may affect vulnerability to the increased/decreased frequency of occurrence and/or severity of hazards due to climate change.

- The plan must document the assessment how climate change may affect the following hazards (at a minimum): flooding, wildfire, drought and extreme temperatures.
- The plan must document strategies and/or projects to address the above hazards as they specifically relate to climate change.
- For coastal jurisdictions, the plan must discuss sea level rise and its potential impacts.

# 10. Post Draft Plan Online

Allowing the public to comment on the draft plan increases awareness about how mitigation saves lives and reduces risk, and allows a final opportunity for public input.

The public must have an opportunity to view and comment on the draft plan prior to submittal.

• The draft plan must be posted in full (with the exception of discretionary sensitive information) on an existing county/jurisdiction website, or one created for the purpose of soliciting comments, for 30 days or the time prescribed by local law, whichever is greater. The website must clearly identify how the public can comment on the plan, to include either specific contact information to send comments or a user-friendly form or survey.

# • After NYS DHSES and FEMA Approval

- Once designated Approvable Pending Adoption (APA) by FEMA, the final plan must be placed on the same website (cited above) in its entirety (with the exception of discretionary sensitive information).
- Final payment will occur only after 50% of the participating jurisdictions have adopted the FEMA-approved plan and provided adoption resolutions to NYS DHSES. For county-led hazard mitigation planning efforts, the county must be one of the adopting jurisdictions.





The chart below shows the requirements as they appear on the plan review tool used by NYS DHSES and FEMA Region II to determine whether or not a submitted plan meets federal and state requirements.

1. REGULATION CHECKLIST	Location in Plan		Not
Regulation (44 CFR 201.6 Local Mitigation Plans)	(section and/or page number)	Met	Met
ELEMENT F. ADDITIONAL STATE REQUIREMENTS - NYS DH	ISES HAZARD MITIGATIO	N PLAN	NING
STANDARDS.			
These are required actions for plans developed with N	IYS DHSES-administered	funds.	
F1. Does the plan document how stakeholders were invited to			
participate at each phase of the planning process and provide a			
summary of feedback?			
F2. Do jurisdictions identify critical facilities, assess			
vulnerabilities and ensure protection to a 500-year flood event			
or worst case scenario?			
F3. Do jurisdictions containing an SFHA identify:			
<ul> <li>a. potential sites for the placement of temporary housing</li> </ul>			
units for residents displaced by disaster; and			
<ul> <li>potential sites within the jurisdiction suitable for</li> </ul>			
relocating houses out of the floodplain, or building new			
houses once properties in the floodplain are razed?			
F4. Do jurisdictions identify:			
a. routes and procedures to evacuate citizens prior to and			
during an event; and			
b. shelters for evacuated citizens, to include provisions for			
a range of medical needs, accommodation for pets,			
and compliance with the Americans with Disabilities			
Act ( <u>www.ada.gov</u> )?			
F5. Do jurisdictions identify mitigation projects completed since			
the approval of the previous mitigation plan (or within the last			
The peak the plan include on ennov for even divided the within			
the Countrie houndaries?			
E7 Within each jurisdictional annex are:			
a projects developed in accordance with the NVS			
a. projects developed in accordance with the NTS DHSES Proposed Projects Table: and			
b two (2) NYS DHSES Action Worksheets provided?			
F8 Does the plan include a list of potential funding sources?			
F9 Does the plan assess how climate change may affect			
vulnerability to bazards, propose actions to address this, and			
discuss sea level rise (if applicable)?			
F10. Was the draft plan posted for public comment?			
<b>Note</b> : The applicant is required to address the 2016 NVS DHSES	Hazard Mitigation Plannin	a Stand	ards
as required actions for a hazard mitigation plan developed	with funds administered by	NYS DF	ISES
ELEMENT F: REQUIRED REVISIONS			

Please see opportunities for improvement











## 1. Establish Jurisdictional Teams

Plans developed with the participation of the widest range of organizations and stakeholders personally familiar with past damages to local infrastructure are likely to contain valuable, relevant information that will lead to a comprehensive plan and feasible projects.

During initial stages of development, jurisdictions should identify organizations and key stakeholders in order to develop individual jurisdictional teams. Once jurisdictional teams are established, all members should be invited at every stage of the process.

Jurisdictions must invite key stakeholders when initiating the planning process and identifying mitigation strategies. At a minimum (if applicable), this should include:

- County Hazard Mitigation Coordinator
- County Floodplain Administrator (or person acting as such)
- County Emergency Managers
- County Planners
- County GIS staff
- County Soil & Water Conservation Districts
- · Elected and executive officials
- Regional & Metropolitan (Transportation) Planning Organizations
- Statewide/Local Watershed Commissions
- Educational Representation (Schools/Universities)
- Economic Development/Chamber of Commerce

- Local Hazard Mitigation Coordinators and Floodplain Managers
- Local Code Enforcement Officials
- First Responder Organizations
- Local Emergency Planning Committees (LEPC)
- Local Emergency Management
- Local Planners and planning consultants
- · Local Engineers and engineering consultants
- Local Public Works or Highway Superintendents
- Health Care
- Neighboring Counties
- · Utilities (gas, electric, water)

The plan must present information to show that such persons were included in the process. Examples:

- Copies of electronic or hard copy meeting invitations.
- A list of persons invited, their position, the jurisdiction represented and if they participated.
- Meeting sign-in sheets, minutes or other documentation showing specific activity in which the identified persons
  participated, and how their input was included in the plan.

Plans developed with the participation of a wide range of organizations and stakeholders are the most likely to contain viable, innovative or useful projects and project data, as they each bring unique perspectives to the table:

- Elected and executive officials have an understanding of overall jurisdiction needs and are able to
  communicate how the mitigation plan can support social, economic, or environmental conditions.
- Local planners can help the jurisdiction understand past, current, and future jurisdiction development trends, policies or activities that affect development, how development affects vulnerability to hazards, and how hazard mitigation can be incorporated into various planning mechanisms.
- Emergency Managers and first responders have information on past occurrences and existing
  preparedness measures, and have a direct line of communication with the NYS DHSES.
- Geographic Information System (GIS) specialists can analyze and map data to support the planning
  process and communicate complex information, such as the locations of assets at risk in hazard prone
  areas and estimates of damage for a particular disaster scenario. This might be done in consultation
  with County GIS staff.
- Floodplain administrators provide information on local flood hazard maps, floodplain ordinance, repetitive loss properties, and actions to continue compliance with the National Flood Insurance Program and reduce flood losses.
- Public works staff can help identify current or projected problems for the jurisdictions' infrastructure that
  can be addressed through capital improvements supported by the mitigation plan.

For more guidance on stakeholder identification, see: <u>Mitigation Guide - Worksheet 2.1</u>

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The following table provides an example of how the plan might document the identification and invitation of key stakeholders for each jurisdiction.

Insert Jurisdiction's Name Here

Individuals Notified of the Mitigation Plan Development and Invited to Participate

Local Jurisdiction Role/Position	Name of Person Invited	Email of Person Invited	Date of Invitation	Method of Invitation	Agreed to participate? yes/no	Feedback Provided? Yes/no
Land Use/ Jurisdiction Planner						
Emergency Manager						
Floodplain Manager/ Administrator						
Public Works Director/ City Engineer						
Building Code Official						
Fiscal/Budget Officer						
Elected Officials						
Local Hospital						
Major University						
Significant Business						
Neighboring County 1						
Neighboring County 2						
Tribal Nation						
Example	George Washington	gwashington@town.gov	12/12/14	Email and letter sent	Yes	Yes

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# 2. Assess Critical Facilities

Critical facilities must remain accessible and functional before, during and after disasters to meet the jurisdiction's Continuity of Government (COG) and Continuity of Operations (COOP) standards, and to support emergency, government and sheltering functions.

#### Identifying Critical Facilities: Federal Guidelines (FEMA)

FEMA defines a critical facility as one that provides services and functions essential to a community, especially during and after a disaster. More information can be found on the agency web site at <a href="https://www.fema.gov/critical-facility">https://www.fema.gov/critical-facility</a>. Examples of critical facilities include:

- Police stations
- Fire stations
- · Critical vehicle and equipment storage facilities
- Emergency Operations Centers
- · Utilities and power generating stations
- · Communication centers
- Medical facilities, including hospitals, nursing homes, blood banks, and health care facilities
- Schools and day care centers, especially if designated as a disaster shelter
- · Public and private utility facilities

- Drinking water and wastewater treatment plants
- Drug and alcohol treatment custodial care programs
- Homeless shelters
- Tier 2 facilities: Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, and/or waterreactive materials; facilities designed for bulk storage of chemicals, petrochemicals, hazardous or toxic substances, or floatable materials (as defined by NYS DEC)

Jurisdictions may also want to analyze risks to major employers and assess the economic impact of prolonged down-time due to disasters.

#### Identifying Critical Facilities: State Guidelines (NYS DEC and NYS DHSES)

New York Department of Environmental Conservation (DEC) Statute 6 CRR-NY 502.4 sets forth floodplain management criteria for State projects located in flood hazard areas. The law states that no such projects related to critical facilities shall be undertaken in a Special Flood Hazard Area (SFHA) unless constructed according to specific mitigation specifications, including being raised 2' above the Base Flood Elevation (BFE). This statute is outlined at <a href="http://tinyurl.com/6-CRR-NY-502-4">http://tinyurl.com/6-CRR-NY-502-4</a>.

#### Protecting Critical Facilities

In assessing vulnerabilities to critical facilities, jurisdictions must identify exposure to hazards and propose methods to mitigate risks. This can be accomplished through a table, or with GIS overlay maps specific to hazards of concern.

FEMA provides the following recommendations for protecting infrastructure and critical facilities from damage:

- · Incorporate hazard mitigation principles into all aspects of publicly-funded development;
- Incorporate mitigation retrofits for public facilities into the annual capital improvements program;
- · Engineer or retrofit roads and bridges to withstand hazards and ensure access;
- Relocate or underground electrical infrastructure;
- Design and build water tanks or wells for use in times of potable water interruption;
- Install quick-connect emergency generator hook-ups for critical facilities.

While all vulnerabilities should be assessed and documented, the State places a high priority on exposure to flooding. Critical facilities located in an SFHA, or having ever sustained previous flooding, must be protected to the 500-year flood even, or worst damage scenario. For those that do not meet this criteria, the jurisdiction must identify an action to achieve this level of protection.

For at-risk facilities that are not owned by or the responsibility of the jurisdiction, the jurisdiction should include an action to work with the responsible party to develop a mitigation strategy

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#### 3. Plan for Displaced Residents

Intermediate and long-term housing options must be available for relocating displaced residents and maintain post-disaster social and economic stability.

#### Intermediate Needs – Temporary Housing

The jurisdiction must identify sites for the placement of temporary housing units to house residents displaced by disaster. While sites can be coordinated county wide, it is critical that each jurisdiction identify a site. Residents may be accommodated by a temporary housing location that is outside of the jurisdiction in which they live as long as mutual aid agreements between municipalities are in place.

Examples of potential locations include existing mobile home parks; recreational vehicle/camping grounds; public or private land or parkland; or a site easily convertible for the placement of temporary housing units. Such sites must:

- Be compliant with the New York State Uniform Fire Prevention and Building Code <a href="http://www.dos.ny.gov/cnsl/lg03.htm">http://www.dos.ny.gov/cnsl/lg03.htm</a>;
- Be constructed with a first-floor elevation placed no less than 2' above the Base Flood Elevation (i.e., of the 100-year flood level);
- If located in a neighboring jurisdiction, include discussion about plans with residents and ensure
  procedures are consistent with local mitigation and emergency plans, recovery plans, evacuation routes,
  etc.;
- Consider water, wastewater, electrical and firefighting accessibility.

#### Long-term Needs – Permanent Housing

Structures located in the SFHA may need to be relocated, or new properties must be built once severely damaged properties are razed. Jurisdictions must identify all suitable sites currently owned by the jurisdiction, and potential sites under private ownership that meet applicable local zoning requirements and floodplain laws.

Consideration should be given to allowing residents of a given jurisdiction to continue to reside there. However, discussion of this matter may need to include site development elsewhere if such available locations are not available in a given jurisdiction.

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## 4. Plan for Evacuation Needs and Sheltering

Evacuation and sheltering measures must be in place and available for public awareness to protect residents and mitigate risk, stress and personal hardships during hazard events

A jurisdiction's existing Comprehensive Emergency Management Plan (CEMP) or other plans, policies and procedures may outline evacuation routes and procedures to remove citizens from a vulnerable location prior to and during an incident. If plans for evacuation and sheltering are already in place, the mitigation planning jurisdiction should analyze and update these materials as needed. The plan must refer to this information and include the URL of where it can be found on the county web site.

If such plans do not exist, they must be developed and:

- · Identify evacuation routes and how this information is accessible to the public;
- Identify shelters for evacuated citizens and how this information is accessible to the public leading up to and during an incident;
- Explain provisions available to address medical needs, access and functional needs, accommodation for
  pets, and compliance with the Americans with Disabilities Act (see www.ada.gov);
- Outline pre-disaster actions required to make evacuation and shelter plans viable;
- Document evidence of coordination with adjoining jurisdictions (if applicable).

The plan should address jurisdictions with residential neighborhoods and critical facilities that have been flooded, inundated, or isolated by water.

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#### 5. Document Past Mitigation Accomplishments

Past mitigation actions provide a context for the jurisdiction's projects, and can help to evaluate accuracy of assumptions to support future mitigation planning.

FEMA Element D2 (see FEMA Local Mitigation Plan Review Guide, page 27) requires a progress update on local mitigation efforts and changes in priorities since the approval of the previous plan. NYS DHSES requirement F5 requires the documentation of local mitigation efforts and accomplishments within the past five (5) years for new plans as well as updates, regardless of inclusion in the previous plan, and regardless of funding source.

The goal is to provide a context for the jurisdictions' projects, act as a source of ideas for mitigation projects and evaluate the accuracy of assumptions and engineering solutions to inform future projects, and to support future mitigation planning and its coordination with other planning, zoning and environmental procedures within the jurisdiction.

It is recommended that a table be included within each jurisdictional annex to convey this information.

The following table provides an example of how the plan might include this information within each jurisdictional annex:

Proj #	Project Name	Hazard Addressed	Brief Summary of the Original Problem and the Solution (Project)	Evaluation of Success	
				Cost	
				Level of Protection	
				Damages Avoided;	
				Evidence of	
				Success	
				Cost	
				Level of Protection	
				Damages Avoided;	
				Evidence of	
				Success	
				Cost	
				Level of Protection	
				Damages Avoided;	
				Evidence of	
				Success	

#### Insert Jurisdiction's Name Here Past Mitigation Accomplishments

Other resources and ideas for documentation can be found at: <u>http://mitigationguide.org/wp-</u>content/uploads/2013/05/Worksheet-7.1.pdf? sm au =iVVnVbMZWRTNJKgi.

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## 6. Include Jurisdictional Annexes

Jurisdictional annexes provide a unique, stand-alone guide to mitigation planning for each jurisdiction.

Multi-jurisdictional Hazard Mitigation Plans allow certain elements of the planning process to be streamlined and shared, taking some of the burden of effort and cost off of each jurisdiction. The goal is to develop a shared portion of the plan that relates to the multiple jurisdictions therein from a county wide perspective, while also developing individual jurisdictional annexes to identify the unique local risks and mitigation strategies.

#### Identify Jurisdictional Participation

Every jurisdiction within the county's borders should be included in this multi-jurisdictional plan, including the county itself. Efforts to participate should be included for all jurisdictions, including those that did not fully participate and are therefore not seeking FEMA/NYS DHSES approval at the time of submittal.

The plan must clearly identify all jurisdictions and whether or not they are seeking approval for adoption from FEMA and NYS DHSES.

The following table provides an example of how the plan might include this information in the introduction section:

Jurisdiction	Letter of Commitment to Planning Process	Attended Planning Meetings	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (Meets all previous requirements)
Howard County	x	x	x	x	x
Aubrey, City	x	x		x	
Easterville, Town	x	x		x	
Easterville, Village	x	×	×	x	x
Louden, Town	x	x	x	x	x
Ontario, Village					
Pasadena, City	x			x	
Scupper, Town	x	x	x	x	x
Yardley, Village	x	x		x	

#### XXX County Jurisdictions

Letters of Commitment to Planning Process establishes a commitment from and a cooperative working relationship between all participating jurisdictions in the development and implementation of the plan. http://mitigationguide.org/wp-content/uploads/2013/05/Worksheet-1.2.pdf

Attending Planning Meetings is a critical component of participation which facilitates group discussion and allows for a greater perspective of how jurisdictions can work together to further mitigation efforts.

Jurisdictions must *Provide an Update on Past Projects* to help evaluate past efforts and inform future planning.

Jurisdictions must *Submit Mitigation Actions for the Current Plan* to establish priorities and make successful implementation as likely as possible.

In order to Seek Approval for Adoption, jurisdictions must meet all Federal requirements.

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#### Provide Jurisdictional Information

The plan must be organized to include an annex for every jurisdiction. Non-participating jurisdictions must have an annex included in the plan, with as much of the information noted below that is available, as a placeholder to allow for future participation.

Each jurisdictional annex must include the following information:

- Contact Information;
  - o Name, Title, Phone Number, Address, Email Address;
  - o If alternate contact information is available, this should be included as well.
- Jurisdiction Profile;
  - For example: population, land size, demographics, topography, brief history, governing body format.
- Hazard Identification;
  - Hazard Identification and Risk Assessment occurs in the county wide shared plan. The jurisdictional annex should identify only those hazards that are unique and specific to the jurisdiction.
- · Summary of Unique Hazard Event History/Impact on jurisdiction;
  - A complete Hazard Event History will be included in the county wide shared plan. The jurisdictional annex should be a discretionary list of events that have had particular impact on the jurisdiction, and therefore inform the unique mitigation strategies developed to address.
- National Flood Insurance Program (NFIP) Summary (to meet Federal Standards);
- Critical Facilities Information (to meet State Standard F2);
- Public involvement;
  - Jurisdictional annexes should identify any specific problems, solutions or ideas brought to the planning process from the public or local authorities; if this is done holistically at the County level, this can be included only in the County annex.
- Capabilities Assessment;
- Mitigation Strategy;
  - All identified previous mitigation activities with current status;
  - Previous mitigation activities completed (to meet State Standard F5);
  - All proposed mitigation activities (both new and carried forward, to meet State Standard F7);
  - Action Worksheets for a minimum of two (2) proposed mitigation activities (to meet State Standard 7).

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### 7. Develop Mitigation Actions

Projects that are well developed and documented in one place are more quickly identifiable for selection when grants become available, making implementation that much more likely.

#### List all proposed mitigation activities

The plan must include a single complete list of mitigation projects in each jurisdictional annex. While all mitigation projects on a jurisdiction's wish list should be assessed and discussed, only those that have reasonable potential to be accomplished within the lifespan of the plan should be included. The capabilities and resources of a given jurisdiction should be taken into consideration when establishing its wish list. Projects should be prioritized according to jurisdiction need and focus on achievable efforts. The project list should include those that may not meet FEMA eligibility or cost-effectiveness requirements since funding should be sought from multiple sources to achieve a jurisdiction's mitigation goals most quickly.

The information requested in the NYS DHSES Proposed Project Table on the following page must be provided within the plan.

- Project Name and Number;
- · Goal and/or Objective being met;
- · Hazard to be mitigated;
- Description of the Problem;
- Description of the Solution (Project Description);
- Whether or not the project is related to a Critical Facility (and if so, assurance that the facility will be
  protected to the 500-year event or greatest damage scenario, to meet State Standard F2);
- Estimated Timeline;
- · Lead Agency responsible for implementation;
- Estimated Costs;
- Estimated Benefits;
- Potential Funding Sources;
- Priority.

#### Complete a NYS DHSES Action Worksheet for a minimum of two projects

If a proposed mitigation project is viable and a priority to the jurisdiction, consideration should be given to the elements required to successfully implement. This provides the jurisdiction with a more developed starting point for implementation should funding become available or priorities dictate urgency. This also provides a guide for NYS DHSES to assess a county or jurisdiction's needs and quickly identifies eligible projects for funding should grants become available at the state level.

For mitigation activity ideas and suggestions, see: <u>https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema mitigation ideas final508.pdf</u>

While we recommend further consideration be given to all proposed actions by completing a NYS DHSES Action Worksheet, each jurisdiction must complete a minimum of two (2) NYS DHSES Action Worksheets for the jurisdiction's highest priority projects. For jurisdictions containing a Special Flood Hazard Area, one (1) of these Action Worksheets must be for a project that addresses flooding.

DHSES administers three mitigation grant programs: the Hazard Mitigation Grant Program (HMGP) rolled out after a declared disaster in NYS, and the annual Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) programs. Letters of Intent (LOIs) for projects more fully developed in the NYS DHSES Action Worksheets will rank higher and will be prioritized for funding over those that are not.

The NYS DHSES Action Worksheet can be found on page 12, with subsequent guidance. This Worksheet will be made available for completion in electronic format as well.

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	*Projects related to Critical Facilities (CF) will protect the facility to the 500-year event or worst damage scenario, whichever is greater.												
roj	Project Name	Goal/ Objective being Met	Hazard to be Mitigated	Description of the Problem	Description of the Solution	CF?"	EHP Issues	Estimated Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priorit
The • P	euseofth Project Na	iis table is i ame and N 'his should	not a requ lumber; be a unig	irement, but r	may be used a	as a st If the	arting poin	t to develop	p actions th	at must provide:	ing carried ov	er, the identi	fier
• 6 • F • C	ioal and/ o T lazard to o lo escriptio o F escriptio o F	or Objectiv he project be mitigat dentify the l on of the P rovide a br on of the <b>S</b> Provide a br	ve being i must be c ted; Hazard to roblem; rief descrip folution (F rief descrip	met; onsistent with be mitigated. Dition of hazar Project Desco otion of the pro- promotion of the pro- promotion of the pro-	n a goal and/o d's impact to t ription); roposed project	r objec the col	ctive identif mmunity, b uding locat	fied in the p ooth previou tion, scope	olan. us damages of work of i	s and/or potential mitigation action	damages.	lies/assessn	nents
• V • E • L	Vhether o o la stimated o lo ead Age	or not the p s this project ssure that I Timeline; dentify the f ncy respon	time requi	related to a to a critical fa will be prote red for compl implementa	Critical Facili cility? Yes/No. cted to the 500 etion of the pr tion;	i <b>ty;</b> . As s )-year oject u	ampled ab event or g	ove, it mus reatest dar mentation.	t be noted nage scena	that any project r ario, to meet Stat	elated to a crit e Standard F2	iical facility n	nust
• E	o lo stimated o F stimated o F	l Costs; Provide an e Benefits; Provide a de	ead agen estimated escription	cy or departm cost for imple of the estimat	ent responsib ementation. R ted benefits, e	ough (	implement dollar figur quantitative	auon. es are idea e and/or qua	l, but if unk alitative.	nown, a specified	d range is acc	eptable.	
• P	otential	Funding S	ources;	ing sources fo	or implementa	tion, w	which will b	e supporte	d by a list a	s required in Sta	te Standard F	3: and	





	(Nam	ne of Jurisdiction)	
Project Name:	NYS DHS.	ES Action Worksheet	
Project Number:			
	Risl	k / Vulnerability	
Hazard of Concern:			
Description of the Problem:			
•	Action or Project	Intended for Implementation	
Description of the Solution:			
Is this project	related to a Critical Facility?	Yes	No 🗆
(If yes, this projec	t must intend to protect to the 500-year	flood event or the actual worst damage scen	ario, whichever is greater.)
Level of Protection:		Estimated Renefits	
Useful Life:		(losses avoided):	
Estimated Cost:			
	Plan fe	or implementation	
Prioritization:		Implementation:	
Estimated Time Required for Project Implementation:		Potential Funding Sources:	
Responsible		Local Planning Mechanisms	
Organization:		if any:	
	Three Alternatives O	Considered (including No Action)	
1	Action	Estimated Cost	Evaluation
Alternatives:	No Action	\$0	
	Progress Rep	ort (for plan maintenance)	
Date of Status Report:			
Report of Progress:			
Update Evaluation of the Problem and/or Solution:			



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	(Name of	Jurisdiction)			
	NYS DHSES A	ction Worksheet			
Project Name:	Each action must have a unique project num	ber referenced here and in the Actio	n Tables.		
Project Number:	Each action must have a unique project hand Risk / Vi	e rererenced nere and in the Action ilnerability	Tables.		
Hazard of Concern:	Identify the hazard being addressed with this	action.			
Description of the Problem:	Provide a detailed narrative of the problem jurisdiction, past damages and loss of service applicable), adjacent streets, and easily ident with a brief description of existing condition	Describe the natural hazard you wi e, etc. Include the street address of ified landmarks such as water bodi s (topography, terrain, hydrology) (	sh to mitigate, its impacts to the the property/project location (if es and well-known structures, and end of the site.		
	Action or Project Inter	nded for Implementation			
Description of the Solution:	Provide a detailed narrative of the solution. work and by the project's effects; how the ac proposed construction methods, including an development process (e.g., are studies and/or (attach any reports or studies).	Describe the physical area (project tion would address the existing con sy excavation and earth-moving act r drawings complete), etc., the exter	limits) to be affected, both by direct ditions previously identified; ivities; where you are in the at of any analyses or studies performed		
Is this proje	ct related to a Critical Facility?	Yes 🗆	No 🗆		
(If yes, this proj	ect must intend to protect to the 500-year flood	event or the actual worst damage s	cenario, whichever is greater.)		
Level of Protection:	Identify the level of protection the proposed project will provide. Ex. 100- year (1%) flood.	. 100- Estimated Benefits Estimated Benefits			
Useful Life:	will provide protection against the hazard.     (losses avoided):     amounts are unknown or unquantifiable, describe for the second se				
Estimated Cost:	implementation. that will be avoided.				
Plan for Implementation					
Prioritization:	Identify the priority based on the prioritization method agreed upon.         Desired Timeframe for Implementation:         Identify the desired this project. Ex. V		Identify the desired start time for this project. Ex. Within 6 months.		
Estimated Time Required for Project Implementation:	Provided the estimated time required to complete the project from start to end.	Potential Funding Sources:	Multiple sources of potential funding should be listed when appropriate.		
Responsible Organization:	Identify the name of a department or agency responsible for implementation, not the jurisdiction	Local Planning Mechanisms to be Used in Implementation, if any:	Consider the use of local planning mechanisms that will be used to implement this project		
	Three Alternatives Consi	dered (including No Action)	imprement uns project.		
	Action	Estimated Cost	Evaluation		
	No Action	\$0			
Alternatives:	Alternative 1 – Brief Description		Include a description of pros/cons of Alternative 1.		
	Alternative 2 - Brief Description		Include a description of pros/cons of Alternative 2.		
	Progress Report (fe	or plan maintenance)			
Date of Status Report:	This section should be completed during play	n maintenance/evaluation.			
Report of Progress:	Describe what progress, if any, has been mad wishes to pursue implementation, state that h	de on this project. If it has been det here and indicate why.	termined the jurisdiction no longer		
Update Evaluation of the Problem and/or Solution:         Provide an updated description of the problem and solution, and what has happened since initial consideration/development.					

Æ



#### 8. Identify Funding Sources

Identifying strategic funding sources is integral to successful coordination and implementation of mitigation actions

The list of potential funding sources must include a brief description of each funding program and a link to the web pages describing the funding opportunity.

Section 4 Table 4.5h of the NYS Hazard Mitigation Plan provides an example of how to document sources and can be used as a starting point to identify potential funding sources as applicable to the county. The jurisdiction is also expected to research and identify additional funding opportunities.

http://www.dhses.ny.gov/recovery/mitigation/documents/2014-shmp/Section-4-Mitigation-Strategy.pdf

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#### 9. Plan for Climate Change

Acknowledging and planning for climate change protects residents, avoids or reduces damage to property and public infrastructure, and reduces personal hardship.

Plans developed with NYS DHSES-administered funds must include this information as part of the hazard vulnerability analysis and contain strategies/projects to address increased vulnerability that may result from climate change. This requirement was established to encourage jurisdictions to plan for and accommodate climate change and sea level rise. By developing mitigating strategies and/or projects for hazards that are exacerbated by climate change, jurisdictions will better protect residents, avoid or reduce damage to property and public infrastructure, and reduce personal hardship.

Jurisdictions must consider how climate change may affect their vulnerability or increased frequency of occurrence and/or severity in exposure to flooding, wildfire, drought and extreme temperatures.

Jurisdictions with coastal property must also analyze their vulnerability to sea level rise.

Numerous resources are available to the mitigation planning committee, including the following:

Resource: Description:	NY State 2014 Hazard Mitigation Plan: Section 3.4 – Climate Change Climate Change was first discussed in the 2011 NYS mitigation plan and expanded in 2014 update. The Climate Change section highlights current initiatives and reports on adaptation strategies being developed by the state.
Location:	http://www.dhses.ny.gov/recovery/mitigation/plan.cfm
Resource: Description:	Responding to Climate Change in New York State (ClimAID) – 2014 Update ClimAID is a climate analysis of the seven regions of New York State. The report, produced by the NYS Energy Research and Development Authority (NYSERDA), builds on data released in 2014 by the worldwide Intergovernmental Panel on Climate Change.
Location:	https://www.nyserda.ny.gov/climaid
Resource: Description:	New York Climate Change Science Clearinghouse The Clearinghouse is a gateway for policymakers, local planners, and the public to identify and access documents, data, websites, tools, and maps relevant to climate change adaptation and mitigation across New York State. The goal of the NYCCSC is to support scientifically sound and cost-effective decision-making. The vision is a dynamic site where users can find information in multiple ways, including through interactive tools that use data from different sources.
Location:	https://www.nvclimatescience.org/
Resource:	FEMA: Climate Resilient Mitigation Activities
Description:	FEMA provides fact sheets, job aids and cost-benefit analysis tools to support community efforts to reduce the risk associated with climate change. Climate Resilient Mitigation Activities are eligible for Hazard Mitigation Grant Program funding available following a major disaster; and for competitive grants under the annual Pre-Disaster Mitigation and Flood Mitigation Assistance programs.
Location:	https://www.fema.gov/climate-resilient-mitigation-activities-hazard-mitigation-assistance
Resource:	NYS Climate Smart Communities Climate Smart Resiliency Planning: A Planning Evaluation Tool
Description:	Designed specifically for NYS Communities, this NYSDEC-developed resource is a self- administered planning assessment tool designed to help local officials assess their communities' readiness and resilience in the face of changing weather patterns and rising sea levels.
Location:	See the Climate Smart Resiliency Planning link on the right under "Important Links" http://www.dec.nv.gov/energy/82168.html

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# Homeland Com

## **Community Lifelines**

## National Response Framework Update (Fourth Edition)

A lifeline provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security.

### Why a lifelines construct?

Decision-makers must rapidly determine the scope, complexity, and interdependent impacts of a disaster. Applying the lifelines construct allows decision-makers to:

- Prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure
- Utilize a common lexicon to facilitate unity of purpose across all stakeholders
- Promote a response that facilitates unity of purpose and better communication amongst the whole community (Federal, state, tribal, territorial, and local governments, and private sector and non-governmental entities)
- Clarify which components of the disaster are complex (multifaceted) and/or complicated (difficult), requiring cross-sector coordination

#### How will lifelines be used?

- Enhance the ability to gain, maintain, and communicate situational awareness for the whole community in responding to disasters
- Analyze impacts to the various lifelines and develop priority focus areas for each operational period during response
- Identify and communicate complex interdependencies to identify major limiting factors hindering stabilization
- Update the National Response Framework to reflect use of lifelines in response planning

## What are the opportunities of lifelines?

- Enable a true unity of effort between government, non-governmental organizations, and the private sector, including infrastructure owners and operators
- Integrate preparedness efforts, existing plans, and identify unmet needs to better anticipate response requirements
- Refine reporting sources and products to enhance situational awareness, best determine capability gaps, and demonstrate progress towards stabilization

#### Lifelines



#### Visit us at http://www.fema.gov/national-planning-frameworks

"With honor and integrity, we will safeguard the American people, our homeland, and our values."





## **APPENDIX K. LINKAGE PROCEDURES**

This Appendix contains the linkage procedures for the Westchester County Multi-Jurisdictional Hazard Mitigation Plan.

## K.1 ADMINISTRATIVE PROCESS FOR "LINKAGE" TO THE WESTCHESTER COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

Even though that initial development of the Westchester County Multi-Jurisdictional Hazard Mitigation Plan (the Plan) included 44 planning partners, not all eligible local governments within the defined planning area are included in this plan. Completed jurisdictional annexes are presented in Section 9. Any non-participating local governments and other local jurisdictions such as Fire Districts, Utility Districts, School Districts and any other eligible local government as defined in 44 CFR 201.2 within the Westchester County planning area can join this plan as a participating jurisdiction and to ultimately achieve approved status by following the linkage procedures defined in this appendix.

It is assumed that some or all of these non-participating local governments may choose to "link" to the Plan at some point in time to gain eligibility for programs under the DMA. In addition, some of the current partnership may not continue to meet eligibility requirements due to the lack of active participation as prescribed by the plan. These "linkage" procedures will define the requirements established by the Westchester County HMP Planning Committee and all planning partners for dealing with the increase or decrease in planning partners linked to this plan. It should be noted that currently non-participating jurisdictions within the defined planning area are not obligated to link to this plan. These jurisdictions can choose to do their own "complete" plan that addresses all required elements of section 201.6 of 44CFR.

## K.1.1 Increasing the Partnership Through Linkage

## Eligibility

Eligible jurisdictions located in the planning area may link to this plan at any point during the plan's performance period. Eligible jurisdictions located in the planning area may link to this plan at any point during the plan's performance period (5 years after final approval). Eligibility will be determined by the following factors:

- The linking jurisdiction is a local government as defined by the Disaster Mitigation Act.
- The boundaries or service area of the linking jurisdiction is completely contained within the boundaries of the planning area established during the 2021 hazard mitigation plan development process.
- The linking jurisdiction's critical facilities were included in the critical facility and infrastructure risk assessment completed during the 2021 plan development process.

## Requirements

It is expected that linking jurisdictions will complete the requirements outlined below and submit their completed template to the lead agency Westchester County Department of Emergency Services for review within six months of beginning the linkage process:

1. The Westchester County Hazard HMP Steering Committee has established an annual window for which linkage to the plan can occur. Linking jurisdictions are instructed to complete the following procedures during this time frame.





2. The current non-participating jurisdiction contacts the Westchester County Hazard Mitigation Planning Coordinator for the Plan and requests a "Linkage Package". The Westchester County Hazard Mitigation Planning Coordinator is:

Mailing Address:	WC Department of Emergency Services Office of Emergency Management 200 Bradhurst Avenue Hawthorne, NY
Contact Name:	Mr. Daniel Olmoz
Email Address:	dno1@westchestergov.com
Telephone:	(914) 864-5451

- 3. The Westchester County Hazard Mitigation Planning Coordinator will provide a linkage packages that includes:
  - Copy of Volume 1 and 2 of the Plan (CDROM).
  - Planning Partner's Expectations Sheet.
  - A Sample "Letter of Intent" to Link to the Plan.
  - A Jurisdictional Template and Instructions.
  - A copy of Section 201.6 of Chapter 44, the Code of Federal Regulations (44CFR), which defines the federal requirements for a local hazard mitigation plan.
- 4. The new jurisdiction will be required to review both volumes of the Plan which includes the following key components for the planning area:
  - The Westchester County risk assessment.
  - The plan's goals and objectives;
  - Plan implementation and maintenance procedures;
  - Catalog of potential mitigation actions; and
  - County-wide initiatives.

Once this review is complete, the jurisdiction will complete its specific jurisdictional annex by following the template and its instructions for completion provided by the Westchester County Hazard Mitigation Planning Coordinator. Technical assistance can be provided upon request by completing the request for technical assistance (TA) form provided in the linkage package. This TA may be provided by the Westchester County Hazard Mitigation Planning Coordinator or any other resource within the Planning Partnership such as a member of the HMP Steering Committee or a currently participating jurisdiction. The Westchester County Hazard Mitigation Planning Coordinator will determine who will provide the TA and the possible level of TA based on resources available at the time of the request.

5. The new jurisdiction will also be required to develop a public involvement strategy that ensures their public's ability to participate in the plan development process. At a minimum, the new jurisdiction must make an attempt to solicit public opinion on hazard mitigation at the onset of this linkage process and a minimum of one public meeting to present their draft jurisdiction specific annex for comment, prior to adoption by the





governing body. The Planning Partnership will have available resources to aid in the public involvement strategy such as the Plan website. However, it will be the new jurisdiction's responsibility to implement and document this strategy for incorporation into their annex.

It should be noted that the Jurisdictional Annex templates do not include a section for the description of the public process. This is because the original partnership was covered under a uniform public involvement strategy that covered the operational area that is described in volume 1 of the plan. Since the new partner was not addressed by that strategy, they will have to initiate a new strategy, and add a description of that strategy to their annex. For consistency, new partners are encouraged to follow the public involvement format utilized by the initial planning effort as described in Volume 1 of the Plan.

- 6. Once their public involvement strategy is completed and they have completed their template, the new jurisdiction will submit the completed package to the Westchester County Hazard Mitigation Planning Coordinator for a pre-adoption review to ensure conformance with the Regional plan format.
- 7. The Westchester County Hazard Mitigation Planning Coordinator will review for the following:
  - Documentation of public involvement and mitigation action development strategies;
  - Conformance of template entries with guidelines outlined in instructions;
  - Chosen actions are consistent with goals, objectives, and mitigation catalog of Westchester County Hazard Mitigation Plan; and
  - Designated point of contact.

The Westchester County Hazard Mitigation Planning Coordinator may utilize members of the HMP Steering Committee or other resources to complete this review. All proposed linked annexes will be submitted to the HMP Steering Committee for their review and comment prior to submittal to the New York State Division of Homeland Security and Emergency Services (NYS DHSES).

- 8. Plans approved and accepted by the HMP Steering Committee will then be forwarded to NYS DHSES for review with cover letter stating the forwarded plan meets local approved plan standards and whether the plan is submitted with local adoption or for criteria met/plan not adopted review.
- 9. NYS DHSES will review plans for state and federal compliance. Non-compliant plans are returned to the jurisdiction for correction. Compliant plans are forwarded to FEMA Region II office for review with annotation as to the adoption status.
- 10. FEMA Region II reviews the new jurisdiction's plan in association with the approved plan to ensure DMA compliance. Region II notifies new jurisdiction of results of review with copies to NYS DHSES and approved planning authority.
- 11. New jurisdiction corrects plan's shortfalls (if necessary) and resubmits to NYS DHSES through the approved plan lead agency.
- 12. For plans with no shortfalls that have not been adopted from the Region II review or outstanding corrected shortfalls, the new jurisdiction governing authority adopts the plan (if not already accomplished) and forwards adoption resolution to Region II with copies to lead agency and NYS DHSES.
- 13. Region II Director notifies new jurisdiction governing authority of plan approval.





The new jurisdiction plan is then included with Westchester County Multi-Jurisdictional HMP and the linking jurisdiction is committed to participate in the ongoing plan implementation and maintenance identified in Volume 1 of the HMP.



## SECTION 8. PLANNING PARTNERSHIP

This section provides a description of the Westchester County's HMP update planning partnership, their responsibilities throughout the planning process, and the jurisdictional annexes developed from their plan update efforts.

## 8.1 Background

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (44 CFR):

"Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan" [Section 201.6a (4)].

For the Westchester County HMP update, a Planning Partnership was formed to leverage resources and to meet requirements for the federal Disaster Mitigation Action of 2000 (DMA) for as many eligible governments as possible. The DMA provides the following definition for a local government:

Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under state law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Each participating planning partner has prepared a jurisdictional annex to this plan. These annexes, as well as information on the process by which they were created, are contained in this Volume 2 of this HMP.

## 8.1.1 Initial Solicitation and Letters of Intent

Westchester County Department of Emergency Services – Office of Emergency Management (WCDES-OEM) solicited the participation of all incorporated cities, towns and villages within the County at the outset of this project. Jurisdictions that expressed interest signed a "Letter of Intent" and/or an authorizing resolution committing their participation and resources to the development of the Westchester County HMP Update.

Table 8-1 lists those jurisdictions that elected to participate in the 2021 Westchester County HMP Update process, and have met the minimum requirements of participation as established by the County and Steering Committee:

Jurisdictions				
Westchester County	Town of North Salem	Village of Hastings-On-Hudson		
City of Mount Vernon	Town of Ossining	Village of Irvington		
City of New Rochelle	Town of Pelham	Village of Larchmont		
City of Peekskill	Town of Pound Ridge	Village of Mamaroneck		
City of Rye	Town of Rye	Village of Mount Kisco		
City of White Plains	Town of Somers	Village of Ossining		

## Table 8-1. Participating Jurisdictions in Westchester County





Jurisdictions				
City of Yonkers	Town of Yorktown	Village of Pelham		
Town of Bedford	Village of Ardsley	Village of Pelham Manor		
Town of Cortlandt	Village of Briarcliff Manor	Village of Pleasantville		
Town of Eastchester	Village of Bronxville	Village of Port Chester		
Town of Greenburgh	Village of Buchanan	Village of Rye Brook		
Town of Lewisboro	Village of Croton-On-Hudson	Village of Scarsdale		
Town of Mamaroneck	Village of Dobbs Ferry	Village of Tarrytown		
Town of New Castle	Village of Elmsford	Village of Tuckahoe		
Town of North Castle	Village of Harrison	-		

## 8.2 Planning Partner Responsibilities

The Planning Committee agreed to the following list of expectations:

- Review 2015 HMP goals and re-establish HMP update goals and objectives.
- Establish a timeline for completion of the HMP update.
- Ensure the HMP update meets the requirements of the DMA 2000 and FEMA and NYS DHSES guidance.
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the HMP development process.
- Assist in gathering information for inclusion in the HMP, including the use of previously developed reports and data.
- Organize and oversee the public involvement process and support outreach efforts in the community.
- Develop, revise, adopt, and maintain Volume I of the HMP update in its entirety and the local jurisdictional annex in Volume II.

As described in Section 7 (Plan Maintenance), the planning partnership is intended to remain active beyond the regulatory update to support plan maintenance. Regarding the composition of the Steering and Planning Committees, it is recognized that individual commitments change over time, and it will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

## 8.2.1 Jurisdictional Annex Preparation Process

As stated in the 2017 New York State Hazard Mitigation Planning Standards, jurisdictional annexes provide a unique, stand-alone guide to mitigation planning for each jurisdiction. The Westchester County HMP Update is organized so that there is an annex for Westchester County and for every jurisdiction within the County's borders. Section 9 (Jurisdictional Annexes) includes an annex for every jurisdiction in Westchester County, including those that did not fully participate.

During the planning process, the nation, the State of New York, and Westchester County were facing the COVID-19 pandemic. The COVID-19 pandemic was declared a major disaster on March 20, 2020 (DR-4480). The Governor of New York issued a stay-at-home Executive Order beginning March 22, 2020, which remained in effect the duration of the planning process. With the stay-at-home orders in place, all meetings during the planning process were held virtually.





## **Annex Development**

In order to facilitate update of the County and Jurisdictional Annexes, data from the 2015 Westchester County HMP annexes was transferred to a new, updated new annex format, developed to meet federal and state criteria. Clear instructions provided to the County and municipality. These instructions provided a basis to address the following:

- Document changes in capabilities and vulnerabilities
- Provide a current status of the 2015 HMP mitigation strategy
- Develop a new mitigation strategy to address identified issues and to increase community resiliency

The County invited all municipalities to participate in a municipal kick-off meeting held on July 20, 2021, to provide an overview of the planning process. Subsequently, the contract consultant distributed a suite of municipal-specific worksheets to each planning partner populated with carryover information from the 1015 plan and designed to provide intuitive guidance to updating key information required to develop the 2021 plan update. This was intended to assist each municipality in updating, integrating, and completing annex input. During this first round of data gathering, the consultant provided guidance upon request to municipal representatives regarding input of growth and development trends; planning, legal, fiscal, and regulatory capabilities; education and outreach capabilities; NFIP information and capabilities; areas of integration; and updating the 2015 mitigation strategy.

On September 22, 2021, the County convened a planning partnership meeting to review the relative risk assessment methodology and County-wide results to inform the municipal points of contact of the information to be reviewed, updated, or confirmed by each planning partner. The consultant distributed individualized risk ranking worksheets to facilitate the municipal review and adjusting of the initial results as needed. The consultant supported municipalities by interpreting results if needed and to provide context of how this supports the development of strong mitigation actions to reduce the impacts of the hazards of concern.

A mitigation workshop was held on October 13, 2021 to provide an overview of developing a strong mitigation strategy. Finally, the last round of support meetings held in October through November 2021 addressed the development of the updated mitigation strategy, the confirmation of sheltering, housing and evacuation route information, and confirmation of the risk ranking and other gaps in information in the draft municipal annexes.

## Hazard Ranking Exercise

As noted above, the risk assessment and risk ranking for each jurisdiction was presented virtually on September 2021 in a meeting including discussion of the overall risk assessment for the hazards of concern. At this meeting, each planning partner was asked to review the ranked risk specific for its jurisdiction. Refer to Section 5.3 (Hazard Ranking) for the methodology of the hazard ranking process. The calculated ranking was presented to each jurisdiction, and they were asked to review the ranking and revised based on history of events, probability of occurrence, and the potential impact on people, property, and the economy. The objectives of this exercise were to familiarize the partnership with how to use the risk assessment as a tool to support other planning and hazard mitigation processes and to help prioritize types of mitigation actions that should be considered. Hazards that were ranked as *high* for each jurisdiction as a result of this exercise were considered to be priorities for identifying appropriate mitigation actions, although jurisdictions also identified actions to mitigate *medium* or *low* ranked hazards, as appropriate.

## Mitigation Strategy Workshop

NYS DHSES attended and presented at a mitigation strategy workshop to Westchester County and its jurisdictions on October 13, 2021 as noted above. At this meeting, the consultant as well as FEMA and NYS





DHSES discussed the importance of developing strong mitigation actions as well as state requirements for the plan. The purpose of this workshop was to guide the planning partnership in completing this portion of the planning process and how projects that are well developed and documented are more quickly identifiable for selection when grants become available. Information regarding consultant support prior to and subsequent to the meeting is provided in the Annex Development section, above.

## Municipal Support Meetings

In addition to the municipal kick-off meeting, municipal support meetings were held throughout October and November 2021. For municipalities that scheduled individual meetings, the consultant worked one-on-one with the planning partners to complete their jurisdictional annex. For the balance of communities, the consultant held three regional group meetings on November 1<sup>st</sup> (one each for Inland, Hudson River, and Long Island Sound communities) to guide the planning partners through the annex update process. Each section of the annex was discussed to ensure accuracy and completeness. This included, but not limited to, the following:

- Reviewing the calculated hazard ranking for the jurisdiction and provide input to adjust the ranking as necessary.
- Inspecting the list of critical facilities located in the jurisdiction and its exposure to the 1 percent and 0.2 percent flood hazard area. As required in the 2017 New York State Hazard Mitigation Planning Standards, critical facilities located in the Special Flood Hazard Area must document that critical facilities are protected to the 500-year flood event, or worst damage scenario. For those that do not meet this level of protection, the plan must include an action to meet this criterion or explain why it is not feasible to do so. By reviewing the list, the jurisdictions could identify additional mitigation actions related to the critical facilities found in the municipality.
- Identifying mitigation initiatives that have reasonable potential to be accomplished within the lifespan of the County HMP (five years), including both FEMA-eligible projects and those projects using funds from non-FEMA sources.

## **Jurisdictional Annexes**

While the jurisdictional annex format is designed to document and assure local compliance with the DMA 2000 regulations, its greater purpose and function includes:

- Providing a locally-relevant synthesis of the overall mitigation plan that can be readily presented, distributed, and maintained.
- Facilitating local understanding of the community's risk to natural hazards.
- Facilitating local understanding of the community's capabilities to manage natural hazard risk, including opportunities to improve those capabilities.
- Facilitating local understanding of the efforts the community has taken, and plans to take, to reduce their natural hazard risk.
- Facilitating the implementation of mitigation strategies, including the development of grant applications.
- Providing a framework by which the community can continue to capture relevant data and information for future HMP updates.

Each jurisdiction's annex is intended to be a *living document* and will continue to be improved as resources permit. As such, its design is intended to promote and accommodate continued efforts to maintain the annex to be current and to improve the effectiveness of the annex as the key tool, reference, and guiding document by which the jurisdiction will implement hazard mitigation locally.





The following provides a description of the various elements of the jurisdictional annex.

**Section 9.X.1: Hazard Mitigation Plan Planning Team:** Identifies the hazard mitigation planning primary and alternate(s) contacts, the floodplain administrator, and additional contributors identified by the jurisdiction or who participated in the plan update. Further detail is provided in Section 3 (Planning Process) and Appendix B (Participation Matrix).

Section 9.X.2: Municipal Profile: Provides an overview and profile of the jurisdiction, including an identification of areas of known and anticipated future development and the vulnerability of those areas to the hazards of concern.

**Section 9.X.3: Capability Assessment and Integration:** Provides an inventory and evaluation of the jurisdiction's tools, mechanisms, and resources available to support hazard mitigation and natural hazard risk reduction. Within the municipal annexes, tables provide an inventory of the municipality's planning, regulatory, administrative, technical, and fiscal capabilities. Further, another table identifies the municipality's level of participation in state and federal programs designed to promote and incentivize local risk reduction efforts. *Integration of Hazard Mitigation into Existing and Future Planning Mechanisms* is provided within the capability assessment table to indicate how each planning mechanism can reduce risk. This annotated table indicates how the jurisdiction integrated hazard risk management into their existing planning, regulatory, and administrative framework (*integration capabilities*) and how they intend to promote this integration (*integration actions*). Further information regarding federal, state, and local capabilities can be found in the Capability Assessment portion of Section 6 (Mitigation Strategy).

• *Evacuation, Sheltering, Temporary Housing, and Permanent Housing:* Identification of evacuation routes, sheltering locations, and temporary and permanent housing solutions.

Section 9.X.4: National Flood Insurance Program (NFIP) Compliance: This section provides specific information on the management and regulation of the regulatory floodplain, including current and future compliance with the NFIP.

- *National Flood Insurance Program (NFIP):* Documents the NFIP as implemented within the jurisdiction. This summary was based on surveys prepared by or interviews conducted with the NFIP Floodplain Administrators for each NFIP-participating community in the county. This subsection identifies actions to enhance implementation and enforcement of the NFIP within the community.
- *National Flood Insurance Program (NFIP) Summary:* Provides NFIP summary statistics for the jurisdiction.

Section 9.X.5: Evacuation, Sheltering, Temporary Housing, and Permanent Housing: This section addresses evacuation routes, sheltering measures, temporary housing, and permanent housing which must be in place and available for public awareness to protect residents, mitigate risk, and relocate residents, if necessary, to maintain post-disaster social and economic stability.

**Section 9.X.6: Growth and Development Trends:** A breakdown of building permits given, within or outside of the regulatory floodplain and an identification of areas of known and anticipated future development and infrastructure and the vulnerability of those areas to the hazards of concern.

**Section 9.X.7: Jurisdictional Risk Assessment:** Provides information regarding each plan participant's vulnerability to the identified hazards. Full data and information on the hazards of concern, the methodology used to develop the vulnerability assessments, and the results of those assessments that serve as the basis of these local risk rankings may be found in Volume 1, Section 5 (Risk Assessment).



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- Natural Hazard Event History Specific to the Municipality: Identifies hazard events that caused significant impacts within the jurisdiction, including a summary characterization of those impacts as identified by the jurisdiction. The documentation of events and losses is critical to supporting the identification and justification of appropriate mitigation actions, including providing critical data for benefit-cost analysis. This inventory of events and losses is a work-in-progress and will continue to be improved as resources permit. As such, the lack of data or information for a specific event does not necessarily mean that the jurisdiction did not suffer significant losses during that event.
- *Critical Facilities Flood Risk:* Identifies potential flood losses to critical facilities in the jurisdiction based on the flood vulnerability assessment process presented in Section 5 (Risk Assessment).
- *Hazard Risk Ranking*: Identifies and characterizes the broad range of hazards that pose risk to the entire planning area; however, each jurisdiction has differing degrees of risk exposure and vulnerability aside from the whole. The local risk ranking serves to identify each jurisdiction's degree of risk to each hazard as it pertains locally, supporting the appropriate selection and prioritization of initiatives that will reduce the highest levels of risk for each community.
- *Identified Issues:* Presents other specific hazard vulnerabilities as identified by the jurisdiction.

Section 9.X.8: Mitigation Strategy and Prioritization: Discusses and provides the status of past mitigations actions and status, describes proposed hazard mitigation initiatives, and prioritization.

- **Past Mitigation Initiative Status:** Where applicable, reviews progress of the jurisdiction's prior mitigation strategy, identifying the disposition of each prior action, project, or initiative in the jurisdiction's updated mitigation strategy. Other completed or on-going mitigation activities that were not specifically part of a prior local mitigation strategy would be included in this sub-section.
- *Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy:* Other completed or ongoing mitigation activities that were not specifically part of a prior local mitigation strategy may be included in this subsection as well.
- **Proposed Hazard Mitigation Initiatives for the Plan Update:** Table 9.X-11 presents the jurisdiction's updated mitigation strategy. As indicated, applicable mitigation actions, projects, and initiatives are further documented on an Action Worksheet, which provides details on the project identification, evaluation, prioritization, and implementation process. Table 9.X-12 provides a summary of the local mitigation strategy prioritization process discussed in Section 6 (Mitigation Strategy).
- *Proposed Mitigation Action Types:* A Matrix Table of the proposed mitigation actions by hazard and FEMA and CRS Category.
- *Hazard Area Extent and Location Map:* Includes a series of maps illustrating identified hazard zones, and critical facilities. Further, these maps show areas of known or anticipated future development, as available and provided by the jurisdiction.

**Section 9.X.8: Action Worksheets:** Provides each municipality with a more developed starting point for project implementation should funding become available. Following NYS DHSES HMP Standards Guide, each municipality developed a minimum of two action worksheets. Workshops and additional meetings (in person, by email, or by teleconference) to complete the jurisdictional annexes were held with the Steering and Planning Committees throughout the planning process. In summary, all participating communities, and the County completed the planning partner expectations and annex-preparation process. Details regarding these meetings are described further in Sections 3 (Planning Process) and 6 (Mitigation Strategy). Completed jurisdictional annexes are presented in Section 9 (Jurisdictional Annexes).





## 8.2.2 Coverage Under the Plan

Of the planning partners identified during the planning process, 44 fully met the participation requirements specified by the Steering Committee. Planning partners not having met principal requirements including completion of the jurisdictional data collection worksheets, completion of the jurisdictional annex, or participation in workshops or individual support meetings. Those that did not meet the requirements will not be able to seek FEMA or NYS DHSES approval at the time of plan submittal nor will they be eligible to obtain FEMA mitigation grant funding. Those jurisdictions can choose to complete their annex and adopt at a later time, working with Westchester County and NYS DHSES to ensure completeness. Any non-participating local government within the Westchester County planning area can "dock" to this plan in the future following the linkage procedures defined in Appendix K (Linkage Procedures).

Table 8-2 lists the status of each jurisdiction, whether or not they submitted letters of intent to participate, and their ultimate status in this plan update. Appendix B (Participation Matrix) and Appendix C (Meeting Documentation) provide details on participation and meeting attendance.

Municipality	Letter of Intent to Participate	Attended Workshops and/or Meetings?	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (meets requirements)
City of Mount Vernon	X	Х	Х	Х	Х
City of New Rochelle	Х	Х	Х	Х	Х
City of Peekskill	Х	Х	Х	Х	Х
City of Rye*	Х	Х	Х	Х	Х
City of White Plains	Х	Х	Х	Х	Х
City of Yonkers	Х	Х	Х	Х	Х
Town of Bedford	Х	Х	Х	Х	Х
Town of Cortlandt	X	Х	X	Х	Х
Town of Eastchester	Х	Х	Х	Х	Х
Town of Greenburgh	X	Х	X	Х	Х
Town of Lewisboro	X	Х	X	Х	Х
Town of Mamaroneck	X	Х	X	Х	Х
Town of Mount Pleasant					
Town of New Castle	X	Х	X	Х	Х
Town of North Castle	Х	Х	Х	Х	Х
Town of North Salem	X	Х	X	Х	Х
Town of Ossining	Х	Х	Х	Х	Х
Town of Pelham	X	Х	X	Х	Х
Town of Pound Ridge	X	Х	X	Х	Х
Town of Rye	X	Х	X	Х	Х
Town of Somers	Х	Х	Х	Х	Х
Town of Yorktown	X	X	X	X	Х
Village of Ardsley	Х	Х	Х	Х	Х
Village of Briarcliff Manor	Х	Х	Х	Х	Х

## Table 8-2. Jurisdictional Status





Municipality	Letter of Intent to Participate	Attended Workshops and/or Meetings?	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (meets requirements)
Village of Bronxville	Х	Х	Х	Х	Х
Village of Buchanan	Х	Х	Х	Х	Х
Village of Croton-On- Hudson	Х	Х	Х	Х	Х
Village of Dobbs Ferry	Х	Х	Х	Х	Х
Village of Elmsford	Х	Х	Х	Х	Х
Village of Harrison (T/V)	Х	Х	Х	Х	Х
Village of Hastings-On- Hudson	Х	Х	Х	Х	Х
Village of Irvington	Х	Х	Х	Х	Х
Village of Larchmont	Х	Х	Х	Х	Х
Village of Mamoroneck	Х	Х	Х	Х	Х
Village of Mount Kisco (T/V)	Х	Х	Х	Х	Х
Village of Ossining	Х	Х	Х	Х	Х
Village of Pelham	Х	Х	Х	Х	Х
Village of Pelham Manor	Х	Х	Х	Х	Х
Village of Pleasantville	Х	Х	Х	Х	Х
Village of Port Chester	Х	Х	Х	Х	Х
Village of Rye Brook	Х	Х	Х	Х	Х
Village of Scarsdale	Х	Х	Х	Х	Х
Village of Sleepy Hollow					
Village of Tarrytown	Х	Х	Х	Х	Х
Village of Tuckahoe	Х	Х	Х	Х	Х





## 9.1 WESTCHESTER COUNTY

This section presents the jurisdictional annex for Westchester County. It includes resources and information to assist public and private sectors to reduce losses from future hazard events. This annex is not guidance of what to do when a disaster occurs. Rather, this annex concentrates on actions that can be implemented prior to a disaster to reduce or eliminate damage to property and people. This annex includes a general overview of the municipality and who in the county participated in the planning process; an assessment of Westchester County's risk and vulnerability; the different capabilities utilized in the County; and an action plan that will be implemented to achieve a more resilient community.

## 9.1.1 Hazard Mitigation Planning Team

The following individuals have been identified as Westchester County's hazard mitigation plan primary and alternate points of contact. Westchester County followed the planning process described in Section 3 (Planning Process) in Volume I of this plan update. This annex was developed over the course of several months with input from many County departments, including: Emergency Services, Public Works and Transportation, Department of Environmental Facilities, and Department of Health. The Director of the Department of Emergency Services, Office of Emergency Management represented the community on the Westchester County Hazard Mitigation Plan Planning Partnership, Steering Committee, and supported the local planning process requirements by securing input from persons with specific knowledge to enhance the plan. All departments were asked to contribute to the annex development through reviewing and contributing to the capability assessment, reporting on the status of previously identified actions, and participating in action identification and prioritization.

The following table summarizes municipal officials that participated in the development of the annex and in what capacity. Additional documentation on the municipality's planning process through Planning Partnership meetings is included in Section 3 (Planning Process) and Appendix C (Meeting Documentation).

## Table 9.1-1. Hazard Mitigation Planning Team

Primary Point of Contact	Alternate Point of Contact				
Name/Title: Dennis Delborgo, Director, Department of	Name/Title: Susan Spear, Deputy Commissioner, Department				
Emergency Services, Office of Emergency Management;	of Emergency Services				
Project Manager	Address: 4 Dana Road, Valhalla, NY 10595				
Address: 200 Bradhurst Avenue, Hawthorne, NY 10532	Phone Number: 914-231-1851				
Phone Number: 914-864-5453	Email: <u>sspear@westchestergov.com</u>				
Email: drd2@westchestergov.com					
Alternate Point of Contact					
Name/Title: Daniel Olmoz, Program Administrator, Department	nt of Emergency Services, Office of Emergency Management				
Address: 200 Bradhurst Avenue, Hawthorne, NY 10532					
Phone Number: 914-864-5450					
Email: dno1@westchestergov.com					
Additional Contributors					
Name/Title: Daniel Olmoz, Program Administrator, Department of Emergency Services, Office of Emergency Management					
Method of Participation: Provided information on past events, capabilities, NFIP information. Provided status update on					
previous actions. Contributed to mitigation strategy.					
Name/Title: Hernane De Almeida, Deputy Commissioner of Pr	ublic Works and Transportation				
Method of Participation: Provided status update on previous actions. Contributed to mitigation strategy.					
Name/Title: Andrew Ziegler, Public Works					
Method of Participation: Contributed to mitigation strategy.					
Name/Title: David Kvinge, Director of Environmental Plannin	g				
Method of Participation: Contributed to mitigation strategy.					
Name/Title: Christopher Gelardo, Capital Program Coordinato	r, Westchester County Department of Environmental Facilities				
Method of Participation: Contributed to mitigation strategy.	Method of Participation: Contributed to mitigation strategy.				



Name/Title: Katherine O'Connor, Program Administrator, Public Health Preparedness, Department of Health Method of Participation: Contributed to mitigation strategy.

## 9.1.2 County Profile

According to the U.S. Census, the 2010 population for Westchester County was 949,113. The estimated 2019 population was 968,065, a 2.0 percent increase from the 2010 Census. Data from the 2019 U.S. Census American Community Survey indicate that 5.6 percent of the population is 5 years of age or younger and 16.8 percent is 65 years of age or older. Communities must deploy a support system that enables all populations to safely reach shelters or to quickly evacuate a hazard area.

For more information on Westchester County, refer to Section 4, County Profile.

## 9.1.3 Jurisdictional Capability Assessment and Integration

Westchester County performed an inventory and analysis of existing capabilities, plans, programs, and policies that enhance its ability to implement mitigation strategies. Section 5 (Capability Assessment) describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities.
- Development and permitting capabilities.
- An assessment of administrative and technical capabilities
- An assessment of fiscal capabilities.
- An assessment of education and outreach capabilities.
- Classification under various community mitigation programs.
- The community's adaptive capacity to withstand hazard events.

For a community to succeed in reducing long-term risk, hazard mitigation must be integrated into the day-today local government operations. As part of this planning effort, planning/policy documents were reviewed, and each jurisdiction was surveyed to obtain a better understanding of their progress in plan integration. Areas with current mitigation integration are summarized in this Jurisdictional Capability Assessment (Section 9.1.3). Westchester County's identified opportunities for integration of mitigation concepts to be incorporated into the County's procedures are included in the updated mitigation strategy.

## Planning, Legal, and Regulatory Capability and Integration

The table below summarizes the regulatory tools that are available to Westchester County. The comment field provides information as to where hazard mitigation has been integrated.

## Table 9.1-2. Planning, Legal, and Regulatory Capability and Integration

	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible
Codes, Ordinances, & Regulations					
Building Code	No	Yes	Regulated at local and state levels	State and Local	Local municipalities
How does this reduce risk?					
Zoning/Land Use Code	No	Yes	Regulated at local levels	State and Local	Local municipalities
How does this reduce risk?					





	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible		
Subdivision Ordinance	No	Yes	Regulated at local levels	State and Local	Local municipalities		
How does this reduce risk?							
Site Plan Ordinance	No	No	Regulated at local levels	Local	Local municipalities		
How does this reduce risk?							
Stormwater Management Ordinance	Yes	Yes	Administration Code, Chapter 241 Department of Public Works and Transportation, Article III-A Westchester County Storm Water Management Law	County	Department of Public Works		
<ul> <li>How does this reduce risk?</li> <li>It is the intention of the County Board of Legislators that this Article relating to storm water management acknowledge the authority of the County to appropriate and expend county funds to protect public and private property within the County from floods and to comply with the procedures set forth in New York State County Law § 223 relating to flood control. In addition, the Storm Water Advisory Board and the Basin-wide Watershed Advisory Boards which are created in this article shall explore, among other things, the feasibility and desirability for the creation of drainage and small watershed protection districts for local municipalities as another viable option to address the issue of flooding in Westchester County as provided in Articles 5-A and 5-D</li> </ul>					wledge the c County from ol. In addition, the hall explore, istricts for local ticles 5-A and 5-D		
Post-Disaster Recovery/ Reconstruction Ordinance	No	No	-	-	-		
How does this reduce risk?							
Real Estate Disclosure	Yes	Yes	Property Condition Disclosure Act, NY Code - Article 14 §460-467	State	NYS Department of State, Real Estate Agent		
<ul> <li>How does this reduce risk?</li> <li>In addition to facing potential liability for failing to disclose under the exceptions to "caveat emptor," a home seller must make certain disclosures under the law or pay a credit of \$500 to the buyer at closing. While the PCDA requires a seller to complete a standardized disclosure statement and deliver it to the buyer before the buyer signs the final purchase contract, in practice, most home seller is New York at a state to complete the statement and environment of the statement and environment of the statement and statement and statement and statement and statement and statement at the statement and stat</li></ul>							
Growth Management	No	No	-	-	-		
How does this reduce risk?	-			•			
Environmental Protection Ordinance	No	-	-	-	-		
How does this reduce risk?							
Flood Damage Prevention Ordinance	Yes	Yes	Administration Code, Chapter 241 Department of Public Works and Transportation, Article III Westchester County Stream Control Law	Federal, State, County and Local	Department of Public Works		
<ul> <li>How does this reduce risk?</li> <li>The alleviation of recurring flood damage to public and private property and the prevention of danger to the public health and safety resulting from floods are hereby declared to be matters of public concern. As an aid in effecting such alleviation and preventing such damage, the county, acting through the commissioner, shall have the power, as hereinafter provided, to (a) establish channel lines; (b) issue or withhold the issuance of permits for channel obstructions; and (c) prescribe regulations with respect to the construction and maintenance of structures within channel lines or within a distance of 100 feet therefrom.</li> </ul>							
Wellhead Protection	No	No	-	-	-		
How does this reduce risk?	1			1	I		
Emergency Management Ordinance	No	No	-	-	-		
How does this reduce risk?							
Climate Change Ordinance	No	No	-	-	-		
How does this reduce risk?							





	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible	
Other	No	-	-	-	-	
Planning Documents						
Comprehensive Plan	Yes	No	Westchester 2025/plan together	County	Planning Department	
<ul> <li>How does this reduce risk?</li> <li>Land Use in Westchester information that will imp development infrastructure</li> </ul>	r describes existi prove leaders' ab are and provision	ng conditions and dev ility to understand the of services.	velopment trends. The report is e physical makeup of their con	s meant to provide v nmunities and make	very precise decisions on land	
Capital Improvement Plan	No	No	-	-	-	
How does this reduce risk?	I					
Disaster Debris Management Plan	Yes	No	Westchester Multi- jurisdictional Disaster Debris Management Plan 2014	County	Department of Emergency Services	
<ul> <li>The Federal Emergency Management Agency (FEMA) encourages state and local governments, tribal authorities, and private non-profit organizations to take a proactive approach to coordinating and managing debris removal operations as part of their overall emergency management plan. Communities with a debris management plan are better prepared to restore public services and ensure the public health and safety in the aftermath of a disaster, and they are better positioned to receive the full level of assistance available to them from FEMA and other participating entities.</li> <li>This Multi-Jurisdictional Disaster Debris Management Plan (Plan) identifies the actions required to plan for and respond to a natural or man-made debris-generating event. It is designed to identify local, New York State (State), and Federal departments and</li> </ul>						
Floodplain Management or Watershed Plan	Yes	No	Flooding and Land Use Planning: A Guidance Document for Municipal Officials and Planners 2010; The Croton Plan for Westchester 2009	County, Local, State	Department of Planning, Municipal partners, New York City Department of Environmental Protection	
How does this reduce risk?       Protection         • Flooding and Land Use Planning: A Guidance Document for Municipal Officials and Planners 2010: This manual was created for elected officials, planning and zoning board members, planners and development professionals to improve land use decisions with respect to flooding causes and the relationship to development         • Flooding causes and the relationship to development       • Flooding causes and the relationship to development         • Regulations for government agencies associated with flood control and flood hazard mitigation       • Comprehensive and watershed planning         • Stormwater management       • Successful floodplain management tools       • Local ordinances         • Site plan review tools       • Site plan review tools       • Stormwater management design         • The Croton Plan for Westchester, The Comprehensive Croton Watershed Water Quality Protection Plan is the product of a comprehensive intermunicipal water quality planning effort. Ten municipalities worked with Westchester County and the New York City Department of Environmental Protection (DEP) to assess the unique conditions in the Croton Watershed, identify water quality impacts and develop a strategy to reduce those impacts and prefer further water quality degradation while enhancing community character. The cooperative effort included:       • Town of Bedford         • Town of Bedford       • Town of North Castle       • Town of North Castle       • Town of North Castle         • Town of Somers       • Town of Somers       • Town of Somers       • Town of Yorktown         • Westchester C						
Stormwater Management Plan	Yes	No	Reconnaissance Plan for the Croton River and Inland Long Island Sound	County	County Stormwater Advisory Board	

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	Iiedietien		Code Citation and Data	Athe a witter	Individual /
	has this?	Required by	(code chapter, name of	(local, county,	Agency
			Watershed 2014; Stormwater Reconnaissance Plan for the Peekskill and Haverstraw Bays Watershed 2014; Stormwater Reconnaissance Plan for the Coastal Long Island Sound Watershed 2013; Stormwater Reconnaissance Plan for the Sawmill River – Pocantico River Watershed 2012; Stormwater Reconnaissance Plan for the Bronx River Basin Watershed 2013, revised		Responsible
			2014;		
<ul> <li>Reconnaissance plans cc based on previous engin Reconnaissance plans dc studies. Nor do they add intended primarily to prr major drainage basins. T provide a comprehensivy</li> </ul>	ompile and evalua eering studies or o not represent a o ress the full rang ovide recommence the plans do discu e analysis of the v	ate existing informati designs to be conside detailed, watershed-w e of natural or man-m lations for physical p uss flooding problems watershed and cannot	on about flood problem areas, red for funding, and present o vide analysis with up-to-date h hade disasters. Rather, they are rojects and other actions to add s and solutions in the context of be characterized as a flood m	provide a list of pri ther recommendati ydrologic and hydra evaluations of avai dress flooding in ea of the watershed; ho itigation study.	oritized projects ons for action. aulic data and ilable information ch of Westchester's wever, they do not
Open Space Plan	No	No	-	-	-
How does this reduce risk?					
Urban Water Management Plan	No	No	-	-	-
How does this reduce risk?					
Habitat Conservation Plan	No	No	-	-	-
How does this reduce risk?					
Economic Development Plan	No	No	-	-	-
How does this reduce risk?					
Shoreline Management Plan	Yes	Yes, in jurisdictions with CEHA areas	Article 34, Environmental Conservation Law, Coastal Erosion Hazard Areas 6 NYCRR Part 505, Coastal Erosion Management Regulations; Westchester RiverWalk Design Guidelines 2005; Hudson River Trailway Plan 2003	State, County, Local	Planning Department
<ul> <li>How does this reduce risk?</li> <li>The "Westchester River providing unity and come constructed in many seg segment will apply these</li> </ul>	Walk Design Gui sistency for its 46 ments over a peri guidelines by in	idelines" manual prov 5-mile length. A consi od of time, rather tha corporating the stand	vides a set of standards and des istent set of guidelines is needen n all at once. Each municipali ards and amenities that apply	sign palette for the p ed because RiverWa ty and other entity t to its category of tra	ourpose of alk will be hat plans a trail ail, such as an

esplanade or trail in a natural area. The goal of this document is to create a cohesive trail that is visually connected, so that users can traverse easily and experience the Hudson River through a unified trailway experience.
The "Hudson River Trailway Plan: RiverWalk" evaluates opportunities for creating a functionally linked Hudson River waterfront for pedestrians and bicyclists through the development, enhancement and linking of trails, esplanades and boardwalks. The Hudson River Trailway Plan: RiverWalk maps a preliminary route and identifies opportunities for developing a continuous trailway along the entire Hudson River shoreline in Westchester County, spanning 46.6 miles from the Town of Cortlandt border with Putnam County on the north to the City of Yonkers border with the City of New York on the south. Providing access to the Hudson River

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	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible		
is a priority of the County of Westchester and the 14 riverfront communities, 13 of which comprise the Historic River Towns of Westchester (HPTW)							
Community Wildfire Protection	No	No	-	-	-		
How does this reduce risk?			<u> </u>				
Community Forest	No	No	-	-	-		
Management Plan How does this reduce risk?							
Transportation Dlan	No	No	[				
How does this reduce risk?	INO	NO	-	-	-		
Agriculturo Plan	Vec	No	Agriculture and Farmland	County	Planning		
Agriculture Fian	1 05	NO	Protection Plan (2004).	County	Department		
<ul> <li>How does this reduce risk?</li> <li>Establishes goals for farm</li> </ul>	nland preservation	m					
Climate Action/			Greenprint for a	_	Planning		
Resiliency/Sustainability Plan	Yes	No	Sustainable Future, June 2004	County	Department		
<ul> <li>The Greenprint for a Sustainable Future is the Westchester County Greenway Compact Plan. Greenprint builds on the planning legacy in Westchester so as to assist the county, city, town and village governments in ensuring a sustainable future for years to come. The Plan provides the basis for participating municipalities to qualify for incentives granted by the New York State Legislation through the Hudson River Valley Greenway Act of 1991. The Plan follows the successful format utilized in Patterns for Westchester: the Land and the People, the County's long-range planning policy document, to create an approach to regional economic development that promotes tourism while incorporating natural, cultural and historic resource protection and increasing Westchester.</li> </ul>							
Tourism Plan	Yes	No	Greenprint for a Sustainable Future, June 2004	County	Planning Department		
<ul> <li>How does this reduce risk?</li> <li>The Greenprint for a Sustainable Future is the Westchester County Greenway Compact Plan. Greenprint builds on the planning legacy in Westchester so as to assist the county, city, town and village governments in ensuring a sustainable future for years to come. The Plan provides the basis for participating municipalities to qualify for incentives granted by the New York State Legislation through the Hudson River Valley Greenway Act of 1991. The Plan follows the successful format utilized in Patterns for Westchester: the Land and the People, the County's long-range planning policy document, to create an approach to regional economic development that promotes tourism while incorporating natural, cultural and historic resource protection and increasing Hudson River access opportunities.</li> </ul>							
<b>Development Plan</b> How does this reduce risk?				<u> </u>			
now woos mis reduce risk:							
Other	No	-	-	-	-		
Comprehensive Emergency Management Plan	Yes	Yes	Westchester County Comprehensive Emergency Management	County	Department of Emergency Services		
<ul> <li>How does this reduce risk?</li> <li>Preparing for and responding to disasters is an ongoing and complex undertaking. Through implementation of Risk Reduction measures before a disaster or emergency occurs; Preparedness efforts to include planning, training and exercises; timely and effective Response during an actual occurrence; and provision of both short and long term Recovery assistance after the occurrence of a disaster, lives can be saved and property damage minimized. This process is called Comprehensive Emergency Management to emphasize the interrelationship of activities, functions, and expertise necessary to deal with emergencies.</li> <li>The comprehensive plan is organized according to the recognized methodology of emergency management. It is organized according to the necessary "all hazard" response functions needed to respond to any disaster. Accordingly, this plan addresses the four basic principles which include: mitigation, preparedness, response, and recovery operations.</li> </ul>							
Continuity of Operations Plan How does this reduce risk?	No	No	-	-	-		
now uses mis reduce fisk?							
Strategic Recovery Planning Report	No	No	-	-	-		





	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible
How does this reduce risk?	-	-	-	-	
Threat & Hazard Identification & Risk Assessment (THIRA)	Yes	Yes	2020 THIRA/SPR, NY City Urban Area Working Group	Federal (NYC Urban Area)	Department of Emergency Services
<ul> <li>How does this reduce risk?</li> <li>The THIRA / SPR is an relative to a series of crit on capability delivery.</li> </ul>	annual requiremo ical tasks; identi	ent and prerequisite for for the second s	or SHSP and UASI grants whe t targets for the future; and det	ere jurisdictions: ass ermine the impacts	ess capability of funding sources
Post-Disaster Recovery Plan	Yes	No	CEMP Section V - Recovery	County	Department of Emergency Services
<ul> <li>How does this reduce risk?</li> <li>Defines the role of the correcovery of disaster improved the second second</li></ul>	ounty and the pro acted communitie	ocedures for coordina es throughout Westch	tion of activities and delivery on the sector in accordance with the R	of assistance to supp obert T. Stafford R	port the overall elief and
Public Health Plan	Yes	No	Westchester County Community Health Improvement Plan 2019- 2021; Westchester County Community Health Assessment 2019-2021	County	Department of Health
<ul> <li>How does this reduce risk?</li> <li>The Community Health Improvement Plan 2019-2021 notes priorities to prevent chronic disease and promote mental health and prevent substance abuse.</li> <li>The Westchester County Community Health Assessment 2019-2021 includes a community health assessment survey report out and identifies the priority health issues for the community and the population needing the greatest attention. It also includes regional health profiles for cities and towns in the County.</li> </ul>					
Other	No	-	-	-	-

## **Development and Permitting Capability**

The table below summarizes the capabilities of Westchester County to oversee and track development.

#### Table 9.1-3. Development and Permitting Capability

Indicate if your jurisdiction implements the following	Yes/No	Comment
Do you issue development permits?	No	Local municipalities
-If yes, what department is responsible?		
-If no, what is your process for development?		
Are permits tracked by hazard area? (For example,	N/A	See above
floodplain development permits.)		
Do you have a buildable land inventory?	Yes	Discussed in Westchester 2025/plan together.
-If yes, describe.		
-If no, quantitatively describe the level of buildout in the		
jurisdiction.		

#### Administrative and Technical Capability

The table below summarizes potential staff and personnel resources available to Westchester County and their current responsibilities which contribute to hazard mitigation.

#### Table 9.1-4. Administrative and Technical Capabilities

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Administrative Capability		
• • •		





		Comments
Pasourcas	Available?	(available staff, responsibilities, support of hazard
Planning Board	Yes	See Planning Department
Zoning Board of Adjustments	No	-
Zoning Board of Adjustments Planning Department	Yes	<ul> <li>The Planning Department conducts a comprehensive work program and shapes and influences growth and development in Westchester County in order to improve quality of life and protect the environment, resulting in more livable and sustainable communities.</li> <li>Three of the five specialized sections of the department – Land Use and Development, Housing and Environmental Planning – focus on the initiatives that carry out this mission. They utilize the technical expertise of the department's two other sections – Design and Administration – to produce quality products and plans in the most cost-effective manner for county residents.</li> <li>Activities within each section focus on the pattern of development, the natural environment and ways in which buildings, transportation and open space can be shaped or utilized to achieve a physical environment that fosters smart growth for Westchester County. The department staff works closely with other county departments, elected and appointed officials and staff of the 45 municipalities and private and non-profit businesses and organizations.</li> <li>The work program includes activities that are mandated by the County charter, New York State and the federal governments. These include the review of certain proposed land use and zoning actions by municipalities, review of county capital projects and the environment largive (SEOR or NEPA) of all</li> </ul>
Mitigation Planning Committee	No	-
Environmental Board/Commission	Yes	The County has an agreement with the County Soil and Water Conservation District, providing staff support to the District through the Planning Department. In conjunction with the District, the County develops education and outreach workshops and materials and implements projects to restore habitats, most of which improve resilience to natural hazards.
Open Space Board/Committee	No	-
Economic Development Commission/Committee	No	
Public Works/Highway Department	Yes	The Department of Public Works maintains almost 160 miles of county roads - including the Bronx River Parkway, the only parkway the county owns. (Most Westchester roads are maintained by local governments; the other parkways are maintained by the state.) Public Works is also responsible for 86 bridges, 71 traffic signals, 29 traffic cameras and a variety of county government buildings. The Department oversees the county's capital projects and oversees the Traffic Safety program to minimize traffic accidents. Westchester County Parks is responsible for the County parks and conservation programs
Construction/Building/Code Enforcement		County parks and conservation programs.
Department	Yes	See Public Works

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Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Emergency Management/Public Safety Department	Yes	The Department of Emergency Services, headed by Commissioner Richard G. Wishnie, plays a critical role in keeping Westchester safe. The Fire Services Division is comprised of four units: fire training, fire inspection, special operations, and fire prevention and protection. The division administers, coordinates, and maintains the fire training program that is available to Westchester County's 58 fire departments. The Emergency Communications Center commonly referred to as "60 Control" provides primary dispatch services for 52 fire departments and 32 EMS agencies in Westchester. The center is staffed 24 hours, seven days a week to handle fire and EMS mutual-aid requests going in and out of the county. The OEM works with local, state, and federal government to prepare Westchester for disasters. During a major emergency, OEM may activate the county's Emergency Operations Center, a state-of-the- art facility where the county, local municipalities, hospitals, utilities work together to keep the County safe. The EMS division collaborates with local, regional, and state agencies to enhance the effectiveness of the county's Emergency Medical Services System, by providing emergency preparedness training, mutual aid coordination, and incident management assistance during large-scale events.
Warning Systems / Services (mass notification system, outdoor warning signals)	Yes	Managed collaboratively with the County Department of Information Technology and Communications Office, the Department of Emergency Services has access to a mass notification system.
Maintenance programs to reduce risk (stormwater maintenance, tree trimming, etc.)	Yes	See Department of Public Works
Mutual aid agreements	Yes	Public Works shared service agreements with local municipalities.
Human Resources Manual - Do any job descriptions specifically include identifying or implementing mitigation projects or other efforts to reduce natural hazard risk?	Yes	There is a County Office of Emergency Management Program Administrator position with duties specific to hazard mitigation and disaster recovery.
Other	Yes	<ul> <li>The Westchester County Department of Environmental Facilities oversees the operations of various facilities that deal with the environment. These include the: <ul> <li>Material Recovery Facility (the recycling center)</li> <li>Garbage transfer stations</li> <li>H-MRF (for hazardous and "hard-to-dispose-of" waste)</li> <li>County sewer treatment plants</li> <li>Four county water districts</li> </ul> </li> <li>Westchester County Department of Health</li> </ul>





	Amailahla?	Comments
Resources	(Yes/No)	(available stall, responsibilities, support of nazard mitigation)
		<ul> <li>The Department of Laboratories and Research is the behind-the-scenes agency that conducts scientific tests in matters ranging from criminal evidence to public health concerns.</li> <li>The Division of Environmental Services provides testing to a number of government agencies, health officials, DA's Office, engineers, hospitals, schools, businesses, homeowners, residents and others. The state- of-the-art facility and highly trained analysts provide the best in bacteriological, inorganic, organic and radiological testing. The QA/QC department ensures all reported results meet or exceed all quality standards set by New York State and the US EPA.</li> <li>The Division of Microbiological Services provides diagnosis and identification of infectious agent that may cause diseases of public health significance.</li> </ul>
Planners or engineers with knowledge of land	T	
development and land management practices	Yes	Department of Planning
Engineers or professionals trained in building or infrastructure construction practices	Yes	Department of Public Works & Transportation, Department of Planning
Planners or engineers with an understanding of natural hazards	Yes	Department of Public Works & Transportation, Department of Planning, Department of Emergency Services/OEM
Staff with expertise or training in benefit/cost analysis	Yes	Department of Public Works & Transportation, Department of Planning, Department of Emergency Services/OEM
Professionals trained in conducting damage assessments	Yes	Department of Public Works & Transportation, Department of Parks, Contractors
Personnel skilled or trained in GIS and/or Hazards United States (HAZUS) – Multi-Hazards (MH) applications	Yes	Department of Information Technology, commonly referred to as DoIT, designs, builds, procures, implements and supports information systems and technology to help all Westchester County departments and stakeholder agencies operate more effectively and efficiently, and to make information more accessible.
Scientist familiar with natural hazards	Yes	Department of Planning
Surveyor(s)	NO	- County Emergency Management Director and support
	Yes	staff.
Grant writer(s)		Department of Emergency Services/OEM, Department of Planning, Department of Public Works & Transportation
Resilience Officer	No	-
Other (this could include stormwater engineer, environmental specialist, etc.)	No	-

## Fiscal Capability

The table below summarizes financial resources available to Westchester County.





## Table 9.1-5. Fiscal Capabilities

	Are these accessible or eligible to use for mitigation? (Yes/No) If yes, please describe. If no, can this be used to
Financial Resources	support in the future?
Community development Block Grants (CDBG, CDBG-DR)	Yes
Capital improvements project funding	County Capital Program, CHIPS
Authority to levy taxes for specific purposes	No
User fees for water, sewer, gas or electric service	Yes, County Water and Sewer Districts
Impact fees for homebuyers or developers of new development/homes	No
Stormwater utility fee	No
Incur debt through general obligation bonds	Yes. The County issues long-term debt in the form of General Obligation Serial Bonds to fund capital construction and renovation projects within Westchester.
Incur debt through special tax bonds	No
Incur debt through private activity bonds	Available, but not used
Withhold public expenditures in hazard-prone areas	No
Other federal or state funding programs	Yes, mitigation grant programs from FEMA
Open Space Acquisition funding programs	No
Other (for example, Clean Water Act 319 Grants [Nonpoint Source Pollution])	The County Stormwater Management Law provides funding assistance to local municipalities for flood mitigation projects.

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## **Education and Outreach Capability**

The table below summarizes the education and outreach resources available to Westchester County.

## Table 9.1-6. Education and Outreach Capabilities

Outreach Resources	Available? (Yes/No)	Does the jurisdiction have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events? If yes, please describe.
Public information officer or communications office	Yes	Related preparedness information is developed and distributed accordingly in advance of expected or impending hazards.
Personnel skilled or trained in website development	Yes	County Information Technology, Communications Office, and individual departments.
Hazard mitigation information available on your website	Yes	Planning Department includes dedicated webpages for hazard mitigation resources including the county plan. Health Department includes information on pandemic, heat related illness, etc.
Social media for hazard mitigation education and outreach	Yes	County e-bulletins include non-emergency news.
Citizen boards or commissions that address issues related to hazard mitigation	Yes	The Westchester County Department of Public Safety
Other programs already in place that could be used to communicate hazard- related information	Yes	The Department of Social Services provides an array of services to Westchester residents in need of assistance, including the areas of financial support, child support, food, housing, medical services and home energy costs. It also provides protective and preventive services for children, adults, and families.
Warning systems for hazard events	Yes	Emergency Notification System (On the Alert) and Special Needs Registry
Natural disaster/safety programs in place for schools	No	-
Other	No	-







## **Community Classifications**

The table below summarizes classifications for community programs available to Westchester County.

## Table 9.1-7. Community Classifications

Program	Participating? (Yes/No)	Classification (if applicable)	Date Classified (if applicable)
Community Rating System (CRS)	N/A	-	-
Building Code Effectiveness Grading Schedule (BCEGS)	N/A	-	-
Public Protection (ISO Fire Protection Classes 1 to 10)	N/A	-	-
NYSDEC Climate Smart Community	N/A	-	-
Storm Ready Certification	No	-	-
Firewise Communities classification	No	-	-
Other	No	-	-

Note:

N/A Not applicable

NP Not participating

- Unavailable

## **Adaptive Capacity**

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or respond to consequences" (IPCC 2014). In other words, it describes a jurisdiction's current capabilities to adjust to, protect from, or withstand a future hazard event, future conditions, and changing risk. The table below summarizes the adaptive capacity for each hazard of concern and the jurisdiction's rating.

#### Table 9.1-8. Adaptive Capacity

Hazard	Adaptive Capacity - Strong/Moderate/Weak*		
Disease Outbreak	Moderate		
Earthquake	Moderate		
Extreme Temperature	Moderate		
Flood	Moderate		
Severe Storm	Moderate		
Severe Winter Storm	Strong		
Wildfire	Moderate		
CBRN	Moderate		

\*Strong Capacity exists and is in use

Moderate Capacity may exist; but is not used or could use some improvement

Weak Capacity does not exist or could use substantial improvement

## 9.1.4 National Flood Insurance Program (NFIP) Compliance

This section provides specific information on the management and regulation of the regulatory floodplain, including current and future compliance with the NFIP.

## National Flood Insurance Program (NFIP) Summary

The following table summarizes the NFIP statistics for Westchester County.





## Table 9.1-9. NFIP Summary

Municipality	# Policies	# Claims (Losses)	Total Loss Payments	# RL Properties
Westchester County	6,551	11,902	165,570,638.79	1,227
Source: FEMA 7-2021				•

Notes:

RL Repetitive Loss; SRL Severe Repetitive Loss

### Flood Vulnerability Summary and NFIP Compliance

The following table provides a summary of the NFIP program in Westchester County.

### Table 9.1-10. Flood Vulnerability Summary and NFIP Compliance

NFIP Topic	Comments						
Flood Vulnerability Summary							
Note: Flood vulnerability for Westchester	County is discussed in the Flood Profile (Section 5.4.3).						
<ul> <li>Describe areas prone to flooding in your jurisdiction.</li> <li>Do you maintain a list of properties that have been damaged by flooding?</li> </ul>	The County maintains a map and list of County infrastructure located in floodplains.						
<ul> <li>Do you maintain a list of property owners interested in flood mitigation?</li> <li>How many homeowners and/or business owners are interested in mitigation (elevation or acquisition)?</li> </ul>	No. This is done at the local municipal level.						
Are any RiskMAP projects currently underway in your jurisdiction? • If so, state what projects are underway.	Yes. FEMA update to coastal maps.						
NFIP Compliance							
Note: NFIP compliance is the responsibility o	f the individual municipalities which participate in the NFIP.						
Are any certified floodplain managers on staff in your jurisdiction?	Yes. David Kvinge, Director of Environmental Planning						
Are there other local ordinances, plans or programs (e.g. site plan review) that support floodplain management and meeting the NFIP requirements? For instance, does the planning board or zoning board consider efforts to reduce flood risk when reviewing variances such as height restrictions?	County Planning Board and staff review of capital projects						

## 9.1.5 Evacuation, Sheltering, Temporary Housing, and Permanent Housing

Evacuation routes, sheltering measures, temporary housing, and permanent housing must all be in place and available for public awareness to protect residents, mitigate risk, and relocate residents, if necessary, to maintain post-disaster social and economic stability.

## **Evacuation Routes and Procedures**

Westchester County has identified the following routes and procedures to evacuate residents prior to and during an event.

• The County lacks official evacuation procedures. Existing evacuation routes may be at risk in certain hazard events. WCDES in conjunction with ARC, local municipalities, and other Westchester County Departments will lead a countywide effort to identify existing evacuation routes, identify areas for





improvement and provide recommendations as needed, and compile a comprehensive database to enhance jurisdictional planning and preparedness (action 2021-Westchester County-003).

## Sheltering

Westchester County has identified the following designated emergency shelters within the County.

## Table 9.1-11. Designated Emergency Shelters

Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided
The County lacks official sheltering procedures. Existing shelters may be at risk in certain hazard events. WCDES in conjunction with ARC, local municipalities, and other Westchester County Departments will lead a countywide effort to identify existing shelters, identify areas for improvement and provide recommendations as needed, and compile a comprehensive database to enhance jurisdictional planning and preparedness (action 2021-Westchester County-003).							

## **Temporary Housing**

Each jurisdiction must identify sites for the placement of temporary housing units to house residents displaced by a disaster. Westchester County has identified the following sites suitable for placing temporary housing units.

## Table 9.1-12. Temporary Housing Locations

Site Name	Site Address	Capacity (number of sites)	Туре	Infrastructure / Utilities Available (water, electric, septic, etc.)	Actions Required to Ensure Conformance with the NYS Uniform Fire Prevention and Building Code		
A Cc by disasters. A county departn for the placem local efforts in	Site Name         Site Address         sites)         Type         septic, etc.)         Building Code           A County-wide effort is needed to identify potential sites for placement of temporary housing for residents displaced by disasters. As part of the Planning Partnership established by the HMP, WCDES in conjunction with WC Parks other key county departments and all municipalities, will lead a countywide effort, including all municipalities, to identify potential sites for the placement of temporary housing units to house residents displaced by disaster. To improve upon ongoing County and local efforts in this regard, all communities will be surveyed to identify potential sites, including any pre-disaster actions that may be required to make them viable for these purposes (action 2021-Westchester County-004).						

## **Permanent Housing**

Structures located in the regulatory floodplain may need to be relocated due to high flood risk or new properties must be built once severely damaged properties are demolished. Jurisdictions must identify suitable sites currently owned by the jurisdiction and potential sites under private ownership that meet applicable local zoning requirements and floodplain laws. Westchester County has identified the following areas suitable for relocating homes outside of the floodplain.

## **Table 9.1-13. Permanent Housing Locations**

Site Name	Site Address	Capacity (number of sites)	Туре	Infrastructure / Utilities Available (water, electric, septic, etc.)	Actions Required to Ensure Conformance with the NYS Uniform Fire Prevention and Building Code		
A Co of the floodp local efforts in may be requi cannot ident	A County-wide effort is needed to identify potential sites within the community suitable for relocation of houses out of the floodplain or building new houses once properties in the floodplain are razed. To improve upon ongoing County and local efforts in this regard, all communities will be surveyed to identify potential sites, including any pre-disaster actions that may be required to make them viable for these purposes. In the case of municipalities that are fully built-out, or otherwise cannot identify suitable areas, that shall be noted and considerations shall be made regarding suitable areas in neighboring communities. or otherwise throughout the County (action 2021-Westchester County-004)						





## 9.1.6 Growth/Development Trends

Understanding how past, current, and projected development patterns have or are likely to increase or decrease risk in hazard areas is a key component to understanding a jurisdiction's overall risk to its hazards of concern. Table 9.1-14 summarizes recent and expected future development trends, including major residential/commercial development and major infrastructure development.

## Table 9.1-14. Recent and Expected Future Development

Type of Development	2015	2016	2017	2018	2019	2020	
Number of Building Permits for New Construction Issued Since the Previous HMP* (within regulatory floodplain/ Outside							
regulatory floodplain)							
Building permits are issued by individual municipalities within Westchester County.							

## 9.1.7 Jurisdictional Risk Assessment

The hazard profiles in Section 5 (Risk Assessment) provide detailed information regarding each plan participant's vulnerability to the identified hazards. Refer to Section 5.2 (Methodology and Tools) and Section 5.4 (Hazard Ranking) for a detailed summary for Westchester County's risk assessment results and data used to determine the hazard ranking discussed later in this section.

Hazard area extent and location maps were generated to illustrate the probable areas impacted within the jurisdiction. These maps are based on the best available data at the time of the preparation of this plan and are adequate for planning purposes. Maps have been generated only for those hazards that can be clearly identified using mapping techniques and technologies and for which Westchester County has significant exposure. The maps also show the location of potential new development, where available. Countywide maps are found in the Hazard Profiles (Section 5.4). Maps for each municipality are found in each municipal annex (Sections 9.2 through 9.46).

## **Hazard Event History**

Westchester County has a history of natural and non-natural hazard events as detailed in Volume I, Section 5 (Risk Assessment) of this plan. A summary of historical events is provided in each of the hazard profiles and includes a chronology of events that have affected the county and its municipalities.

Westchester County's history of federally-declared (as presented by FEMA) and significant hazard events (as presented in NOAA-NCEI) is consistent with that of Westchester County. Table 9.1-15 provides details regarding municipal-specific loss and damages the County experienced during hazard events since the last hazard mitigation plan update. Information provided in the table below is based on reference material or local sources. For details of these and additional events, refer to Volume I, Section 5.0 of this plan.

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Municipal Summary of Damages and Losses
February 13, 2017	High Wind	No	Low pressure passed to the east of Westchester County and rapidly deepened, resulting in strong winds with gusts exceeding 70 mph.	High winds caused scattered downed trees throughout the county.
March 2, 2018	High Wind	No	A deep area of low pressure passed off the coast resulting in strong winds with gusts exceeding 70 mph.	High winds downed trees throughout the county resulting prolonged power outages.

## Table 9.1-15. Hazard Event History


Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Municipal Summary of Damages and Losses
April 13, 2020	High Wind	No	Deep low pressure passed to the west of the area resulting in high winds with gusts near 70 mph.	No major County impacts were reported.
August 4, 2020	Tropical Storm (DR-4567)	Yes	Tropical Storm Isaias passed over the region, resulting in high winds with gusts between 60-80 mph.	High winds downed trees and power lines throughout the county resulting in widespread debris, blocked roadways and power outages resulted in an estimated 5.9-million-dollar cost impact county-wide with 2.3 million dollars incurred by the county alone.
January 20, 2020 – Present	Covid-19 Pandemic (EM-3434) (DR-4480)	Yes	Between March 1, 2020 and June 6, 2021, Westchester County reported 129,488 confirmed cases of COVID-19, and 2,284 total fatalities.	Severe disruption to healthcare, business and social sectors.
March 14, 2021	Nor'easter	No	Blizzard conditions occurred over portions of the Northeast with snowfall totals of 1' to 2' across the interior lower Hudson Valley.	Significant transportation impacts, power outages and snow removal operations – resulted in an estimated cost impact of over 2 million dollars county-wide.
September 2, 2021	Flood	TBD	Remnants of Hurricane Ida led to heavy rainfall and severe flooding across the region.	Flash flooding and severe urban flooding led to extensive property damage and numerous fatalities.

Notes:

EM Emergency Declaration (FEMA) FEMA Federal Emergency Management Agency DR Major Disaster Declaration (FEMA)

N/ANot applicable

## Hazard Ranking and Vulnerabilities

The hazard profiles in Section 5.0 (Risk Assessment) of this plan have detailed information regarding each plan participant's vulnerability to the identified hazards. The following summarizes Westchester County's risk assessment results and data used to determine the hazard ranking.

#### Hazard Ranking

This section provides the community specific identification of the primary hazard concerns based on identified problems, impacts and the results of the risk assessment as presented in Section 5 (Risk Assessment) of the plan. The ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property, and the economy as well as community capability and changing future climate conditions. This input supports the mitigation action development to target those hazards with highest level of concern.

As discussed in Section 5.3 (Hazard Ranking), each participating jurisdiction may have differing degrees of risk exposure and vulnerability compared to Westchester County as a whole. Therefore, each municipality ranked the degree of risk to each hazard as it pertains to their community. The table below summarizes the hazard risk/vulnerability rankings of potential natural hazards for Westchester County. Westchester County has reviewed the county hazard risk/vulnerability risk ranking table as well as its individual results to reflect the relative risk of the hazards of concern to the community.

During the review of the hazard/vulnerability risk ranking, the County indicated the following:





The County agreed with the following hazard rankings.

## Table 9.1-16. Hazard Ranking Input

Disease Outbreak	Earthquake	Extreme Temperature	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN
Medium	Medium	Medium	High	High	Medium	Low	Low

Note: The scale is based on the hazard rankings established in Section 5.3 and modified as appropriate during review by the jurisdiction

#### Critical Facilities

New York State Department of Environmental Conservation (DEC) Statute 6 CRR-NY 502.4 sets forth floodplain management criteria for State projects located in flood hazard areas. The law states that no such projects related to critical facilities shall be undertaken in a Special Flood Hazard Area (SFHA) unless constructed according to specific mitigation specifications, including being raised 2' above the Base Flood Elevation (BFE). This statute is outlined at <u>http://tinyurl.com/6-CRR-NY-502-4</u>. While all vulnerabilities should be assessed and documented, the State places a high priority on exposure to flooding. Critical facilities located in an SFHA, or having ever sustained previous flooding, must be protected to the 0.2-percent annual chance flood event, or worst damage scenario. For those that do not meet these criteria, the jurisdiction must identify an action to achieve this level of protection (NYS DHSES 2017).

The table below identifies critical facilities in the community located in the 1-percent and 0.2-percent floodplain and presents Hazards United States (HAZUS) – Multi-Hazards (MH) estimates of the damage and loss of use to critical facilities as a result of a 1-percent annual chance flood event.

		Exp	osure	Potential 1% Floo	Loss from d Event	
Name	Туре	1% Event	0.2% Event	Percent Structure Damage	Percent Content Damage	Addressed by Proposed Action
County Road Maintenance Garage	County Building	Х	Х	0.0	0.2	2021- Westchester County-005
35 Alexander Street	County Building	Х	Х	0.0	0.0	2021- Westchester County-005
'COUNTY ROAD 310'	Bridge	Х	Х	0.0	0.0	2021- Westchester County-005
'COUNTY ROAD 306'	Bridge	Х	Х	0.0	0.0	2021- Westchester County-005
County Center	DPW	-	Х	0.0	0.0	-
Westchester County, Yonkers Joint Treatment Plant Wharf	Port Facility	Х	Х	8.5	28.5	2021- Westchester County-019
Westchester County WD #1	Potable Water Treatment Facility	Х	Х	0.0	0.0	2021- Westchester County-019

#### Table 9.1-17. Potential Flood Losses to Critical Facilities

Source: Westchester HMP; FEMA 2007





## **Identified Issues**

After review of Westchester County's hazard event history, hazard rankings, jurisdiction specific vulnerabilities, hazard area extent and location, and current capabilities, Westchester County has identified the following vulnerabilities within their community:

- The Bronx River channel has drifted against the wall supporting the Bronx River Parkway. This could result in damages to the wall and the Parkway.
- The Sheldrake-Mamaroneck Rivers area requires flood mitigation.
- The County lacks official evacuation and sheltering procedures. Existing evacuation routes and shelters may be at risk in certain hazard events.
- A County-wide effort is needed to identify potential sites for placement of temporary housing for residents displaced by disasters, as well as the identification of sites suitable for the relocation of houses out of the floodplain (acquisition, relocation).
- A comprehensive list of critical facilities and lifeline facilities is needed to support enhanced vulnerability/risk assessment, and emergency management planning, preparedness, response and recovery activities and programs.
- Critical facilities require backup power to maintain continuity of operations. The WC Public Works Central County Garage lacks a backup power source. Public Works provides critical services before, during, and after hazard events.
- Power failure can result in the shutdown of traffic signals, leading to safety concerns, traffic, and emergency access issues.
- County facilities should be able to stand snow loads on rooves.
- The shoreline at the Edith Read Sanctuary/Rye Playland is exposed to wave action during storm events and experiences erosion.
- Bridges over Fulton Brook to the north of the County Center are degraded and require rehabilitation/ replacement to prevent damage or failure during flooding and storm events.
- Coastal areas of Westchester County are at risk of today's hazard impacts and heightened risk in the future due to sea level rise and climate change. Impacts include flood and storm damages and storm system backups. A study needs to be completed for the county's coastal areas to determine cost effective measures that can be taken to increase and sustain the County's resiliency.
- The County has numerous communities that have significant flood risk that would benefit from applying to join the Community Rating System program. Municipalities have noted a lack of resources or knowledge of the program as being an obstacle to joining.
- 112 134 E Post Road in White Plains serves as a medical storage facility for the department of health. Over the last two years the facility has had new refrigeration and freezer units installed to assist with the storage and distribution of vaccines. Temperature control is necessary to keep vaccines for coronavirus and other medication viable. While the facility has backup power, it is unknown if these refrigeration in freezer units are connected to the backup power supply. It is also unknown if the current generator has sufficient capacity to power these units.
- 25 Moore Avenue in Mount Kisco houses the Department of Health for Westchester County. The building currently lacks a backup power source. Loss of power results in the prevention of the Department from providing critical services.
- The County includes many major roadways and rail lines which could potentially be impacted by a CBRN spill or release. Many areas of the county also have fixed site facilities where spill or release could originate from. While the county has staff to identify and address these events, additional support through additional County staff or trained local officials would greatly improve the county's capabilities.





- Warming and cooling centers are set up by local municipalities during extreme temperature events. Westchester County's municipalities are actively working to expand warming and cooling center capabilities and offerings. New York State often requests information from the Department of Health on the location and services that will be offered to respond to extreme temperature events. As this information is often in flux, a streamlined process to determine what facilities will be available for specific events needs to be developed.
- The development of this hazard mitigation plan update can be used to supplement outreach currently being conducted on natural hazards. Increased frequency of heavy rainfall events and future impacts from climate change warrant additional hazard mitigation outreach efforts.
- The County has completed a survey of pump stations that may be exposed to flooding and currently lack flood protections. Roughly two dozen pump stations were identified during this survey. Since the survey was completed, heavy rainfall events such as Ida have resulted in flooding outside of the typical floodplain. The exposure of the County's pump stations needs to be re-evaluated to include urban flooding impacts.
- The County's treatment plants are exposed to flooding. Work has been completed at many plants 2 provide better flood protection. However, increased frequency of heavy rainfall events and future impacts from climate change warrant additional evaluation and higher levels of protection.
- During heavy flooding events, backflow is a recurring issue in flood prone neighborhoods. The county has worked to address this in the past through a program designed to provide support to municipalities installing backflow prevention devices. While a majority of the work has been completed, there are still areas that would benefit from backflow prevention.
- The Pocantico River is floodprone. A study of sources of flooding and identification of potential mitigation actions needs to be completed.
- Flooding is a major concern throughout Westchester County. One of the major obstacles for implementation of actions at the local level is funding. The County has developed a flood funding assistance program to provide up to 50 percent financial match for flood mitigation projects. However, many municipal officials are not fully aware of this program and the opportunities it may provide.

Specific areas of concern based on resident response to Westchester County Hazard Mitigation Citizen survey include:

- Lack of redundancy and backup signal at cell phone towers. Insufficient wireless communication towers in large swaths of northern Westchester leave elderly and other residents without ability to contact authorities or seek help during frequent disaster/weather events. Cell phone signal must be increased.
- Generally rising sea level due to storms causes all storm system backups
- Saw Mill River watershed stormwater runoff has caused significant damage to private property, municipal facilities, and private sector during numerous high precipitation events.
- Flooding occurs on the Saw Mill Parkway, Route 9A, the Hutch River Parkway, and the Bronx River Parkway.
- Up and down the Bronx River; coastal flooding occurs, particularly in Mamaroneck.
- Water treatment plants are unable to process all the water during storms and release untreated waste water into the Sound.
- Route 6 between Sunnyside Street and Barger Street experiences flooding in both directions that closes lanes and potentially the entire roadway, depending on the amount of rainfall.
- Indian Point Plant has always been a concern, but now with the high-pressure gas pipelines running through the site, the situation is of far greater concern.

# 9.1.8 Mitigation Strategy and Prioritization





This section discusses past mitigations actions and status, describes proposed hazard mitigation initiatives, and their prioritization.

#### **Past Mitigation Initiative Status**

The following table indicates progress on the community's mitigation strategy identified in the 2015 HMP. Actions that are carried forward as part of this plan update are included in the following subsection in its own table with prioritization. Previous actions that are now on-going programs and capabilities are indicated as such in the following table and may also be found under 'Capability Assessment' presented previously in this annex.





### Table 9.1-18. Status of Previous Mitigation Actions

Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
WCDP-1 (LOI #903)	Westchester County Stream and Weather Monitoring Program:	Flood, Severe Storm	Westchester County Dept. of Planning (WCDP)	The proposed stream and weather monitoring program is intended to address these data needs, developing and implementing a program to better understand how the watersheds in the county respond to a variety of precipitation events.	No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Reevaluating program and pursuing project components individually.</li> </ol>
WCDP-2	Mamaroneck River Restoration Project Phase II:	Flood, Severe Storm, Severe Winter Storm	WCDP, PRC	Remove invasive vegetation, embankment stabilization, and re- planting in the area of Saxon Woods Park along the Mamaroneck River in the Town of Mamaroneck. The design of the project is complete and the bond authorization is granted. Construction to begin in 2015.	Complete	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Project completed.</li> </ol>
WCDP-3	Flood Mitigation Project South of Harney Road, BRP Reservation:	Flood, Severe Storm, Severe Winter Storm	WCDP, WC DPW&T, PRC	Remove substantial amount of coarse sediment from Bronx River channel, stabilize river banks, and construct river channel low improvement structures in the Bronx River south of Harney Road in Eastchester and Yonkers. Design has been completed	Complete	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>2.</li> <li>3. Project completed.</li> </ol>





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
				and bonding authorized. Construction to begin in 2016.			
WCDP-4	Flood Mitigation Project at Garth Woods, BRP Reservation:	Flood, Severe Storm, Severe Winter Storm	WCDP, WC DPW&T, PRC	Re-direct the Bronx River channel away from the wall supporting the Bronx River Parkway in the area of Garth Woods and the Bronx River in Eastchester and Yonkers. Construction to begin in 2016.	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Project in design for 2022.</li> <li>Applied for grant funding for 2023 construction.</li> </ol>
WCDP-5	Bronx River and Sprain Brook:	Flood, Severe Storm, Severe Winter Storm	WCDP, WC DPW&T, PRC	Project will remove the large sediment deposit at the confluence and stabilize the stream banks at the confluence of the Bronx River and Grassy Sprain Brook within the Bronx River Reservation. The survey for the project has been completed and the design is underway. Construction to begin in 2016.	Complete	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Project completed.</li> </ol>
WCDP-6	Flood Mitigation Project at Anita Lane/Valley Place on Mamaroneck River:	Flood, Severe Storm, Severe Winter Storm	WCDP, WC DPW&T, WC DEF	Replace existing bridge carrying county sewer pipe over Mamaroneck River with a new bridge that will enable improved flow in river channel during severe storms in the Village of Mamaroneck at Anita Lane. The project is	Complete	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>Project completed – flood mitigation component was not constructed due to SHPO review comments.</li> </ol>





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
				the design phase and construction is anticipated for 2016- 2017.			
WCDP-7	Sheldrake- Mamaroneck Rivers General Reevaluation Report by USACE:	Flood, Severe Storm, Severe Winter Storm	USACE, NYSDEC, WCDP, WC DPW&T with the support of the Village of Mamaroneck	Partnership among USACE, NYS DEC and Westchester County, led by USACE, to re-study flood mitigation options and develop specific recommendation for Mamaroneck Village. Study anticipated to be completed by end of 2015.	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Project in progress, awaiting funding.</li> <li>3.</li> </ol>
WCDP-8	Stormwater management along Fulton Brook:	Flood, Severe Storm, Severe Winter Storm	WCDP, WC DPW&T PRC	Stormwater management practices and embankment stabilization in the area Bronx River Reservation near County Center and White Plains. Construction anticipated for 2016.	Complete	Cost: Level of Protection: Damages Avoided; Evidence of Success:	1. Discontinue 2. 3. Complete
WCDP-9	Provide information and technical resources to assist municipalities in meeting the requirements of the NFIP, enrolling in the CRS and related activities.	Flood, Severe Storm, Severe Winter Storm	WCDP, WCDES/OEM		Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>Ongoing Capability</li> </ol>
WCDP- 10	Sponsor or co- sponsor technical workshops for municipal officials, board members and design professionals on hazard	All Hazards	WCDP, WCSWCD		Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>Ongoing Capability</li> </ol>





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
	mitigation tools and techniques.						
WCDP- 11	Provide funding assistance to municipalities for projects addressing problem areas identified in County Stormwater Reconnaissance Plans.	Flood, Severe Storm, Severe Winter Storm	WCDP, WCDPW&T		Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>Ongoing Capability. Currently one active project, one active study, two proposed projects and two proposed studies.</li> </ol>
WCDES-1	County-Wide Evacuation Route and Shelter Planning Initiative: A County-wide effort to identify existing evacuation routes and shelters, and compile a comprehensive database to enhance jurisdictional planning and preparedness.	Flood, Severe Storm, Severe Winter Storm, Earthquake, CBRN	WCDES, with support of all municipalities and ARC	WCDES in conjunction with ARC, local municipalities, and other WC Departments will lead a countywide effort to identify existing evacuation routes and shelters, identify areas for improvement and provide recommendations as needed, and compile a comprehensive database to enhance jurisdictional planning and preparedness. Creating a centralized inventory of evacuation routes and shelters will enhance awareness of established routes and shelter locations, reduce potential for conflicting routing, and expedite decision	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	1. Include in HMP Update 2. No change 3.



Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
				making for evacuations and sheltering during times of emergencies and disasters.			
WCDES-2	County-Wide Disaster Housing Location/Relocation Planning Initiative for Disaster Displaced Residents and Structures: A County-wide effort to identify potential sites for placement of temporary housing for residents displaced by disasters, as well as the identification of sites suitable for the relocation of houses out of the floodplain (acquisition, relocation).	Flood, Severe Storm, Severe Winter Storm, Earthquake	WCDES, WC Parks, with support of all municipalities	As part of the Planning Partnership established by the HMP, WCDES in conjunction with WC Parks other key county departments and all municipalities, will lead a countywide effort, including all municipalities, to identify potential sites for the placement of temporary housing units to house residents displaced by disaster; sites within the community suitable for relocation of houses out of the floodplain, or building new houses once properties in the floodplain are razed. To improve upon ongoing County and local efforts in this regard, all communities will be surveyed to identify potential sites, including any pre- disaster actions that may be required to make them viable for	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	1. Include in HMP Update 2.Revise to be consistent with current DHSES requirements 3.



							Next Steps
					Status		1. Project to be included in 2021
		- <del>-</del> -			(In Progress,		HMP or Discontinue
#		sei [[s]		Brief Summary of	Ongoing		2. If including action in the 2021
ect		res		the Original	Capability, No		HMP, revise/reword to be
joj.		aza	Responsible	Problem and the	Progress,	Evaluation of Success	more specific (as appropriate).
<u> </u>	Project Name	Ψ	Party	Solution (Project)	Complete)	(if complete)	3. If discontinue, explain why.
				these purposes. In the			
				case of municipalities			
				that are fully built-out,			
				or otherwise cannot			
				identify suitable areas,			
				that shall be noted and			
				considerations shall be			
				made regarding			
				suitable areas in			
				neighboring			
				communities, or			
				otherwise throughout			
				the County.			
				WC Parks has a			
				number of park			
				facilities throughout			
				the county that are, or			
				could be made.			
				suitable for locating			
				temporary housing -			
				large payed areas in			
				proximity to services			
				(electricity, water,			
				waste disposal) and			
				nublic facilities			
				(restrooms showers)			
				As part of this			
				initiative the County			
				will continue to assess			
				the suitability of these			
				sites to support			
				temporary housing and			
				other emergency			
				management and			
				recovery functions and			
				operations and			
				provide			
				recommendations for			
				recommendations for			



Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
				improvements (e.g. upgrades to existing facilities and infrastructure, new facilities and infrastructure). Planning for temporary housing sites will shorten schedules and reduce costs of both short and long term housing needs that are used in emergencies and are obtained in a slow and complicated process at premium prices.			
WCDES- 3	Build Local Floodplain Management and Disaster Recovery Capabilities:	All Hazards	WCDES, as supported by WCDP, NYS DHSES, FEMA and ISO; with participation of all municipalities and other County department and agencies	<ul> <li>Facilitate Workshops and Seminars to build County and local capabilities in floodplain management, mitigation and disaster recovery:</li> <li>NFIP Community Rating System (CRS)</li> <li>Benefit-Cost Analysis (BCA)</li> <li>Substantial Damage Estimating (SDE)</li> <li>NFIP Elevation Certificates (EC)</li> <li>Certified Floodplain Manager (CFM)</li> </ul>	Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Already facilitate information as made available by host organizations (FEMA, DEC, DHSES)</li> </ol>



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Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
				Certification See also WCDP-9 and WCDP-10.			
WCDES- 4	Create a Multi- Jurisdictional Access and Functional Needs Preparedness Committee in Westchester County: One of the most important roles of local government is to protect their citizenry from harm, including helping people prepare for and respond to emergencies. Making local government emergency preparedness and response programs accessible to people with disabilities is a critical part of this responsibility. Making these programs accessible is also required by the Americans with Disabilities Act of 1990 (ADA).	All Hazards	WCDES; working with WC DSS	Westchester County would like to facilitate and participate in a Multi-Jurisdictional Access and Functional Needs Safety Preparedness Committee with the towns, cities and villages in the County to assess local capabilities, evaluate existing programs versus current standards, identify areas for improvement and provide recommendations as needed. The goal of the Committee will be to provide annual improvements and education in the area of Access and Functional Needs preparedness.	Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success: Ongoing collaboration with technical experts to review key emergency preparedness policies and procedures.	<ol> <li>Discontinue</li> <li>3.Completed and now ongoing capability</li> </ol>
WCDES- 5	Develop comprehensive county-wide Critical Facility	All Hazards	WCDES working along with WCDoIT,	Depending on the availability of funding, this database could be enhanced to	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	1. Include in HMP Update 2.Revise to incorporate FEMA Community Lifelines 3.



Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
	database: Working along with Westchester County Department of Information Technology (WCDoIT) GIS, critical facility owners (stakeholders) and all municipalities, develop and maintain a comprehensive database of critical facilities through the county to support enhanced vulnerability/risk assessment, and emergency management planning, preparedness, response and recovery activities and programs.		municipalities and stakeholders	better support an assessment of seismic risk at critical facilities throughout the County, using data collection methods and tools such as FEMA's Rapid Observation of Vulnerability and Estimation of Risk (ROVER) and Rapid Visual Screening (RVS) techniques.			
DPW&T- 1	Install backup power (generator) at the WC Public Works Central County Garage at Brockway Place in White Plains – Due to ground space restrictions, this may require roof mounting.	All hazards resulting in loss of power		WC DPW&T - Building, Roads, Bridges	No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>3.</li> </ol>
DPW&T- 2	Traffic Signal Back Up Power: Continue to	All hazards resulting in		WC DPW&T - Building, Roads, Bridges; working with	In Progress	Cost: Level of Protection:	<ol> <li>Include in HMP Update</li> <li>As of 2021, most signals are complete</li> <li>3.</li> </ol>





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
	work with municipalities and NYSDOT to install portable backup power hook-ups at critical traffic signals.	loss of power		NYSDOT and local municipalities		Damages Avoided; Evidence of Success:	
DPW&T- 3	Facility-Level Awareness of Flood Risk:	Flood; Severe Storm	Work with WC GIS to develop facility level mapping identifying flood vulnerable areas, and post at all DPW&T facilities to support awareness of on- site and local flood hazard areas.	WC DPW&T - Building, Roads, Bridges; working with WC GIS and OEM	No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Risk level determined not to be high enough to merit the level of effort for this project.</li> </ol>
DPW&T- 4	Work with WC OEM and WC GIS to develop a seismic risk facility inventory, and identify those facilities/structures with particular risk that may need to be addressed. This initiative can be supported through FEMA tools and methodologies, specifically FEMA's Rapid Observation of Vulnerability and Estimation of Risk (ROVER) and Rapid Visual Screening (RVS).	Earthquake		WC OEM and WC GIS; as supported by all County agencies with critical facilities and infrastructure	No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. Risk level determined not to be high enough to merit the level of effort for this project.</li> </ol>

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Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
DPW Trans - 1	Investigate roof retrofits to mitigate snow loading at: • Liberty Lines Central Maintenance Facility at 475 Saw Mill River Road Liberty Lines Valhalla Maintenance Facility	Severe Winter Storm		WC DPW&T – Transit, Paratransit, Airport	In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Roof systems currently being evaluated structurally for various loads including snow load and solar panels.</li> <li>3.</li> </ol>
DPW Trans - 2	PTLA Bus Shop – Elevate generator on a pad	All hazards resulting in loss of power		WC DPW&T – Transit, Paratransit, Airport	No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>The facility is contractor owned and operated and also houses only a few, inconsequential number of buses</li> </ol>





## **Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy**

Westchester County has identified the following mitigation projects/activities that have also been completed but were not identified in the previous mitigation strategy in the 2015 HMP:

- The County has established a funding program to provide a 50 percent match for Westchester municipalities looking to complete flood mitigation projects.
  - Phase I funding is for: (a) the preparation of analysis required to develop data necessary to evaluate the project against the project criteria (described briefly below) and (b) the preparation of detailed construction plans and specifications necessary for bidding purposes.
  - Phase II funding is for construction of the project. An operation and maintenance plan will be prepared during the development of detailed construction plans. All operation and maintenance costs associated with the project will be the responsibility of the municipality.

### Proposed Hazard Mitigation Initiatives for the HMP Update

Westchester County participated in a mitigation action workshop in October 2021 and was provided the following FEMA publications to use as a resource as part of their comprehensive review of all possible activities and mitigation measures to address their hazards: FEMA 551 'Selecting Appropriate Mitigation Measures for Floodprone Structures' (March 2007) and FEMA 'Mitigation Ideas – A Resource for Reducing Risk to Natural Hazards' (January 2013).

The table below indicates the range of proposed mitigation action categories.

		FE	MA				CI	RS		
Hazard	LPR	SIP	NSP	EAP	PR	PP	PI	NR	SP	ES
Disease Outbreak	Х	Χ		Х	Х		Х			Х
Earthquake	Х	Х		Х	Х		Х			Х
Extreme Temperature	Х	Х		Х	Х		Х			Х
Flood	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Severe Storm	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Severe Winter Storm	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Wildfire	Х	Х		Х	Х		Х			Х
CBRN	Х	Х		Х	Х		Х			Х

#### Table 9.1-19. Analysis of Mitigation Actions by Hazard and Category

Note: Section 6 (Mitigation Strategy) provides for an explanation of the mitigation categories.

Table 9.1-20 summarizes the comprehensive-range of specific mitigation initiatives Westchester County would like to pursue in the future to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities. Both the four FEMA mitigation action categories and the six CRS mitigation action categories are listed in the table below to further demonstrate the wide-range of activities and mitigation measures selected.

As discussed in Section 6, 14 evaluation/prioritization criteria are used to complete the prioritization of mitigation initiatives. For each new mitigation action, a numeric rank is assigned (-1, 0, or 1) for each of the 14 evaluation criteria to assist with prioritizing your actions as 'High', 'Medium', or 'Low.' The table below summarizes the evaluation of each mitigation initiative, listed by Action Number.

Table 9.1-21 provides a summary of the prioritization of all proposed mitigation initiatives for the HMP update.





### Table 9.1-20. Proposed Hazard Mitigation Initiatives

Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Westchester County-001	Flood Mitigation Project at Garth Woods, BRP Reservation:	1, 2, 4	Flood, Severe Storm, Severe Winter Storm	<ul> <li>Problem: The Bronx River channel has drifted against the wall supporting the Bronx River Parkway. This could result in damages to the wall and the Parkway.</li> <li>Solution: Re-direct the Bronx River channel away from the wall supporting the Bronx River Parkway in the area of Garth Woods and the Bronx River in Eastchester and Yonkers. Project in design for 2022. Applied for grant funding for 2023 construction.</li> </ul>	No	May require permittin g	Withing 5 years	WCDP, WC DPW&T, PRC	High	Reduction in flooding	BRIC, HMGP, County budget	High	NSP	N R
2021- Westchester County-002	Sheldrake- Mamaroneck Rivers General Reevaluation Report by USACE:	1, 2	Flood, Severe Storm, Severe Winter Storm	<ul> <li>Problem: The Sheldrake-Mamaroneck Rivers area requires flood mitigation.</li> <li>Solution: The County will continue the partnership among USACE, NYS DEC and Westchester County, led by USACE, to re-study flood mitigation options and develop specific recommendation for Mamaroneck Village. Cost-effective</li> </ul>	No	None	Within 5 years	USACE, NYSDEC, WCDP, WC DPW&T with the support of the Village of Mamaroneck	\$100 million	Increased flood protection	USACE, BRIC, HMGP, FMA, Village of Mamaronec k, County budget	Hig h	LPR , SIP	PP, SP





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution mitigation actions will be implemented.	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Westchester County-003	County-Wide Evacuation Route and Shelter Planning Initiative	1	All Hazards	Problem: The County lacks official evacuation and sheltering procedures. Existing evacuation routes and shelters may be at risk in certain hazard events. Solution: WCDES in conjunction with ARC, local municipalities, and other WC Departments will lead a countywide effort to identify existing evacuation routes and shelters, identify areas for improvement and provide recommendations as needed, and compile a comprehensive database to enhance jurisdictional planning and preparedness. Creating a centralized inventory of evacuation routes and shelters will enhance awareness of established routes and shelter locations, reduce potential for conflicting routing, and expedite decision making for evacuations and sheltering during times	Yes	None	Within 5 years	WCDES, with support of all municipalities and ARC	Staff time	Evacuation and sheltering procedures established	County budget	Hig h	LPR	ES





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution of emergencies and	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Westchester County-004	County-Wide Disaster Housing Location/Relocat ion Planning Initiative for Displaced Residents and Structures	1, 2	All Hazards	Problem: A County- wide effort is needed to identify potential sites for placement of temporary housing for residents displaced by disasters, as well as the identification of sites suitable for the relocation of houses out of the floodplain (acquisition, relocation). Solution: As part of the Planning Partnership established by the HMP, WCDES in conjunction with WC Parks other key county departments and all municipalities, will lead a countywide effort, including all municipalities, to identify potential sites for the placement of temporary housing units to house residents displaced by disaster; sites within the community suitable for relocation of houses out of the floodplain, or building new houses once properties in the floodplain are razed. To improve upon ongoing County and local efforts in this	No	None	Within 5 years	WCDES, WC Parks, with support of all municipalities	Staff time	Temporary and permanent housing locations established	County budget	Hig h	LPR	PR , ES



Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021	Davislar			regard, all communities will be surveyed to identify potential sites, including any pre- disaster actions that may be required to make them viable for these purposes. In the case of municipalities that are fully built-out, or otherwise cannot identify suitable areas, that shall be noted and considerations shall be made regarding suitable areas in neighboring communities, or otherwise throughout the County.	Ver	Nees	Within 6	WCDES	Staff time	Tint	County		LDD	ES
2021- Westchester County-005	Develop Comprehensive County-Wide Critical Facility and Lifeline Database	1, 2	All Hazards	<ul> <li>Problem: A comprehensive list of critical facilities and lifeline facilities is needed to support enhanced vulnerability/risk assessment, and emergency management planning, preparedness, response and recovery activities and programs.</li> <li>Solution: Working along with Westchester County Department of Information Technology (WCDoIT) GIS, critical facility owners (stakeholders) and all municipalities, the County will develop</li> </ul>	Yes	None	Within 5 years	WCDES working along with WCDoIT, municipalities and stakeholders	Staff time	List established to support planning and mitigation	County budget	Hig h	LPR	ES





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution and maintain a comprehensive database	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				of critical facilities										
2021- Westchester County-006	Backup Power for WC Public Works Central County Garage	1, 2	All Hazards	<ul> <li>Problem: Critical facilities require backup power to maintain continuity of operations. The WC Public Works</li> <li>Central County Garage lacks a backup power source. Public Works provides critical services before, during, and after hazard events.</li> <li>Solution: The Engineer will research what size generator is needed to power the facility. The County will then purchase and install the selected generator and necessary electrical components to supply backup power to the Public Works Central County Garage. Due to ground space restrictions, this may require roof mounting. Public Works will be responsible for maintenance and testing of the generator following installation.</li> </ul>	Yes	None	Within 5 years	WC DPW&T - Building, Roads, Bridges	High	Protect public health and safety, and ensure continued operation of critical facility and essential functions during power outages.	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Managemen t Performance Grants (EMPG) Program, County Budget	Hig h	SIP	ES
2021-	Traffic Signal	1, 2	All	Problem: Power failure	No	None	2 years	WC DPW&T		Continuity	FEMA	Hig	SIP	ES
westchester County-007	Back Up Power		Hazards	can result in the shutdown of traffic signals, leading to safety concerns, traffic,				- Building, Roads, Bridges; working with		of traffic signals	HMGP and BRIC, County budget	h		





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				and emergency access issues. Solution: The County will work with municipalities and NYSDOT to install portable backup power hook-ups at critical traffic signals.				NYSDOT and local municipalities						
2021- Westchester County-008	Snow Load Roof Retrofits	1, 2	Severe Winter Storm	<ul> <li>Problem: County facilities should be able to stand snow loads on rooves.</li> <li>Solution: The County will investigate roof retrofits to mitigate snow loading and solar panels at: <ul> <li>Liberty Lines Central Maintenance Facility at 475 Saw Mill River Road</li> <li>Liberty Lines Valhalla Maintenance Facility</li> </ul> </li> </ul>	Yes	None	2 years	WC DPW&T – Transit, Paratransit, Airport	Medium for surveys of facilities, High for necessary retrofits	Building protected from collapse	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, County Budget	Hig h	SIP	рр
2021- Westchester County-009	Living Shoreline	4	Flood, Severe Storm, Severe Winter Storm	<b>Problem</b> : The shoreline at the Edith Read Sanctuary/Rye Playland is exposed to wave action during storm events and experiences erosion.	No	May require permittin g	Within 5 years	Planning	Medium	Erosion reduced, natural shoreline restored	County budget	Hig h	NSP	N R





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				Solution: The County will design and a living shoreline for Edith Read Sanctuary/Rye Playland. The living shoreline will include a reef structure seaward of the shoreline to provide wave attenuation and reduce erosion.										
2021- Westchester County-010	Fulton Brook Bridges	1, 2	Flood, Severe Storm, Severe Winter Storm	<ul> <li>Problem: Bridges over Fulton Brook to the north of the County Center are degraded and require rehabilitation/ replacement to prevent damage or failure during flooding and storm events.</li> <li>Solution: The County will oversee the repair/retrofit/replaceme nt of degraded bridges over Fulton Brook.</li> </ul>	No	May require permittin g	Within 5 years	WC DPW&T – Transit	High	Bridges restored/reb uilt to prevent collapse	BRIC, County budget	Hig h	SIP	РР
2021- Westchester County-011	Coastal Resiliency Study	1, 2, 4	Flood, Severe Storm, Severe Winter Storm	<b>Problem</b> : Coastal areas of Westchester County are at risk of today's hazard impacts and heightened risk in the future due to sea level rise and climate change. Impacts include flood and storm damages and storm system backups. A study needs to be completed for the county's coastal areas to determine cost effective measures that can be	No	None	Within 5 years	Planning	High	Coastal resilience	BRIC, HMGP, FMA, County budget	Hig h	LPR	PP, SP





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				taken to increase and sustain the County's resiliency. Solution: The County will complete a coastal resiliency study to identify assets at risk to future coastal hazard impacts. Analysis will include buildings and infrastructure, natural systems, and areas of anticipated development. Cost- effective mitigation actions identified by the study will be implemented.										
2021- Westchester County-012	CRS Municipal Assistance Program	3	Flood	Problem: The County has numerous communities that have significant flood risk that would benefit from applying to join the Community Rating System program. Municipalities have noted a lack of resources or knowledge of the program as being an obstacle to joining. Solution: The County will establish a municipal assistance program for the CRS program that provides information and data that can be used by municipalities to	No	None	Within 5 years	Planning	Medium	Increased floodplain managemen t capabilities, reduction in flood insurance premiums for participatin g communitie s	BRIC, County budget	Hig h	LPR	All





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution support applications to	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				join the program and maintain their class rating once accepted.										
2021- Westchester County-013	Backup Power for Medical Storage Facility	1	Disease Outbreak, Severe Storm, Severe Winter Storm, Extreme Temperatur e	Problem: 112 134 E Post Road in White Plains serves as a medical storage facility for the department of health. Over the last two years the facility has had new refrigeration and freezer units installed to assist with the storage and distribution of vaccines. Temperature control is necessary to keep vaccines for coronavirus and other medication viable. While the facility has backup power, it is unknown if these refrigeration in freezer units are connected to the backup power supply. It is also unknown if the current generator has sufficient capacity to power these units. Solution: The Department of Public works will evaluate the current backup power supply for the facility and ensure that newly installed refrigeration and freezer units are included in hook up to	Yes	None	1 year	WC DPW, Department of Health	Medium	Protect Medication, medical supplies, and vaccines that require temperature control.	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Managemen t Performance Grants (EMPG) Program, County Budget	High	SIP	ES



Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution the backup power on site.	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Westchester County-014	Backup Power for Department of Health	1	Disease Outbreak, Severe Storm, Severe Winter Storm, Extreme Temperatur e	Problem: 25 Moore Avenue in Mount Kisco houses the Department of Health for Westchester County. The building currently lacks a backup power source. Loss of power results in the prevention of the Department from providing critical services. Solution: The will research what size generator is needed to power each facility. The County will then purchase and install the selected generator and necessary electrical components to supply backup power to each facility. Public Works will be responsible for maintenance and testing of each generator following installation.	Yes	None	Within 5 years	WC DPW, Department of Health	High	Protect public health and safety, and ensure continued operation of critical facility and essential functions during power outages.	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Managemen t Performance Grants (EMPG) Program, County Budget	Hig h	SIP	ES
2021- Westchester County-015	CBRN Identification and Response Training	1, 3	CBRN	<b>Problem:</b> The County includes many major roadways and rail lines which could potentially be impacted by a CBRN spill or release. Many areas of the county also have fixed site facilities where spill or release could originate from.	Yes	None	Within two years	OEM, Department of Health	Low	Increased county and local capabilities to address CBR events	County budget	Hig h	LPR	ES





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				While the county has staff to identify and address these events, additional support through additional County staff or trained local officials would greatly improve the county's capabilities. <b>Solution</b> : The County will train additional staff and offer training to local officials for the identification of CBRN spills and releases and the necessary emergency response and cleanup operations.										
2021- Westchester County-016	Regional Warming and Cooling Planning	1	Extreme Temperatur e	Problem: Warming and cooling centers are set up by local municipalities during extreme temperature events. Westchester County's municipalities are actively working to expand warming and cooling center capabilities and offerings. New York State often requests information from the Department of Health on the location and services that will be offered to respond to extreme temperature events. As this information is often in flux, a streamlined	Yes	None	2 years	OEM, Department of Health	Staff time	Increased efficiency of warming and cooling center planning	County budget	Hig h	LPR	ES





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021	Hozard Outraach	3	411	process to determine what facilities will be available for specific events needs to be developed. <b>Solution</b> : The Department of Health will work with local municipalities and New York State to evaluate the current process of designating and opening warming and cooling centers for extreme temperature events and move to streamline the flow of information between local county and state agencies to better serve the residents of Westchester County. <b>Broblem:</b> The	No	None	1 veer	Administratio	Madium	Increased	County	Hig	EAD	DI
2021- Westchester County-017	Hazard Outreach	3	AII Hazards	<b>Problem:</b> The development of this hazard mitigation plan update can be used to supplement outreach currently being conducted on natural hazards. Increased frequency of heavy rainfall events and future impacts from climate change warrant additional hazard mitigation outreach efforts. <b>Solution:</b> The County will explore additional	Νο	None	1 year	Administratio n	Medium	increased public awareness and preparednes s for hazard events	County budget	Hig h	EAP	14





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				opportunities for outreach and education regarding hazards. This will include exploration of partnerships with nonprofits and local governments to provide updated information to the general public.										
2021- Westchester County-018	Pump Station Flood Protection	2	Flood, Severe Storm	<ul> <li>Problem: The County has completed a survey of pump stations that may be exposed to flooding and currently lack flood protections. Roughly two dozen pump stations were identified during this survey. Since the survey was completed, heavy rainfall events such as Ida have resulted in flooding outside of the typical floodplain. The exposure of the County's pump stations needs to be re-evaluated to include urban flooding impacts.</li> <li>Solution: The County will complete a new evaluation of County owned pump stations and include known urban flooding locations as potential areas of flood exposure. Pump stations exposed to flooding will then be inspected to determine</li> </ul>	Yes	None	Within 5 years	Engineer, WC DPW	High	Protection of pump stations from flood damage, continuity of operations during flooding events.	BRIC, HMGP, FMA, County budget	Hig h	SIP	SP





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				level of flood protection. For those pump stations that do not have flood protections to the 500- year flood level, the County will complete an engineering analysis to determine potential solutions and implement cost effective mitigation actions identify.										
2021- Westchester County-019	Treatment Plant Flood Protection	2	Flood	<ul> <li>Problem: The County's treatment plants are exposed to flooding. Work has been completed at many plants to provide better flood protection. However, increased frequency of heavy rainfall events and future impacts from climate change warrant additional evaluation and higher levels of protection.</li> <li>Solution: The County will evaluate the flood protection of all county owned treatment plants and complete engineering assessments for those plants that are flood protection is identified to provide flood protection to the 500-year flood</li> </ul>	Yes	None	Within 5 years	Engineer, WC DPW	High	Protection of critical facility from flood damages	BRIC, HMGP, USDA Community Facilities Grant Program, County budget	Hig h	SIP	рр





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution level will be implemented.	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Westchester County-020	Backflow Prevention	2	Flood, Severe Storm	<ul> <li>Problem: During heavy flooding events, backflow is a recurring issue in flood prone neighborhoods. The county has worked to address this in the past through a program designed to provide support to municipalities installing backflow prevention devices. While a majority of the work has been completed, there are still areas that would benefit from backflow prevention.</li> <li>Solution: The County will explore additional funding opportunities to continue this program and move forward with continued partnership with local municipalities to install backflow prevention devices.</li> </ul>	No	None	2 years	WC DPW, Planning	High	Reduction in backflow during flooding events	BRIC, HMGP, County budget	Hig h	LPR , SIP	SP
2021- Westchester County-021	Flood Study for Pocantico River	1, 2, 3	Flood	<b>Problem:</b> The Pocantico River is floodprone. A study of sources of flooding and identification of potential mitigation actions needs to be completed.	No	None	Within 5 years	Planning	Medium for study	Cost- effective actions to reduce flooding impacts identified and	BRIC, HMGP, FMA, County budget	Hig h	LPR	PP, SP





Project Number	Project Name	Goals Met	Hazard(s) to be Mitigated	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimate d Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				<b>Solution:</b> The County will complete a flood study of the Pocantico River. Cost-effective mitigation actions identified will be implemented.						implemente d				
2021- Westchester County-022	County Support of Local Flood Mitigation	3	Flood	<ul> <li>Problem: Flooding is a major concern throughout Westchester County. One of the major obstacles for implementation of actions at the local level is funding. The County has developed a flood funding assistance program to provide up to 50 percent financial match for flood mitigation projects. However, many municipal officials are not fully aware of this program and the opportunities it may provide.</li> <li>Solution: The County will conduct outreach and provide workshops for interested municipalities and highlight the ability of the County's program to provide for many of the flood mitigation selected municipalities and highlight the flood mitigation selected municipalities and highlight the flood mitigation actions being identified in this HMP.</li> </ul>	No	None	1 year	Environmenta l Planning	Staff time	Municipal Officials aware of additional funding resources for flood mitigation.	County budget	Hig h	EAP	PI

#### Notes:

Not all acronyms and abbreviations defined below are included in the table.



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#### Acronyms and Abbreviations:

- CAV Community Assistance Visit
- CRS Community Rating System
- DPW Department of Public Works
- *EHP Environmental Planning and Historic Preservation*
- FEMA Federal Emergency Management Agency
- FPA Floodplain Administrator
- HMA Hazard Mitigation Assistance
- N/A Not applicable
- NFIP National Flood Insurance Program
- OEM Office of Emergency Management

#### Critical Facility:

Yes 

 Critical Facility located in 1% floodplain

#### Mitigation Category:

- Local Plans and Regulations (LPR) These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Project (SIP) These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection (NSP) These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs (EAP) These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities

#### CRS Category:

- Preventative Measures (PR) Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.
- Property Protection (PP) These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- Public Information (PI) Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.
- Natural Resource Protection (NR) Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- Structural Flood Control Projects (SP) Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- Emergency Services (ES) Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities



#### Potential FEMA HMA Funding Sources:

- FMA Flood Mitigation Assistance Grant Program
- HMGP Hazard Mitigation Grant Program
- BRIC Building Resilient Infrastructure and Communities Program

#### <u>Timeline:</u> The time required for completion of the project upon implementation

Cost:

The estimated cost for implementation.

#### <u>Benefits:</u>

A description of the estimated benefits, either quantitative and/or qualitative.



### Table 9.1-21. Summary of Prioritization of Actions

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2021-Westchester County-001	Flood Mitigation Project at Garth Woods, BRP Reservation:	1	1	1	1	1	0	0	1	1	1	1	0	1	1	11	High
2021-Westchester County-002	Sheldrake- Mamaroneck Rivers General Reevaluation Report by USACE:	1	1	1	1	1	0	1	1	1	1	1	0	1	1	12	High
2021-Westchester County-003	County-Wide Evacuation Route and Shelter Planning Initiative	1	1	1	1	1	1	1	1	1	1	1	0	1	1	13	High
2021-Westchester County-004	County-Wide Disaster Housing Location/Relocation Planning Initiative for Disaster Displaced Residents and Structures	1	1	1	1	1	1	1	1	1	1	1	0	1	1	13	High
2021-Westchester County-005	Develop Comprehensive County-Wide Critical Facility and Lifeline Database	1	1	1	1	1	1	1	1	1	1	1	0	1	1	13	High
2021-Westchester County-006	Backup Power for WC Public Works Central County Garage	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Westchester County-007	Traffic Signal Back Up Power	1	1	1	1	1	0	0	1	1	1	1	1	1	1	12	High
2021-Westchester County-008	Snow Load Roof Retrofits	1	1	1	1	1	1	0	1	1	1	0	1	1	1	12	High
2021-Westchester County-009	Living Shoreline	1	1	1	1	1	0	1	1	1	1	1	0	1	1	12	High
2021-Westchester County-010	Fulton Brook Bridges	1	1	1	1	1	0	0	1	1	1	1	0	1	1	11	High
2021-Westchester County-011	Coastal Resiliency Study	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High





Project Number	Project Name	- Life Safety	- Property Protection	- Cost-Effectiveness	- Technical	- Political	- Legal	- Fiscal	- Environmental	- Social	- Administrative	• Multi-Hazard	- Timeline	- Agency Champion	Other Community Objectives	5 Total	High / Medium / Low
County-012	Assistance Program	1	1	1	1	1	1	1	1	1	1	0	1	1	1	13	High
2021-Westchester County-013	Backup Power for Medical Storage Facility	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Westchester County-014	Backup Power for Department of Health	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13	High
2021-Westchester County-015	CBRN Identification and Response Training	1	1	1	1	1	1	1	1	1	1	0	1	1	1	13	High
2021-Westchester County-016	Regional Warming and Cooling Planning	1	1	1	1	1	1	1	1	1	1	0	1	1	1	13	High
2021-Westchester County-017	Hazard Outreach	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	High
2021-Westchester County-018	Pump Station Flood Protection	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Westchester County-019	Treatment Plant Flood Protection	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Westchester County-020	Backflow Prevention	1	1	1	1	1	0	0	1	1	1	1	1	1	1	12	High
2021-Westchester County-021	Flood Study for Pocantico River	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Westchester County-022	County Support of Local Flood Mitigation	1	1	1	1	1	1	1	1	1	1	0	1	1	1	13	High

Note: Refer to Section 6, which conveys guidance on prioritizing mitigation actions. Low (0-4), Medium (5-8), High (9-14).




# 9.1.9 Action Worksheets

The following action worksheets have been developed by Westchester County to aid in the submittal of grant applications to support the funding of high priority proposed actions.





		Action V	Norks	Action Worksheet						
Project Name:	Backup Power for W	C Public	Work	s Central County Gar	rage					
Project Number:	2021-Westchester Co	ounty-00	6							
Risk / Vulnerability										
Hazard(s) of Concern:	All Hazards									
Description of the Problem:	Critical facilities require backup power to maintain continuity of operations. The WC Public Works Central County Garage lacks a backup power source. Public Works provides critical services before, during, and after hazard events.									
Action or Project Intended	for Implementation	l								
Description of the Solution:	The Engineer will research what size generator is needed to power the facility. The County will then purchase and install the selected generator and necessary electrical components to supply backup power to the Public Works Central County Garage. Due to ground space restrictions, this may require roof mounting. Public Works will be responsible for maintenance and testing of the generator following installation.									
Is this project related to a	Critical Facility? Yes 🛛 No 🗌									
Is this project related to a located within the 100-y	e a Critical Facility -year floodplain?									
(If yes, this project must intend t	to protect the 500-year f	lood ever	nt or th	e actual worse case da	mage so	cenario, whichever is greater)				
Level of Protection:	N/A		Estimated Benefits (losses avoided):			Protect public health and safety, and ensure continued operation of critical facility and essential functions during power outages.				
Useful Life:	20 years		Goals Met:			1, 2				
Estimated Cost:	High		Mitigation Action Type:		:	Structure and Infrastructure Projects (SIP)				
Plan for Implementation										
Prioritization:	High		Desired Timeframe for Implementation:		•	Within 5 years				
Estimated Time Required for Project Implementation:	1 year		Potential Funding Sources:		ces:	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Management Performance Grants (EMPG) Program, Municipal Budget				
Responsible Organization:	WC DPW&T - Build Roads, Bridges	ling,	Loca to be Imp	ll Planning Mechan e Used in lementation if any:	isms	Hazard Mitigation, Emergency Management				
Three Alternatives Conside	ered (including No A	ction)								
	Action		E	stimated Cost	Evaluation					
	No Action			\$0	117	Problem continues.				
Alternatives:	Install solar pane	els		\$100,000	amo e	eather dependent; need large ount of space for installation; xpensive if repairs needed				
	Install wind turbi	ne	\$100,000		Wea to v	Weather dependent; poses a threat to wildlife; expensive repairs if needed				
Progress Report (for plan i	maintenance)									
Date of Status Report:										
Report of Progress:										
Update Evaluation of the Problem and/or Solution:										





Action Worksheet						
Project Name:	Backup Power for WC Pu	blic Works Central County Garage				
Project Number:	2021-Westchester County	7-006				
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate				
Life Safety	1	Project will protect critical services of Central County Garage				
Property Protection	1	Project will protect Central County Garage from power loss.				
Cost-Effectiveness	1					
Technical	1	The project is technically feasible				
Political	1					
Legal	1	The County has the legal authority to complete the project.				
Fiscal	0	Project requires funding support.				
Environmental	1					
Social	1					
Administrative	1					
Multi-Hazard	1	All Hazards				
Timeline	0	Within 5 years				
Agency Champion	1	WC DPW&T - Building, Roads, Bridges				
Other Community Objectives	1					
Total	12					
Priority (High/Med/Low)	High					





		Action V	Norks	heet				
Project Name:	Pump Station Flood	Protectio	n					
Project Number:	2021-Westchester C	County-01	8					
Risk / Vulnerability	1							
Hazard(s) of Concern:	Flood, Severe Storn	Flood, Severe Storm						
Description of the Problem:	The County has con currently lack flood survey. Since the su flooding outside of to be re-evaluated to	The County has completed a survey of pump stations that may be exposed to flooding and currently lack flood protections. Roughly two dozen pump stations were identified during this survey. Since the survey was completed, heavy rainfall events such as Ida have resulted in flooding outside of the typical floodplain. The exposure of the County's pump stations needs to be re-evaluated to include urban flooding impacts.						
Action or Project Intended	or Project Intended for Implementation The County will complete a new evaluation of County owned pump stations and include							
Description of the Solution:	known urban flooding locations as potential areas of flood exposure. Pump stations exposed to flooding will then be inspected to determine level of flood protection. For those pump stations that do not have flood protections to the 500-year flood level, the County will complete an engineering analysis to determine potential solutions and implement cost effective mitigation actions identify							
Is this project related to a	Critical Facility? Yes 🛛 No 🗌							
Is this project related to a located within the 100-y	e a Critical Facility -year floodplain? Yes 🖂 No 🗌							
(If yes, this project must intend to protect the 500-year flood event or the actual worse case damage scenario, whichever is greater)								
Level of Protection:	500-year flood l	0-year flood level		Estimated Benefits (losses avoided):			Protection of pump stations from flood damage, continuity of operations during flooding events	
Useful Life:	TBD by evalua	tion	Goal	s Met	:			2
Estimated Cost:	TBD by evalua	tion	Miti	gatior	n Action	n Type:		Structure and Infrastructure Projects (SIP)
Plan for Implementation								
Prioritization:	High		Desi Imp	red T lemen	'imefrar ntation:	me for		Within 5 years
Estimated Time Required for Project Implementation:	1 year		Pote	ntial	Fundin	g Sourc	es:	BRIC, HMGP, FMA, County budget
Responsible Organization:	Engineer, WC DPW	T	Loca to be Impl	l Plan e Usec lemen	nning M d in ntation i	echanis if any:	sms	Hazard Mitigation, Stormwater Management
Three Alternatives Conside	ered (including No	Action)			. 10			
	Action No Action		E	stima	so So	st		Evaluation Problem continues
Alternatives:	Relocate pump sta	ations	50 N/A			Not possible		
	Build levee around stations	l pump		Ν	√A		No	space for full levee system
Progress Report (for plan i	maintenance)		L			1		
Date of Status Report:								
Report of Progress:								
Update Evaluation of the Problem and/or Solution:								





Action Worksheet					
Project Name:	Pump Station Flood Prote	ection			
Project Number:	2021-Westchester County	7-018			
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate			
Life Safety	1	Project will protect critical services of pump stations			
Property Protection	1	Project will protect pump stations from flood damage.			
Cost-Effectiveness	1				
Technical	1				
Political	1				
Legal	1	The County has the legal authority to complete the project.			
Fiscal	0	Project requires funding support.			
Environmental	1				
Social	1				
Administrative	1				
Multi-Hazard	1	Flood, Severe Storm			
Timeline	0	Within 5 years			
Agency Champion	1	Engineer, WC DPW			
Other Community Objectives	1	Protection of critical services			
Total	12				
Priority (High/Med/Low)	High				





		Action V	Vorks	heet			
Project Name:	Treatment Plant Flo	od Protect	tion				
Project Number:	2021-Westchester C	County-019	9				
Risk / Vulnerability							
Hazard(s) of Concern:	Flood, Severe Storn	1					
Description of the Problem:	The County's treatm plants to provide be events and future im of protection.	The County's treatment plants are exposed to flooding. Work has been completed at many plants to provide better flood protection. However, increased frequency of heavy rainfall events and future impacts from climate change warrant additional evaluation and higher levels of protection.					
Action or Project Intended	for Implementatio	n			. 0.11		
Description of the Solution:	he The County will evaluate the flood protection of all county owned treatment plants and complete engineering assessments for those plants that are flood prone. Cost effective mitigation actions identified to provide flood protection to the 500-year flood level will be implemented.						
Is this project related to a	a Critical Facility? Yes 🛛 No 🗌						
Is this project related to a located within the 100-y	Critical Facility ear floodplain?	Yes	$\boxtimes$	No			
(If yes, this project must intend t	o protect the 500-year	flood even	t or th	e actua	ıl worse cas	se damage sc	enario, whichever is greater)
Level of Protection:	500-year flood level		Estimated Benefits (losses avoided):			Protection of critical facility from flood damages	
Useful Life:	TBD by evalua	tion	Goals Met:			2	
Estimated Cost:	TBD by evalua	tion	Mitigation Action Type:		уре:	Structure and Infrastructure Projects (SIP)	
Plan for Implementation							
Prioritization:	High		Desired Timeframe for Implementation:		e for	Within 5 years	
Estimated Time Required for Project Implementation:	1 year		Potential Funding Sources:		Sources:	BRIC, HMGP, USDA Community Facilities Grant Program, County budget	
Responsible Organization:	Engineer, WC DPW	Ţ	Local Planning Mechanisms to be Used in Implementation if any:		chanisms any:	Hazard Mitigation	
Three Alternatives Conside	ered (including No	Action)					
	Action		E	stima	ted Cost		Evaluation
Altornativos	No Action	mlanta	\$0 N/A			Problem continues.	
Alter hatives.	Build levee around to	reatment	N/A N/A No		No	space for full levee system	
Progress Report (for plan r	naintenance)						
Date of Status Report:							
Report of Progress:							
Update Evaluation of the Problem and/or Solution:							





Action Worksheet					
Project Name:	Treatment Plant Flood Pr	otection			
Project Number:	2021-Westchester County	<i>y</i> -019			
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate			
Life Safety	1	Project will protect critical services of treatment plants			
Property Protection	1	Project will protect treatment plants from flood damage.			
Cost-Effectiveness	1				
Technical	1				
Political	1				
Legal	1	The County has the legal authority to complete the project.			
Fiscal	0	Project requires funding support.			
Environmental	1				
Social	1				
Administrative	1				
Multi-Hazard	1	Flood, Severe Storm			
Timeline	0	Within 5 years			
Agency Champion	1	Engineer, WC DPW			
Other Community Objectives	1	Protection of critical services			
Total	12				
Priority (High/Med/Low)	High				





# 9.31 Town/Village of Harrison

This section presents the jurisdictional annex for the Town/Village of Harrison. It includes resources and information to assist public and private sectors to reduce losses from future hazard events. This annex is not guidance of what to do when a disaster occurs. Rather, this annex concentrates on actions that can be implemented prior to a disaster to reduce or eliminate damage to property and people. This annex includes a general overview of the municipality and who in the Town/Village participated in the planning process; an assessment of the Town/Village of Harrison's risk and vulnerability; the different capabilities utilized in the Town/Village; and an action plan that will be implemented to achieve a more resilient community.

# 9.31.1 Hazard Mitigation Planning Team

The following individuals have been identified as the Town/Village of Harrison's hazard mitigation plan primary and alternate points of contact. The Town/Village of Harrison followed the planning process described in Section 3 (Planning Process) in Volume I of this plan update. This annex was developed over the course of several months with input from many Town/Village departments, including: Engineering and Administration. The Town/Village Engineer represented the community on the Westchester County Hazard Mitigation Plan Planning Partnership and supported the local planning process requirements by securing input from persons with specific knowledge to enhance the plan. All departments were asked to contribute to the annex development through reviewing and contributing to the capability assessment, reporting on the status of previously identified actions, and participating in action identification and prioritization.

The following table summarizes municipal officials that participated in the development of the annex and in what capacity. Additional documentation on the municipality's planning process through Planning Partnership meetings is included in Section 3 (Planning Process) and Appendix C (Meeting Documentation).

	Alternate Point of Contact					
Name/Title: Michael Amodeo, P.E., CFM, Town/Village	Name/Title: Jackie Greer, Town Clerk					
Engineer/Engineering Department A	Address: Alfred F. Sulla, Jr. Municipal Building, 1 Heineman					
Address: Alfred F. Sulla, Jr. Municipal Building, 1 P	Place Harrison, NY 10528					
Heineman Place Harrison, NY 10528 P	Phone Number: (914)-670-3030					
Phone Number: (914)-670-3102	Email: jgreer@harrison-ny.gov					
Email: mamodeo@harrison-ny.gov and						
engineering@harrison-ny.gov						
NFIP Floodplain Administrator						
Name/Title: Michael Amodeo, P.E., CFM, Town/Village Enginee	er/Engineering Department					
Address: Alfred F. Sulla, Jr. Municipal Building, 1 Heineman Plac	ace Harrison, NY 10528					
Phone Number: (914)-670-3102						
Email: mamodeo@harrison-ny.gov						
Additional Contributors						
Name/Title: Michael Amodeo, P.E., CEM, Town/Village Engines	er/Engineering Department					
Method of Participation: Provided information on past events car	nabilities NEIP administration services status of previous					
actions, permitting, and provided feedback on bazerd rankings. Contributed to mitigation strategy. Paviawad anney						
Name/Title: Megan Pierroz Assistant Engineer						
Method of Participation: Contributed to the mitigation strategy Reviewed annex						

#### Table 9.31-1. Hazard Mitigation Planning Team

# 9.31.2 Municipal Profile

The Town/Village of Harrison is situated in southeastern Westchester County, approximately 20 miles northeast of New York City. Harrison is bordered by the Town of North Castle to the north; the Town of Rye and the Villages of Rye Brook and Port Chester to the east, the City of Rye to the southeast, the Town of Rye and the





Village of Mamaroneck to the south, the Town of Mamaroneck to the southwest, and the City of White Plains to the west.

The Town/Village of Harrison consists of three sections which includes West Harrison in the northeast section of the Town, Purchase in the northwest section of the Town, and Harrison in the south section of the Town.

Per the New York Department of State Legal Memorandum LG06: Coterminous Town-Village, the Mount Kisco jurisdiction is considered a Coterminous Town-Village. A coterminous town-village is a unique form of local government organization. Geographically, one town and one village share the same boundaries. Depending on how the coterminous unit is formed, the town and the village function together as a single local government or as two separate local governments. As a single unit of government, the governing body of one unit of the coterminous government serves as the governing body of the other unit. This process results in one of the forms of government being the primary form of government – either town or village – effectively eliminating the other as far as administration is concerned. Where the coterminous entity functions as two local governments, separate officers and boards are chosen or selected and both town and village entities possess governance authority.

According to the U.S. Census, the 2010 population for the Town/Village of Harrison was 27,472. The estimated 2019 population was 28,135, a 2.4 percent increase from the 2010 Census. Data from the 2019 U.S. Census American Community Survey indicate that 5.6 percent of the population is 5 years of age or younger and 14.7 percent is 65 years of age or older. Communities must deploy a support system that enables all populations to safely reach shelters or to quickly evacuate a hazard area.

# 9.31.3 Jurisdictional Capability Assessment and Integration

The Town/Village of Harrison performed an inventory and analysis of existing capabilities, plans, programs, and policies that enhance its ability to implement mitigation strategies. Section 5 (Capability Assessment) describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities.
- Development and permitting capabilities.
- An assessment of administrative and technical capabilities
- An assessment of fiscal capabilities.
- An assessment of education and outreach capabilities.
- Classification under various community mitigation programs.
- The community's adaptive capacity to withstand hazard events.

For a community to succeed in reducing long-term risk, hazard mitigation must be integrated into the day-today local government operations. As part of this planning effort, planning/policy documents were reviewed, and each jurisdiction was surveyed to obtain a better understanding of their progress in plan integration. Areas with current mitigation integration are summarized in this Jurisdictional Capability Assessment (Section 9.31.3). The Town/Village of Harrison's identified opportunities for integration of mitigation concepts to be incorporated into municipal procedures are included in the updated mitigation strategy.

## Planning, Legal, and Regulatory Capability and Integration

The table below summarizes the regulatory tools that are available to the Town/Village of Harrison. The comment field provides information as to where hazard mitigation has been integrated.



### Table 9.31-2. Planning, Legal, and Regulatory Capability and Integration

	Iurisdiction		Code Citation and Date	Authority	Individual / Department /		
	has this?	Required by	(code chapter, name of	(local, county,	Agency		
Document Type	(Yes/No)	State? (Yes/No)	plan, date of plan)	state, federal)	Responsible		
Coues, Orumances, & Regulation	8	Γ	Chapter 103 Building	Γ			
Building Code	Yes	Yes	Construction, Chapter 105 Building Enforcement, Chapter 109 Unsafe Buildings	State and Local	Building Department		
How does this reduce risk?							
<ul> <li>Chapter 103 Building Construction: It is declared to be the public policy of the Town of Harrison that the town's building codes shall be in conformance in all respects with the New York State Uniform Fire Prevention and Building Code, as referenced in Article 18 of the New York State Executive Law, so that a single adequate, enforceable code exists which establishes standards for, among other things, the construction, maintenance and use of materials in buildings.</li> <li>Chapter 105 Building Enforcement: This chapter provides for the administration and enforcement of the New York State Uniform Fire Prevention and Building Code (the Uniform Code) and the State Energy Conservation Construction Code (the Energy Code) in the Town of Harrison. This chapter is adopted pursuant to § 10 of the Municipal Home Rule Law. Except as otherwise provided in the Uniform Code, other state law, or other section of this chapter, all buildings, structures, and premises, regardless of use or occupancy, are subject to the provisions of this chapter.</li> <li>Chapter 109 Unsafe Buildings: The purpose of this chapter is to promote the public health, safety and general welfare of the residents of the Town of Harrison and the conservation of property and property values and to eliminate safety and health hazards. All buildings or structures which are structurally unsafe, dangerous, unsanitary or not provided with adequate egress or which, in relation to existing use, constitute a hazard to safety or health by reason of inadequate maintenance, dilapidation, obsolescence or abandonment are, severally, for the purpose of this chapter, unsafe buildings. All such buildings and structures are hereby declared to be illegal and are prohibited and shall be abated by repair and rehabilitation or by demolition and removal in accordance with the procedures of this chapter.</li> </ul>							
Zoning/Land Use Code	Yes	No	Chapter 235 Zoning	Local	Building Department, Zoning Board Planning Board		
<ul> <li>Establishes an amended constitutes this chapter. S and welfare, shall be dee         <ul> <li>The facilitatio</li> <li>The assurance</li> <li>The prevention pedestrians.</li> <li>The maximum</li> <li>The gradual e</li> <li>The encourag appropriate u natural and so</li> <li>The protection</li> </ul> </li> </ul>	<ul> <li>Establishes an amended Comprehensive Zoning Plan for the Town of Harrison, which plan is set forth in the text and map that constitutes this chapter. Said amended plan is adopted in the interest of the protection and promotion of the public health, safety and welfare, shall be deemed to specifically include the following purposes relating to hazard mitigations:         <ul> <li>The facilitation of the efficient and adequate provisions of public facilities and services.</li> <li>The assurance of adequate sites for residence and commerce, including protection from flood damage.</li> <li>The prevention and reduction of traffic congestion so as to promote efficient and safe circulation of vehicles and pedestrians.</li> <li>The gradual elimination of nonconforming uses.</li> <li>The encouragement of flexibility in the design and development of land in such a way as to promote the most appropriate use of lands to facilitate the adequate and economical provision of streets and utilities and to preserve the natural and scenic qualities of open lands.</li> </ul> </li> </ul>						
• The assurance	e of adequate pro	vision of safety and h	nealth features in the construct	ion and use of struc	tures and land.		
Subdivision Ordinance	Yes	No	of Land	Local	Planning Board		
<ul> <li>How does this reduce risk?</li> <li>The Planning Board declares that these regulations for the subdivision of land for various purposes are promulgated to provide for the orderly growth and coordinated development of the municipality and to assure the comfort, convenience, safety, health and welfare of its people, and further, that the approval of such subdivision shall be based on the following considerations: <ul> <li>A. Conformance with the various parts of the Master Plan and Zoning Ordinance</li> <li>B. Recognition of a desirable relationship to the general land form, its topographic and geologic character, to natural drainage and ecological concerns.</li> <li>C. Recognition of desirable standards of subdivision design for pedestrian and vehicular traffic, surface water runoff, utility services and building sites for the land use contemplated.</li> <li>D. Encouragement of flexible subdivision design to promote the planning objectives of the Master Plan, to realize development and maintenance economies and to provide for a variety of housing types.</li> <li>E. Provision of such facilities as are desirable adjuncts to the contemplated use, such as parks, recreation areas, school sites, firehouses and off-street parking.</li> <li>F. Preservation of such natural resources and assets as lakes, ponds, streams, marshes, flora, fauna, general scenic beauty and historic features of the municipality.</li> </ul> </li> <li>The subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas.</li> <li>The regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources.</li> </ul>							





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Document Type	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible				
Site Plan Ordinance	te Plan Ordinance Yes No Section 235-71 of the Zoning Ordinance								
How does this reduce risk?	intended to immle	mont the deviation	at alkana staniatian musicated in t	ha Maatan Dian and	to george				
<ul> <li>Site plan provisions are r compliance with the requ</li> </ul>	irements and sta	indards set forth in the	is chapter and with accepted p	rofessional design p	bractice for such				
site improvements as gra	site improvements as grading, drainage, sidewalks, curbs, parking, landscaping, fences and driveways.								
Stormwater Management Ordinance	Yes	Yes	Chapter 130 Stormwater Management Erosion & Sediment Control, Chapter 131 Illicit Discharge	Local	Engineering Department and Public Works				
How does this reduce risk?			· •						
<ul> <li>The purpose of this local the general health, safety hereof. This local law se         <ul> <li>A. Meet the r Municipal Se</li> <li>B. Require la Environment: Activities GP</li> <li>C. Minimize increases in s</li> <li>D. Minimize otherwise deg</li> <li>E. Minimize the environment of the store of</li></ul></li></ul>	How does this reduce risk?         • The purpose of this local law is to establish minimum stormwater management requirements and controls to protect and safeguard the general health, safety, and welfare of the public residing within this jurisdiction and to address the findings of fact in § 130-3 hereof. This local law seeks to meet those purposes by achieving the following objectives: <ul> <li>A. Meet the requirements of minimum measures 4 and 5 of the SPDES General Permit for Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s), Permit No. GP-02-02 or as amended or revised;</li> <li>B. Require land development activities to conform to the substantive requirements of the NYS Department of Environmental Conservation State Pollutant Discharge Elimination System (SPDES) General Permit for Construction Activities GP-02-01 or as amended or revised;</li> <li>C. Minimize increases in stormwater runoff from land development activities in order to reduce flooding, siltation, increases in steam temperature, and streambank erosion and maintain the integrity of stream channels;</li> <li>D. Minimize increases in pollution caused by stormwater runoff from land development activities which would otherwise degrade local water quality;</li> <li>E. Minimize the total annual volume of stormwater runoff thich flows from any specific site during and following development to the maximum extent practicable; and</li> <li>F. Reduce stormwater runoff rates and volumes, soil erosion and nonpoint source pollution, wherever possible, through stormwater management practices to control stormwater runoff such as protecting natural areas, reducing impervious cover, and runoff reduction techniques to the maximum extent practicable.</li> </ul> <li>Chapter 131 Illicit Discharge: The purpose of this law is to provide for the health, safety, and general welfare of t</li>								
compliance w	vith this ordinance	e.	ction, surveillance and monito	oring procedures neo	cessary to ensure				
Post-Disaster Recovery/ Reconstruction Ordinance	No	No	-	-	-				
How does this reduce risk?			• •						
Real Estate Disclosure	Yes	Yes	Property Condition Disclosure Act, NY Code - Article 14 §460-467	State	NYS Department of State, Real Estate Agent				
<ul> <li>How does this reduce risk?</li> <li>In addition to facing pote certain disclosures under standardized disclosure s home sellers in New Yor</li> </ul>	ential liability for the law or pay a statement and del the opt not to com	r failing to disclose un credit of \$500 to the liver it to the buyer be plete the statement ar	nder the exceptions to "caveat buyer at closing. While the PO efore the buyer signs the final nd instead pay the credit.	emptor," a home se CDA requires a sell purchase contract, i	ller must make er to complete a n practice, most				
Growth Management	Yes	No	Master Plan adopted 2013	Local	Planning Board and Town Board				
How does this reduce risk?	dentified within	the Master Dlan	1		into renit bourd				
Environmental Protection Ordinance	Yes	Yes	Chapter 126 Environmental Quality Review, Chapter 133 Excavation and Soil Removal, Chapter 139	Local	Planning Board, Town Board, Building Department,				





Document Type	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible	
			Filling and Grading, Chapter 149 Freshwater Wetlands, Chapter 199 Steep Slope Protection, Chapter 220 Trees, Chapter 230 Water Pollution		Engineering Department	
<ul> <li>How does this reduce risk?</li> <li>Chapter 126 Environmental Quality Review: Lays out the requirements for environmental quality review.</li> <li>Chapter 149 Freshwater Wetlands: It is declared to be the public policy of the Town of Harrison to preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of freshwater wetlands and to regulate the development of such wetlands in order to secure the natural benefits of freshwater wetlands, consistent with the general welfare and beneficial economic, social and agricultural development of the Town of Harrison. It is further declared to be the policy of the Town Board to exercise its authority pursuant to Article 24 of the State Environmental Conservation Law, as such Article may, from time to time, be amended.</li> <li>Chapter 199 Steep Slope Protection: It is the intent of this chapter to ensure preservation wherever possible and careful review and regulation, including stringent mitigation measures, of disturbance of soil and vegetation on steep slopes where they have been disturbed. The proponent of any activity proposed for hilltops, ridgelines, or steep slopes shall demonstrate that the impacts on the functions and essential characteristics of such areas can be effectively minimized.</li> <li>Chapter 220 Trees: Prohibits the killing, cutting, or destroying of trees, guides the removal of dangerous trees and the trimming of trees near power lines.</li> <li>Chapter 230 Water Pollution: It is declared to be the public policy of the Town of Harrison to preserve, protect and conserve local waters and to regulate the discharge or runoff of pollutants into such local waters to avoid contamination of such local waters and to regulate the discharge or runoff of pollutants into such local waters to avoid contamination of such local waters and to resure a future supply of safe and healthful diriking water, consistent with the protection of the public health, safety and general welfare of the</li></ul>						
Flood Damage Prevention Ordinance	Yes	Yes	Chapter 146 Flood Damage Prevention	Federal, State, County and Local	Town Board, Engineering Department, Assessor and Building Department	
<ul> <li>How does this reduce risk?</li> <li>It is the purpose of this local law to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to: <ul> <li>A. regulate uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;</li> <li>B. require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;</li> <li>C. control the alteration of natural floodplains, stream channels, and natural protective barriers that are involved in the accommodation of flood waters;</li> <li>D. control filling, grading, dredging and other development which may increase erosion or flood damages;</li> <li>E. regulate the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards to other lands, and;</li> <li>F. qualify and maintain for participation in the National Flood Insurance Program.</li> </ul> </li> <li>BFE+2 feet for all construction in the SFHA (residential and non-residential)</li> </ul>						
Wellhead Protection	No	No	-	-	-	
now does this reduce risk?			1	1		
Emergency Management Ordinance	No	No	-	-	-	
How does this reduce risk?						
Climate Change Ordinance	No	No	-	-	-	
How does this reduce risk?						
Other	No	-	-	-	-	
Planning Documents						





Document Type	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible		
Comprehensive Plan	Yes	No	Town/ Village of Harrison Comprehensive Plan Update, 2013	Local	Planning Board and Town Board		
<ul> <li>How does this reduce risk?</li> <li>This Comprehensive Plan for the Town/Village of Harrison has been prepared to update the existing 1988 Plan, to better reflect the current planning framework for Harrison. Many of the 1988 recommendations have been enacted, and some are in progress. This update process, which began in late 2004, focuses on three key topics:         <ul> <li>Resolving remaining planning issues since the 1988 Update;</li> <li>Identifying and resolving critical new issues; and</li> <li>Incorporating any new town projects into the plan.</li> </ul> </li> <li>This plan is a guide to Harrison's decision makers on major planning issues and their solutions (or options). Data and analyses are updated where necessary. Following the format as laid down by the 1988 update, this plan provides specific geographically based planning action guides for the downtown Central Business District, downtown Harrison, West Harrison (Silver Lake and Park Lane), southern Harrison. Purchase and the Platinum Mile.</li> </ul>							
Capital Improvement Plan	Yes	No	Annual Capital Budget	Local	Public Works, Engineering and Town Board		
<ul><li>How does this reduce risk?</li><li>Town only adopts a 1 ye</li></ul>	ar capital budget	. Provisions have bee	n made for multi-phase planni	ng of capital projec	ts.		
Disaster Debris Management Plan	No	No	-	-	-		
How does this reduce risk?							
Floodplain Management or Watershed Plan	No	No	-	-	-		
How does this reduce risk?							
Stormwater Management Plan	No	No	-	-	-		
o	N	N		[	Γ		
How does this reduce risk?	NO	No	-	-	-		
Urban Water Management	No	No	_	_	-		
How does this reduce risk?							
Habitat Conservation Plan	No	No	-	-	-		
How does this reduce risk?							
Economic Development Plan	Yes	No	Part of Master Plan	Local	Planning Board and Town Board		
How does this reduce risk?	s a component o	f the Master Plan					
Shoreline Management Plan	Yes	Yes, in jurisdictions with CEHA areas	Article 34, Environmental Conservation Law, Coastal Erosion Hazard Areas 6 NYCRR Part 505, Coastal Erosion Management Regulations	State, Local	Town Board		
How does this reduce risk?							
Community Wildfire Protection Plan	No	No	-	-	-		
How does this reduce risk?							
Community Forest Management Plan	No	No	-	-	-		
How does this reduce risk?							
Transportation Plan	No	No	-	-	-		





	Iuniadiation		Code Citation and Data	Authonity	Individual /
	has this?	Required by	(code chapter. name of	flocal. county.	Agency
Document Type	(Yes/No)	State? (Yes/No)	plan, date of plan)	state, federal)	Responsible
	-	-	-	-	-
Agriculture Plan	No	Yes	-	-	-
How does this reduce risk?					
Climate Action/ Resiliency/Sustainability Plan	No	No	-	-	-
How does this reduce risk?					
Tourism Plan	No	No	-	-	-
How does this reduce risk?					
Business/ Downtown Development Plan	No	No	-	-	-
How does this reduce risk?					
Other	No	-	-	-	-
<b>Response/Recovery Planning</b>	-				
Comprehensive Emergency Management Plan	Yes	Yes	Emergency Response Plan	Local	Town Board, Police Department, and Legal Department
<ul> <li>How does this reduce risk?</li> <li>The current Emergency Response Plan identifies responsibilities for response during hazard events. The Plan could be expanded to</li> </ul>					
Continuity of Operations Plan	No	No	-	-	-
How does this reduce risk?					
Strategic Recovery Planning Report	No	No	-	-	-
How does this reduce risk?					
Threat & Hazard Identification & Risk Assessment (THIRA)	No	Yes	-	-	-
How does this reduce risk?					
Post-Disaster Recovery Plan	No	No	-	-	-
How does this reduce risk?					
Public Health Plan	No	No	-	-	-
How does this reduce risk?					
Other	Yes	No	Mutual Aid Plan in place for entire County	Local, County	OEM
<ul> <li>How does this reduce risk?</li> <li>Mutual Aid Plan provides assistance Countywide.</li> </ul>					

# **Development and Permitting Capability**

The table below summarizes the capabilities of the Town/Village of Harrison to oversee and track development.

#### Table 9.31-3. Development and Permitting Capability

Indicate if your jurisdiction implements the following	Yes/No	Comment
Do you issue development permits? -If yes, what department is responsible? -If no, what is your process for development?	Yes	Engineering Department provides Land Development approvals, Building Department provides permits, Department of Public Works provides permits





Are permits tracked by hazard area? (For example, floodplain development permits.)	Yes	Floodplain Permits
Do you have a buildable land inventory? -If yes, describe. -If no, quantitatively describe the level of buildout in the jurisdiction.	No	80 percent built out

# Administrative and Technical Capability

The table below summarizes potential staff and personnel resources available to the Town/Village of Harrison and their current responsibilities which contribute to hazard mitigation.

#### Table 9.31-4. Administrative and Technical Capabilities

		Comments
	Available?	(available staff, responsibilities, support of hazard
Resources	(Yes/No)	mitigation)
Administrative Capability		
Planning Board	Yes	The Planning Board is charged with the responsibility of reviewing and approving Subdivisions, Site Plans, Special Exception Uses, Steep Slope Permits and Wetland Permits. Additionally, the Planning Board serves in an advisory role to the Town Board and routinely provides comment and recommendations regarding amendments to the Town's Zoning Ordinance, official map and Subdivision Regulations as well as other regulations pertaining to the development of land within the Town.
Zoning Board of Adjustments	Yes	The Zoning Board of Appeals is charged with deciding on individual variances from the over-all Zoning Code, in such cases where a question of hardship for the property owner is involved. If an application to build is denied by the Building Inspector because it does not conform to the Zoning Ordinance, his decision may be appealed to this Board. The Board is not empowered to make any changes in the Zoning Code; it may only grant Variances.
Engineering Department	Yes	The Engineering Department is responsible for the planning, designing and construction oversight of public works and infrastructure projects funded by the Town/Village of Harrison, including bid preparation and contract administration. The Department also reviews all subdivisions, commercial site development, public improvement proposals and residential site plan applications for technical sufficiency with respect to stormwater regulation and land development compliance, which includes grading, FEMA flood plain development requirements and drainage. The staff is responsible for the operation and maintenance of the Town's GIS data and utilizes the latest computer applications in the creation of various types of maps. The Department acts as staff technical advisors to the Supervisor/Mayor, Town/Village Board, Planning Board and various internal departments and responds to inquiries from Town residents and various public and private agencies.
Mitigation Planning Committee	No	-
Environmental Board/Commission	No	Planning Board serves this function
Open Space Board/Committee	No	-
Economic Development Commission/Committee	No	-





		Comments
	Available?	(available staff, responsibilities, support of hazard
Resources	(Yes/No)	mitigation)
Public Works/Highway Department	Yes	The Department of Public Works office is the central contact point for residents calling with requests for service (such as roadway repairs, street lighting/signs, trees, sewers and sidewalks). The Highway staff is responsible for the paving, maintenance and repair of all Town roads; the care and maintenance of sidewalks, sewer lines, and storm drains. Snow removal, seasonal curbside leaf pick-up, and the monthly collection of cut and tied brush are also the responsibility of the Highway Division. The care and removal of Town trees and maintenance of Town owned parking lots (resurfacing, sweeping and snow plowing as needed) are also the responsibility of this department. The Parks and Playgrounds Division maintains Town parks and playgrounds.
		of Harrison
Construction/Building/Code Enforcement Department	Yes	<ul> <li>Building Department. The Building Inspector is responsible for inspecting and approving all construction within the Town, to ensure that such construction meets the Town standards and codes. Building permits are issued for all new commercial and residential buildings in Harrison, as well as any additions, alterations, accessory structures or facilities. Plans and specifications are reviewed for compliance with construction codes and the Zoning Ordinance. The Building Inspector is responsible for issuance of a Certificate of Occupancy.</li> <li>Most residential construction requires approval from the Architectural Review Board. Building permits and applications for sheds, decks, pools, interior alterations are also reviewed, with permits issued and approved by the Building Inspector. New commercial construction and site division requires site plan approval from the Planning Board and Architectural Review Board.</li> <li>In addition, permits are required for fences, driveways, tree removals, signs, awnings, plumbing and electrical work, blasting, temporary structures, special outdoor events, excavation and regrading, fill and trucking, demolition and ADA compliance.</li> </ul>
Emergency Management/Public Safety Department	No	-
Warning Systems / Services	Ves	Phone Blasts from the Town Supervisor
(mass notification system, outdoor warning signals)	103	
Maintenance programs to reduce risk (stormwater	Yes	Administered by DPW. Includes brining of roadways
Mutual aid agreements	Vac	Countravide Mutual Aid Plan in place
Human Resources Manual - Do any job descriptions	108	County where whether Alle Fian in place.
specifically include identifying or implementing mitigation projects or other efforts to reduce natural hazard risk?	No	-
Other	No	-
Technical/Staffing Capability		



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Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Planners or engineers with knowledge of land development and land management practices	Yes	Engineering and Planning Departments
Engineers or professionals trained in building or infrastructure construction practices	Yes	Engineering and Building Departments
Planners or engineers with an understanding of natural hazards	Yes	Engineering and Planning Departments
Staff with expertise or training in benefit/cost analysis	Yes	Comptroller's office
Professionals trained in conducting damage assessments	Yes	Engineering and Public Works Departments
Personnel skilled or trained in GIS and/or Hazards United States (HAZUS) – Multi-Hazards (MH) applications	Yes	Engineering Department and Information Technology
Scientist familiar with natural hazards	Yes	Engineering Department and staff consultants
Surveyor(s)	No	-
Emergency Manager	Yes	Supervisor
Grant writer(s)	Yes	The Town hires an outside company to manage and write grants.
Resilience Officer	No	-
Other (this could include stormwater engineer, environmental specialist, etc.)	No	-

## **Fiscal Capability**

Westchester

The table below summarizes financial resources available to the Town/Village of Harrison.

#### Table 9.31-5. Fiscal Capabilities

Financial Resources	Are these accessible or eligible to use for mitigation? (Yes/No) If yes, please describe. If no, can this be used to support in the future?
Community development Block Grants (CDBG, CDBG-DR)	No. HUD is preventing funding to County administrators.
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes – Special assessment districts
User fees for water, sewer, gas or electric service	Yes
Impact fees for homebuyers or developers of new development/homes	No
Stormwater utility fee	
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	No
Other federal or state funding programs	Yes, mitigation grant programs
Open Space Acquisition funding programs	Yes, Subdivision Fee-in-Lieu
Other (for example, Clean Water Act 319 Grants [Nonpoint Source Pollution])	No

## **Education and Outreach Capability**

The table below summarizes the education and outreach resources available to the Town/Village of Harrison.





#### Table 9.31-6. Education and Outreach Capabilities

Outreach Resources	Available? (Yes/No)	Does the jurisdiction have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events? If yes, please describe.
Public information officer or communications office	Yes	Supervisors Office
Personnel skilled or trained in website development	Yes	The Department of Information Technology provides technology solutions, strategies, and support to meet the needs of all internal Town/Village departments. Providing service and support for all Town/Village systems including Computers, Internet, Network, Web, Email, Servers, Telephone and Mobile Devices.
Hazard mitigation information available on your website	Yes	Community Notes
Social media for hazard mitigation education and outreach	No	-
Citizen boards or commissions that address issues related to hazard mitigation	Yes	All Boards
Other programs already in place that could be used to communicate hazard- related information	Yes	The Mayor has an email and calling list where he makes announcements regarding events and anything that is impacting the Town/Village.
Warning systems for hazard events	Yes	Phone and email blasts
Natural disaster/safety programs in place for schools	No	-
Other	No	-

#### **Community Classifications**

The table below summarizes classifications for community programs available to the Town/Village of Harrison.

#### Table 9.31-7. Community Classifications

Program	Participating? (Yes/No)	Classification (if applicable)	Date Classified (if applicable)
Community Rating System (CRS)	Yes	Class 7	May 1, 2020
Building Code Effectiveness Grading Schedule (BCEGS)	Yes	4	2008
Public Protection (ISO Fire Protection Classes 1 to 10)	No	-	-
NYSDEC Climate Smart Community	No		
Storm Ready Certification	No	-	-
Firewise Communities classification	No	-	-
Other	No	-	-

Note:

N/A Not applicable

NP Not participating

- Unavailable

#### **Adaptive Capacity**

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or respond to consequences" (IPCC 2014). In other words, it describes a jurisdiction's current capabilities to adjust to, protect from, or withstand a future hazard event, future conditions, and changing risk. The table below summarizes the adaptive capacity for each hazard of concern and the jurisdiction's rating.





#### Table 9.31-8. Adaptive Capacity

Hazard	Adaptive Capacity - Strong/Moderate/Weak*		
Disease Outbreak	Moderate		
Earthquake	Moderate		
Extreme Temperature	Moderate		
Flood	Moderate		
Severe Storm	Moderate		
Severe Winter Storm	Strong		
Wildfire	Moderate		
CBRN	Moderate		

\*Strong Capacity exists and is in use

Moderate Capacity may exist; but is not used or could use some improvement

Weak Capacity does not exist or could use substantial improvement

# 9.31.4 National Flood Insurance Program (NFIP) Compliance

This section provides specific information on the management and regulation of the regulatory floodplain, including current and future compliance with the NFIP.

#### National Flood Insurance Program (NFIP) Summary

The following table summarizes the NFIP statistics for the Town/Village of Harrison.

#### Table 9.31-9. NFIP Summary

Municipality	# Policies	# Claims (Losses)	Total Loss Payments	# RL Properties
Town/Village of Harrison	321	949	\$5,882,727.30	94

Source: FEMA 7-2021 Notes:

RL Repetitive Loss; SRL Severe Repetitive Loss

#### Flood Vulnerability Summary and NFIP Compliance

The following table provides a summary of the NFIP program in the Town/Village of Harrison.

#### Table 9.31-10. Flood Vulnerability Summary and NFIP Compliance

NFIP Topic	Comments
Flood Vulnerability Summary	
<ul> <li>Describe areas prone to flooding in your jurisdiction.</li> <li>Do you maintain a list of properties that have been damaged by flooding?</li> </ul>	Areas prone to flooding in the Town are the low lying areas and areas along the waterways.
<ul> <li>Do you maintain a list of property owners interested in flood mitigation?</li> <li>How many homeowners and/or business owners are interested in mitigation (elevation or acquisition)?</li> </ul>	No
Are any RiskMAP projects currently underway in your jurisdiction? • If so, state what projects are underway.	The Town is currently finishing up a Drainage Manual that will also provide a GIS map showing problem areas.
How do you make Substantial Damage determinations? • How many were declared for recent flood events in your jurisdiction?	The Town/Village follows FEMA guidelines.





NFIP Topic	Comments
<ul> <li>How many properties have been mitigated (elevation or acquisition) in your jurisdiction?</li> <li>If there are mitigation properties, how were the projects funded?</li> </ul>	One structure has been elevated. Privately funded.
<ul><li>Do your flood hazard maps adequately address the flood risk within your jurisdiction?</li><li>If not, state why.</li></ul>	Current FIRMs do not include some areas. The Town plans to expand flood mapping and establish a Town specific flood map that identifies all flooding sources (riverine, precipitation, urban, over land flooding) and use this improved mapping and data to update the Town/Village code. (action 2021-Harrison-009).
NFIP Compliance	
What local department is responsible for floodplain management?	Engineering Department and Building Department
Are any certified floodplain managers on staff in your jurisdiction?	Engineering Department
Do you have access to resources to determine possible future flooding conditions from climate change?	No
<ul> <li>Does your floodplain management staff need any assistance or training to support its floodplain management program?</li> <li>If so, what type of assistance/training is needed?</li> </ul>	Additional training would be beneficial for building inspectors.
Provide an explanation of NFIP administration services you provide (e.g. permit review, GIS, education/outreach, inspections, engineering capability)	The Town provides permit review, GIS, education/outreach, property inspections and engineering capability.
How do you determine if proposed development on an existing structure would qualify as a substantial improvement?	The Engineering Department requests the construction cost estimate for the proposed project and obtains the property value from the Assessor to determine if the proposed development is a substantial improvement.
What are the barriers to running an effective NFIP program in the community, if any?	Limited staffing, funding, and flood map limitations.
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, state the violations.	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	The Town/Village had a Community Assistance Visit (CAV) on August 1, 2018.
<ul> <li>What is the local law number or municipal code of your flood damage prevention ordinance?</li> <li>What is the date that your flood damage prevention ordinance was last amended?</li> </ul>	The Town Code for Flood Damage Prevention can be found under Chapter 146 and was last amended in 2007.
<ul><li>Does your floodplain management program meet or exceed minimum requirements?</li><li>If exceeds, in what ways?</li></ul>	Yes, the Town participates in the CRS program and exceeds NFIP requirements.
Are there other local ordinances, plans or programs (e.g. site plan review) that support floodplain management and meeting the NFIP requirements? For instance, does the planning board or zoning board consider efforts to reduce flood risk when reviewing variances such as height restrictions?	The Engineering Department reviews all site plans for proposed projects to reduce risks of flooding and to meet the NFIP requirements.
<ul> <li>Does your jurisdiction participate in CRS?</li> <li>If yes, is your jurisdiction interested in improving its CRS Classification?</li> <li>If no, is your jurisdiction interested in joining the CRS program?</li> </ul>	The Town participates in CRS and currently has improved to a Class 7 classification.

# 9.31.5 Evacuation, Sheltering, Temporary Housing, and Permanent Housing





Evacuation routes, sheltering measures, temporary housing, and permanent housing must all be in place and available for public awareness to protect residents, mitigate risk, and relocate residents, if necessary, to maintain post-disaster social and economic stability.

#### **Evacuation Routes and Procedures**

The Town/Village of Harrison has identified the following routes and procedures to evacuate residents prior to and during an event.

- The current Emergency Response Plan identifies responsibilities for response during hazard events. The Plan could be expanded to include more information on evacuation routes/procedures and sheltering (action 2021-Harrison-003). Currently identified evacuation routes include:
  - Halstead Avenue
  - Harrison Avenue
  - Westchester Avenue
  - Purchase Street
  - North Street
  - Lake Street
  - West Street

#### Sheltering

The Town/Village of Harrison has identified the following designated emergency shelters within the Town/Village.

Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided
Legion Hall	210 Halstead Avenue	150	Unknown	Yes	Yes, portable	EMS	-
Mintzer Center Annex	251 Underhill Avenue	150	Unknown	Yes	Yes, portable	EMS	-
Harrison Fire Department	206 Harrison Avenue	Unknown	Unknown	Unknown	Yes	EMS	-
West Harrison Fire Department	95 Lake Street	Unknown	Unknown	Unknown	Yes	EMS	-

### Table 9.31-11. Designated Emergency Shelters

## **Temporary Housing**

Each jurisdiction must identify sites for the placement of temporary housing units to house residents displaced by a disaster. The Town/Village of Harrison has identified the following sites suitable for placing temporary housing units.





#### Table 9.31-12. Temporary Housing Locations

Site Name	Site Address	Capacity (number of sites)	Туре	Infrastructure / Utilities Available (water, electric, septic, etc.)	Actions Required to Ensure Conformance with the NYS Uniform Fire Prevention and Building Code				
The Town/V	The Town/Village has not identified appropriate locations for the placement of temporary housing. The Town/Village will work with Westchester County to identify appropriate regional locations (action 2021-Harrison-006).								

#### **Permanent Housing**

Structures located in the regulatory floodplain may need to be relocated due to high flood risk or new properties must be built once severely damaged properties are demolished. Jurisdictions must identify suitable sites currently owned by the jurisdiction and potential sites under private ownership that meet applicable local zoning requirements and floodplain laws. The Town/Village of Harrison has identified the following areas suitable for relocating homes outside of the floodplain.

#### **Table 9.31-13. Permanent Housing Locations**

Site Name	Site Address	Capacity (number of sites)	Туре	Infrastructure / Utilities Available (water, electric, septic, etc.)	Actions Required to Ensure Conformance with the NYS Uniform Fire Prevention and Building Code			
The Town/Village has not identified appropriate locations for the placement of permanent housing. The Town/Village will work with Westchester County to identify appropriate regional locations (action 2021-Harrison-006).								

## 9.31.6 Growth/Development Trends

Understanding how past, current, and projected development patterns have or are likely to increase or decrease risk in hazard areas is a key component to understanding a jurisdiction's overall risk to its hazards of concern. Table 9.31-14 summarizes recent and expected future development trends, including major residential/commercial development and major infrastructure development.

#### Table 9.31-14. Recent and Expected Future Development

Type of Development	20	)14	2(	)15	2	016	2(	)17	2(	)18	2(	)19	20	020
Number of Buil floodplain)	Number of Building Permits for New Construction Issued Since the previous HMP* (total/within regulatory floodplain)													
	Total	Within SFHA	Total	Within SFHA	Total	Within SFHA	Total	Within SFHA	Total	Within SFHA	Total	Within SFHA	Total	Within SFHA
Single Family & Multi- Family	22	0	25	4	29	4	21	4	22	5	35	10	34	4
Other (commercial, mixed-use, etc.)	0	0	1	0	2	0	1	0	2	0	3	0	2	0
Total Permits Issued	22	0	26	4	31	4	22	4	24	5	38	10	36	4
Property or Development Name	ן Deve	Type of lopment	# : S	of Units tructure	/ es	Locati (addro and/or l and lo	on ess block bt)	Kn	own Ha Zone(s	zard )*	D	escriptio Devel	on / Stat opment	tus of
			Rece	nt Major	Develo	pment an	d Infras	tructure	from 20	15 to Pre	sent			



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Residences at	Residential	421 units	103-105		Under construction
Corporate Park			Corporate Park	-	
Drive			Drive		
Wegmans	Retail	132,000 sq ft	106-110		Completed
C		· •	Corporate Park	-	1
			Drive		
PepsiCo Master	Office	141.835	700 Anderson		Under construction
Plan Expansion		,	Hill Road	-	
3 Westchester	Residential	450 units	3 Westchester		Under construction
Park Drive			Park Drive	-	
104 Corporate	Office	113.678 sq ft	104 Corporate		Completed
Park Drive	011100	110,070 54 10	Park Drive	-	Compressed
Harrison	Residential	42 units	230-240		Under Construction
Playhouse Lofts	residential	12 dilito	Harrison Avenue	-	ender construction
MTV/Avalon	Residential	143 units	Halstead Avenue		Under Construction
train station	Residential	145 units	& Harrison	_	Childer Construction
development			Avenue	_	
Harrison	Mixed use	26 units	22.55 Calvort		Under Construction
Commons	witzed use	20 units	SS-SS Calvert	-	Under Construction
	F1 (	1			
Harrison High	Education	1	255 Union		Completed – expansion of
School			Avenue	-	existing structure
Improvements					~
Keio Academy	Institution	22,000 sq ft	3 College Road	-	Completed
of New York					
	Known or An	ticipated Major Dev	velopment and Infra	structure in the Next Five (5	) Years
550 Halstead	Residential	36 units	550 Halstead		Approved
Avenue			Avenue	-	
Multifamily					
Building					
Brightview	Residential	84 units,	600 Lake Street		Approved
Senior Living		169,168 sq ft		-	
		institution			
Purchase	Office	46,000 sq ft	3040		Approved – expansion of
Professional			Westchester	-	existing structure
Park			Avenue		
2700	Residential	TBD	2700		Proposed
Westchester			Westchester	-	
Avenue			Avenue		
Webb Avenue	Residential	TBD	Webb Avenue	-	Proposed
SUNY Purchase	Residential	385 units	735 Anderson		Proposed
Senior Learning			Hill Road	-	·
Community					

SFHA Special Flood Hazard Area (1% flood event)

\* Only location-specific hazard zones or vulnerabilities identified.

# 9.31.7 Jurisdictional Risk Assessment

The hazard profiles in Section 5 (Risk Assessment) provide detailed information regarding each plan participant's vulnerability to the identified hazards. Refer to Section 5.2 (Methodology and Tools) and Section 5.4 (Hazard Ranking) for a detailed summary for the Town/Village of Harrison's risk assessment results and data used to determine the hazard ranking discussed later in this section.

Hazard area extent and location maps were generated to illustrate the probable areas impacted within the jurisdiction. These maps are based on the best available data at the time of the preparation of this plan and are adequate for planning purposes. Maps have been generated only for those hazards that can be clearly identified using mapping techniques and technologies and for which the Town/Village of Harrison has significant exposure. The maps also show the location of potential new development, where available. These maps are illustrated below.





































### Hazard Event History

Westchester County has a history of natural and non-natural hazard events as detailed in Volume I, Section 5 (Risk Assessment) of this plan. A summary of historical events is provided in each of the hazard profiles and includes a chronology of events that have affected the county and its municipalities.

The Town/Village of Harrison's history of federally-declared (as presented by FEMA) and significant hazard events (as presented in NOAA-NCEI) is consistent with that of Westchester County. Table 9.31-15 provides details regarding municipal-specific loss and damages the Town/Village experienced during hazard events since the last hazard mitigation plan update. Information provided in the table below is based on reference material or local sources. For details of these and additional events, refer to Volume I, Section 5.0 of this plan.

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Municipal Summary of Damages and Losses
February 13, 2017	High Wind	No	Low pressure passed to the east of Westchester County and rapidly deepened, resulting in strong winds with gusts exceeding 70 mph.	Downed trees, wires and flooding made some roads impassable. Debris removal was performed following the event.
March 2, 2018	High Wind	No	A deep area of low pressure passed off the coast resulting in strong winds with gusts exceeding 70 mph.	Downed trees, wires and flooding made some roads impassable. Debris removal was performed following the event.
April 13, 2020	High Wind	No	Deep low pressure passed to the west of the area resulting in high winds with gusts near 70 mph.	Downed trees, wires and flooding made some roads impassable. Debris removal was performed following the event.
August 4, 2020	Tropical Storm (DR-4567)	Yes	Tropical Storm Isaias passed over the region, resulting in high winds with gusts between 60-80 mph.	Downed trees, wires and flooding made some roads impassable. Debris removal was performed following the event.
January 20, 2020 – Present	Covid-19 Pandemic (EM-3434) (DR-4480)	Yes	Between March 1, 2020 and June 6, 2021, Westchester County reported 129,488 confirmed cases of COVID-19, and 2,284 total fatalities.	Municipal Building was retrofitted with safety shields/barricades. Anyone entering any Town Building was required to submit to a temperature scan. All high touch surfaces and Town vehicles were sanitized daily. Hand sanitizer masks and gloves were provided to all employees.
August 21, 2021	Hurricane Henri	No	Hurricane Henri resulted in heavy rainfall in Westchester County	Town had major flooding making some roads impassable.
September 1, 2021	Hurricane Ida remnants	TBD	Remnants of Hurricane Ida resulted in intense rainfall, resulting in widespread flash flooding.	Town had major flooding making some roads impassable.

#### Table 9.31-15. Hazard Event History

Notes:

EM Emergency Declaration (FEMA)

FEMA Federal Emergency Management Agency

DR Major Disaster Declaration (FEMA)

N/A Not applicable





## Hazard Ranking and Vulnerabilities

The hazard profiles in Section 5.0 (Risk Assessment) of this plan have detailed information regarding each plan participant's vulnerability to the identified hazards. The following summarizes the Town/Village of Harrison's risk assessment results and data used to determine the hazard ranking.

#### Hazard Ranking

This section provides the community specific identification of the primary hazard concerns based on identified problems, impacts and the results of the risk assessment as presented in Section 5 (Risk Assessment) of the plan. The ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property, and the economy as well as community capability and changing future climate conditions. This input supports the mitigation action development to target those hazards with highest level of concern.

As discussed in Section 5.3 (Hazard Ranking), each participating jurisdiction may have differing degrees of risk exposure and vulnerability compared to Westchester County as a whole. Therefore, each municipality ranked the degree of risk to each hazard as it pertains to their community. The table below summarizes the hazard risk/vulnerability rankings of potential natural hazards for the Town/Village of Harrison. The Town/Village of Harrison has reviewed the county hazard risk/vulnerability risk ranking table as well as its individual results to reflect the relative risk of the hazards of concern to the community.

During the review of the hazard/vulnerability risk ranking, the Town/Village indicated the following:

• The Town/Village agreed with the calculated hazard rankings.

#### Table 9.31-16. Hazard Ranking Input

Disease Outbreak	Earthquake	Extreme Temperature	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN
Low	Low	Low	High	High	Medium	Low	Low
Note: The scale	is based on the hazar	d rankings establishe	d in Section 5.3 and	modified as ap	propriate during	g review by the	jurisdiction

#### Critical Facilities

New York State Department of Environmental Conservation (DEC) Statute 6 CRR-NY 502.4 sets forth floodplain management criteria for State projects located in flood hazard areas. The law states that no such projects related to critical facilities shall be undertaken in a Special Flood Hazard Area (SFHA) unless constructed according to specific mitigation specifications, including being raised 2' above the Base Flood Elevation (BFE). This statute is outlined at <u>http://tinyurl.com/6-CRR-NY-502-4</u>. While all vulnerabilities should be assessed and documented, the State places a high priority on exposure to flooding. Critical facilities located in an SFHA, or having ever sustained previous flooding, must be protected to the 0.2-percent annual chance flood event, or worst damage scenario. For those that do not meet these criteria, the jurisdiction must identify an action to achieve this level of protection (NYS DHSES 2017).

The table below identifies critical facilities in the community located in the 1-percent and 0.2-percent floodplain and presents Hazards United States (HAZUS) – Multi-Hazards (MH) estimates of the damage and loss of use to critical facilities as a result of a 1-percent annual chance flood event.





		Exp	osure	Potential 1% Floo	Loss from d Event	
Name	Туре	1% Event	0.2% Event	Percent Structure Damage	Percent Content Damage	Addressed by Proposed Action
WESTCHESTER JOINT WATER WORKS	Potable Water Treatment Facility	Y	Y	0.0	0.0	2021-Harrison- 005
Spring Lake Dam	Dam	Y	Y	0.0	0.0	2021-Harrison- 005
Forest Lake Dam	Dam	Y	Y	0.0	0.0	2021-Harrison- 005
Mamaroneck Reservoir Dam	Dam	Y	Y	0.0	0.0	2021-Harrison- 005, 2021- Harrison-011
Bowman Ave Dam	Dam	Y	Y	0.0	0.0	2021-Harrison- 005
Nelson Brook Flood Control Dam	Dam	Y	Y	0.0	0.0	2021-Harrison- 005
HARRISON COMMUNITY SERVICES FP	Food Bank	Y	Y	18.5	70.6	2021-Harrison- 005
County Road Maintenance Garage	County Building	Y	Y	0.0	0.2	2021-Harrison- 005
HAR Resid DD	DPW	Y	Y	4.6	27.6	2021-Harrison- 008
UnNamed	DPW	Y	Y	15.2	100.0	2021-Harrison- 008
Gleason Place Utility Garage	DPW	Y	Y	6.0	39.5	2021-Harrison- 008
Brae Burn Drive Pump Station	Wastewater Pump Station	Y	Y	0.0	0.0	2021-Harrison- 008

#### Table 9.31-17. Potential Flood Losses to Critical Facilities

Source: Westchester HMP 2021; FEMA 2007

## **Identified Issues**

After review of the Town/Village of Harrison's hazard event history, hazard rankings, jurisdiction specific vulnerabilities, hazard area extent and location, and current capabilities, the Town/Village of Harrison has identified the following vulnerabilities within their community:

- Frequent flooding events have resulted in damages to residential properties. These properties have been repetitively flooded as documented by paid NFIP claims. The Town/Village has 94 repetitive loss properties, but other properties may be impacted by flooding as well. Areas prone to flooding in the Town/Village are the low lying areas and areas along the waterways. Specifically identified are properties in the following areas: Temple Street, Bradford Street, Congress Street, Ellsworth Avenue, Indian Trail, Shawnee Trail, Pinehurst Drive, Walnut Lane, Crotona Avenue, Glendale Road, Oak Street, Osborne Road, Woodlands Road, Park Avenue, West Street, Batavia Place, Ramapo Trail, Post Place, Condit Street, Crystal Street, and Genesee Trail.
- Critical facilities require backup power to maintain continuity of services. Two libraries, two community centers, and the Veterans Building lack backup power. The Sollazzo Center is an emergency shelter. The other community center, the libraries, and the Veterans Building can be used for warming and cooling shelters.
- The current Emergency Response Plan identifies responsibilities for response during hazard events. The Plan could be expanded to include more information on evacuation routes/procedures and sheltering.





- Flooding is a regional problem which requires regional solutions for Beaver Swamp.
- The Town/Village has numerous critical facilities with flood exposure which are privately owned.
- The Town/Village has not identified appropriate locations for the placement of temporary and permanent housing outside of the Special Flood Hazard Area.
- Residents are not receiving Town/Village notifications.
- The Town/Village has numerous Town/Village owned critical facilities located within the SFHA or the 500-year floodplain. Flood exposed facilities under the Town/Village's jurisdiction that are considered critical include:
  - Gleason Place Utility Garage and other DPW facilities
  - Brae Burn Drive Pump Station
- Current FIRMs do not include some areas that are experience flooding.
- Flooding take place on Brentwood Brook in the vicinity of the Louis M Kline Middle School and the Harrison Avenue Elementary School.
- The Mamaroneck Reservoir Dam is located in the Town/Village of Harrison but under the jurisdiction of the Town of Mamaroneck. The Town/Village would like to see removal of the dam as the reservoir is no longer being used.
- Additional floodplain administration training is needed for staff, specifically for building inspectors.
- Drainage upgrades are needed in areas that experience nuisance flooding and poor drainage in Downtown Harrison, Purchase, and West Harrison.
- Near the Harrison Elementary School, a pond floods and impacts nearby homes. Poor drainage and filling of the pond is suspected to be the cause of flooding. The pond is under the jurisdiction of the school district.
- The Town/Village piping, sewage, and plumbing drainage systems are outdated and inefficient.

Specific areas of concern based on resident response to the Westchester County Hazard Mitigation Citizen survey include:

- Ramapo Trail down to Union Ave is prone to flooding. There is a "Duck Pond" on the property of the school on Harrison Avenue at the corner of Nelson and Union Avenues that has been completely disregarded by the School. It floods over every terrible storm event and floods the school parking lot, fields, and causes dozens if not hundreds of houses in our beautiful neighborhood to flood. The pipes are 10 inch pipes and have not been replaced in 50 years.
- The Town/Village is impacted by poor drainage and the piping, sewage, and plumbing drainage systems are outdated and inefficient. Harrison Trails area sewer system not adequate and the system backs up into houses with heavy rains.

# 9.31.8 Mitigation Strategy and Prioritization

This section discusses past mitigations actions and status, describes proposed hazard mitigation initiatives, and their prioritization.

## **Past Mitigation Initiative Status**

The following table indicates progress on the community's mitigation strategy identified in the 2015 HMP. Actions that are carried forward as part of this plan update are included in the following subsection in its own table with prioritization. Previous actions that are now on-going programs and capabilities are indicated as such in the following table and may also be found under 'Capability Assessment' presented previously in this annex.





### Table 9.31-18. Status of Previous Mitigation Actions

Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
TVH- 1 (old)	Acquire backup generators for all critical facilities	All Hazards	Mayor		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Sollazzo Center Emergency Shelter, community centers, libraries, Veterans Building need backup power.</li> <li>3.</li> </ol>
TVH-2	Evaluate potential mitigation measures for reducing icing along steep streets in West Harrison	Ice	Engr.		Ongoing Capability	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>Discontinue</li> <li>Ongoing Capability. Apply brine to roadways before storms.</li> </ol>
TVH-3	Evaluate potential flood mitigation needs along Brentwood Brook near two local schools; this may include flood storage at the middle school.	Flooding	Engr.		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Louis M Kline Middle School. Harrison Avenue Elementary School. Flood control project</li> <li>3.</li> </ol>
TVH-4	Replace culverts along Pleasant Ridge Road.	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>No longer a priority</li> </ol>
TVH-5	Implement flood mitigation measures along Glendale Road	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. No longer a priority</li> </ol>
TVH-6	Implement flood mitigation measures in the vicinity of West Street along LeCount Creek	Flooding	Engr. / DPW		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>No longer a priority</li> </ol>
TVH-7	Implement flood mitigation measures along Oakland Avenue	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>No longer a priority</li> </ol>
TVH-8	Implement flood mitigation measures along Westerleigh Road	Flooding	Engr. / DPW		Complete	Cost: \$171,475.00 Level of Protection: Damages Avoided; Evidence of Success:	1. Discontinue 2. 3. Complete





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
TVH-9	Implement flood mitigation measures along the Mamaroneck River between Barnes Land and Anderson Hill Road	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. No longer a priority within the next 5 years.</li> </ol>
TVH- 10	Implement flood mitigation measures in the vicinity of Lake Street East, Old Lake Street, and Barnes Lane, including replacement of culverts along Barnes Lane.	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. No longer a priority within the next 5 years.</li> </ol>
TVH- 11	Implement flood mitigation measures from Osborne Road to Harrison Avenue and Haviland Street to Sterling Avenue	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>3. No longer a priority within the next 5 years.</li> </ol>
TVH- 12	Complete feasibility study for using solar energy to power municipal buildings and implement recommendations	All Hazards	Mayor		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>Remaining actions not related to hazard mitigation.</li> </ol>
TVH- 13	Upgrade and acquire new portable generators for emergency services	All Hazards	Mayor		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Looking for fixed site generators at two libraries, two recreation centers, and Veterans Building which could be potentially used as warming and cooling centers.</li> <li>3.</li> </ol>
TVH- 14	Evaluate methods to mitigate nuisance flooding in low-lying and/or poorly draining areas in Downtown Harrison, Purchase, and West Harrison	Flooding	Engr. / DPW		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Drainage upgrades needed. Complete engineering study to identify potential solutions.</li> <li>3.</li> </ol>





Project #	Project Name	Hazard(s) Addressed	Responsible Party	Brief Summary of the Original Problem and the Solution (Project)	Status (In Progress, Ongoing Capability, No Progress, Complete)	Evaluation of Success (if complete)	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate). 3. If discontinue, explain why.
TVH- 15	Update Comprehensive Plan and Emergency Response Plan to incorporate elements of hazard mitigation plan	All Hazards	Mayor / Planning Board		In Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Comprehensive Plan was recently done.</li> <li>Emergency Response Plan requires update. Include info on sheltering, evacuation, and housing.</li> <li>3.</li> </ol>
TVH- 16	At Woodlands Road, construct a 4' x 6' concrete box culvert, approximately 800 feet in length, to help convey floodwaters	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Include in HMP Update</li> <li>Combine with Brentwood Brook project</li> <li>.</li> </ol>
TVH- 17	Culvert beneath Dinsmore Place will be resized and realigned to more efficiently convey Nelson Creek.	Flooding	Engr. / DPW		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	<ol> <li>Discontinue</li> <li>.</li> <li>No longer a priority</li> </ol>
TVH- 18	Assess and prioritize non-structural flood hazard mitigation alternatives for at risk properties within the floodplain, including those that have been identified as repetitive loss, such as acquisition/relocation, or elevation depending on feasibility. The parameters for feasibility for this initiative would be: funding, benefits versus costs and willing participation of property owners. Implement as funding becomes available. Specifically identified	All	Village Engineering via NFIP FPA) with NYS DHSES, FEMA support		No Progress	Cost: Level of Protection: Damages Avoided; Evidence of Success:	1. Include in HMP Update 2. 3.





oject #		ızard(s) İdressed	Responsible	Brief Summary of the Original Problem and the	Status (In Progress, Ongoing Capability, No Progress,	Evaluation of Success	Next Steps 1. Project to be included in 2021 HMP or Discontinue 2. If including action in the 2021 HMP, revise/reword to be more specific (as appropriate).
Pr	Project Name	Ha Ad	Party	Solution (Project)	Complete)	(if complete)	3. If discontinue, explain why.
	are properties in the						
	following areas:						
	Temple Street,						
	Bradiord Street,						
	Elagler Drive						
	Filsworth Avenue						
	Indian Trail Shawnee						
	Trail Pinehurst						
	Drive, Walnut Lane.						
	Crotona Avenue,						
	Glendale Road, Oak						
	Street, Osborne Road,						
	Hickory Grove Drive,						
	Belmont Avenue,						
	Woodlands Road,						
	Park Avenue, West						
	Street, Batavia Place,						
	Ramapo Trail, Post						
	Place, Condit Street,						
	Crystal Street, and						
	Genesee Trail.						





#### **Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy**

The Town/Village of Harrison has identified the following mitigation projects/activities that have also been completed but were not identified in the previous mitigation strategy in the 2015 HMP:

None identified

# Proposed Hazard Mitigation Initiatives for the HMP Update

The Town/Village of Harrison participated in a mitigation action workshop in October 2021 and was provided the following FEMA publications to use as a resource as part of their comprehensive review of all possible activities and mitigation measures to address their hazards: FEMA 551 'Selecting Appropriate Mitigation Measures for Floodprone Structures' (March 2007) and FEMA 'Mitigation Ideas – A Resource for Reducing Risk to Natural Hazards' (January 2013).

The table below indicates the range of proposed mitigation action categories.

	FEMA				CRS					
Hazard	LPR	SIP	NSP	EAP	PR	PP	PI	NR	SP	ES
Disease Outbreak	X	Х		Х			Х			Х
Earthquake	Х	Х		Х			Х			Х
Extreme Temperature	Х	Х		Х			Х			Х
Flood	Х	Х		Х	Х	Х	Х		Х	Х
Severe Storm	Х	Х		Х		Х	Х		Х	Х
Severe Winter Storm	Х	Х		Х			Х			Х
Wildfire	Х	Х		Х			Х			Х
CBRN	X	X		Y		Y	Y			Y

#### Table 9.31-19. Analysis of Mitigation Actions by Hazard and Category

Note: Section 6 (Mitigation Strategy) provides for an explanation of the mitigation categories.

Table 9.31-20 summarizes the comprehensive-range of specific mitigation initiatives the Town/Village of Harrison would like to pursue in the future to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities. Both the four FEMA mitigation action categories and the six CRS mitigation action categories are listed in the table below to further demonstrate the wide-range of activities and mitigation measures selected.

As discussed in Section 6, 14 evaluation/prioritization criteria are used to complete the prioritization of mitigation initiatives. For each new mitigation action, a numeric rank is assigned (-1, 0, or 1) for each of the 14 evaluation criteria to assist with prioritizing your actions as 'High', 'Medium', or 'Low.' The table below summarizes the evaluation of each mitigation initiative, listed by Action Number.

Table 9.31-21 provides a summary of the prioritization of all proposed mitigation initiatives for the HMP update.




## Table 9.31-20. Proposed Hazard Mitigation Initiatives

Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Harrison -001	Repetitive Loss Mitigation	1, 2	Flood, Severe Storm	<ul> <li>Problem: Frequent flooding events have resulted in damages to residential properties. These properties have been repetitively flooded as documented by paid NFIP claims. The Town/Village has 94 repetitive loss properties, but other properties may be impacted by flooding as well. Areas prone to flooding in the Town/Village are the low-lying areas and areas along the waterways. Specifically identified are properties in the following areas: Temple Street, Bradford Street, Congress Street, Ellsworth Avenue, Indian Trail, Shawnee Trail, Pinehurst Drive, Walnut Lane, Crotona Avenue, Glendale Road, Oak Street, Osborne Road, Woodlands Road, Park Avenue, West Street, Batavia Place, Ramapo Trail, Post Place, Condit Street, Crystal Street, and Genesee Trail.</li> <li>Solution: Conduct outreach to 100 flood-prone property owners, including RL/SRL property owners and provide information on mitigation alternatives. After preferred mitigation measures are identified, collect required property-owner information and develop a FEMA grant application</li> </ul>	No	None	5 years	NFIP Floodplain Administrator , supported by homeowners	High	Eliminates flood damage to homes and residents, creates open space for the municipality increasing flood storage.	FEMA HMGP and FMA, local cost share by residents	High	SIP	PP





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution implement acquisition/purchase/moving/elevat ing residential homes in the flood	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Harrison -002	Emergency Shelter Backup Power	1, 2	All Hazards	rone areas that experience frequent flooding (high risk areas). <b>Problem:</b> Critical facilities require backup power to maintain continuity of services. Two libraries, two community centers, and the Veterans Building lack backup power. The Sollazzo Center is an emergency shelter. The other community center, the libraries, and the Veterans Building can be used for warming and cooling shelters. <b>Solution:</b> The Engineer will research what size generator is needed to power each facility. The Town/Village will then purchase and install the selected generators and necessary electrical components to supply backup power to the facilities. Public Works will be responsible for maintenance and testing of the generators following installation.	Yes	None	Within 5 years	Engineer, Public Works	High	Protect public health and safety and ensure continued operation of critical facility and essential functions during power outages.	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Managemen t Performance Grants (EMPG) Program, Municipal Budget	Hig h	SIP	ES
2021- Harrison -003	Evacuation and Sheltering Planning	1	All Hazards	<ul> <li>Problem: The current Emergency Response Plan identifies responsibilities for response during hazard events. The Plan could be expanded to include more information on evacuation routes/procedures and sheltering.</li> <li>Solution: The Town/Village will update the Emergency Response Plan to include guidance on</li> </ul>	Yes	None	Within 5 years	OEM	Staff time	Evacuation and sheltering procedures established	Municipal Budget	Hig h	LPR	ES





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution evacuation procedures and	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				snenering.										
2021- Harrison -004	Regional Flood Control for Beaver Swamp	1, 2, 4	Flood	Problem: Flooding is a regional problem which requires regional solutions for Beaver Swamp. Solution: The Town/Village will coordinate with neighbors in the Town of Mamaroneck and the City of Rye as well as Westchester County, to study flooding in the area of Beaver Swamp and identify sources and potential solutions. Cost-effective mitigation actions will be implemented.	No	None	Within 5 years	Engineer, FPA, Town of Mamaroneck, City of Rye, Westchester County	TBD by flood study	Reduction in flood risk in Beaver Swamp region	BRIC, HMGP, municipal and county budgets	Hig h	LPR , SIP	PP , SP
2021- Harrison -005	Critical Facility Flood Outreach	3	Flood	Problem: The Town/Village has numerous critical facilities with flood exposure which are privately owned. Solution: The FPA will conduct outreach to facility managers to discuss flood exposure and potential options for mitigation.	Yes	None	Within 6 months	FPA	Staff time	Facility managers aware of flood exposure and potential mitigation options	Municipal budget	Hig h	EAP	PI
2021- Harrison -006	Temporary and Permanent Housing	1, 2	All Hazards	<ul> <li>Problem: The Town/Village has not identified appropriate locations for the placement of temporary and permanent housing outside of the Special Flood Hazard Area.</li> <li>Solution: The Town/Village will work with Westchester County to identify appropriate locations for the siting of temporary and permanent housing within the region.</li> </ul>	No	None	6 months	Administratio n working with Westchester County	Staff time	Temporary and permanent housing locations identified	Municipal budget	Hig h	LPR	ES





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Harrison -007	Emergency Notifications	1	All Hazards	Problem: Residents are not receiving Town/Village outreach and emergency notifications. Solution: The Town/Village will explore options for increasing the effectiveness of emergency notification. Notification could be made to the residents via a community alert such as Nixle. This would be a plausible option, prior to an event. If possible and necessary residents could be notified in person by law enforcement going "door to door" during an actual event. The Mutual Aid System could also be invoked, to assist with notification. Effective measures identified will be implemented.	No	None	2 years	OEM	Medium	Increased effectiveness of emergency notifications	Town/Villag e budget	Hig h	EAP	PI, ES
2021- Harrison -008	Critical Facility Flood Protection	1, 2	Flood	<ul> <li>Problem: The Town/Village has numerous Town/Village owned critical facilities located within the SFHA or the 500-year floodplain. Flood exposed facilities under the Town/Village's jurisdiction that are considered critical include: <ul> <li>Gleason Place Utility Garage and other DPW facilities</li> <li>Brae Burn Drive Pump Station</li> </ul> </li> <li>Solution: The Engineer will survey each flood exposed critical facility to determine level of flood protection. For facilities not protected to the 500-year flood</li> </ul>	Yes	None	Within 5 years	Engineer	Low for survey	Protect critical facilities to the 500-year flood level	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Municipal Budget	Hig h	SIP	рр





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution	Critical Facility (Yes/No)	EHP lssues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
				level, the Town/Village will complete a feasibility assessment to determine cost-effective measures that can be completed to provide 500-year flood protection. Cost-effective measures will be completed.										
2021- Harrison -009	Town/Village Flood Map	3	Flood	<ul> <li>Problem: Current FIRMs do not include some areas that are experience flooding.</li> <li>Solution: The Town/Village plans to expand flood mapping and establish a Town/Village specific flood map that identifies all flooding sources (riverine, precipitation, urban, over land flooding). Once complete, the Town/Village will use this flood map to make updates to the Town/Village code.</li> </ul>	No	None	Within 5 years	Engineer, FPA, Administratio n	Medium	Better flood map data for floodplain administratio n	BRIC, Town/Villag e budget	Hig h	LPR	PR
2021- Harrison -010	Brentwood Brook Flood Control	1, 2	Flood, Severe Storm	<ul> <li>Problem: Flooding take place on Brentwood Brook in the vicinity of the Louis M Kline Middle School and the Harrison Avenue Elementary School.</li> <li>Solution: The Town/Village will evaluate potential flood mitigation needs along Brentwood Brook near the two schools. Cost effective mitigation measures will be implemented. Expected cost effective measures include: <ul> <li>Creation of flood storage at the Louis M Kline Middle School</li> </ul> </li> </ul>	No	May require permittin g	Within 5 years	Engineer, Louis M Kline Middle School, Harrison Avenue Elementary School.	High	Reduction in flooding along Brentwood Brook	BRIC, HMGP, FMA, CHIPS, Town/Villag e budget	Hig h	SIP	SP





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution	Critical Facility (Yes/No)	EHP Issues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
2021- Harrison -011	Mamaroneck Reservoir Dam	1, 2	Flood	<ul> <li>At Woodlands Road, construct a 4' x 6' concrete box culvert, approximately 800 feet in length, to help convey floodwaters</li> <li>Problem: The Mamaroneck Reservoir Dam is located in the Town/Village of Harrison but</li> </ul>	Yes	May require permittin	1 year	FPA, OEM, Administratio n	Staff time	Removal of dam would eliminate	Town/Villag e budget	Hig h	EAP	PI
	Removal			under the jurisdiction of the Town of Mamaroneck. The Town/Village would like to see removal of the dam as the reservoir is no longer being used. <b>Solution:</b> The Town/Village will conduct outreach to the Town of Mamaroneck and encourage the Town to remove the Mamaroneck Reservoir Dam.		g				threat of dam failure				
2021- Harrison -012	Floodplain Administratio n Training	3	Flood	<ul> <li>Problem: Additional floodplain administration training is needed for staff, specifically for building inspectors.</li> <li>Solution: Staff will undergo floodplain management training to increase floodplain management capabilities and enforcement in the Town/Village.</li> </ul>	No	None	Within 5 years	Administratio n, FPA, Building Inspectors	Staff time	Increased staff capabilities for floodplain administratio n	Town/Villag e budget	Hig h	LPR	PR
2021- Harrison -013	Downtown Harrison, Purchase, and West	1, 2	Flood	<b>Problem:</b> Drainage upgrades are needed in areas that experience nuisance flooding and poor drainage in Downtown Harrison, Purchase, and West Harrison.	No	None	Within 5 years	Engineer	TBD by engineerin g study	Increased drainage and reduction in flooding	BRIC, HMGP, CHIPS, Town/Villag e budget	Hig h	SIP	SP





Project Number	Project Name	Goal s Met	Hazard(s ) to be Mitigate d	Description of Problem and Solution	Critical Facility (Yes/No)	EHP lssues	Estimate d Timeline	Lead Agency	Estimated Costs	Estimated Benefits	Potential Funding Sources	Priority	Mitigation Category	CRS Category
	Harrison Drainage			<b>Solution:</b> The Town/Village will complete an engineering study to identify potential solutions. Cost- effective measures will be implemented.										
2021- Harrison -014	Harrison Elementary School Pond	2, 3	Flood	<ul> <li>Problem: Near the Harrison</li> <li>Elementary School, a pond floods</li> <li>and impacts nearby homes. Poor</li> <li>drainage and filling of the pond is</li> <li>suspected to be the cause of</li> <li>flooding. The pond is under the</li> <li>jurisdiction of the school district.</li> </ul> Solution: The Town/Village will bring the flooding to the attention <ul> <li>of the school and request the</li> <li>school district to clean the pond</li> <li>and make drainage improvements.</li> </ul>	No	None	Within 6 months	FPA	Staff time	School district aware of flooding and encouraged to act	Town/Villag e budget	Hig h	EAP	PI
2021- Harrison -015	Sanitary Sewer Pipe Rehabilitatio n	2	Flood, CBRN	<ul> <li>Problem: The Town/Village piping, sewage, and plumbing drainage systems are outdated and inefficient.</li> <li>Solution: The Town is in the middle of performing a Town-wide sanitary sewer project to repair, replace, line pipes that are in need of rehabilitation.</li> </ul>	No	None	Within 5 years	Engineer	High	Reduction in risk of sanitary sewer damage/spill s	Town/Villag e budget	Hig h	SIP	РР

Notes:

Not all acronyms and abbreviations defined below are included in the table.

#### Acronyms and Abbreviations:

- CAV Community Assistance Visit
- CRS Community Rating System
- DPW Department of Public Works
- EHP Environmental Planning and Historic Preservation
- Potential FEMA HMA Funding Sources:
- FMA Flood Mitigation Assistance Grant Program
- HMGP Hazard Mitigation Grant Program
- BRIC Building Resilient Infrastructure and Communities Program

#### Timeline:

*The time required for completion of the project upon implementation* 

Cost:

The estimated cost for implementation.





- FEMA Federal Emergency Management Agency
- FPA Floodplain Administrator
- HMA Hazard Mitigation Assistance
- N/A Not applicable
- NFIP National Flood Insurance Program
- OEM Office of Emergency Management

### Critical Facility:

*Yes I Critical Facility located in 1% floodplain* 

#### Mitigation Category:

- Local Plans and Regulations (LPR) These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Project (SIP) These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection (NSP) These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs (EAP) These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities

#### CRS Category:

- Preventative Measures (PR) Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.
- Property Protection (PP) These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- Public Information (PI) Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.
- Natural Resource Protection (NR) Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- Structural Flood Control Projects (SP) Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- Emergency Services (ES) Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities



Benefits:

*A* description of the estimated benefits, either quantitative and/or qualitative.



## Table 9.31-21. Summary of Prioritization of Actions

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2021-Harrison- 001	Repetitive Loss Mitigation	1	1	1	1	1	1	0	1	0	0	1	0	1	1	10	High
2021-Harrison- 002	Emergency Shelter Backup Power	1	1	1	1	1	1	0	1	1	1	1	0	1	1	12	High
2021-Harrison- 003	Evacuation and Sheltering Planning	1	0	1	1	1	1	1	1	1	1	1	0	1	1	12	High
2021-Harrison- 004	Regional Flood Control for Beaver Swamp	1	1	1	1	1	1	0	1	1	1	0	0	1	1	11	High
2021-Harrison- 005	Critical Facility Flood Outreach	1	1	1	1	1	1	1	1	1	1	0	1	1	1	13	High
2021-Harrison- 006	Temporary and Permanent Housing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	High
2021-Harrison- 007	Emergency Notifications	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	High
2021-Harrison- 008	Critical Facility Flood Protection	1	1	1	1	1	1	0	1	1	1	0	0	1	1	11	High
2021-Harrison- 009	Town/Village Flood Map	1	1	1	1	1	1	0	1	1	1	0	0	1	1	11	High
2021-Harrison- 010	Brentwood Brook Flood Control	1	1	1	1	1	0	0	1	1	1	1	0	1	1	11	High
2021-Harrison- 011	Mamaroneck Reservoir Dam Removal	1	1	1	1	0	1	1	1	1	1	0	1	1	1	12	High
2021-Harrison- 012	Floodplain Administration Training	1	1	1	1	1	1	1	1	1	1	0	0	1	1	12	High
2021-Harrison- 013	Downtown Harrison, Purchase, and West Harrison Drainage	1	1	1	0	1	1	0	1	1	1	0	0	1	1	10	High
2021-Harrison- 014	Harrison Elementary School Pond	0	1	1	1	0	1	1	1	1	1	0	1	1	1	11	High
2021-Harrison- 015	Sanitary Sewer Pipe Rehabilitation	0	1	1	1	1	1	1	1	1	1	1	0	1	1	12	High

Note: Refer to Section 6, which conveys guidance on prioritizing mitigation actions. Low (0-4), Medium (5-8), High (9-14).









# 9.31.9 Action Worksheets

The following action worksheets have been developed by the Town/Village of Harrison to aid in the submittal of grant applications to support the funding of high priority proposed actions.





Action Worksheet											
Project Name:	Repetitive Loss Mitiga	ation									
Project Number:	2021-Harrison-001										
	Ri	sk / Vul	nerabilit	У							
Hazard(s) of Concern:	Severe Storm, Flood										
Description of the Problem:	Frequent flooding eve have been repetitively repetitive loss properti prone to flooding in th Specifically identified Congress Street, Ellsw Lane, Crotona Avenue Avenue, West Street, 1 and Genesee Trail.	nts have flooded ies, but o ie Town/ are prop vorth Av o, Glenda Batavia l	resulted in as docum other proper Village ar perties in t enue, Indi ale Road, o Place, Ran	n damages to residentia ented by paid NFIP cla erties may be impacted e the low lying areas a he following areas: Te an Trail, Shawnee Tra Dak Street, Osborne R hapo Trail, Post Place,	al properties. These properties aims. The Town/Village has 94 l by flooding as well. Areas and areas along the waterways. mple Street, Bradford Street, il, Pinehurst Drive, Walnut oad, Woodlands Road, Park Condit Street, Crystal Street,						
	Action or Projec	t Inten	ded for Ir	nplementation							
Description of the Solution:	Conduct outreach to 1 and provide informatic identified, collect requ application and BCA t residential homes in th	00 flood on on mi uired proj to obtain ne flood j	-prone pro tigation al perty-own funding to prone area	perty owners, includir ternatives. After prefe er information and dev o implement acquisitions s that experience frequ	ng RL/SRL property owners erred mitigation measures are velop a FEMA grant on/purchase/moving/elevating uent flooding (high risk areas).						
Is this project related to a Critical Facility or Lifeline? Yes No X											
Is this project related to a C located within the 100-yea	Critical Facility r floodplain?		No 🖾								
(If yes, this project must intend to protect the 500-year flood event or the actual worse case damage scenario, whichever is greater)											
Level of Protection:	1% annual chance floo event + freeboard (in accordance with flood ordinance)	od	Estimat (losses	ed Benefits avoided):	Eliminates flood damage to homes and residents, creates open space for the municipality increasing flood storage.						
Useful Life:	Acquisition: Lifetime Elevation: 30 years (residential)		Goals M	let:	1, 2						
Estimated Cost:	High		Mitigat	ion Action Type:	Structure and Infrastructure Project						
	Plan	for Imp	lementa	tion	2						
Prioritization:	High		Desired Implen	l Timeframe for entation:	5 years						
Estimated Time Required for Project Implementation:	5 years		Potenti Sources	al Funding S:	FEMA HMGP and FMA, local cost share by residents						
Responsible Organization:	NFIP Floodplain Administrator, support homeowners	ted by	Local P Mechar in Impl	lanning lisms to be Used ementation if any:	Hazard Mitigation						
	Three Alternatives	Consid	ered (inc	luding No Action)	Evolvetter						
	Action No Action		Es	\$0	Evaluation						
Alternatives:	Elevate homes			\$500,000	When this area floods, the entire area is impacted; elevating homes would not eliminate the problem and still lead to road closures and impassable roads						
	Elevate roads			\$500,000	Elevated roadways would not protect the homes from flood damages						
	Progress Rei	oort (fo	r plan ma	intenance)							





Date of Status Report:	
Report of Progress:	
Update Evaluation of the Problem and/or Solution:	







Action Worksheet											
Project Name:	Repetitive Loss Mitigation 2021-Harrison-001										
Project Number:	2021-Harrison-001										
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate									
Life Safety	1	Families moved out of high-risk flood areas.									
Property Protection	1	Properties removed from high-risk flood areas.									
Cost-Effectiveness	1	Cost-effective project									
Technical	1	Technically feasible project									
Political	1										
Legal	1	The Town/Village has the legal authority to conduct the project.									
Fiscal	0	Project will require grant funding.									
Environmental	1										
Social	0	Project would remove families from the flood prone areas of the Town/Village.									
Administrative	0										
Multi-Hazard	1	Severe Storm, Flood									
Timeline	0	5 years									
Agency Champion	1	NFIP Floodplain Administrator, supported by homeowners									
Other Community Objectives	1										
Total	10										
Priority (High/Med/Low)	High										





		Action	Works	sheet			
Project Name:	Emergency Shelter	Backup P	ower				
Project Number:	2021-Harrison-002						
Risk / Vulnerability							
Hazard(s) of Concern:	All Hazards						
Description of the Problem:	Critical facilities red community centers, emergency shelter. be used for warmin	quire back and the V The other g and cool	tup pov veteran comm ling sh	wer to maintain con s Building lack bac unity center, the lib elters.	tinuity of kup pow raries, ar	f services. Two libraries, two er. The Sollazzo Center is an nd the Veterans Building can	
Action or Project Intended	for Implementatio	n					
Description of the Solution:	The Engineer will r Town/Village will t components to supp maintenance and tes	esearch w hen purch oly backup sting of th	hat siz ase an powe e gene	e generator is neede d install the selected r to the facilities. Pu rators following ins	d to pow l generat Iblic Wo tallation.	ver each facility. The ors and necessary electrical rks will be responsible for	
Is this project related to a	Critical Facility?	Yes	$\boxtimes$	No 🗌			
Is this project related to a	Critical Facility	Yes		No 🖂			
(If yes, this project must intend t	to protect the 500-year	flood ever	nt or th	e actual worse case d	lamage so	cenario whichever is greater)	
Level of Protection:N/AEstimated Benefits (losses avoided):Protect p safety and operation and essiduring							
Useful Life:	20 years		Goal	s Met:		1, 2, 6	
Estimated Cost:	High		Miti	gation Action Typ	e:	Structure and Infrastructure Projects (SIP)	
Plan for Implementation							
Prioritization:	High		Desired Timeframe for Implementation:			Within 5 years	
Estimated Time Required for Project Implementation:	1 year		Pote	ential Funding Sou	irces:	FEMA HMGP and BRIC, USDA Community Facilities Grant Program, Emergency Management Performance Grants (EMPG) Program, Municipal Budget	
Responsible Organization:	Engineer, Public W	orks	Loca to be Imp	ll Planning Mecha e Used in lementation if an	nisms y:	Hazard Mitigation, Emergency Management	
Three Alternatives Conside	ered (including No	Action)					
	Action		E	stimated Cost		Evaluation	
	No Action			\$0	337	Problem continues.	
Alternatives:	Install solar par	nels		\$100,000	amo e	ount of space for installation; xpensive if repairs needed	
	Install wind tur	oine		\$100,000	Wea to v	ther dependent; poses a threat wildlife; expensive repairs if needed	
Progress Report (for plan	maintenance)						
Date of Status Report:							
Report of Progress:							
Update Evaluation of the Problem and/or Solution:							







Action Worksheet		
Project Name:	Emergency Shelter Backup Power	
Project Number:	2021-Harrison-002	
Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Project will protect critical services of sheltering facilities
Property Protection	1	Project will protect buildings from power loss.
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	The Town/Village has the legal authority to complete the project.
Fiscal	0	Project requires funding support.
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	Severe Storm, Severe Winter Storm, Hurricane, Nor'Easter
Timeline	0	Within 5 years
Agency Champion	1	Engineer, Public Works
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

