Town of East Fishkill Hazard Mitigation Plan

June 2013

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SECTION 1: INTRODUCTION

BACKGROUND

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), the Town of East Fishkill, New York has developed this Hazard Mitigation Plan (HMP or Plan). DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for HMPs. The New York State Office of Emergency Management (NYSOEM) also supports plan development for jurisdictions in the State of New York.

> ***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*** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

Specifically, DMA 2000 requires that states with support from local governmental agencies develop HMPs 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.

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 encouraged communities to first assess their vulnerability to various disasters and then 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, consequently, 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 post-disaster damage repair.

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 a 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 NYSOEM. FEMA also provides support through guidance, resources, and plan reviews.

Organizations Involved in the Mitigation Planning Effort

The Town of East Fishkill intends to implement this plan with the participation of its various departments, organizations, and governing body, as well as by coordinating with relevant State, and federal entities. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and implement the mitigation strategy identified in Section 6.

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 the State of New York, NYSOEM is the lead agency providing hazard mitigation planning assistance to local jurisdictions. NYSOEM provides guidance to support mitigation planning. In addition, FEMA provides grants, tools, 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). Oversight for the preparation of this plan was provided by the Town of East Fishkill Hazard Mitigation Planning Committee (Planning Committee), identified in Table 1-1.

Table 1-1. Town of East Fishkill Hazard Mitigation Planning Committee

Name	Title
John Hickman	Town Supervisor
Rick Witt	Town Engineering Assistant
Mark Pozniak	Town Comptroller
Kenneth Beyer	Town Acting Building Inspector and Zoning Administrator
Bill McClellan (formerly John Paraskeva)	Town MS-4 Enforcement Officer
Dennis Miller	Town Highway Superintendent
Michelle Robbins	Contract Planner – AKRF, Inc.
Walter Artus	Contract Stormwater Management Planner - SMC, Inc.
Brian C. Nichols	Chief of Police
Corey Ehrhart	Police Sergeant and Fire Commissioner
Lori Gee (formerly Timothy A. Paraskeva	Chairman – Planning Board
Pam Baier	Secretary to Town Planning Board

This HMP was prepared in accordance with the following regulations and guidance:

- 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. 2004. "How-To Guide for Using HAZUS-MH for Risk Assessment." FEMA Document No. 433. February.
- FEMA Mitigation Planning How-to Series (FEMA 386-1 through 4, 2002), available at: http://www.fema.gov/fima/planhowto.shtm.

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

Table 1-2. FEMA Local Mitigation Plan Review Crosswalk

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 B
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Sections 1.0 and 3.0
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Sections 5.2 and 5.3
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)	Sections 4.0
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 and 5.4
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 6.0
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Section 6.0
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 6.0
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7.0, Appendix D
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7.0
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7.0

IMPLEMENTATION OF THE PLANNING PROCESS

The planning process and findings are to be documented in local HMPs. To support the planning process to develop this HMP, the Town of East Fishkill has accomplished the following:

- Developed a Hazard Mitigation Planning Committee (planning committee)
- Identified the hazards of concern that pose the greatest risk to the Town
- Profiled these hazards
- Estimated the inventory at risk and potential losses associated with these hazards
- Developed mitigation goals, objectives and actions that address the identified risks
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NYSOEM and FEMA

To address the requirements of DMA 2000 and better understand their potential vulnerability to and losses associated with hazards of concern, Town of East Fishkill used the Hazards U.S. – Multi-Hazard (HAZUS-MH) software package (discussed in greater detail later in this Plan) supplemented by local data, as feasible, to support the risk assessment and vulnerability evaluation. HAZUS-MH assesses risk and estimates potential losses for natural hazards. It produces outputs that will assist state and local governments, communities, and the private sector in implementing emergency response, recovery, and mitigation programs, including the development of HMPs.

As required by DMA 2000, the planning process has informed the public and provided opportunities for public comment and input. In addition, local and regional stakeholders have participated in the planning process, providing input and expertise throughout the planning process, and helping to identify appropriate mitigation actions.

This plan documents the process and outcomes of the Town's efforts. Additional information on the planning 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.

Benefits of Mitigation Planning

The planning process will help prepare citizens and government agencies to better respond when disasters occur. Also, mitigation planning allows the Town of East Fishkill to become eligible for mitigation grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning include:

- An increased understanding of hazards faced by the Town of East Fishkill
- A more sustainable and disaster-resistant 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 and reduced repair costs

Organization of this Mitigation Plan

This Plan was organized in accordance with FEMA and NYSOEM guidance, and its structure follows the four-phase planning process recommended by FEMA and summarized in Figure 1-2.

Section 2, Plan Adoption: Information regarding the adoption of the Plan by the Town of East Fishkill.

Section 3, Planning Process: A description of the Plan methodology and development process, Planning Committee and stakeholder involvement efforts, and a description of how this Plan will be incorporated into existing programs.

Section 4, Town Profile: An overview of the Town of East Fishkill, including: (1) general information, (2) population and demographics, (3) general building stock inventory, (4) land use trends, (5) future growth and development, and (6) critical facilities.

Section 5, Risk Assessment: Documentation of the hazard identification and 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, the economy and future growth and development). Description of the status of local data and planned steps to improve local data to support mitigation planning.

Section 6, Mitigation Strategy: Information regarding the mitigation goals, objectives, capability assessment, and mitigation action items identified by the Town in response to priority hazards of concern.

Section 7, Plan Maintenance Procedures: The system established by the Town of East Fishkill to monitor, evaluate, maintain, and update the Plan.

Acronyms: Abbreviations used throughout this Plan.

Glossary: Glossary of terms found throughout the Plan.

References: Sources of data and information used throughout this plan.

Appendices –

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, FEMA Guidance Worksheets: example FEMA Guidance Worksheets to facilitate plan maintenance and review by the Town.

Appendix E, Federal Mitigation Programs, Activities, and Initiatives: Summary of federal funding options that could be used to fund mitigation activities.

Figure 1-1. Town of East Fishkill Hazard Mitigation Planning Process

Ongoing Stakeholder Involvement

Phase 1: Organize Resources
The Planning Committee is developed; resources are identified and obtained; public involvement is initiated. Technical, regulatory, and planning experts are identified to support the planning process.

Phase 2: Assess Risks
The Planning Committee, with appropriate input, identifies potential hazards, collects data, and evaluates the characteristics and potential consequences of natural hazards on the community.

HAZUS-MH was applied to assist the Town of East Fishkill:

- Identify Hazards (Phase 2)
- Profile Hazards (Phase 2)
- Perform a Vulnerability Assessment (Phase 2) including:
  - Inventory Assets
  - Estimate Losses
  - Evaluate Development Trends
  - Present Results of Risk Assessment

These results provide an input to Phase 3.

Phase 3: Develop a Mitigation Plan
The Planning Committee uses the risk assessment process and stakeholder input to understand the risks posed by natural hazards, determine what its mitigation priorities should be, and identify options to avoid or minimize undesired effects. The results are a hazard mitigation plan, including mitigation strategies and a plan for implementation.

Phase 4: Implement the Plan and Monitor Progress
The Planning committee brings the plan to life in a variety of ways including: implementing specific mitigation projects; changing the day-to-day operation of the Town of East Fishkill, as necessary, to support mitigation goals; and monitoring progress and updating the plan over time.

SECTION 2: PLAN ADOPTION

OVERVIEW

This section contains information regarding adoption of the plan by the Town of East Fishkill.

> 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). August.

Plan Adoption by Local Governing Body

Adoption by the local governing body demonstrates the commitment of the Town to fulfill the mitigation goals and objectives outlined in the plan, and specifically to implement the mitigation strategy identified. Adoption legitimizes the plan and authorizes responsible departments and municipal representative to execute their responsibilities.

The Town will proceed with formal adoption proceedings when FEMA provides conditional approval of this plan. Following adoption or formal action on the plan, the Town must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the plan to NYSOEM. This will then be submitted to FEMA with the resolution in Appendix A of this Plan. The Town understands 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.

SECTION 3: PLANNING PROCESS

3.1 Introduction

This section includes a description of the planning process used to develop this hazard mitigation plan (HMP), including how it was prepared, who was involved in the process, how the public and stakeholders were involved, and how existing plans and programs were integrated into, and coordinated with, this planning process.

To ensure that the Plan met the requirements of the DMA 2000, an approach to the planning process and Plan documentation was developed to achieve the following:

- The Plan considered 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 to the Town were considered.

- The Plan was developed following the process outlined by DMA 2000, FEMA regulations, and FEMA and NYSOEM guidance. Following this process ensures 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 Town of East Fishkill Hazard Mitigation Plan (HMP or Plan) was written using the best available information obtained from a wide variety of sources. Throughout plan development, 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 Town. The Town of East Fishkill Hazard Mitigation Planning Committee (Planning Committee) solicited information from local agencies and individuals with specific knowledge of natural hazards and past historical events, as well as reviewed planning and zoning codes, ordinances, and other relevant planning documents. The hazard mitigation strategies identified in this plan have been developed through an extensive planning process involving local, county and regional agencies, and Town residents and stakeholders.

This section of the Plan describes the mitigation planning process, including (1) Preparing to Plan, (2) Organization of Planning Process, (3) Planning Activity, (4) Stakeholder Outreach and Involvement, (5) Public Outreach and Participation, (6) Integration/Coordination of Existing Plans, Programs and Information, and (7) Continued Public Involvement.

3.2 Preparing to Plan

While this planning effort represents the first time East Fishkill has worked to develop a DMA-compliant local plan, it does not represent the start of hazard risk management efforts in the Town. Hazard mitigation programs and projects have been implemented in the Town prior to this planning effort; specifically the Town has:

- Actively participates in the NFIP, which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.

- Developed and maintained a Comprehensive Plan controlling land-use and development in the Town.

- Developed and implemented a stormwater management program that includes requiring that flooding be identified during home and commercial construction through the land use and permitting process, and requiring onsite drainage detention to mitigate stormwater increases.

- Adopted higher regulatory and zoning standards to protect environmentally sensitive areas and manage natural hazard risk; including:
    - Reduced allowable densities of wetlands and steep slopes, specifically all acreage in slopes greater than 20%, floodplains, and wetlands shall not count more than 50% towards development density.
    - Adopted an R-3 zone in the Township (minimum lot size of 3 acres per dwelling unit), to apply to the to the southern part of East Fishkill covered by the Taconic Mountain range and the New York City watershed, to recognize the environmentally sensitive lands throughout the mountains.

- Leads and participates in regional organizations, such as the Fishkill Creek Watershed Association and Community Emergency Response Teams that directly supports hazard risk management and reduction in the Town.

- Conducted studies of specific vulnerabilities in the Town in an effort to develop appropriate and cost-effective solutions.

- Performed mitigation projects to public infrastructure as needed, including:
    - Retrofitted the flood vulnerable bridge in Wiccopee (Tamarack 2).
    - Upgraded culverts throughout the Town as needed.
    - Performed streambank stabilization projects as needed.

- Supports an ongoing program to purchase undeveloped vulnerable property to prevent inappropriate development, including the recent purchase (2012) of over 147 acres that included ~40 acres of floodplain.

- Works with utilities to prune trees and vegetation vulnerable to winter storm damage to minimize or avoid power outages.

In 2008, the Town of East Fishkill organized a consortium of southwest Dutchess County municipalities to prepare a multi-jurisdictional HMP, including the Towns of Lagrange, Wappinger, and Fishkill, and the Villages of Fishkill and Wappingers Falls. East Fishkill, on behalf of the consortium, applied for and was awarded a FEMA mitigation planning grant under the 2009 Pre-Disaster Mitigation (PDM) grant program. Unfortunately due to the economic downturn, the consortium eventually dissolved and East Fishkill had to decline the multi-jurisdictional planning grant.

Recognizing the importance of mitigation planning to the Town, East Fishkill applied for a single-jurisdiction planning grant under the Hazard Mitigation Grant Program (HMGP) DR-1899, which was awarded in November 2011, and has supported the development of this plan.

These past efforts and actions have contributed to the Town's understanding of its hazard vulnerability, preparedness and future mitigation action needs, costs, and benefits. These efforts provide a strong foundation for the planning committee to use in developing this plan.

3.3 Organization of Planning Process

Project management and grant administration has been the responsibility of the Town Supervisor, with close support from the engineering department and the Town's comptroller.

Through an open bid process, the Town selected a contract planning consultant (Tetra Tech, Inc. – Morris Plains, NJ). The contract consultant was tasked with:

- Assisting with the organization of a planning committee;
- Assisting with the development and implementation of a public and stakeholder outreach program;
- Data collection;
- Facilitation and attendance at meetings (planning committee, stakeholder, public and other);
- Identification of the hazards of concern, and hazard profiling and risk assessment;
- Assistance with the development of mitigation planning goals and objectives;
- 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.

At the commencement of the project, the contract consultant worked with the Town to identify a Planning Committee comprised of municipal personnel, local emergency first responders, contract consultants, and other stakeholders as identified in Table 3-1:

Table 3-1. Town of East Fishkill Hazard Mitigation Planning Committee

Name	Title
John Hickman	Town Supervisor
Rick Witt	Town Engineering Assistant
Mark Pozniak	Town Comptroller
Kenneth Beyer	Town Acting Building Inspector and Zoning Administrator, NFIP Floodplain Admin.
Bill McClellan (formerly John Paraskeva)	Town MS-4 Enforcement Officer
Dennis Miller	Town Highway Superintendent
Michelle Robbins	Contract Planner (AKRF, Inc.)
Walter Artus	Contract Stormwater Management Planner (SMC, Inc.)
Brian C. Nichols	Chief of Police
Corey Ehrhart	Police Sergeant and Fire Commissioner
Lori Gee (formerly Timothy A. Paraskeva)	Chairman – Planning Board
Pam Baier	Secretary to Town Planning Board

The Planning Committee supported the following planning activities, under the guidance and direction of the contract consultant:

- Establish plan development goals;
- Establish a timeline for completion of the plan;
- Ensure that the plan meets the requirements of DMA 2000, and FEMA and NYSOEM guidance;
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the plan development process;
- Assist in gathering information for inclusion in the plan, including the use of previously developed reports and data;
- Identify, develop and prioritize appropriate mitigation initiatives.
- Review, amend and approve all sections of the plan;
- Support the adoption, implementation and maintenance of the plan.

3.4 Planning Process Activity

Members of the Planning Committee (individually and as a whole), as well as key stakeholders, convened and/or communicated on an as-needed basis to compile information and participate in planning activities to identify hazards; assess risks; identify critical facilities; assist in developing mitigation goals, objectives and actions; and provide continuity through the plan development process to ensure that natural hazards vulnerability information and appropriate mitigation strategies were incorporated into the plan. The planning committee reviewed the plan, supported interaction with other stakeholders and assisted with public involvement efforts.

Table 3-2 presents a summary of Planning Committee 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 B.

Table 3-2. Summary of Mitigation Planning Activities / Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
April 15, 2010	1b, 2	Presentation by Tetra Tech to East Fishkill Town Board and neighboring municipalities on the pending multi-jurisdictional planning process	Members of the Town Board, representatives from Towns of Lagrange, Wappinger, Fishkill and Villages of Fishkill and Wappingers Falls; Jonathan Raser, Cynthia Bianco – Tetra Tech
April 14, 2011	1b, 2	Presentation by Tetra Tech to East Fishkill Town Board on the benefits of mitigation planning and the pending Town of East Fishkill mitigation planning process	Members of the Town Board; Jonathan Raser, Tetra Tech
February 7, 2012	2, 3a, 3b	Project organizational meeting to discuss project administration, develop schedule, identify Planning Committee members, and commence the data collection process.	John Hickman – Town Supervisor; Mark Pozniak – Town Comptroller; Rick Witt – Engineering Assistant; Jonathan Raser – Tetra Tech
February	1b, 2, 3a-e	Planning Committee Kick Off Meeting –	John Hickman – Town Supervisor;

Date	DMA 2000 Requirement	Description of Activity	Participants
21, 2012		Introductions by Planning Committee members; discussed data collection needs and status; reviewed local capability assessment; reviewed potential hazards of concern; discussed and developed the public and stakeholder outreach program; briefing by FEMA Mitigation Planning representative on planning process and new plan review guidance.	Mark Pozniak – Town Comptroller; Rick Witt – Engineering Assistant; Michelle Robbins – Planner, AKRF, Inc.; Walter Artus – Stormwater Management Plan coordinator; John Paraskeva – MS4 and Engineering; Corey Ehrhart – Police Sergeant and Fire Commissioner; Ken Beyer – Building and Zoning Administrator; Paul Hoole – FEMA Planning; Jonathan Raser – Tetra Tech
April 12, 2012	1b, 2	Town Board Work Session - Public Outreach Presentation – Contract consultant presented the planning process to the Board and public, explained the need and benefits of public involvement, and answered questions. The project was widely advertised and videotaped and made available on the Town website for public review. Interested residents asked to submit a Property Owner Notice of Voluntary Interest.	Town Board and the public; Jonathan Raser – Tetra Tech
April 2012	1b	Town launches the project webpage on the Town website with an announcement and link on the homepage. Project webpage included the April 12 Public Outreach presentation, and a copy of the Property Owner Notice of Voluntary Interest.	Town of East Fishkill; public and stakeholders
May 9, 2012	3c	Critical Facility Data Collection Meeting – Review of the current critical facility inventory, including site reconnaissance throughout the town to update facility attribute information and assess specific vulnerable areas.	Town of East Fishkill Engineering, Public Works, Tetra Tech
June 25, 2012	1b, 2, 3b-e,4a, 4b	Planning Committee Meeting – Review and approve critical facility inventory; review draft hazard profiles; initiate capability assessment; review public and stakeholder outreach; discuss goals and objectives; continue process of identifying potential mitigation projects.	John Hickman – Town Supervisor; Mark Pozniak – Town Comptroller; Rick Witt – Engineering Assistant; Michelle Robbins – Planner, AKRF, Inc.; Walter Artus – Stormwater Management Plan Coordinator; Dennis Miller – Highway Superintendent; John Paraskeva – MS4 and Engineering; Ken Beyer – Building and Zoning Administrator; Jonathan Raser – Tetra Tech
October 2012	1b	Town updates project webpage to make available draft sections of the plan for public review and input.	Town of East Fishkill; public and stakeholders
November 2012	1b	Draft Town Profile (Section 4) and draft Hazard Profiles (Section 5) posted to project webpage for public review and input.	Town of East Fishkill; public and stakeholders
November 8, 2012	1b, 2, 4b, 4c	Project presented and discussed at the regular meeting of the Fishkill Creek	Members of the Fishkill Creek Watershed Association of Dutchess

Date	DMA 2000 Requirement	Description of Activity	Participants
		Watershed Association of Dutchess and Putnam Counties. Members asked to review and comment on draft sections of the plan, and to help in the identification of appropriate mitigation projects and initiatives.	and Putnam Counties
December 14, 2012	1a, 2, 4b, 4c, 5a-c	Planning Committee Meeting – Reviewed mitigation strategy section; reviewed plan maintenance and implementation plan; reviewed progress and upcoming activity on public and stakeholder outreach.	John Hickman – Town Supervisor; Mark Pozniak – Town Comptroller; Rick Witt – Engineering Assistant; Michelle Robbins – Planner, AKRF, Inc.; Walter Artus – Stormwater Management Plan coordinator; Corey Ehrhart – Police Sergeant and Fire Commissioner; Ken Beyer – Building and Zoning Administrator; Dennis Miller – Highway Superintendent; Jonathan Raser – Tetra Tech
January – March, 2013	1b, 5b	Town distributes hazard mitigation surveys to academic, commerce/business, and utilities in the Town to solicit specific input from these stakeholder groups.	Town and local/regional stakeholders
May 7, 2013	1b, 2, 3b-e,4a, 4b	Planning Committee Meeting – Review of draft plan sections prior to making available to public for comment.	John Hickman – Town Supervisor; Bill McClellan – Stormwater Management Officer; Scott Bryant – Town Engineer; Rick Witt – Engineering Assistant; Michelle Robbins – Planner, AKRF, Inc.; Walter Artus – Stormwater Management Plan Coordinator; Dennis Miller – Highway Superintendent; Ken Beyer – Building and Zoning Administrator; Jonathan Raser – Tetra Tech
May 1, 2013	1b	Complete draft plan posted to public website, advertised on the Town homepage, and at local meetings.	Town of East Fishkill; public and stakeholders
June 2013	2	Final draft plan submitted to NYSOEM and FEMA for review and approval	Town of East Fishkill, NYSOEM, FEMA Region II
Upon plan approval by FEMA	1a	Plan adoption by resolution by the Town of East Fishkill Town Board	Town Board

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

3.5 Stakeholder Outreach and Involvement

Municipal and Local Government Agency Involvement

The Planning Committee and/or its members and contract consultant met and communicated with relevant representatives of the Town to obtain data and information, review existing plans and capabilities, and facilitate the identification of an appropriate mitigation strategy. Further, these departments have reviewed the draft plan and provided direct input during its development. The Town of East Fishkill departments, agencies, and contractors that have been involved in this effort include:

- Supervisor's Office
- Town Board
- Engineering Department (including MS4 compliance)
- Building Department (includes NFIP Floodplain Administrator)
- Planning/Zoning Department
- Conservation Advisory Council (CAC)
- Finance Department
- Public Works / Highway Department
- Legal
- Police Department
- East Fishkill Fire District
- Fire Inspector
- Fire Advisory Board
- Geographic Information Systems (GIS)
- Municipal planning contractor - AKRF, Inc.
- Stormwater management planning contractor - SMC, Inc.

Federal, State, County, Regional and other Local Stakeholders

FEMA Region II: Provided updated planning guidance; provided summary and detailed NFIP data for planning area; conducted plan review.

United States Department of Agriculture (USDA) - National Resource Conservation Service (NRCS): Provided information on technical and financial resources available to address dam safety concerns in the Town.

New York State Office of Emergency Management (NYSOEM: Headquarters and Region II – Administered planning grant and facilitated FEMA review.

New York State Department of Environmental Conservation (NYSDEC): Provided data on dams in the Town, and information on how the Town can address concerns with Lake Sekunna Dam (Bureau of Flood Protection and Dam Safety).

Cornell Cooperative Extension – Dutchess County: Provided data and information on Dutchess County watersheds, and environmental codes and regulations for municipalities in the County.

Fishkill Creek Watershed Association of Dutchess and Putnam Counties: Provided representation on the planning committee through the Town's Engineering Assistant. Provided review and input to draft plan sections, including identifying potential mitigation initiatives. Project has been presented and discussed at regular meetings of the Association. Please see review letter in Appendix C.

East Fishkill Fire District: The East Fishkill Fire District, which consists of four individual fire companies located throughout the town, provided representation to the planning committee through the fire commissioner, provided relevant vulnerability data and information, identified potential mitigation and other emergency management (response) activities, and reviewed plan documents.

Utilities:

The Town Highway Department oversees the maintenance of the ten water districts in the Town (most serving private interests), including the Four Corners Water District. In addition, the Town is served by the Four Corners Sewer District. These districts were represented on the planning committee by the Town's Highway Superintendent, who provided relevant inventory and vulnerability data and information, identified potential mitigation actions, and reviewed draft plan documents.

Outreach to these was further supported through the distribution of the Utilities Stakeholder Survey. Specific information and input provided by these entities has been incorporated within this Plan Update as appropriate. Beekman Water District (Beekman Golf LLC) response to the survey is provided in Appendix C.

Repeated attempts to obtain electric service interruption data from New York State Electric and Gas (NYSEG) and Central Hudson Gas and Electric were unsuccessful.

Academia:

While residents in the Town of East Fishkill are served by the Arlington Central School District (CSD), Carmel CSD, Pawling CSD and Wappingers CSD, only Wappingers CSD has facilities located in the Town.

The Wappingers CSD – The Wappingers CSD was advised of the mitigation planning project and provided the Academic Stakeholder Survey. Their response may be found in Appendix C. They noted that their facilities lack backup power. This was noted in the critical facilities inventory, and has been included as a mitigation action in the plan (Action ES-2).

Civic and Non-Profit Organizations:

Rotary of East Fishkill – The Rotary of East Fishkill was provided a stakeholder survey to facilitate input to the project (see Appendix C), however no response was provided as of the date of this plan.

Hudsonia - The Town, specifically through the Planning Board and Conservation Advisory Council, work with Hudsonia to identify and protect critical environmental resources within the Town and region. The hazard mitigation planning project was presented and discussed with Hudsonia, with input and recommendations incorporated as appropriate, including within the mitigation strategy (Action PV-13).

Hospitals and Health Care:

There are no hospital facilities, nursing homes or adult care facilities located in the Town of East Fishkill.

Industrial and Commercial Interests:

Outreach to industrial and commercial interests in the Town was supported through the distribution of the Business/Commerce Stakeholder Survey (see Appendix C). Specifically, surveys were distributed to:

- Rotary of East Fishkill (no response to date)
- IBM/Hudson Valley Research Park (see response Appendix C)
- Dutchess County Economic Development Corporation (no response to date)

Neighboring Counties and Municipalities:

Representatives from Dutchess and Putnam County's and surrounding communities were regularly advised of the project and provided input to the plan (review of draft plan, identification of potential mitigation initiatives) through the Fishkill Creek Watershed Association of Dutchess and Putnam Counties.

The surrounding Towns of Lagrange, Wappinger, Fishkill and the Villages of Fishkill and Wappingers Falls were part of the 2008 consortium that first attempted to develop a multi-jurisdictional HMP. These municipalities have continued to be advised of the project and invited to attend project related public and stakeholder outreach efforts.

3.6 Public Outreach and Input

In order to facilitate coordination and communication between the planning committee and citizens, various methods of public outreach were conducted to inform the public of the plan and encourage their participation in the planning process. The following public outreach efforts were made during the development of this plan:

- The planning project was presented to the Town Board at regular working meetings in April, 2010 and April, 2011 (prior to receiving the FEMA grant for this planning effort), and April 2012 to "kick-off" this planning process and inform the public of the project. These meetings are open to public, well-advertised, and are videotaped and remain available for viewing on the Town website.

- The April 2012 Town Board project presentation was advertised on the Town website and on the bulletin board in front of Town Hall. Further, all NFIP Repetitive Loss (RL) and Severe Repetitive Loss (SRL) property owners in the town were mailed an announcement of the meeting. The meeting and presentation was attended by several dozen residents who were encouraged to submit a "Homeowner Interest Sign-Up Sheet and Voluntary Notice" stating their interest to voluntarily participate in efforts to investigate mitigating their properties.

- Property owners who submitted a Notice of Voluntary Interest were provided a property information survey (see Appendix C) to collect critical information to assist in evaluating properties for mitigation, and facilitating the mitigation grant application process.

- The Town developed a public Hazard Mitigation Planning webpage (http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan) to explain the project and elicit public participation in the process and input to the plan. The webpage was launched in April 2012 and has been supported by an announcement on the Town homepage since the April launch. Draft versions of the plan sections were posted on the website as they became available, starting with the Town Profile (Section 4) and Hazard Profiles (Section 5) in October, 2012. A print-out of the full mitigation webpage as of May 2013 is available in Appendix C.

Figure 3-1: Town Homepage with Link to Plan Webpage and Citizen Survey

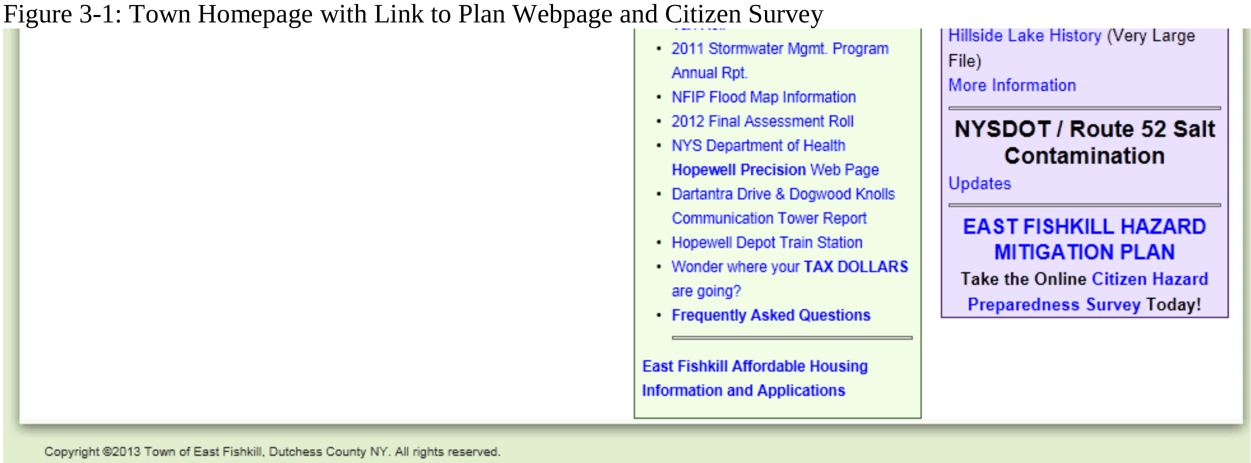


Figure 3-2: Hazard Mitigation Plan Webpage

- An on-line natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact residents in the Town and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards (http://www.surveymonkey.com/s/P8FSYT6). The questionnaire asked 24 quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asked several demographic questions to help analyze trends.

  The questionnaire has been available on the public website since April 2012. Appendix C includes a copy of the survey, and summarizes public input received through the website, the online survey, and other sources.

- The project has been presented by members of the Planning Committees at various regularly scheduled local meetings to encourage awareness of the project and elicit input to the Plan, including the following:

  - Fishkill Creek Watershed Association of Dutchess and Putnam Counties
  - Planning Board
  - Conservation Advisory Council

- Draft and ultimately final versions of the plan have been posted to the public website for public review and comment. Beginning in October 2012, available sections of the Interim Draft Plan were posted for review, beginning with the Regional Profile (Chapter 4) and the Risk Assessment sections (Chapter 5) of the Plan. A complete draft of the plan was posted in May 2013.

- In May 2013, the full draft of the plan was made available to the public in hardcopy format at Town Hall, along with forms for public comment. The public was informed of the availability of the draft plan for public review via legal notice (date), and as an announcement on the Town website homepage.

- The Town has continued outreach to those residents who completed the Homeowner Notice of Voluntary Interest, and advised these residents of the June 2013 announcement of the NYS Sandy HMGP.

- The Town has identified continued public outreach as a high priority mitigation initiative (see Sections 6 and 7). Under this initiative, the Town will implement a program of media releases and other public notifications regarding where the public can review the plan and provide ongoing input, and may include additional public meetings to further promote awareness and implementation of the plan.

Documentation of these public outreach efforts is presented in Appendix C.

3.7 Integration/Coordination of Existing Plans, Programs and Information

The "Legal and Regulatory" capability assessment, included as Table 6-1 in Section 6, provides a listing of the local codes, ordinances, regulations and planning mechanisms available in the Town, and reviewed during this planning process in an effort to develop mitigation planning goals, objectives and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms; and thus develop complementary and mutually supportive plans.

Included in this review and integration were the following:

- NFIP Flood Damage Prevention Ordinance (2012)
- FEMA Flood Insurance Study - Dutchess County, NY (May 2012)
- Floodplain Management Plan (1987)
- Zoning Regulations (2012, updated regularly)
- Subdivision Regulations (2010, updated regularly)
- Comprehensive Plan (May 2002)
- Stormwater Management Plan/Ordinance (2010)
- New York State Stormwater Design Manual (2013)
- Steep Slope Ordinance (2007)
- Natural Resources Management Plan for the Fishkill Creek Watershed (May 2005)
- Recommendations for Steam & Floodplain Management in Dutchess County (Sept. 2008)
- Water Impoundment Survey – Town of East Fishkill (Sept. 2000)
- Updated Water Impoundment Survey – Town of East Fishkill (Dec. 2005)
- Section 905(b) USACE Reconnaissance Study – Dutchess County Watersheds (Oct. 2008)

Further description of these plans and programs can be found in the Capability Assessment subsection of Section 6. By incorporating data from existing programs into this plan, the Town also was able to identify the relevance of mitigation planning to these existing programs. Implementation of this plan through these existing plans is identified as a specific mitigation action in several areas in Section 6 of this plan, and is further defined in Section 7.

Further, the planning committee worked to identify and incorporate the best available data and information to support the planning process. Data and information is documented throughout this plan, while a complete list of the existing data and plans used to support this plan is included in the References section of this document.

Examples of other hazard mitigation programs in which the Town is involved with are the NFIP, FEMA's Unified Hazard Mitigation Assistance (HMA) grant programs. These programs assist the Town in receiving funding for flood mitigation projects and flood insurance (this Plan can also provide funds to mitigate other natural hazards). A summary of some of these programs follows.

HMA Grant Program:

FEMA 404 mitigation grant programs are available to support eligible mitigation activities according to the specifics of the programs, and include:

- HMGP
- PDM Program

- FMA Program
- Repetitive Flood Claims (RFC) Program
- SRL Program

NFIP:

Established in 1968, the NFIP provides federally-backed flood insurance to residents of communities that enact and enforce regulations that more carefully regulate development within floodplain areas. For individual property owners to be eligible to buy the federally-backed flood insurance, their property must be located within a community that participates in NFIP.

For a community to be eligible in NFIP, it must adopt and enforce a floodplain management ordinance to regulate proposed development in floodplains and officially designate a local floodplain coordinator/administrator. The intent of the program is to ensure that new construction does not exacerbate existing flood hazards and is designed to better withstand flooding. The community also has Flood Insurance Rate Maps (FIRM) that at a minimum show floodways, 100-year flood zones, and 500-year flood zones. Mitigation activities related to this program are included in Section 6 and data from FEMA Region II regarding NFIP Insurance Reports was used in the risk assessment for the flood hazard included in Section 5.

CRS:

The NFIP has been successful in protecting property owners who acquire flood insurance through the program from catastrophic financial losses due to flooding, and in requiring that new buildings constructed within 100-year flood plains are better protected from flood damage.

In the 1990s, the Flood Insurance Administration (FIA) established the CRS to encourage local governments to increase their standards for floodplain development. The goal of this program is to encourage communities, through flood insurance rate adjustments, to implement standards above and beyond the minimum required in order to:

- Reduce losses from floods
- Facilitate accurate insurance ratings
- Promote public awareness of the availability of flood insurance

CRS is a voluntary program designed to reward participating jurisdictions for their efforts to create more disaster-resistant communities using the principles of sustainable development and management. While the Town of East Fishkill does not currently participate in the CRS program, the town intends to join CRS in the short term as identified in Section 6, "Mitigation Strategy".

3.8 Continued Public Involvement

The Town of East Fishkill is committed to the continued involvement of the public. Therefore, copies of the Plan are available for review on their public website (http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan), as well as in hard-copy at the clerk's office in Town Hall (330 Route 376 Hopewell Junction).

After completion of the Plan, implementation and ongoing maintenance of the plan will remain a function of the mitigation Planning Committee. Per the plan review and maintenance procedures specified in Section 7, the Committee will review the plan and accept public comment as part of an annual review and as part of 5-year mitigation plan updates. A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the Committee's annual evaluation and posted on the public web site.

The public will have an opportunity to comment on the Plan as a part of the annual mitigation planning evaluation process and the 5-year mitigation Plan update. The 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 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.

Mr. Rick Witt, has been identified as the ongoing Town Hazard Mitigation Plan Coordinator (see Section 7), and is responsible for receiving, tracking, and filing public comments regarding this Plan.

SECTION 4: TOWN PROFILE

Profile information is presented and analyzed to develop an understanding of a study area, including the economic, structural, and population assets at risk and the particular concerns that may be present related to hazards analyzed later in this plan (e.g., low lying areas prone to flooding or a high percentage of vulnerable persons in an area). This section provides information on the Town of East Fishkill in terms of location, history, physical setting, population and demographics, general building stock, critical facilities, land use trends and development, and economic assets and resources.

4.1 Location

The Town of East Fishkill is located in the southern part of Dutchess County at the northernmost edge of the New York City Metropolitan Area. New York City is approximately 75 miles from the Town. East Fishkill is bordered by five other Dutchess County towns; Fishkill to the west; Wappinger to the northwest; LaGrange to the north; Beekman to the east; and Pawling at the southeastern-most corner of the Town. To the south, East Fishkill shares its border with towns of Kent and Philipstown in Putnam County. Poughkeepsie, the seat of Dutchess County, lies approximately ten miles northwest of Hopewell Junction. The Hudson River flows approximately eight miles west of the Town (EF Comp Plan, 2002). Figure 4-1 displays the municipalities of Dutchess County, and indicates the location of the Town of East Fishkill.

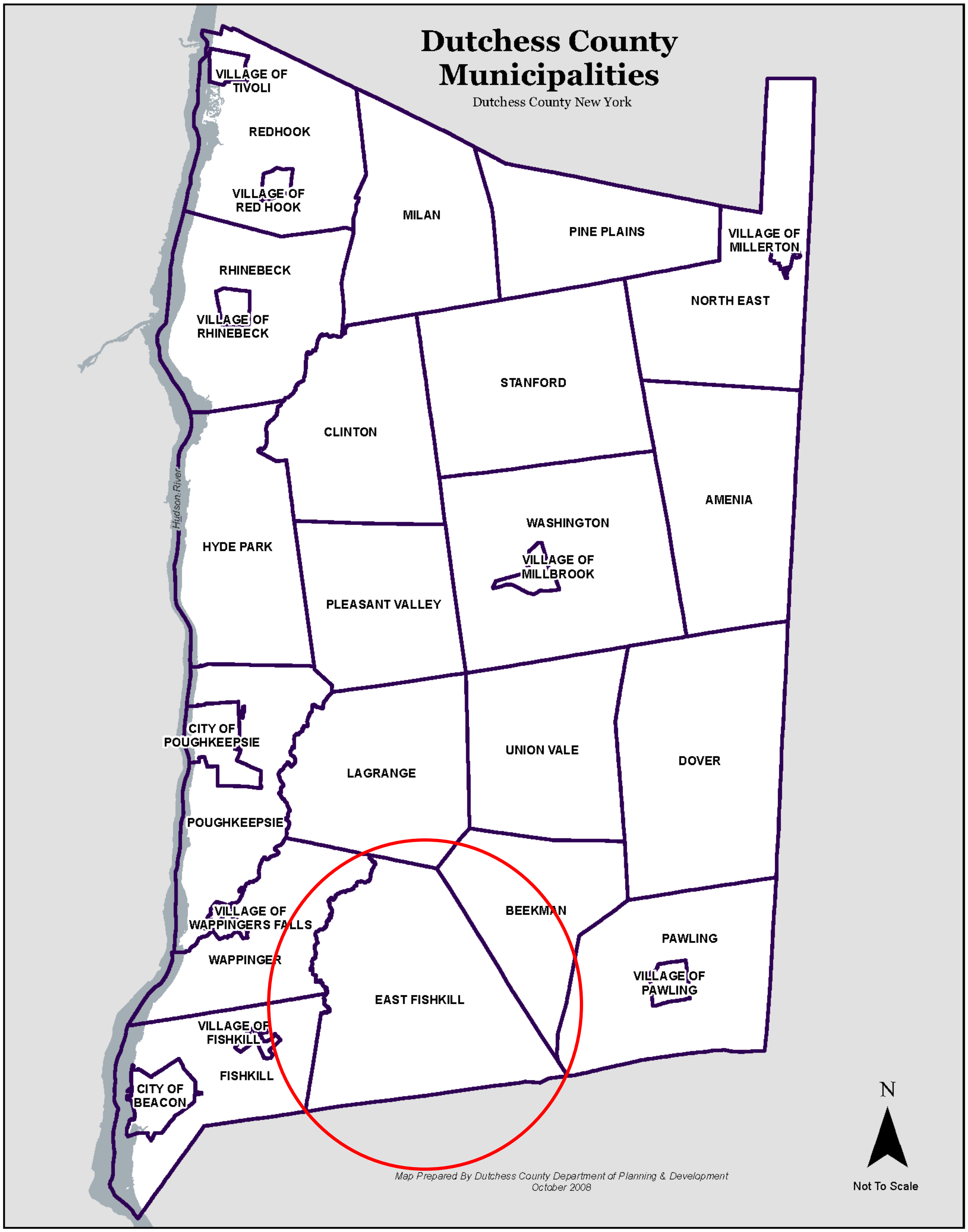
4.2 History

The first known inhabitants of East Fishkill and the surrounding towns were the Wappinger Indians. The Town Historian reports that there may have been an Indian settlement just to the southwest of the area now known as Wiccopee. By 1685, three New York City residents had obtained land grants to the region and began a colonial settlement at Old Hopewell, opposite the Hopewell Reformed Church. These English and Dutch settlers were drawn to the area by the abundance of timber and game, and the name Fishkill derives from the Dutch words vis or “fish” and kill meaning “stream”. Early population growth soon led to a more domesticated economy consisting of farming and orchards. The Town of East Fishkill was established in 1849 when it formally split from Fishkill. This agricultural economy dominated the area, and characterized the town at its inception (EF Comp Plan, 2002).

In the last half of the 19th century, a new town center developed next to the junction of the two railroad lines that passed through East Fishkill; the Central New England, and New York/New Haven/Hartford lines. The station and village shared the name of Hopewell Junction, and they served as the central location for a local economy anchored by the rail connections east to New York City. By the first half of the 20th century, many City residents had bought land and built summer cottages around the lakes of East Fishkill and in the Town’s southern hills. Even with an active transient population, East Fishkill remained a rural community of roughly one thousand people near the end of the 19th century (EF Comp Plan, 2002).

In the 20th century, the construction of Interstate-84 and the Taconic Parkway provided new means of transportation, as the railroad ceased to service the Town. Construction of these roadways spurred new growth in residential, commercial, and industrial subdivisions, transforming the landscape and the town’s population. Today, the Town is largely suburban in nature, although long-time residents and some land uses maintain strong ties to their rural and agricultural past (EF Comp Plan, 2002).

Figure 4-1. Dutchess County, New York



Source: Dutchess County DPD, 2008
Note: East Fishkill locator circle added.

4.3 Physical Setting

This section presents the physical setting of the Town, including hydrology and hydrography; topography, geology and soils; climate; and land use/land cover.

4.3.1 Hydrography and Hydrology

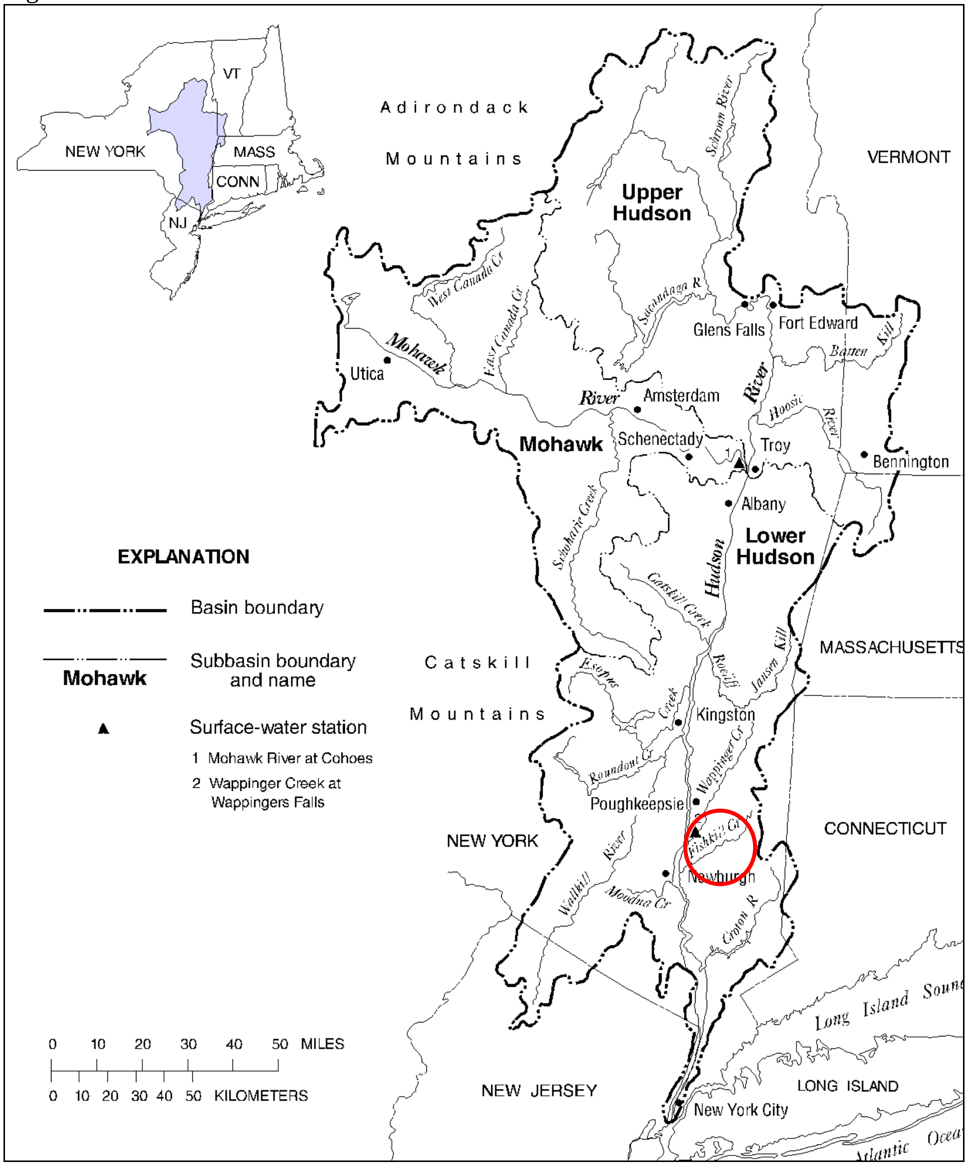
Every piece of land within East Fishkill belongs to a drainage basin (watershed). Drainage basins consist of an entire geographical area of land and water that eventually join together at one location. They channel water from rain, snow, and ice, and from underground sources to larger bodies of water. Drainage basins are different sizes and consist of a network of smaller watersheds (Green-Ct, Date Unknown). New York State is divided into seventeen (17) drainage basins, or watersheds (NYSDEC, Date Unknown). According to the Dutchess Watersheds organization, Dutchess County is divided into six watersheds: Hudson Direct, Wappinger Creek, Fishkill Creek, Tenmile River, Roeliff Jansen Kill, and Croton Watersheds. The Town of East Fishkill is part of the Fishkill Creek and Croton Watersheds, both within the greater Hudson River drainage basin (DutchessWatersheds.org).

Hudson River Basin and the Lower Hudson River Watershed

The Hudson River Basin has an area of 13,400 square miles and lies almost entirely within New York State, with parts in Vermont, Massachusetts, New Jersey, and Connecticut. The Basin is divided into three major sub-basins: the upper and lower Hudson River and the Mohawk River (Figure 4-2). The source of the Hudson River is Lake Tear of the Clouds, a small lake in the Adirondack Mountains, 4,322 feet above sea level. The River flows south-southeast out of the mountain region to its confluence with the Mohawk River near Troy in Rensselaer County (Freeman, 1991).

The lower Hudson River begins at the Federal Dam in Troy, New York (Rensselaer County), just downstream from the confluence with the Mohawk River. Over its total length of 154 miles, the lower Hudson River flows south through farmland, industrial areas, and forested mountain slopes, and finally outlets to upper New York Harbor (Freeman, 1991).

Figure 4-2. Hudson River Basin



Source: Freeman, 1991

Note: East Fishkill locator circle added.

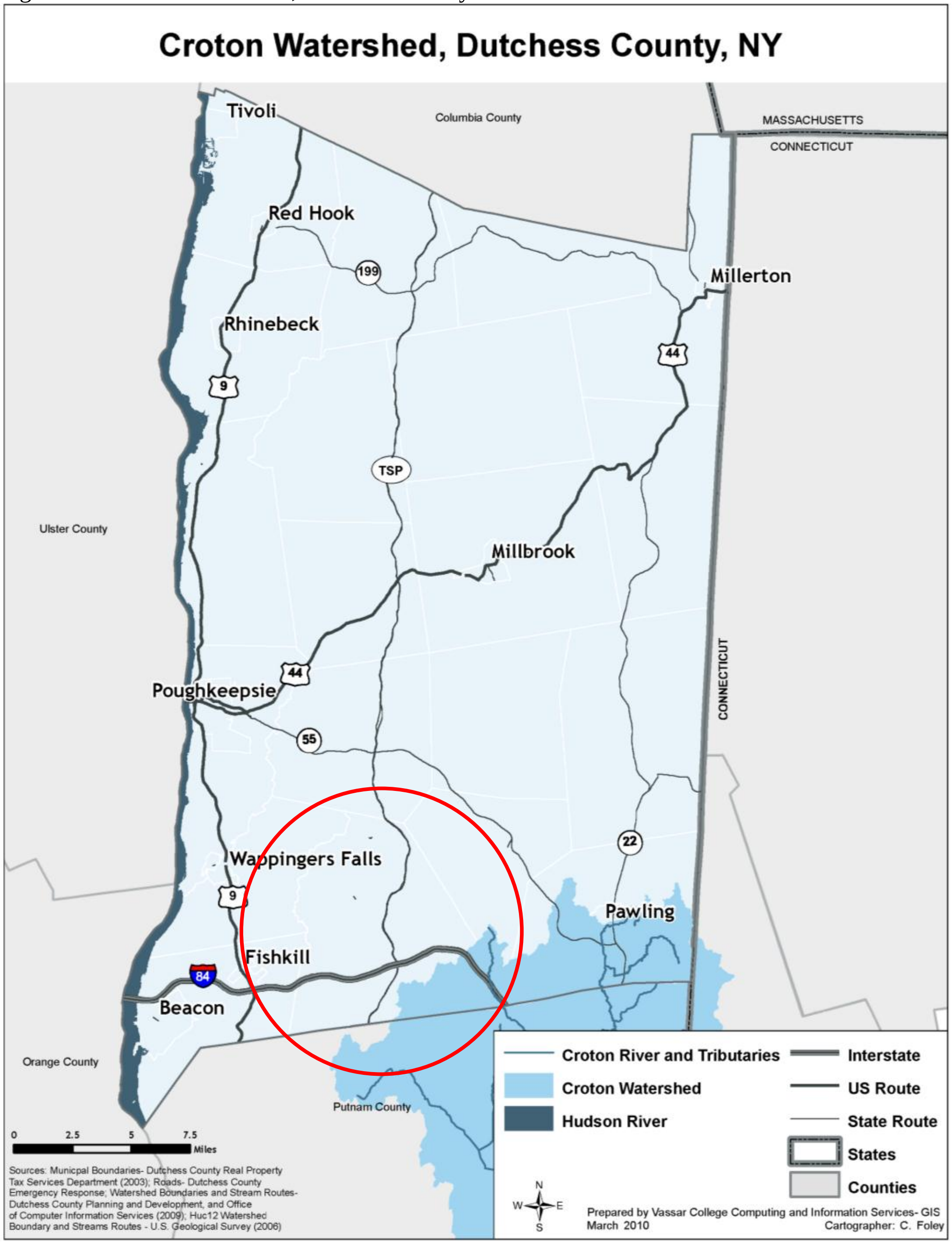
The Lower Hudson Watershed has a drainage area of 727 square miles and approximately 750 miles of streams. It is located in Connecticut, New York State, and New Jersey. The major waterways of this watershed includes the Croton River (NYSDEC, 1998), a tributary of which drains the southeast area of East Fishkill. The Fishkill Creek, the most prominent water feature in East Fishkill, is also located in the lower Hudson River Watershed.

Croton Watershed

While most of the Croton Watershed lies outside of Dutchess County in Putnam and Westchester Counties and in western Connecticut as shown in Figure 4-3, the northernmost part of the watershed is located in the Dutchess County towns of East Fishkill, Beekman, and Pawling. The Croton River Watershed is also part of the municipal drinking water system (East of Hudson Watersheds) that provides drinking water for New York City. Because parts of the town lie within the eastern portion of Hudson

Croton watershed, for which a total maximum daily load (TMDL) for pollutant loading has been developed, the Town of and East Fishkill is referred to as an "additionally designated MS4," and has to comply with more stringent MS4 (municipal separate storm sewer systems) requirements (DutchessWatersheds.org).

Figure 4-3. Croton Watershed, Dutchess County

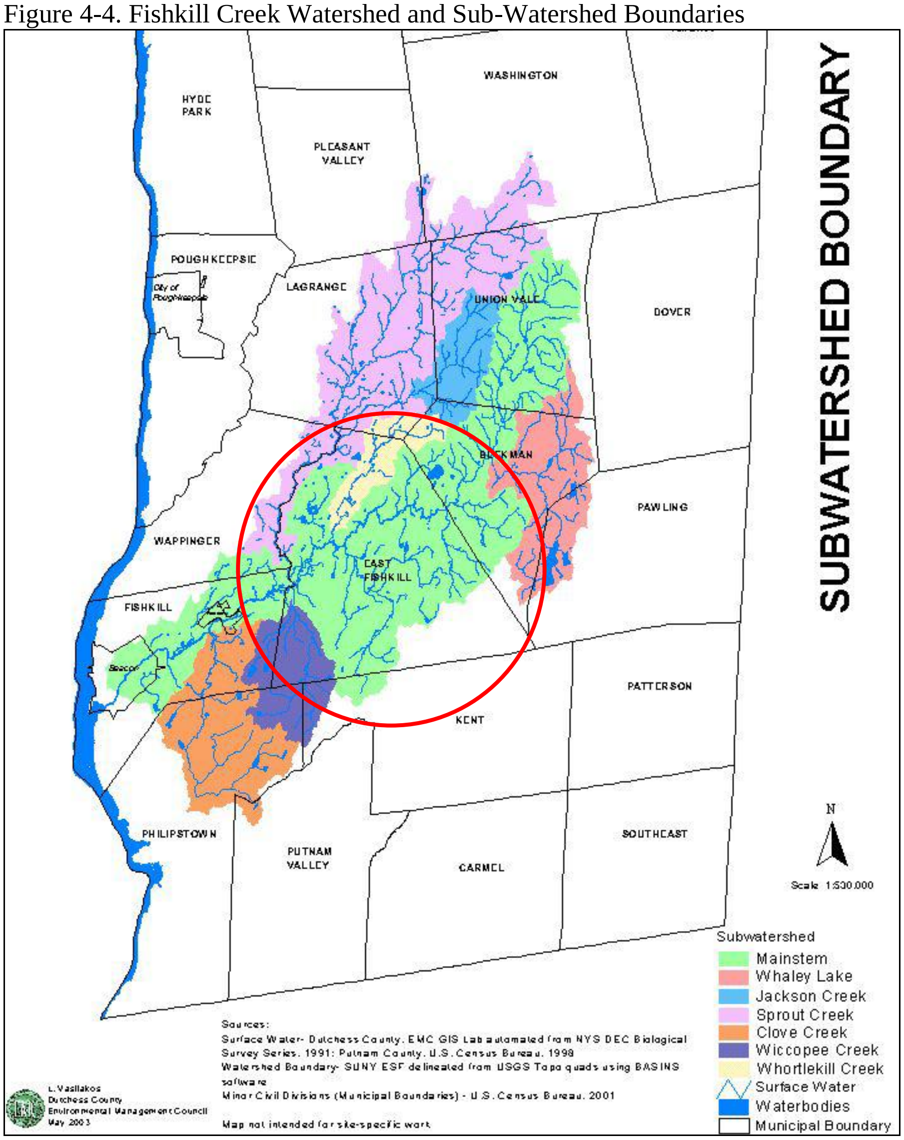


Source: DutchessWatersheds.org
Note: East Fishkill locator circle added.

Fishkill Creek Watershed

The Fishkill Creek watershed, located in Dutchess and Putnam Counties, NY drains approximately 193 square miles (123,627 acres) in eleven Dutchess County and three Putnam County municipalities, as shown in Figure 4-4 below. 84.1% of the town of East Fishkill falls within the Fishkill Creek Watershed (Fishkill Creek Watershed Committee, 2005). The main stem of the Fishkill Creek is the main surface water feature in East Fishkill, and through its tributaries drains large sections of the Town of East Fishkill. Fishkill Creek flows from east to west through the north-central portion of the Town. The Sprout Creek, Fishkill Creek's largest tributary, drains smaller portions the Town in the northeast. Whortlekill Creek and Wiccopee Creek are also tributaries, draining the north-central and southwestern portions of the town, respectively (EF Comp Plan, 2002). Figure 4-5 displays the major watercourses within the East Fishkill Area.

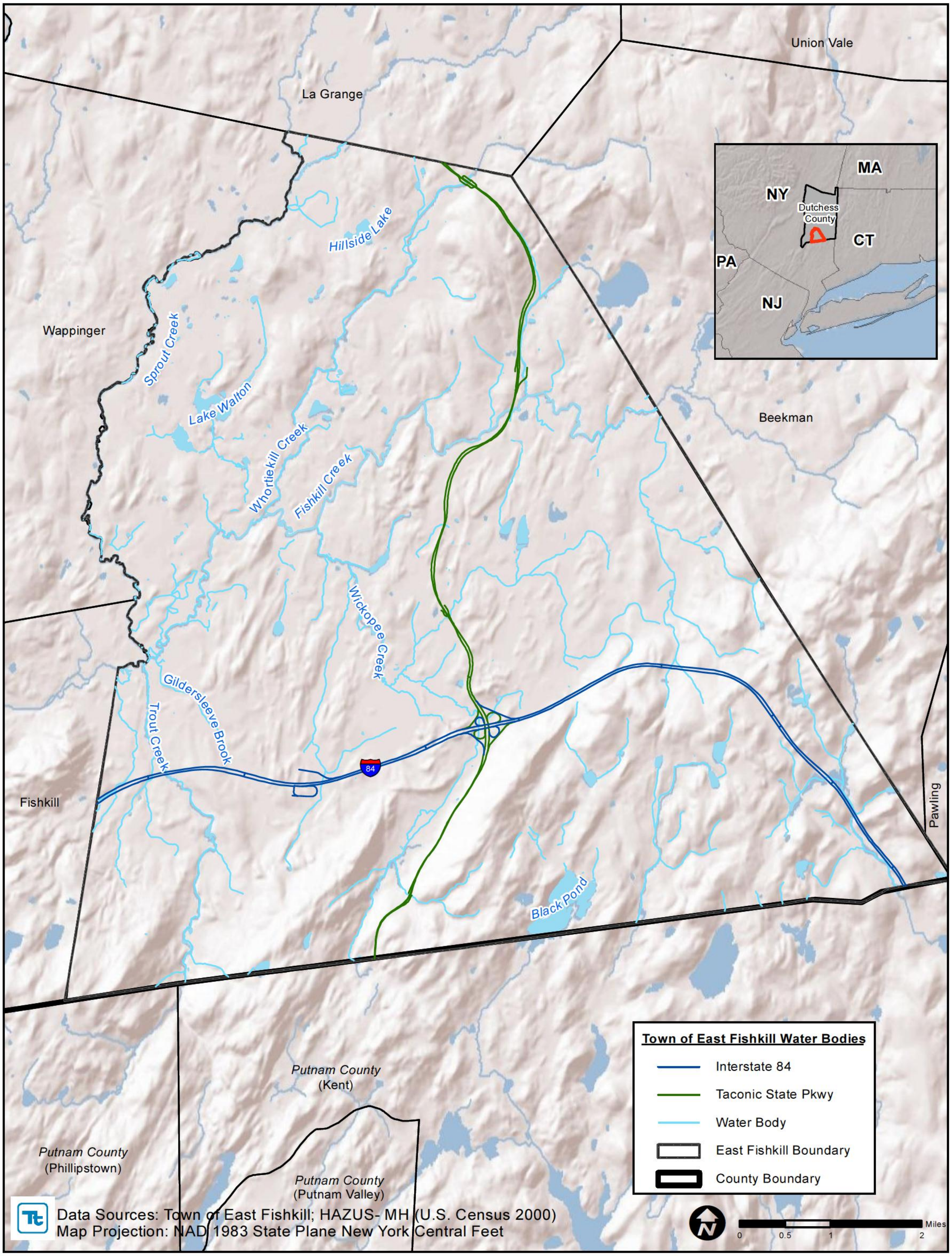
Figure 4-4. Fishkill Creek Watershed and Sub-Watershed Boundaries



Source: Fishkill Creek Watershed Committee, 2005

Note: East Fishkill locator circle added.

Figure 4-5. Major Watercourses in East Fishkill



Source: Town of East Fishkill

4.3.2 Topography, Geology and Soils

The Town, roughly triangular in shape, can be divided into two fairly distinct physiographic zones: a stream valley zone and an upland zone. The southeast corner of the Town and a narrow band running along the southern boundary comprise the upland zone that includes a portion of the Taconic Mountains. This area contains approximately one-third of the entire Town's area and is characterized by relatively high elevations ranging from 600 to 1,200 feet, steep slopes, and shallow soils. Approximately half of the land in the upland zone has slopes in excess of 25%.

The remaining two-thirds of the town is essentially a stream valley consisting of fertile soils, lower elevations, gentle hills, and containing a number of water bodies. Fishkill Creek and Whortlekill Creek (a tributary of the Fishkill) are the predominant lowland environmental features. This lower lying area holds most of the Town's developed land (EF Comp Plan, 2002).

The geology in and around East Fishkill includes portions of two physiographic regions: the Hudson Highlands and the Mid-Hudson Valley. Distinctly different types of bedrock dominate each physiographic region. The Mid-Hudson Valley is underlain by sedimentary and meta-sedimentary rocks formed in the early Paleozoic Era (540 million years old to 450 million years old), while the Hudson Highlands bedrock is predominantly high temperature and pressure metamorphic gneisses of Pre-Cambrian age (more than 1 billion years old). The surficial geology of East Fishkill includes a mixture of bedrock, glacial outwash, lake sediment, stream sediments, and till.
http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/nrichapthree.pdf

4.3.3 Climate

The National Climatic Data Center divides New York State into 10 climate divisions. East Fishkill and Dutchess County are located in Region #5: the Hudson Valley. Specifically, the Town's climate is humid continental, characterized by strong seasonal contrasts and highly variable weather. Major storm systems moving through the continental United States or up the nearby Atlantic Coast have a significant impact on the weather in East Fishkill, especially during the fall, winter, and spring months. The relatively close proximity of East Fishkill and Dutchess County to the Atlantic Ocean generally has a moderating influence on the climate, leading to relatively milder winter days and cooler days in the summer. Conversely, polar air masses from Canada move southeast into the area and strongly influence winter weather conditions (The Natural Resource Inventory of Dutchess County, NY).

Precipitation during the warm, growing season (May 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, Date Unknown).

The cool season (October through April) 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, Date Unknown).

East Fishkill generally experiences short winters and long summers. Temperature extremes between the seasons measured at Hopewell Junction are from -22°F to 101°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 annual precipitation at Poughkeepsie from 1971-2000 was approximately 48.8 inches. July is the wettest month in East Fishkill, with a maximum average monthly precipitation of 4.73 as measured at Hopewell Junction (http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/nrichaptwo.pdf; The Weather Channel, 2012).

4.3.4 Land Use and Land Cover

According to the East Fishkill Master Plan, the land within the Town is occupied and utilized in several different ways. This includes residential, commercial, industrial, public/institutional, agriculture, parks, and vacant land. Figure 4-6 illustrates the location of the different land uses within East Fishkill in 2001. According to the East Fishkill GIS Department's database and Dutchess County, the Town comprises approximately 36,825 acres or 57.5 square miles (EF Comp Plan, 2002). Table 4-1 shows the 1981 and 2002 land use categories within the town, the number of acres in each category, and the number of acres as a percent of town land.

With an approximate land area of 15,640 acres in 2001, residential land uses comprised approximately 32% of the Town's landscape in 2001. Another 18.5% of the land area was classified as "Vacant", which represents land that has the potential to be developed but remained idle in 2001. The comparison between uses in 1981 and 2002 illustrates the growth of the residential sector from 30% to 31.7%, or 1.7% of the land. The commercial and industrial sectors grew by approximately 0.3% and 0.9%, respectively. While the amount of parkland in East Fishkill doubled in those years, that growth was offset by losses in the agricultural and vacant sectors, and 6,000 acres of prior vacant or agricultural land had been transformed into residential areas. Only 7.7% of the Town remained in active agricultural use in 2001, and just under 7% of the land area was dedicated to recreation (EF Comp Plan, 2002).

As of 2001, most of the residential dwelling units in East Fishkill were located in subdivisions built in the north and central parts of the Town, though the number of new residences in the south and east was growing rapidly. Many of the highest densities of single family houses existed on the perimeters of the Town's many lakes. Shopping, professional offices, automobile services, and other services are generally concentrated in the Hopewell Junction neighborhood, and amongst East Fishkill's other hamlets, which are remnants of older, compact neighborhood commercial centers. A number of commercial enterprises also exist along Routes 376 and 52, supplementing commercial activities in Hopewell Junction. Industrial and larger commercial activities have located near Interstate 84 to take advantage of the convenient transportation access (EF Comp Plan, 2002).

Table 4-1. East Fishkill Land Uses, 1981-2002

Land Uses	Acres - 1981	Percent Total	Acres – 2002*	Percent Total*
Residential	9,636	29.9%	15,640	31.7%
Commercial	144	0.4%	350	0.7%
Industrial/Utilities	637	2.0%	1,430	2.9%
Public/Institutional	195	0.6%	500	1.0%
Parks/Recreational	1,075	3.3%	3,400	6.9%
Public			1,320	2.7%
Private			2,080	4.2%
Active Agricultural	5,650	17.5%	3,790	7.7%
Vacant	14,873	46.2%	9,160	18.5%
Residential			7,350	14.9%
Commercial			250	0.5%
Industrial			735	1.5%
Agriculture			825	1.7%
Roads	N/A		2,555	5.2%
Total			**49,385**	**100%**

Source: EF Comp Plan, 2002
*Acreage and percentages reflect adjusted numerical totals that differ from results found in the East Fishkill Comprehensive Plan

East Fishkill encompasses the communities of Arthursburg, East Fishkill, Fishkill Plains, Gayhead, Hillside Lake, Hopewell Junction, Hortontown, Lomala, Pecksville, Shenandoah, Stormville, and Wiccopee. Hillside Lake and Hopewell Junction are Census Designated Places (CDPs).

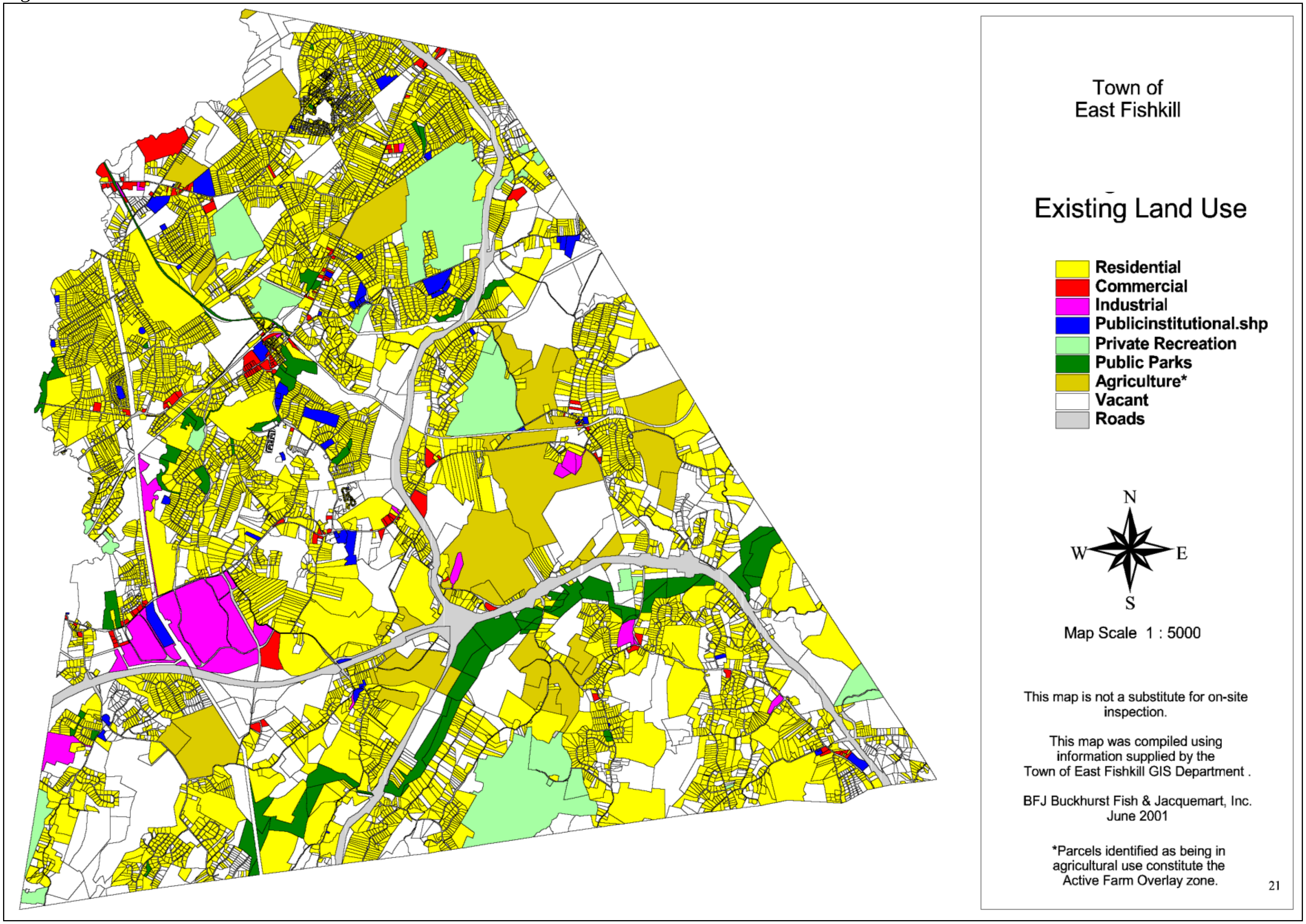
Hillside Lake CDP

Hillside Lake is a hamlet (and CDP) located in the northeastern part of the Town of East Fishkill, covering an area of 1.6 square miles and encompassing Hillside Lake. Route 33 (Hillside Lake Road) passes through the Hamlet, connecting it to the New York state highway system via CR 29.

Hopewell Junction CDP

Hopewell Junction is a hamlet (and CDP) located in the northwest part of the Town of East Fishkill. It covers an area of 2.8 square miles and encompasses Walton Lake and Sylvan Lake. Hopewell Junction was originally a railroad junction where the Newburgh, Dutchess and Connecticut Railroad met the New York and New England Railroad and Dutchess County Railroad, and has long served as the economic center of East Fishkill. Hopewell Junction is the location of the East Fishkill Town Hall and the East Fishkill site of IBM Corporation of Armonk, NY.

Figure 4-6. East Fishkill 2001 Land Use Distribution



Source: EF Comp Plan, 2002

4.4 Population and Demographics

According to the 2010 U.S. Census, the Town of East Fishkill has a population of 29,029. Table 4-2 presents the population statistics for the Town based on the 2010 U.S. Census 2006-2010 American Community Survey (ACS). Figure 4-7 shows the distribution of the general population density (persons per square mile) for the entire Town and two CDPs within the town: Hopewell Junction and Hillside Lake. For the purposes of this plan, population and demographic data available in HAZUS-MH as of September 2012 were used in conducting the risk assessments in Section 5.

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. Data on these populations is shown in Table 4-2, below. Figures 4-8 and 4-9 show the distribution of elderly and low-income populations in the Town, respectively.

Table 4-2. East Fishkill Population Statistics (2010 U.S. Census)

Municipality	U.S. Census 2010 Population	U.S. Census 2010 Population Over 65	U.S. Census 2010 Population Under 5	Census Low-Income Households **
Town of East Fishkill	29,029	3,104	1,520	941

Source: U.S. Census, 2010
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_3YR_DP03&prodType=table
Note: ** 2008-2010 American Community Survey (3-Yer Estimates) - Households with an income of less than $24,999
*** Households with an income of less than $20,000

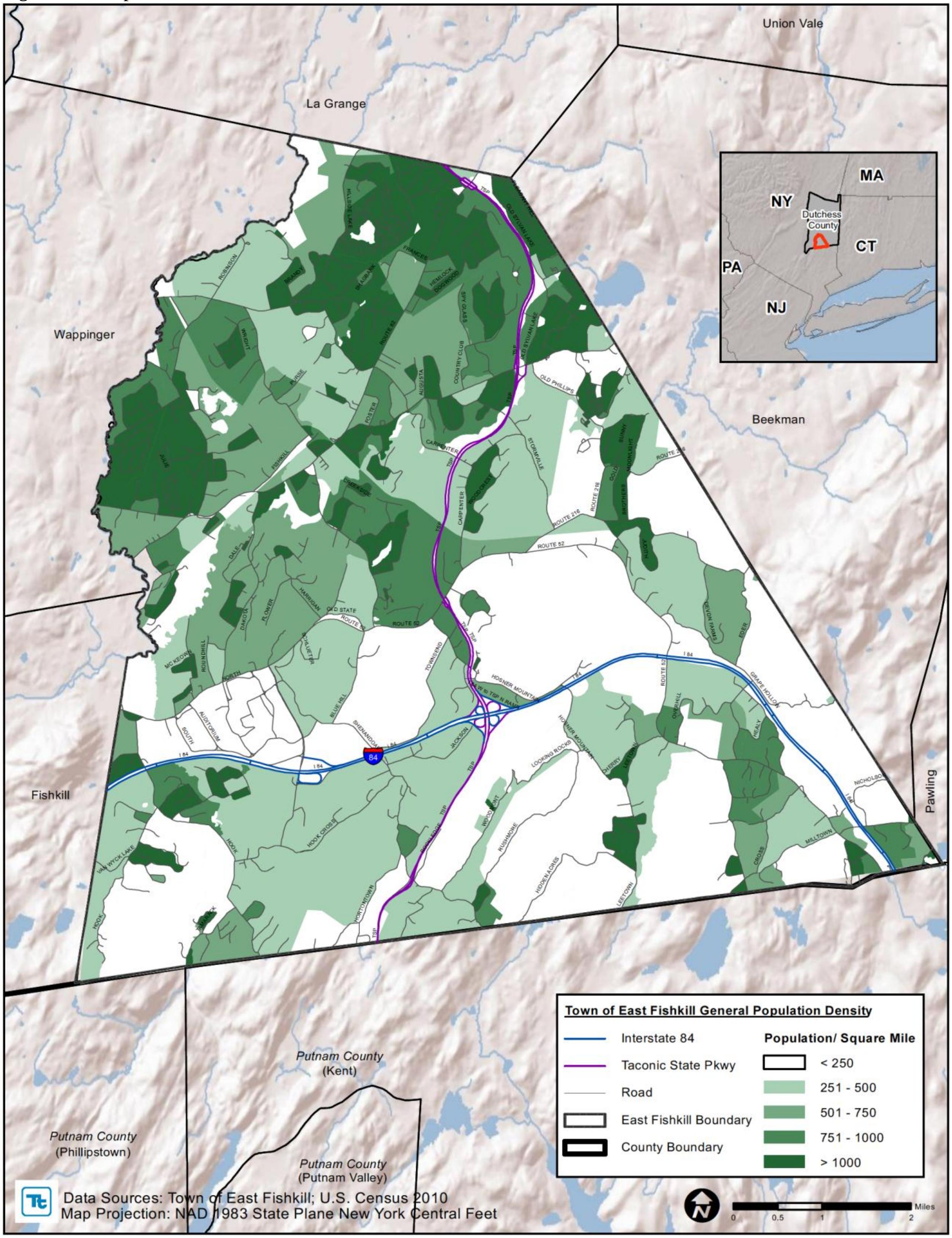
As of the 2010 Census, approximately 16 percent of the Town's population is either under the age of five or over the age of 64 (U.S. Census Bureau, 2010 Census), and therefore is anticipated to be more vulnerable to the effects of natural hazards. (http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_DP_DPDP1&prodType=table)

An annual household income of $17,374 per year is considered as "low income" for a three-family household (the average number of persons comprising a "household" in East Fishkill). The 2010 Census breaks down the data in $5,000 increments ($0-10,000/year; $10,000 to $14,999/year; $15,000 to $24,999/year). The total number of households with income and benefits less than $24,999 in the Town is 941.
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_3YR_DP03&prodType=table .

According to the 2006-2010 U.S. Census American Community Survey, for 2006 to 2009, 240 of the 9,250 households in the Town were reported as having an annual income of less than $15,000. The U.S. Census ACS data indicates that a total of 1,113 individuals were below the poverty level (3.9-percent).

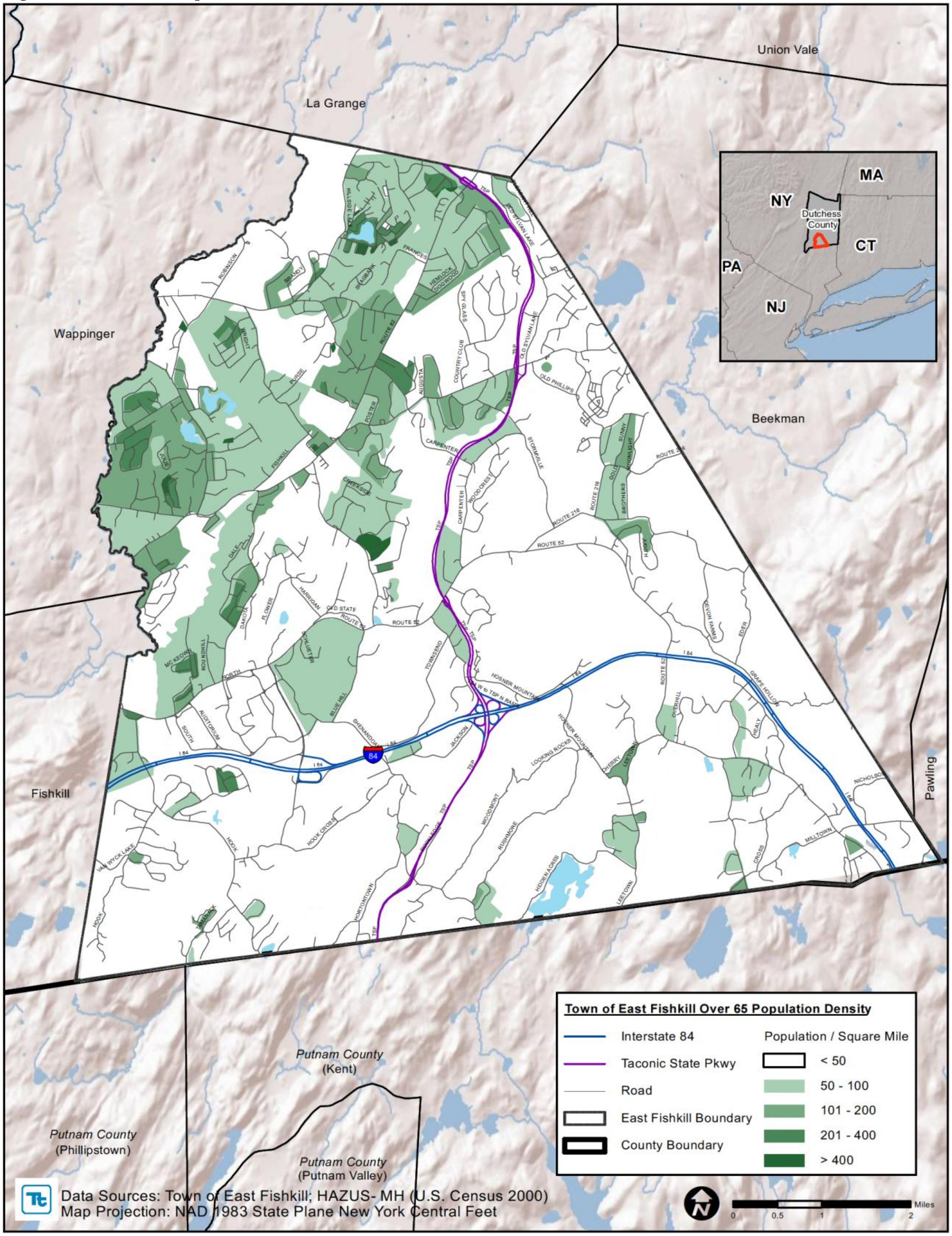
It is noted that the census data for household income provided in HAZUS-MH includes two ranges ($0 to $10,000 and $10,000 to $20,000/year) that were totaled to provide the "low-income" data used in this study. This does not correspond exactly with the "poverty" thresholds established by the U.S. Census Bureau, however the difference between using the 2010 Census and HAZUS-MH income ranges is not believed to be significant for the purposes of this planning effort.

Figure 4-7. Population Distribution in the Town of East Fishkill



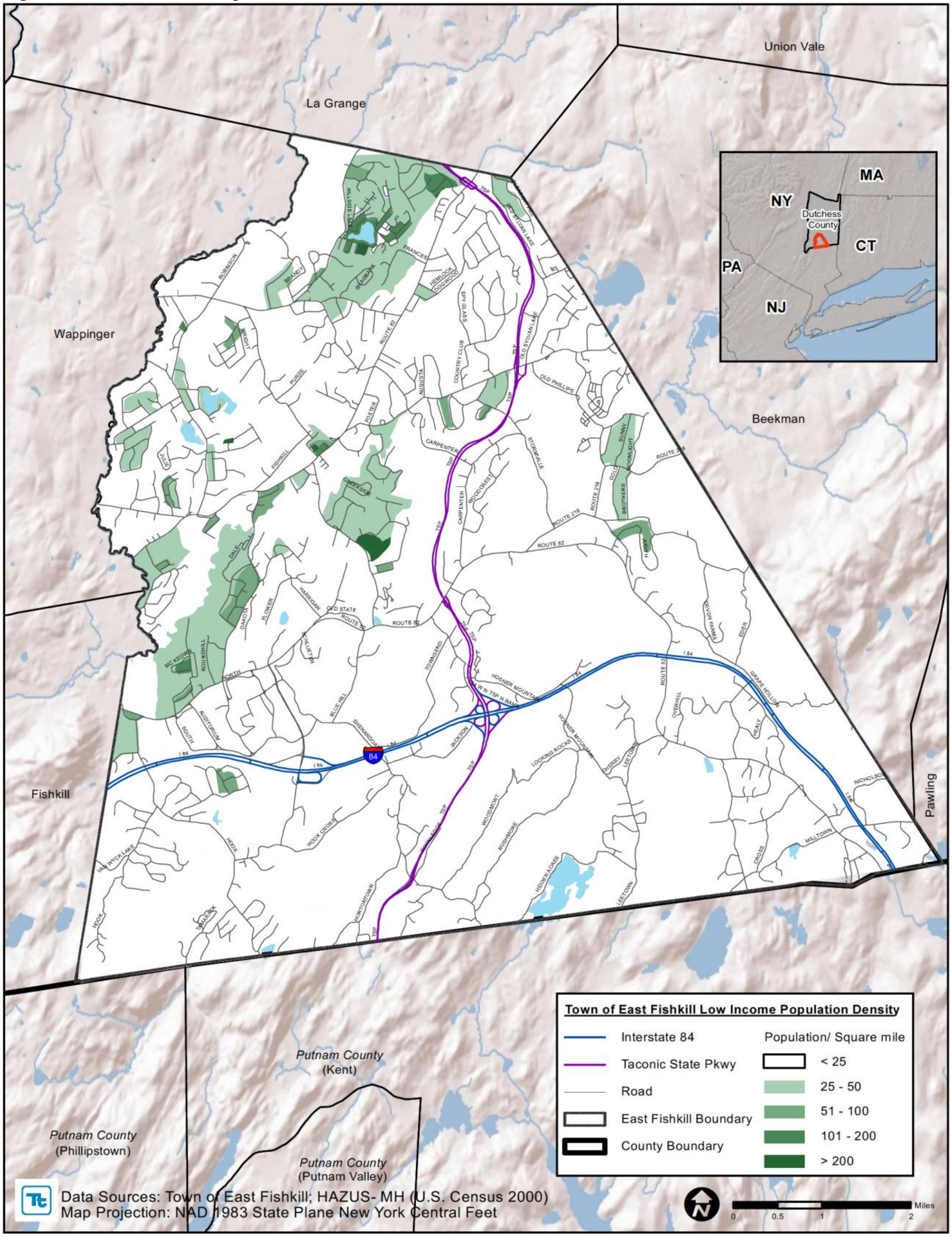
Source: Town of East Fishkill; U.S. Census 2010.

Figure 4-8. Over 65 Population Distribution in the Town of East Fishkill



Source: Town of East Fishkill; HAZUS-MH (U.S. Census 2000.)

Figure 4-9. Low-Income Population Distribution in the Town of East Fishkill



Source: Town of East Fishkill; HAZUS-MH (U.S. Census 2000.)

Population Trends

Table 4-3 displays the past, current and projected population data for the Town of East Fishkill and population trends from 1970 to projected 2025. The U.S. Census Bureau provides estimate of population once a year, based on birth and death rates and migration data. Projections for the years 2015, 2020, and 2025 were prepared in 2003 by the Poughkeepsie-Dutchess County Transportation Council as part of their 2005-2025 population projections.

Table 4-3. East Fishkill Population Trends, 1970 to 2025

	Historical Census Population					Population Projections*		
	1970	1980	1990	2000	2010	2015	2020	2025
Town of East Fishkill	11,092	18,091	22,101	25,589	29,029	28,124	29,594	30,947
Dutchess County	222,295	245,055	259,462	280,150	297,488	307,900	324,006	338,809

Source: U.S. Bureau of the Census (1970-2000 data come from the Population Estimates Program, providing intercensal estimates of the population for the nation, states, and counties; for 2010, the Decennial Census provides the official counts of the population for the nation, states, counties, cities and towns.);
*Dutchess County, 2003.

4.5 General Building Stock

The 2010 U.S. Census data identifies 9,512 households and 10,039 housing units in the Town of East Fishkill. U.S. Census defines household as all 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 value of an owner-occupied housing unit in East Fishkill between 2006 and 2010 was estimated at $391,200 (U.S. Census ACS, 2006-2010).

The 2010 Census data shows that a majority of housing units in the Town of East Fishkill (91-percent) are single family detached units. The 2010 U.S. Census Bureau's County Business Patterns data identified 7,440 business establishments employing 96,409 people in Dutchess County. The majority (60-percent) of these establishments employed between one and four employees (U.S. Census, 2010).

The data in HAZUS-MH 2.1 is not current in terms of building count and underestimates replacement cost values. For the purposes of this HMP, a custom updated building inventory at the structure level was developed for the Town. The East Fishkill Assessor's data and structure shapefile provided by the Town were used to develop this inventory. In total, the Assessor identified 10,695 structures in the Town of which 10,031 are classified as residential. Table 4-4 summarizes the building stock statistics by occupancy class and count developed for the Town of East Fishkill and used for this planning effort.

Table 4-4. Town of East Fishkill Building Stock Inventory

Total (All Occupancies				Residential			
	RCV				RCV		
Count	Structure	Contents	Total	Count	Structure	Contents	Total
10,695	$3,901,907,518	$2,543,930,216	$6,445,837,734	10,031	$2,687,827,085	$1,343,913,543	$4,031,740,628

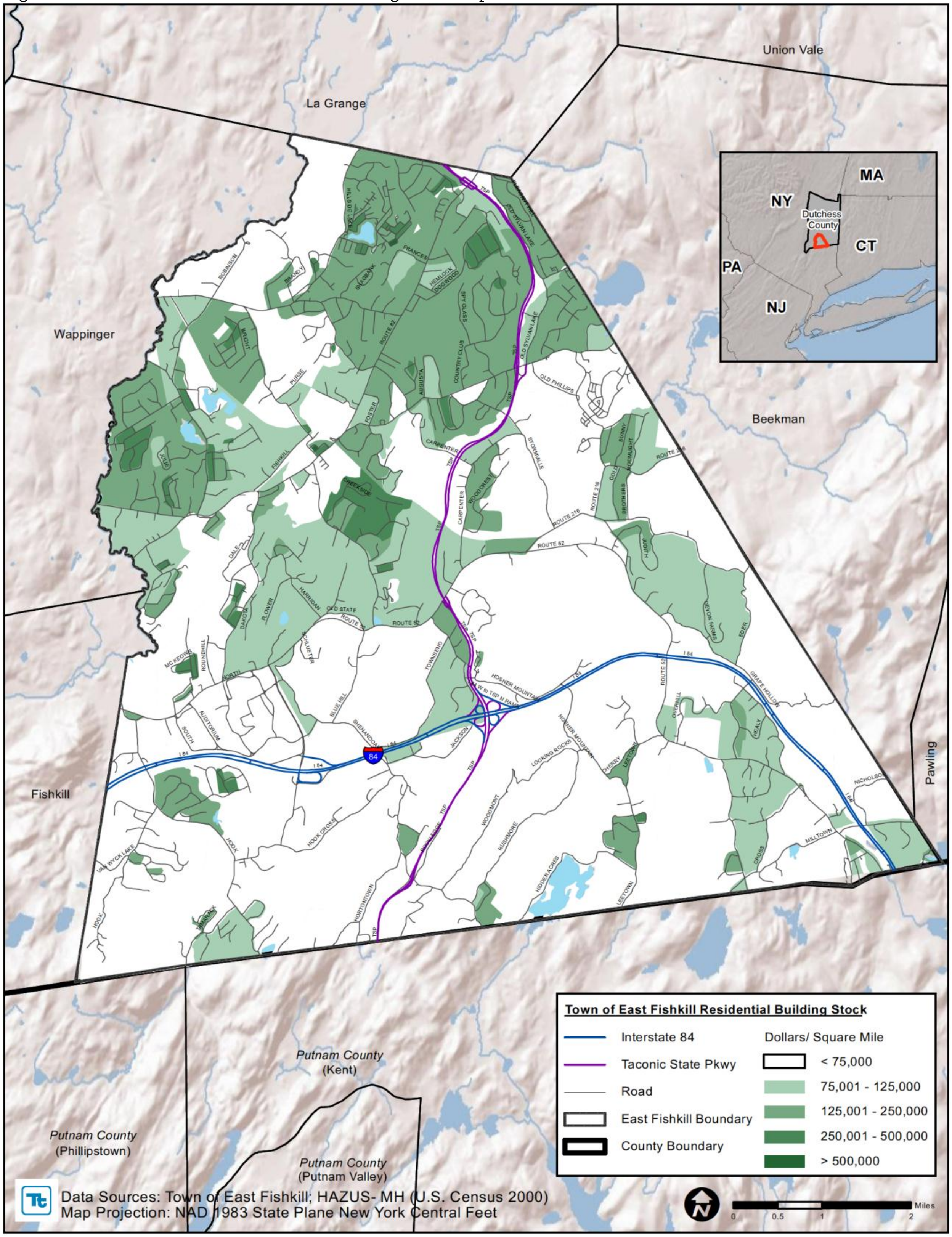
Commercial		Industrial		Agriculture		Religious	
Count	Total RCV	Count	Total RCV	Count	Total RCV	Count	Total RCV
327	$632,749,712	160	$1,183,132,726	124	$46,988,108	29	$54,935,528

Government		Education	
Count	Total RCV	Count	Total RCV
13	$40,437,887	11	$469,916,906

Source: Town of East Fishkill
Note: RCV = Replacement Cost Value
The structural values were calculated based on square footage and 2011 RS Means values. The contents for residential structures are valued at about 50 percent of the building's value. For call other occupancy types, the value of the content is estimated as equal to the building's structural value.

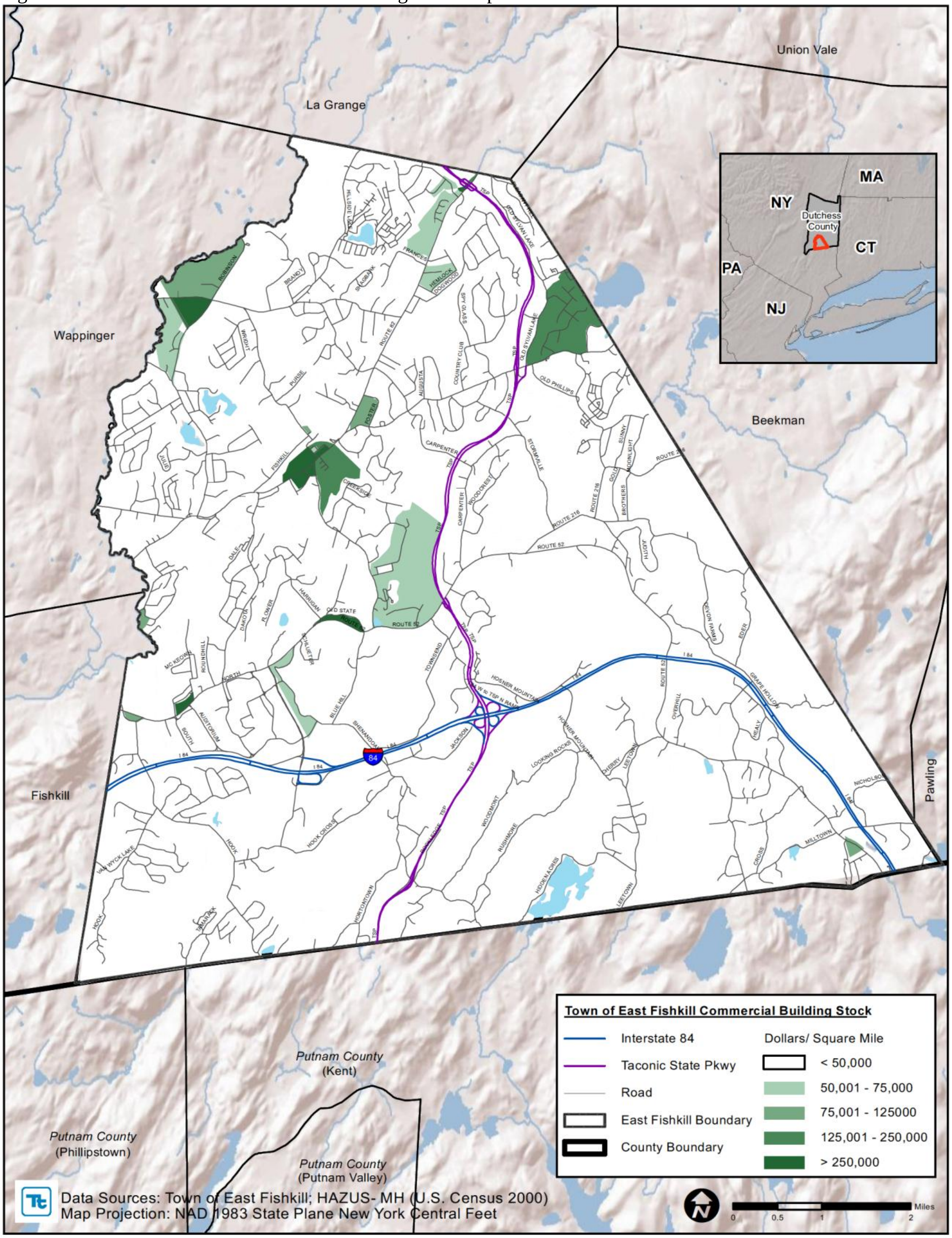
Figures 4-10, 4-11 and 4-12 illustrate the distribution and exposure density of residential, commercial and industrial buildings in the Town, respectively. Exposure density is the dollar value of structures per unit area, including building content value. Generally, contents for residential structures 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. Viewing exposure distribution maps can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.

Figure 4-10. Distribution of Residential Building Stock Replacement Value in the Town of East Fishkill



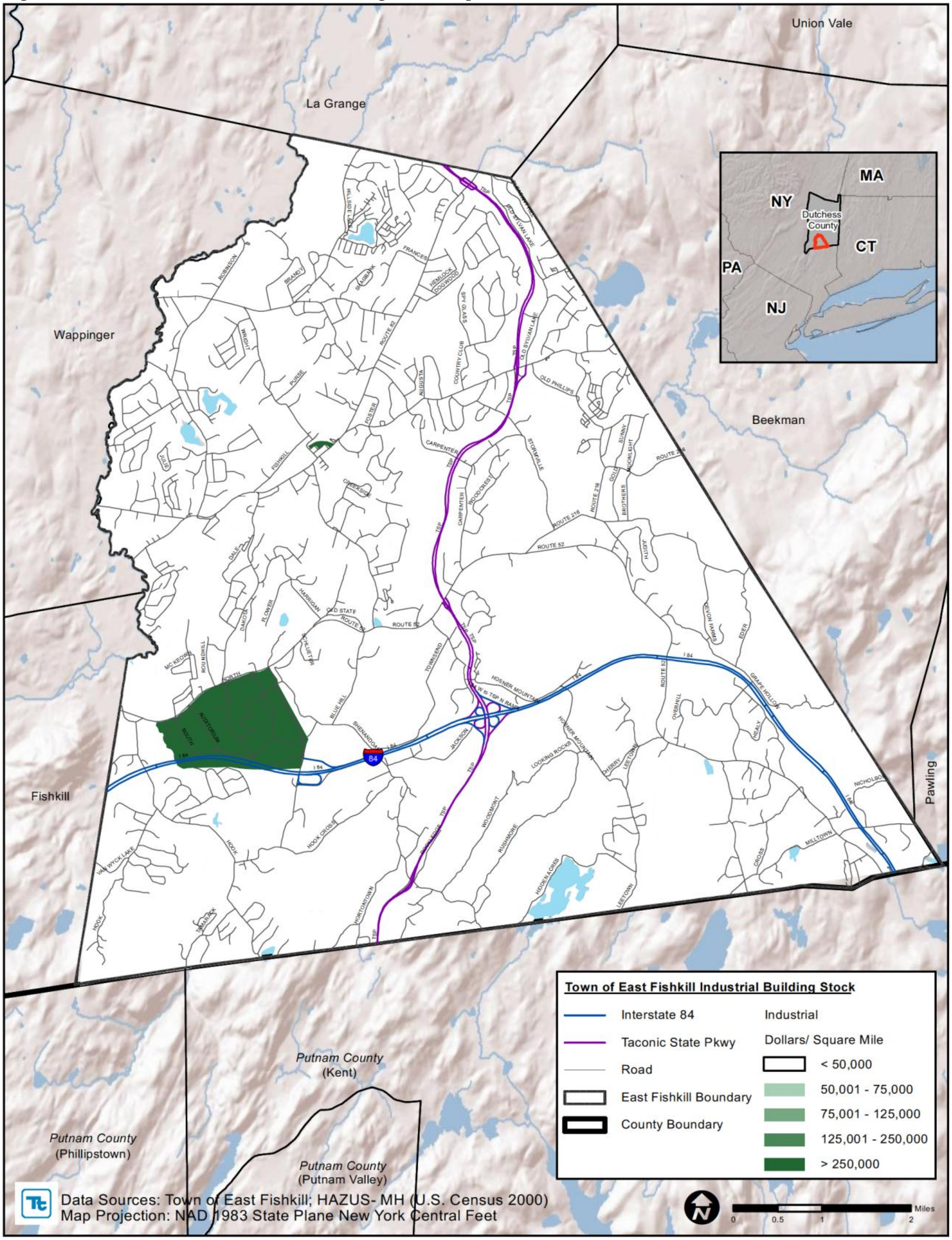
Source: Town of East Fishkill; HAZUS-MH (U.S. Census 2000.)

Figure 4-11. Distribution of Commercial Building Stock Replacement Value in the Town of East Fishkill



Source: Town of East Fishkill; HAZUS-MH (U.S. Census 2000.)

Figure 4-12. Distribution of Industrial Building Stock Replacement Value in the Town of East Fishkill



Source: Town of East Fishkill; HAZUS-MH (U.S. Census 2000.)

Development and Land Use Trends

Land use regulatory authority is vested in New York State's towns, villages, and cities. However, many development and preservation issues transcend location 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 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 land use trends and the types of development occurring within the Town of East Fishkill. An understanding of these development trends can assist in planning for further development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

Land Use Trends

Residential uses dominate the landscape in East Fishkill, and population growth has transformed East Fishkill from a rural, agricultural community to one that is now a suburban community. The most obvious manifestation of this growth has been the conversion of open space, farmland, and forestland into residential subdivisions. As of 2001, approximately 10% of the Town remained in agricultural uses (EF Comp Plan, 2002).

East Fishkill's suburban development boom over recent decades contributed to the number of dwelling units rising from 5,700 in 1980, to 8,495 in 2000, and 10,039 in 2010 according to the Census Bureau. Most of the units are located in subdivisions built in north and central East Fishkill, though the number of new residences in the south and east has grown rapidly (EF Comp Plan, 2002). Many of the highest densities of single-family houses exist surrounding the many lakes in town. Most of these residences were converted years ago from summer vacation homes to permanent, year-round residences (EF Comp Plan, 2002).

Development

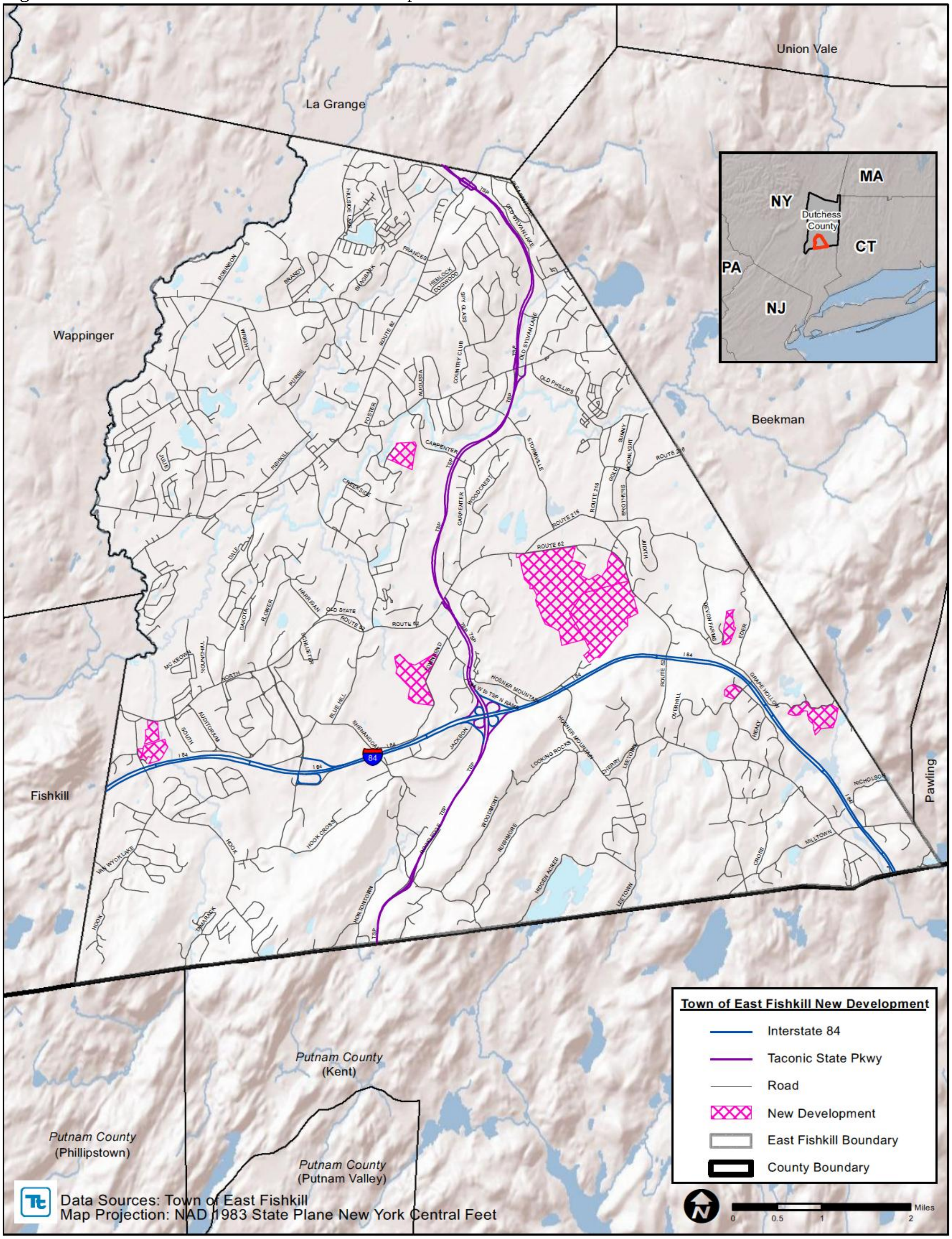
The East Fishkill Planning Department identified major areas of current and potential future growth and development within the City. These projects include residential development, mixed use and commercial development structures. Table 4-5 lists these projects and Figure 4-13 illustrates the location of these parcels.

Table 4-5. Current and Potential New Development in the Town of East Fishkill

Project Name	Location / Address	Parcel Identification			Type	Number of Potential Structures / Units	Hazard Vulnerability*
		Section	Subsection	Lot			
Bonnano	Mountain Top Road	6636	00	832259	RES	4	
Hilltop Manor	Creek Bend Road	6457	02	885725	RES	21	NEHRP E Soil
Montage	Route 52/216	6656	00	802836	RES	126	Flood Zone A; NEHRP D Soil; NEHRP E Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6356	03	410029	RES	12	Flood Zone A; NEHRP D Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6355	00	410812	RES		Flood Zone A; NEHRP D Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6355	00	317899	RES		Flood Zone A; NEHRP D Soil
Sprainbrook Meadows	Townsend Road	6456	04	955335	RES	11	Flood Zone A; NEHRP E Soil
Summit Woods	Route 52	6656	00	045715	RES	175	Flood Zone A
Grape Hollow	Grape Hollow Road	6756	03	379100	RES	11	Flood Zone A
Hunters Ridge	Devon Farms Road	6656	00	810625	RES	8	

Source: East Fishkill
RES = Residential

Figure 4-13. Current and Potential Future Development in the Town of East Fishkill



Source: Town of East Fishkill

4.6 Critical Facilities

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 essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material 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.

A comprehensive inventory of critical facilities in the Town of East Fishkill was developed from various sources including HAZUS-MH provided data and input from the Town's GIS department. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the draft HMP and used for the risk assessment in Section 5.

4.6.1 Essential Facilities

This section provides information on emergency facilities, hospital and medical facilities, shelters, schools, and senior care and living facilities.

Emergency Facilities

For the purposes of this Plan, emergency facilities include Emergency Operation Centers (EOC), police, fire and emergency medical services (EMS). Table 4-6 provides an inventory of EOC, police stations, fire stations and EMS facilities in the Town of East Fishkill. Figure 4-14 displays the location of these facilities based on the HAZUS-MH inventory data and input from the Planning Committee.

Table 4-6. Police, Fire and EMS Stations in the Town East Fishkill

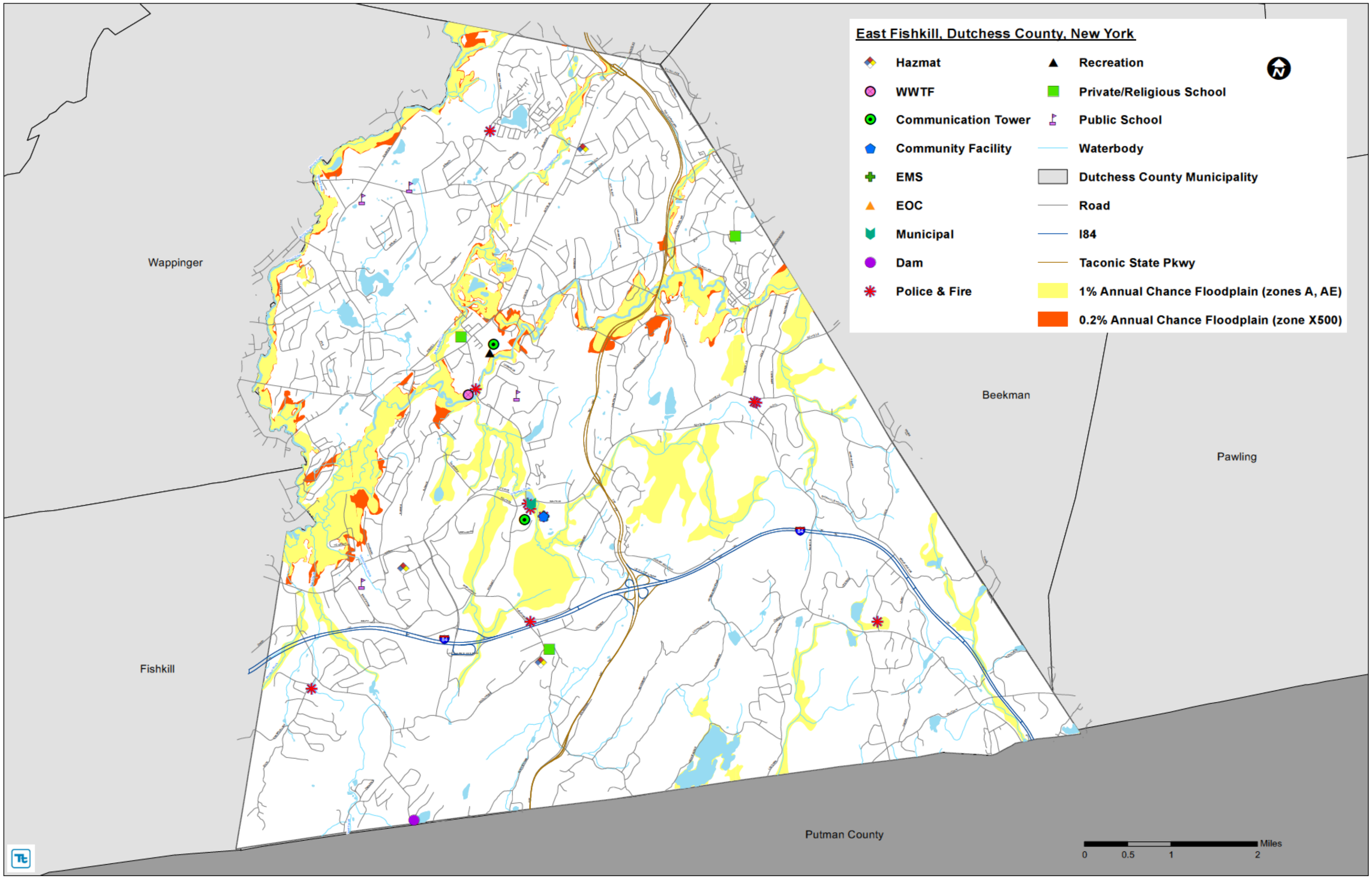
Name	Address	Type	Estimated Replacement Cost (Structural Value)	Building Type	Backup Power
East Fishkill Fire District Headquarters and Training Center	2502 Route 52	EOC/Fire/EMS	$5,500,000	Concrete	Yes
Town of East Fishkill Police Department / Town Hall	2468 Route 52	Police	$800,000	Concrete	Yes
Wiccopee Fire Company No. 4	6 West Hook Road	Fire	$79,400	Concrete	TBD
Wiccopee Fire Company Sub.	Townsend	Fire	$257,000	Concrete	Yes
Stormville Fire Co Inc	Mountain Top Road	Fire	$150,000	Metal	No
Stormville Fire Co Inc	Seaman Road	Fire	$500,940	Concrete	No
Stormville Fire Co	112 Old Route 52 and Seaman Road	Fire	$100,300	Concrete/ Wood	No
Hillside Lake Fire Co. No. 3	Hillside Lake	Fire	$440,500	Concrete	TBD
Hopewell Hose Co #1 Inc	Route 376	Fire	$1,500,000	Concrete	Yes

Source: East Fishkill GIS, 2012
TBD = To be determined

Hospitals and Medical Centers

There are no hospitals or major medical centers in the Town of East Fishkill. The closest medical center is the VA Medical Center in Castle Point, New York.

Figure 4-14. Emergency Facilities in East Fishkill



Source: East Fishkill GIS, 2012

Shelters

The shelter facilities identified by the Planning Committee are identified below in Table 4-7 and are shown in Figure 4-14. In the event of an emergency, it is best to consult your municipality to find out where to seek shelter.

Table 4-7. Shelter Facilities in the Planning Area

Name	Address	Capacity	Estimated Replacement Cost (Structural Value)	Building Type	Backup Power
Wappingers Central School District John Jay High School	2012 Route 52	TBD	$4,000,000	Masonry	Yes

Source: East Fishkill GIS, 2012

Schools

The Town of East Fishkill is serviced by four school districts: Wappinger Central, Arlington, Carmel, and Pawling School District. Most of the Town lies within the Wappinger Central School District and most school-age children attend its schools. The Wappinger Central School District is the only school district with facilities within the Town limits.

Table 4-8 lists public, private, and religious schools in the Town. Figure 4-14 displays the schools located within the Town of East Fishkill, as available through the Town GIS database.

Table 4-8. Schools in the Town of East Fishkill

Name	Address	Type of Facility	Enroll	Designated Shelter/ Shelter Capacity	Estimated Replacement Cost (Structural Value) **	Building Type*	Backup Power
Van Wyck Jr. High School (WCSD)	6 Hillside Lake Rd	Middle	TBD	TBD	$2,344,700	Masonry	No
Gayhead Elementary School (WCSD)	15 Entry Rd	Elementary	TBD	TBD	$2,346,100	Masonry	No
Fishkill Plains Jr. High School (WCSD)	17 Lake Walton Rd	Middle	TBD	TBD	$961,800	Masonry	No
John Jay High School (WCSD)	2012 Route 52	High School	TBD	Yes	$4,000,900	Masonry	Yes
Saint Denis – Saint Columba Catholic Church	849 Route 82	Elementary	TBD	TBD	$2,210,870	Masonry	No
Bethal Baptist Church of	511 Shenandoah Road	Elementary	TBD	TBD	$112,600	Masonry	TBD

Sources: East Fishkill GIS, 2012 Notes: WCSD = Wappingers Central School District
*Default HAZUS data
** Values populated are assessed values

Senior Care and Senior Living Facilities

There are no senior care or senior living facilities in the Town of East Fishkill.

4.6.2 Transportation Systems

This section presents available inventory data for transportation systems for the Town of East Fishkill.

Highway, Roadways and Associated Systems

The Town of East Fishkill's 2002 Comprehensive Plan suggests that the Town is well served by regional highways and has a relatively developed network of local roads. Interstate 84, the Taconic State Parkway and State Routes 52, 82, 216 and 376 traverse the Town. Interstate 84 traverses the Town in an east-west direction and the Taconic State Parkway traverses the Town in a north-south direction. Together these highways form the backbone of East Fishkill's transportation system. The major arterial streets in East Fishkill are NYS Routes 82 and 376 as well as NY State Route 52 west of the intersection with the Taconic State Parkway (EF Comprehensive Plan, 2002).

HAZUS-MH identified 33 highway bridges within the Town of East Fishkill. Table 4-9 summarizes the 33 highway bridges, which excluded privately-owned bridge in the Town. Table 4-10 identifies the highway garage in the Town.

Table 4-9. Highway Bridges in the Town of East Fishkill

Name	Owner	Year Built
CR 9BEEKMAN ROAD	County Highway Agency	1989
CARPENTR RD CR 2	County Highway Agency	1940
STORMVILLE ROAD	County Highway Agency	1940
PHILIPS ROAD	County Highway Agency	1932
COUNTY ROAD 31	County Highway Agency	1963
CO RD 29	Railroad	1998
RTE 52	State Highway Agency	1935
RTE 52	State Highway Agency	1935
TSP	State Highway Agency	1937
RTE 82	State Highway Agency	1936
TSP	State Highway Agency	1938
FISHKILL HOOK RD	State Highway Agency	1963
LIMEKILN RD	State Highway Agency	1963
SHENANDOAH ROAD	State Highway Agency	1963
RTE 84	State Highway Agency	1963
RTE 84	State Highway Agency	1963
GAYHEAD POND STR	State Highway Agency	1935
RTE 376	State Highway Agency	1947
RTE 376	State Highway Agency	1915
RTE 84	State Highway Agency	1968
RTE 84	State Highway Agency	1968
RTE 84	State Highway Agency	1968

Name	Owner	Year Built
RTE 84	State Highway Agency	1968
STORMVILLE MTN R	State Highway Agency	1968
HOLMES ROAD	State Highway Agency	1968
SB-I84 WB	State Highway Agency	1962
CR 9BEEKMAN RD.	State Highway Agency	1989
RTE 987G	State Highway Agency	1937
TSP	State Highway Agency	1936
TO TSP	State Highway Agency	1989
TSP	State Highway Agency	1999
CAROL DRIVE	Town Highway Agency	1987
WARREN LANE	Town Highway Agency	1980

Source: HAZUS-MH

Table 4-10. DPW Garage/Facilities in the Town of East Fishkill

Name	Address	Estimated Replacement Cost (Structural Value)	Building Type*	Backup Power
Town of East Fishkill Highway Garage	2484 Route 52	$120,000	Metal	Yes

Airports and Heliports

While there are no airports within the Town of East Fishkill boundaries, two airports exist within close vicinity and provide local and regional air service to East Fishkill. The Dutchess County Airport (POU) is located in Wappinger Falls, four nautical miles south of Poughkeepsie. This airport is County owned, and provides control tower and landing services on three runways for public use. The Stormville Airport (FAA ID N69) is privately owned, maintains one runway, and open for public use (http://www.airport-data.com/airport/3NK3/nearby-airports.html).

IBM East Fishkill owns and operates two private Heliports, one of which is located within East Fishkill (FAA IDs# 3NK3 and NK56). 3NK3 is located on Route 52 in Hopewell Junction on the IBM East Fishkill Facility, while the other is in Wappinger Falls at the Dutchess County Municipal Airport (http://www.airport-data.com/airport/3NK3/).

Public Transportation

The Dutchess County Division of Mass Transportation (LOOP) provides public transit service through two modes of service: fixed route service and demand response services like Dial-A-Ride and Paratransit. LOOP also runs a RailLink bus service in cooperation with the Metro-North Railroad (MNR), and coordinates non-emergency Medicaid transportation for the Dutchess County Department of Social Services. LOOP operates six bus services, one of which passes through East Fishkill. This bus service, labeled Route F, begins in Poughkeepsie and travels through Beacon and East Fishkill, making seven scheduled stops, and terminating at Hopewell Junction (Dutchess County, 2012). This route also provides access to connections on buses going to other destinations, such as the Leprechaun Connection to White Plains and Poughkeepsie. There are no direct bus connections to either the MNR Harlem Line or the MNR Hudson Line.

The 2001 East Fishkill Comprehensive Plan identified two park and ride lots in East Fishkill: the first is on Lime Kiln Road just south of I-84, and the second is at the intersection of the Taconic State Parkway and Route 52. These lots provide carpool & vanpool Parking, but are not served by any of the LOOP busses or RailLink (Dutchess County, 2012) (http://www.co.dutchess.ny.us/CountyGov/Departments/MassTransit/PLLoopbus.htm).

Bicycle and pedestrian transportation are provided along the Dutchess Rail Trail, a 12-mile route connecting Hopewell Junction at Route 82 in East Fishkill with Morgan Lake on the Town/City of Poughkeepsie border, via the towns of LaGrange and Wappinger (http://www.co.dutchess.ny.us/CountyGov/Departments/DPW-Parks/17043.htm).

Rail

An active railroad line, owned by the Metropolitan Transportation Authority (MTA), traverses East Fishkill. The rail line crosses East Fishkill's easterly boundary south of Route 216 in the Stormville Area and travels west, northwest in to Hopewell Junction, where it bends to the southwest and intersects the westerly boundary of town between SR 52 and SR 82 (EF CompPlan, 2001).

4.6.3 Lifeline Utility Systems

This section presents potable water, wastewater, and energy resource utility system data. Due to heightened security concerns, local utility lifeline data sufficient to complete the analysis have only partially been obtained. Utility data are included in HAZUS-MH but are not sufficient to support detailed analyses for this the Town of East Fishkill.

Potable Water Supply

According to the Town of East Fishkill's 2002 Comprehensive Plan, most residents rely on the abundant supply of groundwater from aquifers to supply water to their individual wells. However, development pressure and the ever-growing population forced the Town to consider a gradual shift to a community well system, which would serve a wider geographic area. As of 2002, Town had acquired five independent water systems: Hopewell Hamlet, Pinewood Knolls, Little Switzerland, Brettview, and Dogwood Knolls, and was looking into the possible expansion of the Hopewell Hamlet water system. The Plan stated a goal to eventually connect the water systems into one large, central system (EF Comprehensive Plan, 2002). In 2004, the Town released maps, plans, and reports (updated in 2011) for a water and sewer district servicing the Four Corners subdivision, which would include one 660,000 gallon water storage tank. These reports are available at the Town's website, at http://www.eastfishkillny.org/content/town-special-districts (EastFishkillny.org, 2012).

Table 4-11 summarizes the portable water plants, storage tanks, wells and pump houses in the Town of East Fishkill.

Table 4-11. The Town of East Fishkill Potable Water Facilities, Pump Stations and Storage Tanks

Type	Name	Address	Capacity	Population Served
Plant	Brettview Water Plant	TBD	TBD	TBD
Plant, Tank, Wells	Fishkill Plains Plant, Storage Tank & Wells	TBD	TBD	TBD
Plant	Four Corners Water Plant 1	TBD	TBD	TBD
Plant	Four Corners Water Plant 1	TBD	TBD	TBD

Type	Name	Address	Capacity	Population Served
Tank	Four Corners Water Storage Tank	TBD	TBD	TBD
Storage Building	Hopewell Glen Water Building	TBD	TBD	TBD
Plant, Tank, Wells	Hopewell Hamlet Plant, Storage Tank Wells	TBD	TBD	TBD
Tank	Little Switzerland Water Storage Tank	TBD	TBD	TBD
Plant, Pump House	Little Switzerland Water TP & PH	TBD	TBD	TBD
Pump House, Wells	Pinewood Knolls Pump House & Wells	TBD	TBD	TBD
Pump House, Wells	Revere Park Water Plant & Wells	TBD	TBD	TBD
Plant	Shenandoah Water Plant	TBD	TBD	TBD
Tank	Shenandoah Water Storage Tank	TBD	TBD	TBD
Pump House, Wells	Taconic Estates Pump House & Wells	TBD	TBD	TBD

Source: East Fishkill GIS, 2012
TBD = To be determined

Wastewater Facilities

According to the 2002 EF Comprehensive Plan, most residents rely on individual septic systems to treat their effluent. Few community sewage systems and/or wastewater systems exist throughout the Town, at Wildflower Hills, Beekman Country Club, Sagamor and Forest Hills, and Fishkill Plains Water Treatment Facility. IBM (Hudson Valley Research Park) also has an independent wastewater treatment facility (EF Comp Plan, 2002).

Table 4-12 lists the wastewater facilities as identified by the Planning Committee.

Table 4-12. The Town of East Fishkill Wastewater Facilities

Name	Address	Capacity	Population Served	Replacement Cost (Structural Value)
Four Corners - Chestnut Street Sewage Pump Station	TBD	TBD	TBD	TBD
Four Corners - Philips Road Wastewater Treatment Plant (WWTP)	TBD	TBD	TBD	TBD
Four Corners WWTP	TBD	TBD	TBD	TBD
Hopewell Hamlet Main Sewage Pump Station	TBD	TBD	TBD	TBD
Hopewell Hamlet Main WWTP	TBD	TBD	TBD	TBD
Leg 2A Sanitary Sewage Pump Station	TBD	TBD	TBD	TBD
Penney Lane Sewage Pump Station	TBD	TBD	TBD	TBD
Sagamore-Beekman Road Sewer Pump Station	TBD	TBD	TBD	TBD

Name	Address	Capacity	Population Served	Replacement Cost (Structural Value)
Sagamore WWTP	TBD	TBD	TBD	TBD
Town Hall Sewage Pump Station	TBD	TBD	TBD	TBD
Unity Plaza Sewage Pump Station	TBD	TBD	TBD	TBD
East Fishkill Treatment Facility	376 Route 52	TBD	TBD	TBD

Source: East Fishkill GIS, 2012
PSt = Pumping Station TBD = To be determined

Energy Resources

The Town of East Fishkill is serviced by New York State Electric and Gas (NYSEG) and Central Hudson Electric and Gas.

Communication Resources

The Town of East Fishkill is serviced by Cablevision, Frontier Communications, RCN and Verizon for phone, cable and internet along landlines.

The Planning Committee identified the following communication facilities and towers listed in Table 4-13 below.

Table 4-13. Communication Facilities and Towers in the Town of East Fishkill

Name	Address	Owner	Cost	Backup Power
East Fishkill Fire District Headquarters and Training Center	2505 Route 52	Town	TBD	Yes
Hopewell Recreation	TBD	TBD	TBD	TBD
Town Highway Department Garage	TBD	Town	TBD	TBD
Old Sylvan Lake Road	TBD	TBD	TBD	TBD
Woodmont Road (Probst)	TBD	TBD	TBD	TBD
IBM West Complex	TBD	TBD	TBD	TBD
NYSDOT Maintenance Yard / Lime Kiln Road	TBD	TBD	TBD	TBD
Interstate 84 Median	TBD	TBD	TBD	TBD
High Tension Tower	TBD	TBD	TBD	TBD
High Tension Tower	TBD	TBD	TBD	TBD

Source: East Fishkill GIS, 2012
TBD = To be determined
UNK = Unknown

4.6.4 High-Potential Loss Facilities

High-potential loss facilities include dams, levees, nuclear power plants, military installations and hazardous materials (HAZMAT) facilities. No levees, nuclear power plants or military installations were identified in the Town.

HAZMAT Facilities

The Town of East Fishkill planning committee identified three (3) HAZMAT facilities within the planning area. Table 4-14 below lists these facilities.

Table 4-14. HAZMAT Facilities in the Town of East Fishkill

Name	Address	Replacement Cost (Structural Value)	Building Type	Backup Power (Y/N)
IBM Research Center	2070 Route 52	Unknown	Concrete	Yes
Hopewell Precision (Superfund Site)	Ryan Drive	No	No	No
East Hook Cross Road Hazard Site	East Hook Cross Road	No	No	No

Sources: East Fishkill GIS, 2012

Dams

According to the National Inventory of Dams (NID), input from the Planning Committee, and data received from the New York State Department of Environmental Conservation, there are fourteen (14) dams in the Town of East Fishkill. A dam is included in the NID if: 1) it is a "high" or "significant" hazard potential class dam or, 2) it is a "low" hazard potential class dam that exceeds 25 feet in height and 15 acre-feet storage or, 3) it is a "low" hazard potential class dam that exceeds 50 acre-feet storage and 6 feet height. Of the 14 dams inventoried, there are four (4) classified as significant and the remaining eight (8) classified as low. Table 4-15 defines the hazard potential classification, as accepted by the NID Interagency Committee on Dam Safety. Table 4-16 lists the dams in the Planning Area. Further information on dams within the Town and region may be found in the Dam Failure hazard profile, Section 5.4.1.

Table 4-15. Dam Hazard Potential Classifications

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Source: NID, 2007

Table 4-16. Dams in the Town of East Fishkill

Name	National / State ID #	Hazard Code	Water Course	Year Built	Dam Type	Crest Length (ft)	Height (ft)	Storage Capacity (acre-ft)	Drainage Capacity (acre-ft)
Groveville	NY00072	N/A	Fishkill Creek	N/A	Lower Saranac Corporation	N/A	N/A	N/A	N/A
Lake Sekunna (Long Hill Road)	NY15080 / 212-5374	B	N/A	1935	RE	0	10	0	0
Ballard	NY00663 / 230-0905	B	TR – Stump Pond Stream	1931	MS	225	15	60	0.25
Camp Alamar Lower Lake	NY01259 / 230-4476	B	Leetown Brook	1950	RE	225	25	80	0.4
Hillside Lake	NY01169 / 212-1025	B	TR – Sprout Creek	1934	RE	300	9	75	0.3
Lake Walton	NY01204 / 212-4502	B	TR – Fishkill Creek	1895	RE	150	10	180	0
Greenburg Henderson	NY13521 / 212-4805	B	Fishkill Creek	Unknown	MS	0	10	40	0
Storm Lake	NY13519 / 212-4687	A	TR – Fishkill Creek	Unknown	CN	0	4	30	0
Steven Kelly Pond	NY13512 / 212-3268	A	TR – Fishkill Creek	1964	RE	540	10	7	0.05
Fishkill Farms Pond	NY15063 / 212-5375	A	Wiccopee Creek	Unknown	MS	70	15	0	0
Larkspur	NY16123 / 212-5503	A	Wiccopee Creek	Unknown	RE	0	15	0	0
Camp Alamar Upper Lake	NY00409 / 230-2964	A	Leetown Brook	1961	RE	400	6	67	0.22
Torch Pond	NY13911 / 230-4138	A	TR – Leetown Brook	1974	RE	500	17	19	0.11
Deerwood	NY13515 / 212-4197	A	TR – Wiccopee Creek	1977	CN, RE	20	5	5	0.05
Turner Mill Pond	NY13885 / 230-0582	A	TR – Middle BR Croton River	Unknown	MS	255	5	4	25

Source: National Inventory of Dams (NID); East Fishkill GIS, 2012
Note: MS = Masonry, RE = Earth, CN = Concrete Gravity, TR = Tributary, BR = Branch

A 1999 "Water Impoundment Survey of the Town of East Fishkill," prepared by Morris Associates Engineering Consultants, identified 38 impoundment sites within the Town. While some of these sites match dam locations listed above from the NYSDEC database, others are smaller impoundments owned and/or maintained by private land owners and located on private land. The 2005 follow-up to the 1999 survey reported that eight (8) of those sites were in poor condition and posed potential hazards for damage to life and property (Morris Associates, 1999). Section 5.4.4 of this HMP provides further information on the surveyed dam and impoundment sites.

4.6.5 Other Facilities

The user-defined facilities category includes all assets that the Planning Area and participating municipalities deemed critical to include in the inventory and that do not fit within a pre-defined HAZUS-MH facility category. These facilities include municipal halls, community centers, and Town-owned buildings, etc. Table 4-17 below lists the user-defined facilities for East Fishkill.

Table 4-17. Other Facilities in the Town of East Fishkill

Name	Address	Replacement Value	Building Type	Backup Power
Community Center	Route 82	$50,000	TBD	No
Municipal Building	330 Rt. 376	TBD	Masonry	No
East Fishkill Library	348 Rt. 376	TBD	Masonry	TBD

Source: Town of East Fishkill
TBD = To Be Determined

4.7 Economic Profile

The 2010 U.S. Census Bureau's County Business Patterns data identified 7,440 business establishments employing 96,409 people in Dutchess County. The majority (60-percent) of these establishments employed between one and four employees (U.S. Census, 2010). According to the 2007 U.S. Census Business Patterns, overall, the top industries for number of establishments in the Town of East Fishkill includes Professional, scientific, and technical services; Health care and social assistance; and Other services (except public administration). The Manufacturing industry leads the Town in the overall number of employees, while Retail trade and Accommodation and food services industries are the second and third largest employers, respectively. Many of these manufacturing jobs may be attributed to the IBM Microelectronics plant in East Fishkill, located at the Hudson Valley Research Park. Table 4-18 displays the number of establishments in the Town and the estimated number of employees employed in each of the sectors.

Table 4-18. Number of Establishments and Employees in the Town of East Fishkill

2007 North American Industry Classification System (NAICS)	Number of Establishments	Number of Employees
Manufacturing	18	5,000-9,999
Wholesale trade	22	229
Retail trade	72	616
Information	9	54
Real estate and rental and leasing	30	112
Professional, scientific, and technical services	77	329
Administrative and support and waste management and remediation services	35	221

2007 North American Industry Classification System (NAICS)	Number of Establishments	Number of Employees
Educational services	12	20-99
Educational services	1	0-19
Health care and social assistance	53	367
Arts, entertainment, and recreation	7	62
Accommodation and food services	52	446
Other services (except public administration)	53	259
Total	**441**	**7,715 - 12,812**

Source: U.S. Census Bureau, 2007

IBM's East Fishkill facility is located in Hopewell Junction, bordered on the north by U.S. Route 52, to the east by County Highway 27, and to the south by U.S. Route 84. The 592-acre facility is divided into the East and West Complexes. In December 2005, the West Complex, which covers 162 acres of the IBM facility and had previously been used for research and development operations, was sold for $20 million to a real estate company for purposes of redevelopment. (http://www.epa.gov/region2/waste/fsibmhop.htm)

SECTION 5: RISK ASSESSMENT

According to FEMA Guidance 386-2, "risk assessment is the process of measuring the potential loss of life, personal injury, economic injury and property damage resulting from natural hazards by assessing the vulnerability of people, buildings and infrastructure to natural hazards." The Town of East Fishkill's risk assessment is organized into four sections. Section 5.1 describes the methodology and tools used to support the risk assessment process. Section 5.2 identifies the natural hazards of concern for further profiling and evaluation. In Section 5.3, the identified hazards of concern are ranked for the Town as a whole to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Lastly, Section 5.4 profiles and assesses vulnerability for each hazard of concern.

5.1 METHODOLOGY AND TOOLS

This section describes the methodology and tools used to support the risk assessment process.

Methodology

The risk assessment process used for this Plan is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA, 2001). This process identifies and profiles the hazards of concern and assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs (Section 6 of this plan).

Step 1: The first step of the risk assessment process is to identify the hazards of concern. FEMA's current regulations only require an evaluation of natural hazards. Natural hazards are natural events that threaten lives, property, and many other assets. Often, natural hazards can be predicted, where they tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Step 2: The next step of the risk assessment is to prepare a profile for each hazard of concern. These profiles assist communities in evaluating and comparing the hazards that can impact their area. Each type of hazard has unique characteristics that vary from event to event. That is, the impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, the probability of occurrence of a hazard in a given location impacts the priority assigned to that hazard. Finally, each hazard will impact different communities in different ways, based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: To understand risk, a community must evaluate what assets it possesses and which assets are exposed or vulnerable to the identified hazards of concern. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4, prepares the community to develop risk scenarios and estimate potential damages and losses for each hazard.

Tools

To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, the Town of East Fishkill used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Our standardized tools used to support the risk assessment are described below.

Hazards U.S. – Multi-Hazard (HAZUS-MH)

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-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations that 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-MH 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-MH uses default HAZUS-MH provided 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-MH's 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. The guidance Using HAZUS-MH for Risk Assessment: How-to Guide (FEMA 433) was used to support the application of HAZUS-MH for this risk assessment and plan. More information on HAZUS-MH is available at http://www.fema.gov/plan/prevent/hazus/index.shtm.

In general, probabilistic analyses were performed to develop estimates of long-term average losses (annualized losses) as well as an expected/estimated distribution of losses (mean return period losses) for the earthquake, flood and wind hazards. The probabilistic hazard generates estimates of damage and loss for specified return periods (e.g., 100- and 500-year). For annualized losses, HAZUS-MH 2.1 calculates the maximum potential annual dollar loss resulting from various return periods averaged on a "per year" basis. It is the summation of all HAZUS-supplied return periods (e.g., 10, 50, 100, 200, 500) multiplied by the return period probability (as a weighted calculation). In summary, the estimated cost of a hazard each year is calculated.

Custom methodologies in HAZUS-MH 2.1 were used to assess potential exposure and losses associated with hazards of concern for the Town of East Fishkill:

- Inventory: The default demographic data in HAZUS-MH 2.1, based on the 2000 U.S. Census, was used for analysis. However, the 2010 U.S. Census data was used to estimate hazard exposure at the municipal level.

  The default building inventory in HAZUS-MH 2.1 was updated and replaced at the Census-block level with a custom building inventory developed for the Town of East Fishkill. The custom building inventory was developed using detailed structure-specific assessor data, New York State Property Type Classification Codes, as well as parcel and structure location information. Structural and content replacement cost values were calculated for each building utilizing available assessor data and RSMeans 2011 values. An updated critical facility inventory was also developed and incorporated into HAZUS-MH replacing the default essential facility (police, fire, schools, etc.) and utility inventories.

  The occupancy classes available in HAZUS-MH 2.1 were condensed into the following categories (residential, commercial, industrial, agricultural, religious, government, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single family dwellings.

  The critical facility inventory (essential facilities, utilities, transportation features and user-defined facilities) was updated for the earthquake, flood and wind hazard models. This comprehensive inventory was developed by gathering GIS data and input from the Town of East Fishkill.

- Earthquake: HAZUS-MH 2.1 was used to evaluate the Town of East Fishkill's risk to the seismic hazard. A probabilistic assessment was performed to analyze the earthquake hazard losses (annualized losses and 100-, 500- and 2,500-year mean return period [MRP] losses). 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.

  The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications 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. For this HMP, a local soil map with the Town of East Fishkill's NEHRP soil types provided by NYSOEM was entered into HAZUS-MH 2.1 and used for all analyses. Groundwater was set as at a depth of five-feet (default setting). Damages and loss due to liquefaction, landslide or surface fault rupture were not included in this analysis.

- Flood: The 1-percent and 0.2-percent chance flood events were examined to evaluate the Town of East Fishkill's risk and vulnerability to the riverine flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

  A Level 2 HAZUS-MH riverine flood analysis was performed. Using GIS tools and the best available data including the Dutchess County FEMA DFIRM database effective May 2012 and five-foot contours provided by the Town were used to develop a Digital Elevation Model (DEM) and generate 1-percent and 0.2-percent flood depth grids. The depth grids were integrated into the HAZUS-MH riverine flood model and used to estimate potential losses to the structure inventory.

  To estimate exposure to the 1-percent and 0.2-percent flood events, the DFIRM flood boundaries, updated building and facility inventories and 2010 U.S. Census population data were used. The HAZUS-MH 2.1 riverine flood model was run to estimate potential losses for the Town of East Fishkill for the 1-percent and 0.2-percent flood events. HAZUS-MH 2.1 calculated the estimated potential sheltering of the population (default 2000 U.S. Census data) and potential damages to the updated general building stock and critical facility inventories based on the depth grid generated and the default HAZUS damage functions in the flood model.

- Hurricane/Wind: A HAZUS-MH 2.1 probabilistic analysis was performed to analyze the wind hazard losses for the Town of East Fishkill. The probabilistic hurricane hazard 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 the Planning Area. HAZUS-MH 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. Annualized losses and the 100- and 500-year MRPs were examined for the wind/severe storm hazard. Default demographic and updated building and critical facility inventories in HAZUS-MH 2.1 were used for the analysis.

- Other Hazards: HAZUS-MH support was used to evaluate other hazards, as feasible. For many of the hazards evaluated in this risk assessment, historic data are not adequate to model future losses at this time. However, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data are available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Section 6. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

For this risk assessment, the 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 affects 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 Town of East Fishkill and the amount of advance notice residents have to prepare for a specific hazard event

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, the Town of East Fishkill will collect additional data to assist in developing refined estimates of vulnerabilities to natural hazards.

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

Hazards of Concern is defined as those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

To provide a strong foundation for mitigation strategies considered in Section 6, the Town of East Fishkill in Dutchess County focused on considering a full range of hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The hazards of concern identification process incorporated input from the Town of East Fishkill planning committee; review of the 2011 New York State Hazard Mitigation Plan (NYS HMP) 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, and one man-made/technological hazard of concern (dam failure), 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 NYS HMP.

The "Flooding" hazard includes riverine flooding, flash flooding, urban/stormwater flooding, and ice jam 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 tropical (hurricanes, tropical storms and tropical depressions) and windstorms that often entail a variety of other influencing weather conditions including thunderstorms, hail, and tornadoes. This hazard grouping is consistent with that used in FEMA 386-1.

The "Severe Winter Storm" hazard includes heavy snow, blizzards, sleet, freezing rain, ice storms and Nor'Easters. This grouping is consistent with that used in the NYS HMP, as well as the "Severe Winter Storm" hazard used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

These groupings do not change the definition of the included specific events/hazards, as defined within FEMA guidance and other risk assessment documents, and does not affect the hazard analysis conducted through the use of HAZUS-MH, either directly or as a risk assessment support tool.

Table 5.2-1. Identification of Hazards of Concern for the Town of East Fishkill, New York

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in the Town of East Fishkill?	If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Why was this determination made?	Source(s)
Avalanche	No	No	• The NYS HMP does not identify avalanche as a hazard of concern for New York State. • The topography and climate of the Town of East Fishkill does not readily support the occurrence of an avalanche event. • New York State in general has a very low occurrence of avalanche events based on statistics provided by National Avalanche Center – American Avalanche Association (NAC-AAA) between 1950 and 2007. Between this time period, New York State experienced four fatalities due to avalanches.	• NYSDPC • Review of NAC-AAA database between 1950 and 2007
Coastal Erosion / Coastal Storm	No	No	• The NYS HMP does not identify the Town of East Fishkill as a Coastal Erosion Hazard Area community within Dutchess County. • The Town is not bounded by coastal waters; therefore, not directly impacted by coastal storms and coastal erosion does not occur.	• NYSDPC
Drought	Yes	No	• The NYS HMP identifies drought as a hazard of concern for New York State. The NYS HMP indicated that Dutchess County was impacted by drought between November 2001 and January 2002 and April through October 2002. • According to the NYSDEC, Dutchess County is located in Drought Management Region II (Catskills). According to the NRCC, Dutchess County is located in the Hudson Valley Climate Division and has experienced the following drought periods: o November 1908 – January 1909 o November – December 1909 o October 1910 – January 1911 o December 1930 – January 1931 o October 1941 – February 1942 o April – May 1942 o October – December 1949 o August – November 1957 o October – December 1963 o May 1964 – September 1966 o January – February 1967 o April – May 1985 o August – September 1995 o December 2001 – February 2002 • While there is historical record of drought events in the Town of East Fishkill	• NYSDPC • NOAA-NCDC • Drought Reporter • SHELDUS • U.S. Drought Monitor Archive

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Source(s)
			and Dutchess County, there is very little evidence of significant impacts (human, structural, economic) resulting from these events. Further, these risks are properly managed through preparedness and response. Mitigation opportunities are limited or are being addressed along with other hazards and their resulting impacts. The County and Planning Area have experienced several major droughts which have impacted both the residential and business communities. Even with significant improvement to the water supply systems, the possibility of shortfalls or water emergencies always exists. • The Planning Committee identified drought as a low ranked hazard affecting the Town of East Fishkill.	
Earthquake	Yes	Yes	• The NYS HMP identifies earthquake as a hazard of concern for New York State. • According to the NGDC, New York State has only had eight significant* earthquakes between 2150 B.C. and 2012. • NYCEM indicates that no earthquakes have taken place in or immediately surrounding the Town of East Fishkill between 1730 and 2002. However, NY-NJ-CT Metro region, which includes Dutchess County, does have a *low hazard / high risk* earthquake potential with its dense population, vulnerable infrastructure and substantial economic value. • According to the USGS online seismic hazard maps, the peak ground acceleration with a 10-percent probability of exceedance over 50 years for Dutchess County is between 2 and 4 %g. FEMA guidance recommends earthquakes be evaluated further if an area has a 3 %g peak acceleration or more.	• NYSDPC • NGDC • NYCEM • USGS – Earthquake Hazards Program, Review of USGS Seismic Maps
Expansive Soils	No	No	• The NYS HMP identifies expansive soils as a hazard of concern for New York State. • USGS indicated that Dutchess County has little or no clays with swelling potential with some locations having generally less than 50-percent of clay, having slight to moderate swelling potential that could result in expansive or swelling soils. • Based on all sources reviewed, no known historical occurrences are reported for the Town of East Fishkill.	• NYSDPC • Review of USGS 1989 Swelling Clays Map of the Conterminous United States
Extreme Temperature	Yes	Yes	• NOAA's NCDC storm events database indicates that Dutchess County was impacted by approximately 17 extreme temperature events (11 cold and seven	• NOAA-NCDC • The Weather

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Source(s)
			warm) between 1950 and 2012. • According to the Weather Channel, the following are record low events for the winter months for the Town of East Fishkill: ○ January 1994 – -22°F ○ February 1996 – -11°F ○ November 2000 – -11°F ○ March 2003 – -2°F ○ March 2004 – -1°F • According to the Weather Channel, the following are record low events for the winter months for the Town of East Fishkill: ○ July 1991 - 100°F ○ May 1996 - 96°F ○ June 1999 - 93°F ○ September 1999 - 92°F ○ August 2001 - 101°F	Channel
Flood (Riverine, Flash, Ice Jam and Dam Failure Flooding [overtopping or breaching from natural causes])	Yes	Yes	• The NYS HMP identifies flooding as the main hazard of concern for New York State. • The NYS HMP, NYSOEM, FEMA, and SHELDUS indicate that Dutchess County has been issued eight FEMA Disaster Declarations for flood-related events, each event resulting in extensive damages. ○ **FEMA DR-45** (August 12-19, 1955) - Losses in Dutchess County and East Fishkill are unknown. ○ **FEMA DR-311** (September 1971) - Losses in Dutchess County and East Fishkill are unknown. ○ **FEMA DR-401** (July 1973) - Losses in Dutchess County and East Fishkill are unknown. ○ **FEMA DR-1095** (January 1996) – Dutchess County experienced $7.03 M in property damages. Specific losses for East Fishkill are unknown. ○ **FEMA DR-1296** (September 1999) – Dutchess County experienced $1.4 M in property damages. ○ **FEMA DR-1335** (May 3 – August 12, 2000) – Dutchess County experienced approximately $6.1 M in property damages. ○ **FEMA DR-1692** (April 14-18, 2007) – Dutchess County experienced approximately $5.7 M in property damages. • NOAA's NCDC storm events database indicates that Dutchess County was	• NYSDPC • NYSOEM • FEMA • Hazards & Vulnerability Research Institute (SHELDUS) • NOAA-NCDC • NFIP

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Source(s)
			impacted by approximately 45 flood events between 1950 and 2012. Total property damages as a result of these flood events were estimated at $7.314 M. According to SHELDUS, there were 56 flood events between 1960 and 2012, with approximately $58.7M in property damage and over $1M in crop damage. • The 2011 NYS HMP indicated that Dutchess County has been ranked as the 17th most flood vulnerable county in New York State based on potential flood exposure and vulnerability to loss. Approximately 14.3% of East Fishkill is located within a 100-year floodplain and 15% is located within a 500-year floodplain. • NFIP identifies that the Town of East Fishkill has made 97 flood claims as of December 2011, receiving over $1.6M in total loss payments. • Ice Jams are mentioned separately in this Table but are grouped with the Flood hazard in this plan (see below).	
Hailstorm	Yes	Yes	Please see Severe Storm	
Hurricane (and other Tropical Cyclones)	Yes	Yes	Please see Severe Storm	
Ice Jams (categorized as a Flood hazard in this HMP)	No	No	• The NYS HMP does identify ice jam flooding as a hazard of concern for New York State (grouped as a type of flood). New York State ranks 2nd in the Nation for total number of ice jam events, with approximately 1,596 incidents documented between February 1, 1867 and May 24, 2010. The NYS HMP indicates that five ice jams have occurred in Dutchess County between 1987 and 2007. • The USACE CRREL Ice Jam Database and the NYS HMP, indicates that two reported ice jam events have occurred within Dutchess County between 1900 and 2012. • The planning committee identified no incidences of ice jam within the Town.	• NYSDPC • Review of USACE CRREL Ice Jam Database
Ice Storm	Yes	Yes	Please see Severe Winter Storm	
Infestation	Yes	No	• The NYS HMP does not identify infestation as a hazard of concern for New York State. • Based on all sources reviewed, no known significant occurrences are reported for the Town of East Fishkill. However, the following have been reported in the Town:	• NYSDPC • NYSDEC • USGS

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Source(s)
			○ Hemlock Wooly Adelgid ○ Emerald Ash Borer – tree infestation ○ West Nile Virus – three human cases in Dutchess County in 2012	
Land Subsidence	No	No	• The NYS HMP indicates that New York State is vulnerable to land subsidence; however, this hazard is "extremely localized" and poses a "very low risk to population and property." The NYS HMP does not identify the Town of East Fishkill as a community that has experienced land subsidence in the past. • According to USGS, Dutchess County is not made up of unconsolidated aquifer systems, creating the unlikelihood of permanent subsidence and related ground failures.	• NYSDPC • USGS Fact Sheet 165-00 (Dec. 2000)
Landslide	Yes	No	• The NYS HMP does identify landslide as a hazard of concern for New York State, with most of Dutchess County located in a low landslide incidence area. The western border of the County has a high landslide incidence. The Town of East Fishkill includes areas indicated as having a high landslide incidence. • The NYS HMP indicates that the Town of East Fishkill has had one landslide occurrences from 1837 to 2007. On April 16, 1982, a landslide occurred on Stormville Mountain. A rockslide blocked a 200-foot section of I-84 for at least three days. • The NYS HMP listed Dutchess County as the 23rd County in the State most threatened by and vulnerable to landslides and landslide losses. • USGS indicates through the National Atlas Map Maker program that the Town of East Fishkill has areas indicated as having a high landslide incidence. • The planning committee believes that landslides pose a limited risk to the Town as those areas identified as having a high landslide incidence tend to be in areas of limited development or development potential.	• NYSDPC • National Atlas.gov (USGS)
Nor'Easters (and other extra tropical storms)	Yes	Yes	Please see Severe Winter Storm	
Severe Storm (Windstorms, Thunderstorms, Hail, Lightning, Tornadoes and Hurricanes)	Yes	Yes	• The NYS HMP does identify all types of severe storms as hazards of concern for New York State. Dutchess County is identified as a highest risk area for tornadoes and has experienced eight tornado events. NYS HMP listed Dutchess County as the 4th County in the State most threatened by and vulnerable to extreme wind and wind losses. • The NYS HMP, NYSOEM, FEMA indicate that Dutchess County has been	• NYSDPC • FEMA • Hazards & Vulnerability Research Institute

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Step 3 Source(s)
			issued five FEMA Disaster Declarations for severe storm events (also identified as flooding events). Losses and details regarding each of these events are identified in 'Flood' above. ○ **FEMA DR-1095** (January 1996) ○ **FEMA DR-1296** (September 1999) ○ **FEMA DR-1335** (May-August 2000) ○ **FEMA DR-1692** (April 2007) ○ **FEMA DR-4020** (August-September 2011) – Tropical Storm Irene ○ **FEMA DR-4031** (September 2011) – Tropical Storm Lee • NOAA's NCDC storm events database indicates that Dutchess County was impacted by approximately 547 severe storm events between 1950 and 2012. The SHELDUS database indicated 352 severe storm events impacted Dutchess County between 1960 and 2011.	(SHELDUS) • NOAA-NCDC
Severe Winter Storm (Heavy Snow, Blizzards, Freezing Rain/Sleet, Ice Storms, Nor'Easters)	Yes	Yes	• The NYS HMP does identify all types of severe winter storms as hazards of concern for New York State. The NYSDPC and NYSOEM listed Dutchess County as the 10th county in the State most threatened by and vulnerable to snow and snow loss, with an annual average snowfall 42.3 inches. Dutchess County is also listed as the 34th county in New York State most threatened by and vulnerable to ice storms and ice storm loss. • Dutchess County was declared a disaster areas for four FEMA Disaster Declarations (DR) or Emergencies (EM) for severe storm events, including: ○ **FEMA EM-3184** (February 2003) - Snowstorm ○ **FEMA DR-1692** (April 2007) – Nor'Easter ○ **FEMA EM-3299** (December 2008) – Severe Winter Storm ○ **FEMA DR-1957** (December 2010) – Winter Storm/Nor'Easter • NOAA's NCDC storm events database indicates that Dutchess County was impacted by approximately 98 winter storm events between 1950 and 2012. However, most events are of a regional extent rather then localized to just one county. SHELDUS indicated Dutchess County was impacted by 177 winter storm events between 1960 and 2011.	• NYSDPC • NYSOEM • FEMA • NOAA-NCDC Hazards & Vulnerability Research Institute (SHELDUS)
Tornado	Yes	Yes	Please see Severe Storm	
Tsunami	No	No	• Tsunami is not identified as a hazard of concern in the NYS HMP.	• NYSDPC
Volcano	No	No	• Volcanoes are not identified as a hazard of concern in the NYS HMP, because there are no known volcanoes located in the state.	• NYSDPC

Hazard	Step 1 Is this a hazard that may occur in the Town of East Fishkill?	Step 2 If yes, does this hazard pose a significant threat to the Town of East Fishkill?	Step 3 Why was this determination made?	Source(s)
Wildfire	Yes	No	• The NYS HMP does identify wildfire as a hazard of concern for New York State. • The NYS HMP identified between six and 10 reported incidences of wildfires within the Town of East Fishkill. • Dutchess County is located within the Hudson Valley Fire Danger Rating Area. This is based on vegetation, fire climate and topography. • GeoMac indicates that all of the Town of East Fishkill is located within the Wildland-Urban Interface. There were no wildfire occurrences between 2002 and 2011 in the Town. • USGS indicates that no wildfires greater than 250 acres were experienced in Westchester County and the Town of East Fishkill between 1980 and 2001. • The planning committee believes that wildfires pose limited risk to the Town.	• NYSDPC • NYSDEC • GeoMAC • USGS
Windstorm	Yes	Yes	Please see Severe Storm	

Note (1): A significant earthquake defined by NGDC is an earthquake that presented at least one of the following criteria: moderate damage (approximately $1 million or more); 10 or more deaths; magnitude 7.5 or greater; MMI X or higher; or an earthquake caused by a tsunami.

AAA	American Avalanche Association	NPDP	National Performance of Dams Program
CRREL	Cold Regions Research and Engineering Laboratory	NWPD	National Wildfire Programs Database
DR	Presidential Disaster Declaration Number	NYCEM	New York Town Area Consortium For Earthquake Loss Mitigation
EM	Presidential Emergency Declaration	NYS	New York State
FEMA	Federal Emergency Management Agency	NYSDEC	New York State Department of Environmental Conservation
GeoMAC	Geospatial Multi-Agency Coordination	NYSDPC	New York State Disaster Preparedness Commission
HMP	Hazard Mitigation Plan	NYSOEM	New York State Emergency Management Office
K	Thousand ($)	SHELDUS	Spatial Hazard Events and Losses Database for the U.S.
M	Million ($)	TSTM	Thunderstorm
MMI	Modified Mercalli Scale	U.S.	United States
NAC	National Avalanche Center	USACE	U.S. Army Corp of Engineers
NCDC	National Climatic Data Center	USGS	U.S. Geologic Survey
NFIP	National Flood Insurance Program		
NOAA	National Oceanic and Atmospheric Administration		

According to input from the planning committee, and review of all available resources, a total of five natural and one man-made/technological hazard of concern were identified as significant hazards affecting the Town, to be addressed within this plan:

- Dam Failure
- Earthquake
- Extreme Temperatures
- Flood
- Severe Storm
- Severe Winter Storm

Other natural hazards of concern have occurred within the Town, but typically have a low potential to result in significant impacts within the Town. The Town deemed these hazards as minor in comparison to those bulleted above; therefore, these hazards will not be further addressed within this version of the Plan. However, if deemed necessary by the Town, these hazards may be considered in future versions of the Plan.

In addition to the above natural hazards of concern, the Planning Committee has elected to also consider the non-natural hazards of Dam Failure and Utility Interruption in this planning process. Dam Failure shall be addressed as a specific non-natural hazard, while utility interruptions shall be considered as a vulnerability/loss resulting from the Severe Storm and Severe Winter Storm hazards.

5.3 HAZARD RANKING

After the hazards of concern were identified for the Town of East Fishkill, the hazards were ranked to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. This section describes factors that influence the ranking including the probability of occurrence and impact; it also presents the ranking process and outcome.

HAZARD RANKING METHODOLOGY

The methodology used to rank the hazards of concern for the Town of East Fishkill is described below. Estimates of risk for the Town were developed using methodologies promoted by FEMA's hazard mitigation planning guidance and generated by FEMA's HAZUS-MH risk assessment tool.

Probability of Occurrence

The probability of occurrence is an estimate of how often a hazard event occurs that has causes measurable impact to your community. "Measurable impact" means that the event required response and incurred expenses and/or losses beyond usual levels. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions in Table 5.3-1. These definitions are consistent with the New York State Plan's ranking methodology; however the rating of zero (0), an event is not likely to occur, is not used because these hazards were screened out during the hazard identification process.

Table 5.3-1. Probability of Occurrence Ranking Factors

Rating	Probability	Definition
0	None	Hazard event is not likely to occur.
1	Rare	Hazard event is not likely to occur within 100 years
2	Occasional	Hazard event is likely to occur within 100 years.
3	Frequent	Hazard event is likely to occur within 25 years.

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 a subjective assessment by the Planning Committee, 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: three (3) for population, two (2) for property, and one (1) for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard.

Table 5.3-2 presents the numerical rating, weighted factor and description for each impact category. The impact rating definitions for population and property are also consistent with the New York State Hazard Mitigation Plan (NYS HMP) ranking methodology with minor modifications. Impact to the economy is also being evaluated.

Table 5.3-2. Numerical Values and Definitions for Impacts on Population, Property and Economy

Category	Weighting Factor	Low Impact (1)	Medium Impact (2)	High Impact (3)
Population*	3	14% or less of your developed land area is exposed to a hazard due to its extent and location	15% to 29% of your developed land area is exposed to a hazard due to its extent and location	30% or more of your developed land area is exposed to a hazard due to its extent and location
Property*	2	Property exposure is 14% or less of the total replacement cost for your community	Property exposure is 15% to 29% of the total replacement for your community	Property exposure is 30% or more of the total replacement cost for your community
Economy	1	Loss estimate is 9% or less of the total replacement cost for your community	Loss estimate is 10% to 19% of the total replacement cost for your community	Loss estimate is 20% or more of the total replacement cost for your community

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.

Risk Ranking Value

The risk ranking for each hazard is then calculated by multiplying the numerical value for probability of occurrence by the sum of the numerical values for impact. The equation is as follows: Probability of Occurrence Value (1, 2, or 3) × Impact Value (6 to 18) = Hazard Ranking Value. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low).

HAZARD RANKING RESULTS

Using the process described above, the risk ranking for the identified hazards of concern was determined for the Town of East Fishkill. Based on the combined risk values for probability of occurrence and impact to the Town, a priority ranking of "high", "medium" or "low" risk was assigned. The hazard ranking for the Town of East Fishkill, from high to low risk, is summarized below:

High Risk: Flood, Severe Storm, Severe Winter Storm
Medium Risk: Dam Failure, Extreme Temperatures
Low Risk: Earthquake

The following tables present the step-wise process for the ranking. Table 5.3-3 shows the probability ranking assigned for likelihood of occurrence for each hazard that has causes measurable impact.

Table 5.3-3. Probability of Occurrence Ranking for Hazards of Concern for the Town of East Fishkill

Hazard of Concern	Probability	Numeric Value
Dam Failure	Occasional	2
Earthquake	Occasional	2
Extreme Temperature	Frequent	3
Flood	Frequent	3
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3

Table 5.3-4 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy. The weighting factor results and a total impact for each hazard also are summarized.

Table 5.3-4. Impact Ranking for Hazards of Concern for the Town of East Fishkill

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Numeric Value Multiplied by Weighting Factor (3)	Impact	Numeric Value	Numeric Value Multiplied by Weighting Factor (2)	Impact	Numeric Value	Numeric Value Multiplied by Weighting Factor (1)	
Dam Failure	Medium*	2	6	Medium*	2	4	Low	1	1	11
Earthquake	Low	1	3	High	3	6	Low	1	1	10
Extreme Temperature	High	3	9	Low	1	2	Low	1	1	12
Flood	High	3	9	Medium	2	4	Medium	2	2	15
Severe Storm	High	3	9	High	3	6	Medium	2	2	17
Severe Winter Storm	High	3	9	High	3	6	Low	1	1	16

* For the Dam Failure hazard, the impact ranking for population and property was adjusted based on direct input from the Planning Committee and specific concerns in the community.

Table 5.3-5 presents the total ranking value for each hazard.

Table 5.3-5. Total Risk Ranking Value for Hazards of Concern for the Town of East Fishkill

Hazard of Concern	Probability	Impact	Total = (Probability x Impact)
Dam Failure	2	11	22
Earthquake	2	10	20
Extreme Temperature	3	12	36
Flood	3	15	45
Severe Storm	3	17	51
Severe Winter Storm	3	16	48

Table 5.3-6 presents the hazard ranking category assigned for each hazard of concern. The ranking categories are determined by an evaluation of the total risk ranking score into three categories, low, medium, and high whereby a total score of 20 or less is categorized as low, 21 to 40 is medium, and 41 and over is considered a high risk category.

Table 5.3-6. Hazard Ranking Results for Hazards of Concern for the Town of East Fishkill

Hazard Ranking	Hazard of Concern	Category
2	Dam Failure	Medium
3	Earthquake	Low
2	Extreme Temperature	Medium
1	Flood	High
1	Severe Storm	high
1	Severe Winter Storm	High

5.4.1 DAM FAILURE

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

HAZARD PROFILE

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

Description

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, 2010). 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 affect a dam's primary function of impounding water (FEMA, 2010). 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);
- 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, 2011).

Extent

According to the New York State Department of Environmental Conservation (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 NYCRR Part 673.3. 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 more than 6 lives would be in jeopardy and excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure (NYSDEC, Date Unknown).

Two factors which influence the potential severity of a full or partial dam failure include (1) the amount of water impounded; and (2) the density, type, and value of development and infrastructure located downstream (City of Sacramento Development Service Department, 2005).

Location

According to the National Inventory of Dams (NID), input from the Planning Committee, and data received from the New York State Department of Environmental Conservation, there are approximately seventeen (17) dams in the Town of East Fishkill. A dam is included in the NID if: 1) it is a "high" or "significant" hazard potential class dam or, 2) it is a "low" hazard potential class dam that exceeds 25 feet in height and 15 acre-feet storage or, 3) it is a "low" hazard potential class dam that exceeds 50 acre-feet storage and 6 feet height. Of the 17 dams identified/inventoried, there are four (4) classified as significant and the remaining classified as low. Table 5.4.1-1 defines the hazard potential classification, as accepted by the NID Interagency Committee on Dam Safety.

Table 5.4.1-2 lists the dams identified in the Town of East Fishkill during this planning process. Further it is noted that the Sharp Reservation Dam, a 90' high earthen dam located in the Town of Fishkill, would result in flooding impacts in the Wiccopee section of East Fishkill were it to fail.

Table 5.4.1-1. Dam Hazard Potential Classifications

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Source: NID, 2007

Table 5.4.1-2. Dams in the Town of East Fishkill

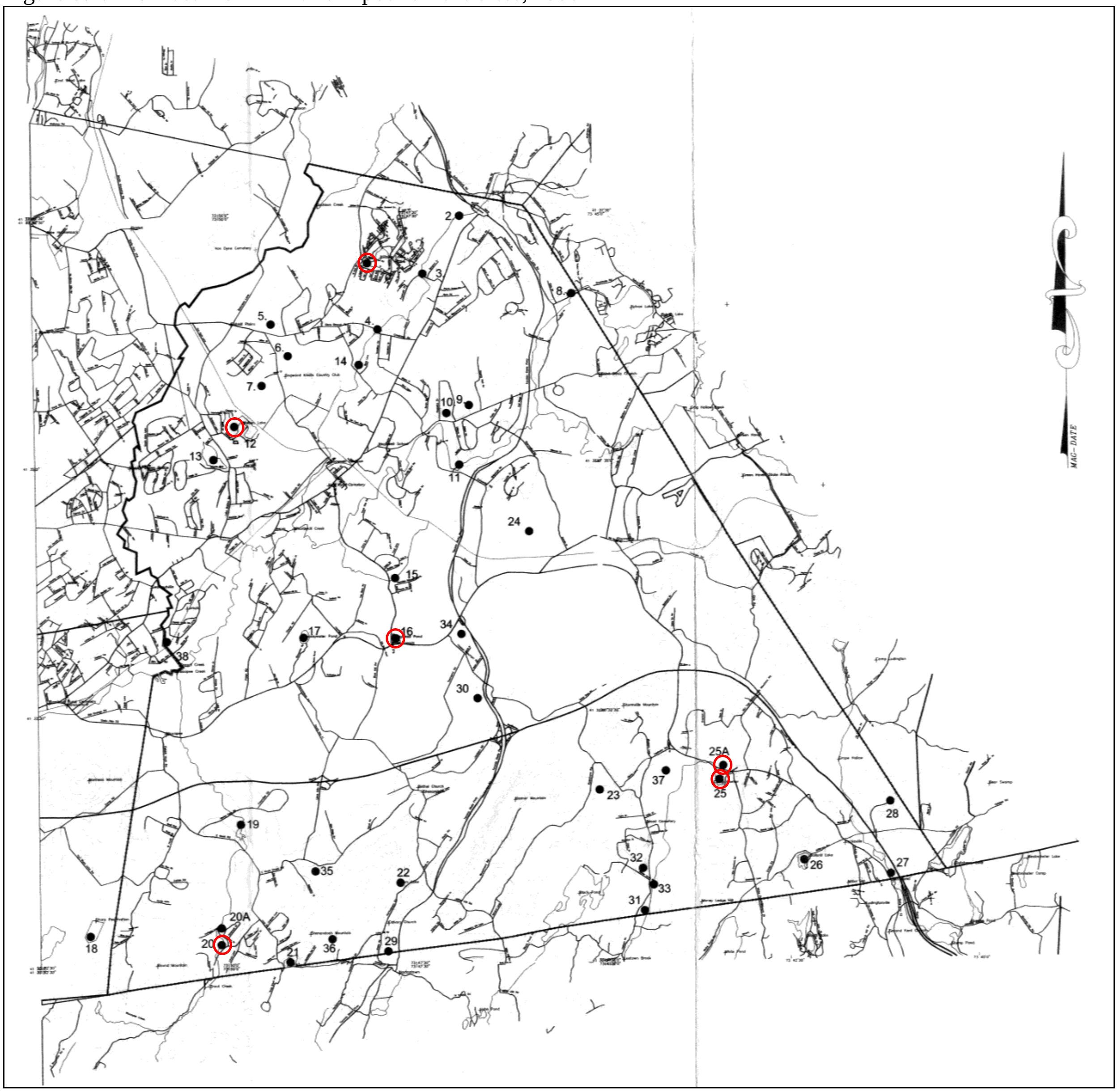
Name	National / State ID #	Hazard Code	Water Course	Year Built	Dam Type	Crest Length (ft)	Height (ft)	Storage Capacity (acre-ft)	Drainage Capacity (acre-ft)
Groveville (Lower Saranac Corporation)	NY00072	TBD	Fishkill Creek	TBD	TBD	TBD	TBD	TBD	TBD
Lake Sekunna (Long Hill Road)	NY15080 / 212-5374	B	N/A	1935	RE	0	10	0	0
Ballard	NY00663 / 230-0905	B	TR – Stump Pond Stream	1931	MS	225	15	60	0.25
Camp Alamar Lower Lake	NY01259 / 230-4476	B	Leetown Brook	1950	RE	225	25	80	0.4
Hillside Lake	NY01169 / 212-1025	B	TR – Sprout Creek	1934	RE	300	9	75	0.3
Lake Walton	NY01204 / 212-4502	B	TR – Fishkill Creek	1895	RE	150	10	180	0
Greenburg Henderson	NY13521 / 212-4805	B	Fishkill Creek	Unknown	MS	0	10	40	0
Storm Lake	NY13519 / 212-4687	A	TR – Fishkill Creek	Unknown	CN	0	4	30	0
Steven Kelly Pond	NY13512 / 212-3268	A	TR – Fishkill Creek	1964	RE	540	10	7	0.05
Fishkill Farms Pond	NY15063 / 212-5375	A	Wiccopee Creek	Unknown	MS	70	15	0	0
Larkspur	NY16123 / 212-5503	A	Wiccopee Creek	Unknown	RE	0	15	0	0
Camp Alamar Upper Lake	NY00409 / 230-2964	A	Leetown Brook	1961	RE	400	6	67	0.22
Torch Pond	NY13911 / 230-4138	A	TR – Leetown Brook	1974	RE	500	17	19	0.11
Deerwood	NY13515 / 212-4197	A	TR – Wiccopee Creek	1977	CN, RE	20	5	5	0.05
Turner Mill Pond	NY13885 / 230-0582	A	TR – Middle BR Croton River	Unknown	MS	255	5	4	25
Hope's Terrace	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Emmadine Pond	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Source: National Inventory of Dams (NID); East Fishkill GIS, 2012; NYSDEC, 2012; Burns, et al., 2005.

Note: MS = Masonry; RE = Earth
CN = Concrete Gravity; TR = Tributary
BR = Branch; TBD = To Be Determined

A 1999 "Water Impoundment Survey of the Town of East Fishkill," prepared by Morris Associates Engineering Consultants, identified 38 impoundment sites within the Town. While some of these sites match dam locations listed above from the NYSDEC database, others are smaller impoundments owned and/or maintained by private land owners and located on private land. The 38 sites reviewed were identified from interviews with local officials, USGS quadrangle maps, and FIRMs. Field reconnaissance of those sites was performed to assess conditions which may put life and property at risk in the event of an impoundment failure. The survey reported ten (10) of the 38 sites were in poor condition and had potential for damage to life and property (Morris Associates, 1999). Figure 5.4.1-1, below, shows a map of the surveyed sites.

Figure 5.4.1-1. East Fishkill Dam/Impoundment Sites, 1999



Source: Morris Associates, 1999
Note: Sites discussed as potential hazards in the 2005 survey are circled.

The 2005 follow-up to the 1999 survey re-evaluated all 38 sites, and reported that eight (8) of those sites posed potential hazards for damage to life and property. Each of those eight sites was also listed as a potential hazard and in poor condition in the 1999 survey. Two of the sites on the potential hazard list from the 1999 survey had been repaired / reinforced prior to the 2005 survey and were, as such, removed from the list (Morris Associates, 2005). Recommendations from the 2005 report include Town authorization of in-depth investigation at those sites eight (8), which are listed below, as well as interim actions to mitigate the potential hazards of impoundment failure:

- **Hillside Lake** – There are two separate impoundment sections at the site, as the lake has a dividing embankment. The upper impoundment is an earth structure with a concrete spillway draining the main lake. There are three overflows emptying into a former swimming area and an outlet stream. The lower impoundment is an earthfill structure with a concrete core wall that runs along the former swimming area. There is one concrete spillway at the northern end of the wall, as well as a corrugated metal drain pipe below the spillway structure.

  The 1999 report recommends that the upper impoundment be monitored for damage and erosion, and repaired/maintained as necessary. The lower impoundment was in need of repair to insure the structural integrity of the structure. The downstream potential damage appeared to be limited to two homes plus roadway and culvert damage. As of the 2005 report, the lower impoundment continues to deteriorate and is in need of maintenance / repair.
- **Beekman Country Club** – The site consists of two separate ponds. The upstream pond is an earth structure with a concrete spillway, where extensive erosion had occurred at the time of the 1999 report due to seepage through cold joints in the structure. The lower pond was created by a constructed earthen berm and diversion of as adjacent stream into the pond.

  At the upper pond, repair of the cold joints and erosion behind the impoundment was recommended in the 1999 report, and had not been addressed at the time of the 2005 report. A residential area located downstream would be vulnerable to property damage in the event of an impoundment failure. At the lower pond, potential for damage to life and property appeared to be minimal.
- **Lake Walton** – The impoundment consists of two separate earth structures, each with concrete outlet structures. While both structures were reported to contain some small seeps in 1999, no evidence of impending collapse of the structures was evident. Repair to the east structure concrete spillway was recommended. The concrete spillway of the West Structure was not functioning at the time of the 2005 survey report.

  Immediately downstream of the structures there is a large wooded wetland area. However, a number of residential homes are located downstream in the area of Tina Drive. In the event of flooding or failure there is a possibility of damage to life and property in this area.
- **Gayhead Pond** – The structure is constructed of concrete, stone, and mortar, and is neglected site with deteriorating conditions. Recommendations in both the 1999 and 2005 report call for maintenance and repair, or removal of the structure.

  A number of houses were observed to be located in the floodplain downstream of the structure. Under the structure’s collapsed state at the time of reporting, it did not appear to pose a threat to those houses. However, the collapsed structure is a choke point in the stream, with the potential to create an unstable log jam or ice jam in the future. Recommendations were made to monitor the site during times of spring thaw and heavy rainfall to ensure that these potentially damaging conditions do not occur.
- **Larkspur** – This site, also inspected by the NYSDEC, consists of three interconnected ponds created for fish farms by diversion of the Wiccopee Creek. The condition of the berms along Wiccopee Creek was reported to be very poor in the 1999 report, and continued to erode at the

time of the 2005 report. The primary outlet downstream was clogged with debris, and an earth fill berm was eroding around a small concrete spillway which provided the only other outflow/overflow control.

In the event of a failure of the lowest earth berm a number of houses located along the stream could be severely damaged. The 2005 report found continued deterioration, water seepage along the entire length of the berm, and trees leaning towards houses. It recommended that the berms and stone dam be repaired immediately, or the ponds should be drained and kept drained, or the ponds should be removed.

- **Lake Sekunna (Long Hill Road)** – This site has an earthen water impoundment which was overgrown with dense brush and in poor condition at the times of both the 1999 and the 2005 reports. In the event of a failure, there is potential for damage to a number of houses downstream, including the Larkspur site. Repairs to the outlet structure and embankment improvements were recommended.
- **Camp Alamar** – Both impoundments, also inspected by NYSDEC, are constructed of earth fill with concrete outlet structures.
  - South: Erosion near the spillway structure was observed in 1999, and the 2005 report deemed the overall condition of the dam to be poor. In the event of a failure, some floodwater damage to homes downstream of the structure is possible.

    At the time of the 2005 survey, a spillway which directs water to the east side of the outflow was inhibited by a large blockage of rocks. Water had undermined the existing spillway slab and had removed much of the supporting soil for the spillway and dam, increasing the risk of a dam failure. Repair work/maintenance was recommended.
  - North: The site drains into Camp Alamar South. Erosion along the earth fill section was observed in 1999, as well as partial blockages of the overflow structure. Repair and maintenance work were recommended. As of 2005, the overall condition of the dam was poor. The earthen portion of the impoundment is overgrown with trees and underbrush, and the concrete spillway had small fallen trees funneling the outflow to one side. A number of houses located downstream from the structure could sustain damage in the event of a failure. Repair work/maintenance was recommended.
- **Gem Lake** – The impoundment is constructed of stone and mortar with a concrete headwall, and was heavily overgrown with vegetation at the time of the 1999 survey. Leakage through mortar joints was also observed. As of 2005, the overall condition of the structure was poor. Water leaked through this impoundment on the east side, and seepage directly downstream of the structure was observed. Potential damage at houses observed along the steam below the site would be possible in the event of a failure. A thorough inspection of the structure was recommended in both the 199 and 2005 reports.

Range of Magnitude

The impact of dam failures varies by the amount of water being held by the dam. Failures of small dams, such as those created to form a pond or other small water body, may result in a flood of only a few hundred gallons of water and may not impact any structures or other property. Failures of large dams, such as those created to form large water supply reservoirs or recreational lakes, may result in millions of gallons of water destroying hundreds of structures and potentially killing large numbers of people.

The environmental effects of dam failure can also be significant. Reservoirs held behind dams affect many ecological aspects of a river, and water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks. The environment would be exposed to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways, resulting in potential destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species-listed aquatic species.

Previous Occurrences and Losses

According to the National Performance of Dams Program (NPDP) Dams Directory (Database), none of the dams identified by NYSDEC within East Fishkill have experienced failure events (NPDP, Date Unknown). Local research performed for the 1999 and 2005 water impoundment surveys provided probable failure locations of small-scale and/or private impoundment failures, but did not report any known previous failure events.

Probability of Future Events

The likelihood of a dam failure in East Fishkill is extremely difficult to predict. However, the risk of such an event increases for each dam as the dam's age increases and/or frequency of maintenance decreases. Given the variety and multitude of impoundment structures throughout East Fishkill, it is likely that the Town will be at risk from the dam failure hazard in the future. However, provided that the recommended repairs, regular maintenance, and routine inspections of the dams in in East Fishkill are performed in the future, dam failures are considered unlikely.

In Section 5.3, the relative risks of the identified hazards of concern for the Town of East Fishkill were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard risk rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for dam failure in the Town is considered 'occasional' (likely to occur within 100 years, as presented in Table 5.3-3).

The Role of Global Climate Change on Future Probability

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. 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).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. East Fishkill is part of Region 2, Catskill Mountains, and the West Hudson River Valley. Some of the issues in this region, affected by climate change, include: the watershed for New York City's water supply, spruce/fir forests disappear from mountains, decline in popular apple varieties, winter recreation declines/summer opportunities increase, Hemlock woolly adelgid destroys trees, and native brook trout decline and replaced by bass (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3ºF by the 2020s, 3 to 5.5ºF by the 2050s and 4 to 9ºF by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.1-3 displays the projected seasonal precipitation change for the Catskill Mountains and West Hudson River Valley ClimAID Region (NYSERDA, 2011).

Table 5.4.1-3. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA, 2011

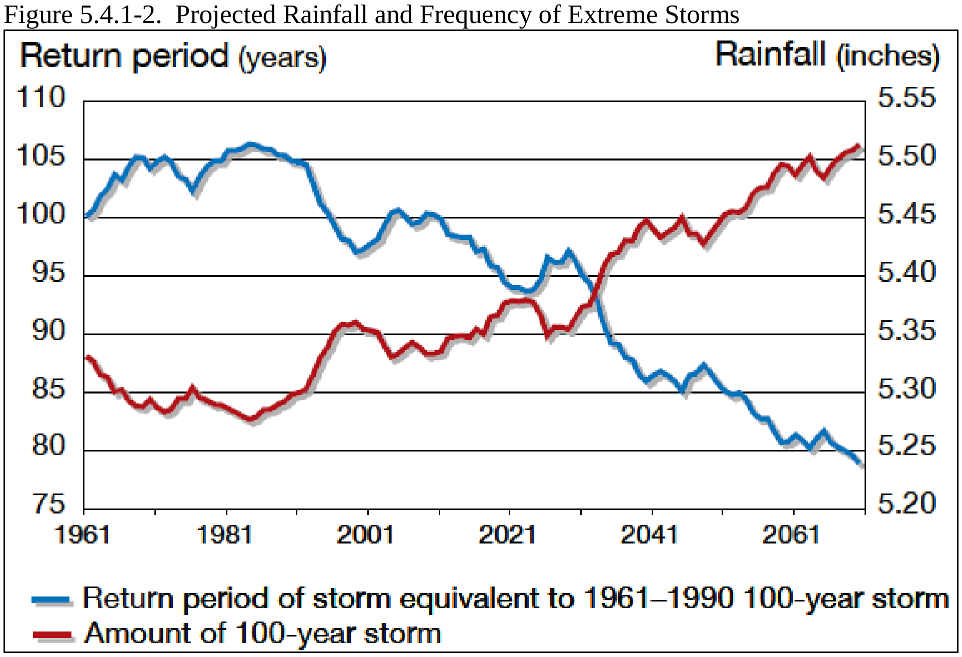
The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA, 2011). It may be assumed that the risk of dam failure will increase with an increase in heavy rainfall and flood events.

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).

Over the past 50 years, heavy downpours have increased and this trend is projected to continue. This can cause an increase in localized flash flooding in urban areas and hilly regions. Flooding has the potential to increase pollutants in the water supply and inundate wastewater treatment plants and other vulnerable facilities located within floodplains. Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA, 2011).

Figure 5.4.1-2 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).

Figure 5.4.1-2. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA, 2011

Total precipitation amounts have slightly increased in the Northeast U.S., by approximately 3.3 inches over the last 100 years. There has also been an increase in the number of two-inch rainfall events over a 48-hour period since the 1950s (a 67-percent increase). The number and intensity of extreme precipitation events are increasing in New York State as well. More rain heightens the danger of localized flash flooding, streambank erosion and storm damage (DeGaetano et al [Cornell University], 2011) (http://files.campus.edublogs.org/blogs.cornell.edu/dist/8/90/files/2011/03/ny_changing_climate.pdf).

VULNERABILITY ASSESSMENT

The dam failure hazard is of significance to the Town of East Fishkill due to the presence of a number of dams of known or questionable repair. As discussed earlier in this profile, the 2005 follow-up to the1999 survey and report re-evaluated all impoundment sites within the Town, and reported that eight (8) of those sites posed potential hazards for damage to life and property. Each of those eight sites was also listed as a potential hazard and in poor condition in the 1999 survey. Two of the sites on the potential hazard list from the 1999 survey had been repaired / reinforced prior to the 2005 survey and were, as such, removed from the list (Morris Associates, 2005). Specific vulnerabilities to potential dam failures at impoundments in the Town, as identified in the 1999/2005 report, may be found earlier in this section.

The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources.

All populations in a dam failure inundation zone are considered exposed and vulnerable. Of the populations exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. 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 also highly vulnerable because they are more likely to seek or need medical attention which may not be available due to isolation during a flood event and they may have more difficulty evacuating.

There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard.

All buildings and infrastructure located in the dam failure inundation zone are considered exposed and vulnerable. Property located closest to the dam inundation area has the greatest potential to experience the largest, most destructive surge of water. All transportation infrastructure in the dam failure inundation zone is vulnerable to damage and potentially cutting off evacuation routes, limiting emergency access, and creating isolation issues. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

5.4.2 EARTHQUAKE

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

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 (Federal Emergency Management Agency [FEMA], 2011; Shedlock and Pakiser, 1997). 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 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 (FEMA, 2011).

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

- <u>Surface faulting</u>: 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.
- <u>Ground motion (shaking)</u>: 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.
- <u>Landslide</u>: A movement of surface material down a slope.
- <u>Liquefaction</u>: 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.
- <u>Tectonic Deformation</u>: A change in the original shape of a material due to stress and strain.
- <u>Tsunami</u>: 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, 2009).

Extent

Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a measured value of the earthquake size, or amplitude of the seismic waves, using a seismograph. The Richter magnitude scale (Richter Scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes (USGS, 1989). The Richter Scale is the most widely-known scale that measures the magnitude of earthquakes (Shedlock and Pakiser, 1997; USGS, 2009). It has no upper limit and is not used to express damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude and shock in a remote area that did not cause any damage (USGS, 1989). Table 5.4.2-1 presents the Richter Scale magnitudes and corresponding earthquake effects.

Table 5.4.2-1. Richter Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: USGS, 2010

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and varies with location. Intensity is expressed by the Modified Mercalli Scale; a subjective measure that describes how strong a shock was felt at a particular location (Shedlock and Pakiser, 1997; USGS, 2009). The Modified Mercalli Scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII. Table 5.4.2-2 summarizes earthquake intensity as expressed by the Modified Mercalli Scale. Table 5.4.2-3 displays the Modified Mercalli Scale and peak ground acceleration equivalent.

Table 5.4.2-2. Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people; barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, some people awakened. Small objects moves, trees and poles may shake.
VI	Felt by everyone; people have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.

Mercalli Intensity	Description
VIII	Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source(s): Michigan Tech University, 2007; Nevada Seismological Laboratory, 1996

Table 5.4.2-3. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .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

Source: NYS HMP, 2011

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). USGS defines PGA and SA as the following: 'PGA is what is experienced by a particle on the ground. Spectral Acceleration (SA) is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building' (USGS, Date Unknown). Both PGA and SA can be measured in *g* (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). PGA and SA hazard maps provide insight into location specific vulnerabilities (NYS HMP, 2011).

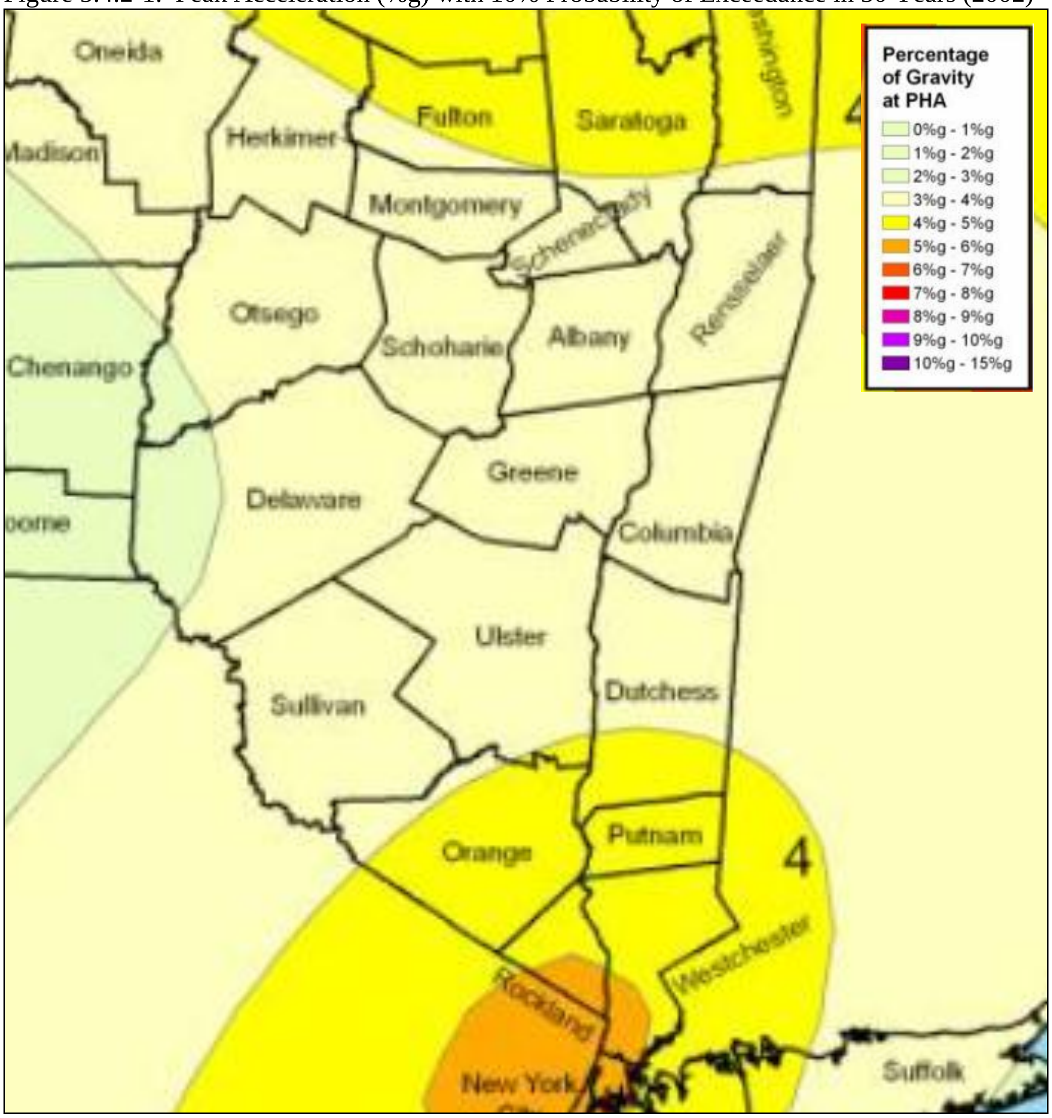
PGA is a common earthquake measurement that shows three things: the geographic area affected, the probability of an earthquake of each given level of severity, and the strength of ground movement (severity) expressed in terms of percent of acceleration force of gravity (%g). In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area (NYS HMP, 2011).

National maps of earthquake shaking hazards have been produced since 1948. They provide information essential to creating and updating the seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning used in the U.S. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damages and disruption. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown et al., 1996).

The USGS recently updated the National Seismic Hazard Maps in 2008. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps, which supersede the 1996 and 2002 versions. The 2008 map represents the best available data as determined by the USGS (USGS, 2009).

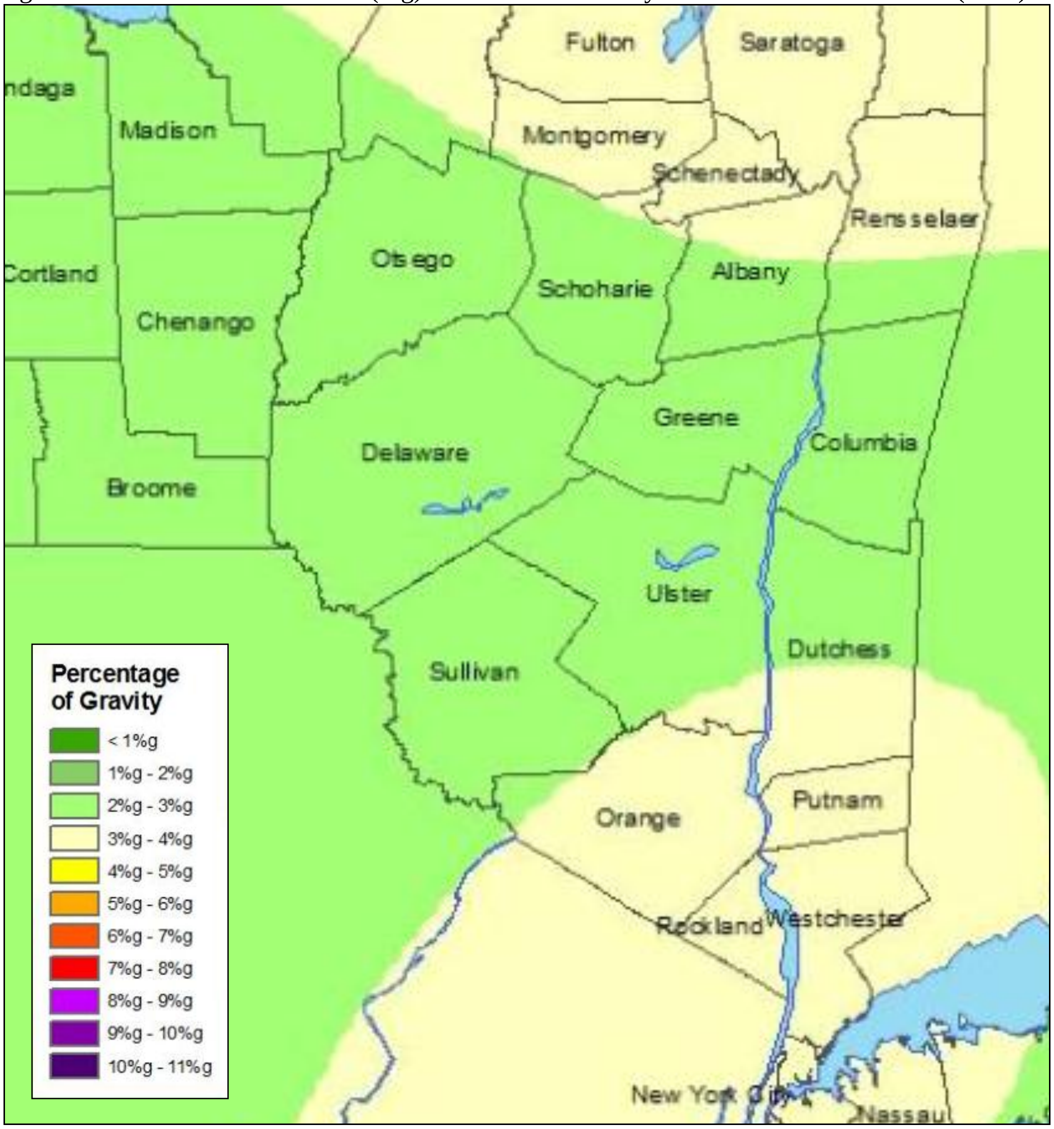
The 2002 Seismic Hazard Map shows that the East Fishkill area of southern Dutchess County County has a PGA between 4 and 5% (Figure 5.4.2-1). The 2008 Seismic Hazard Map shows that this same area of Dutchess County has a PGA between 3 and 4% (Figure 5.4.2-2). These maps are based on peak ground acceleration (%g) with 10% probability of exceedance in 50 years. The difference in PGA from the 2002 to the 2008 Seismic Hazard Map is most likely due to the incorporation of new data collected and reviewed by the USGS.

Figure 5.4.2-1. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years (2002)



Source: NYS HMP, 2011

Figure 5.4.2-2. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years (2008)



Source: NYS HMP, 2011

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 (Figure 5.4.2-3). The NEHRP developed five soil classifications 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. Table 5.4.2-4 summarizes the NEHRP soil classifications shown on Figures 5.4.2-3 and 5.4.2-4.

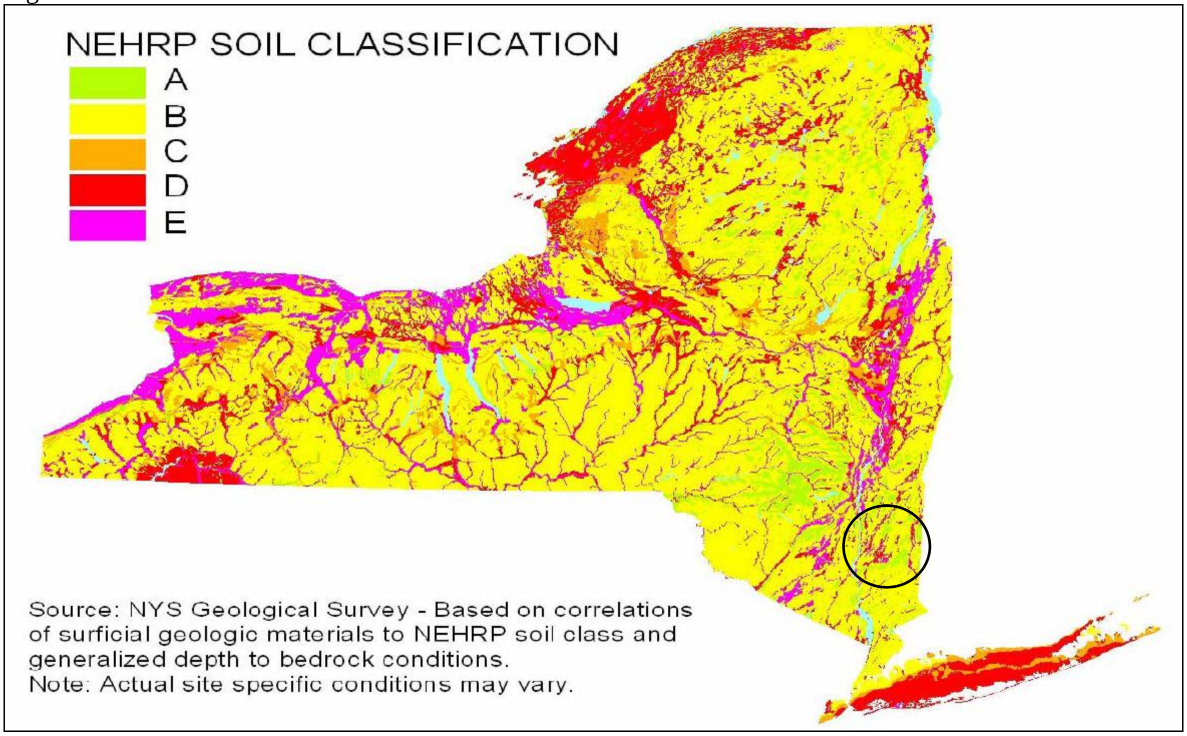
Table 5.4.2-4. NEHRP Soil Classifications

Soil Classification	Description	Map Color
A	Very hard rock (e.g., granite, gneisses)	Green
B	Sedimentary rock or firm ground	Yellow

Soil Classification	Description	Map Color
C	Stiff clay	Orange
D	Soft to medium clays or sands	Red
E	Soft soil including fill, loose sand, waterfront, lake bed clays	Pink

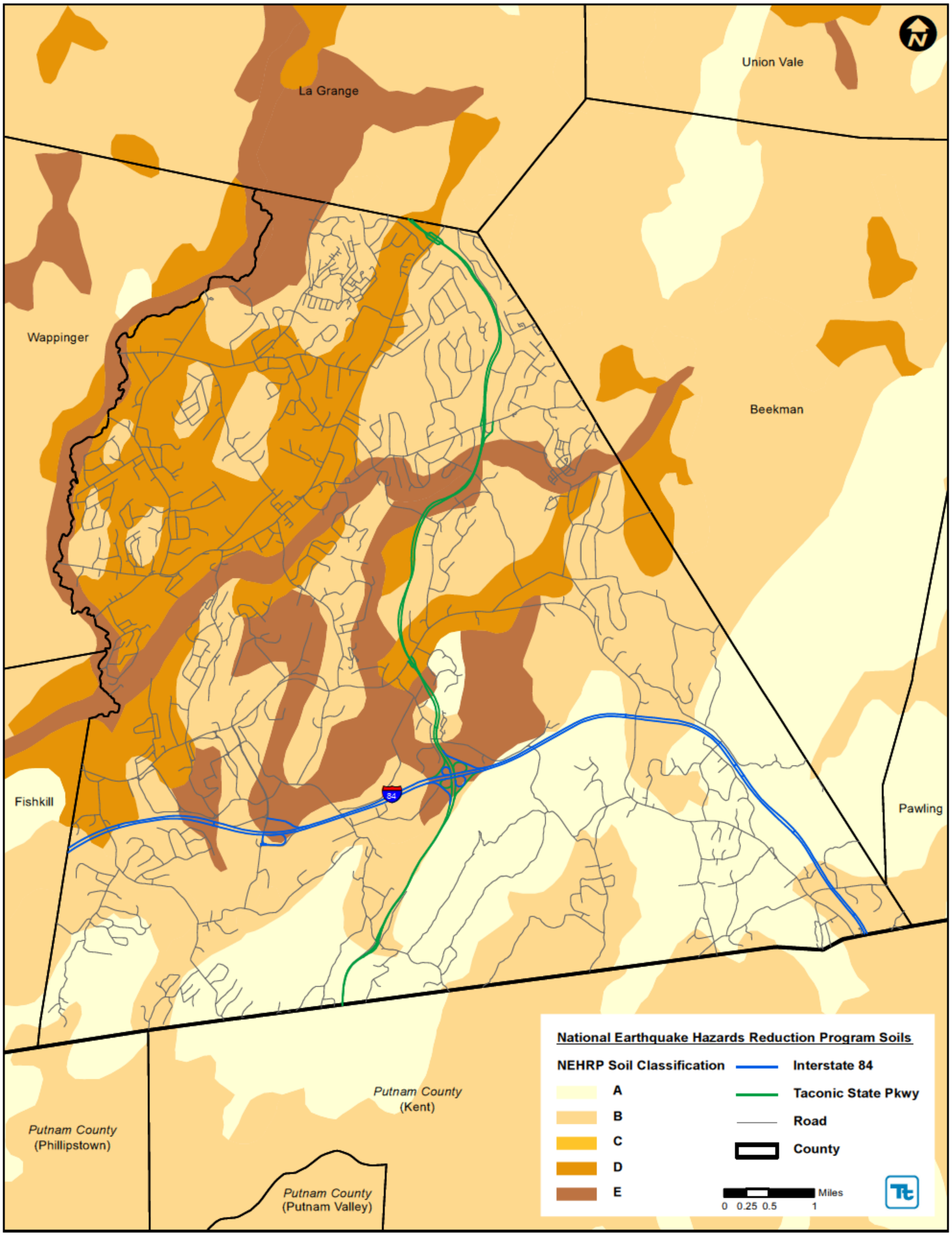
Source: NYS HMP, 2011

Figure 5.4.2-3. NEHRP Soils in New York



Source: NYS HMP, 2011
Note: Circle indicates approximate location of Dutchess County.

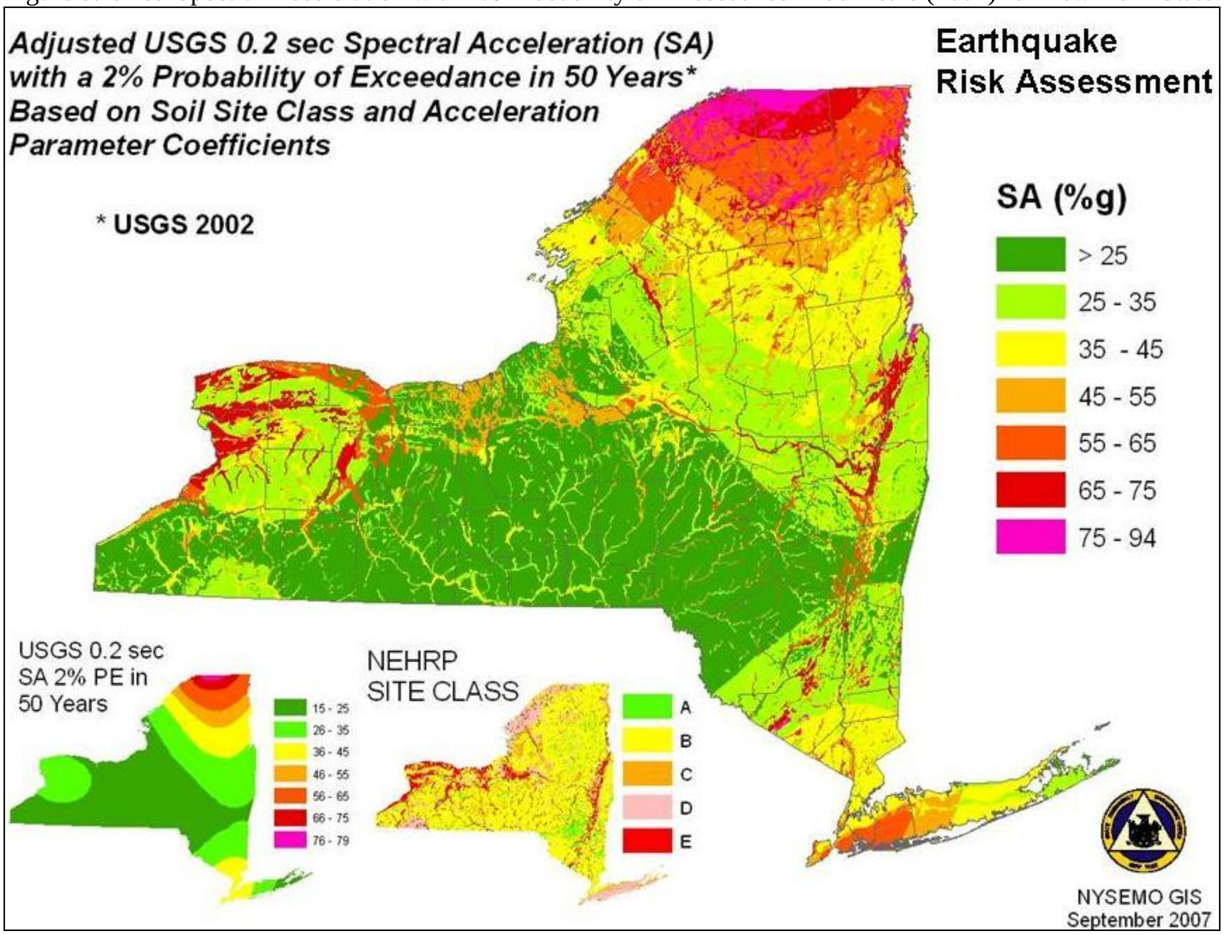
Figure 5.4.2-4. NEHRP Soils in the Town of East Fishkill



Source: NYSOEM

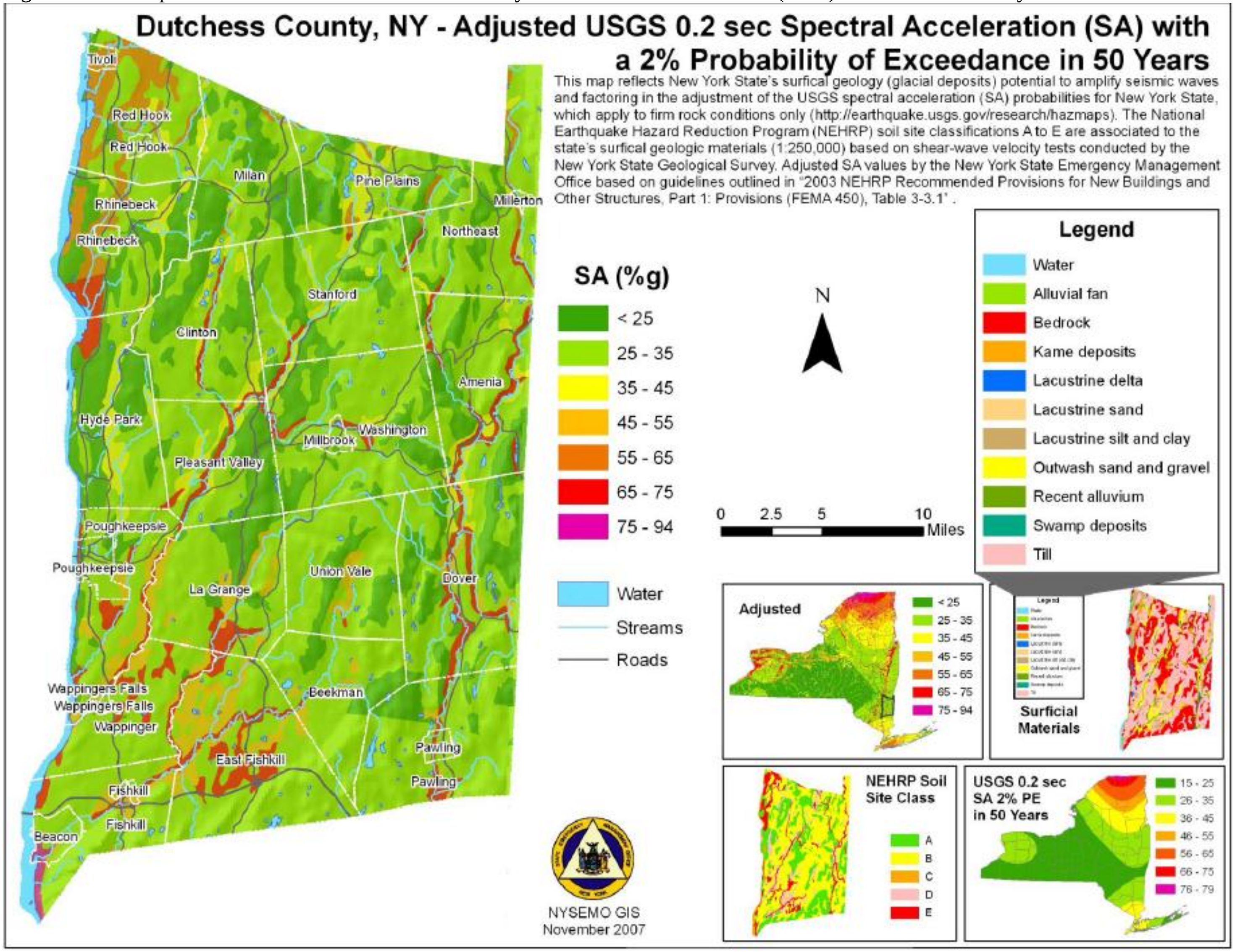
The NEHRP soil classification for the State has enabled the affect of soils to be factored with the 2002 USGS seismic hazard maps. Figure 5.4.2-5 now illustrates the State's earthquake SA hazard with local soil types factored in. This updated hazard map illustrates a similar hazard for Dutchess County to what is shown on the USGS national map (NYS HMP, 2011). One key note is that this map creates a better understanding of risk to jurisditcitons such as the Town of East Fishkill than that of the 10% Peak Accelleration map. For instance jurisdictions that may fall under 3% PGA on the previous map may actually have some areas of high vulnerability within their borders.

Figure 5.4.2-5. Spectral Acceleration with 2% Probability of Exceedance in 50 Years (2002) for New York State



Source: NYS HMP, 2011

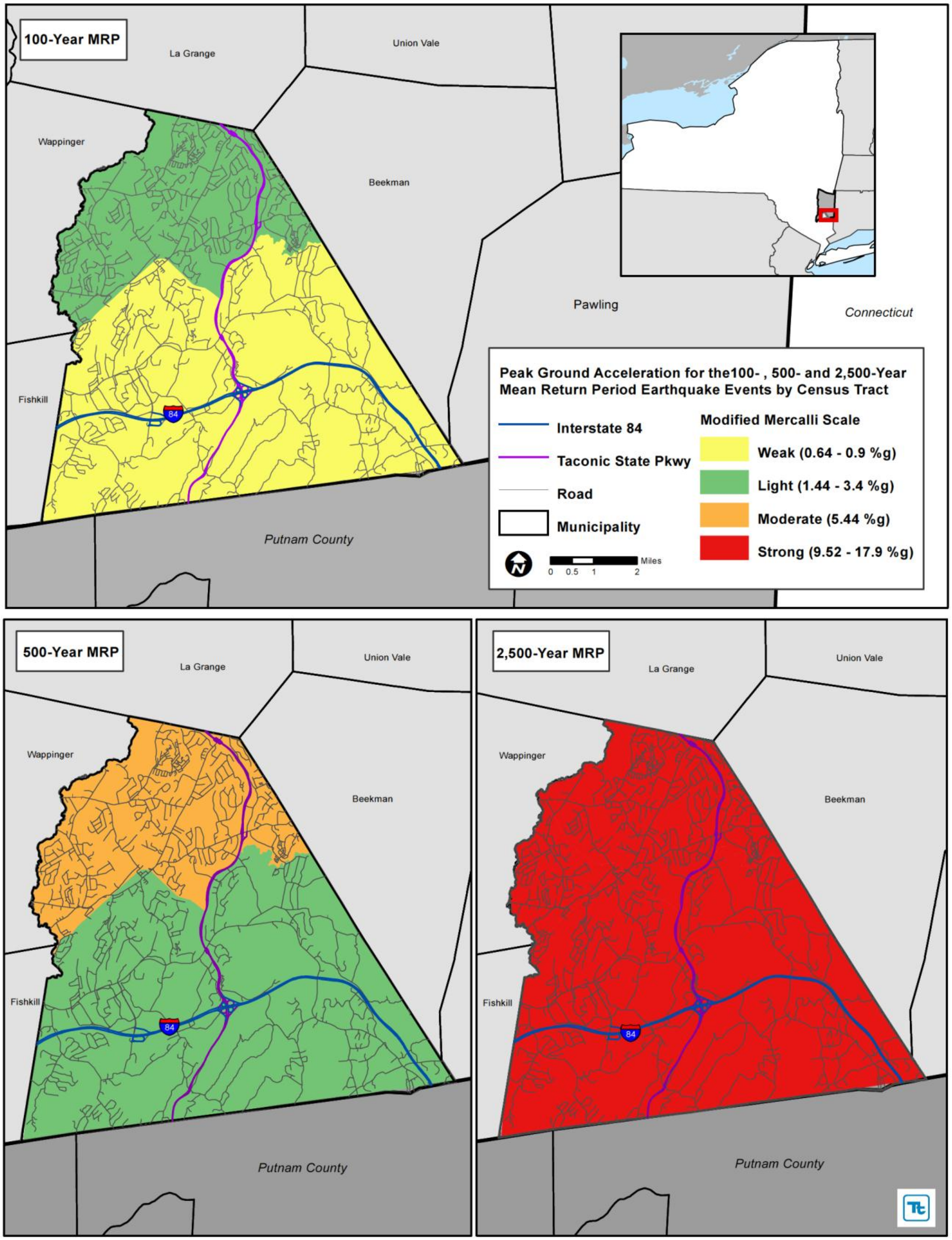
Figure 5.4.2-6. Spectral Acceleration with 2% Probability of Exceedance in 50 Years (2002) for Dutchess County



Source: NYS HMP, 2011

A probabilistic assessment was conducted for the 100-, 500- and 2,500-year mean return periods (MRP) through a Level 2 analysis in HAZUS-MH 2.1 to analyze the earthquake hazard for the Town of East Fishkill. The HAZUS-MH 2.1 analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 100-year MRP event is an earthquake with a 1% chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 500-year MRP, there is a 0.2% chance the mapped PGA will be exceeded in any given year. For a 2,500-year MRP, there is a 0.04% chance the mapped PGA will be exceeded in any given year. Figure 5.4.2-7 illustrates the geographic distribution of PGA (*g*) across the Town of East Fishkill for 100-, 500- and 2,500-year MRP events at the Census-Tract level.

Figure 5.4.2-7. Peak Ground Acceleration in the Town of East Fishkill for 100-, 500- and 2,500-Year MRP Earthquake Events by Census Tract



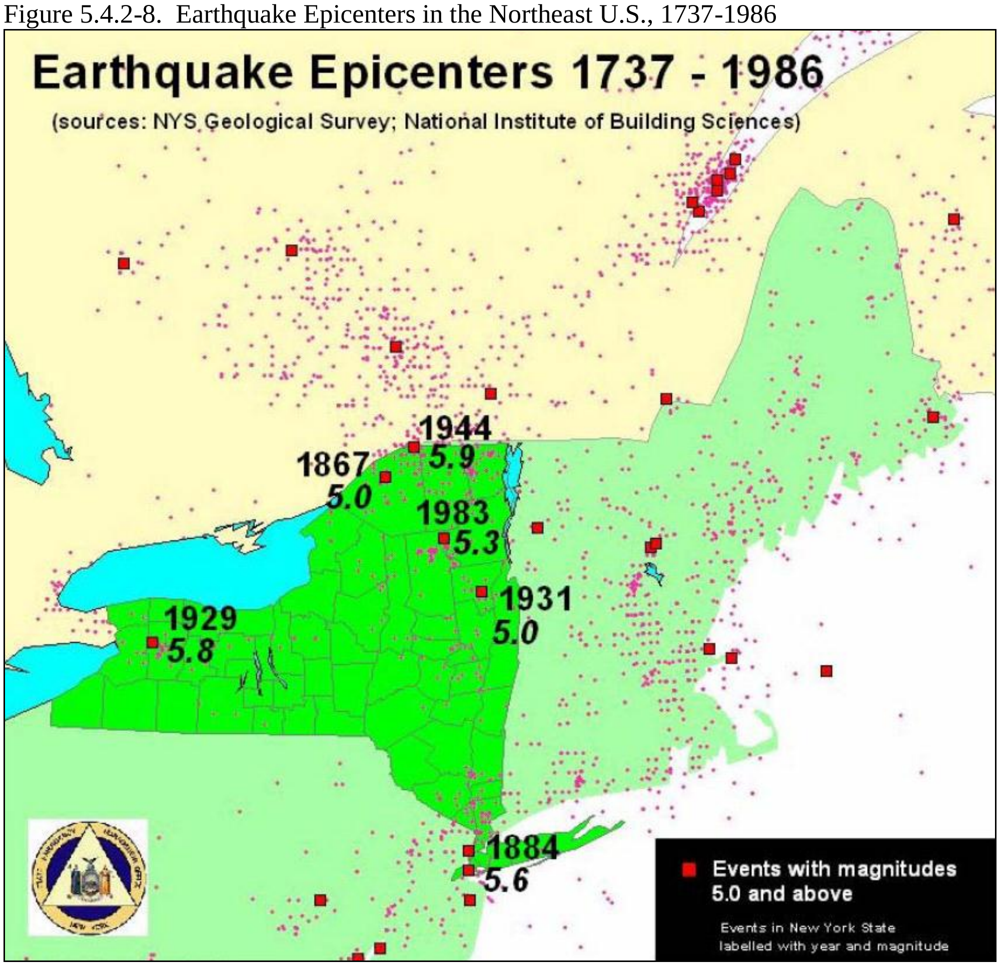
Source: HAZUS-MH 2.1

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 because major floods and hurricanes have occurred more recently than a major earthquake event (NYS HMP, 2011). Typically areas east of the Rocky Mountains experience fewer and generally smaller earthquakes than the western U.S. However, the potential for earthquakes exists across all of New York State and the entire northeastern U.S.

The New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala et al., 2003). Figure 5.4.2-8 illustrates historic earthquake epicenters across the northeast U.S. and New York State between 1737 and 1986. Looking at Figure 5.4.2-8, the concentration of earthquakes in New York State is located in three generally regions. These regions have a seismic risk that tends to be higher than other parts of the State. These regions are: the north and northeast third of the State, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region; the southeast corner, which includes the greater New York City area and western Long Island; and 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 HMP, 2011).

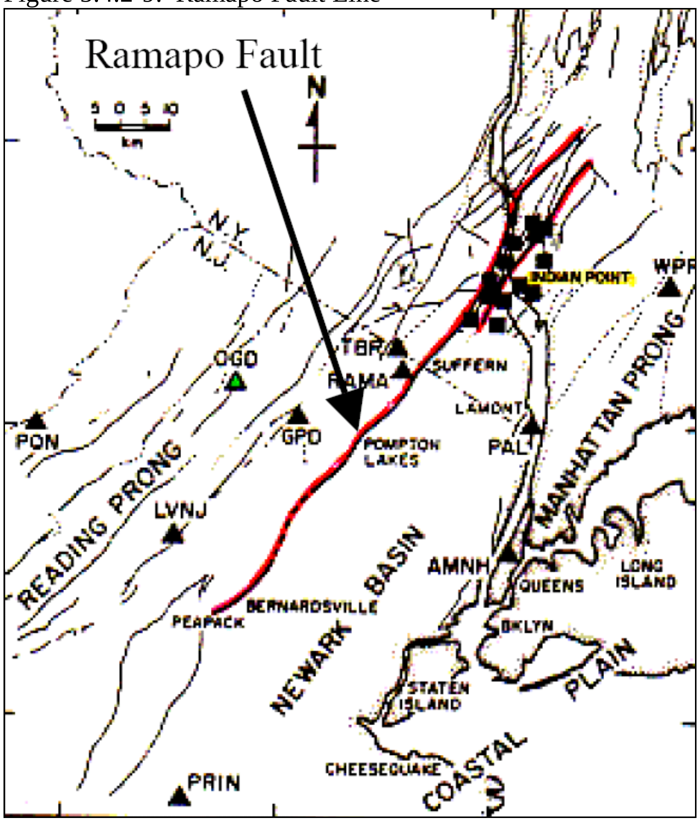
Figure 5.4.2-8. Earthquake Epicenters in the Northeast U.S., 1737-1986



Source: NYS HMP, 2011

The Ramapo Fault (Figure 5.4.2-9) is part of a system of northeast striking, southeast-dipping faults, which runs from southeastern New York State 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, 2004; Pasfield, Date Unknown). 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 (Dombroski, 1998).

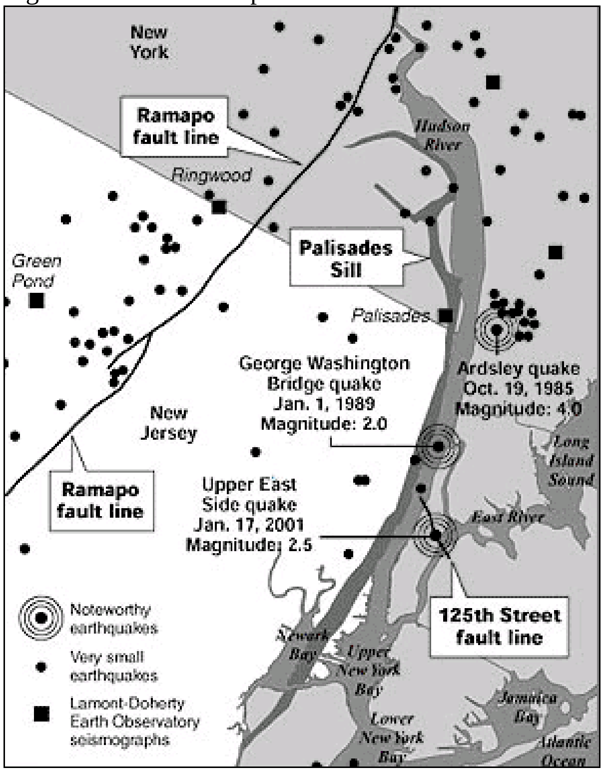
Figure 5.4.2-9. Ramapo Fault Line



Source: Rasmusson, 1993

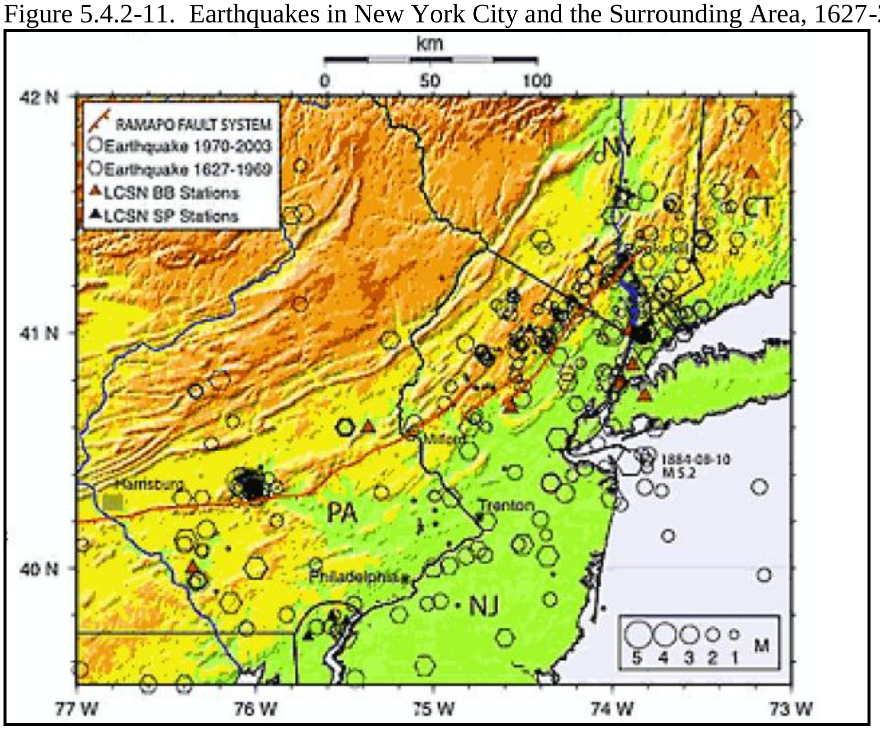
Figures 5.4.2-10 and 5.4.2-11 show the Ramapo Fault Line and the earthquakes that have occurred in the surrounding area of the fault.

Figure 5.4.2-10. Ramapo Fault Line



Source: Groves, 2001

Figure 5.4.2-11. Earthquakes in New York City and the Surrounding Area, 1627-2003



Source: Tobin, 2004

Note: The Ramapo Fault System is shown as a red line. Hexagons indicate earthquake events prior to 1970 and circles indicate earthquakes post 1970 (when systematic earthquake monitoring began in the region). The symbol size is proportional to magnitude.

In the 1970s and 1980s, earthquake risk along the Ramapo Fault became more known due to its close proximity to the Indian Point, New York Nuclear Power Generating Station. The Town of East Fishkill is not located within the 10 mile radius of Indian Point and is not located within the facility's emergency planning zone. East of the Rocky Mountains, including New York State, earthquake faults do not break the ground surface. Their focuses are at least a few miles below the Earth's surface and their locations are determined by interpreting seismographic records. Geological fault lines seen on the surface today are evidence of ancient events. The presence or absence of mapped faults does not denote either a seismic hazard or the lack of one, and earthquake can occur anywhere in New York State (Dombroski, 1998).

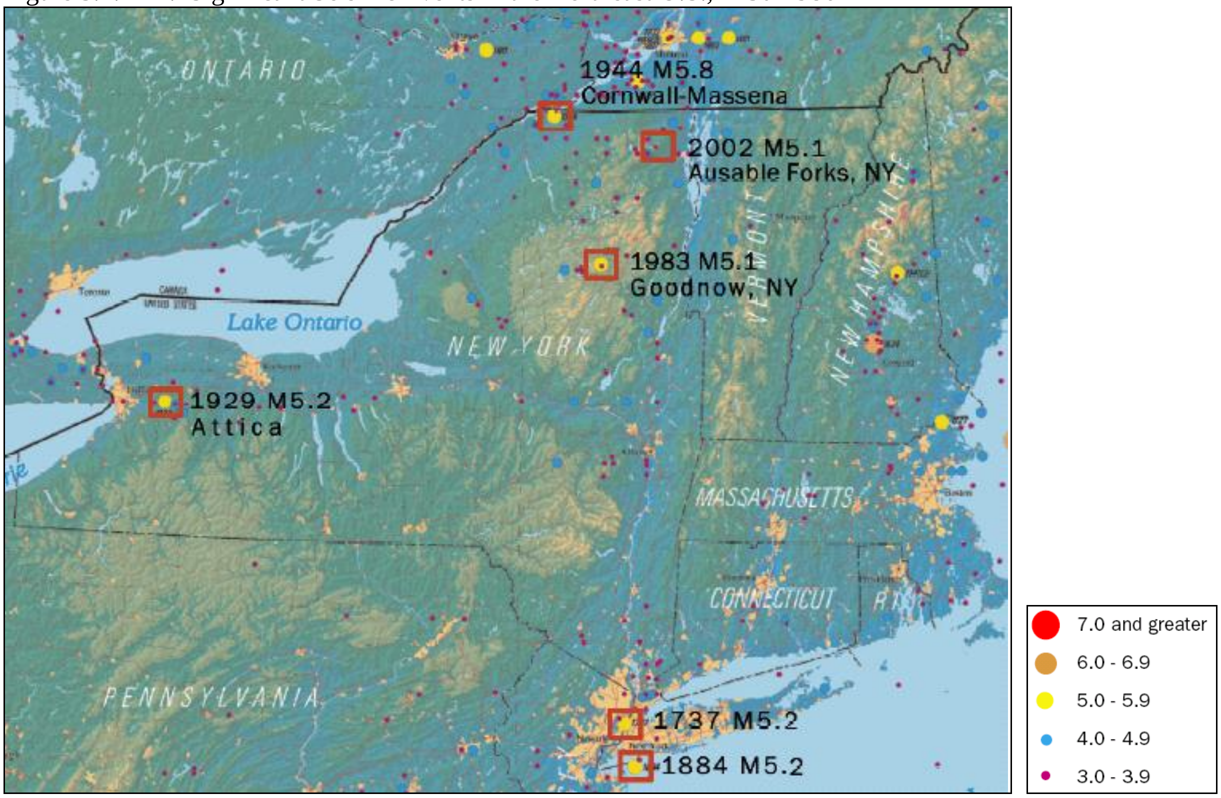
The closest plate boundary to the East Coast is the Mid-Atlantic Ridge, which is approximately 2,000 miles east of Pennsylvania. Over 200 million years ago, when the continent Pangaea rifted apart forming the Atlantic Ocean, the northeast coast of the U.S. was a plate boundary. Being at the plate boundary, 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).

Previous Occurrences and Losses

Due to the varied nature of the sources reviewed for the purpose of this HMP, loss and impact information for previous occurrences and losses associated with earthquakes throughout New York State and the Town of East Fishkill could vary depending on the sources.

Based on seismic records, thousands of earthquakes with magnitudes larger than 2.0, have occurred in New York State over the past few centuries. Between 1730 and 1986, more than 400 earthquakes with a magnitude of greater than 2.0 are on record in New York State, but many more have occurred unrecorded (Figure 5.4.2-1) (Tantala et al., 2003).

Figure 5.4.2-12. Significant Seismic Events in the Northeast U.S., 1730-1986



Source: Tantala et al, 2003

According to the NYSDPC, New York Times and Lamont-Doherty, approximately 55 earthquake events have affected New York State between 1737 and 2012. Additional sources have noted other earthquake events within New York State as well. Table 5.4.2-5 depicts these earthquakes events. The only recorded event in the NYS Statistical Area that has been definitively epicentered in Dutchess County occurred on June 7, 1974, with an epicenter in Wappinger Falls and a magnitude of 3.0. No other historical events had epicenters located within the immediate vicinity of the Town of East Fishkill.

Table 5.4.2-5. Earthquake History in New York State, 1737-2012

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
December 18, 1737	Earthquake 5.0-5.2	New York City	N/A	N/A	Bells rang, chimneys down. Felt in Boston and Philadelphia.	NYSDPC, Kim
November 18, 1755 ("Cape Ann Earthquake")	Earthquake 6 (VIII max.)	Cape Ann, Massachusetts	N/A	N/A	Chimneys and brick buildings down in Boston. Produced a tsunami that grounded boats in the West Indies.	NYSDPC
November 30, 1783	Earthquake 4.9	West of New York City	N/A	N/A	Felt from New Hampshire to Pennsylvania	NYSDPC, Kim
December 16, 1811 ("New Madrid Earthquake"	Earthquake 8.0 – 8.8	New Madrid, Missouri	N/A	N/A	Four great earthquakes. Changed courses of the Mississippi River. Town of New Madrid destroyed. Loss of life low due to sparse settlement. Damage in Chicago.	NYSDPC
January 16, 1840	Earthquake 3.7	Herkimer, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
October 26, 1845	Earthquake 3.8	Greater New York City Area	N/A	N/A	No reference and/or no damage reported	Kim
September 2, 1847	Earthquake 3.5	Offshore of New York City	N/A	N/A	No reference and/or no damage reported	NYSDPC
September 9, 1848	Earthquake 4.4	Rockland Lake, New York	N/A	N/A	Felt by many throughout New York City	NYSDPC, Kim
March 12, 1853	Earthquake 4.8 est.	Lowville, New York	N/A	N/A	Machinery knocked over	NYSDPC
February 7, 1855	Earthquake VI	Saugerties, New York	N/A	N/A	Frost quake occurred; caused by a sudden cracking action in frozen soil or rock saturated with water or ice	NYSDPC, Lacroix
October 23, 1857	Earthquake 4.0	Buffalo, New York	N/A	N/A	Bells rang and crocks fell from shelves	NYSDPC
December 18, 1867	Earthquake 4.8 est.	Canton, New York	N/A	N/A	Awoken people during the night	NYSDPC
July 11, 1872	Earthquake Not Stated	Westchester County	N/A	N/A	Residents of the villages along the eastern shore of Westchester County felt an earthquake. Houses shook, crockery and glasses fell from their shelves. The	New York Times

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
					earthquake was felt and heard in many towns in Westchester County and in Greenwich, Connecticut.	
December 11, 1874	Earthquake 3.4 – 4.8	Tarrytown, New York	N/A	N/A	Portions of Long Island and Westchester County felt an earthquake that struck the area. It was felt in Mount Vernon, New Rochelle, Mamorneck and Rye. It was also felt in Tarrytown. The shock was quite severe in Mount Vernon, East Chester and the surrounding area. Many people were awakened from their sleep.	NYSDPC, New York Times, Kim
August 10, 1884	Earthquake 5.2 – 5.3	Rockaway Beach, New York	N/A	N/A	Toppled chimneys in New York City and New Jersey. Cracked masonry from Hartford, CT to West Chester, PA. Felt from Maine to Virginia and eastern Ohio. In Westchester County, th earthquake was felt in Mount Vernon, Yonkers, New Rochelle, Port Chester, White Plains and other places in the County. Chimneys of houses in these areas were shaken down and brick walls were shattered.	NYSDPC, Kim, Lamont-Doherty (2008) (http://www.ldeo.columbia.edu/~kastens/curriculum/data_puzzles/earthquakes/pdf/1884_EQ_news.pdf)
January 4, 1885	Earthquake 3.4	Hudson Valley, New York	N/A	N/A	No reference and/or no damage reported	Kim
January 28, 1885	Earthquake Not Stated	Long Island Sound	N/A	N/A	Residents in the Village of Port Chester, City of New Rochelle, Town of Mamaroneck, City of Mount Vernon, and other places along the New York, New Haven and Hartford Railroad felt the earthquake. Most said it came from the Long Island Sound direction.	New York Times
September 1, 1886	Earthquake 7.7	Charleston, South Carolina	N/A	N/A	Sixty deaths; over 10,000 chimneys down.	NYSDPC
September 1, 1895	Earthquake 4.3	North-Central New Jersey	N/A	N/A	The earthquake was felt a little after 6 am. The shock was felt more in the northern section of Yonkers. Houses vibrated from the shock. The location of the earthquake was determined by aftershock and fire.	New York Times, Kim
May 28, 1897	Earthquake Not Stated	Plattsburgh, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
February 2 – 3, 1916	Earthquake 3.8	Schenectady, New York	N/A	N/A	Two distinct shocks from the earthquake were felt around 11:25 pm. Houses were shaken and window panes broke. This quake broke windows, threw people from their beds.	NYSDPC, New York Times

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
June 1, 1927	Earthquake 3.9	Asbury Park, New Jersey	N/A	N/A	Very high intensity in Asbury Park.	Kim
March 18, 1928	Earthquake 4.5 est.	Saranac Lake, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
August 12, 1920	Earthquake 5.2	Attica, New York	N/A	N/A	250 chimneys fell, brick buildings damaged, Attica prison walls damaged, wells went dry	NYSDPC
April 20, 1931	Earthquake 4.8	Warrensburg, New York	N/A	N/A	During the afternoon of the 20th, the first shock of the earthquake hit. The shaking was severe in Warren County, New York. Hotels and other buildings swayed and local stores had goods fall from the shelves. Damage was widespread and included 20 collapsed chimneys and a twisted spire of a church.	NYSDPC, National Atlas, Warren
April 15, 1934	Earthquake 3.9	Damnemora, New York	N/A	N/A	House shifted	NYSDPC
July 9, 1937	Earthquake 3.5	Brooklyn, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
September 5, 1944	Earthquake 4.5 - 6.0	Massena, New York	N/A	N/A	Chimneys destroyed, homes damaged, buildings damaged, $2 M in damages	NYSDPC
September 3, 1951	Earthquake 3.6	Rockland Town, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
January 1, 1966	Earthquake 4.6	Attica, New York	N/A	N/A	Chimneys and walls damaged	NYSDPC
June 13, 1967	Earthquake 4.4	Attica, New York	N/A	N/A	Chimneys and walls damaged	NYSDPC
May 23, 1971	Earthquake 3.5 - 4.1	Blue Mountain Lake, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
June 7, 1974	Earthquake 3.0	Wappingers Falls, New York	N/A	N/A	Windows broken	NYSDPC
June 9, 1975	Earthquake 3.5	Plattsburgh, New York	N/A	N/A	Chimneys and fireplaces cracked	NYSDPC
November 3, 1975	Earthquake 4.0	Raquette Lake, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
February 2, 1983	Earthquake 3.0	Scarsdale-Livingston, New York	N/A	N/A	Chimneys cracked	NYSDPC
October 7, 1983	Earthquake 5.1	Newcomb, New York	N/A	N/A	Tombstones rotated, some cracked chimneys, windows broken, walls damaged	NYSDPC
April 22, 1984	Earthquake 4.1	Lancaster, Pennsylvania	N/A	N/A	Residents in northern New Jersey, Westchester County, Staten Island and Queens felt mild tremors from an earthquake	New York Times

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
					that struck 15 miles south of Lancaster, PA. No damage was reported. It was felt as far south as Baltimore, Maryland.	
October 19, 1985	Earthquake 4.0	White Plains, New York	N/A	N/A	Windows broken, walls damaged; many people in New York City reported feeling the earthquake	NYSDPC, Kim
January 4, 1986	Earthquake 2.0 and 3.0	Ardsley and Scarsdale, New York	N/A	N/A	A minor earthquake struck Westchester County. It was centered between Ardsley and Scarsdale. Police departments in the area of the epicenter received reports of people having felt the earthquake.	New York Times
December 20, 1986	Earthquake Not Stated	Ardsley, New York	N/A	N/A	Parts of Westchester County experienced a minor earthquake. Seismologists stated that this event was so small that initial instrument checks failed to establish its time, location or force. The earthquake was very minor and could hardly be felt.	New York Times
June 17, 1991	Earthquake 4.1	Summit, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
March 10, 1992	Earthquake 4.1	East Hampton, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
March 22, 1994	Earthquake 3.6	Cuylerville, New York	N/A	N/A	No reference and/or no damage reported	NYSDPC
February 15, 1995	Earthquake 1.5	North Tarrytown, New York	N/A	N/A	No reference and/or no damage reported	Lamont-Doherty
January 1, 1997	Earthquake 1.0	Dobbs Ferry, New York	N/A	N/A	No reference and/or no damage reported	Lamont-Doherty
April 20, 2000	Earthquake 3.8	Newcomb, New York	N/A	N/A	Aftershock of the 1983 event; no damage reported	NYSDPC
January 17, 2001	Earthquake 2.5	Upper East Side of Manhattan, New York	N/A	N/A	No reference and/or no damage reported	Lamont-Doherty, USGS
January 19, 2001	Earthquake 1.2	Upper East Side of Manhattan, New York	N/A	N/A	No reference and/or no damage reported	Lamont-Doherty
October 27, 2001	Earthquake 2.6	New York City, New York	N/A	N/A	No reference and/or no damage reported	USGS
April 20, 2002	Earthquake 5.1	Au Sable Forks, New York	DR_1415	No	Largest earthquake to hit New York State in 20 years. People felt the earthquake from Washington, D.C. to Bangor, Maine. A state of emergency was declared in Essex and Clinton	NYSDPC, USGS

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
					Counties.	
May 24, 2002	Earthquake 3.1	Au Sable Forks, New York	N/A	N/A	Aftershock of the 4/20/2002 event; no damage reported	NYSDPC, USGS
January 11, 2003	Earthquake 1.2	Westchester County	N/A	N/A	A slight earthquake hit Westchester County. The epicenter was estimated to be in Hastings-on-Hudson. Residents in the surrounding area of the epicenter reported hearing an explosion or feeling the earth shake.	New York Times
January 14, 2003	Earthquake 1.4	Greenburgh, New York	N/A	N/A	First of two minor earthquakes to hit Westchester County in five days. It struck about 8 pm around Greenburgh.	Lamont-Doherty, New York Times
January 15, 2003	Earthquake 1.2	Hastings-on-Hudson, New York	N/A	N/A	Second minor earthquake to hit Westchester County in five days. Many residents in the area of the earthquake experienced a deep, resonating explosion.	New York Times
February 27, 2008	Earthquake 2.7	Amsterdam, New York	N/A	N/A	No reference and/or no damage reported	USGS
May 28, 2008	Earthquake 1.8	Saratoga Springs, New York	N/A	N/A	No reference and/or no damage reported	USGS
February 18, 2009	Earthquake 2.3 – 2.7	East Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 20, 2009	Earthquake 2.7	East Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 23, 2009	Earthquake 2.1	East Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
March 22, 2009	Earthquake 2.1 - 2.8	Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
May 18, 2009	Earthquake 2.1 - 3.0	Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
October 21, 2009	Earthquake 2.9	East Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
December 13, 2009	Earthquake 2.6 – 3.1	Berne, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 15, 2010	Earthquake 2.2	Berne, NY	N/A	N/A	No reference and/or no damage reported.	NEIC
February 18, 2010	Earthquake 2.7	Berne, NY	N/A	N/A	No reference and/or no damage reported.	NEIC
March 24, 2010	Earthquake 2.7	Berne, NY	N/A	N/A	No reference and/or no damage reported.	NEIC

Date of Event	Event Type	Location	FEMA Declaration Number	County Designated ?	Losses / Impacts	Source(s)
August 25, 2011	Earthquake 2.0 – 2.8	Altamont, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
August 26, 2011	Earthquake 2.2	Altamont, NY	N/A	N/A	No reference and/or no damage reported.	NEIC
August 27, 2011	Earthquake 2.9	Altamont, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
November 21, 2011	Earthquake 2.4	Moira, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
January 7, 2012	Earthquake 2.1	Bombay, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
January 23, 2012	Earthquake 2.3	Johnsburg, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
March 23, 2012	Earthquake 2.5	Mt. Morris, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
September 8, 2012	Earthquake 2.1	Greenwich, CT	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
October 16, 2012	Earthquake 4.0	Hollis Center, ME	N/A	N/A	A minor earthquake in Maine was felt throughout New England and New York State. Residents in the Town of East Fishkill (Hopewell Junction and Stormville) reported having felt the earthquake.	USGS, NEIC
October 26, 2012	Earthquake 2.5	Barker, NY	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
November 4, 2012	Earthquake 2.0	Weston, CT	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
November 5, 2012	Earthquake 2.0	Ringwood, NJ	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC

Source(s): NYS HMP, 2011; USGS, 2012; Lamont-Doherty, 2002; Kim, 1999

Earthquakes in the Town of East Fishkill are not common, with documented information on earthquake events and their location is being relatively scarce. According to Town officials, there are no records of damaging earthquake occurrences within the Town. However, depending on the magnitude, the impacts of earthquake events can be far-reaching; therefore, reported incidences within the surrounding counties or states could have created indirect impacts upon the Town.

Probability of Future Events

Earthquake hazard maps illustrate the distribution of earthquake shaking levels that have a certain probability of occurring over a given time period. According to the USGS, in 2008, the Town of East Fishkill had a PGA between 3 and 4%g for earthquakes with a 10-percent probability of occurring within 50 years. Moderate shaking and very light damage is generally associated with a 3 to 4%g earthquake.

The NYSDPC indicates that the earthquake hazard in New York State is often understated because other natural hazards occur more frequently (for example: hurricanes, tornadoes and flooding) and are much more visible. However, the potential for earthquakes does exist across the entire northeastern U.S., and New York State is no exception (NYS HMP, 2011).

Earlier in this section, the identified hazards of concern for the Town of East Fishkill were ranked. NYSOEM conducts a similar ranking process for hazards that affect the State. 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 earthquakes in the Town of East Fishkill is considered "Occasional" (likely to occur within 100 years), however damages from such events is anticipated to be negligible or non-existant. Damages from lower frequency events may result in indirect impacts that may affect the general building stock, local economy and may induce secondary hazards such ignite fires and cause utility failure.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the earthquake hazard, the entire Town has been identified as the exposed hazard area. Therefore, all assets in the Town of East Fishkill (population, structures, critical facilities and lifelines), as described in the Municipal Profile (Section 4), are vulnerable. The following section includes an evaluation and estimation of the potential impact of the earthquake hazard on the Town of East Fishkill including the following:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health 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 of this hazard over time

Overview of Vulnerability

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin. The extent of damage depends on the density of population and building and infrastructure construction in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, the age of the buildings and building codes in place. Compounding the potential for damage – historically, Building Officials Code Administration (BOCA) used in the Northeast were developed to address local concerns including heavy snow loads and wind; seismic requirements for design criteria are not as stringent compared to the west coast's reliance on the more seismically-focused Uniform Building Code). As such, a smaller earthquake in the Northeast can cause more structural damage than if it occurred out west.

The entire population and general building stock inventory of the Town is at risk of being damaged or experiencing losses due to impacts of an earthquake. Potential losses associated with the earth shaking were calculated for the Town of East Fishkill for three probabilistic earthquake events, the 100-year, 500- and 2,500-year MRP. The impacts on population, existing structures, critical facilities and the economy within the Town of East Fishkill are presented below, following a summary of the data and methodology used.

Data and Methodology

A probabilistic assessment was conducted for the Town of East Fishkill for the 100-, 500- and 2,500-year MRPs through a Level 2 analysis in HAZUS-MH 2.1 to analyze the earthquake hazard and provide a range of loss estimates for the Town of East Fishkill. 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. According to NYCEM, probabilistic estimates are best for urban planning, land use, zoning and seismic building code regulations (NYCEM, 2003). The default assumption is a magnitude 7 earthquake for all return periods. In addition, an annualized loss run was also conducted in HAZUS-MH 2.1 to estimate the annualized general building stock dollar losses for the Town of East Fishkill.

As discussed in Section 5.2, a Level 1 analysis is a basic estimate of earthquake losses based on national databases and using the default data in the model. Default demographic data (U.S. Census 2000) in HAZUS-MH 2.1 and updated general building stock data based on the Town's assessor data were used for the earthquake analysis. Critical facilities (essential facilities, transportation features, utilities and user-defined facilities) were also updated and used in place of the HAZUS-MH 2.1 defaults.

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 NEHRP 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. The Town of East Fishkill is comprised of NEHRP soil classes A through E, or very hard rock to soft soils. Figure 5.4.2-X in this profile illustrates the NEHRP soil classifications in the Town of East Fishkill. According to NYCEM, soft soils (NEHRP soil classed D and E) can amplify ground shaking to damaging levels even in a moderate earthquake (NYCEM, 2003).

The local soil map provided by NYSOEM with the Town of East Fishkill's NEHRP soil classes was entered into HAZUS-MH 2.1 to replace default soil conditions (Figure 5.4.2-4). These data updates allowed for a Level 2 earthquake analysis. Groundwater was set at a depth of five-feet (default setting). Damages and loss due to liquefaction, landslide or surface fault rupture were not included in this analysis.

In addition to the probabilistic scenarios mentioned, an annualized loss run was conducted in HAZUS 2.1 to estimate the annualized general building stock dollar losses for the Town. The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods: 100, 250, 500, 750, 1000, 1500, 2000, 2500-year, which are based on values from the USGS seismic probabilistic curves. Annualized losses are useful for mitigation planning because they provide a baseline upon which to 1) compare the risk of one hazard across multiple jurisdictions and 2) compare the degree of risk of all hazards for each participating jurisdiction.

As noted in the HAZUS-MH Earthquake User Manual '*Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainly in loss estimates produced by the HAZUS Earthquake Model, possibly at best a factor of two or more*.' However, HAZUS' potential loss estimates are acceptable for the purposes of this HMP.

The occupancy classes available in HAZUS-MH 2.1 were condensed into the following categories (residential, commercial, industrial, agricultural, religious, government, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single family dwellings. Impacts to critical facilities and utilities were also evaluated.

Data used to assess this hazard include data available in the HAZUS-MH 2.1 earthquake model, USGS data, data provided by NYSOEM, professional knowledge, and information provided by the Town's Planning Committee. All exposure and loss estimates discussed in the assessment below are for the Town of East Fishkill.

Impact on Life, Health and Safety

Overall, the entire population of the Town of East Fishkill is exposed to the earthquake hazard event. According to the 2010 U.S. Census, the Town of East Fishkill had a population of 29,029 people. The impact of earthquakes on life, health and safety is dependent upon the severity of the event. Risk to public safety and loss of life from an earthquake in the Town of East Fishkill is minimal with higher risk occurring in buildings as a result of damage to the structure, or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the quake.

Populations considered most vulnerable include the elderly (persons over the age of 65) and individuals living below the Census poverty threshold. These 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. Table 5.4.2-6 summarizes the Town population over the age of 65 and individuals living below the Census poverty threshold.

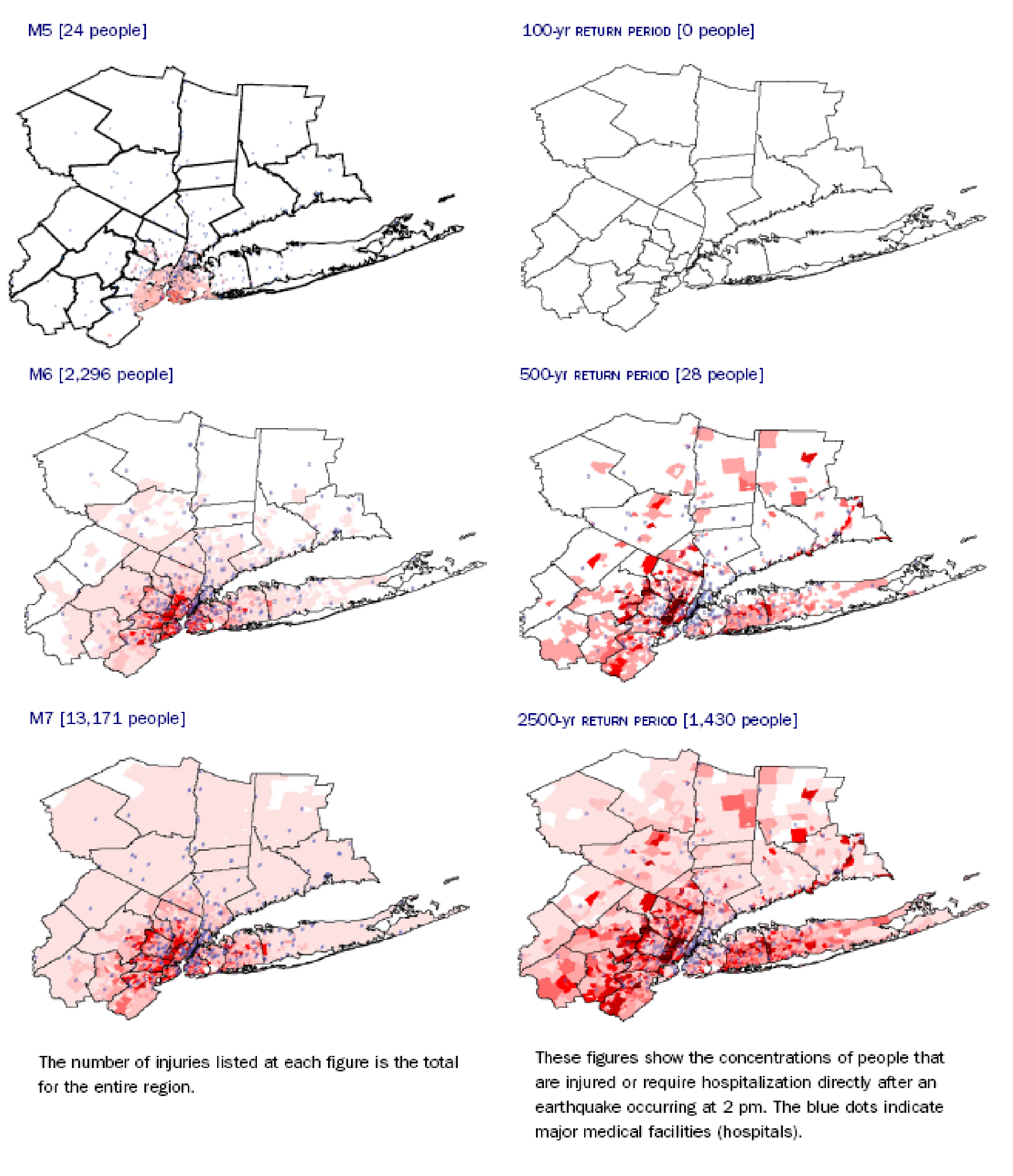
Table 5.4.2-6. Town of East Fishkill Population Statistics (2010 U.S. Census)

U.S. Census 2010 Population	U.S. Census 2010 Population Over 65	U.S. Census 2010 Population Under 5	Census Low-Income Households *
29,029	3,104	1,520	941

Source: U.S. Census, 2010
Note: *2008-2010 American Community Survey (3-Year Estimates) - Households with an income of less than $24,999

According to the 1999-2003 NYCEM Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), there is a strong correlation between structural building damage and the number of injuries and casualties from an earthquake event. NYCEM conducted a HAZUS analysis for the New York, New Jersey, Connecticut region for M5, M6 and M7 deterministic scenarios (1884 M5.2 historic earthquake) and three probabilistic scenarios (100-, 500- and 2500-year events). Figure 5.4.2-17 is a graphic summary of the injury estimates for the different earthquake scenarios in the entire New York, New Jersey, Connecticut region, occurring at 2 pm. The color code indicates that the highest number of injuries would be concentrated in the New York City metropolitan area due to high population concentration.

Figure 5.4.2-17. Injuries in the New York/New Jersey/Connecticut Region based on NYCEM HAZUS Analysis



Source: NYCEM, 2005

Residents may be displaced or require temporary to long-term sheltering due to the event. 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. Table 5.4.2-7 summarizes the population HAZUS-MH 2.1 estimates will be displaced or will require short-term sheltering as a result of the 100-, 500- and 2,500-year MRP earthquake events.

Table 5.4.2-7. Summary of Estimated Sheltering Needs for the Town of East Fishkill

Scenario	Displaced Households	People Requiring Short-Term Shelter
100-Year Earthquake	0	0
500-Year Earthquake	0	0
2,500-Year Earthquake	8	5

Source: HAZUS-MH 2.1

HAZUS-MH 2.1 estimates the number of people that may potentially be injured and/or killed by an earthquake depending upon the time of day the event occurs. These estimates are provided for three times of day (2:00am, 2:00pm and 5:00pm), representing the periods of the day that different sectors of the community are at their peak. The 2:00am estimate considers the residential occupancy at its maximum, the 2:00pm estimate considers the educational, commercial and industrial sector at their maximum and the 5:00pm estimate represents peak commuter time.

There are no injuries or casualties estimated for the 100-year event. For the 500-year event, a total of two injuries (medical attention, no hospitalization) are estimated if the event occurs at 2:00am, 2:00pm or 5:00pm. There are zero injuries that will require hospitalization and no casualties estimated at any time.

Table 5.4.2-8 summarizes the injuries and casualties estimated for the 2,500-year MRP earthquake event.

Table 5.4.2-8. Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	8	7	8
Hospitalization	1	1	3
Casualties	0	0	0

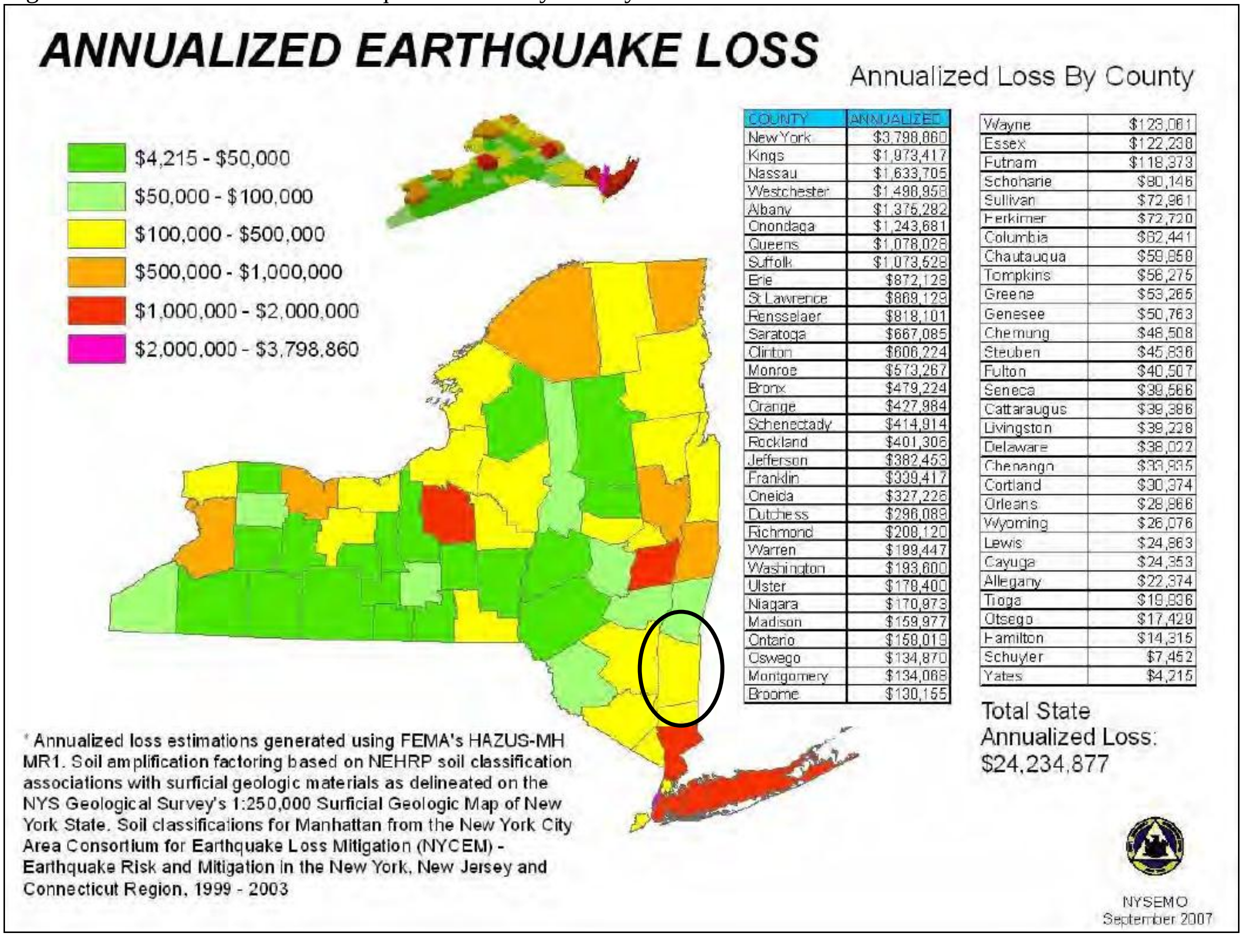
Source: HAZUS-MH 2.1

Impact on General Building Stock

After considering the population exposed to the earthquake hazard, the value of general building stock exposed to and damaged by 100-, 500- and 2,500-year MRP earthquake events was evaluated. In addition, annualized losses were calculated using HAZUS-MH 2.1. The entire study area's general building stock is considered at risk and exposed to this hazard. The HAZUS-MH 2.1 model estimates the value of the exposed building stock and the loss (in terms of damage to the exposed stock). Refer to Table 4-X in the Municipal Profile (Section 4) for general building stock data replacement value statistics (structure and contents).

The NYS HMP conducted a HAZUS vulnerability assessment and reports estimates of earthquake losses factoring in NEHRP soil classes. The annualized losses are reported at the county level. For Dutchess County, the estimated annualized earthquake loss is $296,089. Using HAZUS-MH 2.1, a probabilistic model was run for the purposes of this Plan to estimate annualized dollar losses for the Town of East Fishkill, also factoring in NEHRP soil classes. The estimated annualized losses are approximately $53,622 per year (building and contents) for the Town.

Figure 5.4.2-18. Annualized Earthquake Losses by County



Source: NYS HMP, 2011
Note: The black circle indicates the approximate location of the Dutchess County

According to the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM), where earthquake risks and mitigation were evaluated in the New York, New Jersey and Connecticut region, most damage and loss caused by an earthquake is directly or indirectly the result of ground shaking (NYCEM, 2003). NYCEM indicates there is a strong correlation between PGA and the damage a building might experience. The HAZUS-MH model is based on the best available earthquake science and aligns with these statements. HAZUS-MH 2.1 methodology and model were used to analyze the earthquake hazard for the general building stock for the Town of East Fishkill. See Figure 5.4.2-7 earlier in this profile that illustrates the geographic distribution of PGA (g) across the Town for 100-, 500- and 2,500-year MRP events at the Census-Tract level.

According to NYCEM, a building's construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that un-reinforced 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 contribute to a building's capability to withstand an earthquake's force include its age, number of stories and quality of construction. HAZUS-MH considers building construction and the age of buildings as part of the analysis. Because the default general building stock was used for this HAZUS-MH analysis, the default building ages and building types already incorporated into the inventory were used.

Potential building damage was evaluated by HAZUS-MH 2.1 across the following damage categories (none, slight, moderate, extensive and complete). Table 5.4.2-9 provides definitions of these five categories of damage for a light wood-framed building; definitions for other building types are included in HAZUS-MH technical manual documentation. General building stock damage for these damage categories by occupancy class and building type on a Town-wide basis is summarized for the 100-, 500- and 2,500-year events in Tables 5.4.2-10, -11 and -12.

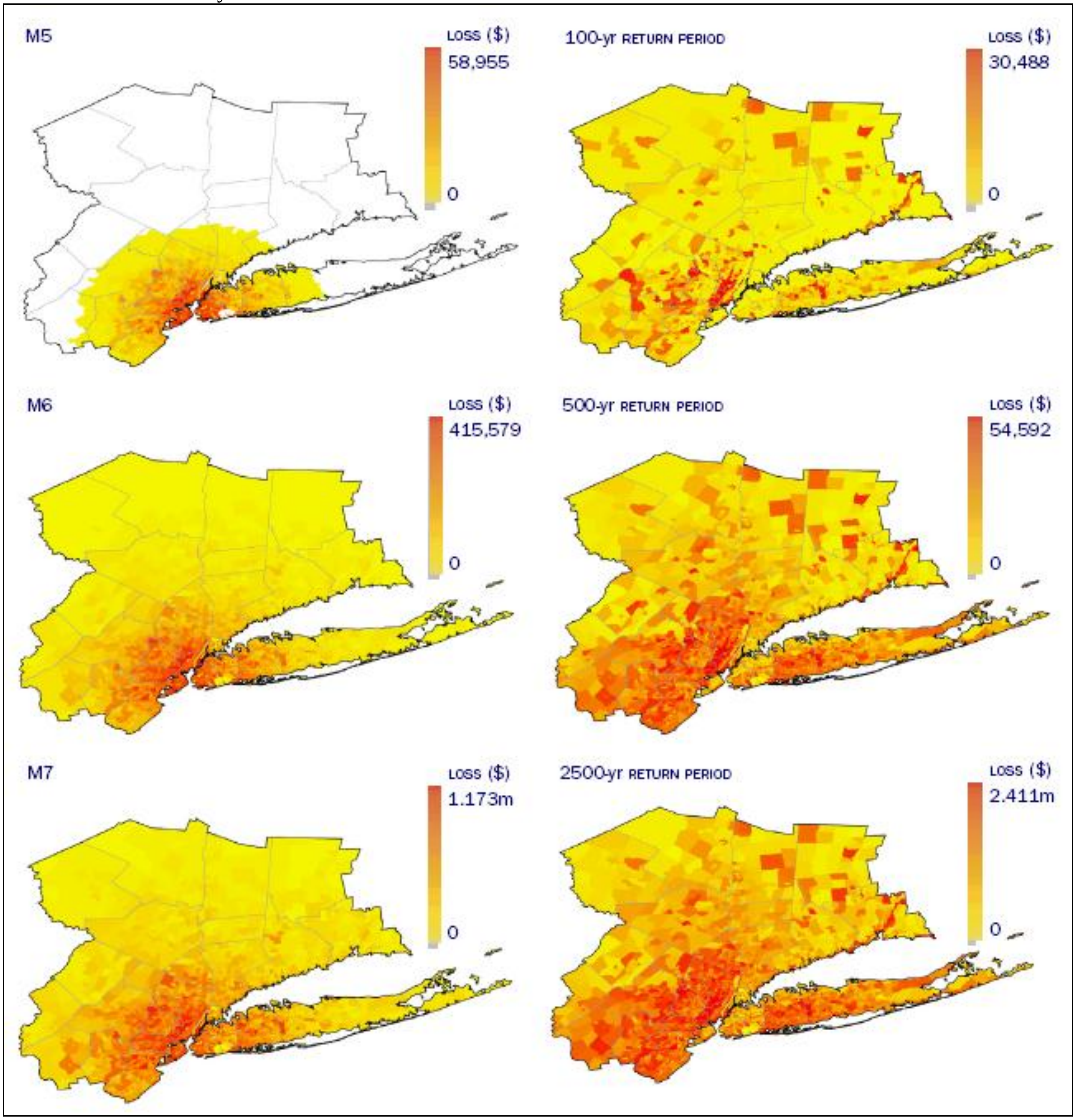
Table 5.4.2-9. Example of Structural Damage State Definitions for a Light Wood-Framed Building

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.

Source: HAZUS-MH Technical Manual

Figure 5.4.2-19 is a graphic summarizing the total building-related losses per Census tract for the New York, New Jersey and Connecticut region, based on the magnitude of the deterministic scenario earthquakes (M5, M6, M7) or the average return period (100, 500, 2,500 years) for the probabilistic case. The total value listed next to each figure includes both direct building losses and building-related business interruption losses (NYCEM, 2005).

Figure 5.4.2-19. Total Building-Related Losses for the New York/New Jersey/Connecticut Region based on NYCEM HAZUS Analysis



Source: NYCEM, 2003

HAZUS-MH 2.1 estimates zero damage to the Town of East Fishkill's general building stock as a result of a 100-year MRP event. Tables 5.4.2-10 through 5.4.2-12 summarize the damage estimated for the 100-, 500- and 2,500-year MRP earthquake events. Damage loss estimates include structural and non-structural damage to the building and loss of contents.

Table 5.4.2-10. Estimated Buildings Damaged by General Occupancy for 100-year, 500-year and 2,500-year MRP Earthquake Events

Category	Average Damage State														
	100-Year MRP					500-Year MRP					2,500-Year MRP				
	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete
Residential	10,004	0	0	0	0	9,760	198	41	4	0	8,376	1,191	376	54	7
Commercial	326	0	0	0	0	316	7	2	0	0	260	38	23	5	1
Industrial	160	0	0	0	0	157	2	1	0	0	141	12	6	1	0
Education, Government, Religious and Agricultural	175	0	0	0	0	171	1	1	0	0	143	19	10	1	0

Source: HAZUS-MH 2.1

Table 5.4.2-11. Estimated Number of Buildings Damaged by Building Type for 100-year, 500-year and 2,500-year MRP Earthquake Events

Category	Average Damage State														
	100-Year MRP					500-Year MRP					2,500-Year MRP				
	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete
Wood	8,346	0	0	0	0	8,197	132	16	1	0	7,166	943	218	17	1
Steel	344	0	0	0	0	336	6	2	0	0	284	33	22	4	0
Concrete	188	0	0	0	0	183	4	1	0	0	148	23	14	3	0
Reinforced Masonry	95	0	0	0	0	92	2	1	0	0	79	8	7	2	0
Un-reinforced Masonry	1,529	0	0	0	0	1,440	62	24	3	0	1,123	231	136	34	6
Manufactured housing	163	0	0	0	0	155	6	2	0	0	120	24	16	2	0

Source: HAZUS-MH 2.1

Table 5.4.2-12. Estimated Building Value (Building and Contents) Damaged by the 500- and 2,500-Year MRP Earthquake Events

Municipality	Estimated Total Damages*		Percent of Total Building and Contents RV**		Estimated Residential Damage		Estimated Commercial Damage	
	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year
Town of East Fishkill	$3,657,050	$53,384,331	< 1%	< 1%	$2,630,171	$35,322,795	$473,735	$6,998,741

Source: HAZUS-MH 2.1
RV: Replacement Value
*Total is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious and government)].
**Total replacement value (building and contents) for the Town is greater than $6.4 billion.

It is estimated that there would be $3.6 million in damages to buildings in the Town during a 500-year earthquake event. This includes structural damage, non-structural damage and loss of contents, representing less than one-percent of the total replacement value for general building stock in the Town of East Fishkill. For a 2,500-year MRP earthquake event, the estimated total building damage is greater than $53 million, less than one-percent of the total general building stock replacement value (total replacement value is greater than $6.4 billion for the Town). Residential buildings account for most of the damage for earthquake events. This is likely because they comprise the majority of the building inventory.

Earthquakes can cause secondary hazard events such as fires. No fires are anticipated as a result of the 100-, 500- or 2,500-year MRP events.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 100-, 500- and 2,500-year MRP earthquake events, critical facilities were evaluated. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities and user-defined facilities) in the Town of East Fishkill are considered exposed and vulnerable to the earthquake hazard. Refer to subsection "Critical Facilities" in Section 4 (Municipal Profile) of this Plan for a complete inventory of critical facilities in the Town.

HAZUS-MH 2.1 estimates the probability that critical facilities may sustain damage as a result of 100-, 500- and 2,500-year MRP earthquake events. Additionally, HAZUS-MH estimates percent functionality for each facility days after the event. For the 100-Year MRP event, HAZUS-MH 2.1 estimates it is 99% probable that emergency facilities (police, fire, EMS and medical facilities), schools and specific facilities identified by Town of East Fishkill as critical (i.e., user-defined facilities such shelters, municipal buildings and Departments of Public Works) will not experience any structural damage. These facilities are estimated to be nearly 100% functional on day one of the 100-year MRP earthquake event. Therefore, the impact to critical facilities is not significant for the 100-year event.

Tables 5.4.2-13 and 5.4.2-14 list the probability of critical facilities sustaining the damage category as defined by the column heading and percent functionality after the event for the 500-year and 2,500-year MRP earthquake events.

Table 5.4.2-13. Estimated Damage and Loss of Functionality for Critical Facilities in Town of East Fishkill for the 500-Year MRP Earthquake Event

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Town of East Fishkill PD	Police	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8
Stormville Fire Co Inc	Fire	98.6	1.1	0.3	0	0	98.5	99.6	99.9	99.9
Stormville Fire Co Inc	Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Hillside Lake Fire Co. No. 3	Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Hopewell Hose Co #1 Inc	Fire	85.4	9.7	4.2	0.7	0.1	85.3	94.8	99.2	99.5
Stormville Fire Co	Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
East Fishkill Fire District	Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Wiccopee Fire Company No. 4	Fire	97.5	1.9	0.5	0.1	0	97.4	99.3	99.9	99.9
Wiccopee Fire Company Sub.	Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
East Fishkill Fire District Training Building 2	Fire	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8
East Fishkill Fire District Training Building 3	Fire	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8
East Fishkill EOC/EMS/Fire HQ/Training Facility	EOC/EMS/Fire	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Wappingers Central School	School	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8
Wappingers Central School	School	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Wappinger Central School	School	93.5	4.7	1.6	0.2	0	93.5	98	99.7	99.8
Church Of St Columba	School	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8
St Dennis Catholic Church	School	97.6	1.8	0.5	0.1	0	97.6	99.3	99.9	99.9
Bethal Baptist Church of	School	97.5	1.9	0.5	0.1	0	97.5	99.3	99.9	99.9
Wappingers CS Dist. John Jay High School	School	93.3	4.8	1.7	0.2	0	93.3	97.9	99.7	99.8

Source: HAZUS-MH 2.1

Table 5.4.2-14. Estimated Damage and Loss of Functionality for Critical Facilities in Town of East Fishkill for the 2,500-Year MRP Earthquake Event

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Town of East Fishkill PD	Police	67.1	18.7	11.2	2.7	0.4	67	85.3	85.7	96.9
Stormville Fire Co Inc	Fire	87.3	8.5	3.5	0.6	0.1	87.3	95.6	95.8	99.3
Stormville Fire Co Inc	Fire	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
Hillside Lake Fire Co. No. 3	Fire	82.5	11.3	5.2	0.9	0.1	82.4	93.5	93.7	98.9
Hopewell Hose Co #1 Inc	Fire	43.8	25.3	21.6	7.6	1.7	43.8	68.5	69.1	90.7
Stormville Fire Co	Fire	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
East Fishkill Fire District	Fire	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Wiccopee Fire Company No. 4	Fire	81.7	11.8	5.5	1	0.1	81.6	93.1	93.4	98.9
Wiccopee Fire Company Sub.	Fire	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
East Fishkill Fire District Training Building 2	Fire	67.1	18.7	11.2	2.7	0.4	67	85.3	85.7	96.9
East Fishkill Fire District Training Building 3	Fire	67.1	18.7	11.2	2.7	0.4	67	85.3	85.7	96.9
East Fishkill EOC/EMS/Fire HQ/Training Facility	EOC/EMS/Fire	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
Wappingers Central School	School	67.7	18.4	10.9	2.6	0.4	67.7	85.7	86.1	97
Wappingers Central School	School	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
Wappinger Central School	School	67.7	18.4	10.9	2.6	0.4	67.7	85.7	86.1	97
Church Of St Columba	School	67.7	18.4	10.9	2.6	0.4	67.7	85.7	86.1	97
St Dennis Catholic Church	School	82.5	11.3	5.2	0.9	0.1	82.4	93.5	93.7	98.9
Bethal Baptist Church of	School	82.1	11.5	5.3	1	0.1	82	93.3	93.6	98.9
Wappingers CS Dist. John Jay High School	School	67.1	18.7	11.2	2.7	0.4	67	85.3	85.7	96.9

Source: HAZUS-MH 2.1

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. A Level 2 HAZUS-MH analysis estimates the total economic loss associated with each earthquake scenario, which includes building- and lifeline-related losses (transportation and utility losses) based on the available inventory (facility [or GIS point] data only). 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" section discussed earlier. Lifeline-related losses include the direct repair cost to transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic loss includes business interruption losses associated with the inability to operate a business due to the damage sustained during the earthquake as well as temporary living expenses for those displaced. These losses are discussed below.

For the 500-year event, HAZUS-MH 2.1 estimates the Town will incur approximately $500,000 in income losses (wage, rental, relocation and capital-related losses). For the 2,500-year event, HAZUS-MH 2.1 estimates the Town will incur approximately $5.28 million in income losses, mainly to the residential and commercial occupancy classes associated with wage, rental, relocation and capital-related losses.

Damage results are not considered to be significant as a result of a 100-year event; therefore, utility loss estimates are not discussed further in this assessment for this HMP. Tables 5.4.2-15 and 5.4.2-16 summarize the HAZUS-MH 2.1 estimated probability of damage that each utility may sustain (as defined by the column heading) and estimated loss of use in days a result of a 500-year and 2,500-year MRP earthquake event, respectively. Damage categories are related to the damage ratio (defined as ratio of repair to replacement cost) for evaluation of direct economic loss. Refer to the HAZUS-MH Earthquake Technical Manual for a description of the damage categories for each utility feature.

The HAZUS-MH analysis conducted did not compute damage estimates for roadway segments and railroad tracks. However, it is assumed these features will experience damage due to ground failure and regional transportation and distribution of these materials will be interrupted as a result of an earthquake event. Losses to the community that result from damages to lifelines can be much greater than the cost of repair (HAZUS-MH MR3 Earthquake User Manual, 2007).

For the 100-, 500- and 2,500-year MRP events, HAZUS-MH 2.1 estimates all highways in the Town of East Fishkill will be fully functional day one of the event. For the 100-year and 500- year MRP events, HAZUS-MH 2.1 estimates highway and railway bridges will be nearly 100% functional day one of the event.

For the 2,500-year MRP event, HAZUS-MH 2.1 estimates highway bridges will be 60 to100-percent functional day one of the event. The most vulnerable bridges appear to be on NEHRP soil class E and are identified in the HAZUS-MH 2.1 default highway bridge inventory as: 1) Route 84 bridge (near the exchange with the Teconic Parkway; and 2) bridge on Fishkill Hook Road.

Table 5.4.2-15. Estimated Utility Impacts in Town of East Fishkill from the 500-year MRP Earthquake Event

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Brettview Water Plant	Potable Water	94	4.5	1.5	0	0	97.1	99.9	99.9	99.9
Fishkill Plains Plant, Stor Tank & Wells	Potable Water	98	1.6	0.4	0	0	99	99.9	99.9	99.9
Four Corners Water Plant 1	Potable Water	99.5	0.4	0.1	0	0	99.7	99.9	99.9	99.9
Four Corners Water Plant 1	Potable Water	94	4.5	1.5	0	0	97.1	99.9	99.9	99.9
Four Corners Water Storage Tank	Potable Water	99.5	0.4	0.1	0	0	99.7	99.9	99.9	99.9
Hopewell Glen Water Building	Potable Water	97.9	1.7	0.4	0	0	99	99.9	99.9	99.9
Hopewell Hamlet Plant, Stor Tank Wells	Potable Water	97.9	1.7	0.4	0	0	99	99.9	99.9	99.9
Little Switzerland Water Storage Tank	Potable Water	99.5	0.4	0.1	0	0	99.7	99.9	99.9	99.9
Little Switzerland Water TP & PH	Potable Water	99.5	0.4	0.1	0	0	99.7	99.9	99.9	99.9
Pinewood Knolls Pump House & Wells	Potable Water	99.5	0.4	0.1	0	0	99.7	99.9	99.9	99.9
Revere Park Water Plant & Wells	Potable Water	98	1.6	0.4	0	0	99	99.9	99.9	99.9
Shenandoah Water Plant	Potable Water	93.8	4.6	1.5	0	0	97	99.9	99.9	99.9
Shenandoah Water Storage Tank	Potable Water	99.8	0.2	0	0	0	99.8	99.9	99.9	99.9
Taconic Estates Pump House & Wells	Potable Water	94	4.5	1.5	0	0	97.1	99.9	99.9	99.9
Four Corners - Chestnut St Sewage PSt	Wastewater	98	1.6	0.4	0	0	98.5	99.9	99.9	99.9
Four Corners - Philips Road WWTP	Wastewater	94	4.5	1.5	0	0	95.6	99.8	99.9	99.9
Four Corners WWTP	Wastewater	99.5	0.4	0.1	0	0	99.6	99.9	99.9	99.9
Hopewell Hamlet Main Sewage PSt	Wastewater	93.8	4.6	1.5	0	0	95.4	99.7	99.9	99.9
Hopewell Hamlet Main WWTP	Wastewater	93.8	4.6	1.5	0	0	95.4	99.7	99.9	99.9
Leg 2A Sanitary Sewage Pump Station	Wastewater	97.9	1.7	0.4	0	0	98.4	99.9	99.9	99.9
Penney Lane Sewage Pump Station	Wastewater	97.9	1.7	0.4	0	0	98.4	99.9	99.9	99.9
Sagamore-Beekman Rd Sew Pump St	Wastewater	99.5	0.4	0.1	0	0	99.6	99.9	99.9	99.9
Sagamore WWTP	Wastewater	99.5	0.4	0.1	0	0	99.6	99.9	99.9	99.9
Town Hall Sewage Pump Station	Wastewater	93.8	4.6	1.5	0	0	95.4	99.7	99.9	99.9
Unity Plaza Sewage Pump Station	Wastewater	97.9	1.7	0.4	0	0	98.4	99.9	99.9	99.9
East Fishkill Treatment Facility	Wastewater	93.8	4.6	1.5	0	0	95.4	99.7	99.9	99.9
Hopewell Recreation	Communication	97.9	1.7	0.4	0	0	99.7	99.9	99.9	99.9
Town Highway Department Garage	Communication	93.8	4.6	1.5	0	0	99.1	99.9	99.9	99.9
Old Sylvan Lake Road	Communication	99.8	0.2	0	0	0	99.9	99.9	99.9	99.9
Woodmont Road (Probst)	Communication	99.5	0.4	0.1	0	0	99.9	99.9	99.9	99.9
IBM West Complex	Communication	93.8	4.6	1.5	0	0	99.1	99.9	99.9	99.9

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
NYSDOT MaintYard / Lime Kiln Road	Communication	99.5	0.4	0.1	0	0	99.9	99.9	99.9	99.9
Interstate 84 Median	Communication	99.8	0.2	0	0	0	99.9	99.9	99.9	99.9
High Tension Tower	Communication	97.9	1.7	0.4	0	0	99.7	99.9	99.9	99.9
High Tension Tower	Communication	99.5	0.4	0.1	0	0	99.9	99.9	99.9	99.9

Source: HAZUS-MH 2.1

Table 5.4.2-16. Estimated Utility Impacts in Town of East Fishkill from the 2,500-year MRP Earthquake Event

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Brettview Water Plant	Potable Water	50.5	19.9	24.4	4.2	1	69.3	95.7	96.9	99.3
Fishkill Plains Plant, Stor Tank & Wells	Potable Water	71.4	15.5	11.9	1.1	0.2	84	98.9	99.2	99.8
Four Corners Water Plant 1	Potable Water	94.9	3.9	1.2	0	0	97.5	99.9	99.9	99.9
Four Corners Water Plant 1	Potable Water	50.5	19.9	24.4	4.2	1	69.3	95.7	96.9	99.3
Four Corners Water Storage Tank	Potable Water	94.9	3.9	1.2	0	0	97.5	99.9	99.9	99.9
Hopewell Glen Water Building	Potable Water	71.4	15.5	11.9	1.1	0.2	84	98.9	99.2	99.8
Hopewell Hamlet Plant, Stor Tank Wells	Potable Water	71.4	15.5	11.9	1.1	0.2	84	98.9	99.2	99.8
Little Switzerland Water Storage Tank	Potable Water	94.9	3.9	1.2	0	0	97.5	99.9	99.9	99.9
Little Switzerland Water TP & PH	Potable Water	94.9	3.9	1.2	0	0	97.5	99.9	99.9	99.9
Pinewood Knolls Pump House & Wells	Potable Water	94.9	3.9	1.2	0	0	97.5	99.9	99.9	99.9
Revere Park Water Plant & Wells	Potable Water	71.4	15.5	11.9	1.1	0.2	84	98.9	99.2	99.8
Shenandoah Water Plant	Potable Water	49.3	20	25.1	4.5	1.1	68.3	95.4	96.7	99.2
Shenandoah Water Storage Tank	Potable Water	96.7	2.6	0.7	0	0	98.4	99.9	99.9	99.9
Taconic Estates Pump House & Wells	Potable Water	50.5	19.9	24.4	4.2	1	69.3	95.7	96.9	99.3
Four Corners - Chestnut St Sewage PSt	Wastewater	71.4	15.5	11.9	1.1	0.2	77.9	97.7	98.8	99.7
Four Corners - Philips Road WWTP	Wastewater	50.5	19.9	24.4	4.2	1	60.3	92.7	95.4	98.7
Four Corners WWTP	Wastewater	94.9	3.9	1.2	0	0	96.2	99.8	99.9	99.9
Hopewell Hamlet Main Sewage PSt	Wastewater	49.3	20	25.1	4.5	1.1	59.2	92.3	95.1	98.6
Hopewell Hamlet Main WWTP	Wastewater	49.3	20	25.1	4.5	1.1	59.2	92.3	95.1	98.6
Leg 2A Sanitary Sewage Pump Station	Wastewater	71.4	15.5	11.9	1.1	0.2	77.9	97.7	98.8	99.7
Penney Lane Sewage Pump Station	Wastewater	70.6	15.7	12.3	1.1	0.2	77.2	97.5	98.8	99.6
Sagamore-Beekman Rd Sew Pump St	Wastewater	94.9	3.9	1.2	0	0	96.2	99.8	99.9	99.9
Sagamore WWTP	Wastewater	94.9	3.9	1.2	0	0	96.2	99.8	99.9	99.9
Town Hall Sewage Pump Station	Wastewater	49.3	20	25.1	4.5	1.1	59.2	92.3	95.1	98.6
Unity Plaza Sewage Pump Station	Wastewater	71.4	15.5	11.9	1.1	0.2	77.9	97.7	98.8	99.7
East Fishkill Treatment Facility	Wastewater	49.3	20	25.1	4.5	1.1	59.2	92.3	95.1	98.6
Hopewell Recreation	Communication	71.4	15.5	11.9	1.1	0.2	92.9	99.2	99.8	99.9
Town Highway Department Garage	Communication	49.3	20	25.1	4.5	1.1	82.7	96.8	99.3	99.8
Old Sylvan Lake Road	Communication	96.7	2.6	0.7	0	0	99.6	99.9	99.9	99.9
Woodmont Road (Probst)	Communication	94.7	4	1.3	0	0	99.2	99.9	99.9	99.9
IBM West Complex	Communication	49.3	20	25.1	4.5	1.1	82.7	96.8	99.3	99.8

Name	Type	Percent Probability of Sustaining Damage					Percent Functionality			
		None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
NYSDOT MaintYard / Lime Kiln Road	Communication	94.7	4	1.3	0	0	99.2	99.9	99.9	99.9
Interstate 84 Median	Communication	96.7	2.6	0.7	0	0	99.6	99.9	99.9	99.9
High Tension Tower	Communication	71.4	15.5	11.9	1.1	0.2	92.9	99.2	99.8	99.9
High Tension Tower	Communication	94.7	4	1.3	0	0	99.2	99.9	99.9	99.9

Source: HAZUS-MH 2.1

HAZUS-MH 2.1 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 (HAZUS-MH Earthquake User's Manual).

For the 100-year MRP event, HAZUS-MH 2.1 estimates approximately no debris will be generated. For the 500-year MRP event, HAZUS-MH 2.1 estimates approximately 1,355 tons of debris will be generated. For the 2,500-year MRP event, HAZUS-MH 2.1 estimates 11,053 tons of debris will be generated.

Table 5.4.2-17. Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Events

500-Year		2,500-Year	
Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
1,106	249	7,908	3,144

Source: HAZUS-MH 2.1

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the Town. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the Town. 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.

New development located in areas with softer NEHRP soil classes (D and E) may be more vulnerable to the earthquake hazard. The potential new development is listed in Table 5.4.2-18 with identified vulnerabilities to earthquake. Refer to Figure 5.4.2-20 for potential new development and NEHRP soil in the Town of East Fishkill.

Table 5.4.2-18 Potential new Development Located In NEHRP D and E Soils

Project Name	Location / Address	Parcel Identification			Type	Number of Potential Structures / Units	Hazard Vulnerability*
		Section	Subsection	Lot			
Hilltop Manor	Creek Bend Road	6457	02	885725	RES	21	NEHRP E Soil
Montage	Route 52/216	6656	00	802836	RES	126	NEHRP D Soil; NEHRP E Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6356	03	410029	RES	12	NEHRP D Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6355	00	410812	RES		NEHRP D Soil
Saxon Woods	Old Fishkill Hook Road/Fishkill	6355	00	317899	RES		NEHRP D Soil

Project Name	Location / Address	Parcel Identification			Type	Number of Potential Structures	Hazard Vulnerability*
	Hook Road						
Sprainbrook Meadows	Townsend Road	6456	04	955335	RES	11	NEHRP E Soil

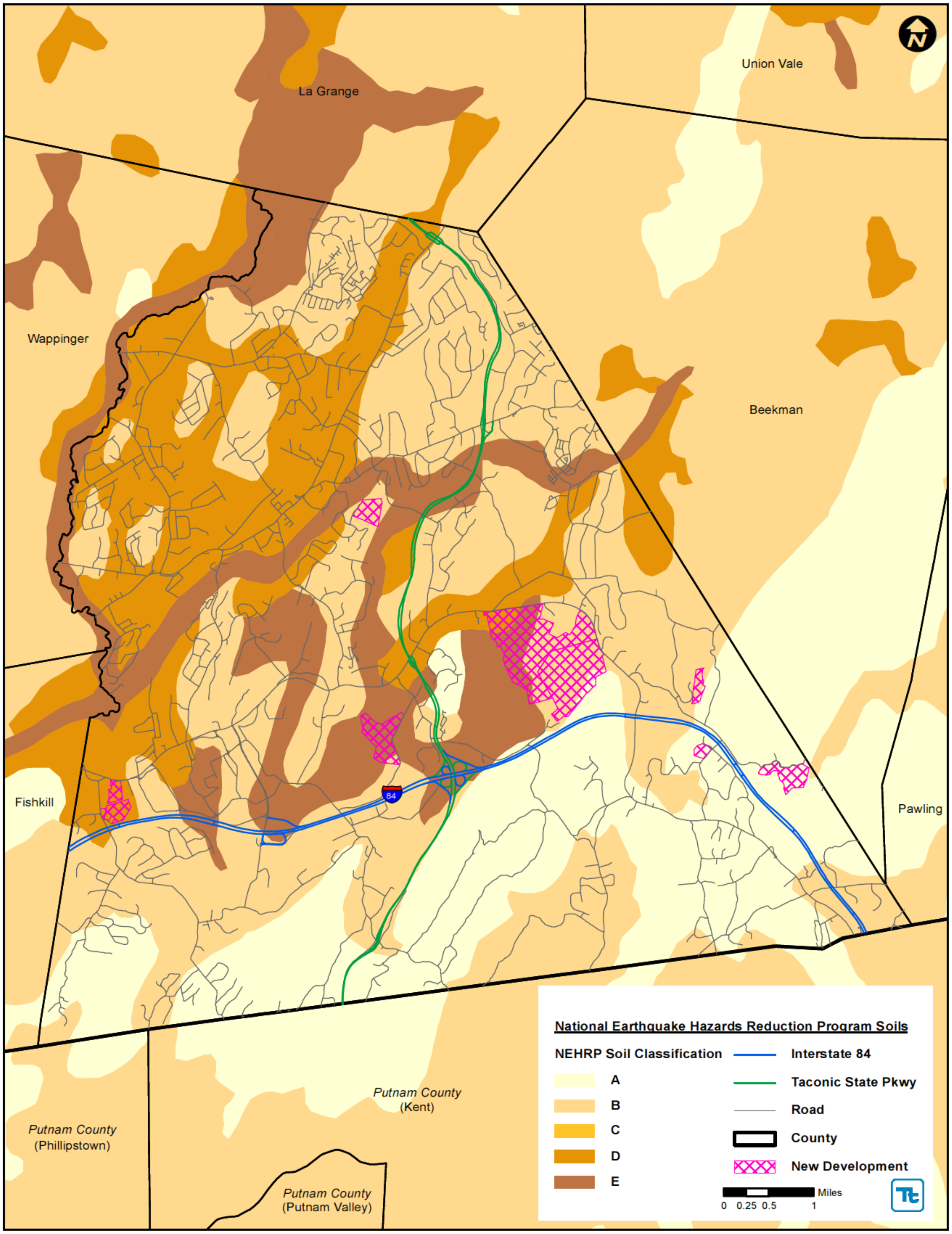
Source: East Fishkill; NYSOEM

Effect of Climate Change on Vulnerability

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. National Aeronautics and Space Administration (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. Increased saturation of soils by more frequent and/or intense storms could increase the risk for liquefaction. 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.

Figure 5.4.2-20 Potential New Development in the Town of East Fishkill and NEHRP Soil Types



Source: Town of East Fishkill; NYSOEM

Additional Data and Next Steps

A Level 2 HAZUS-MH earthquake analysis was conducted for the Town of East Fishkill using the default model data, with the exception of the updated building and critical facility inventories which included user-defined data, and NEHRP soil data. Additional data needed to further refine the Town's vulnerability assessment include: (1) updated demographic data to update the default data in HAZUS-MH; and (2) soil liquefaction data. Additionally, the Town can identify un-reinforced masonry critical facilities and privately-owned buildings (i.e., residences) using local knowledge and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts for these properties can be set in place.

5.4.3 EXTREME TEMPERATURE

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

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 on what the population is accustomed to.

Extreme Cold: Extreme cold events are when temperatures drop well below normal in an area. What constitutes extreme cold and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit (ºF) or below.

Exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems such as hypothermia, cold stress, frostbite or freezing of the exposed extremities such as fingers, toes, nose, and ear lobes. Hypothermia occurs when the core body temperature is <95ºF. If persons exposed to excessive cold are unable to generate enough heat (e.g., through shivering) to maintain a normal core body temperature of 98.6ºF, their organs (e.g., brain, heart, or kidneys) can malfunction. When brain function deteriorates, persons with hypothermia are less likely to perceive the need to seek shelter. Signs and symptoms of hypothermia (e.g., lethargy, weakness, loss of coordination, confusion, or uncontrollable shivering) can increase in severity as the body's core temperature drops. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are particularly at risk, but anyone can be affected (Centers of Disease Control and Prevention [CDC], 2007).

Extremely cold temperatures often accompany a winter storm, so individuals may have to cope with power failures and icy roads. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, individuals may also face indoor hazards. Many homes will be too cold—either due to a power failure or because the heating system is not adequate for the weather. The use of space heaters and fireplaces to keep warm increases the risk of household fires and carbon monoxide poisoning.

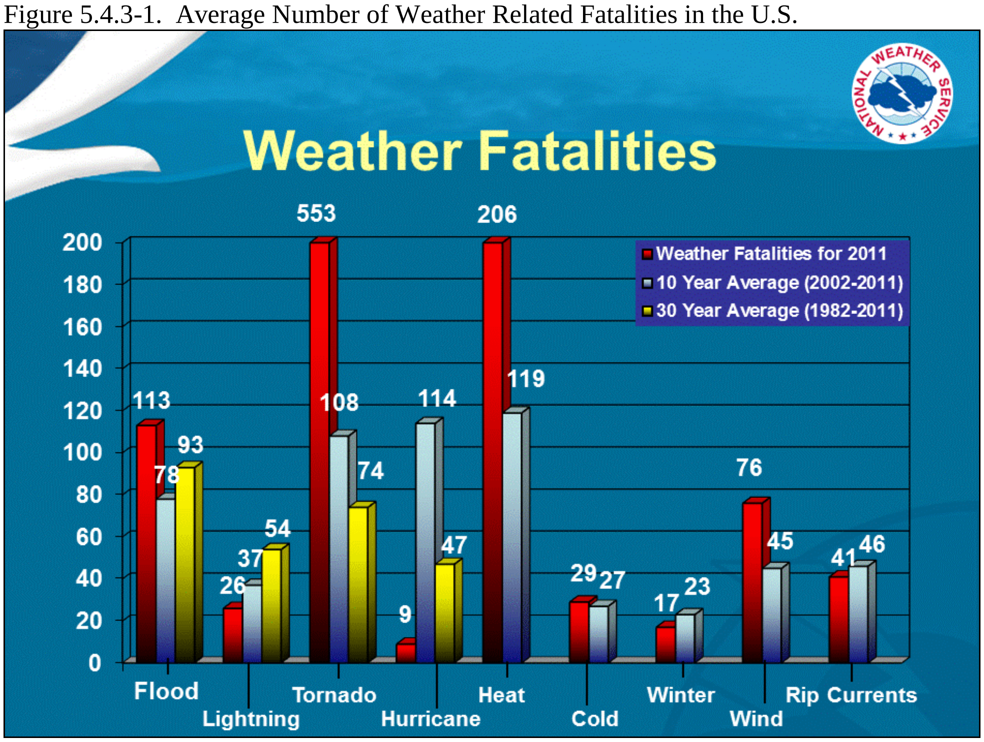
During cold months, carbon monoxide may be high in some areas because the colder weather makes it difficult for car emission control systems to operate effectively. Carbon monoxide levels are typically higher during cold weather because the cold temperatures make combustion less complete and cause inversions that trap pollutants close to the ground (U.S. Environmental Protection Agency [USEPA], 2009).

Extreme Heat: Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat (FEMA *Ready*, Date Unknown; CDC, 2007). 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 (FEMA *Ready*, Date Unknown; NWS, Date Unknown). There is no universal definition of a heat wave because the term is relative to the usual weather in a particular area. The term heat wave is applied both to routine weather variations and to extraordinary spells of heat which may occur only once a century (Meehl and Tebaldi, 2004). A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population (Robinson, 2000). The Weather Channel uses the following criteria for a heat wave in the U.S.: a minimum of 10 states with greater than or equal to 90°F temperatures and the temperatures must be at least five degrees above normal in parts of that area for at least two days or more (The Weather Channel, 1995-2010; NWS, Date Unknown).

Depending on severity, duration and location; extreme heat events can create or provoke secondary hazards including, but not limited to, dust storms, droughts, wildfires, water shortages and power outages (FEMA *Ready*, Date Unknown; CDC, 2007). This could result in a broad and far-reaching set of impacts throughout a local area or entire region. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy and infrastructure; and losses of ecosystems, wildlife habitats and water resources (Adams, Date Unknown; Meehl and Tebaldi, 2004; CDC, 2007; NYS HMP, 2011).

Extreme heat is the number one weather-related cause of death in the U.S. On average; more than 1,500 people die each year from excessive heat. This number is greater than the 30-year mean annual number of deaths due to tornadoes, flooding, hurricanes and lightning combined. In 2006, New York State reported 42 heat-related fatalities (NOAA, Date Unknown). Figure 5.4.3-1 shows the number of weather fatalities based on a 10 year average and 30 year average. Heat has the highest average of weather related fatalities between 2000 and 2009.

Figure 5.4.3-1. Average Number of Weather Related Fatalities in the U.S.



Source: NOAA, 2012

Urbanized areas and urbanization creates an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. As defined by the U.S. Census Bureau, urban areas are classified as all territory, population, and housing units located within urbanized areas and urban clusters. The term urbanized area denotes an urban area of 50,000 or more people. Urban areas under 50,000 people are called urban clusters. The U.S. Census delineates urbanized area and urban cluster boundaries to encompass densely settled territory, which generally consists of:

- A cluster of one or more block groups or census blocks each of which has a population density of at least 1,000 people per square mile at the time.
- Surrounding block groups and census blocks each of which has a population density of at least 500 people per square mile at the time.
- Less densely settled blocks that form enclaves or indentations, or are used to connect discontiguous areas with qualifying densities (U.S. Census Bureau, 2010).

Approximately 47-percent of the world's population lives in urban areas. This number is expected to increase by two-percent each year between 2000 and 2015. Urbanization is caused by natural growth of the urban population and migration of the rural population towards cities. As these urban areas develop and change, so does the landscape. Buildings, roads and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (USEPA, 2011).

The term 'heat island' describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than one million people can be between 1.8 and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50 to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality (USEPA, 2011). Detailed information regarding the affects of heat islands are described below.

- Elevated summer temperatures increase the energy demand for cooling. Research has shown that for every 1ºF, electricity demand increases between 1.5 and 2-percent, starting when temperatures reach between 68 and 77ºF. Urban heat islands increase overall electricity demand, as well as peak demand. This generally occurs during hot, summer afternoons when homes and offices are running cooling systems, electricity and appliances. During extreme heat events, the demand for cooling can overload systems and require utility companies to institute controlled brownouts or blackouts to prevent power outages (USEPA, 2011).

- Urban heat islands raise the demand for electricity during the summer. Companies that provide the electricity generally rely on fossil fuel power plants to meet the demand. This can lead to an increase in air pollution and greenhouse gas emissions. The primary pollutants include sulfur dioxide (SO_2), nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and carbon dioxide (CO_2). These can all contribute to global climate change. Elevated temperatures can also directly increase the rate of ground-level ozone formation. Ground-level ozone is formed when NOx and volatile organic compounds (VOCs) react to the presence of sunlight and hot weather (USEPA, 2011).

- Increased temperatures and higher air pollution levels can affect human health by causing discomfort, respiratory difficulties, heat cramps and exhaustion, heat stroke, and mortality. Heat islands can also intensify the impact of heat waves. High risk populations are at particular risk from extreme heat events (USEPA, 2011).

- Urban areas often have many buildings and paved areas. During the hot, summer months, high pavement and rooftop surface temperatures can heat stormwater runoff. Pavements that are 100ºF can elevate initial rainwater temperature from approximately 70ºF to over 95ºF. The heated stormwater usually becomes runoff and drains into storm sewers and raises water temperatures of streams, river, ponds and lakes. Water temperature affects aquatic life. Rapid temperature changes in aquatic ecosystems from stormwater runoff can be stressful and sometimes fatal to aquatic habitats (USEPA, 2011).

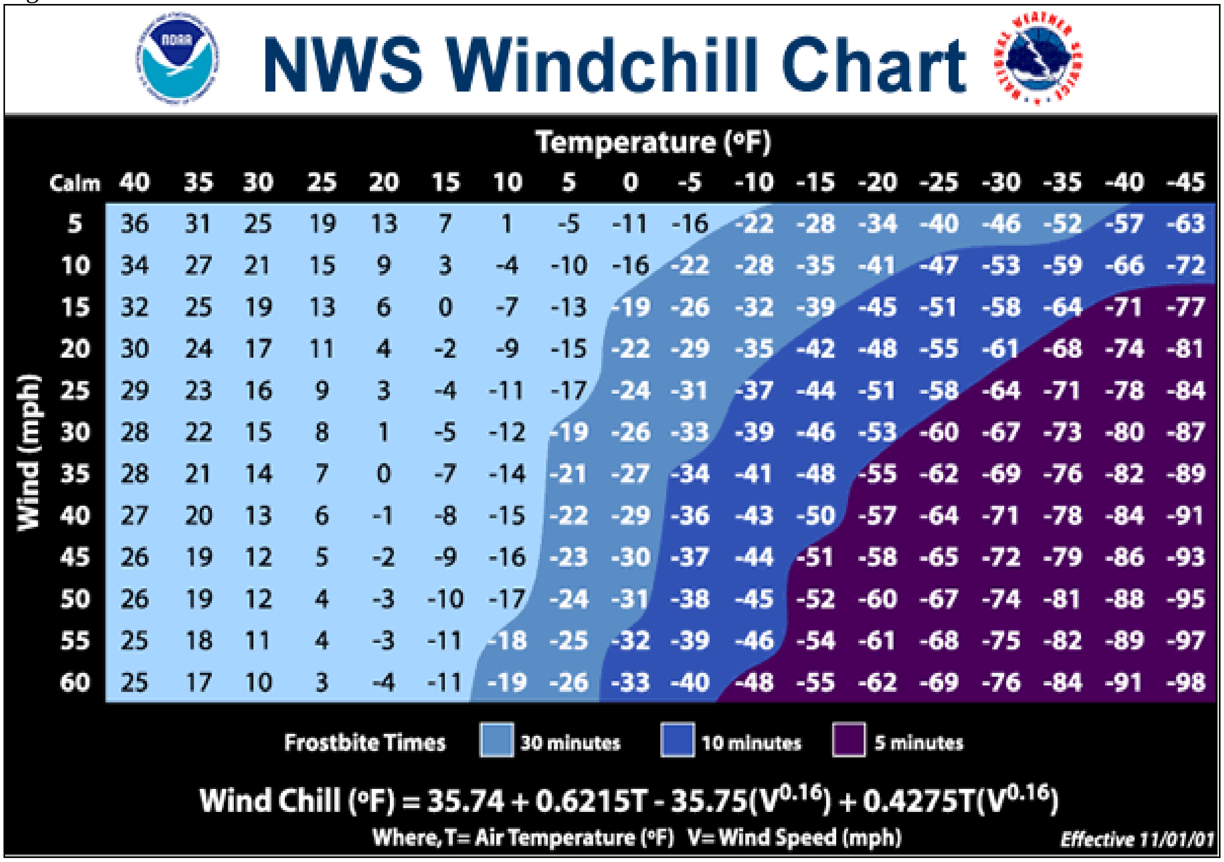
Extent

Extreme Cold Temperatures

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature (WCT) Index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (NWS, 2009).

On November 1, 2001, the NWS implemented a new WCT Index. It was designed to more accurately calculate how cold air feels on human skin. Figure 5.4.3-2 shows the new WCT Index. The Index includes a frostbite indicator, showing points where temperature, wind speed and exposure time will produce frostbite to humans. The chart shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops (NWS, 2009).

Figure 5.4.3-2. NWS Wind Chill Index



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

Source: NWS, 2009

According to the New York State Climate (NYSC) Office of Cornell University, cold winter temperatures prevail over New York State whenever Arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay. High-pressure systems often move just off the Atlantic coast, become more or less stagnant for several days, and then a persistent airflow from the southwest or south affects 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. The highest temperature of record in New York State is 108° at Troy on July 22, 1926. Temperatures of 107° have been observed at Lewiston, Elmira, Poughkeepsie, and New York City. The record coldest temperature is -52° at Stillwater Reservoir (northern Herkimer County) on February 9, 1934 and also at Old Forge (also northern Herkimer County) on February 18, 1979. Some 30 communities have recorded temperatures of -40° or colder, most of them occurring in the northern one-half of the state and the remainder in the Western Plateau Climate Division and in localities just south of the Mohawk Valley (NYSC, Date Unknown).

Extreme Heat Temperatures

The extent of extreme heat temperatures are generally measured through the Heat Index, identified in Table 5.4.3-1. Created by the NWS, the Heat Index is a chart which accurately measures apparent temperature of the air as it increases with the relative humidity. The Heat Index can be used to determine what effects the temperature and humidity can have on the population (NYS HMP, 2011).

Table 5.4.3-1. Heat Index Chart

		Temperature (°F)															
Relative Humidity (%)		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	128	136					
	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										

Source: NYS HMP, 2011

Table 5.4.3-2 describes the adverse effects that prolonged exposure to heat and humidity can have on an individual.

Table 5.4.3-2. Adverse Effects of Prolonged Heat Exposure

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke / Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

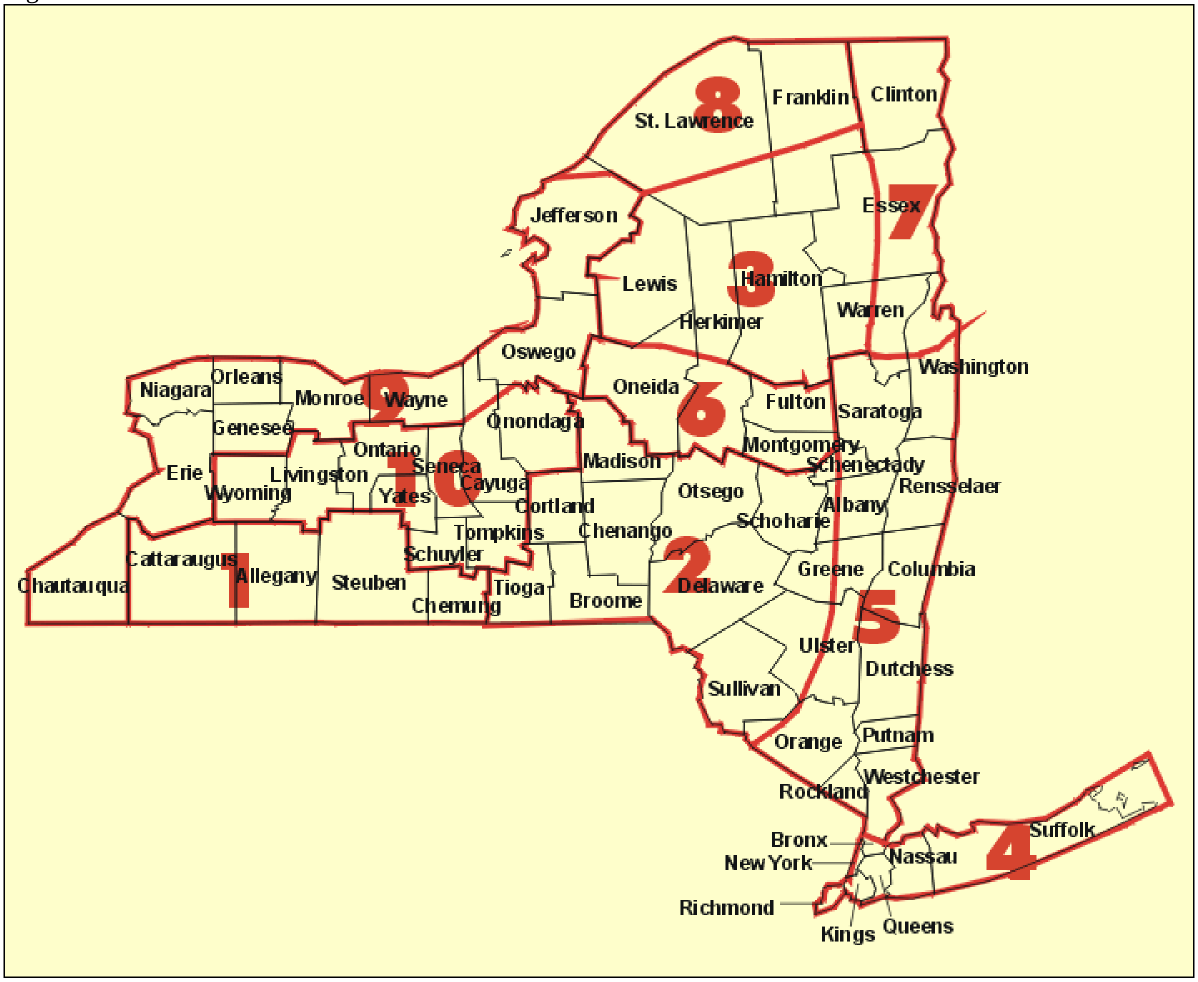
Source: NYS HMP, 2011

To determine the Heat Index, one needs to know the temperature and relative humidity. Once both values are known, the Heat Index will be the corresponding number with both values. That number provides a temperature that the body feels. It is important to know that the Heat Index values are devised for shady, light wind conditions. Exposure to full sunshine can increase the Heat Index by up to 15 degrees (NYS HMP, 2011).

Location

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. According to NCDC, "Climatic divisions are regions within each state that have been determined to be reasonably climatically homogeneous" (NWS, 2005; NCDC, 2010.) The Town of East Fishkill is located within the Hudson Valley Climate Division. Figure 5.4.3-3 depicts the climate divisions in New York State.

Figure 5.4.3-3. New York State Climate Divisions



Source: NWS, 2005

Note: (1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Champlain Valley; (7) St. Lawrence Valley; (8) Great Lakes; and (10) Central Lakes.

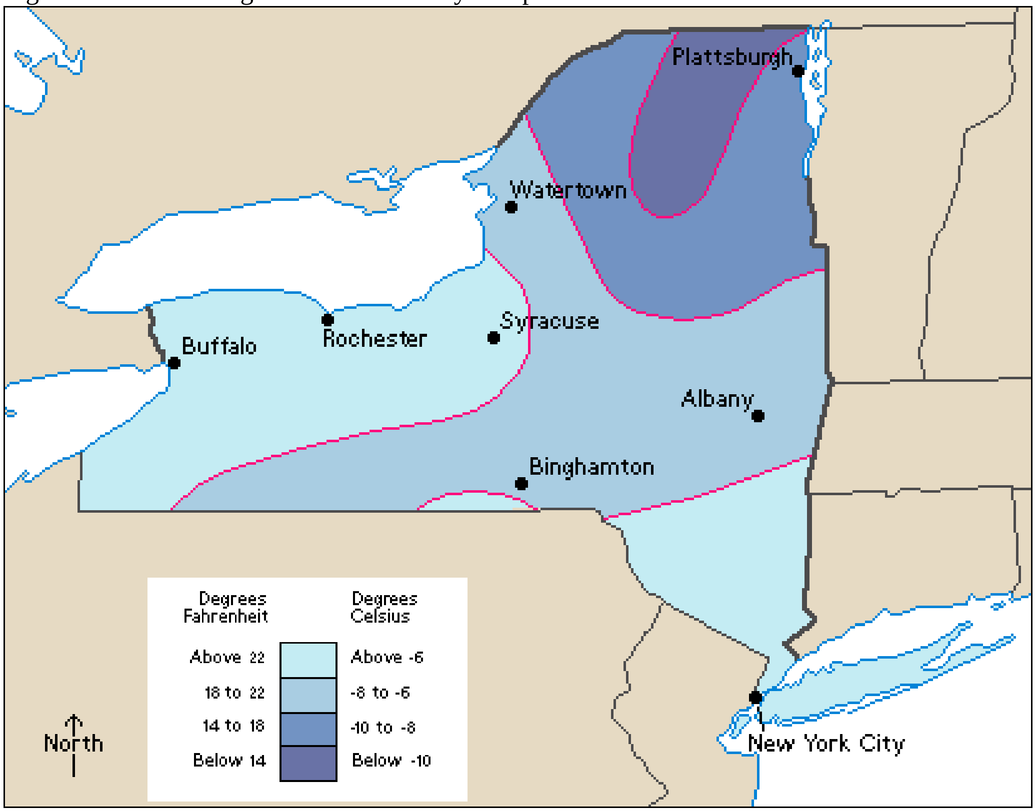
During the winter months in the southern portion of the Hudson Valley Climate Division, the coldest temperatures during most winters range between 0ºF and -10ºF. The New York City area experiences below zero minimums in two or three winters out of 10, with the low temperature typically near -5ºF (NYSC, Date Unknown).

The southern portions of the Hudson Valley Climate Division and the New York City area have warm summers, with some periods of high humidity. Temperature averages range from 18 to 25 days with temperatures greater than 90ºF. Temperatures of 100ºF area rare, many long-term weather stations, especially those in the southern half of New York State, have recorded maximums in the 100ºF to 105ºF range (NYSC, Date Unknown).

Extreme Cold Temperatures

Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the State. The NYSC Office of Cornell University indicates that cold temperatures prevail over the State whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (NYSC, Date Unknown). Figure 5.4.3-4, identifies the average January temperatures of the State, with the northeast sections experiencing the coldest conditions and the west and southeast experiencing the mildest winters.

Figure 5.4.3-4. Average Statewide January Temperatures



Source: World Book Inc., 2007

Many atmospheric and physiographic controls on the climate result in a considerable variation of temperature conditions over New York State. The average annual mean temperature ranges from about 40°F in the Adirondacks to near 55°F in the New York City area. In January, the average mean temperature is approximately 16°F in the Adirondacks and St. Lawrence Valley, but increases to about 26°F along Lake Erie and in the lower Hudson Valley (Westchester County) and to 31°F on Long Island. The record coldest temperature in New York State is -52°F at Stillwater Reservoir (northern Herkimer County) on February 9, 1934. Approximately 30 communities have recorded temperatures of -40°F or colder, most of them occurring in the northern half of New York State and the remainder in the Western Plateau Climate Division and in localities just south of the Mohawk Valley (Earth System Research Laboratory [ESRL], Date Unknown; NYSC, Date Unknown).

The Town of East Fishkill falls within the Hudson Valley Division (Division 5) (NCDC, Date Unknown; ERSL, Date Unknown). Winter temperatures in this division are moderated by the Atlantic Ocean. The coldest temperatures in most winters range between 0° and -10°F. Long Island and New York City experience below zero minimums in two or three winters out of 10, with the low temperature generally near -5°F (NYSC, Date Unknown).

As provided by The Weather Channel, average high and low temperatures during the winter months in the Hamlet of Hopewell Junction located within the Town of East Fishkill are identified in Table 5.4.3-3.

Table 5.4.3-3. Average High and Low Temperature Range for Winter Months in Hopewell Junction, NY

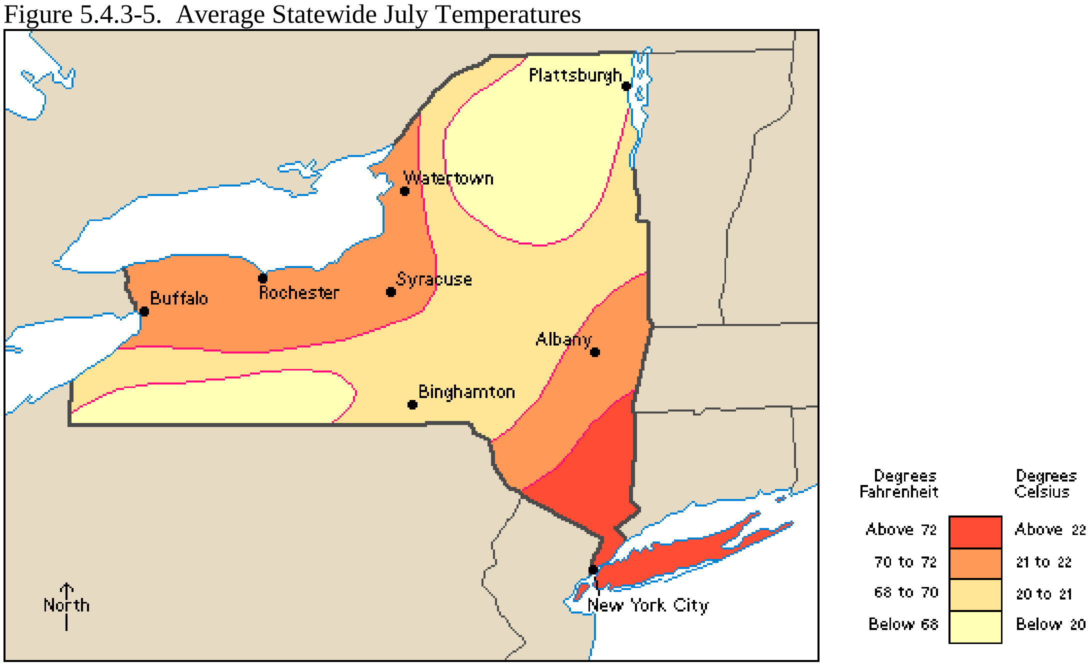
Month	Average High	Average Low	Record Low Event(s)
January	34 °F	16°F	-22 °F (1994)
February	39°F	19 °F	-11 °F (1996)
March	49°F	27 °F	-2°F (2003)
November	51°F	42 °F	11°F (2000)
December	39°F	22°F -30 °F	-1 °F (2004)

Source: The Weather Channel, 2012

Extreme Heat Temperatures

Extreme heat temperatures of varying degrees are existent throughout the State for most of the summer season, except for areas with high altitudes. Figure 5.4.3-5 identifies the average July temperatures of the State, with the southeast and northwest sections experiencing the hottest conditions.

Figure 5.4.3-5. Average Statewide July Temperatures



Source: World Book Inc., 2008

As provided by The Weather Channel, average high and low temperatures during the summer months in the Hamlet of Hopewell Junction located within the Town of East Fishkill are identified in Table 5.4.3-4.

Table 5.4.3-4. Average High and Low Temperature Range for Summer Months in in Hopewell Junction, NY

Month	Average High	Average Low	Record High Event(s)
May	72ºF	48ºF	96ºF in 1996
June	78ºF	57ºF	93ºF in 1999
July	83ºF	62ºF	100ºF in 1991
August	81ºF	61ºF	101ºF in 2001
September	74ºF	53ºF	92ºF in 1999

Source: The Weather Channel, 2012

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Dutchess County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events that may have impacted East Fishkill could vary. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

The National Weather Service Forecast Office operates an online annual temperature extremes database, otherwise known as "NOWData". The data set contains the annual maximum and minimum temperature records for stations in the U.S. Each station has a cooperative observer system i.d. number (coop number). In New York City Cooperative Area, there are over 25 stations on record; however, none within the Town of East Fishkill. Not every city, town and/or village in New York State contains a station. The closest station is located in the Village of Walden (Orange County), less than twenty miles west of the Town of East Fishkill (MRCC, 2010).

There may be some potential problems with the data collected at the stations. The values of the all-time records for stations with brief histories are limited in accuracy and could vary from nearby stations with longer records. Although the data sets have been through quality control, there is still a need for more resources to quality control extremes. The record sets are for single stations in the cooperative observer network and are limited to the time of operation of each station under one coop number. The records for a place may need to be constructed from several individual station histories. Some of the data may vary from NWS records due to NWS using multiple stations and additional sources like record books (MRCC, Date Unknown).

Based on the NWS data, Table 5.4.3-5 presents the extreme cold (minimum) and hot (maximum) temperature records for the Village of Dobbs Ferry from 1945 to 2003.

Table 5.4.3-5. MRCC Temperature Extremes – Town of East Fishkill

Station ID	Name	Begin	End	Max (ºF)	Max Date	Min (ºF)	Min Date
308906	WALDEN 1 ESE	1973	2012	100	7/16/1995	-27	1/21/1994

Source: MRCC, 2012
Notes: Begin Year is when the data collection began; End Year is when the data collection stopped.

Between 1954 and 2010, New York State was not included in any major disaster declarations or emergency declarations due to extreme temperatures. Information regarding specific details of temperature extremes in East Fishkill is scarce; therefore, previous occurrences and losses associated with extreme temperature events are limited and are based in County-level data. Table 5.4.3-6 summarizes the extreme temperature events effecting the Town of East Fishkill or Dutchess County.

Table 5.4.3-6. Extreme Temperature Events between 1950 and 2012

Event Date / Name	Location	Losses / Impacts	Source(s)
Record Heat July 15, 1995	Dutchess County	High pressure over the Mid-Atlantic states produced a southerly flow of hot and humid air across the Northeast. Poughkeepsie established a new record high for the date when the temperature reached 106 degrees. Hopewell Junction reached 97 degrees setting a new record high for that date.	NOAA-NCDC
Cold / Wind Chill January 25-26, 2007	Dutchess County	An arctic airmass moved into east central New York State late Thursday night on January 25th, and remained in place into Friday, January 26th. Early morning low temperatures on Friday ranged between five degrees above zero and five degrees below zero. The coldest temperature recorded on January 26th at Hopewell Junction was 3 degrees. In addition, wind speeds between 10 and 20 mph produced windchills as low as ten degrees below zero at Hopewell Junction.	NOAA-NCDC, WeatherUnderground.com
Heat Wave June 9-10, 2008	Dutchess County	Unseasonably hot and humid conditions persisted from Monday June 9th, until Tuesday afternoon on June 10th. Temperatures reached a record 97 degrees at Hopewell Junction. The combination of high temperatures and humidity levels up to 90% produced heat indices of up to 101 degrees. Many schools across the region either cancelled classes, or had early dismissals due to the extreme heat.	NOAA-NCDC, WeatherUnderground.com
Cold / Wind Chill January 1, 2009	Dutchess County	The combination of gusty winds, and low temperatures during the early morning hours of Thursday January 1st produced wind chills of -6 F in Hopewell Junction.	NOAA-NCDC, WeatherUnderground.com
Cold / Wind Chill January 16, 2009	Dutchess County	A bitterly cold air mass spread across much of east central New York and adjacent western New England during Friday January 16th. Widespread subzero temperatures were recorded across the region, with temperatures as low as -5 degrees in Hopewell Junction. In addition, some wind added to the extreme cold across portions of the southern Adirondacks and eastern Catskills, with wind chills of -20 to -25 F.	NOAA-NCDC
Arctic Blast January 23-24, 2011	Dutchess County	Bitterly cold air settled into the region as Canadian high pressure built in. Temperatures plummeted to 5 to 30 degrees below zero across east central New York. Brisk westerly winds diminished during the evening, becoming light and variable to calm after midnight. The winds resulted in wind chill readings of 10 to 40 degrees below zero throughout Dutchess County, and as low as -13 degrees at Hopewell Junction. Numerous schools were closed or had delayed starts across east central New York due to the extreme cold. Amtrak temporarily suspended service between Albany and New York City because the extreme cold caused some signals, switches and equipment to freeze.	NOAA-NCDC

Note (1): This table does not represent all events that may have occurred throughout Dutchess County and East Fishkill due to a lack of detail and/or their minor impact upon the County and Town. NOAA-NCDC storm query indicated that Dutchess County has experienced 11 temperature extremes between 1960 and 2012, many of which affected a large region of New York State.

NOAA-NCDC	National Oceanic Atmospheric Administration – National Climate Data Center
NWS	National Weather Service
NYS	New York State
SHELDUS	Spatial Hazard Events and Losses Database for the United States

Probability of Future Events

Several extreme temperature events occur each year throughout Dutchess County and the Town of East Fishkill. It is estimated that the Town will continue to experience extreme temperatures annually that may induce secondary hazards such potential snow, hail, ice or wind storms, thunderstorms, drought, human health impacts, utility failure and transportation accidents as well as many other anticipated impacts.

Based on historical records and input from the Town, the probability of occurrence for extreme temperatures in the Town of East Fishkill is considered 'frequent' (hazard event is likely to occur within 25 years).

The Role of Global Climate Change on Future Probability

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).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. East Fishkill is part of Region 5, Hudson and Mohawk River Valley. Some of the issues in this major river region, affected by climate change, include: saltwater front mover further up the Hudson River, potential contamination of New York City's back-up water supply, propagation of storm surge up the Hudson from the coast, and popular apple varieties decline (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3ºF by the 2020s, 3 to 5.5ºF by the 2050s and 4 to 9ºF by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.3-7 displays the projected seasonal precipitation change for the Hudson and Mohawk River Valley ClimAID Region (NYSERDA, 2011).

Table 5.4.3-7. 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

It is important to understand that directly linking any one specific extreme event (for example, a severe hurricane) to climate change is not possible. However, climate change and global warming may increase the probability of some ordinary weather events reaching extreme levels or of some extreme events becoming more extreme (USEPA, 2006). It is uncertain exactly how climate change will impact extreme temperature events. Predictions include heat waves becoming more frequent and intense, increasing heat-related illness and death, and posing new challenges to the energy system, air quality, and agriculture. New York State, with its irregular, intense heat waves, could be especially susceptible (USEPA, 1997).

However, overall winter temperatures in New York State are almost five degrees warmer than in 1970 (NYSDEC, Date Unknown) (http://www.dec.ny.gov/energy/63848.html). The State has seen 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 to 50% by end of the next century. (DeGaetano et al [Cornell University], 2010) (http://files.campus.edublogs.org/blogs.cornell.edu/dist/8/90/files/2011/03/ny_changing_climate.pdf).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the extreme temperature events, the entire Town of East Fishkill is considered the hazard area. Therefore, all assets in the Town (population, structures, critical facilities and lifelines), as described in the Town Profile (Section 4), are vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on the Town of East Fishkill including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health 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 of this hazard over time

Overview of Vulnerability

Extreme temperatures generally occur for a short period of time but can cause a range of impacts, particularly to vulnerable populations that may not have access to adequate cooling or heating. This natural hazard can also cause impacts to agriculture (crops and animals), infrastructure (e.g., through pipe bursts associated with freezing, power failure) and the economy.

Data and Methodology

At the time of this Plan, insufficient data is available to model the long-term potential impacts of extreme temperature on the Town of East Fishkill. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

For the purposes of this HMP, the entire population in the Town of East Fishkill is vulnerable to extreme temperature events. Refer to Section 4 for a summary of population statistics for the Town. Extreme temperature events have potential health impacts including injury and death.

According to the Centers for Disease Control and Prevention, 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 who are physically ill (e.g., heart disease or 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, 2006).

Meteorologists can accurately forecast extreme heat 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 of the building stock in the Town is exposed to the extreme temperature hazard. Refer to Section 4 which summarizes the building inventory in the Town of East Fishkill. Extreme heat generally does not impact buildings. Losses may be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

Impact on Critical Facilities

All critical facilities in the Town of East Fishkill are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as described for general building stock (above). Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failure, commonly referred to as "brown-outs", due to increased usage from air conditioners, appliances, etc. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption as well. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage/loss of inventory. Business-owners may 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, telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage due to extreme temperature events. Extreme heat events can result in drought and dry conditions and directly impact livestock and crop production.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as extreme temperature events. While predicting changes of extreme temperature events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

The 2011 'Responding to Climate Change in New York State' report was prepared for New York State Energy Research and Development Authority to study the potential impacts of global climate change on New York State. The report indicates it is very likely that New York State will continue to experience increased temperatures through the 21st century. Heat waves are projected to become more frequent and intense. Higher summer temperatures will result in an increased stress on people, plans, animals and the environment. Increased temperatures may cause higher ozone concentrations in urban areas which can negatively impact vulnerable population's respiratory health. In addition, higher temperatures will likely increase the demand for electricity for cooling and cause more heat-related deaths. Meanwhile, increased winter temperatures will mean fewer cold-related deaths. It is clear that temperature changes will impact the population and economy of New York State (NYSERDA, 2011).

Future Growth and Development

Areas targeted for potential future growth and development in the next five (5) years have been identified across the Town (refer to Section 4). It is anticipated that any new development and new residents will be exposed to the extreme temperature hazard.

Additional Data and Next Steps

For future plan updates, the Town can track data on extreme temperature events, obtain additional information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe freeze, agricultural losses and other impacts. This will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated extreme heath/cold events may be feasible as data is gathered and improved.

5.4.4 FLOOD

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

HAZARD PROFILE

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

Description

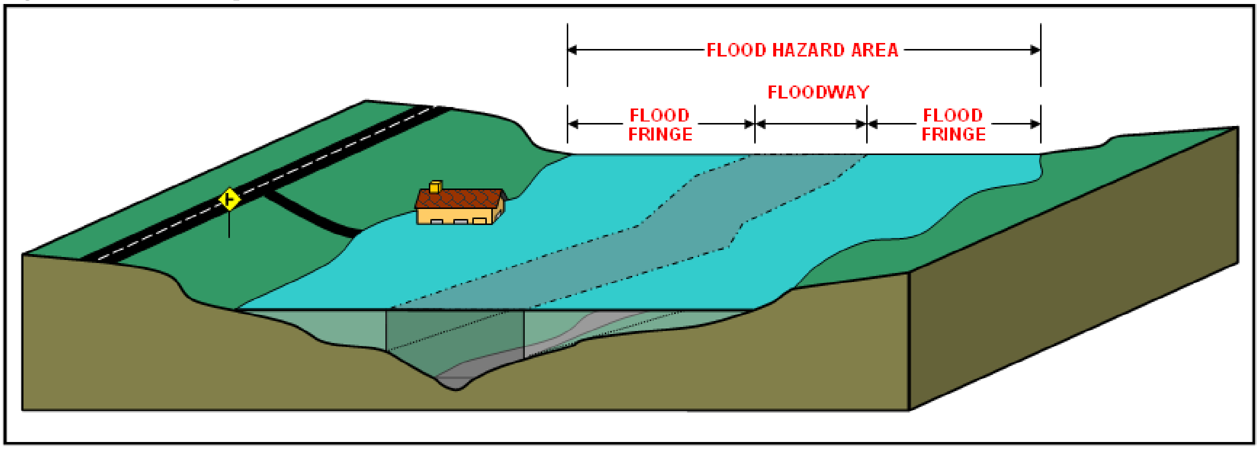
Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (Federal Emergency Management Agency [FEMA], 2011). Most communities in the U.S. have experienced some kind of flooding, after spring rains, heavy thunderstorms, coastal storms, or winter snow thaws (George Washington University, 2001). Floods are the most frequent and costly natural hazards in New York State in terms of human hardship and economic loss, particularly to communities that lie within flood prone areas or flood plains of a major water source. As defined in the NYS HMP, flooding is a general and temporary condition of partial or complete inundation on normally dry land from the following:

- Riverine flooding, including overflow from a river channel, flash floods, alluvial fan floods, dam-break floods and ice jam floods;
- Local drainage or high groundwater levels;
- Fluctuating lake levels;
- Coastal flooding;
- Coastal erosion (NYS HMP, 2011);
- Unusual and rapid accumulation or runoff of surface waters from any source;
- Mudflows (or mudslides);
- Collapse or subsidence of land along the shore of a lake or similar body of water caused by erosion, waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above (Floodsmart.gov, 2012);
- Sea Level Rise; or
- Climate Change (USEPA, 2011).

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. Most often floodplains are referred to as 100-year floodplains. A 100-year floodplain is not the flood that will occur once every 100 years, rather it is the flood that has a one-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. With this term being misleading, FEMA has properly defined it as the one-percent annual chance flood. This one percent annual chance flood is now the standard used by most Federal and State agencies and by the National Flood Insurance Program (NFIP) (FEMA, 2003).

Figure 5.4.4-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 5.4.4-1. Floodplain



Source: NJDEP, Date Unknown

Many floods fall into three categories: riverine, coastal, and shallow (FEMA, 2009). Other types of floods may include ice-jam floods, alluvial fan floods, dam failure floods, and floods associated with local drainage or high groundwater (as indicated in the previous flood definition). For the purpose of this HMP and as deemed appropriate by East Fishkill project team, riverine/flash, dam failure and ice jam flooding are the main flood types of concern for the Planning Area. These types of flood or further discussed below.

Riverine/Flash Floods – Riverine floods are the most common flood type and 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 (FEMA, 2009; The Illinois Association for Floodplain and Stormwater Management, 2006).

Flash floods are "a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters" (NWS, 2004).

Ice-Jam Floods – An ice jam is an accumulation of ice that acts as a natural dam and restricts flow of a body of water. Ice jams occur when warm temperatures and heavy rains cause rapid snow melt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and often pile up near narrow passages and obstructions (bridges and dams). Ice jams may build up to a thickness great enough to raise the water level and cause flooding (NESEC, Date Unknown; U.S. Army Corps of Engineers [USACE], 2002).

There are two different types of ice jams: freeze-up and breakup. Freeze-up jams occur in the early to mid-winter 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. The ice cover breakup is usually associated with a rapid increase in runoff and corresponding river discharge due to a heavy rainfall, snowmelt or warmer temperatures (USACE, 2002).

Dam Failure Floods – 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. 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 affect a dam's primary function of impounding water (FEMA, 2010). 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);
- 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, 2011).

The dam failure hazard is further discussed in Section 5.4.1, Dam Failure Hazard Profile.

Extent

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).

The severity of a flood 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, 2008).

Location

Flooding is the primary natural hazard in New York State because the State exhibits a unique blend of climatological and meteorological features that influence the potential for flooding. These factors include topography, elevations, latitude and water bodies and waterways. Flooding is the primary natural hazard in New York State and they occur in every part of the State. Some areas are more flood-prone than others, but no area is exempt, including the Town of East Fishkill. There are over 52,000 miles of river and streams in New York State, and along their banks there are 1,480 communities that are designated as flood prone. It is estimated that 1.5 million people live in these flood-prone areas. Millions more work, travel through or use recreational facilities located in areas subject to flooding. Areas outside recognized and mapped flood hazard zones can also experience flooding (NYS HMP, 2011).

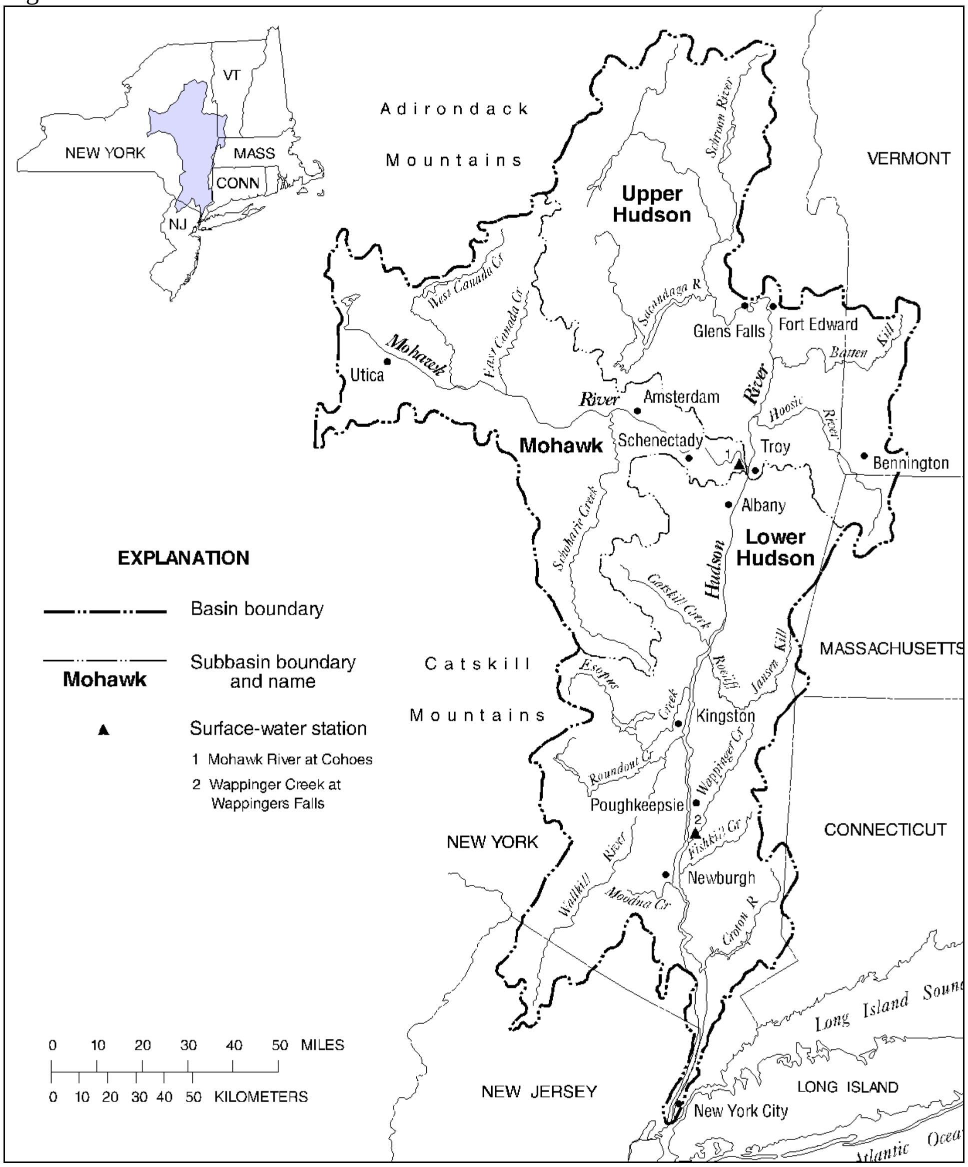
The NYSDEC conducted a vulnerability assessment that depicted how vulnerable a county may be to flood hazards. This was determined by a rating score; each county accumulated points based on the value of each vulnerability indicator. The higher the indication for flood exposure, the more points assigned, resulting in a final rating score. The result of this assessment presented an indication of a county's vulnerability to the flood hazard. Dutchess County's rating is 23, out of a possible 35. The rating was based on number of NFIP insurance policies, number of NFIP claims, total amount of NFIP claims, total amount of NFIP policy coverage, number of repetitive flood loss properties, and number of flood disasters (NYS HMP, 2011).

Riverine flooding problems are most severe in the Delaware, Susquehanna, Chemung, Erie-Niagara, Genesse, Allegany, Hudson and Mohawk River Basins (NYS HMP, 2011). The Town of East Fishkill is part of the Fishkill Creek and Croton Watersheds, within the greater Hudson River drainage basin (DutchessWatersheds.org).

Hudson River Basin and the Lower Hudson River Watershed

Located in southeastern New York State, the Lower Hudson River Basin makes up about 40% of the larger Hudson/Mohawk River Basin, which is one of the largest drainage areas on the eastern seaboard of the United States. Most of this 12,800 square mile basin lies in New York State, with small portions in New Jersey, Connecticut, Massachusetts and Vermont, as shown in Figure 5.4.4-2 below. The Lower Hudson Watershed extends from the Battery at the southern end of Manhattan to the Troy Dam at the confluence of the Mohawk River. Along this entire 153 mile reach the Hudson is actually a tidal estuary, rather than a river (NYSDEC, 2012).

Figure 5.4.4-2. Hudson River Basin



Source: Freeman, 1991

The major waterways of this watershed includes the Croton River (NYSDEC, 1998), a tributary of which drains the southeast area of East Fishkill. The Fishkill Creek, the most prominent water feature in East Fishkill, is also located in the lower Hudson River Watershed.

While most of the Croton Watershed lies outside of Dutchess County in Putnam and Westchester Counties, and western Connecticut, the northernmost part of the watershed is located in the Dutchess County towns of East Fishkill, Beekman, and Pawling. The Croton River Watershed is also part of the municipal drinking water system (East of Hudson Watersheds) that provides drinking water for New York City. Because parts of the town lie within the East of Hudson Croton watershed, for which a total maximum daily load (TMDL) for pollutant loading has been developed, the Town of and East Fishkill is referred to as an “additionally designated MS4,” and has to comply with more stringent MS4 (municipal separate storm sewer systems) requirements (DutchessWatersheds.org).

The Fishkill Creek watershed, located in Dutchess and Putnam Counties, NY drains approximately 193 square miles (123,627 acres) in eleven Dutchess County and three Putnam County municipalities. The main stem of the Fishkill Creek is the main surface water feature in East Fishkill, and through its tributaries drains large sections of the Town of East Fishkill. Fishkill Creek flows from east to west through the north-central portion of the Town. The Sprout Creek, Fishkill Creek's largest tributary, drains smaller portions the Town in the northeast. Whortlekill Creek and Wiccopee Creek are also tributaries, draining the north-central and southwestern portions of the town, respectively (EF Comp Plan, 2001).

FEMA Flood Hazard Areas

According to FEMA, flood hazard areas are defined as areas that are shown to be inundated by a flood of a given magnitude on a map. These areas are determined using statistical analyses of records of riverflow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FEMA's Flood Insurance Rate Maps (FIRM), which are official maps of a community on which the Federal Insurance and Mitigation Administration has indicated both the Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community. These maps identify the SFHAs; the location of a specific property in relation to the SFHA; the base (100-year) flood elevation (BFE) at a specific site; the magnitude of a flood hazard in a specific area; the undeveloped coastal barriers where flood insurance is not available and locates regulatory floodways and floodplain boundaries (100-year and 500-year floodplain boundaries) (FEMA, 2003; FEMA, 2004; FEMA, 2006; FEMA, 2010).

The land area covered by the floodwaters of the base flood is the SFHA on a FIRM. It is the area where the National Flood Insurance Programs (NFIP) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V. (FEMA, 2012). This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps showing the extent of the base flood and likely depths that will be experienced. The base flood is often referred to as the "100-year" flood designation. The BFE on a FIRM is the elevation of a base flood event, or a flood which has a 1-percent chance of occurring in any given year as defined by the NFIP. The BFE describes the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating the potential damage to occur in a given area. A structure located within a 100-year floodplain has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage. The 100-year flood is a regulatory standard used by Federal agencies and most states, to administer floodplain management programs. The 100-year flood is used by the NFIP as the basis for insurance requirements nationwide. FIRMs also depict 500-year flood designations, which is a boundary of the flood that has a 0.2-percent chance of being equaled or exceeded in any given year (FEMA, 2003; FEMA, 2006).

Flood Insurance Study (FIS)

In addition to FIRM and DFIRMs, FEMA also provides FISs for entire counties and individual jurisdictions. These studies aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. They are narrative reports of countywide flood hazards, including descriptions of the flood areas studied and the engineered methods used, principal flood problems, flood protection measures and graphic profiles of the flood sources (FEMA, 2009). A countywide FIS for Dutchess County has been completed; however, it is a preliminary document. The Dutchess County preliminary FIS, Dated May 2, 2012, discussed the principal flood problems within the County and in/around the Town of East Fishkill.

- In the Fishkill Creek basin, the flood of record occurred in April 2007. A storm that developed in Texas moved eastward, off the coast of Virginia, before turning northward. The storm reached the New York City area on April 15th and produced discharges on Fishkill Creek that surpassed the previous peak of October 2005. USGS New York estimated the peak discharge at gage 01372800, Fishkill Creek at Hopewell Junction, NY to be 3,910 cubic feet per second (cfs). The previous peak from the October 2005 event was 2,830 cfs.

- Other major events in the basin include September 1938, August 1955, and October 1955. In addition to coastal storms, rain events on melting snow, can also contribute to heavy runoff volumes.

- In the Town of Beekman, seasonal residential homes have been subject to flooding from Sylvan Lake Outlet. The most highly flood-prone areas along Frog Hollow Brook extend from the Hamlet of Greenhaven to the confluence with Fishkill Creek. Along Whaley Lake Stream, the downstream areas between its confluence and the Hamlet of Poughquag are subject to inundation (FEMA, Date Unknown).

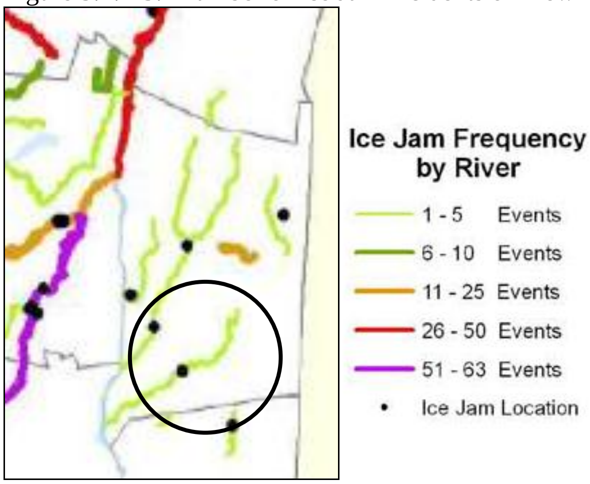
- After a 3-day deluge which dropped nearly eight inches of rain in May 1984 Dutchess County was declared a disaster area by Governor Mario Cuomo (FEMA, Date Unknown). More recently, a Federal Disaster declaration was made in April 2007 after a severe flooding event.

- In the Town of East Fishkill, areas adjacent to Sprout Creek, Whortlekill Creek, and Sylvan Lake Outlet are also subject to inundation. This includes residential areas near Sprout Creek in Lomala. Industrial and residential developments near the low-lying floodplain of Whortlekill Creek in the vicinity of Hopewell Junction can be inundated. Areas which are currently being developed along Sylvan Lake Outlet are also subject to flooding.

Ice Jam Hazard Areas

Ice jams are common in the Northeast U.S. and New York is not an exception. In fact, according to the USACE, New York State ranks second in the U.S. for total number of ice jam events, with over 1,500 incidents documented between 1867 and 2010. Areas of New York State that include characteristics lending to ice jam flooding include the northern counties of the Finger Lakes region and far western New York, the Mohawk Valley of central and eastern New York State and the North Country (NYS HMP, 2011). Figure 5.4.4-3 presents the number of ice jam incidences within the vicinity of East Fishkill between 1780 and 2010.

Figure 5.4.4-3. Number of Ice Jam Incidents on New York State Rivers (1875 – 2007)



Source: NYS HMP, 2011
Note (1): Circle indicates location of East Fishkill
Note (2): This map displays the number of instances a river was referenced as being the location for an ice jam in the USACE Cold Regions Research and Engineering Laboratory (CRREL) database.
Note (3): Multiple instances of ice jams can be associated to a single point location.

The Ice Jam Database, maintained by the Ice Engineering Group at the USACE Cold Regions Research and Engineering Laboratory (CRREL), currently consists of over 18,000 records from across the U.S. According to the USACE-CRREL, East Fishkill experienced 2 historic ice jam events between 1875 and 2011 (Ice Engineering Research Group, Date Unknown). Historical events are further mentioned in the "Previous Occurrences" section of this hazard profile.

Previous Occurrences and Losses

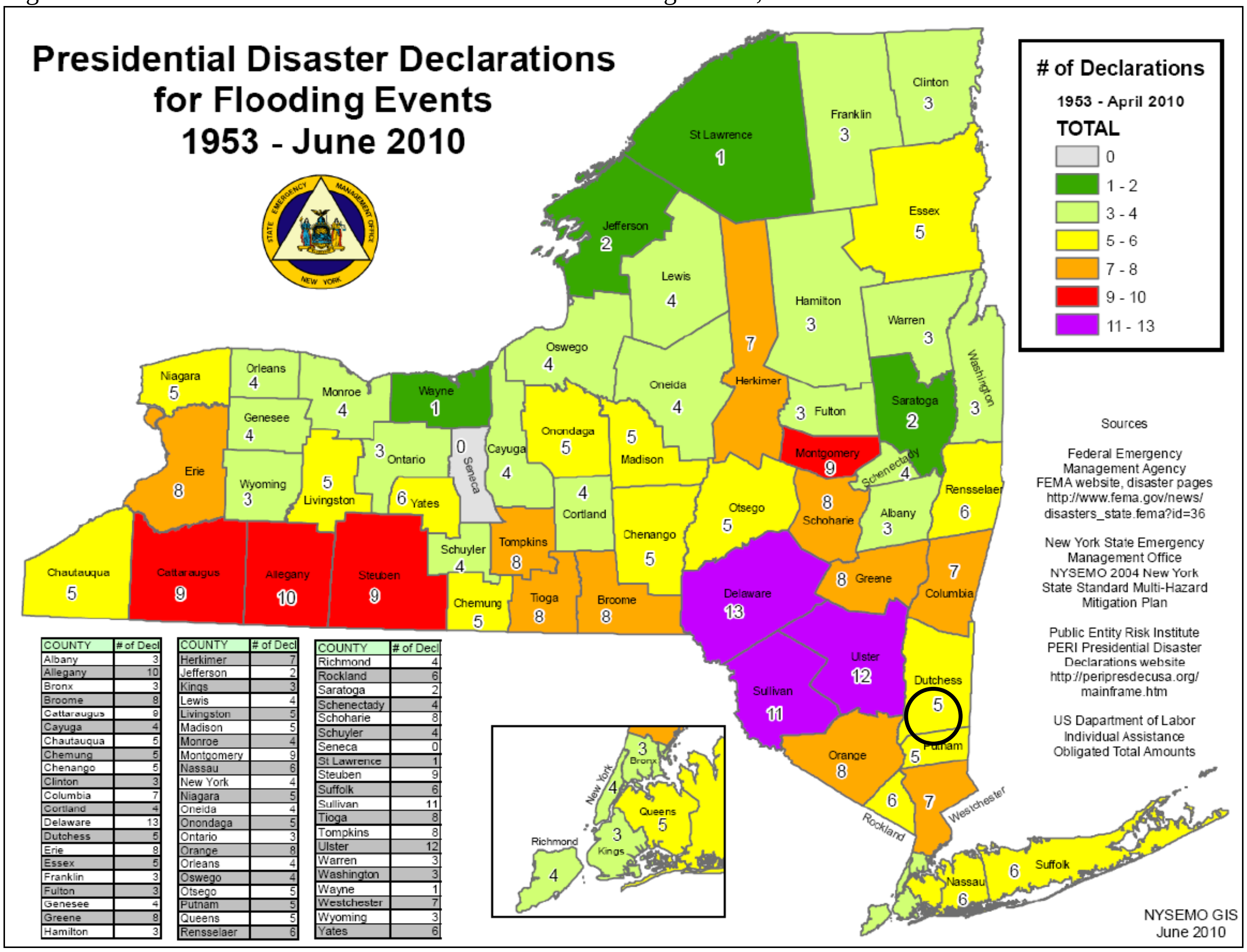
Many sources provided historical information regarding previous occurrences and losses associated with flooding events throughout New York State and areas within Dutchess County in the vicinity of East Fishkill. With so many sources reviewed for the purpose of this HMP, loss and impact information for 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.

According to NOAA's NCDC storm events database, Dutchess County experienced 45 flood events between April 30, 1950 and July 31, 2012. Total property damages, as a result of these flood events, were estimated at $7.314 million. This total also includes damages to other counties. No crop damages were reported as results of these events in the NCDC database. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS, 2011), between 1960 and 2012, 56 flood events occurred within the County. The database indicated that flood events and losses specifically associated with Dutchess County and its municipalities totaled over $58.7 million in property damage and over $1 million in crop damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1953 and 2012, FEMA declared that New York State experienced 38 flood-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: severe storms, coastal storms, flash flooding, heavy rain, tropical storm, hurricane, high winds, ice jam, wave action, high tide and tornado. 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 declarations and emergencies. Of those events, the NYS HMP and other sources indicate that Dutchess County has been declared as a disaster or emergency area as a result of seven flood events (FEMA, 2012).

Figure 5.4.4-4 shows the FEMA disaster declarations (DR) (and does not indicate emergency (EM) declarations) for flooding events in New York State, from 1953 to June 2010. This figure indicates that Dutchess County was included in five disaster declarations. Since the date of this figure, Dutchess County has not been included in any additional FEMA disaster declarations for flooding.

Figure 5.4.4-4. Presidential Disaster Declarations for Flooding Events, 1953-2010



Source: NYS HMP, 2011

Note: The black circle indicates the approximate location of East Fishkill.

Table 5.4.4-1 summarizes the FEMA Presidential Disaster (DR) or Emergency (EM) Declarations for flood events in Dutchess County, which encompasses East Fishkill. Many of these federal disasters were the remnants of severe storms or tropical or extra tropical disturbances (hurricanes, tropical storms, Nor'Easters) either passing over or located within proximity to the State. These disasters resulted in flooding in the County, hence the reason for the occasional categorization by FEMA as "severe storms and flooding" event. Because flooding was the primary impact of many of these types of hazard events, only the severe flooding impact of major events are discussed in this Hazard Profile and are also mentioned in their designated sections of this HMP: Section 5.4.3 (Extreme Temperatures), Section 5.4.5 (Severe Storms) and Section 5.4.6 (Severe Winter Storm).

Based on all additional sources researched, known flooding events that have affected Dutchess County, with specific note to those reported to have directly affected East Fishkill, are identified in Table 5.4.4-2. With flood documentation for New York State being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.4-2 may not include all events that have impacted the County or the Town. Also, loss information is generally provided for the County as a whole for an event; therefore, damages for just the Town of East Fishkill may be limited or scarce.

Table 5.4.4-1. Flooding Events Between 1955 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 12-19, 1955	Hurricane Diane, Floods	DR-45	Yes	Major disaster declared for Southeastern N.Y. Property damage, road closures, and four deaths. Damages in millions, but not quantified.	NYHMP, FEMA
September 13, 1971	Severe Storms, Flooding	DR-311	Yes	This storm caused seven deaths and $147.6 M in damage throughout its path. New York State experienced approximately $7.4 M in total eligible damages.	FEMA
July 20, 1973	Severe Storms, Flooding	DR-401	Yes	Estimated damages exceeded $38 million.	SHELDUS, FEMA
May 28, 1984	Flooding, Severe Storm, Thunderstorm	N/A	N/A	After a 3-day deluge which dropped nearly eight inches of rain in May 1984 Dutchess County was declared a disaster area by Governor Mario Cuomo. Property damages in Dutchess County were estimated at $2,380,950, and crop damages were $2,380.	SHELDUS, https://www.rampp-team.com/county_maps/new_york/dutchess/dutchess_ny_fis_tables.pdf
April 3-7, 1987	Flooding	DR-792	No	Weather systems throughout New York caused flooding in Dutchess County on April 4th. According to SHELDUS, Dutchess County had over $2 Million in property damage and over $200 K in crop damage.	FEMA, SHELDUS
July 26, 1995	Flooding	N/A	N/A	Severe thunderstorms accompanied by torrential rains occurred across the Capital District and the Mid-Hudson valley. In Albany many streets were flooded due to overloaded storm sewers. SHELDUS reported $50,000 in property damages for Dutchess County.	NOAA-NCDC, SHELDUS
January 24, 1996	Severe Storms, Flooding	DR-1095	Yes	A strong low pressure system produced damaging southerly winds across all of eastern New York. Heavy winds downed trees, limbs and power lines across the area. Southern Dutchess County saw some of the worst damage with over 6,000 customers losing power. In the days following, rapid rainfall of up to 3 inches and snowmelt from unseasonably warm temperatures resulted in widespread flooding across Dutchess County. Small stream flooding washed out roads across the county, and extensive flooding occurred along the Hudson River and Wappingers Creek. The wind, rain, and floods led to an estimated $7.03 million in property damages in Dutchess County.	FEMA, NYHMP
July 13, 1996	Flooding	N/A	N/A	$40,000 in property damages reported for Dutchess County.	NOAA-NCDC, SHELDUS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
September 16-19, 1999	Hurricane Floyd	DR-1296	Yes	Remnants of Hurricane Floyd brought heavy rains and strong wind gusts of up to 60 mph into New York State September 16th to 17th. Strong winds combined with saturated grounds to cause major tree, power line, and vehicle damage throughout Eastern NY. Rains produced widespread flooding, and in a nine-year-old girl was drowned in Dutchess County. Massive power outages followed, affecting as many as 80,000 people in the Mid-Hudson Valley for a week or more. Floyd resulted in the counties of Albany, Dutchess, Greene and Rensselaer being declared "major disaster areas" by Governor Pataki, and on September 30 these counties were included in the national Disaster Declaration. As of December6, 1999, 69 grants totaling $121,441 in disaster aid for Dutchess County had been approved. Other sources reported combined property damages in Dutchess County to be approximately $1.4 million.	FEMA, NYHMP, NOAA
May 3 – August 12, 2000	Severe Storms	DR-1335	Yes	A series of severe thunderstorms and hailstorms overwhelmed the region in the spring and summer of 2000. On July 14th, rainfall totals at Poughkeepsie, Dutchess County, reached 1.23 inches over 24 hours. On July 21, FEMA declared a disaster declaration due to major storms and flooding and authorized funding for the counties throughout New York State. On August 9th, a severe thunderstorm swept through the region, further crippling recovering communities. On August 25th, FEMA added six counties, including Dutchess, to the disaster declaration. Estimates of the damage incurred during the incident period range up to $6.1 million for Dutchess County.	FEMA, SHELDUS, NWS
August 11, 2003	Flooding	N/A	N/A	On August 11, eastern New York was entrenched in a tropical air mass, producing scattered slow-moving thunderstorms and flooding rains. Flooding in Dutchess County led to property damages estimated at $75K.	NOAA-NCDC, SHELDUS
April 14-18, 2007	Severe Storms and Inland and Coastal Flooding	DR-1692	Yes	Heavy rain led to widespread flooding of small streams and creeks across the county, which began during the early morning hours of Monday, April 16th, and persisted into Wednesday morning on the 18th. New York State experienced millions in eligible damages. FEMA gave out more than $61 million in assistance to affected counties within the State. Property damages in Dutchess County were estimated at $5.7 M.	FEMA, NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 11, 2008	Flash Floods	N/A	N/A	Penny size hail was reported in Wappingers Falls during a thunderstorm. In addition, locally very heavy rainfall resulted in flash flooding in portions of eastern New York. No damages were reported.	NYHMP, NOAA-NCDC
December 11-13, 2008	Flooding	N/A	N/A	Heavy rain and flooding coincident with Ice Storm. Mixed precipitation of 1 to 4 inches fell across the Capital Region, eastern Mohawk Valley, the Saratoga region, and upper Hudson Valley. This heavy rain led to flooding of small streams and creeks across the region, in addition to widespread ponding of water in urban areas due to ice blocking storm drains.10K in damages was reported at Wappinger Falls, Dutchess County.	NOAA-NCDC

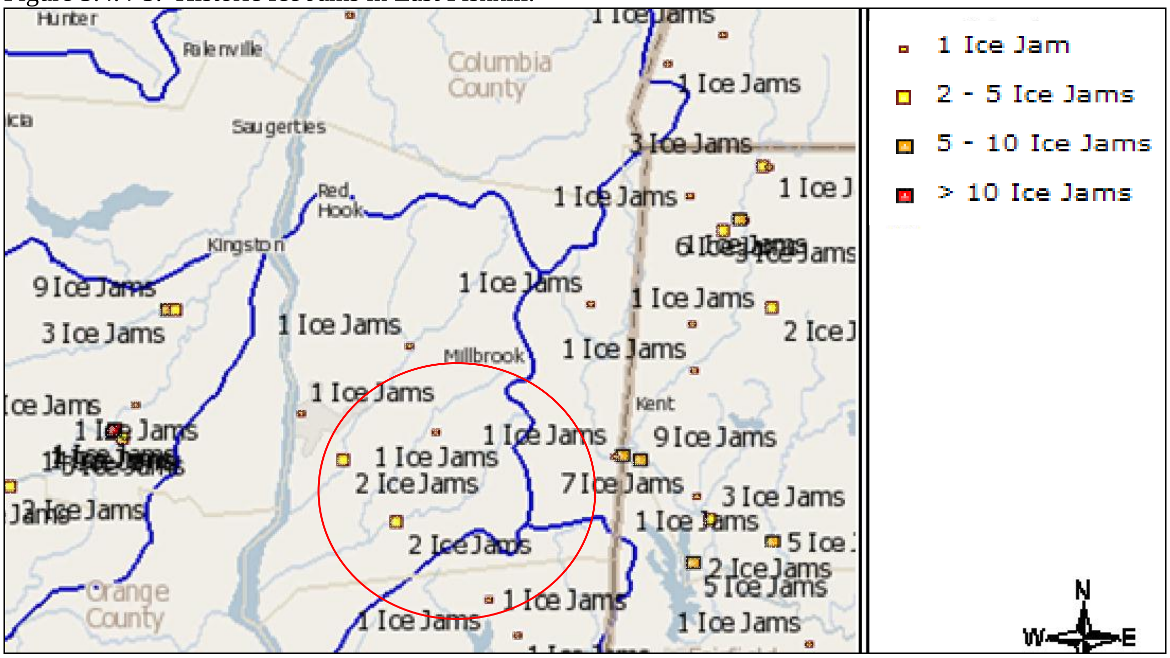
Note (1): Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
FEMA	Federal Emergency Management Agency
FSA	Farm Service Agency
IA	Individual Assistance
K	Thousand ($)
M	Million ($)
N/A	Not applicable
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NWS	National Weather Service
PA	Public Assistance
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.

Ice Jams

According to the CRREL database, ice jams have historically formed at various points along the Fishkill Creek in the hamlet of Hopewell Junction within the Town of East Fishkill. Locations of historical ice jam events are indicated in Figure 5.4.4-5 below.

Figure 5.4.4-5. Historic Ice Jams in East Fishkill.



Source: CRREL, 2012

Based on review of the CRREL Database, Table 5.4.4-3 lists the ice jam events that have occurred in East Fishkill between 1900 and 2012. Information regarding losses associated with these reported ice jams was limited.

Table 5.4.4-3. Ice Jam Events in East Fishkill, Dutchess County between 1900 and 2011

Event Date	River / Location	Description	Source(s)
January 22, 1964	Fishkill Creek, Hopewell Junction	The maximum annual gage height of 5.61 feet on Fishkill Creek in Hopewell Junction, NY occurred on 22 Jan 1964 and was caused by an ice jam. The associated discharge was 300 cfs.	CRREL
January 20, 1996	Fishkill Creek, Hopewell Junction	USGS Water Resources Data for New York WY 2003 reported a maximum gage height of 11.71ft on 20-JAN-1996 due to an ice jam at USGS gaging station 01372800 Fishkill Creek at Hopewell Junction, NY. The average daily discharge was not reported.	CRREL

Source: CRREL, 2012
Note: Due to limited availability of historic ice jam data, this table may not represent all ice jams ever occurring in East Fishkill.

National Flood Insurance Program

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. As stated in the NYS HMP, the NFIP collects and stores a vast quantity of information on insured structures, including the number and location of flood insurance policies, number of claims per insured property, dollar value of each claim and aggregate value of claims, repetitive flood loss properties, etc. NFIP data presents a strong indication of the location of flood events among other indicators (NYS HMP, 2011).

There are three components to NFIP: flood insurance, floodplain management and flood hazard mapping. Nearly 20,000 communities across the U.S. and its territories 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 is reduced by nearly $1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing of flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance (FEMA, 2010).

As of December 31, 2011, there were 138 NFIP policyholders in the Town of East Fishkill. There were 97 claims made, totaling nearly $1.7 million for damages to structures and contents. There are 16 NFIP Repetitive Loss (RL) properties, and two NFIP Severe Repetitive Loss (SRL) properties in the Town. As of March 3, 2013, online NFIP statistics indicate there are 222 NFIP policyholders in the Town, with 110 loss claims totaling over $1.8 million in losses. NFIP data for the Town of East Fishkill is presented further in Table 5.4.4-8 in the Vulnerability Assessment section of this profile.

As an additional component of 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, 2008). According to FEMA, East Fishkill does not participate in the CRS; therefore specific repetitive loss areas other than those identified by FEMA are not available for the town (FEMA, 2011) (http://www.fema.gov/library/viewRecord.do?id=3629).

Probability of Future Events

Given the history of flood events that have impacted Dutchess County and East Fishkill, it is apparent that future flooding of varying degrees will occur. The fact that the elements required for flooding exist and that flooding has occurred in, or in the near vicinity of, the Town in the past suggests that many people and properties are at risk from the flood hazard in the future.

In addition to riverine flooding, ice jams frequently occur in New York State, and East Fishkill is no exception. According to the New York State HMP, New York State is ranked as the second highest state with the highest number of ice jam events compared to the remainder of the U.S. (NYS HMP, 2011). Please refer to the Vulnerability Assessment for a complete discussion of vulnerable population, facilities, utilities and infrastructure in East Fishkill.

In Section 5.3, the identified hazards of concern for the Town of East Fishkill 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 flood in the Town is considered ‘frequent’ (likely to occur within 25 years).

It is estimated that East Fishkill will continue to experience direct and indirect impacts of floods annually. Some of the flooding events may induce secondary hazards such as: water quality and supply concerns and experience evacuations, infrastructure deterioration and failure, utility failures, power outages, transportation delays/accidents/inconveniences, and public health concerns.

The Role of Global Climate Change on Future Probability

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).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. East Fishkill is part of Region 2, Catskill Mountains and West Hudson River Valley. Some of the issues in this region, affected by climate change, include: the watershed for New York City's water supply, spruce/fir forests disappear from mountains, decline in popular apple varieties, winter recreation declines/summer opportunities increase, Hemlock wooly adelgid destroys trees, and native brook trout decline and replaced by bass (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3ºF by the 2020s, 3 to 5.5ºF by the 2050s and 4 to 9ºF by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.4-4 displays the projected seasonal precipitation change for the Catskill Mountains and West Hudson River Valley ClimAID Region (NYSERDA, 2011).

Table 5.4.4-3. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA, 2011

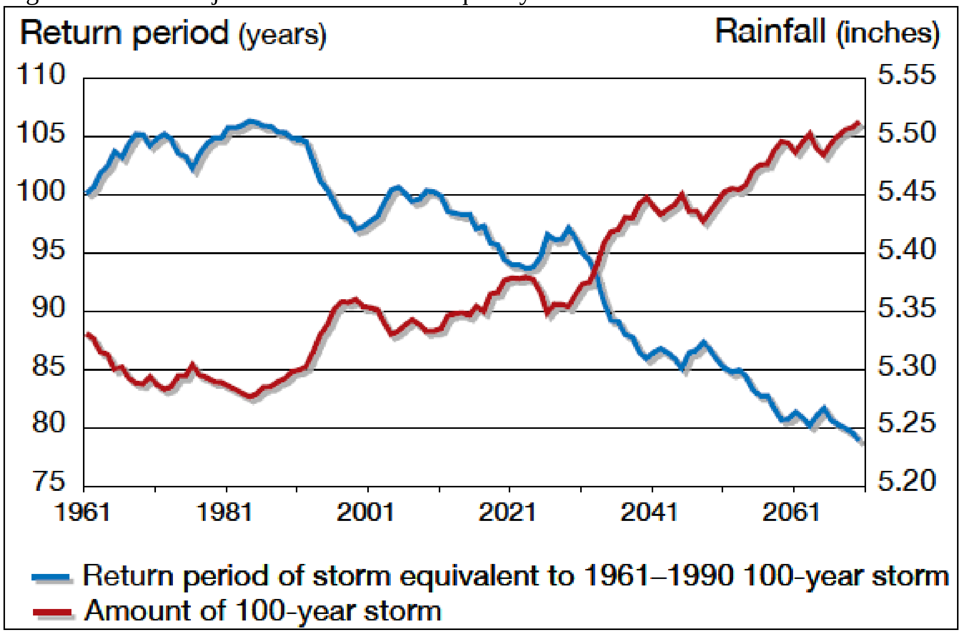
The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways and transportation hugs; and increase delays and hazards 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).

Over the past 50 years, heavy downpours have increased and this trend is projected to continue. This can cause an increase in localized flash flooding in urban areas and hilly regions. Flooding has the potential to increase pollutants in the water supply and inundate wastewater treatment plants and other vulnerable facilities located within floodplains. Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA, 2011).

Figure 5.4.4-6 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).

Figure 5.4.4-6. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA, 2011

Total precipitation amounts have slightly increased in the Northeast U.S., by approximately 3.3 inches over the last 100 years. There has also been an increase in the number of two-inch rainfall events over a 48-hour period since the 1950s (a 67-percent increase). The number and intensity of extreme precipitation events are increasing in New York State as well. More rain heightens the danger of localized flash flooding, streambank erosion and storm damage (DeGaetano et al [Cornell University], 2011) (http://files.campus.edublogs.org/blogs.cornell.edu/dist/8/90/files/2011/03/ny_changing_climate.pdf).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the flood hazard, areas identified as hazard areas include the 1-percent and 0.2-percent chance flood event boundaries (Figure 5.4.4-7). The following text evaluates and estimates the potential impact of flooding for the Town of East Fishkill including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health 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 of this hazard over time

Overview of Vulnerability

All types of flooding can cause widespread damage throughout rural and urban areas, including but not limited to: water-related damage to the interior and exterior of buildings; destruction of electrical and other expensive and difficult-to-replace equipment; injury and loss of life; proliferation of disease vectors; disruption of utilities, including water, sewer, electricity, communications networks and facilities; loss of agricultural crops and livestock; placement of stress on emergency response and healthcare facilities and personnel; loss of productivity; and displacement of persons from homes and places of employment (Foster, Date Unknown).

The flood hazard is a major concern for the Town of East Fishkill. To assess vulnerability, potential losses were calculated for the Town for riverine flooding for 1-percent and 0.2-percent MRP flood events. Historic loss data associated with ice jam events and dam failures is limited. Flooding, impacts and losses associated with ice jam and dam failure events are similar to flash flooding events. The flood hazard exposure and loss estimate analysis is presented below.

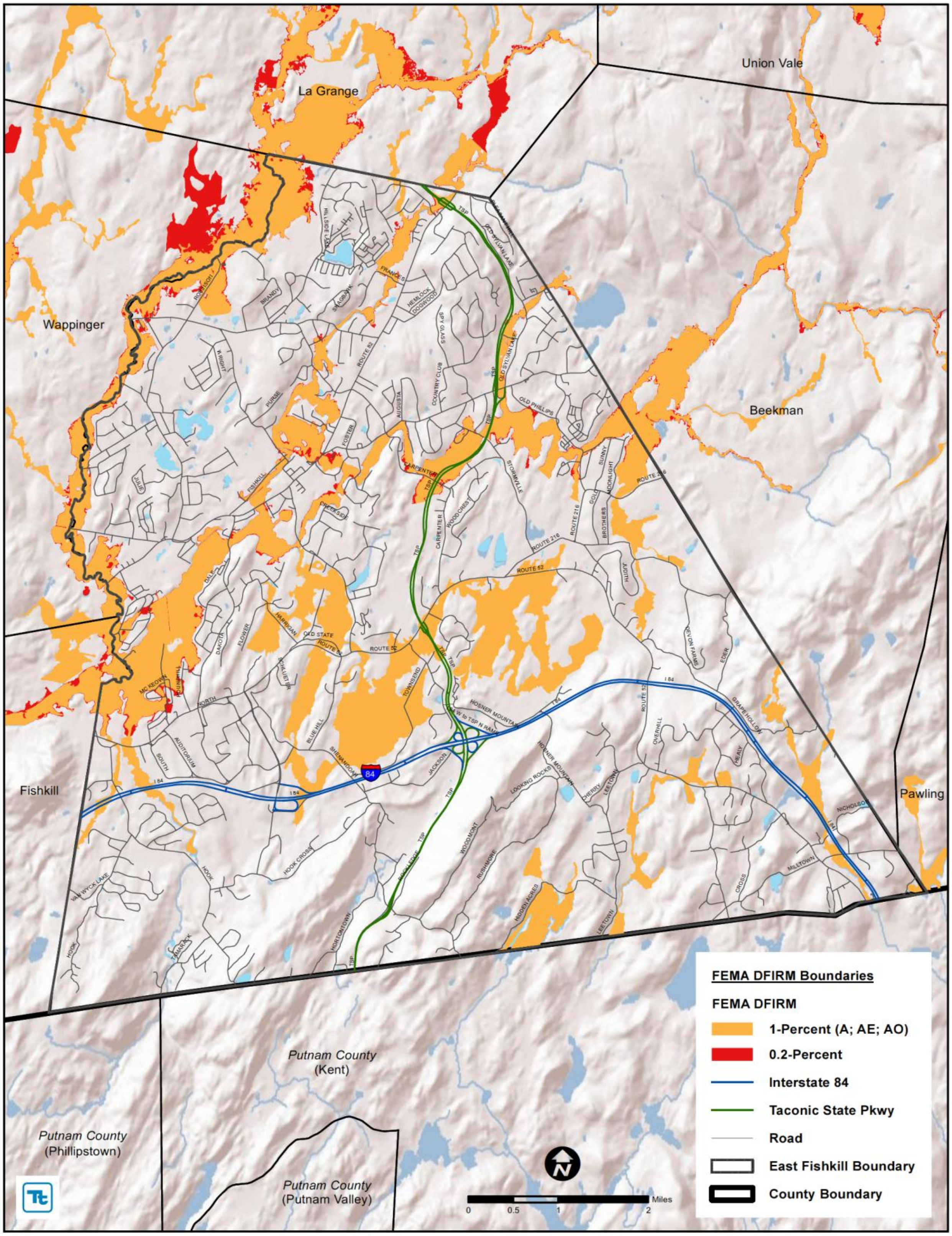
Data and Methodology

The 1-percent and 0.2-percent MRP flood events were examined to evaluate the Town of East Fishkill's risk and vulnerability to the flood hazard. These MRP flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

A Level 2 HAZUS-MH riverine flood analysis was performed. The default building inventory in HAZUS-MH was updated and replaced with a custom building inventory developed for the Town. The updated building inventory was developed using detailed structure-specific assessor data, as well as parcel and structure location information. An updated critical facility inventory was also developed and incorporated into HAZUS-MH replacing the default essential facility (police, fire, schools, etc.) and utility inventories.

Using Geographic Information System (GIS) tools and the best available data including the Dutchess County FEMA DFIRM database effective May 2012 and five-foot contours provided by the Town were used to develop a Digital Elevation Model (DEM) and generate 1-percent and 0.2-percent flood depth grids. The depth grids were integrated into the HAZUS-MH riverine flood model and used to estimate potential losses to the structure inventory.

Figure 5.4.4-7. FEMA DFIRM 1-Percent and 0.2-Percent Flood Boundaries in the Town of East Fishkill



Source: FEMA, 2012

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 measurable.

To estimate the population exposed to the 1% and 0.2% flood events, the preliminary FEMA DFIRM floodplain boundaries were overlaid upon the 2010 Census population data in GIS (U.S. Census 2010). Census blocks do not follow the boundaries of the floodplain. The 2010 Census blocks with their centroid the flood boundaries were used to calculate the estimated population exposed to this hazard. Using this approach, it is estimated that 3,497 people are within the 100-year floodplain or 12% of the total Town population and 3,663 people are within the 500-year floodplain (12.6% of the total Town population). Table 5.4.4-5 lists the estimated population located within the 100- and 500-year flood zones by municipality.

Table 5.4.4-4. Estimated Town of East Fishkill Population Exposed to the 1% and 0.2% MRP Flood Hazard Events

2010 U.S. Census Population	Population in SFHA		Population in 0.2% Flood Zone	
	Number	% of Total	Number	% of Total
29,029	3,497	12.0	3,663	12.6

Source: Census, 2010; FEMA, 2011
Notes: SFHA = Special Flood Hazard Area (or 1% event)

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. 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 also 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.

HAZUS-MH 2.1 estimates the potential sheltering needs as a result of a % and 0.2% MRP flood events (based on 2000 U.S. Census statistics). For the 1% event, HAZUS-MH 2.1 estimates 2,648 people will be displaced and 1,892 people will seek short-term sheltering, representing 10.3% and 7.4% of the Town population, respectively. For the 0.2% event, HAZUS-MH 2.1 estimates 2,863 people will be displaced and 2,105 people will seek short-term sheltering, representing approximately 11.2% and 8.2% of the County population, respectively.

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.

Impact on General Building Stock

After considering the population exposed to the flood hazard, the exposure and potential losses to the buildings were evaluated for the 1% and 0.2% flood events. Exposure includes those buildings located in the flood zone. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content value.

To provide a general estimate of number of properties and structural/content replacement value exposure, the FEMA DFIRM flood boundaries and building inventory developed for the Town for the purposes of this HMP were used. The structures in the Town of East Fishkill with their centroid in the FEMA DFIRM flood zones were used to estimate the building replacement cost value exposed to this hazard. There are 278 buildings and greater than $125 million in total replacement cost value (structure and contents) exposed to the 1% flood event. In addition, there are 341 buildings and greater than $165 million in total assessed value exposed to the 0.2% flood event. Please refer to Table 5.4.4-7.

In summary, there are approximately 8.3 square miles of land in the Town of East Fishkill located in the 1% flood zones, and 8.6 square miles of land in the 0.2% flood zones. Refer to Tale 5.4.4-6 below.

Table 5.4.4-5 Area Located in the 1% and 0.2% Flood FEMA DFIRM Flood Boundaries

Total Area (sq. mi.)	Area Exposed (sq. miles)		Percent Area Exposed	
	1%	0.2%	1%	0.2%
57.6	8.3	8.6	14.3%	15.0%

Source: FEMA, 2012
Notes: sq. mi. = square miles

HAZUS-MH 2.1 estimates the potential damage to the building inventory associated with the 1% flood event is approximately $10.7 million or less than one-percent of the Town's general building stock inventory. For the 0.2% flood event, the HAZUS-MH 2.1 potential damage estimate is nearly $37 million (structure and contents) or less than one-percent of the Town's general building stock inventory. HAZUS-MH damage assessments for the Town East Fishkill are displayed in Table 5.4.4-8.

Table 5.4.4-6. Estimated Building Replacement Value (Structure and Contents) Exposed to the 1% and 0.2% Flood Events

Total (All Occupancies)								Residential Buildings			
1% Flood Event (100-Year)				0.2% Flood Event (500-Year)				1% Event		0.2% Event	
Count	% Total	RCV	% Total	Count	% Total	RCV	%Total	Count	RCV	Count	RCV
278	2.6	$125,894,857		341	3.2	$165,401,151		247	$96,692,228	295	$116,733,819

Commercial Buildings				Industrial Buildings				Agriculture Buildings			
1% Event		0.2% Event		1% Event		0.2% Event		1% Event		0.2% Event	
Count	RCV	Count	RCV	Count	RCV	RCV	%Total	Count	RCV	Count	RCV
25	$26,905,563	39	$45,021,866	0	$0	1	$1,348,400	6	$2,297,065	6	$2,297,065

Religious Buildings				Government Buildings				Education Buildings			
1% Event		0.2% Event		1% Event		0.2% Event		1% Event		0.2% Event	
Count	RCV	Count	RCV	Count	RCV	Count	RCV	Count	RCV	Count	RCV
0	$0	0	$0	0	$0	0	$0	0	$0	0	$0

Source: FEMA, 2012

Notes: The total number of buildings in the inventory for this HMP is 10,695 buildings. Values represent replacement values (RV) for building structure and contents.

Table 5.4.4-7. Estimated Potential Building Loss (Structure and Contents) by the 1% and 0.2% MRP Flood Events

Total Buildings (All Occupancies)		Percentage of Total Building Value		Residential Buildings		Commercial Buildings		Industrial Buildings	
1% Event	0.2% Event	1% Event	0.2% Event	1% Event	0.2% Event	1% Event	0.2% Event	1% Event	0.2% Event
$10,753,357	$36,982,710	<1%	<1%	$7,739,240	$30,637,255	$2,594,315	$5,868,803	$0	$0

Agriculture Buildings		Religious Buildings		Government Buildings		Education Buildings	
1% Event	0.2% Event	1% Event	0.2% Event	1% Event	0.2% Event	1% Event	0.2% Event
$419,802	$476,652	$0	$0	$0	$0	$0	$0

Source: HAZUS-MH 2.1

Notes: Values represent replacement values (RV) for building structure and contents.

In addition to total building stock modeling, individual data available on flood policies, claims, RLP and severe RLP (SRLs) were analyzed. FEMA Region 2 provided a list of properties with NFIP policies, past claims and multiple claims (RLPs). According to the metadata provided: "The NFIP Repetitive Loss File contains losses reported from individuals who have flood insurance through the Federal Government. A property is considered a repetitive loss property when there are two or more losses reported which were paid more than $1,000 for each loss. The two losses must be within 10 years of each other and be as least 10 days apart. Only losses from (*sic* since) 1/1/1978 that are closed are considered."

Severe RLPs (SRL) were then examined in the Town of East Fishkill. According to section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a, an SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- Has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.
- For both of the above, at least two of the referenced claims must have occurred within any 10-year period, and must be greater than 10 days apart.

Table 5.4.4-9 summarizes the NFIP policies, claims and repetitive loss statistics for the Town of East Fishkill, Dutchess County. According to the data provided by FEMA, all 16 RL properties are single-family residential properties; therefore, both SRL properties are single-family residential properties (FEMA Region 2, 2012). This information is current as of December 31, 2011.

The location of the properties with policies, claims and repetitive and severe repetitive flooding were geocoded by FEMA with the understanding that there are varying tolerances between how closely the longitude and latitude coordinates correspond to the location of the property address, or that the indication of some locations are more accurate than others.

Table 5.4.4-8. NFIP Policies, Claims and Repetitive Loss Statistics

# Policies	# Claims (Losses)	Total Loss Payments	# Rep. Loss Prop.	# Severe Rep. Loss Prop.	# Policies in 1% Boundary	# Policies in combined 1% and 0.2% Boundary	# Policies Outside the FEMA 1% and 0.2% flood boundaries
138	97	$1,654,669	16	2	39	46	92

Source:

(1) Policies, claims, repetitive loss and severe repetitive loss properties and their locations were provided by FEMA Region 2 for the Town of East Fishkill. According to FEMA, some properties may have more than one policy in force. The NFIP stats are current as of December 31, 2011. The repetitive loss property count includes the severe repetitive loss property count for that municipality.

Impact on Critical Facilities

HAZUS-MH 2.1 estimates the probability critical facilities and utilities may sustain damage as a result of a 100-year and 500-year MRP flood event. Table 5.4.4-10 lists facilities exposed and that may be impacted by these events; if a damage estimate was not calculated by HAZUS-MH 2.1, and the facility is located within the FEMA DFIRM flood boundaries, it is also included in the tables below.

Table 5.4.4-9. Estimated Percent Damage to Critical Facilities due to a 100- and 500-Year MRP Flood Events in East Fishkill

Name	Description	Exposure	% Damaged
1% Flood Event			
Hopewell Hamlet Main Sewage Pump Station	Wastewater	AE zone	-
Four Corners WWTP	Wastewater	AE zone	-
Unity Plaza Sewage Pump Station	Wastewater	AE zone	-
Brettview Water Plant	Potable Water	AE zone	3.3
0.2% Flood Event			
Brettview Water Plant	Potable Water	AE zone	8.3
Hopewell Hamlet Main Sewage Pump Station	Wastewater	AE zone	30.0
Four Corners WWTP	Wastewater	AE zone	-
Four Corners Philips Road	Wastewater	0.2 PCT	-

Source: East Fishkill; FEMA, 2012

Notes:

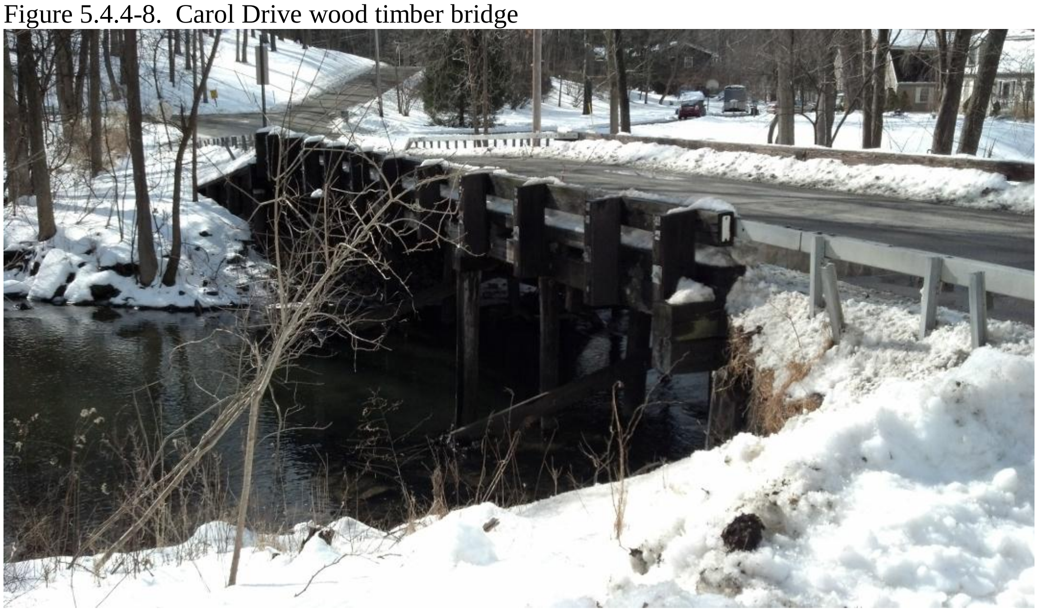
- = There is no damage estimate because HAZUS did not calculate potential loss estimates for some facilities located in the DFIRM flood hazard zone. This may be because even though these facilities are located within the boundary of the flood depth grid generated by HAZUS, the depth of flooding does not amount to any damages to the structure or contents according to the depth damage function used in HAZUS.

Exposure and potential damages are based on the location of each facility provided by the Town.

Transportation features are not included in Table 5.4.4-10; roadway segments and brides are also vulnerable to the flood hazard. To estimate the highway bridges exposed to the flood hazard, the FEMA DFIRM flood boundaries were overlaid upon the major bridge inventory (33 total bridges) provided in HAZUS-MH 2.1. There are 11 bridges with their center within the FEMA DFIRM 1% flood boundary and one bridge in the 0.2% flood boundary. This listing does not convey whether or not the bridge is designed and built above the base flood elevation.

The Town has specifically identified the Carol Drive wood timber bridge (see Figure 5.4.4-8), and the Phillips Road bridge over the Fishkill Creek, as being vulnerable to the flood hazard and causal to local flooding issues.

Figure 5.4.4-8. Carol Drive wood timber bridge



Impact on Economy

For impact on economy, estimated losses from a flood event are considered. Losses include but are not limited to general building stock damages, business interruption, impacts to tourism and tax base to the Town of East Fishkill. Damages to general building stock can be quantified using HAZUS-MH as discussed above. Other economic components such as loss of facility use, functional downtime, loss of tourism revenue and social economic factors are less measurable with a high degree of certainty.

Direct building losses are the estimated costs to repair or replace the damage caused to the building. The potential damage estimated to the general building stock inventory associated with the 100-year flood is $10.7 million. This estimate represents less than one-percent of the Town's overall total general building stock inventory. For the 500-year event, the potential damage estimate is nearly $37 million (structure and contents), less than one-percent of the Town's total general building stock replacement value inventory. These dollar value losses to the Town's total building inventory replacement value would greatly impact East Fishkill's tax base and the local economy.

When a flood occurs, the agricultural industry is at risk in terms of economic impact and damage (i.e., damaged crop, financial loss to the farmer). For Dutchess County, the market value of all agricultural products sold was $44.8 million with 52% in crop sales with the remainder in livestock sales (USDA, 2007). Any agricultural losses will impact the agricultural industry.

HAZUS-MH 2.1 estimates the amount of debris generated from the riverine flood events as a result of 100- and 500-year MRPs. 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. For the 100-year event, HAZUS estimates 3,256 tons of debris will be generated. For the 500-year event, HAZUS estimates 17,776 tons of debris will be generated, as indicated in Table 5.4.4-11.

Table 5.4.4-10. Estimated Debris Generated from the 1% and 0.2% Flood Events

Event	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
1% Flood	3,257	2,719	252	286
0.2% Flood	17,776	5,047	7,175	5,553

Source: HAZUS-MH 2.1

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as flood events. While predicting changes of flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

The 2011 'Responding to Climate Change in New York State' report was prepared for New York State Energy Research and Development Authority to study the potential impacts of global climate change on New York State. According to the synthesis report, heavy rains are increasing and are projected to increase further. Increased frequency and intensity of rainfall may lead to increased flooding and related impacts on water quality, infrastructure, and agriculture in the State (NYSERDA, 2011).

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the Town. Any areas of growth could be potentially impacted by the flood hazard if located within the identified hazard areas (Figure 5.4.4-8 below). Table 5.4.4-11 summarizes the potential new development located in the FEMA floodplains.

Table 5.4.4-11. Potential New Development in the Town of East Fishkill in Flood Zones

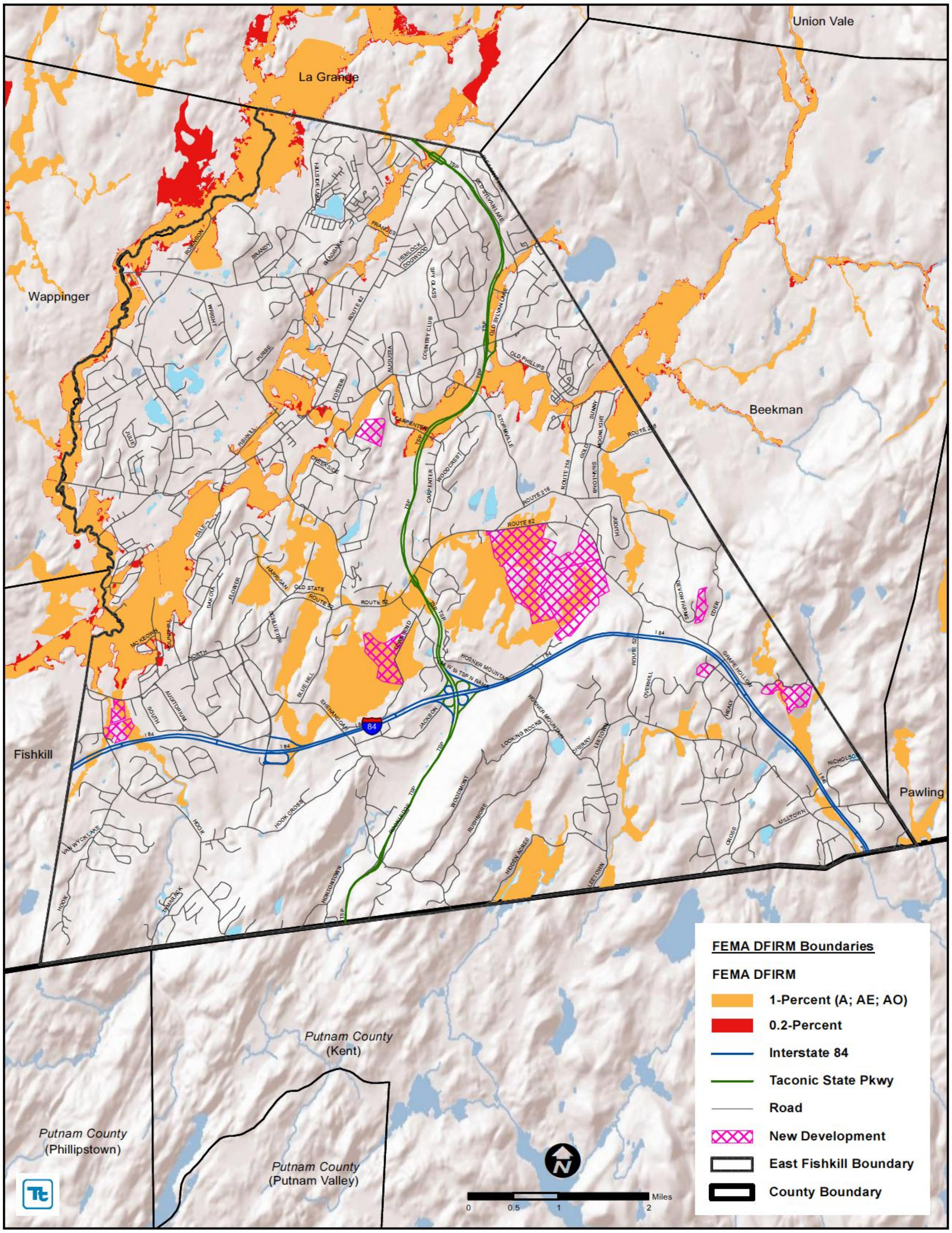
Project Name	Location / Address	Parcel Identification			Type	Number of Potential Structures / Units	Hazard Vulnerability
		Section	Subsection	Lot			
Montage	Route 52/216	6656	00	802836	RES	126	Flood Zone A
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6356	03	410029	RES	12	Flood Zone A
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6355	00	410812	RES		Flood Zone A
Saxon Woods	Old Fishkill Hook Road/Fishkill Hook Road	6355	00	317899	RES		Flood Zone A
Sprainbrook Meadows	Townsend Road	6456	04	955335	RES	11	Flood Zone A
Summit Woods	Route 52	6656	00	045715	RES	175	Flood Zone A
Grape Hollow	Grape Hollow Road	6756	03	379100	RES	11	Flood Zone A

Source: Town of East Fishkill

Additional Data Needs and Next Steps

A HAZUS-MH flood analysis was conducted for the Town of East Fishkill using the most current and best available data including updated building and critical facility inventories, DFIRMs, contours and default model demographic data. For future plan updates, more accurate exposure and loss estimates can be produced by replacing the national default demographic inventory with 2010 U.S. Census data. As Assessor database continues to be updated, the general building inventory should also be maintained. In the future, FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) will be providing the flood depth and analysis grids as part of the DFIRM deliverable. These depth grids can be incorporated into HAZUS and used to calculate the potential losses to the Town inventory. The utilization of the Risk MAP depth grids will provide even more accurate flood loss estimates.

5.4.4-9. Potential New Development and Flood Boundaries



Source: FEMA; East Fishkill GIS

5.4.5 SEVERE STORM

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

HAZARD PROFILE

Hazard profile information is provided in this section, including information on description, extent, location, previous occurrences and losses and the probability of future occurrences within the Town of East Fishkill.

Description

For the purpose of this HMP and as deemed appropriated by the Town of East Fishkill, the severe storm hazard includes hailstorms, windstorms, lightning, thunderstorms, tornadoes, and tropical cyclones (e.g. hurricanes, tropical storms, and tropical depressions), which are defined below. Since most northeasters, (or Nor'Easters) a type of an extra-tropical cyclone, generally take place during the winter weather months, Nor'Easters have been grouped as a type of severe winter weather storm, further discussed in Section 5.4.6 (Severe Winter Storm).

Hailstorm: According to the National Weather Service (NWS), hail is defined as a showery precipitation in the form of irregular pellets or balls of ice more than five millimeters in diameter, falling from a cumulonimbus cloud (NWS, 2009). Hailstorms are a potential damaging outgrowth of severe thunderstorms (Northern Virginia Regional Commission [NVRC], 2006). The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. They cause over $1 billion in crop and property damages each year in the U.S., making hailstorms one of the most costly natural disasters (Federal Alliance for Safe Homes, Inc., Date Unknown).

Windstorm: According to the Federal Emergency Management Agency (FEMA), wind is air moving from high to low pressure. It is rough horizontal movement of air (as opposed to an air current) caused by uneven heating of the Earth's surface. It occurs at all scales, from local breezes generated by heating of land surfaces and lasting tens of minutes to global winds resulting from solar heating of the Earth (FEMA, 1997). Windstorm events are associated with cyclonic storms (for example, hurricanes), thunderstorms and tornadoes (FEMA, 1997). A type of windstorm that is experienced often during rapidly moving thunderstorms is a derecho. A derecho is a widespread and long-lived windstorm associated with thunderstorms that are often curved in shape (Johns et al., 2012).

Lightning: According to the NWS, lightning is a visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground (NWS, 2005). The discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm creates a "bolt" when the buildup of charges becomes strong enough. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit (°F). Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. Annually, on average, 300 people are injured and 89 people are killed due to lightning strikes in the U.S. (NVRC, 2006).

Thunderstorm: According to the NWS, a thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS, 2009). Although thunderstorms generally affect a small area when they occur, they are very dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. A thunderstorm produces wind gusts less than 57 miles per hour (mph) and hail, if any, of less than 3/4-inch diameter at the surface. A severe thunderstorm has thunderstorm related surface winds (sustained or gusts) of 57 mph or greater and/or surface hail 3/4-inch or larger (NWS, 2009). Wind or hail damage may be used to infer the occurrence/existence of a severe thunderstorm (Office of the Federal Coordinator for Meteorology, 2001).

Tornado: A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Tornado season is generally March through August, although tornadoes can occur at any time of year (NCDC, 2012). Tornadoes tend to strike in the afternoons and evening, with over 80 percent (%) of all tornadoes striking between noon and midnight (New Jersey Office of Emergency Management [NJOEM], 2007). The average forward speed of a tornado is 30 mph, but can vary from nearly stationary to 70 mph (NWS, 1995). The NOAA Storm Prediction Center (SPC) indicates that the total duration of a tornado can last between a few seconds to over one hour; however, a tornado typical lasts less than 10 minutes (Edwards, 2012). High-wind velocity and wind-blown debris, along with lightning or hail, result in the damage caused by tornadoes. Destruction caused by tornadoes depends on the size, intensity, and duration of the storm. Tornadoes cause the greatest damage to structures that are light, such as residential homes and mobile homes, and tend to remain localized during impact (NVRC, 2006).

Tropical Cyclone: Tropical cyclone is a generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters (National Atlas, 2011); containing a warm core of low barometric pressure which typically produces heavy rainfall, powerful winds and storm surge (New York City Office of Emergency Management [NYCOEM], 2012). It feeds on the heat released when moist air rises and the water vapor in it condenses (Dorrego, Date Unknown). Depending on their location and strength, there are various terms by which tropical cyclones are known, such as hurricane, typhoon, tropical storm, cyclonic storm and tropical depression (Pacific Disaster Center, 2006). While tropical cyclones begin as a tropical depression, meaning the storm has sustained winds below 38 miles per hour (mph), it may develop into a tropical storm (with sustained winds of 39 to 73 mph) or a hurricane (with winds of 74 mph and higher).

Tropical Depression: A tropical depression is an organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of less than 38 mph. It has no "eye" (the calm area in the center of the storm) and does not typically have the organization or the spiral shape of more powerful storms (Emanuel, Date Unknown; Miami Museum of Science, 2000).

Tropical Storm: A tropical storm is an organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds between 39 and 73 mph (NOAA, 2009). Once a storm has reached tropical storm status, it is assigned a name. During this time, the storm itself becomes more organized and begins to become more circular in shape, resembling a hurricane. The rotation of a tropical storm is more recognizable than a tropical depression. Tropical storms can cause a lot of problems, even without becoming a hurricane; however, most of the problems stem from heavy rainfall (University of Illinois, Date Unknown).

Hurricane: A hurricane is an intense tropical cyclone with wind speeds reaching a constant speed of 74 mph or more (FEMA, 2011). It is a category of tropical cyclone characterized by thunderstorms and defined surface wind circulation. They are caused by the atmospheric instability created by the collision of warm air with cooler air. They form in the warm waters of tropical and sub-tropical oceans, seas, or Gulf of Mexico (NWS, 2004). Most hurricanes evolve from tropical disturbances. A tropical disturbance is a discrete system of organized convection (showers or thunderstorms), that originate in the tropics or subtropics, does not migrate along a frontal boundary, and maintains its identity for 24 hours or more (NWS, 2004). Hurricanes begin when areas of low atmospheric pressure move off the western coast of Africa and into the Atlantic, where they grow and intensify in the moisture-laden air above the warm tropical ocean. Air moves toward these atmospheric lows from all directions and circulates clock-wise under the influence of the Coriolis Effect, thereby initiating rotation in the converging wind fields. When these hot, moist air masses meet, they rise up into the atmosphere above the low pressure area, potentially establishing a self-reinforcing feedback system that produces weather systems known to meteorologists as tropical disturbances, tropical depressions, tropical storms, and hurricanes (Frankenberg, Date Unknown).

Almost all tropical storms and hurricanes in the Atlantic basin, which includes the Gulf of Mexico and Caribbean Sea, form between June 1st and November 30th. This time frame is known as hurricane season. August and September are peak months for hurricane development. The threats caused by an approaching hurricane can be divided into three main categories: storm surge, wind damage and rainfall/flooding:

- *Storm Surge* is simply water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more. Storm surge is responsible for nearly 90-percent of all hurricane-related deaths and injuries.
- *Wind Damage* is the force of wind that can quickly decimate the tree population, down power lines and utility poles, knock over signs, and damage/destroy homes and buildings. Flying debris can also cause damage to both structures and the general population. When hurricanes first make landfall, it is common for tornadoes to form which can cause severe localized wind damage.
- *Rainfall / Flooding* the torrential rains that normally accompany a hurricane can cause serious flooding. Whereas the storm surge and high winds are concentrated around the “eye”, the rain may extend for hundreds of miles and may last for several days, affecting areas well after the hurricane has diminished (Mandia, 2011).

Extent

The extent (that is, magnitude or severity) of a severe storm is largely dependent upon sustained wind speed. Straight-line winds, winds that come out of a thunderstorm, in extreme cases, can cause wind gusts exceeding 100 mph. These winds are most responsible for hailstorm and thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado (NVRC, 2006).

Hail

Hail can be produced from many different types of storms. Typically, hail occurs with thunderstorm events. The size of hail, ranging from 1/4” to 4.5”, is typically estimated by comparing it to a known object. Most hail storms are made up of a variety of sizes, and only the very largest hail stones pose serious risk to people, if exposed (NYS HMP, 2011; NSSL, date unknown).

Tornado

The magnitude or severity of a tornado was originally categorized using the Fujita Scale (F-Scale) or Pearson Fujita Scale introduced in 1971. It is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure (Tornado Project, Date Unknown). The F-Scale categorizes each tornado by intensity and area. The scale is divided into six categories, F0 (Gale) to F5 (Incredible) (Edwards, 2012). Table 5.4.5-1 explains each of the six F-Scale categories.

Table 5.4.5-1. Fujita Damage Scale

Scale	Wind Estimate (MPH)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: SPC, 2011

Limitations with the F-Scale that resulted in inconsistent ratings of tornadoes, led to the development of the Enhanced Fujita Scale (EF Scale), which became operational on February 1, 2007 (SPC, 2011). The EF Scale was revised from the original F-Scale to reflect better examinations of tornado damage surveys. This new scale has to do with how most structures are designed (NOAA, 2008). Table 5.4.5-2 displays the EF Scale and each of its six categories.

Table 5.4.5-2. Enhanced Fujita Damage Scale

F-Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
EF0	Light tornado	65–85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	Moderate tornado	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	Significant tornado	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	Severe tornado	136-165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	Devastating tornado	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	Incredible tornado	>200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of

F-Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
			100 m (109 yards); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: SPC, 2007

Since the EF Scale recently went into effect in February 2007, previous occurrences and losses associated with historic tornado events, described in the next section (Previous Occurrences and Losses) of this hazard profile, are based on the former Fujita Scale. Events after February 2007 are based on the Enhance Fujita Scale.

Hurricanes

The extent of a hurricane is categorized by the Saffir-Simpson Hurricane Scale. This scale categorizes or rates hurricanes from 1 (Very Dangerous) to 5 (Catastrophic 2) based on their intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline, in the landfall region (National Hurricane Center [NHC], 2012). Table 5.4.5-3 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes land fall.

Table 5.4.5-3. The Saffir-Simpson Hurricane Scale

Category	Wind Speed (mph)	Expected Damage
1	74-95	Very Dangerous: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	Extremely Dangerous: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129	Devastating: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	131-156	Catastrophic 1: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Category	Wind Speed (mph)	Expected Damage
5	> 157	Catastrophic 2: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
Additional Classifications		
Tropical Storm	39-73	NA
Tropical Depression	< 38	NA

Source: FEMA, 2012
mph = Miles per hour
> = Greater than
NA = not applicable or not available

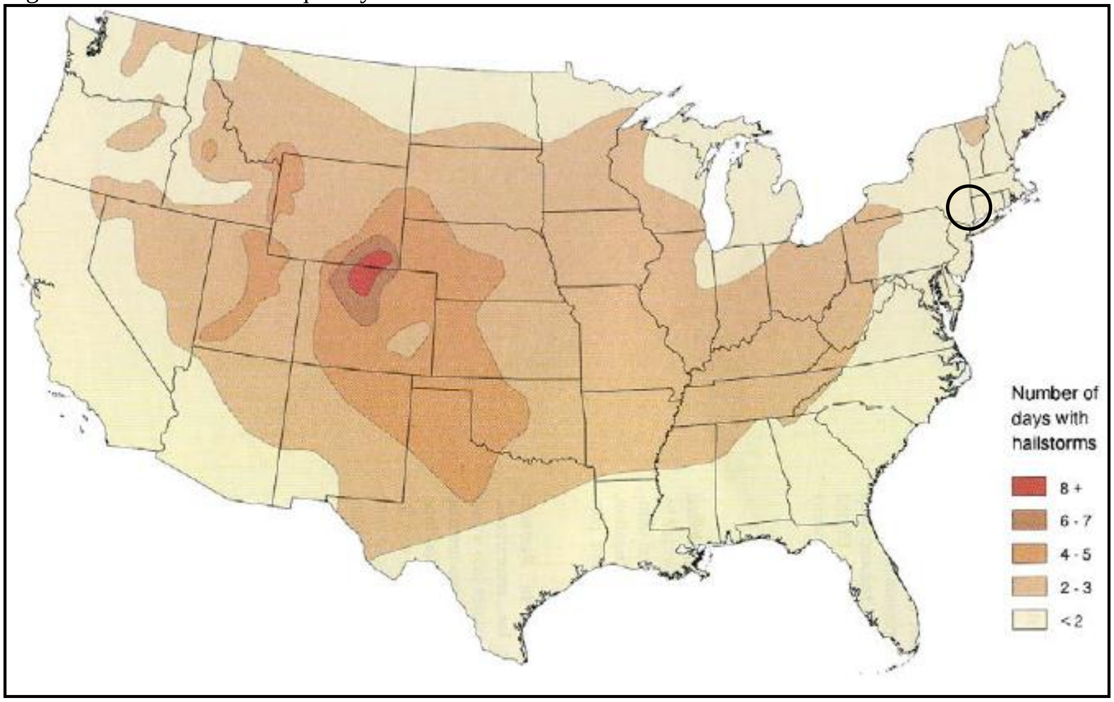
Location

Severe storms are a common natural hazard in New York State because the State exhibits a unique blend of weather (geographically and meteorological) features that influence the potential for severe storms and associated flooding. Factors include temperature, which is affected by latitude, elevation, proximity to water bodies and source of air masses; and precipitation which includes snowfall and rainfall. Precipitation intensities and effects are influenced by temperature, proximity to water bodies, and general frequency of storm systems. The Cornell Climate Report also indicates that the geographic position of the State (Northeast U.S.) makes it vulnerable to frequent storm and precipitation events. This is because nearly all storms and frontal systems moving eastward across the continent pass through, or in close proximity to New York State. Additionally, the potential for prolonged thunderstorms or coastal storms and periods of heavy precipitation is increased throughout the state because of the available moisture that originates from the Atlantic Ocean (NYS HMP, 2011).

Hailstorms

Hailstorms are more frequent in the southern and central plain states, where the climate produces violent thunderstorms. However, hailstorms have been observed in almost every location where thunderstorms occur (Federal Alliance for Safe Homes, Inc., Date Unknown). Figure 5.4.5-1 illustrates that the Town of East Fishkill and most of New York State experience less than two hailstorms per year.

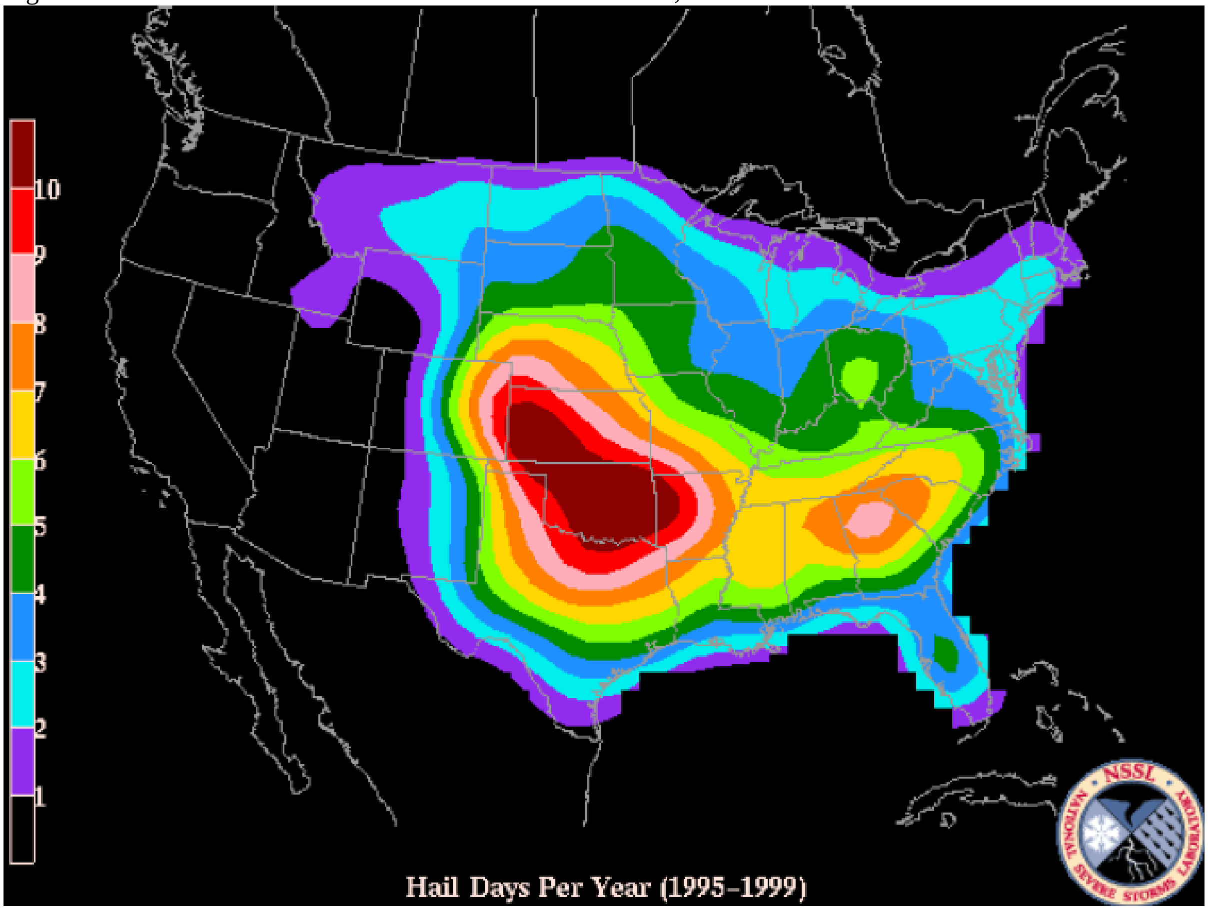
Figure 5.4.5-1. Annual Frequency of Hailstorms in the U.S.



Source: NVRC, 2006
Note: The black circle indicates the approximate location of the Town of East Fishkill.

Figure 5.4.5-2 illustrates the number of hail days, per year, between 1995 and 1999 in the U.S. According to this figure, New York State experiences between one and three days of hail each year, with the Town of East Fishkill and areas in Dutchess County experiencing between two and three days.

Figure 5.4.5-2. Total Annual Threat of Hail Events in the U.S., 1995-1999



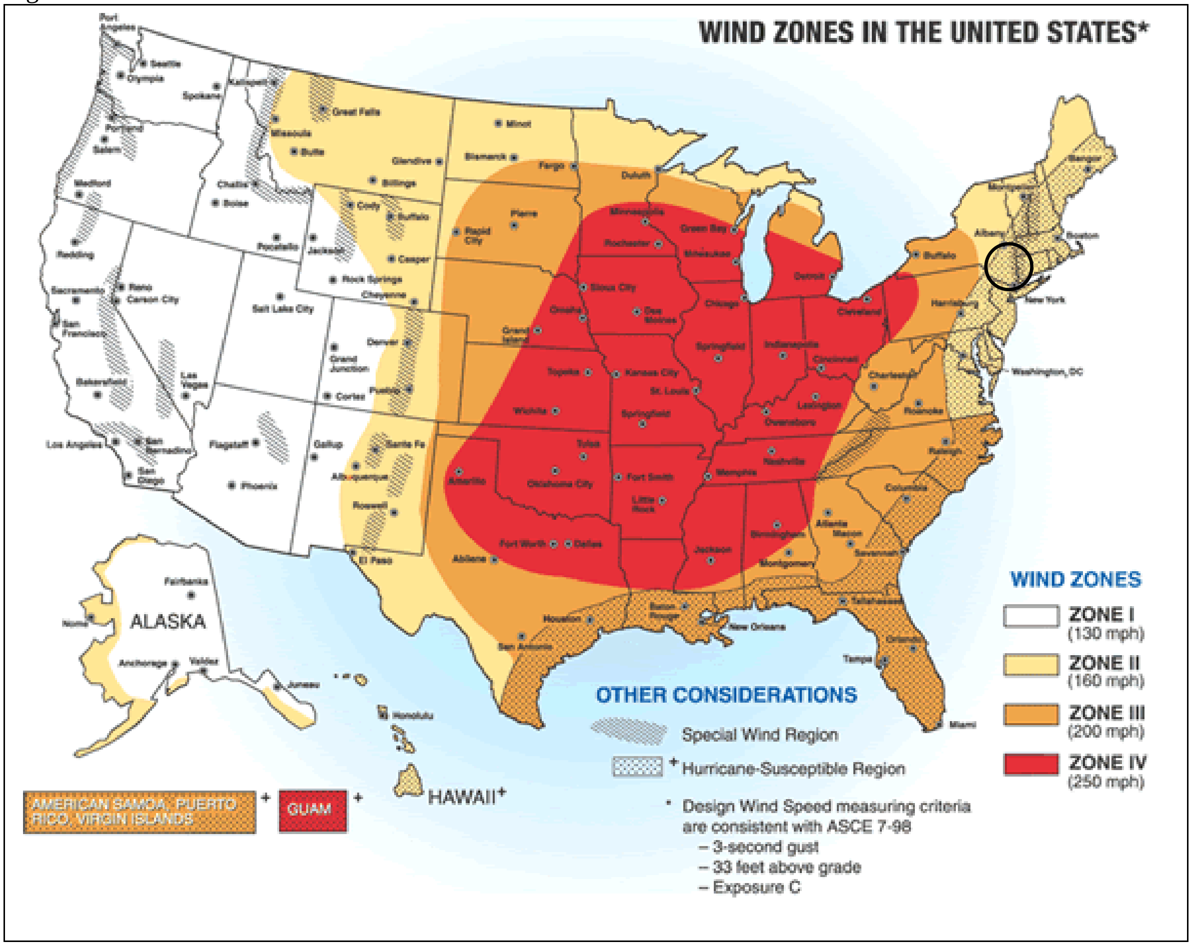
Source: NYS HMP, 2011; NSSL, 2003 (http://www.nssl.noaa.gov/hazard/totalthreat.html)

Note: The mean number of days per year with one or more events within 25 miles of a point is shown here. The fill interval for tornadoes is 0.2, with the purple starting at 0.2 days. For the non-tornado threats, the fill interval is 1, with the purple starting at 1. For the significant (violent), it is 5 days per century (millennium)

Windstorms

Figure 5.4.5-3 indicates how the frequency and strength of windstorms impacts the U.S. and the general location of the most wind activity. This is based on 40 years of tornado history and 100 years of hurricane history, collected by FEMA. States located in Wind Zone IV have experienced the greatest number of tornadoes and the strongest tornadoes (NVRC, 2006). The Town of East Fishkill is located in Wind Zone II with speeds up to 160 miles per hour. The town is also located within the Hurricane Susceptibility Region, which extends along the northeastern coastline of the U.S. (FEMA, 2008). The New York State Hazard Mitigation Plan (NYS HMP, 2011) identifies counties most vulnerable to wind, as determined by a rating score. Counties accumulate points based on the value of each vulnerability indicator, the higher then indication for wind exposure the more points assigned, resulting in a final rating score. Dutchess County was given a rating score of 18, a high vulnerability to wind exposure (NYS HMP, 2011).

Figure 5.4.5-3. Wind Zones in the U.S.



Source: NYS HMP, 2011

Note: The black circle indicates the approximate location of the Town of East Fishkill.

Table 5.4.5-4. Wind Zones in the U.S.

Wind Zones	Areas Affected
Zone I (130 mph)	All of Washington, Oregon, California, Idaho, Utah, and Arizona. Western parts of Montana, Wyoming, Colorado and New Mexico. Most of Alaska, except the east and south coastlines.
Zone II (160 mph)	Eastern parts of Montana, Wyoming, Colorado, and New Mexico. Most of North Dakota. Northern parts of Minnesota, Wisconsin and Michigan. Western parts of South Dakota, Nebraska and Texas. All New England States. Eastern parts of New York, Pennsylvania, Maryland, and Virginia. Washington, DC.
Zone III (200 mph)	Areas of Minnesota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, New York, Michigan, and Wisconsin. Most or all of Florida, Georgia, South Carolina, North Carolina, Virginia, West Virginia. All of American Samoa, Puerto Rico, and Virgin Islands.
Zone IV (250 mph)	Mid US including all of Iowa, Missouri, Arkansas, Illinois, Indiana, and Ohio and parts of adjoining states of Minnesota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, Michigan, and Wisconsin. Guam.
Special Wind Region	Isolated areas in the following states: Washington, Oregon, California, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico. The borders between Vermont and New Hampshire; between New York, Massachusetts and Connecticut; between Tennessee and North Carolina.

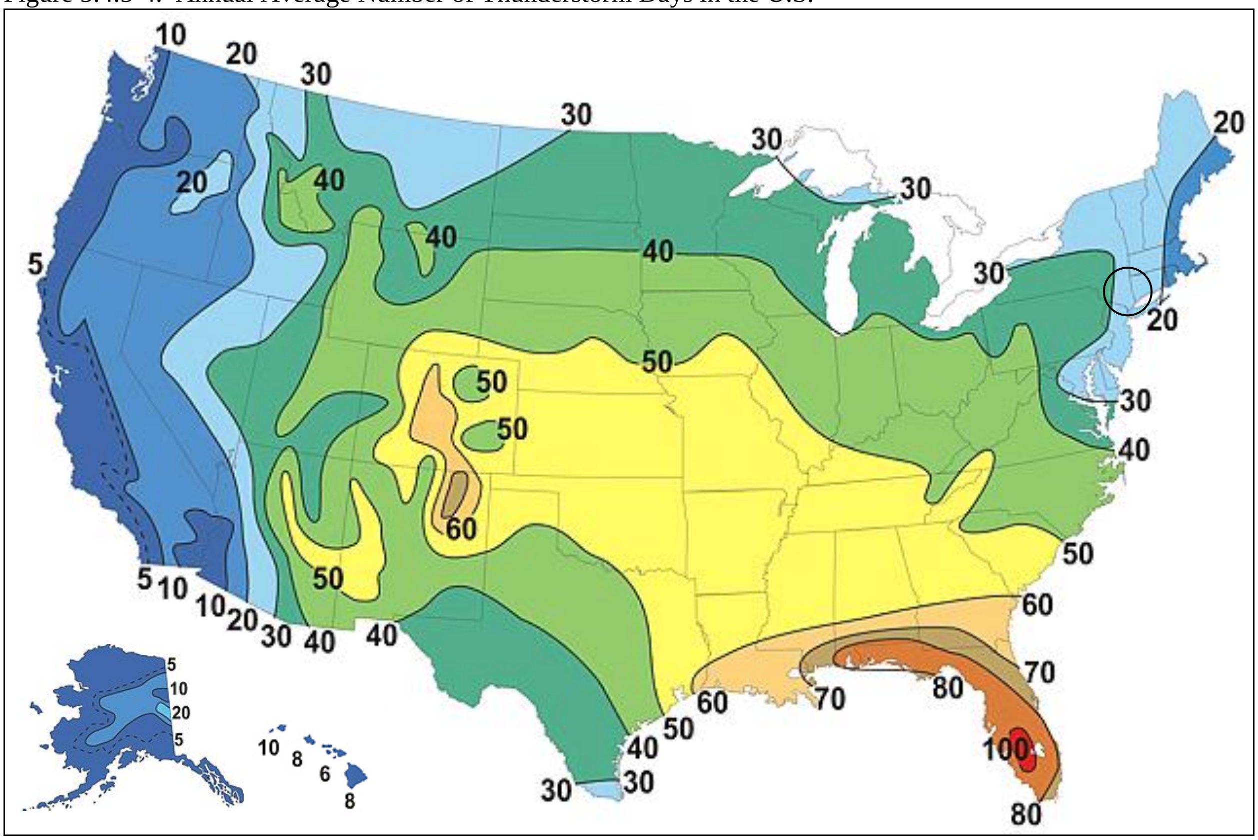
Wind Zones	Areas Affected
Hurricane Susceptible Region	Southern US coastline from Gulf Coast of Texas eastward to include entire state of Florida. East Coastline from Maine to Florida, including all of Massachusetts, Connecticut, Rhode Island, Delaware, and Washington DC. All of Hawaii, Guam, American Samoa, Puerto Rico and Virgin Islands.

Source: NYS HMP, 2011

Thunderstorms

Thunderstorms affect relatively small localized areas, rather than large regions much like winter storms, and hurricane events (NWS, Date Unknown). Thunderstorms can strike in all regions of the U.S.; however, they are most common in the central and southern states. The atmospheric conditions in these regions of the country are most ideal for generating these powerful storms (NVRC, 2006). It is estimated that there are as many as 40,000 thunderstorms each day world-wide. Figure 5.4.5-4 shows the average number of thunderstorm days throughout the U.S. The most thunderstorms are seen in the southeast states, with Florida having the highest incidences (80 to over 100 thunderstorm days each year) (NWS, date unknown). This figure indicates that the Town of East Fishkill experiences approximately 30 thunderstorm days each year.

Figure 5.4.5-4. Annual Average Number of Thunderstorm Days in the U.S.

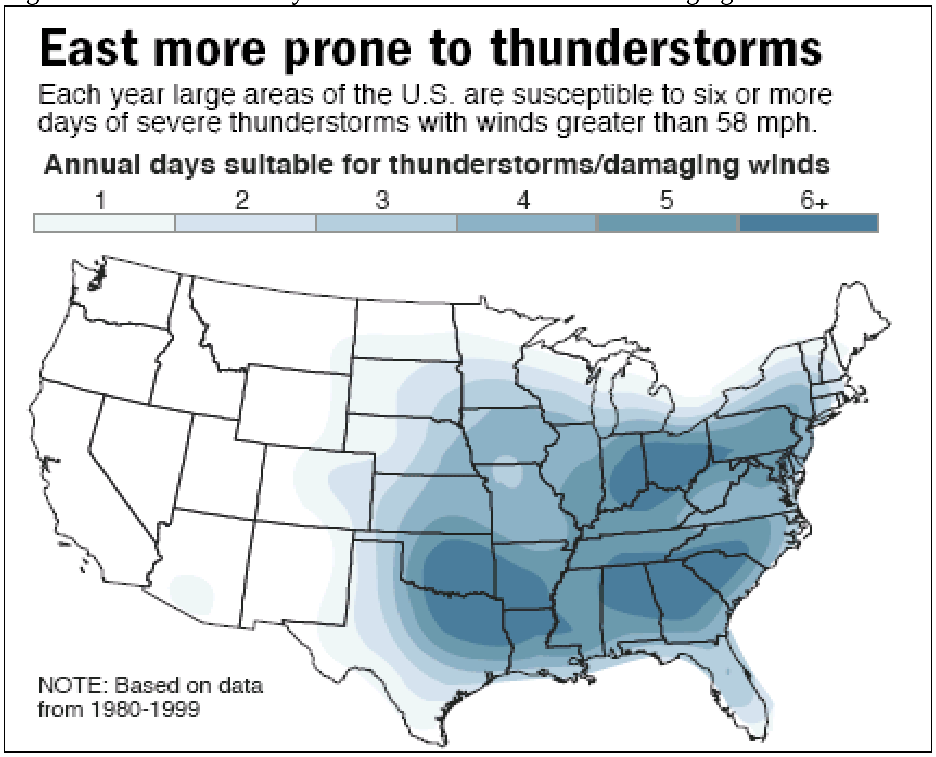


Source: NWS, Date Unknown

Note: The black circle indicates the approximate location of the Town of East Fishkill, Dutchess County.

NASA scientists suggest that the U.S. will face more severe thunderstorms in the future, with deadly lightning, damaging hail and the potential for tornadoes in the event of climate change (Borenstein, 2007). A recent study conducted by NASA predicts that smaller storm events like thunderstorms will be more dangerous due to climate change (Figure 5.4.5-5). As prepared by the NWS, Figure 5.4.5-7 identifies those areas, particularly within the eastern U.S. that are more prone to thunderstorms, which includes New York State.

Figure 5.4.5-5. Annual Days Suitable for Thunderstorms/Damaging Winds

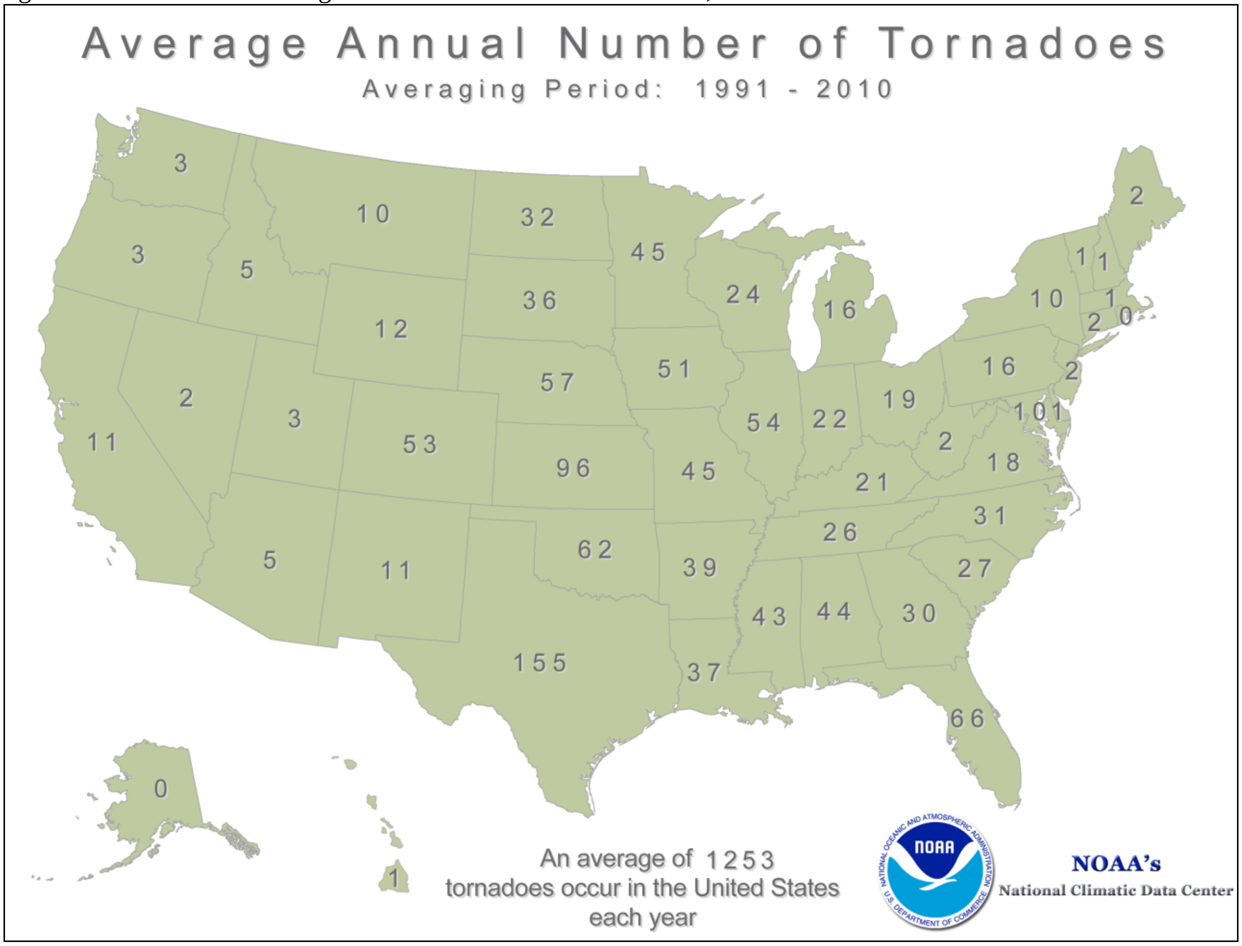


Source: MSNBC.com, 2007

Tornado

The U.S. experiences more tornadoes than any other country. In a typical year, approximately 1,000 tornadoes affect the U.S. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. Figure 5.4.5-6 shows the annual average number of tornadoes between 1991 and 2012 (NCDC, 2012). New York State experienced an average of ten tornado events annually between 1991 and 2012.

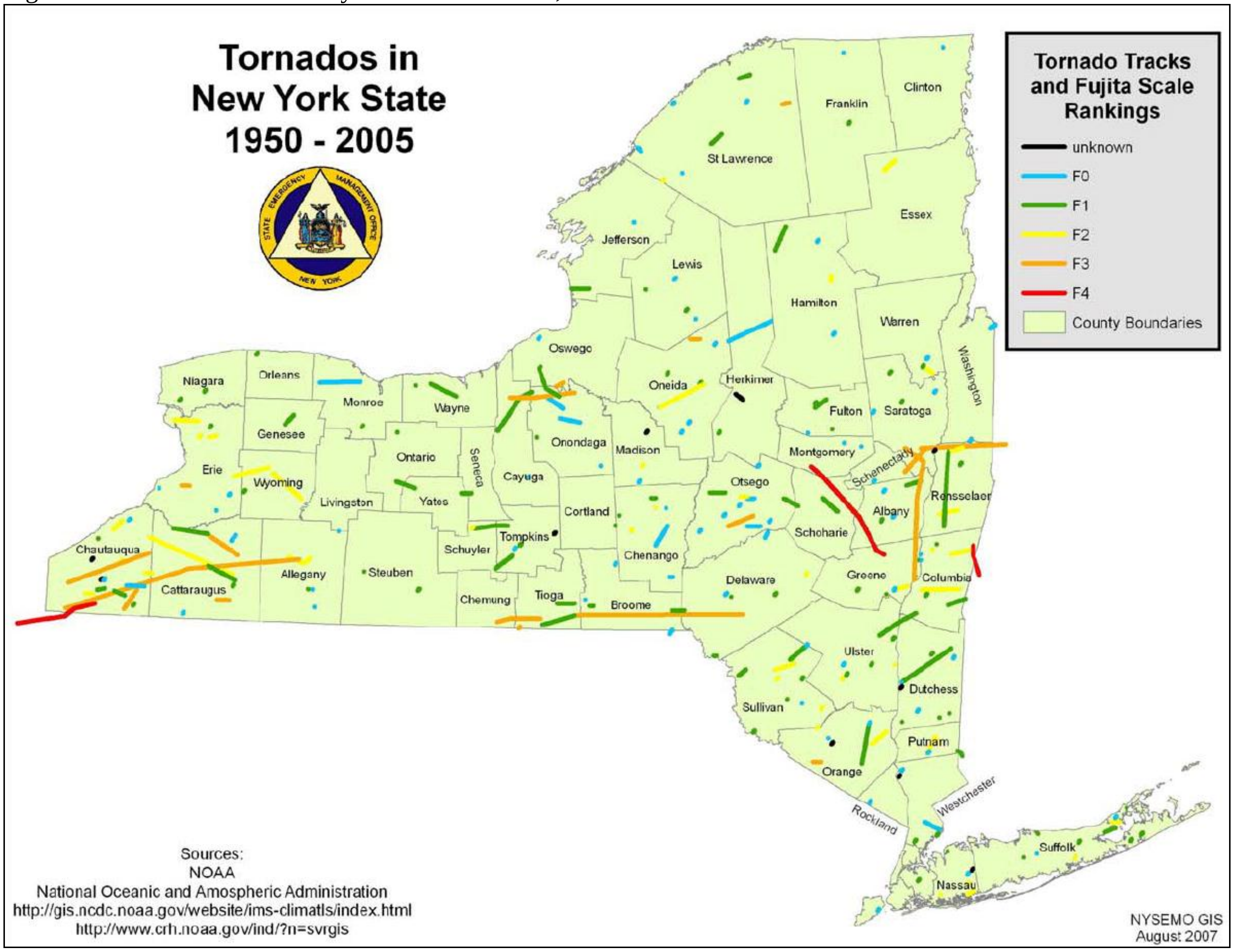
Figure 5.4.5-6. Annual Average Number of Tornadoes in the U.S., 1991 to 2010



Source: NCDC, 2012
Note: Between 1991 and 2010, New York State experienced an average of ten tornadoes each year.

New York State ranks 30th in the U.S. for frequency of tornadoes. When compared to other states on the frequency of tornadoes per square mile, the State ranks 35th (Pacific Disaster Center, 2006). New York State has a definite vulnerability to tornadoes and can occur, based on historical occurrences, in any part of the State. According to Figure 5.4.5-7, Dutchess County has experienced as many as 8 tornadoes between 1950 and 2005 (NYS HMP, 2011).

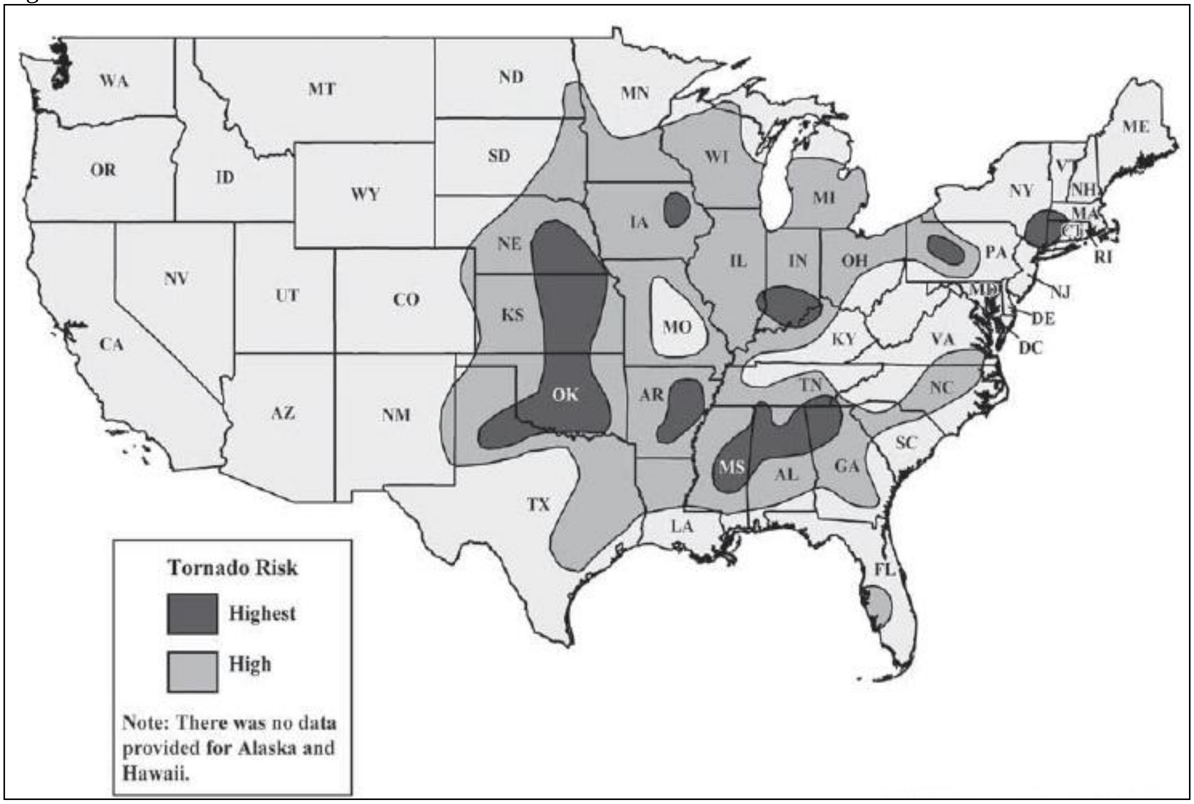
Figure 5.4.5-7. Tornado Activity in New York State, 1950-2005



Source: NYS HMP, 2011

Figure 5.4.5-8 indicates that a majority of the State, with the exception of the southeastern section (Mid-Hudson Region), has an overall low risk of tornado activity. The Town of East Fishkill is located in southeastern New York State, which according to the figure, has the highest risk of tornadoes. Details regarding historical tornado events are discussed in the next section (Previous Occurrences and Losses) of this profile.

Figure 5.4.5-8. Tornado Risk in the U.S.

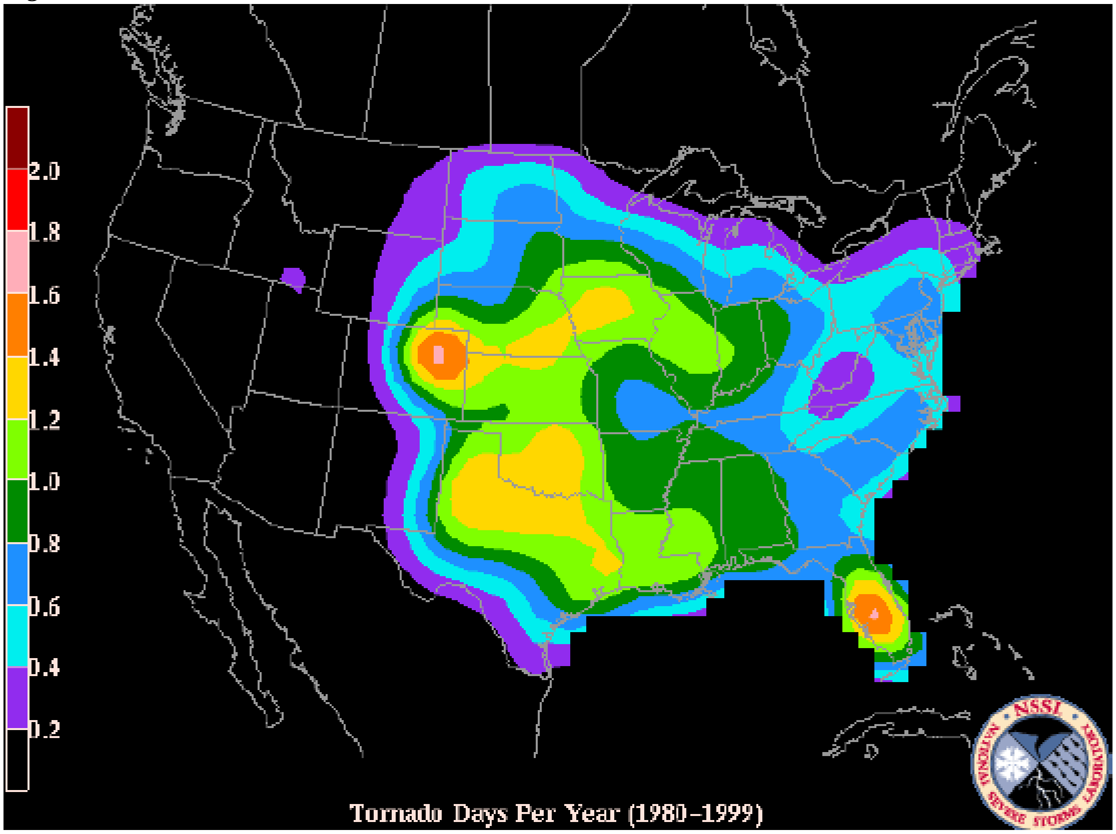


Source: NYS HMP, 2011

Note: The Town of East Fishkill, Dutchess County is shown has having a high risk of tornado occurrences.

A study from NOAA's National Severe Storms Laboratory (NSSL) provided estimates of the long-term threat from tornadoes. The NSSL used historical data to estimate the daily probability of tornado occurrences across the U.S., no matter the magnitude of the tornado. Figure 5.4.5-9 shows the estimates prepared by the NSSL. In New York State, it is estimated that the probability of a tornado occurring is 0 and 0.6 days per year. In Dutchess County, it is estimated that the probability of tornado occurring is 0.4 to 0.6 days per year (NYS HMP, 2011).

Figure 5.4.5-9. Total Annual Threat of Tornado Events in the U.S., 1980-1999



Source: NYS HMP, 2011; NSSL, 2003 (http://www.nssl.noaa.gov/hazard/totalthreat.html)

Note: The mean number of days per year with one or more events within 25 miles of a point is shown here. The fill interval for tornadoes is 0.2, with the purple starting at 0.2 days. For the nontornadic threats, the fill interval is 1, with the purple starting at 1. For the significant (violent), it's 5 days per century (millennium)

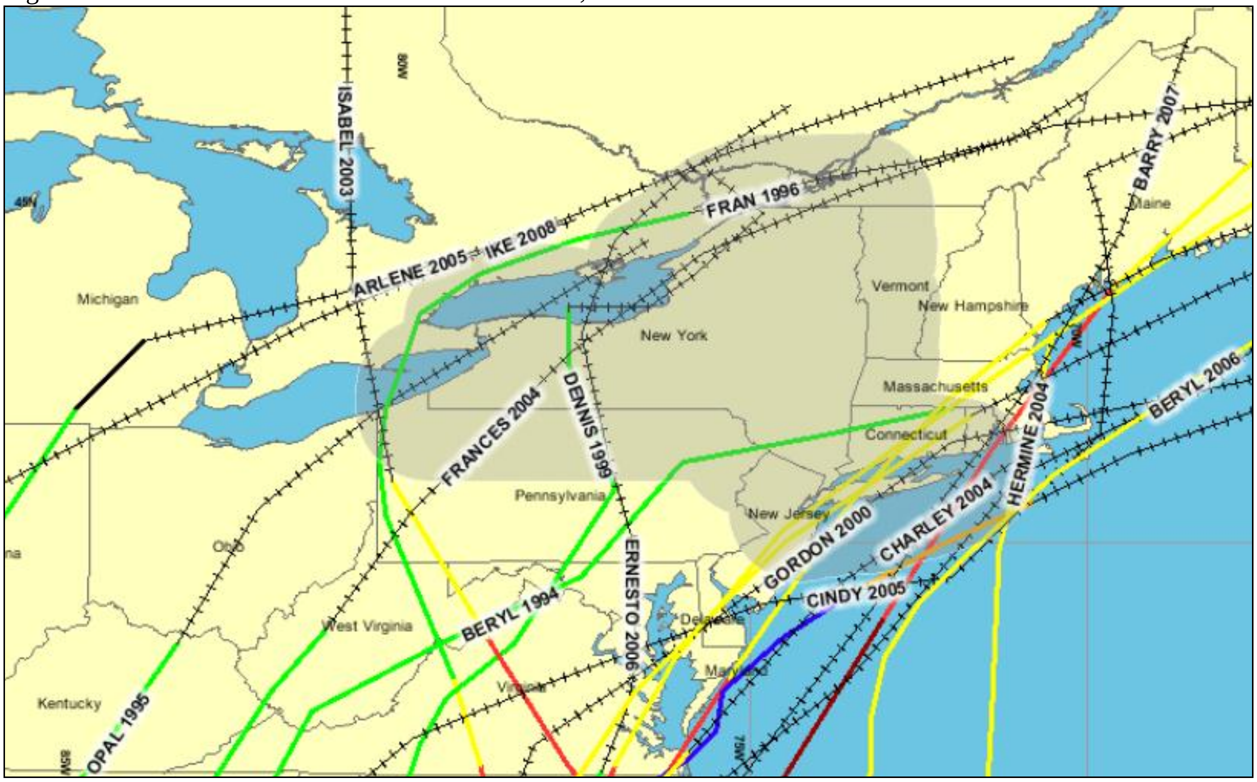
The NOAA NCDC database records 11 tornadoes in Dutchess County between August 1978 and September 2011. These events caused a reported $3.2 million in property damage in total, but no deaths, injuries, or crop damage. None of the 11 events were recorded to have passed directly through the Town of East Fishkill.

Hurricanes/Tropical Storms

Due to the Town of East Fishkill's inland location, hurricanes do not frequently make direct landfall on the mitigation study area. However, areas in Dutchess County have been known to experience the indirect landward effects, including high winds, heavy rains, and major flooding associated with hurricane and/or tropical storm events. Hurricanes and tropical storms can impact New York State from June to November, the official eastern U.S. hurricane season. However, late July to early October is the period hurricanes and tropical storms are most likely to impact New York State, due to the coolness of the North Atlantic Ocean waters (NYS HMP, 2011).

From 1888 to 2005, 32 hurricanes and numerous tropical storms have crossed over New York State. Figure 5.4.5-10 illustrates the storm tracks for storms between 1990 and 2006 for the State. The vast majority of these storms have been over the eastern part of the State, specifically in the southeastern corner. This area includes the New York City metropolitan area and the mid and lower Hudson Valley areas. These areas comprise approximately 61-percent of New York State's population (NYS HMP, 2011).

Figure 5.4.5-10. Hurricane Tracks in New York State, 1990 to 2006.

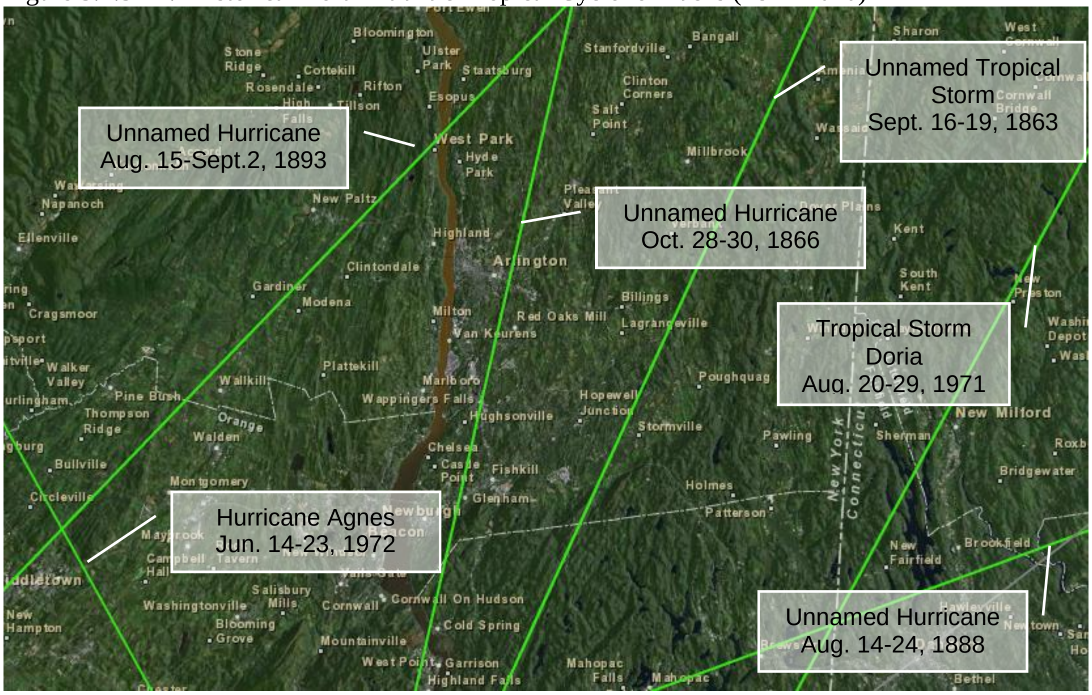


Source: NYS HMP, 2011

Multiple sources have indicated that municipalities within Dutchess County have been impacted by many hurricanes, tropical storms and tropical depressions. According to NOAA historical records, 12 hurricanes or tropical storm tracks have passed within 65 miles of the Town of East Fishkill since 1900. This includes three Category 1 hurricanes; two Category 3 hurricanes; three Category 4 hurricanes; one Category 5 hurricane; and three tropical storms. Of those 12 recorded storm events, none are reported to have traversed directly through the Town of East Fishkill. These storms are based on the Historical Hurricane Tracker, which includes storms through 2010. More recently, areas in Dutchess County felt the effects of Hurricane Irene and Tropical Storm Lee.

The Historical Hurricane Tracks tool is a public interactive mapping application that displays Atlantic Basin and East-Central Pacific Basin tropical cyclone data. This interactive tool tracks tropical cyclones (tropical or sub-tropical storms and tropical or sub-tropical depressions) from 1861 to 2010. Figure 5.4.5-11 displays tropical cyclone tracks for the Town of East Fishkill; however, the associated names for some of these events are unknown. Between 1842 and 2010, the Town of East Fishkill has experienced 17 tropical cyclone events. These events occurred within 65 nautical miles of Dutchess County (NOAA, 2012).

Figure 5.4.5-11. Historical North Atlantic Tropical Cyclone Tracks (1842-2010)

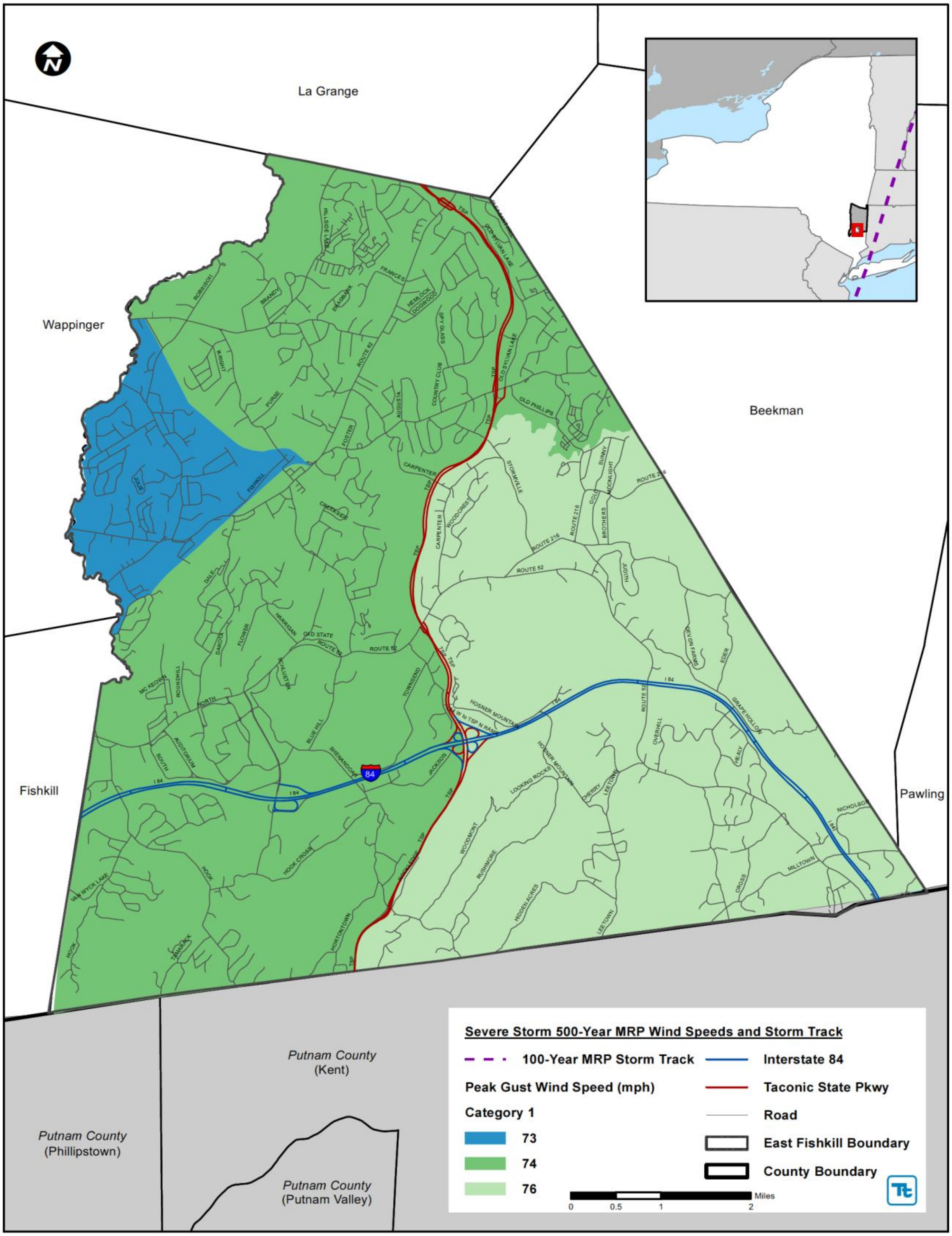


Source: NOAA, 2012

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. MRP is the average period of time, in years, between occurrences of a particular hazard event (equal to the inverse of the annual frequency of exceedance). For example, a flood that has a 1-percent chance of being equaled or exceeded in any given year is also referred to as the base flood and has a MRP of 100. This is known as a 100-year flood. The term “100-year flood” can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a one-percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time or less than one time in 100 years (Dinicola, 2009).

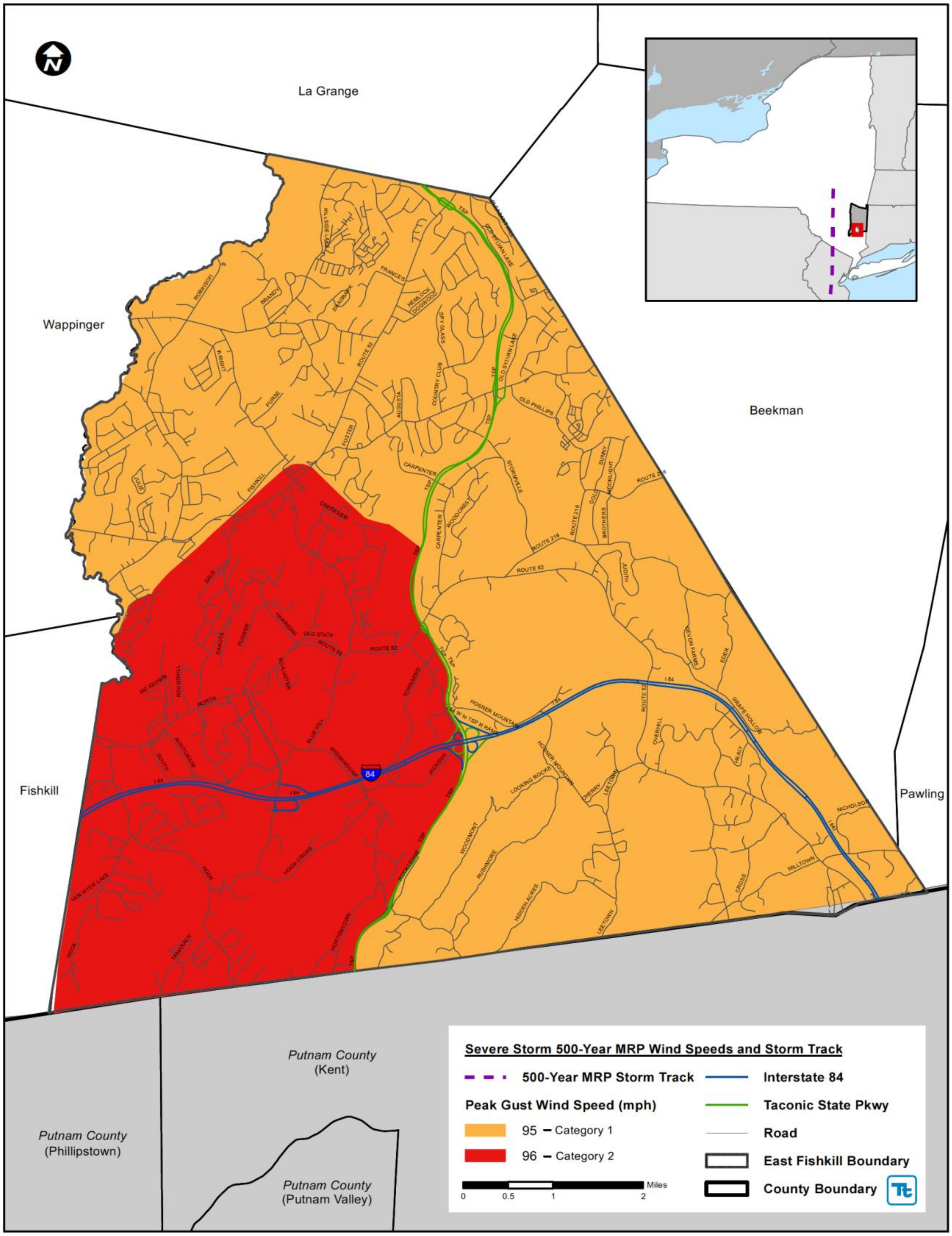
Figures 5.4.5-12 and 5.4.5-13 show the estimated maximum 3-second gust wind speeds that can be anticipated in the Town of East Fishkill study area associated with the 100- and 500-year MRP HAZUS-MH model runs. The estimated hurricane track for the 100- and 500-year event is also shown. For the 100-year MRP event, the maximum 3-second gust wind speeds for the Town of East Fishkill range from 73 to 76 mph. These are wind speeds characteristic of a Category 1 hurricane. For the 500-year MRP event, the maximum 3-second gust wind speeds for the Town range from 95 to 96 mph, characteristic of a hurricane between a Category 1 and 2. The associated impacts and losses from these 100-year and 500-year MRP hurricane event model runs are reported in the Vulnerability Assessment later in this section.

Figure 5.4.5-12. Wind Speeds and Storm Track for the 100-Year Mean Return Period Event in the Town of East Fishkill



Source: HAZUS-MH 2.1

Figure 5.4.5-13. Wind Speeds and Storm Track for the 500-Year Mean Return Period Event in the Town of East Fishkill.



Source: HAZUS-MH 2.1

Previous Occurrences and Losses

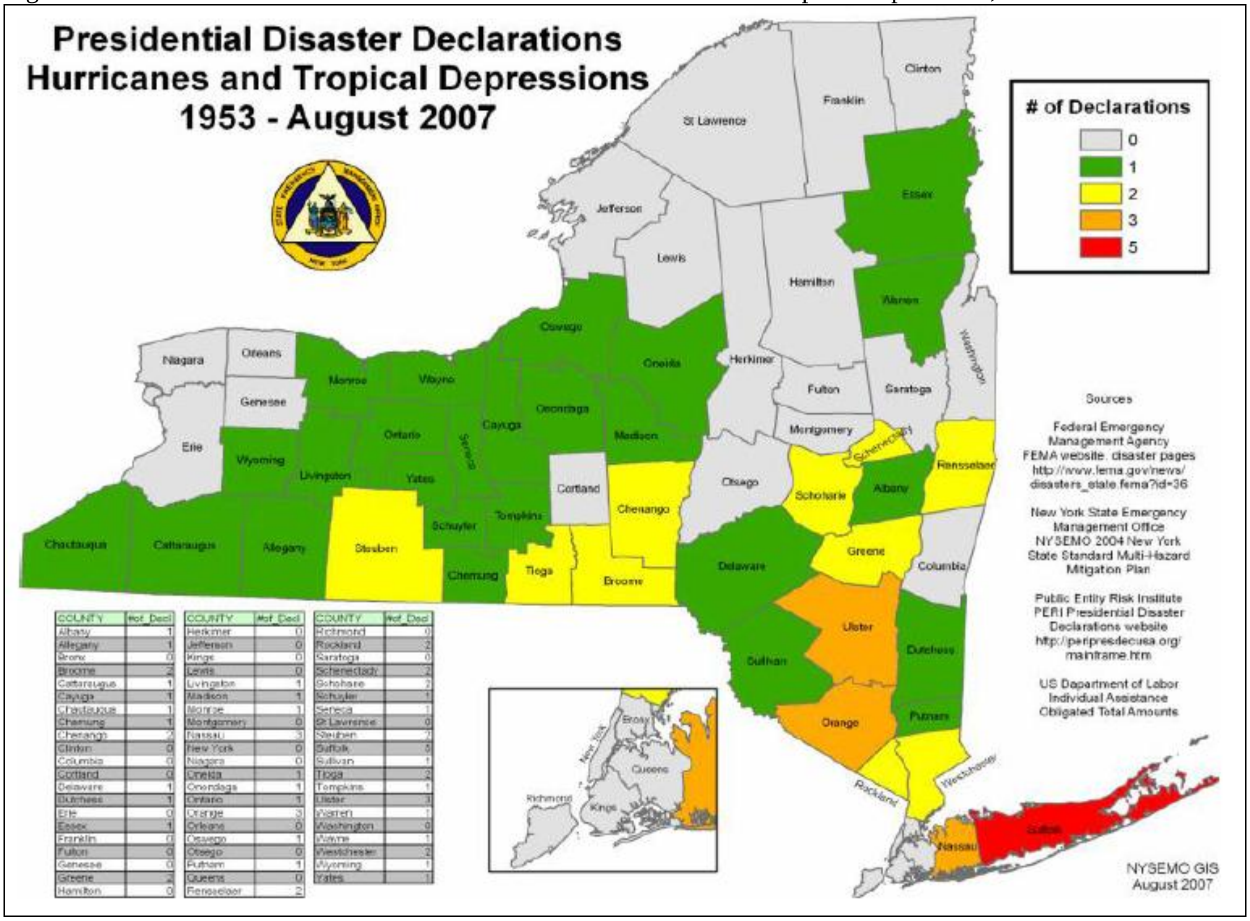
Many sources provided historical information regarding previous occurrences and losses associated with severe storm events throughout New York State and Dutchess County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

According to NOAA's NCDC storm events database, Dutchess County experienced 490 severe storm events between June 14, 1957 and October 29, 2011. These events include funnel clouds, hail, high wins, lightning, hurricane and tropical storms, precipitation, strong winds, thunderstorms and tornadoes. Total property damages, as a result of these severe storm events, were estimated just over $12million. This total also includes damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 241 severe storm events occurred within the County. The database indicated that severe storm events and losses specifically associated with the Town of East Fishkill, Dutchess County and its municipalities totaled over $22.16 million in property damage and over $2.9 million in crop damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2011, FEMA declared that New York State experienced 51 severe storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: winter storms, severe storms, coastal storms, flooding, heavy rain, tropical storm, hurricane, high winds and tornado. 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 declarations. Of those events, the NYS HMP and other sources indicate that Dutchess County has been declared as a disaster area as a result of 20 severe storm events (FEMA, 2011).

Figure 5.4.5-14 shows the FEMA disaster declarations (DR) for hurricanes and tropical depressions in New York State, from 1953 to August 2007. This figure indicates that Dutchess County was only included in one disaster declaration. Since the date of this figure, the Town of East Fishkill, Dutchess County has been included in two additional FEMA disaster declarations for hurricanes and tropical storms.

Figure 5.4.5-14. Presidential Disaster Declarations for Hurricanes and Tropical Depressions, 1953-2007



Source: NYS HMP, 2011

Based on all sources researched, known severe storm events that have affected Dutchess County and its municipalities are identified in Table 5.4.5-5. Where possible, locations in or around the Town of East Fishkill affected directly by these storm events are noted. With severe storm documentation for New York State being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.5-5 may not include all events that have occurred in the town and throughout the County.

Table 5.4.5-5. Severe and Coastal Storm Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
September 13, 1971	Severe Storms and Flooding	DR-311	Yes	Unknown	FEMA
July 20, 1973	Severe Storms and Flooding	DR-401	Yes	Unknown	FEMA
January 19 – 30, 1996	Severe Storms and Flooding	DR-1095 (IA and PA)	Yes	A strong low pressure system produced damaging southerly winds across all of eastern New York from Saturday morning through the evening hours. Heavy winds downed trees, limbs and power lines across the area. Southern Dutchess County saw some of the worst damage with over 6,000 customers losing power. In the days following, rapid rainfall of up to 3 inches and unseasonably warm temperatures contributing to snowmelt resulted in widespread flooding across Dutchess County. Small streams flooded across the entire county which resulted in many roads being washed out. Extensive flooding also occurred along the Hudson River and Wappingers Creek. The wind, rain, and floods led to an estimated $7.03 million in property damages in Dutchess County.	FEMA, NOAA-NCDC, SHELDUS
February 24, 1996	High Wind	N/A	N/A	A rapidly deepening low pressure system brought damaging winds to eastern New York, which downed many trees across the area and produced scattered power outages. Over 20,000 customers were without power across the Hudson Valley and southern Catskill Region. Downed trees and roof damage was reported throughout the region, and gusts up to 61 knots were recorded. Property damages in Dutchess County were estimated at $17,333.	NOAA-NCDC, SHELDUS
May 21, 1996	Thunderstorms/ Wind	N/A	N/A	Severe TSTMs developed along a cold front which crossed eastern NYS and adjacent western New England during the afternoon of May 21. These storms damaged parts of Ulster and Dutchess Counties. Damage was most widespread over southern and central Dutchess County. Approximately 7,000 customers were without power in southern Dutchess County. The Town of East Fishkill had approximately $5K in property damage.	NOAA-NCDC
March 6, 1997	High Wind	N/A	N/A	Damaging winds throughout eastern New York brought many trees and power lines down, which resulted in power outages. In Dutchess County, approximately 4,000 customers lost power. Damages for the County were estimated at $307,143.	NOAA-NCDC, SHELDUS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
September 16-19, 1999	Remnants of Hurricane Floyd	DR-1296 (IA)	Yes	Remnants of Hurricane Floyd moved along the east coast September 16th to 17th. As it entered into New York State, it brought heavy rains and strong wind gusts of up to 60 mph. These strong winds combined with saturated grounds caused major tree, power line, and vehicle damage throughout Eastern NY. Rains produced widespread flooding, and in a nine-year-old girl was drowned in Dutchess County. Massive power outages followed, affecting as many as 80,000 people in the Mid-Hudson Valley for a week or more. Combined property damages from the wind and rain impacts following Hurricane Floyd in Dutchess County were approximately $1.4 million. Floyd resulted in the counties of Albany, Dutchess, Greene and Rensselaer being declared "major disaster areas" by Governor Pataki, and on September 30 these counties were included in the national Disaster Declaration.	FEMA, NOAA-NCDC
May 3 – August 12, 2000	Severe Storms	DR-1335 (PA)	Yes	A series of severe thunderstorms and hailstorms overwhelmed the region in the spring and summer of 2000. On July 14th, rainfall totals at Poughkeepsie, Dutchess County, reached 1.23 inches over 24 hours. On July 21, FEMA declared a disaster declaration due to major storms and flooding and authorized funding for the counties throughout New York State. On August 9th, a severe thunderstorm swept through the region, further crippling recovering communities. On August 25th, FEMA added six counties, including Dutchess County to the disaster declaration. Estimates of the damage incurred during the incident period range up to $6.1 million for Dutchess County.	FEMA, SHELDUS, NWS
December 12, 2000	High Wind	N/A	N/A	A low-pressure storm produced a significant high wind event across eastern New York during the morning hours of December 12th. A strong westerly wind brought down large limbs, trees, and power lines in just about every county in Eastern New York. In addition, there were reports of scattered structural damage. A roof was blown off a trailer in Dover Plains, Dutchess county. During the height of the storm, an estimated 22,000 customers were without power across eastern New York. Property damage in Dutchess County was estimated at $73,076.	NOAA_NCDC, SHELDUS
July 21, 2003	Thunderstorm/ Wind	DR-1486	No	A significant severe weather outbreak occurred across the region, with the largest tornado outbreak since May 31, 1998. The first line of TSTMs worked across the region during the afternoon, causing downed trees and wires across portions of Albany, Greene, Rensselaer, Schenectady, Saratoga and	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				Schoharie Counties. Torrential rains caused flash flooding in the City of Schenectady. Another line of strong storms moved east from central NYS into eastern NYS, producing wind damage of its own, with spotty downed trees and wires across portions of Albany and Washington Counties. Wind damage was more concentrated in Ulster and Dutchess Counties. In Dutchess County, in the Town of East Fishkill, the winds downed a large swath of trees and a state of emergency was declared. A series of tornadoes struck the Mid-Hudson Valley and affected Greene, Columbia and Rensselaer Counties. The tornadoes injured one and caused $10K in property damage in Dutchess County.	
December 1, 2004	High Winds	N/A	N/A	Wind gusts up to 60 mph were recorded in Dutchess County. In Hyde Park, a woman was trapped under a fallen tree at the Mobil Manor Trailer Park. She was later transported to the hospital with minor lacerations.	NOAA-NCDC
April 14-18, 2007	Severe Storms and Inland and Coastal Flooding (Nor'Easter)	DR-1692 (IA and PA)	Yes	Heavy rain led to widespread flooding of small streams and creeks across the county, which began during the early morning hours of Monday, April 16th, and persisted into Wednesday morning on the 18th. New York State experienced millions in eligible damages. FEMA gave out more than $61 million in assistance to affected counties within the State. Property damages in Dutchess County were estimated at $5.7 M.	FEMA, NOAA-NCDC
August 2, 2008	Lightning	N/A	N/A	Lightning struck the roof of a garage in Beekman, causing an electrical box inside the house to ignite, resulting in a house fire. This event caused approximately $30 K in property damages.	NOAA-NCDC
August 25 – September 5, 2011	Tropical Storm	EM-3328 / DR-4020 (PA and IA)	Yes	Tropical Storm Irene tracked north northeast across eastern New York on Sunday, August 28th, producing widespread flooding, and damaging winds across the region. The greatest impact from Irene across eastern New York was from heavy to extreme rainfall amounts, generally from 4 to 8 inches falling within a 12 hour period beginning early Sunday morning. This rainfall resulted in widespread flash flooding and river flooding across eastern New York. Numerous trees and power lines were reported down due to strong winds across Dutchess County, resulting road closures and approximately 25,000 power outages throughout the county. The Automated Surface Observing System Peak wind	FEMA, NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				gusts at the Dutchess County Airport in Poughkeepsie were measured at 43 mph.	
September 7 -10, 2011	Remnants of Tropical Storm Lee	EM-3341 / DR-4031	No	Remnants of Tropical Storm Lee moved into New York State, bringing heavy rain. Rainfall totals across eastern New York ranged between four and eight inches. Moderate flooding occurred on the Wappingers Creek. The Wappingers Falls river gage located 4.5 miles northeast of village of Wappingers Falls crested at 11.47 feet at 8:45pm on September 8.	FEMA, NOAA-NCDC

Sources: FEMA, NOAA-NCDC, NWS, SHELDUS

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
K	Thousand ($)
M	Million ($)
Mph	Miles Per Hour
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NWS	National Weather Service
PA	Public Assistance
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.

Probability of Future Events

Predicting future severe storm events in a constantly changing climate has proven to be a difficult task. Predicting extremes in New England and New York State is particularly difficult because of the region's geographic location. It is positioned roughly halfway between the equator and the North Pole and is exposed to both cold and dry airstreams from the south. The interaction between these opposing air masses often leads to turbulent weather across the region (Keim, 1997).

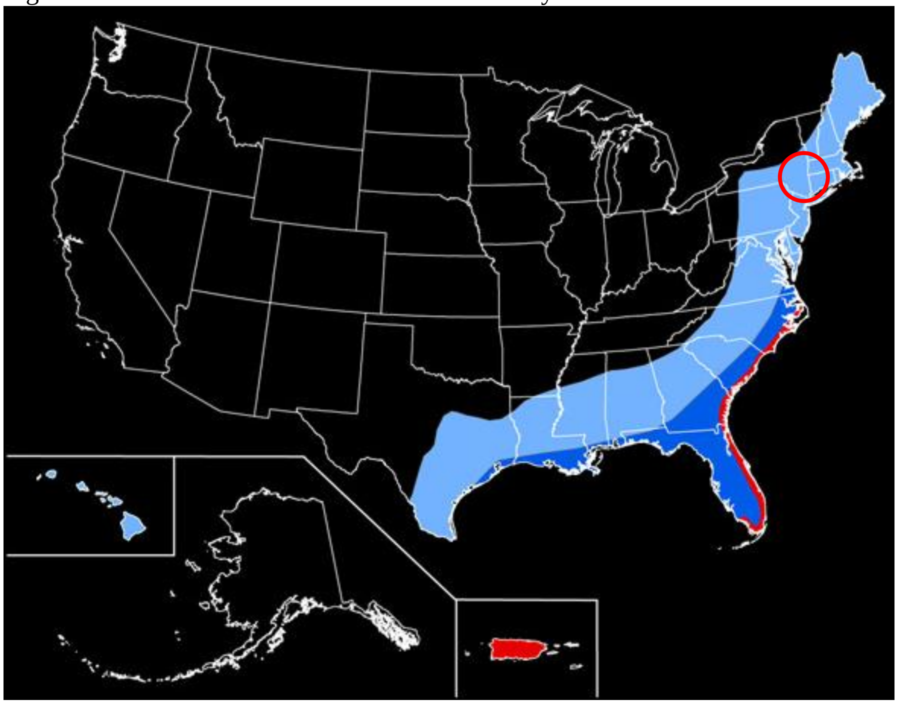
In Section 5.3, the identified hazards of concern for the Town of East Fishkill were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for severe storms in the Town of East Fishkill is considered 'frequent' (likely to occur more than once every 25 years).

It is estimated that the Town of East Fishkill will continue to experience direct and indirect impacts of severe storms annually that may induce secondary hazards such as flooding, infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences.

Hurricanes

Figure 5.4.5-15 illustrates the number of hurricanes expected to occur during a 100-year period. According to this map, portions of New York State, including Dutchess County and the Town of East Fishkill, can expect between 20 and 40 hurricanes during a 100-year return period.

Figure 5.4.5-15. Number of Hurricanes for a 100-year Return Period



Source: USGS, 2005

Note: The number of hurricanes expected to occur during a 100-year MRP based on historical data—light blue area, 20 to 40; dark blue area, 40 to 60; red area, more than 60. Map not to scale.

Nor'Easters

Analysis of Nor'Easter frequency by researchers reveals that fewer Nor'Easters occurred during the 1980s. However, the frequency of major Nor'Easters (class 4 and 5 on the Dolan-Davis Scale) has increased in recent years. In the period of 1987 to 1993, at least one class 4 or 5 storm has occurred each year along the Atlantic coast, a situation duplicated only once in the last 50 years (North Carolina Division of Emergency Management, 2009).

According to the Cape Cod Commission's Emergency Preparedness Handbook, unlike the relatively infrequent hurricane, the northeastern U.S. generally experiences at least one or two Nor'Easter events each year with varying degrees of severity. These storms have the potential to inflict more damage than many hurricanes because high winds can last from 12 hours to three days, while the duration of hurricanes ranges from six to 12 hours (Cape Cod Commission, 2007). Infrastructure, including critical facilities, may be impacted by these events, and power outages and transportation disruptions (for example: snow, heavy rain and/or debris impacted roads, as well as hazards to navigation and aviation) are often associated with Nor'Easters and other winter storms (Northeast States Emergency Consortium [NESEC], Date Unknown). All areas of the Town of East Fishkill are potentially at risk for property damage and loss of life due to Nor'Easters; therefore, having a moderate to high probability for Nor'Easters to occur.

The Role of Global Climate Change on Future Probability

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).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. The Town of East Fishkill is part of Region 5, Hudson and Mohawk River Valley. Some of the issues in this major river region, affected by climate change, include: saltwater front mover further up the Hudson River, potential contamination of New York City's back-up water supply, propagation of storm surge up the Hudson from the coast, and popular apple varieties decline (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3ºF by the 2020s, 3 to 5.5ºF by the 2050s and 4 to 9ºF by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.5-6 displays the projected seasonal precipitation change for the Hudson and Mohawk River Valley ClimAID Region (NYSERDA, 2011).

Table 5.4.5-6. Projected Seasonal Precipitation Change in Region 2, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	+5 to +10	-5 to +5	-5 to +10

Source: NYSERDA, 2011

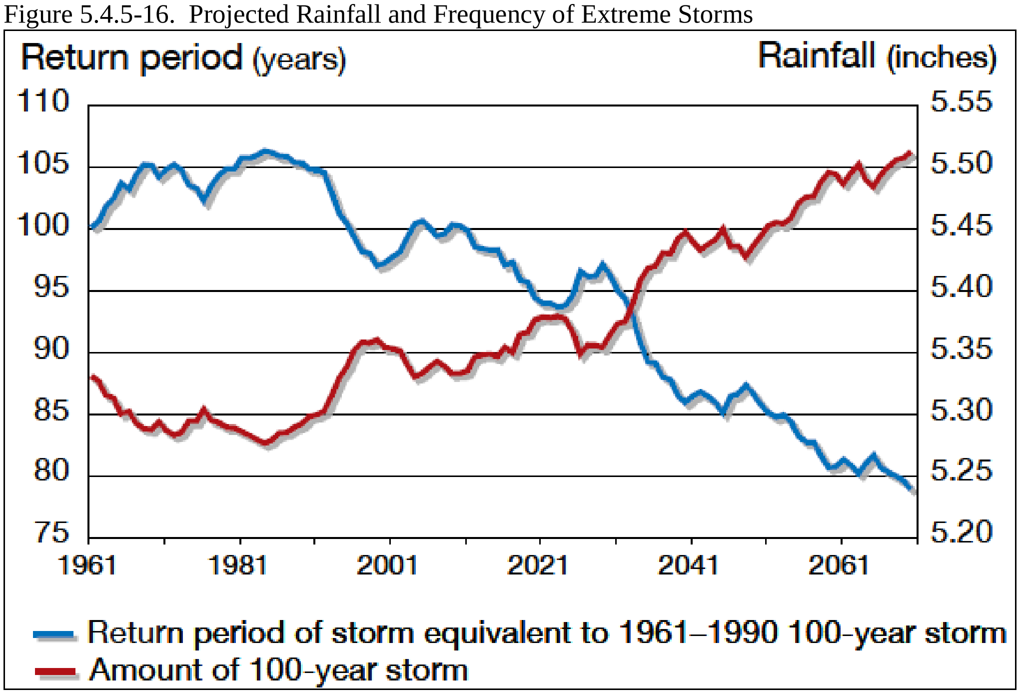
The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways and transportation hugs; and increase delays and hazards 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).

Over the past 50 years, heavy downpours have increased and this trend is projected to continue. This can cause an increase in localized flash flooding in urban areas and hilly regions. Flooding has the potential to increase pollutants in the water supply and inundate wastewater treatment plants and other vulnerable facilities located within floodplains. Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA, 2011).

Figure 5.4.5-16 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).

Figure 5.4.5-16. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA, 2011

Total precipitation amounts have slightly increased in the Northeast U.S., by approximately 3.3 inches over the last 100 years. There has also been an increase in the number of two-inch rainfall events over a 48-hour period since the 1950s (a 67-percent increase). The number and intensity of extreme precipitation events are increasing in New York State as well. More rain heightens the danger of localized flash flooding, streambank erosion and storm damage (DeGaetano et al [Cornell University], 2010) (http://files.campus.edublogs.org/blogs.cornell.edu/dist/8/90/files/2011/03/ny_changing_climate.pdf).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For severe storms, the entire Town of East Fishkill has been identified as the hazard area. Therefore, all municipal assets (population, structures, critical facilities and lifelines), as described in the Municipality Profile (Section 4), are vulnerable. The following text evaluates and estimates the potential impact of severe storms on the Town including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health 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 of this hazard over time

Overview of Vulnerability

The high winds and air speeds of a hurricane or any severe storm often result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, injuries and loss of life, and the need to shelter and care for individuals impacted by the events. A large amount of damage can be inflicted by trees, branches, and other objects that fall onto power lines, buildings, roads, vehicles, and, in some cases, people. The risk assessment for severe storm evaluates available data for a range of storms included in this hazard category.

Due to the Town of East Fishkill's proximity to the Long Island Sound and Atlantic Ocean, the municipality may experience wind and flood losses from severe thunderstorms to hurricanes (see flooding discussion in Section 5.4.5 Flood). Secondary flooding associated with the torrential downpours during severe storms is also a primary concern in the Town. Municipalities in Dutchess County have experienced flooding in association with numerous severe storms in the past.

The entire inventory of the Town is at risk of being damaged or lost due to impacts of severe wind. Certain areas, infrastructure, and types of building are at greater risk than others due to proximity to falling hazards and/or their manner of construction. Potential losses associated with high wind events were calculated for the Town of East Fishkill for two probabilistic hurricane events, the 100-year and 500-year MRP wind events. The impacts on population, existing structures and critical facilities on the town are presented below, following a summary of the data and methodology used.

Data and Methodology

After reviewing historic data, the HAZUS-MH methodology and model were used to analyze the severe storm hazard for the Town of East Fishkill. Data used to assess this hazard include data available in the HAZUS-MH 2.1 hurricane model, professional knowledge, information provided by the Steering and Planning Committees and input from public citizens.

A probabilistic scenario was run for the Town of East Fishkill for annualized losses and the 100- and 500-year MRPs were examined for the wind/severe storm hazard. Figures 5.4.5-12 and 5.4.5-13, earlier in this section, show the HAZUS-MH maximum peak gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP hurricane events. The estimated hurricane track for the 100- and 500-year events is also shown.

HAZUS-MH 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. Hurricane and inventory data available in HAZUS-MH were used to evaluate potential losses from the 100- and 500-year MRP events (severe wind impacts). Other than updated data for the general building stock and critical facility inventories, the default data in HAZUS-MH 2.1 was the best available for use in this evaluation.

Impact on Life, Health and Safety

The impact of a severe storm 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. It is assumed that the entire Town's population (U.S. Census 2010 population of 29,029 people) is exposed to this storm hazard.

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-MH estimates there will be zero people displaced and zero people that may require temporary shelter due to a 100-year MRP event, while two people may be displaced due to a 500-year MRP event.

Economically disadvantaged populations are more 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 more vulnerable and, physically, they may have more difficulty evacuating. The elderly are considered most 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 for the statistics of these populations in the Town.

Impact on General Building Stock

After considering the population exposed to the severe storm hazard, the general building stock replacement value exposed to and damaged by 100- and 500-year MRP events was examined. Wind-only impacts from a severe storm are reported based on the probabilistic hurricane runs in HAZUS-MH 2.1. Potential damage is the modeled loss that could occur to the exposed inventory, including damage to structural and content value based on the wind-only impacts associated with a hurricane (using the methodology described in Section 5.1).

Expected building damage was evaluated by HAZUS across the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 5.4.5-7 summarizes the definition of the damage categories.

Table 5.4.5-7. 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 of no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, 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 dents on walls requiring painting or patching for repair.	> 2% and ≤ 15%	One window, door, or garage door failure	No	< 5 Impacts	No	No
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%	> the larger of 20% & 3 and ≤ 50%	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%	> one and ≤ the larger of 20% & 3	> 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-MH Hurricane Technical Manual

As noted earlier in the profile, HAZUS estimates the 100-year MRP wind speeds for the Town of East Fishkill to be 73 to 76 miles per hour (mph). This equates to a Category 1 hurricane. For the 100-year MRP event, HAZUS-MH 2.1 estimates $3,692,405 in structure damages across the Town. Residential buildings comprise the majority of the building inventory and are estimated to experience the majority of the damage.

HAZUS estimates the 500-year MRP wind speeds for the Town of East Fishkill to range from 95 to 96 mph. This equates to between a Category 1 and 2 hurricane. HAZUS estimates $25,218,211 in damages to the general building stock (structure only). This is less than one-percent of the Town's building inventory. The residential buildings are estimated to experience the majority of the damage (wood and masonry). Table 5.4.5-8 summarizes the building value (structure only) damage estimated for the 100- and 500-year MRP wind-only events by occupancy class.

Table 5.4.5-8. Estimated Building Replacement Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Hurricane-Related Winds for All Occupancy Classes

Total Building Damage				Residential Buildings		Commercial Buildings		Industrial Buildings	
100 Year	% of Total	500 Year	% of Total	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
$3,692,405	<1	$25,218,211	<1	$3,571,579	$21,801,329	$31,569	$525,910	$59,347	$2,415,372

Agriculture Buildings		Religious Buildings		Government Buildings		Education Buildings	
100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
$2,348	$80,290	$2,042	$36,781	$2,021	$24,365	$23,495	$334,163

Source: HAZUS-MH 2.1

Because of differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. The damage counts include buildings damaged at all severity levels from minor damage to total destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level.

Of the $3.9 billion in total residential replacement value (structure) for the entire Town, an estimated $3,571,579 in residential building damage can be anticipated for the 100-year event and greater than $21 million in residential building damage can be anticipated for the 500-year event. Residential building damage accounts for 97-percent and 86-percent of total damages for the 100- and 500-year wind-only events, respectively. This illustrates residential structures are the most vulnerable to the wind hazard.

Annualized losses were also examined for the Town of East Fishkill. A total of $441,739 is estimated as the annualized loss for the entire Town; see Table 5.4.5-9. Please note that annualized loss does not predict what losses will occur in any particular year.

Table 5.4.5-9. Summary of Estimated Annualized Wind General Building Stock Losses for the Town of East Fishkill

Total (Buildings + Contents)	Buildings	Contents
$441,739	$324,397	$90,844

Source: HAZUS-MH 2.1

Impact on Critical Facilities

HAZUS-MH 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) may sustain damage as a result of 100-year and 500-year MRP wind-only events. Additionally, HAZUS-MH estimates the loss of use for each facility in number of days.

HAZUS-MH does not estimate any damage or loss of use for critical facilities as a result of a 100-year MRP event. Table 5.4.5-10 lists the estimated loss of use in days for each critical facility and the probability of sustaining the damage category as defined by the column heading, for the 500-year wind-only events. The damage categories are defined in Table 5.4.5-7, under “Impact on General Building Stock”.

Table 5.4.5-10. Estimated Impacts to Critical Facilities by the 500-Year MRP Hurricane Event (Wind Only)

Name	Type	(Days)	Percent Probability of Sustaining Damage			
		Loss Of Use	Minor	Moderate	Severe	Complete
Stormville Fire Co Inc	Fire	0	2	0	0	0
Stormville Fire Co Inc	Fire	0	2	0	0	0
Hillside Lake Fire Co. No. 3	Fire	0	3	0	0	0
Hopewell Hose Co #1 Inc	Fire	0	3	0	0	0
Stormville Fire Co	Fire	0	2	0	0	0
East Fishkill Fire District Training 1	Fire	0	3	0	0	0
East Fishkill Fire District Training 3	Fire	0	3	0	0	0
East Fishkill Fire District Training 2	Fire	0	3	0	0	0
Wiccopee Fire Company No. 4	Fire	0	3	0	0	0
Wiccopee Fire Company Sub.	Fire	0	3	0	0	0
Town of East Fishkill PD	Police	0	6	1	0	0
East Fishkill EOC/Fire HQ/Training/EMS	EOC/Fire/EMS	0	6	1	0	0
Wappingers Central School	School	3	7	6	1	0
Wappingers Central School	School	0	6	6	1	0
Wappinger Central School	School	3	7	6	1	0
Church Of St Columba	School	0	6	6	1	0
St Dennis Catholic Church	School	3	7	6	1	0
Bethal Baptist Church	School	0	6	6	1	0
Wappingers CS Dist. John Jay High School	School	0	6	6	1	0

Source: HAZUS-MH 2.1

At this time, HAZUS-MH 2.1 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.

Utility structures could suffer damage associated with falling tree limbs or other debris. Such impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts).

Impact on Economy

Severe storms also impact the economy, including: 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. HAZUS-MH 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" section 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.

HAZUS-MH estimates approximately $2,000 in business interruption losses for the Town of East Fishkill as a result of the 100-year MRP wind-only event (relocation cost for the residential occupancy class). It is clear there are minimal business interruption costs as a result of the 100-year wind event.

For the 500-year MRP wind only event, HAZUS-MH estimates $810,000 in business interruption losses for the Town of East Fishkill. These losses are mainly sustained by the residential occupancy from relocation and rental cost losses.

HAZUS-MH 2.1 also estimates the amount of debris that may be produced a result of the 100- and 500-year MRP wind events. Table 5.4.5-11 estimates the debris produced. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur.

Table 5.4.5-11. Debris Production for 100- and 500-Year MRP Hurricane-Related Winds

Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)	
100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
227	2,812	0	5	358	18,671

Source: HAZUS-MH 2.1

Future Growth and Development

As discussed and illustrated in Section 4, areas targeted for future growth and development have been identified across the Town of East Fishkill. Any areas of growth could be potentially impacted by the severe storm hazard because the entire Town is exposed and vulnerable to the wind hazard associated with severe storms.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as storms, including those which may bring precipitation high winds and tornado events. While predicting changes of wind and tornado events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

Refer to 'The Role of Global Climate Change on Future Probability' subsection earlier in this profile for more details on climate change pertaining to New York State.

Additional Data and Next Steps

Over time, the Town of East Fishkill will obtain additional data to support the analysis of this hazard. Data that will support the analysis would include additional detail on past hazard events and impacts, specific building information such as first floor elevation, type of construction, foundation type and details on protective features (for example, hurricane straps). In addition, information on particular buildings or infrastructure age or year built would be helpful in future analysis of this hazard.

5.4.6 SEVERE WINTER STORM

This section provides a profile and vulnerability assessment for the severe winter storm hazard.

HAZARD PROFILE

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

Description

For the purpose of this HMP and as deemed appropriated by East Fishkill, the severe winter storm hazard includes heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. Since most extra-tropical cyclones (mid-Atlantic cyclones locally known as Northeasters or Nor'Easters), generally take place during the winter weather months (with some events being an exception), these hazards have also been grouped as a type of severe winter weather storm. According to the New York State Hazard Mitigation Plan (NYS HMP, 2011), winter storms are frequent events for the State of New York and occur from late October until mid-April. These types of winter events or conditions are further defined below.

<u>Heavy Snow</u>: According to the National Weather Service (NWS), heavy snow is generally defined by snowfall accumulating to 4 inches or more in depth in 12 hours or less; or snowfall accumulating to six inches or more in depth in 24 hours or less. A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers) (NWS, 2009).

<u>Blizzard</u>: Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to ¼-mile or less for an extended period of time (three or more hours) (NWS, 2009).

<u>Sleet or Freezing Rain Storm</u>: Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NWS, 2009).

<u>Ice storm</u>: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous, and can create extreme hazards to motorists and pedestrians (NWS, 2009).

<u>Nor'Easter (abbreviation for North Easter)</u>: Nor'Easters are named for the strong northeasterly winds that blow in from the ocean ahead of the storm and over coastal areas. They are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms). A Nor'Easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the northeastern U.S. and Atlantic Canada. Wind gusts associated with Nor'Easters can exceed hurricane forces in intensity. Unlike tropical cyclones that form in the tropics and have warm cores (including tropical depressions, tropical storms and hurricanes); Nor'Easters contain a cold core of low barometric pressure that forms in the mid-latitudes. Their strongest winds are close to the earth's

surface and often measure several hundred miles across. Nor'Easters may occur at any time of the year but are more common during fall and winter months (September through April) (NYCOEM, 2012).

Nor'Easters can cause heavy snow, rain, gale force winds and oversized waves (storm surge) that can cause beach erosion, coastal flooding, structural damage, power outages and unsafe human conditions. If a Nor'Easter cyclone stays just offshore, the results are much more devastating than if the cyclone travels up the coast on an inland track. Nor'Easters that stay inland are generally weaker and usually cause strong winds and rain. The ones that stay offshore can bring heavy snow, blizzards, ice, strong winds, high waves, and severe beach erosion. In these storms, the warmer air is aloft. Precipitation falling from this warm air moves into the colder air at the surface, causing crippling sleet or freezing rain (McNoldy [Multi-Community Environmental Storm Observatory (MESO)], Date Unknown). While some of the most devastating effects of Nor'Easters are experienced in coastal areas (e.g. beach erosion, coastal flooding), the effects on inland areas, like in East Fishkill, may include heavy snow, strong winds and blizzards.

Winter storms can also generate coastal flooding, ice jams and snow melt, resulting in significant damage and loss of life. Ice jams are caused when long cold spells freeze up rivers and lakes. A rise in the water level or a thaw breaks the ice into large chunks. These chunks become jammed at man-made and natural obstructions. The ice jams act as a dam and result in flooding (NSSL, 2006).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatologically susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements, such as those above, and by evaluating its societal impacts. The Northeast Snowfall Impact Scale (NESIS) categorizes snowstorms, including Nor'Easter events, in this manner. Unlike the Fujita Scale (tornado) and Saffir-Simpson Scale (hurricanes), there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS to characterize and rank high-impact, northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5) (Table 5.4.6-1). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact northeast snowstorms can have on the rest of the country in terms of transportation and economic impact (Kocin and Uccellini, 2004).

Table 5.4.6-1. NESIS Ranking Categories 1 - 5

Category	Description	NESIS Range	Definition
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4-inch accumulations and small areas of 10-inch snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10-inch snows while some include small areas of 20-inch snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations (greater than 30 inches).

Category	Description	NESIS Range	Definition
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10-inch snows (generally between 50 and 150 × 103 mi^2—roughly one to three times the size of New York State with significant areas of 20-inch accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10-inch snowfalls, and each case is marked by large areas of 20-inch and greater snowfall accumulations.
5	Extreme	10 +	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 inches. These are the only storms in which the 10-inch accumulations exceed 200 × 103 mi^2 and affect more than 60 million people.

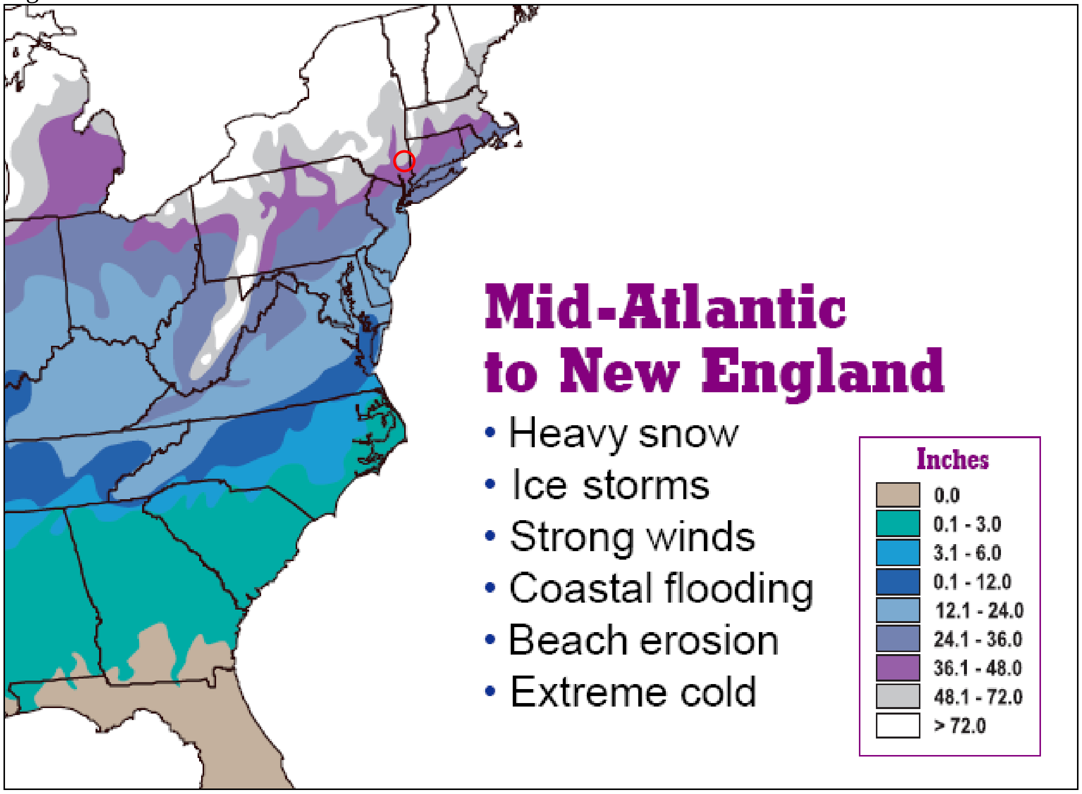
Source: Kocin and Uccellini, 2004

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. These numbers are calculated into a raw data number ranking from "1" for an insignificant fall to over "10" for a massive snowstorm. Based on these raw numbers, the storm is placed into its decided category. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers (Enloe, 2007).

Location

The climate of New York State is marked by abundant snowfall. Winter weather can reach New York State as early as October and is usually in full force by late November with average winter temperatures between 20 and 40° F. As indicated in the NYS HMP, communities in New York State receive more snow than most other communities in the nation. Although the entire State is subject to winter storms, the easternmost and west-central portions of the State are more likely to suffer under winter storm occurrences than any other location (NYS HMP, 2011). With the exception of coastal New York State, the State receives an average seasonal amount of 40 inches of snow or more. The average annual snowfall is greater than 70 inches over 60-percent of New York State's area; average annual amounts range from 48.1 inches to 72 inches in Dutchess County (Figure 5.4.6-1).

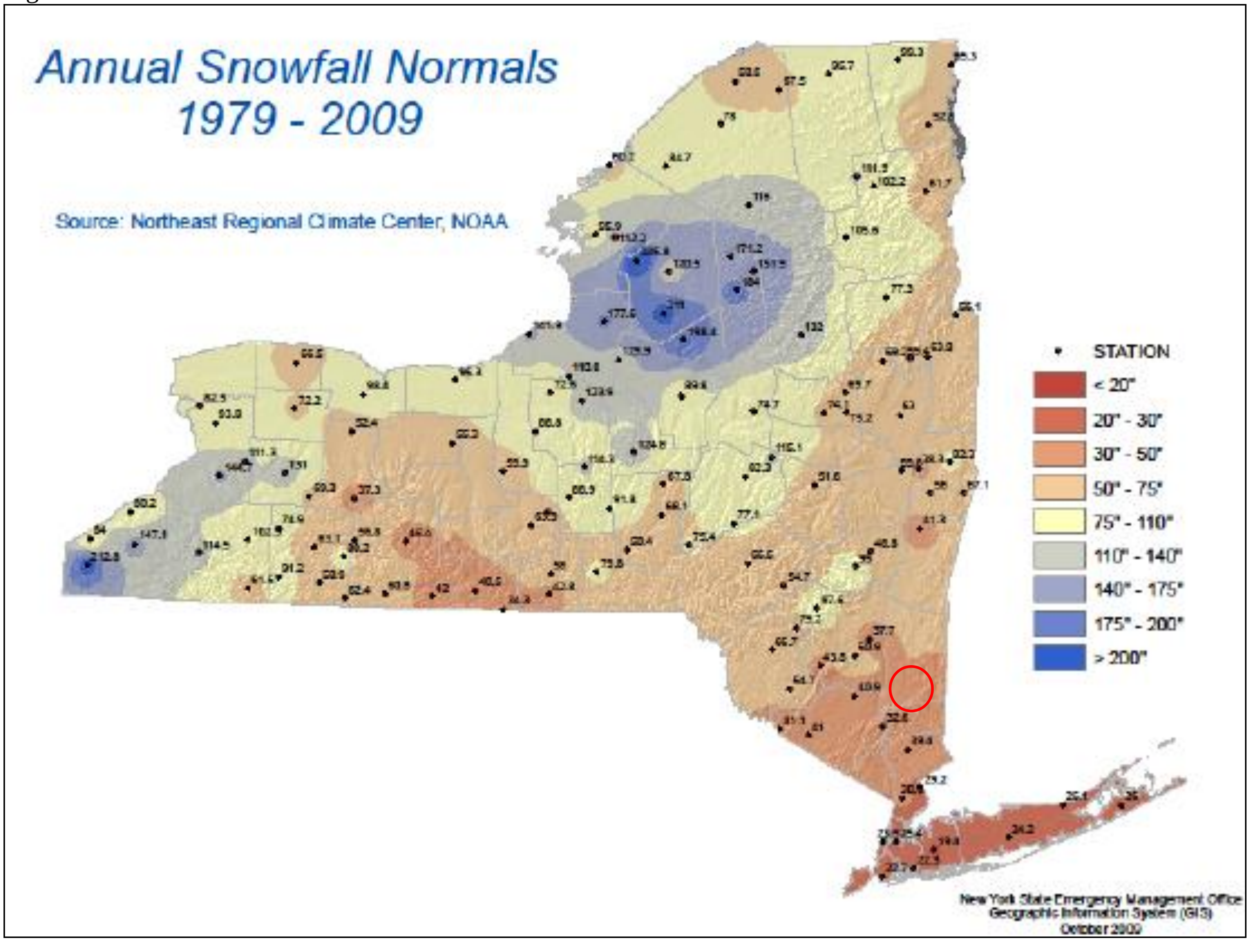
Figure 5.4.6-1. Annual Mean Snowfall within the Eastern U.S.



Source: NWS, 2001

Figure 5.4.6-2, an annual normal snowfalls map, illustrates the annual average snowfall totals over a 30 year period for New York State. The general indication of the average annual snowfall map shows areas that are subject to a consistent risk for large quantities of snow (NYS HMP, 2011).

Figure 5.4.6-2 Annual Snowfall Normals between 1979 – 2009

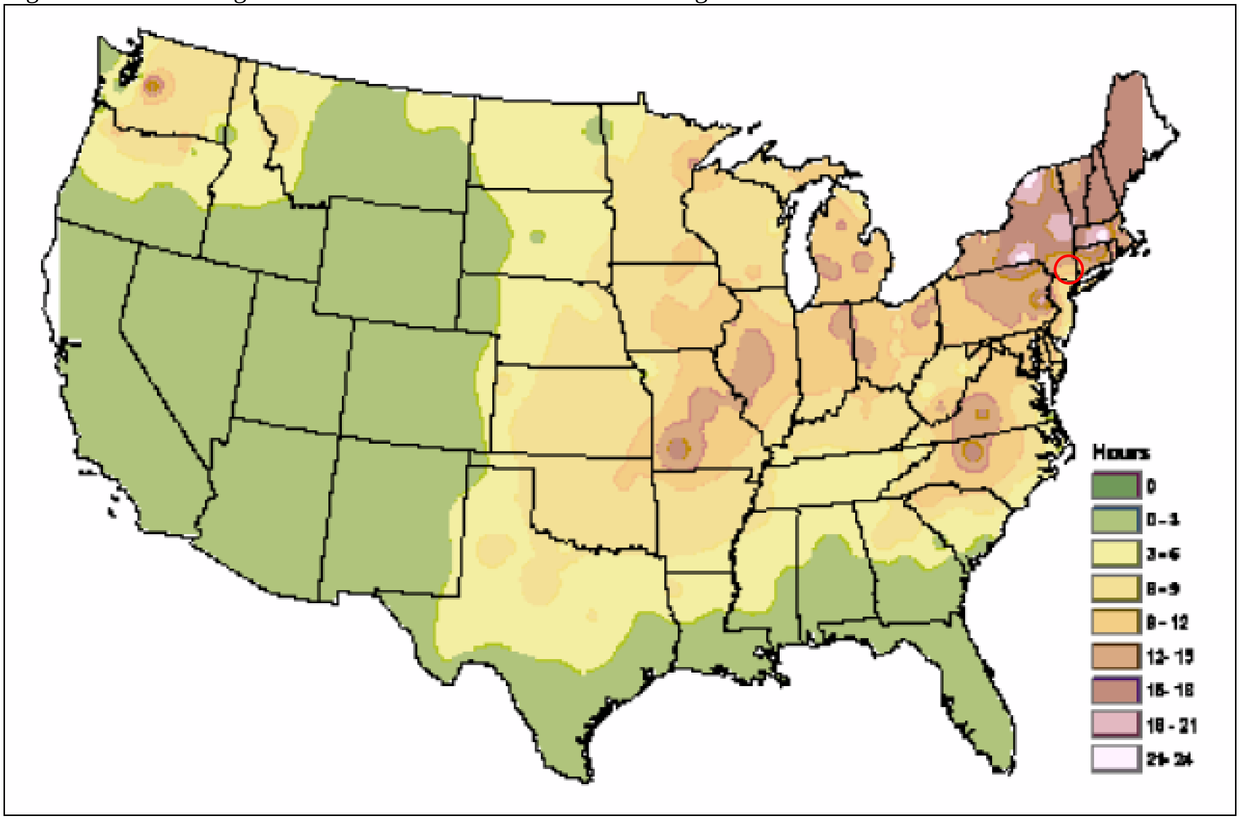


Source: Draft NYS HMP, 2011
Note: Dutchess County is indicated by a red circle with an average annual snow accumulation of 50 to 75-inches.

The general indication of the average annual snowfall map shows that the Town of East Fishkill and surrounding areas are subject to a consistent risk for large quantities of snow measuring 30 inches and more per year (Draft NYS HMP, 2011).

Figure 5.4.6-3 illustrates the average number of hours per year with freezing rain in the U.S. According to the figure, the Town of East Fishkill and surrounding areas experience between 8 and 15 hours per year (Draft NYS HMP, 2011).

Figure 5.4.6-3. Average Number of Hours Per Year with Freezing Rain in the United States



Source: Draft NYS HMP, 2011

Note: Dutchess County is indicated by a red circle with an average number of 13 to 18 hours of freezing rain each year.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe winter storms and extreme cold events throughout New York State and Dutchess County, but do not go so far as documenting losses at the municipal level. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source, and are mostly reported only as far as the county-level. Therefore, the accuracy of monetary figures discussed for East Fishkill is based only on the available information identified during research for this HMP.

The 2011 Draft New York State HMP rated each county in terms of their vulnerability to snow and ice storms hazards. Please refer to the NYS HMP for additional details on their point system. Table 5.4.6-2 summarizes Dutchess County's rating for both hazards.

Table 5.4.6-2. Dutchess County's Vulnerability Rating for Snow Storms.

County Rating Score (Max 25)	Annual Average Snowfall (inches)	*Extreme Snowfall Potential (no/yes)	# of Snow Related Disasters Population Density (per square mile)	Population Density (per square mile)	Total # of Structures (HAZUS)
14	42.3	No	4	339.8	79,721

Source: NYS HMP, 2011

Table 5.4.6-3. Dutchess County's Vulnerability Rating for Snow Storms

County Rating Score	Related Disasters	Total # of Structures (HAZUS)
4	0	79,721

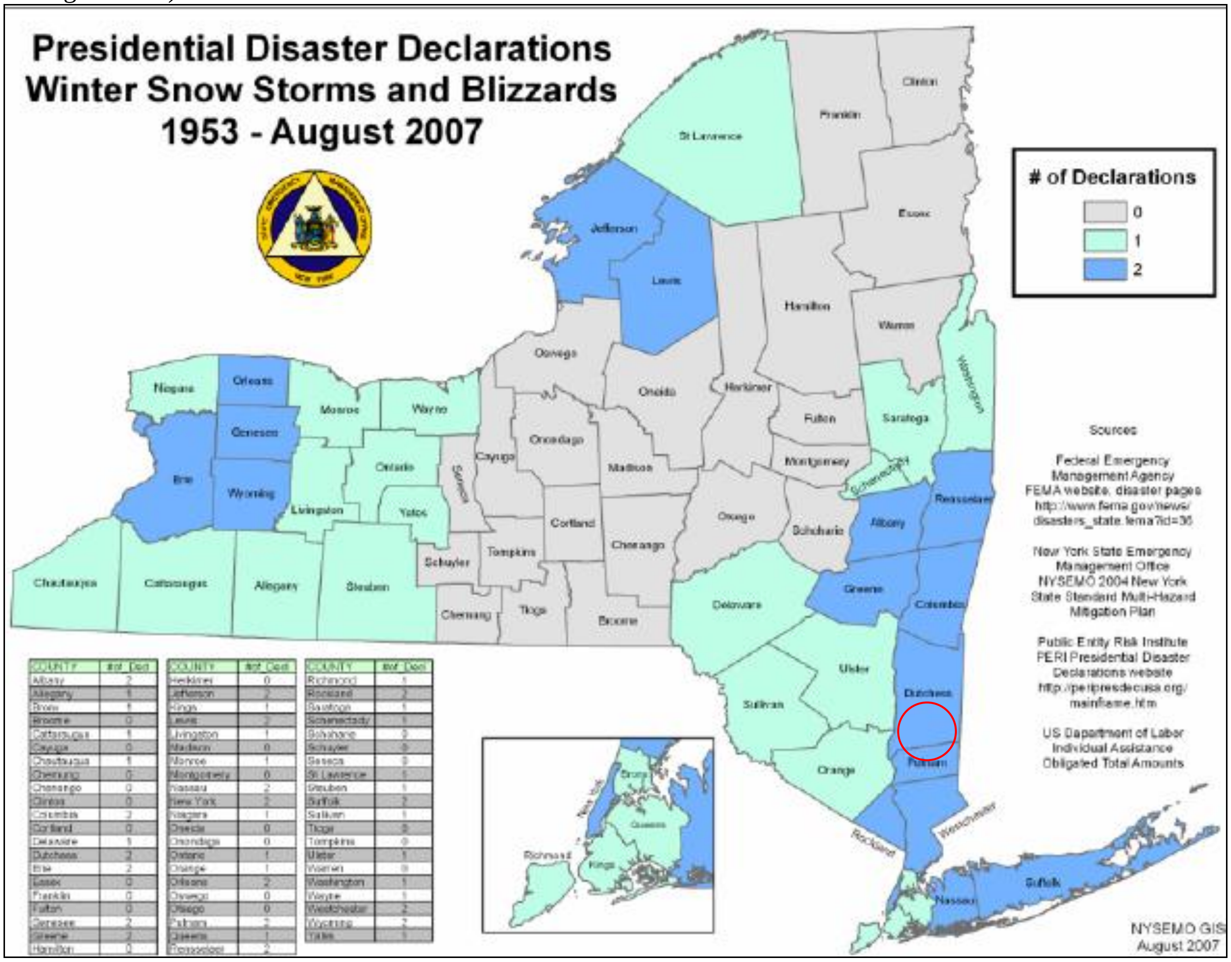
Source: NYS HMP, 2011

According to NOAA's NCDC storm events database, Dutchess County experienced 104 snow, ice storm, and winter weather events between March 1, 1993 and October 29, 2011. Total property damages, as a result of these winter storm events, were estimated at $16.49 million. This total also includes damages to other counties. According to the Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS), between 1960 and 2010, 160 winter storm events occurred within the County. The database indicated that severe winter storm events and losses specifically associated with Dutchess County and its municipalities totaled over $32.6 million in property damage. However, these numbers may vary due to the database identifying the location of the hazard event in various forms or throughout multiple counties or regions.

Between 1954 and 2011, FEMA declared that New York State experienced 23 winter storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: winter storms, severe storms, coastal storms, ice storm, blizzard, snow, snowstorm, Nor'Easter and flooding. 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 declarations. Of those events, the NYS HMP and other sources indicate that Dutchess County has been declared as a disaster area as a result of three winter storm-related events, and as part of an emergency declaration as a result of another three winter storm-related events (FEMA, 2011).

Figure 5.4.6-4 shows the FEMA disaster declarations (DR) for "winter storms" and "blizzards" in New York State, from 1953 to August 2007. This figure indicates that Dutchess County was only included in two disaster declarations. Since the date of this figure, Dutchess County has been included in one other FEMA disaster declaration for "Severe Winter Storm and Snowstorm." Figure 5.4.6-5 shows the FEMA disaster declarations (DR) for ice storms in New York State, from 1983 and August 2007. This figure indicates that the Town of East Fishkill has not been included in any ice storm disaster declarations. Since the date of this figure, the Town of East Fishkill has not been included in any other disaster declarations for ice storms.

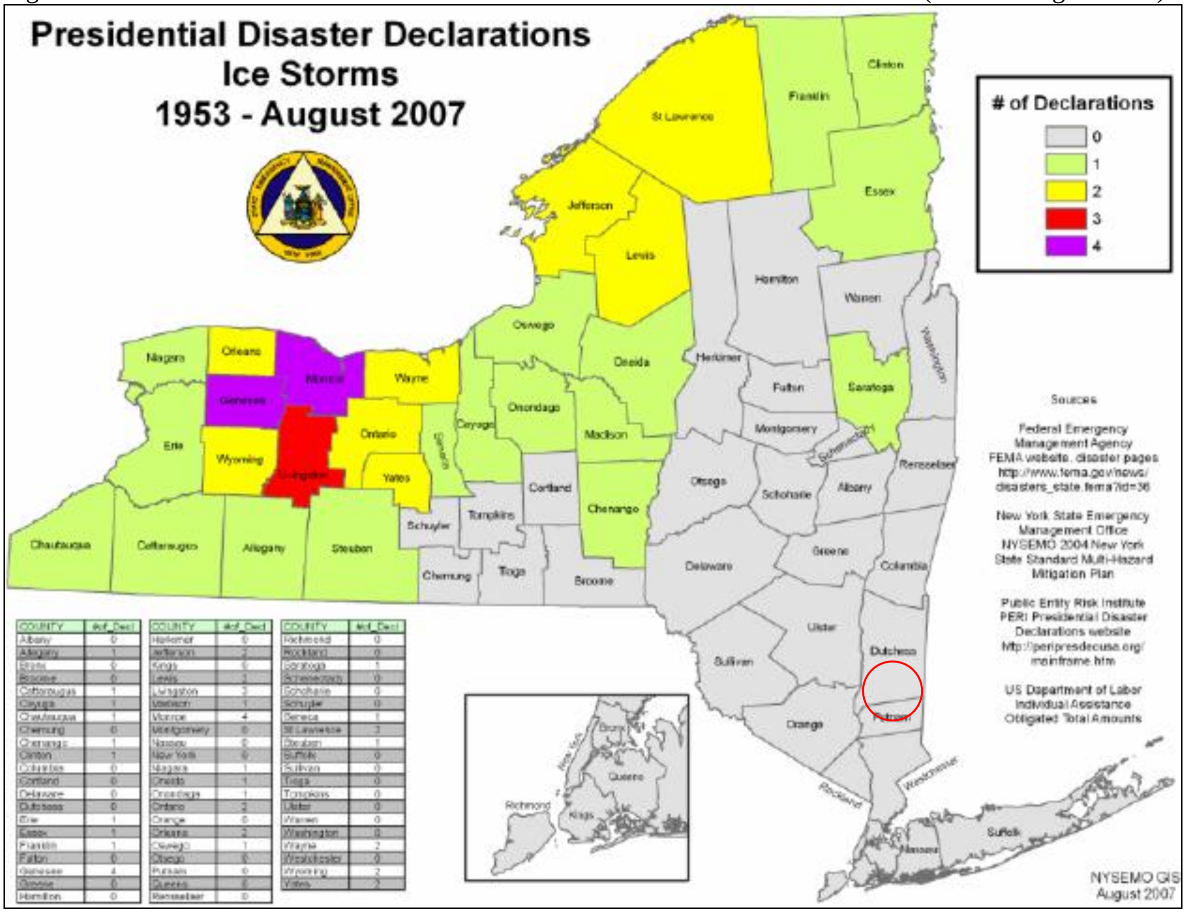
Figure 5.4.6-4. Presidential Disaster Declarations in New York State from Winter Snow Storms and Blizzards (1953 to August 2007)



Source: Draft NYS HMP, 2011

Note: The red circle indicates the approximate location of the Town of East Fishkill in Dutchess County. The Town of East Fishkill had been included in two winter storm/blizzard disaster declarations in New York State as of August, 2007.

Figure 5.4.6-5. Presidential Disaster Declarations in New York State from Ice Storms (1953 to August 2007)



Source: Draft NYS HMP, 2011

Note: The red circle indicates the approximate location of the Town of East Fishkill in Dutchess County. East Fishkill has not been included in any ice storm disaster declarations in New York State.

Based on all sources researched, known winter storm events that have affected the Town of East Fishkill and other municipalities in Dutchess County are identified in Table 5.4.6-4. With winter storm documentation for New York State being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.6-4 may not include all events that have occurred throughout the County and region.

Table 5.4.6-4. Winter Storm Events between 1950 and 2012.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
November 16-17, 2002	Winter Storm	N/A	N/A	A strong nor'easter developed off Cape Hatteras on November 16, slowly moving north along the coast. At the same time, an artic system bled south from eastern Canada, producing a heavy wintery mix of precipitation across eastern New York. The precipitation began as snow, or snow and sleet mixed. A 1-3 inch swath of snow was observed from about Albany southward. As warmer air worked in aloft, the snow changed to sleet, then freezing rain. Freezing rain was more extensive south of Albany, where up to 58,000 customers lost power in the Mid-Hudson Valley. Ice accretion was between one-half and one inch. Wind gusts up to 30mph brought down trees, tree limbs, and power lines, adding to dangerous travel conditions. Warmer air moved in on Sunday, November 17th, with some additional snowfall before the storm passed. Total property damages for Dutchess County were estimated at $38,000.	FEMA, NOAA-NCDC, NWS, SHELDUS
January 3, 2003	Winter Storm	N/A	N/A	Between January 3 and 4, a slow moving Nor'easter moved into central New York State, spreading snow. The snow was heavy at times, with totals ranging between eight and 25 inches. At least 20,000 customers were without power, some without power for a week. Emergency shelters were set up in some areas. Snowfall totals in Dutchess County were measured at15.8 inches at Poughkeepsie. Total property damages for Dutchess County were $28,667.	FEMA, NOAA-NCDC, NWS, SHELDUS
February 17-18, 2003	Snowstorm	EM-3184	Yes	The president issued an emergency declaration for New York communities on March 27, 2003, following record snowfalls from a storm on that hit the area February 17-18. The coastal storm was the third major snowstorm of the season for most of eastern New York, and it delivered heavy snow into the southern Catskills and Mohawk Valley. 16.2 inches were measured at Poughkeepsie, Dutchess County. At times, snow fell at rates of several inches an hour. The Governer of New York Governor declared a snow emergency for Albany, Columbia, Dutchess Greene, and Schenectady Counties. Snowfall totals in the area ranged between 10 and 30 inches. Property damage from the storm was approximately $2.7 M.	FEMA, NOAA-NCDC, NWS
April 14-18, 2007	Nor'Easter	DR-1692	Yes	Heavy rain led to widespread flooding of small streams and creeks across the county, which began during the early morning hours of Monday, April 16th, and persisted into Wednesday morning on the 18th. New York State experienced millions in eligible damages. FEMA gave out more than $61 million in assistance to affected counties within the State. Property damages in Dutchess County were estimated at $5.7 M.	FEMA, NOAA-NCDC
December 11-31, 2008	Severe Winter Storm	EM-3299	Yes	On December 18th, the President announced an emergency declaration for the State of New York in response to storms which struck the area from December 11th -31st. Three separate events occurred in Dutchess County during the incident period, including one incident of flooding on 12/12, and two incidents of strong winds on 12/24 and 12/30. The total damage estimates for these three events was $15,600 for Dutchess County.	FEMA, NOAA-NCDC, SHELDUS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
December 26-27, 2010	Winter Storm/ Nor'easter	DR-1957	Yes	Between December 26th and 27th, a major nor'easter brought significant snows and blizzard conditions to much of east central New York Sunday. Bands of heavy snow with snowfall rates of 1 to 3 inches an hour occurred across the region. Snowfall totals of 1 to 2 feet occurred east of the Hudson River. In addition, strong and gusty winds of 35 to 45 mph caused significant blowing and drifting of the snow. Snow emergencies were declared in Albany, Greene, and Saratoga Counties. On February 8, 2011, Governor Andrew M. Cuomo requested a major disaster declaration due to a severe winter storm and snowstorm during the period of December 26-27, 2010. The Governor requested a declaration Public Assistance (Category B), including snow assistance, for six counties; Public Assistance for two counties and Hazard Mitigation statewide.	FEMA, NOAA-NCDC
February 1, 2011	Winter Storm	N/A	N/A	A complex low pressure system originating from the deep south brought heavy snow and sleet to east central New York. Initially light snow overspread the area on Tuesday, February 1st, but snowfall continued that night and increased into Wednesday. Snowfall reports across east central New York ranged 4 to 15 inches. The heavy wet snow resulted in some roof collapses in Saratoga County, Washington County, and Albany. Snow emergencies were declared in 26 cities, towns, and villages, including the City of Poughkeepsie in Dutchess County.	NOAA-NCDC
January 7-12, 2011	Winter Storm/Nor'easter	N/A	N/A	Two low pressure systems converged in central New York on January 8th, causing up to 15 inches of snowfall across east-central New York. Another storm occurred on January 11th, leading to moderate to heavy snowfall across east central New York. Snowfall rates of 1 to 3 inches an hour occurred across portions of New York east of the Hudson River Valley. Snow emergencies were declared in 18 cities, towns, and villages, including the City of Poughkeepsie in Dutchess County.	NOAA-NCDC

Sources: NOAA-NCDC, FEMA, NWS, SHELDUS

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
N/A Not Applicable
NCDC National Climatic Data Center
NOAA National Oceanic and Atmospheric Administration
NWS National Weather Service
PA Public Assistance
SHELDUS Spatial Hazard Events and Losses Database for the United States

Probability of Future Events

Winter storm hazards in New York State are virtually guaranteed yearly since the State is located at relatively high latitudes resulting in winter temperatures that range between 0°F and 32°F for a good deal of the fall through early spring season (late October until mid-April). In addition, the State is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame (NYS HMP, 2011).

The New York State HMP includes a similar ranking process for hazards that affect the State. Based on historical records and input from the Planning Committee, the probability of at least one winter snow storm of emergency declaration proportions, occurring during any given calendar year is virtually certain in the State. Based on historical snow related disaster declaration occurrences, New York State can expect a snow storm of disaster declaration proportions, on average, once every 3 to 5 years. Similarly, for ice storms, based on historical disaster declarations, it is expected that on average, ice storms of disaster proportions will occur once every 7-10 years within the State (NYS HMP, 2011).

Based on its location in Dutchess County, it is estimated that East Fishkill will continue to experience direct and indirect impacts of severe winter storms annually. Table 5.4.6-5 summarizes the occurrences of winter storm events and their annual occurrence (on average).

Table 5.4.6-5. Occurrences of Severe Winter Storm Events in Dutchess County, 1993 - 2011

Event Type	Total Number of Occurrences	Annual Number of Events (average)
Winter Storm	41	2.3
Snow / Heavy Snow	26	1.4
Winter Weather / Winter Weather Mix	21	1.2
Snow / Freezing Rain / Sleet	14	0.8
Ice Storm	2	0.1
Total:	**104**	**5.8**

Source: NCDC, 2011
Note: On average, Dutchess County experiences 7.4 winter storm events each year.

In Section 5.3, the identified hazards of concern for East Fishkill 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 severe winter storms in East Fishkill is considered 'frequent' (likely to occur within 25 years).

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 (New York State Energy Research and Development Authority [NYSERDA], 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. East Fishkill is part of Region 5, Hudson and Mohawk River Valley. Some of the issues in this major river region, affected by climate change, include: saltwater front mover further up the Hudson River, potential contamination of New York City's back-up water supply, propogation of storm surge up the Hudson from the coast, and popular apple varieties decline (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3ºF by the 2020s, 3 to 5.5ºF by the 2050s and 4 to 9ºF by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.6-6 displays the projected seasonal precipitation change for the Hudson and Mohawk River Valley ClimAID Region (NYSERDA, 2011).

Table 5.4.6-6. 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

It is uncertain how climate change will impact winter storms. Based on historical data, it is expected that the following will occur at least once per 100 years:

- Up to eight inches of rain fall in the rain band near the coast over a 36-hour period
- Up to four inches of freezing rain in the ice band near central New York State, of which between one and two inches of accumulated ice, 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 (NYSERDA, 2011)

New York State is already 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 (NYSDEC, Date Unknown) (http://www.dec.ny.gov/energy/44992.html). Overall winter temperatures in New York State are almost five degrees warmer than in 1970 (NYSDEC, Date Unknown) (http://www.dec.ny.gov/energy/63848.html). The State has seen 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 to 50% 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 (DeGaetano et al [Cornell University], 2010) (http://files.campus.edublogs.org/blogs.cornell.edu/dist/8/90/files/2011/03/ny_changing_climate.pdf).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For severe winter storm events, the entire Town has been identified as the hazard area. Therefore, all assets in the Town of East Fishkill (population, structures, critical facilities and lifelines), as described in the Municipal Profile section (Section 4), are vulnerable. The following section includes an evaluation and estimation of the potential impact severe winter storm events have on East Fishkill including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health 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 of this hazard over time

Overview of Vulnerability

Severe winter storms are of significant concern to the Town of East Fishkill because of their frequency and magnitude in the region. Additionally, they are of significant concern due to the direct and indirect costs associated with these events; delays caused by the storms; and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure (power outages) and traffic accidents, and stress on community resources.

Data and Methodology

National weather databases and local resources were used to collect and analyze severe winter storm impacts on the Town of East Fishkill. The 2010 U.S. Census data and custom building and facility inventories were used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

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. Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. Storms near the coast can cause coastal flooding and beach erosion as well as sink ships at sea. The economic impact of winter weather each year is huge, with costs for snow removal, damage and loss of business in the millions (NSSL, 2006).

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns (NSSL, 2006).

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, 2006).

For the purposes of this Plan, the entire population of the Town of East Fishkill is exposed to winter storm events (U.S. Census, 2010). The elderly are considered most 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. In addition, winter storm events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Refer to the Town Profile (Section 4) for population statistics and a summary of the more vulnerable populations (over the age of 65 and individuals living below the Census poverty threshold).

Impact on General Building Stock

The entire general building stock inventory in the Town of East Fishkill 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 percentage damages that could result from severe winter storm conditions. Table 5.4.6-7 below summarizes percent damages that could result from severe winter storm conditions for the town's total general building stock (structure only). Given professional knowledge and information available, the potential losses for this hazard are considered to be overestimated; hence, conservative estimates for losses associated with severe winter storm events.

Table 5.4.6-7. General Building Stock Exposure (Structure Only) and Estimated Losses from Severe Winter Storm Events in East Fishkill

Total (All Occupancies) RV	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
$3,901,907,518	$39,019,075	$195,095,375	$390,190,751

Source: East Fishkill, 2012

Notes: RV = Replacement Cost Value. The building values shown are building structure only because damage from the severe winter storm hazard generally impact structures such as the roof and building frame (rather than building content).

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. At risk general building stock and infrastructure in floodplains are presented in the flood hazard profile (Section 5.4.6). Generally, losses from flooding associated with severe winter storms should be less than that associated with 1-percent and 0.2-percent chance floods. In summary, snow and ice melt can cause both riverine and urban flooding. Estimated losses due to riverine flooding in the Town of East Fishkill are discussed in Section 5.4.4.

Impact on Critical Facilities

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 for critical facilities and infrastructure.

Impact on Economy

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. The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. The potential secondary impacts from winter storms also impact the local economy including loss of utilities; interruption of transportation corridors; and loss of business function.

Table 5.4.6-8 summarizes the actual and projected 2011 through 2013 snow removal budgets for the Town of East Fishkill. It is clear that the Town is prepared for the severe winter storm hazard; however it is costly.

Table 5.4.6-8. Snow Removal Budget for the Town of East Fishkill

2011 Actual	2012 Actual	2013 Tentative
$1,175,681	$535,873	$686,900

Source: East Fishkill, 2012

Future Growth and Development

Areas targeted for potential future growth and development in the next five (5) years have been identified across the Town in Section 4. For the winter storm hazard, the Town in its entirety has been identified as the hazard area. Therefore, any new development will be exposed to such risks.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such winter storms. While predicting changes of winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

The 2011 'Responding to Climate Change in New York State' report was prepared for New York State Energy Research and Development Authority to study the potential impacts of global climate change on New York State. According to the synthesis report, it is uncertain how climate change will influence extreme winter storm events. Winter temperatures are projected to continue to increase. In general, warmer winters may lead to a decrease in snow cover and an earlier arrival in spring; all of which have numerous cascading effects on the environment and economy. Annual average precipitation is also projected to increase. The increase in precipitation is likely to occur during the winter months as rain, with the possibility of slightly reduced precipitation projected for the late summer and early fall. Increased rain on snowpack may lead to increased flooding and related impacts on water quality, infrastructure, and agriculture in the State. Overall, it is anticipated that winter storms will continue to pass through New York State (NYSERDA, 2011). Future enhancements in climate modeling will provide an improved understanding of how the climate will change and impact the Northeast.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with this hazard of concern. Historic data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA's How to Series (FEMA 386-2), Understanding Your Risks, Identifying and Estimating Losses (FEMA, 2001) and FEMA's Using HAZUS-MH for Risk Assessment (FEMA 433) (FEMA, 2004). The collection of additional/actual valuation data for general building stock and critical infrastructure losses would further support future estimates of potential exposure and damage for the general building stock inventory.

SECTION 6: MITIGATION STRATEGY

This section presents mitigation actions for the Town of East Fishkill to reduce potential exposure and losses identified as concerns in the risk assessment portion of this plan (Section 5). The Planning Committee reviewed the risk assessment to identify and develop these mitigation actions, which are presented herein.

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 and enforcement of building codes, revisions to land-use planning, training and education, and structural and nonstructural safety measures.

This section includes:

(1) Background and past mitigation accomplishments
(2) General mitigation planning approach
(3) Mitigation goals and objectives
(4) Capability assessment
(5) Identification and development of mitigation strategy

This section addresses both mitigation actions that are specific to particular hazards, as well as those that apply to multiple hazards.

BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

Although DMA 2000 does not require a discussion regarding past mitigation efforts, an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and actions outlined in this plan. The Town, through previous and ongoing hazard mitigation actions, has demonstrated that it is pro-active in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing initiatives and projects include:

- The Town participates 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 Town has adopted higher regulatory and zoning standards to protect environmentally sensitive areas and manage natural hazard risk; including:
  - Reduced allowable densities of wetlands and steep slopes, specifically all acreage in slopes greater than 20%, floodplains, and wetlands shall not count more than 50% towards development density.
  - Adopted an R-3 zone in the Township (minimum lot size of 3 acres per dwelling unit), to apply to the to the southern part of East Fishkill covered by the Taconic Mountain range and the New York City watershed, to recognize the environmentally sensitive lands throughout the mountains.
- The Town has performed mitigation projects to public infrastructure as needed, including:
  - Retrofitted the flood vulnerable bridge in Wiccopee (Tamarack 2).
  - Upgraded culverts throughout the Town as needed.
- The Town has had an ongoing program to purchase undeveloped vulnerable property to prevent inappropriate development, including the recent purchase (2012) of over 147 acres that included ~40 acres of floodplain.

- The Town has performed streambank stabilization projects as needed.
- The Town participates in the Fishkill Creek Watershed Association of Dutchess and Putnam Counties, which promotes regional watershed planning and mitigation.
- The Town has a formal, active stormwater management program that includes requiring that flooding be identified during home and commercial construction through the land use and permitting process, and requiring onsite drainage detention to mitigate stormwater increases.
- The Town works with utilities to prune trees and vegetation vulnerable to winter storm damage to minimize or avoid power outages.

These past and ongoing actions have contributed to the Town's understanding of its hazard preparedness and future mitigation action needs, costs, and benefits. These efforts provide a foundation for the planning committee to use in developing this mitigation strategy.

GENERAL MITIGATION PLANNING APPROACH

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.

The general mitigation planning approach used to develop this plan is based on the FEMA publication, *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3), and input provided by NYSOEM. This guidance includes four steps, which were used to support mitigation planning. These steps are summarized below and presented in more detail in the following sections.

- **Develop mitigation goals and objectives:** Mitigation goals were developed using the hazard characteristics, inventory, and findings of the risk assessment, and through the results of the public outreach program. By reviewing these outputs and other municipal and state policy documents, objectives tying to these overarching goals were identified and characterized into similar themes.
- **Identify and prioritize mitigation actions:** Based on the risk assessment outputs, the mitigation goals and objectives, existing literature and resources, and input from the participating entities, alternative mitigation actions were identified. The potential mitigation actions were qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria. The mitigation capabilities within the Town (regulatory, administrative and fiscal) were assessed and considered in the selection and prioritization of appropriate, feasible actions. These actions were then prioritized into three categories: high, medium, and low.
- **Prepare an implementation strategy:** High priority mitigation actions are recommended for first consideration for implementation, as discussed under each hazard description in the following sections. However, based on community-specific needs and goals and available funding and costs, some low or medium priority mitigation actions may also be addressed or could be addressed before some of the high priority actions.
- **Document the mitigation planning process:** The mitigation planning process is documented throughout this plan.

HAZARD MITIGATION PLANNING 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." In addition, FEMA encourages the development of objectives to further guide the development of an appropriate mitigation strategy.

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).

The planning committee developed a set of mitigation goals based on the risk assessment process and findings, and careful consideration of the existing authorities, policies, programs, resources and capabilities within the Town, County and region. The goals were developed from, and/or are compatible with, relevant goals and objectives expressed in other available local and regional planning documents and mechanisms, including:

- New York State Hazard Mitigation Plan – 2011 Update
- Town of East Fishkill Comprehensive Plan – May 2002
- Town of East Fishkill Flood Damage Prevention Ordinance (Chapter 108)
- Town of East Fishkill Freshwater Wetlands, Waterbodies and Watercourses Ordinance (Chapter 110)
- Town of East Fishkill Stormwater Management, Erosion and Sediment Control Ordinance (Chapter 157)
- Natural Resources Management Plan for the Fishkill Creek Watershed – June 2005

The following are the mitigation goals for the Town of East Fishkill hazard mitigation plan:

Goal 1: Protect Life and Property
Note: This goal parallels a similar goal in the Town of East Fishkill Flood Damage Prevention Ordinance (FDPO), "…protect human life and health".

Goal 2: Increase Public Awareness and Preparedness

Goal 3: Protect Natural Resources and the Environment
Note: This goal parallels a similar goal identified in Town Code, Chapter 110, "…preserve, protect and conserve…wetlands, water bodies and watercourses and the benefits derived therefrom".

Goal 4: Promote Local and Regional Sustainability

Goal 5: Enhance Disaster Management Preparedness, Response and Recovery Capabilities

Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

As with the mitigation goals, objectives were established by the planning committee in consideration of the goals and objectives identified in other related planning and regulatory mechanisms, through its knowledge and understanding of local vulnerabilities, and with respect to how the Town believes it can best work towards mitigating their hazard risk.

The objectives are used to 1) measure the success of the plan once implemented, and 2) to help prioritize identified mitigation actions. The objectives serve as a stand-alone measurement of a mitigation action. Achievement of the objectives will be a measure of the effectiveness of a mitigation strategy.

The following table presents the objectives established for this plan, and indicates the relationship between the identified mitigation goals and objectives.

Table 6-1. Objectives with Corresponding Goals

Objective Number and Statement	Goal Statements				
	1. Protect Life and Property	2. Increase Public Awareness and Preparedness	3. Protect Natural Resources and the Environment	4. Promote Local and Regional Sustainability	5. Enhance Disaster Preparedness, Response and Recovery
1. Retrofit, acquire, or relocate structures in high hazard areas making those known to be repetitively damaged as high/first priority.	X			X	
2. Minimize damage to public facilities and utilities, such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in vulnerable areas (FDPO Goal)	X			X	
3. Protect the ongoing operation of critical facilities and infrastructure. (could be combined with above)	X			X	X
4. Maintain or improve drainage and flood control systems.	X		X		
5. Develop, maintain, strengthen and promote enforcement of ordinances, regulations and other mechanisms that result in a higher level of natural hazard risk reduction.	X		X		
6. Address the specific needs of vulnerable populations.	X				X
7. Ensure continuity of government operations, emergency services, and essential facilities at the local level during and immediately after disaster and hazard events.	X			X	X
8. Develop and implement additional education and outreach programs to increase public awareness of hazard areas and the risks associated with hazards, and to educate the public on specific, individual preparedness.	X	X		X	
9. Promote awareness among homeowners, renters, and businesses about obtaining insurance coverage available for natural hazards (i.e., flood, wind).	X	X		X	
10. Develop and implement programs to inform vulnerable property owners of appropriate mitigation activities and available funding programs.	X	X		X	
11. Implement programs that enhance the capabilities to better profile and assess exposure to hazards, and the identification of effective mitigation approaches.	X				

Objective Number and Statement	Goal Statements				
	1. Protect Life and Property	2. Increase Public Awareness and Preparedness	3. Protect Natural Resources and the Environment	4. Promote Local and Regional Sustainability	5. Enhance Disaster Preparedness, Response and Recovery
12. Integrate the recommendations of this plan into existing local and regional plans, programs and mechanisms.	X	X	X	X	X
13. Ensure that local mitigation planning and strategies complement and support other local plans, programs and initiatives.	X	X	X	X	X
14. Encourage land along streams, creeks, and lakes, including flood hazard areas, to be preserved and possibly incorporated into open space networks, through outright purchases, the acquisition of development rights, or other mechanisms as available. (EF Comp. Plan)	X		X		
15. Continue to preserve, protect and acquire open space, particularly in high hazard areas. Include hazard considerations into the prioritization schema for land acquisition. (similar to above)	X		X		
16. Assure that land to be subdivided will produce building sites of such character and area that will permit their development for homes or buildings without danger to…peril from fire, flood or other menace. (per EF Zoning Code)	X				
17. Ensure that development is done according to modern and appropriate standards, including the consideration of natural hazard risk. (similar to above)	X		X		
18. Work with other municipalities, the county and state to preserve and protect critical natural resources on a regional level.	X		X		
19. Minimize expenditure of public money for costly flood-control projects (FDPO Goal)	X			X	
20. To minimize the need for rescue and relief efforts associated with flooding and other hazards, generally undertaken at the expense of the general public (FDPO Goal)	X			X	X

Objective Number and Statement	Goal Statements				
	1. Protect Life and Property	2. Increase Public Awareness and Preparedness	3. Protect Natural Resources and the Environment	4. Promote Local and Regional Sustainability	5. Enhance Disaster Preparedness, Response and Recovery
21. Minimize prolonged business interruptions (FDPO Goal)				X	
22. Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood-blight areas; (FDPO Goal)				X	
23. Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions. (FDPO Goal)	X	X		X	X
24. Identify the need for, and acquire, any special emergency services, training, equipment, facilities and infrastructure to enhance response capabilities for specific hazards.	X				X
25. Create / enhance / maintain shared-services and mutual aid agreements with surrounding municipalities, the County and NYSEMO.	X				X
26. Identify and pursue funding opportunities to develop and implement local mitigation activities.	X				

CAPABILITY ASSESSMENT

According to FEMA 386-3, 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. It identifies, reviews, and analyzes local and state programs, polices, regulations, funding and practices currently in place that may either facilitate or hinder mitigation.

A capability assessment was prepared by the Town. By completing this assessment, the Town learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Types of mitigation actions that may be prohibited by law;
- Limitations that may exist on undertaking actions; and
- 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 (e.g. funding)

Table 6-2 presents planning and regulatory capabilities. Table 6-3 presents the administrative and technical capabilities. Table 6-4 presents fiscal capabilities, and Table 6-5 presents the community classifications for the Town. Additional descriptions of planning and programmatic, administrative and technical, and fiscal capabilities available to and/or implemented within the Town, follow the capability assessment tables.

The Town has also performed a self-assessment of their capabilities with respect to hazard mitigation, and indicates that their capabilities are high in the areas of planning and regulatory capabilities, administrative and technical capabilities, fiscal capabilities, community political capability, and community resiliency capability. Further, the Town intends to continue to build these capabilities through continued integration/coordination with existing plans and programs, and as identified in the mitigation strategy presented later in this Section.

Table 6.2 Planning and Regulatory Capabilities

Tool / Program	Status: In Place	Status: Date Adopted or Updated	Status: Under Develop -ment	Dept./Agency Responsible	Effect on Loss Reduction: + Support O Neutral - Hinder	Change Since Last Plan: + Positive - Negative	Comments
Hazard Mitigation Plan			X	Town Engineer	+	N/A	
Emergency Operations Plan							
Disaster Recovery Plan	X	1993 to 1998		Building / Police / Fire	+	N/A	Needs updating
Evacuation Plan							
Continuity of Operations Plan							
National Flood Insurance Program (NFIP) Flood Damage Prevention Ordinance	X	2012		Building Inspector	+	N/A	Chapter 108 As per FEMA / DEC
Other Flood Damage Prevention	x	4/87		Planning / Building	+	N/A	
Floodplain Management Plan	X	1987		Building Inspector	+	N/A	
Zoning Regulations	X	1964 to 2012		Building / Zoning	+	N/A	Updated regularly
Subdivision Regulations		1974 to 2010		Planning / Zoning	+	N/A	Chapter 163 Updated regularly
Comprehensive Land Use Plan	X	2002		Planning / Zoning	+	N/A	Under review
Open Space Management Plan (or Parks/Rec or Greenways Plan)			X				To be adopted 2013
Stormwater Management Plan / Ordinance	X	2007, 2010		Building / Engineering	+	N/A	Chapter 157 As per DEC

Tool / Program	Status			Dept./Agency Responsible	Effect on Loss Reduction: + Support O Neutral - Hinder	Change Since Last Plan: + Positive - Negative	Comments
	In Place	Date Adopted or Updated	Under Develop -ment				
Natural Resource Protection Plan							
Capital Improvement Plan							
Economic Development Plan							
Historic Preservation Plan							
Farmland Preservation							
Building Code	X	8/74, 1/84		Building Department	+	N/A	As per Department Of State
Fire Code	X	8/74		Building Department	+	N/A	As per Department Of State
Firewise							
Storm Ready							
Steep Slope Protection	X	2007			+	N/A	Chapter 154 Steep slopes are 3:1 slopes and cover a minimum of 5,000 square feet

Table 6.3 Administrative and Technical Capabilities

Staff/Personnel Resources	Yes	No	Department/Agency	Comments
Planners (with land use / land development knowledge)	X		Planning / Building Department	Michelle Robbins / AKRF
Planners or engineers (with natural and/or human caused hazards knowledge)	X		Planning / Building Department	Michelle Robbins / AKRF
Engineers or professionals trained in building and/or infrastructure construction practices (includes building inspectors)	X		Engineering Department	In-house Engineer Scott Bryant (Contract Vendors)
Emergency Manager	X		Police	Lt. Kevin Keefe
NFIP Floodplain Administrator	X		Building Department	Ken Beyer
Land Surveyors	X		Contract Vendor	Morris Associates
Scientists or staff familiar with the hazards of the community		X		
Personnel skilled in Geographic Information Systems (GIS) and/or FEMA's HAZUS program	X		Building Department	Rick Witt
Grant writers or fiscal staff to handle large/complex grants	X		Contract Vendor	Victor Cornelius / Endeavor Inc.
Staff with expertise or training in Benefit-Cost Analysis	X		Finance	
Other				

Table 6.4 Fiscal Capabilities

Financial Resources	Yes	No	Department/Agency	Comments
Capital Improvement Programming	X		Finance	
Community Development Block Grants (CDBG)	X		Town Supervisor	
Special Purpose Taxes	X		Finance / Budget	
Gas / Electric Utility Fees		X	Finance / Budget	
Water / Sewer Fees	X		Finance / Budget	
Stormwater Utility Fees	X		Engineering / Finance / Planning	
Development Impact Fees	X		Engineering / Finance / Planning	
General Obligation, Revenue, and/or Special Tax Bonds	X		Town Board / Finance	
Partnering Arrangements or Intergovernmental Agreements	X		Town Board / Legal	
Other				

Table 6-5. Community Classifications

Program	Classification	Date Classified
Community Rating System (CRS)	NP	N/A
Building Code Effectiveness Grading Schedule (BCEGS)	NP	N/A
Public Protection Classification (PPC)	5	2012/3
Storm Ready	NP	N/A
Firewise	NP	N/A

NA = Not applicable. NP = Not participating. TBD = To be determined.

The classifications listed above relate to the community's effectiveness in providing services that may impact it's vulnerability to the natural hazards identified. These classifications can be viewed as a gauge of the community's capabilities in all phases of emergency management (preparedness, response, recovery and mitigation) and are used as an underwriting parameter for determining the costs of various forms of insurance. The CRS class applies to flood insurance while the BCEGS and Public Protection classifications apply to standard property insurance. CRS classifications range on a scale of 1 to 10 with class one (1) being the best possible classification, and class 10 representing no classification benefit. Firewise classifications include a higher classification when the subject property is located beyond 1000 feet of a creditable fire hydrant and is within 5 road miles of a recognized Fire Station.

- Criteria for classification credits are outlined in the following documents:
- The Community Rating System Coordinators Manual
- The Building Code Effectiveness Grading Schedule
- The ISO Mitigation online ISO's Public Protection website at http://www.isomitigation.com/ppc/0000/ppc0001.html
- The National Weather Service Storm Ready website at http://www.weather.gov/stormready/howto.htm
- The National Firewise Communities website at http://firewise.org/

The following subsections provide additional descriptions of the various planning and regulatory, administrative and technical, and fiscal programs available to promote and support mitigation and risk reduction in the Town. Additional information on how this plan integrates with these planning and regulatory mechanisms may be found in Section 3 under "Integration/Coordination with Existing Plans and Programs", while Section 7 provide further information on how the Town intends to promote the integration and coordination of this plan with these programs.

Planning and Regulatory Capabilities

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 Town of East Fishkill actively participates in the NFIP, has adopted a Flood Damage Prevention Ordinance which is administered locally by their Floodplain Administrator, and makes current NFIP Flood Insurance Rate Maps (FIRMs) available for review by the public. The Town Engineer is designated within the Town’s Flood Damage Prevention Ordinance (Ch. 108) as the NFIP Floodplain Administrator. Floodplain administrative activities are supported by the Building Department through the Town’s Building Inspector/Zoning Administrator. Both the Town Engineer and Building Inspector/Zoning Administrator are members of the mitigation planning committee and were actively involved in the development of this plan.

Currently the Town has no outstanding NFIP compliance issues. As identified in the mitigation strategy, the Town intends to join the CRS program within year one of plan implementation at which time the Town will support a Community Assistance visit with FEMA and ISO.

As of December 31, 2011, there were 138 NFIP policyholders in the Town of East Fishkill. There were 97 claims made, totaling nearly $1.7 million for damages to structures and contents. There are 16 NFIP Repetitive Loss (RL) properties, and two NFIP Severe Repetitive Loss (SRL) properties in the Town. As of March 3, 2013, online NFIP statistics indicate there are 222 NFIP policyholders in the Town, with 110 loss claims totaling over $1.8 million in losses. Further details on the Town’s flood vulnerability may be found in the flood hazard profile in Section 5.

The Town considers themselves to be proactive with floodplain management and mitigating flood risk. Outreach to floodprone property owners has been ongoing, and was further enhanced as a result of this planning effort as detailed in the public outreach discussion in Section 3. The Town’s planning, regulatory and site plan review process have historically given consideration to the flood hazards, and ordinances have continued to be reviewed and strengthened to further manage natural hazard risk. The Town has an ongoing program to acquired undeveloped land in hazard prone areas. This plan includes a number of initiatives that will further enhance their ability to manage flooding and other natural hazard risks, including the amendment of several ordinances, mitigating floodprone properties (including several RL/SRL properties), joining CRS, and becoming a “Climate Smart Community”

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 (NYSOEM). Additional information on the NFIP program and its implementation within the Town may be found in the flood hazard profile (Section 5).

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).

While the Town does not currently participate in the CRS program, they intend to join CRS in the short term as identified in Section 6, “Mitigation Strategy”.

Comprehensive/Master Plans:

Comprehensive planning is a term used in the United States by land use planners to describe a process that determines community goals and aspirations in terms of community development. The outcome of comprehensive planning is the “Comprehensive Plan” or Master Plan” which dictates public policy in terms of transportation, utilities, land use, recreation, and housing. A municipality is authorized to develop and adopt a comprehensive plan by New York State Town Law Section 272-a. State statutes require that all land use laws in a municipality be consistent with a comprehensive plan.

The Town’s current comprehensive plan was adopted in May 2002. Implementation of the Comprehensive Plan is supported by the Town’s zoning, subdivision and other related land-use ordinances, and the Town of East Fishkill Planning Board through their site-plan review process. Further the Town is supported by a contract municipal planner (AKRF, Inc.) to assist with ongoing land-use planning issues in the community.

During the next update of the comprehensive plan, the Town shall ensure that the findings and recommendations of this plan are appropriately incorporated such that these plans become consistent and mutually-supportive mechanisms to manage natural hazard risk, as identified in Section 6, “Mitigation Strategy”.

Stormwater Management Planning:

When proper controls are not in place, research studies show a clear link between urbanization and increased flooding, streambank erosion and pollutant export. The goal of stormwater management is to ensure that the quantity and quality of stormwater runoff from a site that is undergoing construction or development should not be substantially altered from its pre-development conditions (NYSDEC, http://www.dec.ny.gov/chemical/8468.html).

According to the federal law commonly known as Stormwater Phase II, permits are required for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and those additionally designated by the NYSDEC. Owners or operators of such MS4s must be authorized in accordance with the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems. The permit requires development of a Stormwater Management Program (SWMP).

With contract support (Stormwater Management Consultants, Inc.), the Town has developed a stormwater management plan that include local initiatives to protect water quality and reduce local flooding, including a prioritized plan to meet current and future needs for repair, expansion and management of local stormwater infrastructure. Maintenance programs are developed to continually assess the condition of the stormwater system, to track sediment by volume and type removed, and to reduce the likelihood of flooding due to clogged collection and conveyance systems. Progress on, and updates to, the Town’s stormwater management program are documented in annual progress reports.

Stormwater management activities in the Town are further supported by the Dutchess County Regulated MS4 Coordination Committee and the Dutchess County Soil and Water Conservation District. Further guidance is provided by the recently released New York State Stormwater Manual which the Town has found to be a valuable resource.

Administrative and Technical Capabilities - Local

Town Board:

The Town Board enacts legislation, sets policy, authorizes expenditures, and develops and adopts budgets. The Town Supervisor oversees all day-to-day operations.

Planning/Zoning Department:

The Planning and Zoning Department provides support to the Planning Board and the Zoning Board of Appeals, enforcing all Decisions and Approvals by said Boards, in regard to Site Plan, Subdivision and Development Applications.

Planning Board:

The Planning Board has the power and authority to approve plats for subdivisions within the Town. The Planning Board reviews, comments and can approve all Site Plan Applications and Special Permits.

Zoning Board of Appeals:

The Zoning Board of Appeals is appointed by the Town Board and is responsible for the interpretation of the Zoning Code and the granting of special permits and variances.

The Zoning Board of Appeals hears and makes decisions on appeals and requests for variances from the requirements of the Town Zoning Code. In some cases the Zoning Board approves Special Permits.

Engineering Department:

The Engineering Department is responsible for the review of all Site and Plot Plans and provides for on-site inspection as well as review and oversight of contracted projects. The Engineering Department designs and issues Contract Bids for various Town-wide contracts addressing drainage and flooding problems, sanitary sewer and water system expansions, the resurfacing of Town roads and installation of storm water systems, and the expansion and rehabilitation of Town facilities, such as the Community Center, various Recreation facilities and parking areas.

Building Department:

The Building Department is responsible for the review of all Building Applications and the issuance of all Building Permits. The Building Department performs Plan review and onsite inspections to assure compliance with the Town Zoning Code, and New York State Building, Residential, Plumbing Fire Prevention Codes for Public Safety.

Fire Advisory Board:

The Fire Advisory Board is made up of five residents of the town. These members are appointed for one year each in January by the town board. The function of the Board is to review site plans, and subdivision plans for the purposes of addressing safety concerns of the general public, and the needs of emergency services. The Board was created and passed into law by the Town of East Fishkill in 1984 in response to the passage of the New York State Uniform Fire Prevention and Building Code. It operates under the Building Department and reports on plans referred to it by the Planning, Zoning, & Town Boards.

Highway Department:

The Highway Department is responsible for the maintenance of approximately 200 miles of roads in the Town of East Fishkill. In addition, the Highway Department inspects, repairs, and maintains all Town-owned storm water facilities, culverts and bridges and performs clearing and maintenance within all Town rights-of-way and along roadside power lines.

Administrative and Technical Capabilities – State and Regional

Local mitigation is further supported by county, regional, state and federal administrative and technical capabilities, including the following:

Cornell Cooperative Extension of Dutchess County:

The Cornell Cooperative Extension of Dutchess County (CCEDC) works to extend the educational resources of Cornell University and the New York State Colleges of Agriculture and Life Sciences, Human Ecology and Veterinary Medicine, the Land Grant university system and other educational institutions, to the people of Dutchess County to foster economic, social and environmental improvement of its individuals, families and communities. CCEDC is a subordinate governmental agency consisting of an unincorporated organization of residents of Dutchess County in cooperation with Cornell University and the United States Department of Agriculture; and in accordance with subdivision 8(b) of section 224 of the County Law as amended. CCEDC is governed by a Board of Directors comprised of members of the community, and each program area has its own advisory committee. CCEDC works through four main program areas: Agriculture & Horticulture, Environment and Energy, Family & Consumer Education and 4-H Youth Development.

Fishkill Creek Watershed Association (of Dutchess and Putnam Counties):

The mission of the Fishkill Creek Watershed Association is to encourage individuals and entities, both public and private, to work for the protection of the natural environment within the Fishkill Creek Watershed.

New York State Office of Emergency Management (NYSOEM):

For more than 50 years, NYSOEM 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 man-made disasters and emergencies. NYSOEM 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.

NYSOEM 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. NYSOEM prepared the current State Hazard Mitigation Plan working with input from other State agencies, authorities and organizations. It was approved by FEMA on January 4, 2011, 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. For example, the 2008-2011 State Mitigation Plan allowed the State and its communities to access nearly $57 million in mitigation grants to prepare plans and carry out projects.

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.

Fiscal Capabilities-Federal and State

Mitigation projects and initiatives are largely or entirely dependent on available funding. The Town of East Fishkill is able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and through a myriad of Federal and State loan and grant programs.

Federal Hazard Mitigation Funding Opportunities

Federal mitigation grant funding (Stafford Act 404 and 406) is available to all communities with a current hazard mitigation plan (this plan); however most of these grants require a “local share” in the range of 10-25% of the total grant amount. The FEMA mitigation grant programs are described below.

Hazard Mitigation Grant Program (HMGP): The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75% funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing or elevation to reduce future 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 Hazard Mitigation Plan (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 NYSOEM and 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 may be considered as additional HMGP funding becomes available.

Flood Mitigation Assistance (FMA) Program: 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 75%. At least 25% of the total eligible costs must be provided by a non-federal source. Of this 25%, 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. FMA funds are distributed from FEMA to the state. NYSOEM serves as the grantee and program administrator for FMA.

Pre-Disaster Mitigation (PDM) Program: The PDM program is an annually funded, nationwide, competitive grant program. No disaster declaration is required. Federal funds will cover 75% of a project's cost up to $3 million. As with the HMGP and FMA, a FEMA-approved local Hazard Mitigation Plan is required to be approved for funding under the PDM program.

Repetitive Flood Claims (RFC) Program: The RFC program is an annually funded, nationwide mitigation grant program with the goal of reducing flood damages to individual properties for which one or more claim payments for losses have been made under flood insurance coverage, and will result in the greatest amount of savings to the National Flood Insurance Fund (NFIF) in the shortest period of time. RFC funding is available for property acquisition and structure demolition or relocation, structural elevations, and minor localized flood reduction projects. Federal funding covers 100% of the project costs.

Severe Repetitive Loss (SRL) Program: The SRL program is an annually funded, nationwide mitigation grant program with the goal of reducing flood damages to residential properties that have experienced severe repetitive losses under flood insurance coverage, and as such, will result in the greatest amount of savings to the NFIF in the shortest period of time. SRL funding is available for property acquisition and structure demolition or relocation, structural elevations, and minor localized flood reduction projects. Federal funding covers 75% of the project costs (90% if the community has a repetitive loss strategy).

Federal Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance may 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. Among the general types of assistance that may be provided should the President of the United States declare the event a major disaster are the following:

Individual Assistance (IA): 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 may 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 may borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property and an additional 20% for mitigation. For businesses, loans may 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, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted, by law, to small businesses only.

Public Assistance (PA): 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.

Community Development Block Grants (CDBG): CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, as 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, planning, and administration. Public improvements may 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 may 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.

IDENTIFICATION AND DEVELOPMENT OF MITIGATION STRATEGY

This subsection discusses the identification, prioritization, analysis and implementation of mitigation actions for the Town of East Fishkill.

Mitigation Action Identification – Comprehensive Review of Mitigation Activities

As presented in Section 3 (Planning Process), the Town of East Fishkill has a long history of pro-actively managing hazard risk, and as such was well prepared to identify and develop an appropriate local mitigation strategy.

The identification of potential mitigation projects and initiatives began at the commencement of the project, and continued throughout the planning process. Supported by broad-based planning committee, a number of projects and initiatives were immediately identified that have been in progress or in consideration well before the start of the planning process. Other projects and initiatives were identified during the planning process based on the finding of the risk assessment, or as a result of public and stakeholder outreach.

The process by which the planning committee identified and considered potential mitigation initiatives met the following objectives:

- Use information obtained from the public and stakeholder outreach strategy;
- Use information provided in the risk and vulnerability assessment;
- Seek mitigation actions consistent with the goals and objectives of this local plan;
- Identify mitigation actions that are within the capabilities of the Town.
- Identify mitigation actions across the range of mitigation action types (see following).

The list of potential mitigation actions, organized according to the hazards of concern identified for this planning process, include a range of options in line with the six types of mitigation actions described in FEMA guidance (FEMA 386-3), including:

1. **Prevention:** Government, administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.

2. **Property Protection:** 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.

3. **Public Education and Awareness:** 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 school-age and adult education programs.

4. **Natural Resource Protection:** 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.

5. **Emergency Services:** 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.

6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, retaining walls, and safe rooms.

Though this planning effort, the Planning Committee was able to identify a baseline of appropriate mitigation actions backed by a planning process, consistent with the goals and objectives of the planning area, and within the capabilities of the Town. Many of the strategies identified, such as community outreach, could be applied to multiple hazards.

Potential actions that were not selected by the Town were eliminated based on the following:

- Action is currently outside the scope of capabilities
- Action is not in-line with established community goals and vision
- Action is not considered cost-effective
- Action is already being implemented

Although one of the driving influences for preparing this plan was grant funding eligibility, its purpose is more than just access to federal funding. It was important to the planning committee to look at mitigation actions that will work through all phases of emergency management. Some of the actions outlined in this plan may not be grant eligible—grant eligibility was not the focus of the selection. Rather, the focus was the actions' effectiveness in achieving the goals of the plan and whether they are within the Town's capabilities.

The mitigation projects and initiatives comprising the Town's mitigation strategy are summarized in Table 6-6 along with the hazards mitigated, goals and objectives met, lead agency, estimated cost, potential funding sources and the proposed timeline are identified. The parameters for the timeline are as follows:

- Short Term = To be completed in 1 to 5 years
- Long Term = To be completed in greater than 5 years
- Ongoing = Currently being funded and implemented under existing programs.

Table 6-6. Proposed Hazard Mitigation Initiatives

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
Prevention										
PV-1	Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community. Further meet and/or exceed the minimum NFIP standards and criteria through the following NFIP-related continued compliance actions identified in subsequent initiatives.									
	See above.	New and Existing	Flood	5, 6	NFIP Floodplain Administrator (FPA); with support from NYSOEM, ISO, FEMA	Medium - High	Low-Medium	Municipal Budget	Ongoing	High
PV-2	Begin the process to adopt higher regulatory and zoning standards to manage flood hazard risk; specifically through the development and adoption of a cumulative substantial damage/improvements ordinance.	New and Existing	Flood	5, 6	Town NFIP FPA and Town Board, with support of NYSDEC for model ordinance	Medium	Low	Municipal Budget	Short	High
PV-3	Develop and implement a post-event damage assessment program, including the following elements: • Conduct public outreach/education (see Public Education and Awareness Initiatives above) to inform property owners of the need to report property damage and obtain required permitting when making repairs. • Develop and organize local resources to conduct post-event damage assessments, including substantial damage determinations as warranted. • Develop an inventory (file system and/or database) of losses (incl. loss of service, property damage, economic losses, etc.) as reported to and/or identified by the Town (e.g. building permit process).									
	See above.	Existing	Flood; Severe Storm; Severe Winter Storm; Earthquake	7, 8, 9, 10, 11	Engineering (Town NFIP FPA); Town Supervisor's Office	Medium – High (life Safety; Increased eligibility for mitigation grant funding)	Low-Medium	Municipal Budget	Short	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
PV-4	Join the NFIP Community Rating System (CRS) to further manage flood risk and reduce flood insurance premiums for NFIP policyholders. See following related Community Assistance Visit (CAV) initiative.	N/A	Flood	5, 8	Town NFIP FPA	Medium - High	Low	Municipal Budget	Short (year 1)	High
PV-5	Determine if a Community Assistance Visit (CAV) or Community Assistance Contact (CAC) is needed, and schedule if needed. This is a part of the process of joining CRS (above initiative).	N/A	Flood	8	Town NFIP FPA	Low - Medium	Low	Municipal Budget	Short (year 1)	High
PV-6	Have designated NFIP Floodplain Administrator (FPA), and other local officials who would benefit, become a Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers (ASFPM) and New York State Stormwater and Floodplain Managers Association (NYSSFMA), and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis (BCA) and Substantial Damage Estimation (SDE).	N/A	Flood	5, 7, 8, 11	Town NFIP FPA	Medium	Low	Municipal Budget	Short (DOF)	High
PV-7	Obtain and archive elevation certificates, as available, and encourage the preparation of elevation certificates for all structures in the SFHA.	N/A	Flood	1, 5, 11	Town NFIP FPA	Low	Low	Local Budget	Ongoing	High
PV-8	Become a NYSDEC “Climate Smart Community”.	N/A	All Hazards	8, 18, 19	Town NFIP FPA	Medium - High	Low	Municipal Budget	Short (year 1)	High

<table>
<tr><th>Initiative #</th><th>Mitigation Initiative</th><th>Applies to New and/or Existing Structures*</th><th>Hazard(s) Mitigated</th><th>Objectives Met</th><th>Lead Agency</th><th>Estimated Benefits</th><th>Estimated Cost</th><th>Sources of Funding</th><th>Timeline</th><th>Priority</th></tr>
<tr><td>PV-9</td><td>Support the implementation, monitoring, maintenance, and updating of this plan, as defined in Section 7.0</td><td>New and Existing</td><td>All Hazards</td><td>11, 12, 13</td><td>Town (via Supervisor's Office)</td><td>Low-High</td><td>Low – High (for 5-year update)</td><td>Local Budget, possibly FEMA Mitigation Grant Funding for 5-year update</td><td>Ongoing</td><td>High</td></tr>
<tr><td rowspan="2">PV-10</td><td colspan="10">Develop, adopt and enforce regulatory mechanisms (e.g. ordinances, amendments to town code and zoning) to reduce the risk from vulnerable, sub-standard private bridges, and the public safety risk of development in areas where access is limited to a single, vulnerable bridge. The mechanisms developed will provide a definition of "bridge", establish minimum design/construction standards for privately-owned bridges, and will establish the requirements for secondary access to mitigate the safety of residents in areas served by public bridges.

Zoning changes related to this initiative include the following possible amendments:
A197.76 Driveways.
B. Design
(8) Driveways shall be designed to support an H-25 load.

A197-78. Bridge/Underpass/Overpass
A. All new bridges must meet Town definition of bridge and must be approved by the Town Board and the Highway Superintendent. The specific requirements shall be established by the Highway Superintendent and the Town Engineer.
B. In general, the structure shall be designed for an H-25 load. Clearance to another roadway shall be minimum 16 feet. The waterway opening shall be designed to pass a one-hundred year storm.</td></tr>
<tr><td>See above.</td><td>New and Existing</td><td>All Hazards (except Extreme Temperature)</td><td>1, 2, 3, 5, 6</td><td>Engineering and Planning/Zoning, with support of the Town Board</td><td>High (reduced infrastructure vulnerability, reduced public safety risk)</td><td>Low-Medium</td><td>Local Budget</td><td>Short</td><td>High</td></tr>
</table>

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
PV-11	Adopt Zoning Amendment to require subdivisions to provide emergency access when a new public road is created that does not connect to a public road that has secondary access to a public road. Subdivisions created with driveways onto existing Town roads are exempt. The Town engineer may waive this requirement with the consent of the Highway superintendent.									
	See above.	New	All Hazards	2, 3, 5	Engineering and Planning/Zoning, with support of the Town Board	High (reduced infrastructure vulnerability, reduced public safety risk)	Low-Medium	Local Budget	Short	High
PV-12	Adopt Zoning Amendment to limit length of dead end streets.									
	See above.	New	All Hazards	5, 12, 23	Engineering and Planning/Zoning, with support of the Town Board	High (reduced infrastructure vulnerability, reduced public safety risk)	Low-Medium	Local Budget	Short	High
PV-13	Adopt Zoning Amendment requiring that all applications to the planning board shall review any and all Town planning documents and comment on the applicability of these Town polices to the proposed action. The Planning Board shall develop a list of these reports, which shall be updated from time to time, to be reviewed as part of the application. These reports shall include but are not limited to: • East Fishkill Master Plan • East Fishkill Historic Resources Inventory • Hudsonia Report: Significant Habitats of the Town of East Fishkill • Hazard Mitigation Plan (this plan) • Hopewell Hamlet Pedestrian Report • Dutchess County Greenway Connections									
	See above.	New	All Hazards	5, 12, 23	Engineering and Planning/Zon	High (reduced infrastructur	Low-Medium	Local Budget	Short	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
					ing, with support of the Town Board	e vulnerability, reduced public safety risk)				
PV-14	Develop and maintain mapping of all floodprone areas in the Town, FEMA delineated or otherwise, to support land use decision making (e.g. Planning Board, site plan review process, Conservation Advisory Council).	New and Existing	Flood	5, 11, 12, 13, 17	Engineering, Planning Board	Medium (improved understanding of flood risk areas)	Low	Local Budget	Short	High
Property Protection										
PP-1	Mitigate vulnerable structures via retrofit (e.g. elevation, flood-proofing) or acquisition/relocation to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Phase 1: Identify appropriate candidates and determine most cost-effective mitigation option (in progress). Phase 2: Work with the property owners to implement selected action based on available funding from FEMA and local match availability. The town has already conducted outreach to vulnerable property owners, and is currently working with interested property owners in the following areas: • Lake City area • Warren Drive • Bykenhulle Road • McKeown Terrace • Circle Drive • Oak Ridge Road • Crown Hill Road • Harrigan Road • Creek Bend Road • Lomala Lane • Angela Court • Ninham Avenue • Pine Grove									
	See above.	Existing	Flood	1, 6, 10	Town Engineering	High	High	FEMA Mitigation	Ongoing (outreach	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
					via NFIP FPA) with NYSOEM, FEMA support			Grant Programs and local budget (or property owner) for cost share	and specific project identification); Long term DOF (specific project application and implementation)	
PP-2	Elevate East Hook Road in the area of Morgenthau Flats. This section of road has been repetitively damaged in flooding, and has received multiple Public Assistance reimbursements including Hurricane Irene.	Existing	Flood	2, 17	Engineering; Department of Public Works	High (reduced road closures, emergency management services / evacuations; road damage and ongoing maintenance)	High	Local budget; FEMA 404/406 funding as applicable	Short (2013/14)	High
PP-3	Carol Drive and Creek Bend Streambank Stabilization – Engineer and install appropriate streambank stabilization. Previously installed stabilization in this area was inadequate and has been damaged. Currently the residential property in this area is at great risk for property and structural damage in the event of a significant flood event. This	Existing	Flood	2, 4, 6, 14	Engineering and DPW; working with property owner	High (reduced risk to property erosion and residential structure damage)	High	HMA Grants with municipal and/or property owner funds for match	Short (to develop preliminary engineering solution and apply for mitigation grant funding)	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	project is related to the Stream Monitoring and Maintenance initiative (# PE-1).									
PP-4	Hillside Lake / CR33 Culvert Improvement Project – Upgrade the culvert which currently has no bottom and is vulnerable to scouring which would eventually result in damage to the roadway. County has agreed to provide the Town with the materials to upgrade the culvert. The town is investigating if a sufficiently sized culvert here would reduce the hazard category of the Hillside Lake dam from "B" to "A" (lower risk), which may require a formal dam break study.									
	See above.	Existing	Flood	4, 6	Engineering and DPW; working with Dutchess County DPW	High (reduced possibility of damage to County road; possible reduction of dam risk category)	Medium	Town Capital Budget	Short	High
PP-5	Work with utility companies and developers to underground (bury) utility lines wherever possible. Consider requiring underground utilities for new development. This is identified in the East Fishkill Comprehensive Plan. Work along with planning board so that under-grounding of utilities is promoted in development plans.	New and Existing	Severe Storm; Severe Winter Storm	2, 3, 5, 13, 16	Engineering and DPW, working with local utilities and developers	Medium – High (reduced utility outages)	Low	Local Budget	Ongoing	High
PP-6	Carol Drive timber bridge – Replacement of the entire timber bridge structure, including abutments, which serves as the sole access to approximately 69 homes. The bridge pilings are located within the Fishkill Creek floodway, thus both vulnerable to the flood hazard and	Existing	Flood	2, 17	Engineering and DPW, working with NYSDEC	High (reduced flooding and reduced vulnerability of critical infrastructur e)	Est. $1.3M	FEMA mitigation grant; local budget for match	Short	Medium

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	causal to local flooding issues.									
PP-7	Phillips Road Bridge over the Fishkill Creek – Raising and replacement of the entire bridge structure located entirely in the Fishkill Creek floodway. The existing bridge deck is below FEMA's 1% chance (100-year) Base Flood Elevation. The bridge deck routinely overtops in heavy rainfall events as the existing abutments cannot pass large storms, and is thus both vulnerable to the flood hazard and causal to local flooding issues.	Existing	Flood	2, 17	Engineering and DPW, working with NYSDEC	High (reduced flooding and reduced vulnerability of critical infrastructure)	Est. $1.5M	FEMA mitigation grant; local budget for match	Short	Medium
Public Education and Awareness										
PE-1	Develop and implement an enhanced all-hazards, public outreach / education / mitigation information program on natural hazard risks and what they can do in the way of mitigation and preparedness, including flood insurance. This program may include providing general natural hazard risk, preparedness and mitigation and related NFIP information in regular newsletter and mailings; earthquake and severe storm and winter storm mitigation, posting of flyers and other readily available NFIP informational materials at Town hall or distributing at regular civic meetings; preparation, distribution and analysis of public surveys; and developing/maintaining a natural hazard risk management webpage on the municipal website where information and mapping can be posted.									
PE-1	See above.	N/A	All Hazards	6, 8, 9, 10, 11	Town Supervisor's Office	Medium	Low	Municipal Budget; HMA programs with local or county match	Short	High
PE-2	Enhance public outreach to residents of NFIP floodplain areas to inform of annual grant opportunities, etc. which may include periodic articles and handouts in the annual newsletter.	Existing	Flood	6, 8, 9, 11, 23, 26	Town Supervisor's Office	Medium	Low	Municipal Budget	Short	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
PE-3	Provide public education as to code compliance and the proper installation and operation of emergency generators.	Existing	All Hazards	5, 8, 11	Town Supervisor's Office	Low	Low	Operating	Short	High
Natural Resource Protection										
NRP-1	Develop and implement a stream monitoring and maintenance program, working along with the Fishkill Creek Watershed Association and Cornell Cooperative Extension. This program will establish a program and schedule for stream monitoring, identify appropriate resources to implement maintenance activities, and help to facilitate permitting and access issues.									
NRP-1	See above.	N/A	Flood	5, 11, 17, 18	Fishkill Creek Watershed Association working along with Cornell Cooperative Extension	Medium – High (reduced flood risk; improved protection of natural resources)	Medium	Local Budget; Grant funding as available	Short (DOF)	High
NRP-2	Enhance/expand tree maintenance program (under contract with Asplundh) and coordination with utilities (Central Hudson Power).	Existing	Severe Storm; Severe Winter Storm	2, 3, 11	Engineering and DPW, working with contractors and local utilities	Medium – High (reduced risk of utility outages; life safety)	Medium	Local Budget	Short	Medium
NRP-3	Hillside Lake - Replacement of the stormwater collection systems and redirection to and installation of stormwater filtration systems to restore/improve the quality of the existing pond that is suffering from excessive sedimentation and vegetative growth. These efforts will help to maintain the lake's flood storage capacity.	Existing	Flood	4, 19	Engineering and DPW; working with NYSDEC	High	High	TBD	Short	Medium

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
Emergency Services										
ES-1	Develop an East Fishkill Dam Safety Program – Implement the following to improve local dam safety in the Town: • Develop an inventory of dams in the Town, or outside of the Town that would impact the Town in the event of failure (incl. Kiawana, Camp Alomar (DEP), dam at Milltown Road (Lake Ballard), Lake Sekunna, Hillside Lake, Lake Walton, Sharp Reservation Dam, Hope's Terrace, Emmadine Pond) • Coordinate with dam owners, including NYSDEC, to get copies of all prevailing reports, plans, etc. on dams that pose risk to the Town (incl. Emergency Response Plans (ERPs), Inspection Reports, Engineering and Construction Plans). • Conduct a review of regulatory compliance of all medium and high hazard dams (e.g. inspections, ERPs) • Develop and implement a protocol for how such data will be compiled, archived, maintained, and made available (incl. during emergency situations). • Develop and implement a public education outreach program to inform dam owners of their maintenance and inspection responsibilities. • Continue to meet and work with NYSDEC, NYCDEP, USACE and NYSEMO to address dam safety issues, emergency plans and planning, and inspection coordination. • Develop a comprehensive and prioritized list of dam repair, upgrade and retrofit activities, including timelines and completion strategies (funding sources, grant application, permitting, etc.). • Conduct dam-break analysis and risk assessment of all high and moderate hazard dams, identifying areas of inundation and human and property losses. • Investigate and pursue potential funding sources to support the above activities.									
	See above.	Existing	Dam Failure; Flood; Earthquake (due to liquefaction)	3, 5, 11, 13, 18	Engineering; working with owners of dams (e.g. NYSDEC; NYCDEP, private owners) and NYSOEM	High (reduced risk of dam failure; life safety)	Low (develop inventory, compile data, plans, etc.; Medium – High for technical assessments, engineering and construction	Local Budget; Grant funding to support engineering and construction activities as available	Short – Long (DOF)	High
ES-2	Install backup power at the following critical facilities in the Town: • Town Hall • Community Center – This facility would be used as a cooling center once backup power was available • Wappinger Central School District facilities (except John Jay High School which already has backup power)									

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
	See above.	Existing	Severe Storm; Severe Winter Storm; Extreme Temperatures	7, 24	Engineering and DPW, and Wappinger CSD Board	High (reduced interruption of critical facilities and services; life safety)	Medium - High	Local Budget; Emergency Management grants as available	Short (DOF)	High
ES-3	Develop and/or enhance emergency plans.	N/A	All Hazards	7, 12, 24	Town (via Town Supervisor's office)	Medium	Low	Local Budget	Ongoing	Medium
ES-4	Create/enhance/ maintain mutual aid agreements with neighboring communities for continuity of operations.	N/A	All Hazards	7, 12, 18, 24, 25	Town (via Town Supervisor's office)	Low	Low	Local Budget	Ongoing	Medium
Structural Projects										
SP-1	Lake Sekunna Dam (Long Hill) Spillway Improvements– Work with property owner and NYSDEC to address maintenance and safety issues as identified in the April 2012 NYSDEC inspection report. Based on preliminary inspections, the Town has proposed spillway improvements to help mitigate the risk of failure. Currently the town is looking into procedures to conduct work as an emergency action, and is investigating potential funding for the project. Sekunna Lake is routinely pumped by the Town's Highway Department to prevent a dam breach that would result in devastating damage to downstream residences. Downstream vulnerable areas include those in Wiccopee, Deerwood, Tamarack, East Hill and Laura Lane.									
	See above.	Existing	Dam Failure; Flood; Earthquake (due to liquefaction)	2, 11, 12, 13, 18, 25	Engineering; working with NYSDEC; NYSOEM and property owner	High (reduced risk of dam failure; life safety)	Est. $500K	Town is currently investigating possible funding sources	Short (identify appropriate engineering solution and potential funding sources; resolve access	High

Initiative #	Mitigation Initiative	Applies to New and/or Existing Structures*	Hazard(s) Mitigated	Objectives Met	Lead Agency	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority
									and liability issues)	
SP-2	Hemlock Drive / Meli Pond Drainage Improvement Project – Complete this ongoing project by expanding the storage capacity of the pond, and improve the conduit under State Route 82 which is the hydraulic restriction in this area.	Existing	Flood	2, 4, 14	Engineering and Department of Public Works; working with State DOT	High (improved stormwater management; reduced local flooding impacts to properties)	$300,000 (actual)	Town Budget	Ongoing	High (in progress)
SP-3	Continue to develop the Eagle Ridge Drainage Extension project along Clove Brank Road (to Larchmont Drive) and implement as funding is secured. This project will reduce flooding along Clove Branch Road, John Court, Peg Court, Jennifer Drive, and Fairfield Lane.	Existing	Flood	4, 26	Engineering and Department of Public Works	High (improved stormwater management; reduced local flooding impacts to properties)	High	Town Budget	Long-term DOF	Medium
SP-4	Hillside Lake Dam – Repair and upgrade the earthen dam embankment, concrete spillway and emergency spillway.	Existing	Dam Failure; Flood; Earthquake (due to liquefaction)	2, 11, 12, 13, 18, 25	Engineering; working with NYSDEC	High (reduced risk of dam failure; life safety)	High	Town is currently investigating possible funding sources	Short	High

DHS	Department of Homeland Security	Long	5 years or greater.
DOF	Depending on Funding	Short	1 to 5 years
DOT	Department of Transportation		
DPW	Department of Public Works	TBD	To Be Determined
FEMA	Federal Emergency Management Agency	OG	Ongoing program
HMA	Hazard Mitigation Assistance		
NFIP	National Flood Insurance Program		
FPA	Floodplain Administrator		

*Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure?

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. The Town was asked to weigh the estimated benefits of a project versus the estimated costs to establish a parameter to be used in the prioritization of a project.

This benefit/cost review was qualitative; that is, it did 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. This qualitative approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time. Each project was assessed by assigning subjective ratings (high, medium, and low) to its costs and benefits, described in Table 6-7.

Costs: The project cost for each mitigation initiative was reasonably estimated (including preliminary engineering, engineering, design, construction). Costs are presented as follows: Low = < $10,000; Medium = $10,000 to $100,000; High = > $100,000. Where actual project costs could not be reasonably established at this time, a best estimate was provided:

- Low = Possible to fund under existing budget. Project is part of, or can be part of an existing on-going program.
- Medium = Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- High = Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Benefits: Mitigation benefits are future damages and losses that would be eliminated and/or reduced by implementing the proposed mitigation project. When possible, benefits (e.g., physical damages, loss of service or function, emergency management costs, etc.) associated with the project were identified. The benefits value noted (in dollars) is the expected avoided damages and is presented as: Low = < $10,000; Medium = $10,000 to $100,000; High = > $100,000. Where benefits are not quantifiable, a best estimate was provided:

- Low: Long term benefits of the project are difficult to quantify in the short term.
- Medium: Project will have a long-term impact on the reduction of risk exposure to life and property, or project will provide an immediate reduction in the risk exposure to property.
- High: Project will have an immediate impact on the reduction of risk exposure to life and property.

Table 6-7. Project Assessment

Costs	
High	Project cost is =>$100,000 or if unknown, 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	Project cost is $10,000 to $100,000 or if unknown, 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 cost is <$10,000 or if unknown, 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 mitigation benefits are => $100,000 or if unknown, the project will have an

Costs	
	immediate impact on the reduction of risk exposure to life and property.
Medium	Project mitigation benefits are $10,000 to $100,000 or if unknown, the 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	Project mitigation benefits are < $10,000 or if unknown, the long-term benefits of the project are difficult to quantify in the short term.

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-beneficial and are prioritized accordingly. For some of the County initiatives identified, the Town may seek financial assistance under FEMA's HMGP or PDM programs. Both of 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.

Prioritization:

Section 201.c.3.iii of 44 CFR requires an action plan describing how the actions identified will be prioritized. The Planning Committee, along with their contract consultant, developed a prioritization methodology for the Plan that meets the needs of the Town while at the same time meeting the requirements of Section 201.6 of 44 CFR. The mitigation actions identified were prioritized according to the criteria defined below.

- **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 should be noted that these priority definitions are considered to be dynamic and can change from one category to another based on changes to a parameter such as availability of funding. For example, a project might be assigned a medium priority because of the uncertainty of a funding source. This priority could be changed to high once a funding source has been identified such as a grant. The prioritization schedule for this Plan will be reviewed and updated as needed annually through the plan maintenance strategy described in Section 7 of this Plan.

Table 6-8 presents the results of applying the prioritization methodology presented to the set of mitigation actions identified by the Town, and includes the following prioritization parameters:

- Number of goals/objectives met by the initiative
- Benefits of the project (high, medium, or low)

- Cost of the project (high, medium, or low)
- Do the benefits equal or exceed the costs?
- Is the project grant-eligible?
- Can the project be funded under existing programs and budgets?
- Priority (high, medium, or low)

The Town's mitigation action implementation strategy includes:

- Mitigation actions for individual and multiple hazards
- Mitigation goals/objectives supported by each action.
- Implementation priority
- Potential funding sources for the mitigation action (grant programs, current operating budgets or funding, or the agency or jurisdiction that will supply the funding; additional potential funding resources are identified).

- Estimated budget for the mitigation action (financial requirements for new funding or indication that the action is addressed under current operating budgets)
- Time estimated to implement and complete the mitigation action
- Existing policies, programs, and resources to support implementation of the mitigation action (additional policies, programs, and resources identified)

Specific mitigation actions were identified to prevent future losses; however, current funding is not identified for all of these actions at present. The Town has limited resources to take on new responsibilities or projects. The implementation of these mitigation actions is dependent on the approval of the local elected governing body and the ability of the community to obtain funding from local or outside sources. Where such actions are high priorities, the community will work together with NYSOEM, FEMA and other Federal, State and County agencies to secure funds.

In general, mitigation actions ranked as high priorities will be addressed first. However, medium or even low priority mitigation actions will be considered for concurrent implementation. Therefore, the ranking levels should be considered as a first-cut, preliminary ranking and will evolve based on input from the Town departments and representatives, municipal government departments and representatives, the public, municipal government departments and representatives, NYSOEM, and FEMA as the plan is implemented.

Table 6-8. Prioritization of Mitigation Initiatives

Mitigation Action #	# of Objectives Met	Benefits	Costs	Do Benefits equal or exceed Costs? (Y/N)	Is project Grant eligible? (Y/N)	Can project be funded under existing programs/budgets? (Y/N)	Priority
PV-1	2	M-H	L-M	Y	N	Y	H
PV-2	2	M	L	Y	N	Y	H
PV-3	5	M-H	L-M	Y	N	Y	H
PV-4	2	M-H	L-M	Y	N	Y	H
PV-5	1	L-M	L	Y	N	Y	H
PV-6	4	M	L	Y	N	Y	H
PV-7	3	L	L	Y	N	Y	H
PV-8	3	M-H	L	Y	N	Y	H
PV-9	3	H	L-M	Y	Y (5 year update)	Y (annual review); N (5 year update)	H
PV-10	5	H	L-M	Y	N	Y	H
PV-11	3	H	L-M	Y	Y	Y	H
PV-12	3	L	L	Y	N	Y	H
PV-13	3	M	L	Y	N	Y	H
PV-14	5	M	L	Y	N	Y	H
PP-1	3	H	H	Y	Y	Y (outreach and grant support); N (project implementation)	H
PP-2	2	H	H	Y	Y	Y	H
PP-3	4	H	H	Y	Y	N	H
PP-4	2	H	M	Y	Y	Y	H
PP-5	5	M-H	L	Y	N	Y	H
PP-6	2	H	H	Y	Y	N	M
PP-7	2	H	H	Y	Y	N	M
PE-1	5	M	L	Y	N	Y	H
PE-2	6	M	L	Y	N	Y	H
PE-3	3	L	L	Y	N	Y	M
NRP-1	4	M-H	M	Y	Y	Y	H
NRP-2	3	M-H	L	Y	N	Y	H
NRP-3	2	H	H	Y	TBD	N	M
ES-1	5	H	L-H	Y	TBD	Y	H
ES-2	2	H	M-H	Y	Y	Y	H
ES-3	3	M	L	Y	Y (EM Grants)	Y	M
ES-4	5	L	L	Y	N	Y	M
SP-1	6	H	H	Y	TBD	N	H
SP-2	3	H	H	Y	Y	Y	H
SP-3	2	H	H	Y	N	Y	M
SP-4	6	H	H	Y	TBD	N	H

Notes: H = High. L = Low. M = Medium. N = No. N/A = Not applicable. Y = Yes. TBD = To Be Determined.

SECTION 7: PLAN MAINTENANCE PROCEDURES

This section describes the system that the Town of East Fishkill has established to monitor, evaluate, and update the mitigation plan; implement the mitigation plan through existing programs; and solicit continued public involvement for plan maintenance.

MONITORING, EVALUATING AND UPDATING THE PLAN

This section presents the procedures for monitoring, evaluating, and updating the plan.

The Town of East Fishkill mitigation planning committee intends to remain intact as the organization responsible for monitoring; evaluating and updating this Plan (see Table 7-1 identifying the representation of the mitigation planning committee as of the date of this Plan). Mr. Rick Witt shall be the Town's Hazard Mitigation Planning Coordinator and shall continue to act as the coordinator for the mitigation planning committee.

Table 7-1. Town of East Fishkill Hazard Mitigation Planning Committee

Name	Title
John Hickman	Town Supervisor
Rick Witt	Town Engineering Assistant
Mark Pozniak	Town Comptroller
Kenneth Beyer	Town Acting Building Inspector and Zoning Administrator, NFIP Floodplain Admin.
Bill McClellan	Town MS-4 Enforcement Officer
Dennis Miller	Town Highway Superintendent
Michelle Robbins	Contract Planner – AKRF, Inc.
Walter Artus	Contract Stormwater Management Planner - SMC, Inc.
Brian C. Nichols	Chief of Police
Corey Ehrhart	Police Sergeant and Fire Commissioner
Lori Gee	Chairman – Planning Board
Pam Baier	Secretary to Town Planning Board

Monitoring and Evaluating

The planning committee shall be responsible for monitoring progress, evaluating, and documenting the effectiveness of the plan with the New York Office of Emergency Management (NYSOEM) and FEMA Region II. The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the plan goals are being reached, and whether changes are needed. The evaluations will assess if:

- Mitigation goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the plan 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 exist.
- Outcomes have occurred as expected.
- Changes in municipal resources impacted plan implementation (for example, funding, personnel, and equipment)
- Hazard events since plan approval have been documented.

The planning committee will also 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 better accommodate hazard mitigation actions. This is discussed further in the "Implementation of Mitigation Plan through Existing Programs" section.

Annual Plan Review and Maintenance

Monitoring of plan progress and evaluating effectiveness shall be accomplished through an annual plan review process, initiated by the Hazard Mitigation Plan Coordinator and executed by the entire planning committee.

The annual review process shall begin in May of each year, timed to coincide with the annual FEMA Hazard Mitigation Assistance (HMA) program announcement. At this time, the Town HMP Coordinator shall call a meeting of the planning committee to discuss how to conduct the annual review and reporting process for the year. At this meeting, the planning committee shall determine the method by which Town departments and agencies will be surveyed for information to go into the annual review and report, set a schedule, and assign responsibilities to complete the review and reporting process.

The planning committee may use the progress reporting forms, Worksheets #1 and #3 in the FEMA 386-4 guidance document, to facilitate collection of progress data and information on specific mitigation actions. FEMA guidance worksheets are provided in Appendix D. Alternatively, the committee may develop other methods and survey/reporting forms for the annual review and reporting each year. However, it is anticipated the process will include the following elements:

- Preparing and distributing an annual mitigation plan progress survey form to department representatives and/or planning committee members ahead of the annual plan review meeting
- Conducting an annual meeting of the mitigation planning committee, at which the following will be discussed and documented:
    - Mitigation progress and activity.
    - Updating the mitigation strategy; specifically adding, amending or eliminating mitigation projects/activities/initiatives.
    - Mitigation successes, problems, concerns and issues regarding plan implementation.
    - Efforts to integrate/coordinate the plan with other existing plans and programs.
    - Mitigation resources available, including upcoming and potential training programs.
    - Available and pending grant programs (process to apply, schedule, etc.).
    - Status of grant applications and/or awarded grants within the Town.
    - Public and stakeholder input and comment on the plan.
- Preparing and submitting an annual progress report to NYSOEM and FEMA Region II.

The Hazard Mitigation Coordinator shall be responsible for preparing the Annual HMP Progress Report, based on the information compiled at the annual planning committee meeting, and other relevant information appropriated. The main purpose of this report is to document progress on plan implementation and formally document updates to the mitigation strategies. These annual reports will also provide data for the 5-year update of the HMP and will assist in pinpointing implementation challenges. By monitoring the implementation of the plan on an annual basis, the planning committee will be able to asses which projects are completed, no longer feasible, or require additional funding.

The Annual HMP Progress Report shall be posted on the Town of East Fishkill Hazard Mitigation Plan website: http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan to keep the public apprised of the plan's implementation. To meet this recertification timeline, the planning committee will strive to complete the review process and prepare an Annual HMP Progress Report by the end of July.

Plan Update

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 Town of East Fishkill mitigation planning committee to update this plan on a five year cycle from the date of initial plan adoption. Ongoing maintenance and updating of the plan shall be the responsibility of the Hazard Mitigation Coordinator working with the mitigation planning committee.

To facilitate the update process, the Town of East Fishkill HMP Coordinator, with support of the mitigation planning committee, shall use the **third** annual plan review process to develop and commence the implementation of a detailed plan update program. The Town of East Fishkill HMP Coordinator shall invite representatives from NYSOEM and FEMA 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 Town of East Fishkill HMP Coordinator shall be responsible for assuring that needed resources are secured.

IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

It is the intention of the Town to incorporate mitigation planning as an integral component of daily government operations. The planning committee members will work with local government officials and other department/agency representatives to integrate the newly adopted hazard mitigation goals and actions into the general operations of the Town. Further, the sample adoption resolution (Appendix B) includes a resolution item stating the intent of the Town Board to incorporate mitigation planning as an integral component of government operations. By doing so, the Town anticipates that:

1) Hazard mitigation planning will be formally recognized as an integral part of overall planning and risk management efforts;
2) This plan and other planning documents, mechanisms and programs will become mutually supportive efforts that work in concert to meet the goals and needs of the municipality.

Section 3.6 "Integration/Coordination of Existing Plans, Programs and Information" provides a summary of those plans and programs that support mitigation that were reviewed during this planning process. Specific information on these plans, programs and other capabilities to support mitigation within the Town are described in Section 6, "Capability Assessment" along with details as to how they will continue to be integrated into and coordinated with the findings, recommendations and strategies in this plan. Further, specific mitigation initiatives implementing this integration are identified in the Town's mitigation strategy identified in Section 6.

Table 7-2. Existing Processes and Programs for Mitigation Plan Implementation

Process	Action	Implementation of Plan
Administrative	Departmental or organizational work plans, policies, and procedural changes	• Building and Planning Departments • Engineering Department • Police Department • Finance Department
Administrative	Other organizations' plans	• Include reference to this plan in future updates of the following: • Disaster Recovery Plan • Floodplain Management Plan • Zone and Subdivision Regulations • Comprehensive Land Use Plan • Building Code • Fire Code • Stormwater Management Plan • Steep Slope Protection
Administrative	Job/Job Descriptions	• Planners with land use/ land development knowledge • Planners or Engineers with natural and human caused hazard knowledge • Emergency Manager • NFIP Floodplain Administrator • Land Surveyor • Personnel skilled in Geographic Information Systems • Grant writers • Personnel with expertise in Benefit-Cost Analysis
Administrative	Training and Certification	• Take advantage of professional education, training and certification opportunities of staff (e.g. Certified Floodplain Manager, Benefit-Cost Analysis training).
Budgetary	Capital and operational budgets	• Continue to include mitigation related projects in the following: • Capital Improvement Program. • Community Development Block Grants • Special Purpose Taxes • Water/ Sewer/ Stormwater • Development Impact Fees • General Obligation, Revenue, and/or Special tax Bonds

Process	Action	Implementation of Plan
		• Partnering Arrangements and Intergovernmental Agreements.
Regulatory	Executive Orders, ordinances and other directives	• New York State Hazard Mitigation Plan – 2011 Update • Town of East Fishkill Comprehensive Plan – May 2002 • Town of East Fishkill Flood Damage Prevention Ordinance (Chapter 108) • Town of East Fishkill Freshwater Wetlands, Waterbodies and Watercourses Ordinance (Chapter 110) • Town of East Fishkill Stormwater Management, Erosion and Sediment Control Ordinance (Chapter 157) • Natural Resources Management Plan for the Fishkill Creek Watershed – June 2005
Funding	Secure traditional sources of financing	• Apply for grants from federal (including FEMA Hazard Mitigation Assistance (HMA) funding programs), state government, nonprofit organizations, foundations, and private sources. • Continue to make us of grant opportunities through U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG) • Other potential federal funding sources include: ○ Stafford Act, Section 406 – Public Assistance Program Mitigation Grants ○ Federal Highway Administration ○ Catalog of Federal Domestic Assistance ○ United States Fire Administration – Assistance to Firefighter Grants ○ United States Small Business Administration Pre and Post Disaster Mitigation Loans ○ United States Department of Economic Development Administration Grants ○ United States Army Corps of Engineers ○ United States Department of Interior, Bureau of Land Management ○ Other sources as yet to be defined • See Appendix E for additional funding sources
Partnerships	Develop creative partnerships, funding and incentives	• Public-Private Partnerships • State Cooperation • Intergovernmental Agreements • In-kind resources
Partnership	Existing Committees and Councils	• Local Government Committees: ○ Planning Board ○ Zoning Board ○ Conservation Advisory Council ○ Open Space Committee
Partnership	Working with other federal, state, and local agencies	• Army Corps of Engineers (USACE) • American Red Cross • Department of Homeland Security (DHS) • Federal Emergency Management Agency (FEMA) • National Oceanic and Atmosphere Agency (NOAA) • National Weather Service (NWS) • New York Department of Transportation (NJDOT) • New York Department of Environmental Conservation (NYSDEC) • NY State Emergency Management Office (SEMO) • United States Department of Agriculture (USDA) • United States Department of Transportation (USDOT) • United States Geological Service (USGS) • Watershed Associations

During the annual plan evaluation process, the MPC 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.

CONTINUED PUBLIC INVOLVEMENT

The Town of East Fishkill is committed to the continued involvement of the public in the hazard mitigation process. Therefore, copies of the plan will be made available for public review and the Town mitigation webpage and during normal business hours at Town Hall. The Town HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this plan. Contact information is:

Mr. Rick Witt, Engineering Assistant
Town of East Fishkill
330 Route 376
Hopewell Junction, NY 12533

Further, the public will have an opportunity to comment on the annual plan progress report, and during the 5-year plan update. The Town will maintain the mitigation website, posting the annual progress reports and maintaining an active link to collect public comments.

The HMP Coordinator is responsible for facilitating and promoting public review of the plan and annual reports, collecting and reviewing public comment, and ensuring their incorporation in interim updates and the 5-year plan update as appropriate. Specifically, the HMP Coordinator shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate. Opportunity to comment on the plan will be provided directly on the project web site. Provisions for public comment in writing will also be made.
- Copies of the latest approved plan (or draft in the case that the five year update effort is underway) are available for public review along with instructions to facilitate public input and comment on the plan.
- Appropriate links to the Town of East Fishkill mitigation website are maintained.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.

ACRONYMS

AAA	American Avalanche Association
ASFPM	Association of State Floodplain Managers
BCA	Benefit Cost Analysis
BCEGS	Building Code Effectiveness Grading Scale
BOCA	Building Officials Code Administration
BFE	Base Flood Elevation
CAC	Community Assistance Contact
CAV	Community Assistance Visit
CDBG	Community Development Block Grants
CDP	Census Designated Place
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvement Program
ClimAID	Integrated Assessment for Effective Climate Change in New York State
CO	carbon monoxide
CO_2	carbon dioxide
CRRDL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System
CSD	Central School District
DEM	Digital Elevation Model
DMA 2000	Disaster Mitigation Act of 2000
DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
ºF	Fahrenheit
FDPO	Flood Damage Prevention Ordinance
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FSA	Farm Service Agency
GeoMAC	Geospatial Multi-Agency Coordination
GIS	Geographic Information System

H	High
HAZUS	Hazards U.S.
HAZUS-MH	Hazards U.S. Multi-Hazard
HAZMAT	Hazardous Material
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HVAC	Heating, ventilation, and air conditioning
IA	Individual Assistance
L	Low
LOOP	Dutchess County Division of Mass Transportation
M	Million
MGD	Million gallons per day
MMI	Modified Mercalli Intensity
MMS	Modified Mercalli Scale
MNR	Metro-North Railroad
MOA	Memorandum of Agreement
Mph	Miles per hour
MRP	Mean Return Period
MS4	Municipal Separate Storm Sewer Systems
MTA	Metropolitan Transportation Authority
N	No
N/A	Not Applicable
NA	Not Available
NAC	National Avalanche Center
NCDC	National Climate Data Center
NDMC	National Drought Mitigation Center
NEHRP	National Earthquake Hazard Reduction Program
NEIC	National Earthquake Information Center
NESEC	Northeast States Emergency Consortium
NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NFIRS	National Fire Incident Reporting System

NFPA	National Fire Protection Association
NHC	National Hurricane Center
NID	National Inventory of Dams
NIMS	National Incident Management System
NLCD	National Land Cover Dataset
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen Oxides
NPDP	National Performance of Dams Program
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
NWPD	National Wildfire Programs Database
NWS	National Weather Service
NY	New York
NYCEM	New York City Area Consortium for Earthquake Loss Mitigation
NYC	New York City
NYS	New York State
NYSC	New York State Climate Office
NYSDCP	New York State Deferred Compensation Plan
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYSFSMA	New York State Floodplain and Stormwater Managers Association
NYSHMP	New York State Hazard Mitigation Plan
NYSOEM	New York State Office of Emergency Management
NYSOFPC	New York State Office of Fire Prevention and Control
NYSEG	New York State Electric and Gas
NYS TMC	New York State Traffic Management Center
OFA	Office of Aging
PA	Public Assistance
%	Percent
%g	Percent acceleration force of gravity
PD	Police Department

PDM	Pre-Disaster Mitigation Program
PM	Particulate Matter
PGA	Peak Ground Acceleration
Pop	Population
POU	Dutchess County Airport
PPC	Public Protection Classification
PSA	Public Service Announcement
RFC	Repetitive Flood Claims
RLP	Repetitive Loss Properties
RV	Replacement Values
SA	Spectral Acceleration
SBA	Small Business Association
SDE	Substantial Damage Estimation
SDWIS	Safe Drinking Water Information System
SFHA	Special Flood Hazard Areas
SHELDUS	Spatial Hazard Events and Losses Database for United States
SO_2	Sulfur Dioxide
SPC	Storm Prediction Center
SPDES	State Pollutant Discharge Elimination System
Sq.mi.	Square mile
SRL	Severe Repetitive Loss
SWMP	Stormwater Management Program
TBD	To Be Determined
tmdl	Total maximum daily load
TRI	Toxic Release Inventory
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USDOT	United States Department of Transportation
USFA	United States Fire Administration
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

WCT	Wind Chill Temperature
WFAS	Wildland Fire Assessment System
WUI	Wildland/Urban Interface
WWTP	Wastewater Treatment Plant
Y	Yes

This resource defines terms that are used in or support the risk assessment document. These definitions were based on terms defined in documents included in the reference section, with modifications as appropriate to address the Town of East Fishkill specific definitions and requirements.

100-year flood – A flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management to determine the need for flood insurance.

500-year flood – A flood that has a 0.2-percent chance of being equaled or exceeded in any one year.

Aggregate Data – Data gathered together across an area or region (for example, census tract or census block data).

Annualized Loss – The estimated long-term value of losses from potential future hazard occurrences of a particular type in any given single year in a specified geographic area. In other words, the average annual loss that is likely to be incurred each year based on frequency of occurrence and loss estimates. Note that the loss in any given year can be substantially higher or lower than the estimated annualized loss.

Annualized Loss Ratio – Represents the annualized loss estimate as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula: Annualized Loss Ratio = Annualized Losses / Exposure at Risk. The annualized loss ratio gauges the relationship between average annualized loss and building value at risk. This ratio can be used as a measure of relative risk between hazards as well as across different geographic units

Asset – Any man-made or natural feature that has value, including but not limited to people, buildings, infrastructure (such as bridges, roads, and sewer and water systems), and lifelines (such as electricity and communication resources or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks).

At-Risk – Exposure values that include the entire building inventory value in census blocks that lie within or border the inundation areas or any area potentially exposed to a hazard based on location.

Base Flood – Flood that has a 1-percent probability of being equaled or exceeded in any given year. It is also known as the 100-year flood.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as the standard for the National Flood Insurance Program.

Benefit – Net project outcomes, usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of conducting a benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including a reduction in expected property losses (building, content, and function) and protection of human life.

Benefit-cost analysis (BCA) – Benefit-cost analysis is a systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Blizzard – Characterized by low temperatures, wind gusts of 35 mph or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours).

Building – A structure that is walled and roofed, principally aboveground and permanently fixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Codes – Regulations that set forth standards and requirements for construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural disasters.

Capability Assessment – An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Climate – The meteorological elements, including temperature, precipitation, and wind, that characterizes the general conditions of the atmosphere over a period of time (typically 30-years) for a particular region.

Community Rating System (CRS) – CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specific activities, the insurance premiums of these policyholders in communities are reduced.

Comprehensive Plan – A document, also known as a "general plan", covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and transportation. In most states, the comprehensive plan has no authority in and of itself, but serves as a guide for community decision-making.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following a hazard. Critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities. As defined for the Town of East Fishkill risk assessment, this category includes police stations, fire and/or EMS stations, major medical care facilities and emergency communications.

Crop Moisture Index (CMI) – The CMI was developed by Wayne Palmer in 1968, can be used to measure the status of dryness or wetness affecting warm season crops and field activities. It gives the short-term or current status of purely agricultural drought or moisture surplus and can change rapidly from week to week.

Dam Failure – A partial or complete breach in a dam, which impacts its integrity. Dam failures occur for a number of reasons such as flash flooding, inadequate size of spillways, mechanical failure of valves and other equipment, rodent activities in earthen dams, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris – The scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digital Elevation Model (DEM) – U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data files that are digital representations of cartographic information in a raster form. DEMs include a sampled array of elevations for a number of ground positions at regularly spaced intervals. These digital cartographic/geographic data files are produced by USGS as part of the National Mapping Program.

Digital Flood Insurance Rate Maps (DFIRMs) – These maps are used to calculate the cost insurance premiums, establish flood risk zones and base flood elevations to mitigate against potential future flood damages to properties.

Displacement Time – After a hazard occurs, the average time (in days) that a building's occupants must operate from a temporary location while repairs are made to the original building due to damages resulting from the hazard.

Disaster Mitigation Act of 2000 (DMA 2000) – Law that requires and rewards local and state pre-disaster planning, promotes sustainability as a strategy for disaster resistance, and is intended to integrate state and local planning with the aim of strengthening state-wide mitigation planning.

Drought - A deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area.

Drought Impact Reporter (DIR) – The DIR is an interactive tool developed by the NDMC to collect, quantify, and map reported drought impacts for the U.S.

Duration – The length of time a hazard occurs.

Earthquake – A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Essential Facility – A facility that is important to ensure a full recovery of a community or state following the occurrence of a hazard. These facilities can include: government facilities, major employers, banks, schools, and certain commercial establishments (such as grocery stores, hardware stores, and gas stations). For the Town of East Fishkill risk assessment, this category was defined to include schools, colleges, shelters, adult living and adult care facilities, medical facilities and health clinics, hospitals.

Exposure – The number and dollar value of assets that are considered to be at risk during the occurrence of a specific hazard.

Extent – The size of an area affected by a hazard or the occurrence of a hazard.

Extra Tropical Cyclone – A group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes of the Earth. These storms have neither tropical nor polar characteristics and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones". These cyclones produce impacts ranging form cloudiness and mild showers to heavy gales and thunderstorms.

Extreme Heat - Occurs when temperatures hover 10 degrees or more above the average high temperature for a region and last for several weeks.

Federal Emergency Management Agency (FEMA) – Independent agency (now part of the Department of Homeland Security) created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Flash Flood – A flood occurring with little or no warning where water levels rise at an extremely fast rate.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas resulting from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth – Height of the flood water surface above the ground surface.

Flood Elevation – Height of the water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or mean sea level).

Flood Hazard Area – Area shown to be inundated by a flood of a given magnitude on a map.

Flood Information Tool (FIT) – Hazard U.S. Multi-Hazard (HAZUS-MH)- related tool designed to process and convert locally available flood information to data that can be used by the HAZUS-MH Flood Module. The FIT is a system of instructions, tutorials and geographic information system (GIS) analysis scripts. When provided with user-supplied inputs (such as ground elevations, flood elevations, and floodplain boundary information), the FIT calculates flood depth and elevation for river and coastal flood hazards.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Flood Mitigation Assistance (FMA) Program – A program created as a part of the National Flood Insurance Report Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurance structures, with a focus on repetitive loss properties.

Floodplain – Any land area, including a watercourse, susceptible to partial or complete inundation by water from any source.

Flood Polygon – A geographic information system vector file outlining the area exposed to the flood hazard. HAZUS-MH generates this polygon at the end of the flood computations in order to analyze the inventory at risk.

Freezing Rain – Rain that falls as a liquid but freezes into glaze upon contact with the ground.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1-percent chance of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity – Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 (wind speed less than 73 mph) indicates minimal damage such as broken tree limbs or signs, while an F5 (wind speeds of 261 to 318 mpg) indicated severe damage sustained.

Geology – The scientific study of the earth, including its composition, structure, physical properties, and history.

Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Geographic Information Systems (GIS) – A computer software application that relates data regarding physical and other features on the earth to a database to be used for mapping and analysis.

GIS Shape Files – A type of GIS vector file developed by ESRI for their ArcView software. This type of file contains a table and a graphic. The records in the table are linked to corresponding objects in the graphic.

Hailstorm – Storm associated with spherical balls of ice. Hail is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the higher reaches of a well-developed thunderstorm. When hailstones become too heavy to be caught in an updraft back into the clouds of the thunderstorm (hailstones can be caught in numerous updrafts adding a coating of ice to the original frozen droplet of rain each time), they fall as hail and a hailstorm ensues.

Hazard – A source of potential danger or an adverse condition that can cause harm to people or cause property damage. For this risk assessment, priority hazards were identified and selected for the pilot project effort. A natural hazard is a hazard that occurs naturally (such as flood, wind, and earthquake). A man-made hazard is one that is caused by humans (for example, a terrorist act or a hazardous material spill). Hazards are of concern if they have the potential to harm people or property.

Hazards of Interest – A comprehensive listing of hazards that may affect an area.

Hazards of Concern – Those hazards that have been analytically determined to pose significant risk in an area, and thus the focus of the particular mitigation plan for that area (a subset of the Hazards of Interest).

Hazard Identification – The process of identifying hazards that threaten an area.

Hazardous Material Facilities – Facilities housing industrial and hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins.

Hazard Mitigation – Sustained actions taken to reduce or eliminate the long-term risk and effects that can result from the occurrence of a specific hazard. For example, building a retaining wall can protect an area from flooding.

Hazard Mitigation Grant Program (HMGP) – Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard Mitigation Plan – A collaborative document in which hazards affecting the community are identified, vulnerability to hazards assessed, and consensus reached on how to minimize or eliminate the effects of these hazards.

Hazard Profile – A description of the physical characteristics of a hazard, including a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard Risk Gauge – The graphic icon used during the initial planning process to convey the relative risk of a given hazard in the study area. The scale ranges from green indicating relatively low or no risk to red indicating severe risk.

Hazard Analysis New York (HAZNY) - Developed by the American Red Cross and the New York State Emergency Management Office (NYSEMO) on October 2, 2003. It is an automated interactive spreadsheet that asks specific questions on potential hazards in a community and records and evaluates the responses to these questions.

Hazards U.S. (HAZUS) – A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA. HAZUS was replaced by HAZUS-MH (see below) in 2003.

Hazards U.S. – Multi-Hazard (HAZUS-MH) – A GIS-based nationally standardized earthquake, flood, and wind loss estimation tool developed by FEMA. The purpose of this pilot project is to demonstrate and implement the use of HAZUS-MH to support risk assessments

HAZUS-MH Risk Assessment Methodology – This analysis uses the HAZUS-MH modules (earthquake, wind--hurricane and flood) to analyze potential damages and losses. For this pilot project risk assessment, the flood and hurricane hazards were evaluated using this methodology.

HAZUS-MH-Driven Risk Assessment Methodology – This analysis involves using inventory data in HAZUS-MH combined with knowledge such as (1) information about potentially exposed areas, (2) expected impacts, and (3) data regarding likelihood of occurrence for hazards. For this risk assessment, a HAZUS-Driven Risk Assessment Methodology could not be used to estimate losses associated with any hazards because of a lack of adequate data. However, the methodology was used, based on more limited data to estimate exposure for the dam failure, urban fire, fuel pipeline breach, and HazMat release hazards.

Heavy Snow – Snowfall accumulating to 4” or more in depth in 12 hours or less; or snowfall accumulating to 6” or more in depth in 24 hours or less.

High Potential Loss Facilities – Facilities that would have a high loss associated with them, such as nuclear power plants, dams, and military installations.

Hurricane – An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean (east of 160°E longitude). Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Hydraulics – That branch of science, or of engineering, which addresses fluids (especially, water) in motion, its action in rivers and canals, the works and machinery for conducting or raising it, its use as a prime mover, and other fluid-related areas.

Hydrology – The science of dealing with the waters of the earth (for example, a flood discharge estimate is developed through conduct of a hydrologic study).

Infrastructure – The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, transportation system (such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams).

Ice Jam – An accumulation of ice in a river that acts as a natural dam and can flood low-lying areas upstream. They occur when warm temperatures and heavy rains cause rapid snow melt.

Ice Storm – Term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication.

Intensity – A measure of the effects of a hazard occurring at a particular place.

Inventory – The assets identified in a study region. It includes assets that can be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide – A landslide is the process that results in the downward and outward movement of slope-forming materials. Landslide materials can be composed of natural rock, soil, artificial fill or any combination of these materials. The materials move by falling, toppling, sliding, spreading, or flowing.

Level 1 Analysis – A HAZUS-MH analysis that yields a rough estimate or preliminary analysis based on the nationwide default database included in HAZUS-MH. A Level 1 analysis is a great way to begin the risk assessment process and prioritize high-risk communities without collecting or using local data.

Level 2 Analysis – A HAZUS-MH analysis that requires the input of additional or refined data and hazard maps that will produce more accurate risk and loss estimates. Assistance from local emergency management personnel, city planners, GIS professionals, and others may be necessary for this level of analysis.

Level 3 Analysis – A HAZUS-MH analysis that yields the most accurate estimate of loss and typically requires the involvement of technical experts such as structural and geotechnical engineers who can modify loss parameters based on the specific conditions of a community. This level analysis will allow users to supply their own techniques to study special conditions such as dam breaks and tsunamis. Engineering and other expertise is needed at this level.

Lifelines – Critical facilities that include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways).

Lightning – A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground.

Loss Estimation – The process of assigning hazard-related damage and loss estimates to inventory, infrastructure, lifelines, and population data. HAZUS-MH can estimate the economic and social loss for specific hazard occurrences. Loss estimation is essential to decision making at all levels of government and provides a basis for developing mitigation plans and policies. It also supports planning for emergency preparedness, response, and recovery.

Lowest Floor – Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure. For the HAZUS-MH flood model, this information can be used to assist in assessing the damage to buildings.

Magnitude – A measure of the strength of a hazard occurrence. The magnitude (also referred to as severity) of a given hazard occurrence is usually determined using technical measures specific to the hazard. For example, ranges of wind speeds are used to categorize tornados.

Major Disaster Declarations – Post-disaster status requested by a state's governor when local and state resources are not sufficient to meet disaster needs. It is based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery. The event must be clearly more than the state or local government can handle alone.

Mean Return Period (MRP) – The average period of time, in years, between occurrences of a particular hazard (equal to the inverse of the annual frequency of exceedance).

Mitigation Actions – Specific actions that help you achieve your goals and objectives.

Mitigation Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term, and represent global visions.

Mitigation Objectives – Strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Mitigation Plan – A plan that documents the process used for a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a state or community. The plan includes a description of actions to minimize future vulnerability to hazards. This plan should be developed with local experts and significant community involvement.

National Drought Mitigation Center (NDMC) – The NDMC helps develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. Most of the NDMC's services are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning. The NDMC produces a daily drought monitor map that identifies drought areas and ranks droughts by intensity. U.S. Drought Monitor summary maps are available from May 1999 through the present and identify general drought areas and classification droughts by intensity ranging from D1 (moderate drought) to D4 (exceptional drought). Category D0, drought watch areas, are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 Code of Federal Regulations (CFR) §60.3.

Nor'Easter – Named for the strong northeasterly winds blowing in ahead of the storm, are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms). A Nor'Easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the Northeastern U.S. and Atlantic Canada.

North America Drought Monitor (NA-DM) – The NA-DM is a cooperative effort between drought experts in Canada, Mexico and the U.S. to monitor drought across the continent on an ongoing basis. The Drought Monitor concept was developed as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state and academic scientists. Maps of U.S. droughts are available from this source from 2003 to the present.

Objectives – Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Occupancy Classes – Categories of buildings used by HAZUS-MH (for example, commercial, residential, industrial, government, and "other").

Ordinance – A term for a law or regulation adopted by local government.

Outflow – Associated with coastal hazards and follows water inundation creating strong currents that rip at structures and pound them with debris, and erode beaches and coastal structures.

Palmer Drought Severity Index (PDSI) – The PDSI was developed in 1965, and indicates the prolonged and abnormal moisture deficiency or excess. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

Parametric Model – A model relating to or including the evaluation of parameters. For example, HAZUS-MH uses parametric models that address different parameters for hazards such as earthquake, flood and wind (hurricane). For example, parameters considered for the earthquake hazard include soil type, peak ground acceleration, building construction type and other parameters.

Planimetric – Maps that indicate only man-made features like buildings.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Post-disaster mitigation – Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Presidential Disaster Declaration – A post-disaster status that puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities in the areas of human services, public assistance (infrastructure support), and hazard mitigation. If declared, funding comes from the President's Disaster Relief Fund and disaster aid programs of other participating federal agencies.

Preparedness – Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Priority Hazards – Hazards considered most likely to impact a community based on frequency, severity, or other factors such as public perception. These are identified using available data and local knowledge.

Provided Data – The databases included in the HAZUS-MH software that allow users to run a preliminary analysis without collecting or using local data.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Public Education and Outreach Programs – Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Q3 Flood Zone Data – FEMA flood data that delineate the 100- and 500-year flood boundaries. The Q3 Flood Data are digital representations of certain features of FEMA's Flood Insurance Rate Map (FIRM) product, intended for use with desktop mapping and GIS technology.

Recovery – The actions taken by an individual or community after a catastrophic event to restore order and lifelines in the community.

Regulation – Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Recurrence Interval – The average time between the occurrences of hazardous events of similar size in a given location. This interval is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This cost is usually expressed in terms of cost per square foot and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Resolutions – Expressions of a governing body's opinion, will, or intention that can be executive or administrative in nature. Most planning documents must undergo a council resolution, which must be supported in an official vote by a majority of representatives to be adopted. Other methods of making a statement or announcement about a particular issue or topic include proclamations or declarations.

Resources – Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment – A methodology used to assess potential exposure and estimated losses associated with priority hazards. The risk assessment process includes four steps: (1) identifying hazards, (2) profiling hazards, (3) conducting an inventory of assets, and (4) estimating losses. This pilot project report documents this process for selected hazards addressed as part of the pilot project.

Risk Factors – Characteristics of a hazard that contribute to the severity of potential losses in the study area.

Riverine – Of or produced by a river (for example, a riverine flood is one that is caused by a river overflowing its banks).

Saffir-Simpson Scale – This scale categorizes or rates hurricanes from 1 (Minimal) to 5 (Catastrophic) based on their intensity. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the shape of the coastline, in the landfill region.

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scour – Removal of soil or fill material by the flow of floodwaters. This term is frequently used to describe storm-induced, localized, conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1-percent or greater chance of flood occurrence in any given year (that is, the 100-year or base flood zone); represented on FIRMS as darkly shaded areas with zone designations that include the letter "A" or "V."

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law (PL) 100-107 was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder – Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

Standardized Precipitation Index (SPI) – The SPI is a probability index that considers only precipitation. It is based on the probability of recording a given amount of precipitation, and the probabilities are standardized so that an index of zero indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median). The index is negative for drought, and positive for wet conditions.

State Hazard Mitigation Officer (SHMO) – The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structure – Something constructed (for example, a residential or commercial building).

Study Area – The geographic unit for which data are collected and analyzed. A study area can be any combination of states, counties, cities, census tracts, or census blocks. The study area definition depends on the purpose of the loss study and in many cases will follow political boundaries or jurisdictions such as city limits.

Substantial Damage – Damage of any origin sustained by a structure in a SFHA, for which the cost of restoring the structure to its pre-hazard event condition would equal or exceed 50 percent of its pre-hazard event market value.

Thunderstorm – A local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder. It forms from a combination of moisture, rapidly rising warm air and a force capable of lifting air such a warm and cold front, a sea breeze, or a mountain.

Topographic – Map that shows natural features and indicate the physical shape of the land using contour lines based on land elevation. These maps also can include man-made features (such as buildings and roads).

Tornado – A violently rotating column of air extending from a thunderstorm to the ground.

Transportation Systems – One of the lifeline system categories. This category includes: airways (airports, heliports, highways), bridges, tunnels, roadbeds, overpasses, transfer centers; railways (tracks, tunnels, bridges, rail yards, depots), and waterways (canals, locks, seaports, ferries, harbors, dry docks, piers).

Tropical Cyclone – A generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters containing a warm core of low barometric pressure which typically produces heavy rainfall, powerful winds and storm surge.

Tropical Depression – An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of less than 38 mph. It has no "eye"(the calm area in the center of the storm) and does not typically have the organization or the spiral shape of more powerful storms.

Tropical Storm – An organized system of strong thunderstorms with a defined surface circulation and maximum sustained wind between 39 to 73 mph.

Utility Systems – One of the lifeline systems categories. This category includes potable water, wastewater, oil, natural gas, electric power facilities and communication systems.

Vulnerability – Description of how exposed or susceptible an asset is to damage. This value depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. If an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect affects can be much more widespread and damaging than direct affects.

Vulnerability Assessment – Evaluation of the extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard occurrences on the existing and future built environment.

Watershed – Area of land that drains down gradient (from areas of higher land to areas of lower land) to the lowest point; a common drainage basin. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves downstream, eventually reaching an estuary, lake, or ocean.

Wind Chill Index (WCI) – The temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold.

Zone – A geographical area shown on a National FIRM that reflects the severity or type of flooding in the area.

Zoning Ordinance – Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

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This appendix includes an example resolution to be submitted by Town of East Fishkill authorizing adoption of the Town of East Fishkill Hazard Mitigation Plan.

RESOLUTION NO. XXXX-XX

A RESOLUTION OF THE TOWN BOARD OF THE TOWN OF EAST FISHKILL AUTHORIZING THE ADOPTION OF THE TOWN OF EAST FISHKILL HAZARD MITIGATION PLAN

WHEREAS, the Town of East Fishkill has exposure to natural hazards that increase the risk to life, property, environment and the Town's 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 Town of East Fishkill representatives with like planning objectives has been formed to pool resources and create consistent mitigation strategies within Town of East Fishkill; 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 Town of East Fishkill:

1) Adopts the Town of East Fishkill Hazard Mitigation Plan (the "Plan") as this jurisdiction's 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^th^ day of month, 2013, by the following vote:

AYES:
NOES:
ABSENT:
ABSTAIN:

____
Supervisor, Town of East Fishkill

ATTEST: __________________________________
Clerk, Town of East Fishkill

This appendix includes agendas, sign-in sheets, minutes and other documentation (where applicable and as available) for meetings convened during the development of the Town of East Fishkill Hazard Mitigation Plan. Documentation of public and stakeholder outreach is provided in Appendix C.

EAST FISHKILL ALL HAZARDS MITIGATION PLAN UPDATE
SIGN-IN SHEET
MEETING DATE: February 7, 2012 11AM

Name	Title	Municipality	Phone Number	E-mail
Rick Witt	Eng. Asst.	E.F.	845-221-2427, x-239	WITTR@EASTFISHKILLNY.ORG
Mark Pozniak	Comptroller	East Fishkill	845-226-2634	pozniakm@eastfishkillny.org
John Hickman	Town Supervisor	East Fishkill	845-221-4303	hickmanj@eastfishkillny.org
Jonathan Raser	TetraTech HM Planner		973-630-8042	JONATHAN.RASER@TETRATECH.COM

Town of East Fishkill, New York
ALL HAZARDS MITIGATION PLAN

Kick-Off Meeting - Agenda

Tuesday, February 21, 2012 - 9:30 AM

Municipal Building, 330 Route 376, Hopewell Junction, NY

1. **Introduction**

2. **Planning Committee – Membership, Schedule for next meeting**

3. **Data Collection**
   - **Data "Wish List" – provided Feb. 7, hard copy and on Resource CD**
   - **NFIP Data Request – provided Feb. 7, hard copy and on Resource CD**
   - **Capability Assessment - provided Feb. 7, hard copy and on Resource CD**
   - **Local Plan Documents (Comp. Plan, SWMP, CIP, CEMP)**
   - **Shared Site**

4. **Hazards of Concern (HOC) Identification**
   - **HOC Worksheet**
   - **Hazard Events and Losses – Handout**

5. **Public and Stakeholder Outreach**
   - **Public and Stakeholder Meeting – Date, how to announce and invite floodprone property owners and stakeholders**
   - **Review Stakeholder List - Handout**
   - **Project Website**
   - **Public Hazard Preparedness and Mitigation Survey**
   - **Brochure**
   - **Media Releases, Email Blasts, Social Media**

6. **Briefing from FEMA – Mitigation Division**

EAST FISHKILL ALL HAZARDS MITIGATION PLAN
SIGN-IN SHEET
MEETING DATE: February 21, 2012 – 9:30 AM

Name	Title	Dept./Agency	Phone Number	E-mail
Michelle Robbins	Planner	AKRF	845-632-1144	mrobbins@akrf.com
WALTER ARTUS	SWMP COORDINATOR	STORMWATER MGMT. CONST.	845.462.0082	W.ARTUS@VERIZON.NET
RICK WITT	EX. ASST.	T/EF		WITTR@EASTFISHKILLNY.ORG
John Hickman	Town Supervisor	Town E. Fishkill	845-221-4303	hickmanj@eastfishkillny.org
John T. Paraskeva	MSY-Engineering.	Town of East Fishkill	845222 2583	JohnParaskeva@optonline
Mark Pozniak	Comptroller	Town of East Fishkill	845-226-2634	pozniakm@eastfishkillny.org
Corey EHRHART	POLICE SERGEANT FIRE COMMISSIONER	TOWN OF EAST FISHKILL	845.742.2904	CEHRHART0501@Gmail.Com
KEN BEYER	BLDG & ZONING ADM.	T/O EAST FISHKILL	845-742-2887	beyerk@eastfishkillny.org
Paul Hoole	FEMA Planning	FEMA	571-289-7114	Paul.Hoole@fema.dhs.gov

Town of East Fishkill, New York
ALL HAZARDS MITIGATION PLAN

Planning Committee Meeting - Agenda
Monday, June 25, 2012
Municipal Building, 330 Route 376, Hopewell Junction, NY

Critical Facility Inventory

Latest Version of Critical Facility Maps and Tables (060112) on Share Point site

https://partners.ttemi.com/sites/eastfishkillhmp/default.aspx

Draft Hazard Profiles

Latest versions of hazard profiles (less loss estimation) on Share Point site:

- Flood 062012
- Severe Storm 060812
- Severe Winter Storm 060812
- Extreme Temperature 053112
- Earthquake 061212
- Dam Failure 060812

Capability Assessment (worksheet)

Public and Stakeholder Outreach

- April 12 Public Meeting on Project – 9 Letters of Voluntary Interest, including 5 RL and 2 SRL properties
- Public Hazard Preparedness and Mitigation Survey

Goals and Objectives

Identifying Projects (incl. current HMGP application)

EAST FISHKILL ALL HAZARDS MITIGATION PLAN
PLANNING COMMITTEE MEETING
MEETING DATE: June 25, 2012

Name	Title / Agency	E-mail
Mark Pozniak	Comptroller / Town of EF	pozniakm@eastfishkillny.org
John Hickman	Town Supervisor	hickmanj@eastfishkillny.org
Michelle Robbins	Planner / Town of EF	mrobbins@akrf.com
Dennis Miller	Highway Superintendent	
John T. Paraskeva	SMO MSY	JohnParaskeva@optonline.com
WALTER ARTUS	SWMP COORDINATOR	W.ARTUS@VERIZON.NET
RICK WITT	ASST. ENG.	WITTR@EASTFISHKILLNY.ORG
KEN BEYER	BLDG/ZONING ADMIN.	beyerk@eastfishkillny.org
SCOTT BRYANT	TOWN ENGINEER	BRYANTS@EASTFISHKILLNY.ORG
JONATHAN RASER	TETRA TECH / HM PLANNER	JONATHAN.RASER@TETRATECH.COM

Town of East Fishkill Hazard Mitigation Plan
Minutes of Meeting

Purpose of Meeting:	Planning Committee Meeting
Location of Meeting:	Town of East Fishkill Town Board Room Hopewell Junction, New York
Date of Meeting:	June 25, 2012

Attendees:

John Hickman – Town Supervisor
Mark Pozniak – Comptroller
Michelle Robbins – Planner (AKRF, Inc.)
Dennis Miller – Highway Superintendent
John T. Paraskeva – MS4
Walter Artus – SWMP Coordinator
Rick Witt – Assistant Engineer
Ken Beyer – Building/Zoning Administrator
Scott Bryant – Town Engineer
Jonathan Raser -Tetra Tech

Agenda Summary: This meeting was convened to discuss status and progress on the Town of East Fishkill Hazard Mitigation Planning Process, and conduct work on the plan in the areas of data and information collection, review of draft plan sections, discussion of planning goals and objectives, and review and discussion of mitigation projects identified to date.

Item No.	Description	Action By:
1	**Critical Facility Inventory** – Latest version of CF inventory on SharePoint site. Discussion on backup power at CF and identification of schools, shelters and cooling centers. Communication facitlities and towers to be added. Once finalized, the risk assessment modeling will commence.	R. Witt to complete the identification of CF this week, including geo-locating facilities.
2	**Discussion on Backup Power at Critical Facilities in Town** – Town Hall and the Community Center need B/U power. Community Center would be a designated cooling center if it had B/U power.	Town to continue to investigate back-up power at these CF.
3	**Draft Hazard Profiles** – Have been posted to SharePoint site for review by planning committee. Utility outages to be included in the Severe Storm and Severe Winter Storm profiles.	Committee to review draft sections of the plan as they become available. TT to add utility outage data and information to the hazard profiles.
4	**Floodprone Properties and Notices of Voluntary Interest** – Discussion on two properties that are not in the floodplain that are vulnerable to severe flooding (Crown Hill and Bykenhulle Road). Town has not done substantial damage determinations in the past, and should develop a procedure by which residents inform the Town of flood damage, conduct inspections and issue permits as needed. Town to develop a public outreach initiative in this regard.	TT to work with the Town to assure a complete record of the properties who submitted Notices of Voluntary interest. TT to survey these property owners for additional information on their properties and flood history, and compile NFIP claim history. for review by the Town.

5	**Current NYS HMGP and LOI process** – Discussion for possible action by the Town on behalf of floodprone property owners. Other mitigation grant programs discussed, including the SRL. Discussion on mitigation benefits to consider when evaluating possible projects.	TT to contact NYSOEM and FEMA on whether or not the Town should proceed with LOIs for resident who submitted NOVI and/or projects.
6	**Capability Assessment** – Purpose of capability assessment discussed and how to have the Town complete the capability assessment worksheet. Discussion on plans available for review (Comprehensive Plan, Disaster Recovery Plan - old, needs updating). Discussion on insurance ratings in the town.	Town to complete the Capability Assessment worksheet and return to Tetra Tech.
7	**Public and Stakeholder Outreach** – Town Board presentation was videotaped and is available on the town website. Draft Public hazard preparedness and mitigation survey reviewed and discussed.	Committee to review survey and provide comments; TT to complete the public mitigation survey so that it can be advertised on the town website.
8	**Stream Bank Stabilization, Monitoring and Clearing** – Discussion regarding property that is in imminent danger due to stream bank erosion (Creek Bend and Oak Ridge). Discussion on need to establish a stream monitoring program with Cornell Cooperative Extension and East Fishkill Watershed Association.	TT to investigate submitting an LOI on this project. To be included as an initiative in the plan.
9	**Lake Sekunna Dam** – Discussion regarding maintenance and safety issues with the dam, and the April 2012 inspection report from the NYSDEC. Town engineer has proposed the installation of an emergency spillway with rip-rap channel to manage overflow conditions. Town is looking into procedures to conduct work as an emergency action.	Tetra Tech to investigate potential funding sources for emergency spillway project.
10	**Discussion on Potential Mitigation Projects** – The committee discussed the list of potential mitigation projects that have been identified to date.	TT to add list of potential mitigation projects to the draft Town mitigation strategy.
11	**Goals and Objectives** – TT explained the purpose of mitigation planning goals and objectives and reviewed the goals and objectives worksheet developed for the East Fishkill plan. Planner indicated that there is a list of Goals and Objectives in the Town's Open Space Plan and Comprehensive Plan.	TT to review goals and objectives in available Town plans (Open Space and Comprehensive) as well as rationale for the development of wetlands and steep slopes ordinances, and develop a draft set of goals and objectives for review by the planning committee.

Town of East Fishkill, New York
ALL HAZARDS MITIGATION PLAN

Planning Committee Meeting - Agenda
Friday, December 14, 2012
Municipal Building, 330 Route 376, Hopewell Junction, NY

Review of Draft Goals and Objectives

Review Draft Mitigation Strategy

Upcoming Project Grant Funding Opportunities, incl. Hurricane Sandy HMGP

Identifying Known and Anticipated New Development

Plan Maintenance and Update Procedures

Stakeholder Outreach

- Stakeholder Surveys – Review, Distribution
  - School Districts and Higher Education
  - Hospitals and Health Care
  - Business and Commerce
  - Utilities
- Outreach to neighboring communities and the county
- Documenting outreach to date

Public Outreach

- Updated Hazard Mitigation Webpage
- Public Hazard Preparedness and Mitigation Survey
- How to drive public to the website?
- Public Presentation of Draft Plan

EAST FISHKILL ALL HAZARDS MITIGATION PLAN
PLANNING COMMITTEE MEETING
MEETING DATE: December 14, 2012

Name	Title / Agency	E-mail
Jonathan Raser	Tetra Tech	
Ken Beyer	Bldg & Zoning Adm	
W. Corey Ehrhart	East Fishkill Police Dept. / Sergeant	WEHRHART@eastfishkillpoliceny.org.
Rick Witt	EF Engg Dept	
Michelle Robbins	AKRF, Inc.	mrobbins@akrf.com
John Hickman	Town Supervisor	
Dennis Miller	Highway Supt	
Walter Artus	SUMP Coordinator	W.ARTUS@VERIZON.NET
Scott Bryant	Town Engineer	BRYANTS@EASTFISHKILLNY.ORG

Town of East Fishkill Hazard Mitigation Plan
Minutes of Meeting

Purpose of Meeting:	Planning Committee Meeting
Location of Meeting:	Town of East Fishkill Town Board Room Hopewell Junction, New York
Date of Meeting:	December 14, 2012

Attendees:

John Hickman – Town Supervisor
W. Corey Ehrhart- East Fishkill PD
Michelle Robbins – Planner (AKRF, Inc.)
Dennis Miller – Highway Superintendent
Walter Artus – SWMP Coordinator
Rick Witt – Assistant Engineer
Ken Beyer – Building/Zoning Administrator
Scott Bryant – Town Engineer
Jonathan Raser -Tetra Tech

Agenda Summary: This meeting was convened to discuss status and progress on the Town of East Fishkill Hazard Mitigation Planning Process, and conduct work on the plan in the areas of review of draft plan sections, review and approval of planning goals and objectives, review and discussion of mitigation projects identified to date and the draft plan maintenance strategy, and review of and forward actions on the public and stakeholder outreach activity.

Item No.	Description	Action By:
1	Review of Draft Goals and Objectives – the committee reviewed the draft goals and objectives developed for the plan based on input from the planning committee and a review of goals and objectives identified in other local planning mechanisms and documents	Draft Goals and Objectives approved by planning committee
2	Review Draft Mitigation Strategy – the committee reviewed, updated and amended the draft mitigation strategy developed throughout the course of the planning process	Draft Mitigation Strategy review and amendment completed by the planning committee. TT to provide model Cumulative Substantial Damge Ordinance and other related information to Town for review. TT to provide any elevation certificate information obtained during the public Notice of Voluntary Interest and follow-up information survey process. TT to investigate possible funding sources for Lake Sekunna dam.
3	Upcoming Project Grand Funding Opportunities, including Huricane Sandy HMPG	Town is prepared to develop Letters of Intent (LOIs) for the high-priority projects identified in the plan, to be submitted to State once Sandy HMGP is announced.

4	Identifying Known and Anticipated New Development	Town to identify known and anticipated new development and provide to TT (complete provided table).
5	Plan Maintenance and Update Procedures	TT to provide Town with suggested plan maintenance and update procedures, for review and amendment by Town prior to next planning committee meeting.
6	Stakeholder Outreach- Stakeholder Surveys: School Districts and Higher Education, hospitals and health care, business and commerce, utilities, neighboring communities.	TT to provide relevant stakeholder surveys that will be distributed by Town.
7	Public Outreach: Updating Hazard Mitigatigation webpage, public hazard preparedness and Mitigation Survey, and public presentation of the Draft Plan.	Town to better promote public awareness of the planning process (mitigation page) and citizen survey. Town to post links to survey on the homepage. Town will post draft sections of the complete plan once available, then promote public review. Once draft is online, TTwill present at a Town Board Working Meeting.

Town of East Fishkill, New York
ALL HAZARDS MITIGATION PLAN

Planning Committee Meeting - Agenda
Tuesday, May 7, 20132
Municipal Building, 330 Route 376, Hopewell Junction, NY

Review of Updated Planning Process (Section 3)

Review of Updated Mitigation Strategy (Section 6)

Review of Plan Maintenance and Update Procedures (Section 7)

Final Public and Stakeholder Outreach

- Updated Hazard Mitigation Webpage - How to drive public to the website?
- Public Presentation of Draft Plan
    - Special invite to RL/SRL property owners and those who submitted Notices of Voluntary Interest
    - Special invite to neighboring communities and the county?
- Stakeholder Surveys – Review, Distribution
    - School Districts and Higher Education (spec. Wappingers CSD)
    - Business and Commerce (Fishkill Business Association?)
    - Utilities

Upcoming Project Grant Funding Opportunities, incl. Hurricane Sandy HMGP

EAST FISHKILL ALL HAZARDS MITIGATION PLAN
PLANNING COMMITTEE MEETING
MEETING DATE: May 7, 2013

Name	Title / Agency	E-mail
Dennis Miller	Highway Supt	
WALTER ARTUS	SWMP COORDINATOR	W.ARTUS@VERIZON.NET
RICK WITT	ENG. DEPT.	
KEN BEYER	BLDG & ZONING ADM.	beyerk@eastfishkillny.org
John Hickman	Town Supervisor	hickmanj@eastfishkillny.org
Michelle Robbins	Planner	mrobbins@akrf.com
Scott Bryant	Town Engineer	BRYANTS@EASTFISHKILLNY.ORG
Bill McClellan	SMO	McClellanB@EastFishkillNY.org
JONATHAN RASER	Tetra Tech	JONATHAN.RASER@TETRATECH.COM

Town of East Fishkill Hazard Mitigation Plan
Minutes of Meeting

Purpose of Meeting:	Planning Committee Meeting
Location of Meeting:	Town of East Fishkill Town Board Room Hopewell Junction, New York
Date of Meeting:	May 7, 2013

Attendees:

- John Hickman – Town Supervisor
- Bill McClellan - Stormwater M'gt. Officer
- Michelle Robbins – Planner (AKRF, Inc.)
- Dennis Miller – Highway Superintendent
- Walter Artus – SWMP Coordinator
- Rick Witt – Assistant Engineer
- Ken Beyer – Building/Zoning Administrator
- Scott Bryant – Town Engineer
- Jonathan Raser -Tetra Tech

Agenda Summary: This meeting was convened to conduct a final review of draft plan sections, discuss and incorporate input as a result of the ongoing public review period of the draft plan, and review and finalize the mitigation strategy and the plan maintenance.

Item No.	Description	Action By:
1	Review of draft plan sections (general) – The Town noted several edits to the inventory of schools in the Town Profile (Section 4), particularly with respect to parochial schools.	TT to update inventory of schools in Section 4.
2	Stakeholder Outreach- Stakeholder Surveys: Additional outreach to commercial and industrial interests in the Town was discussed. Mitigation survey was sent to the Rotary, and could be sent to IBM/Hudson Valley Research Park which is the largest employer in the Town. The Town is awaiting a completed mitigation survey from the Wappingers Central School District.	Town to send the commercial/industrial mitigation survey to IBM/Hudson Valley Research Park. Town to forward the mitigation survey from the Wappingers Central School District once received. TT to identify this additional outreach in the plan (Section 3).
3	Stakeholder Outreach (general) – The Town indicated that the planning project has been routinely discussed at regular meetings of the planning board and the Conservation Advisory Council. Further, the project was discussed at a recent meeting of the planning board where Hudsonia presented.	TT to identify this additional outreach in the plan (Section 3).
4	Review of Updated Mitigation Strategy (Section 6) – Capability Assessment: Discussed updates of descriptions of various town departments committees.	Town to provide short summaries of department/committee responsibilities as they relate to hazard mitigation.

5	Review of Updated Mitigation Strategy (Section 6) – Capability Assessment: Town identified several additions and amendments to the draft mitigation strategy, specifically: • Town to become a "Smart Climate Community" • Amend private/public bridge initiatives • Ensure that the following dams, both within East Fishkill and outside of the Town that would impact East Fishkill, are included in the profiles and mitigation strategy, including: o Lake Walton and Mill Pond (NYSDEC owned) o Sharp Reservation Dam (in Fishkill) o Hope's Terrace o Emmadine Pond • Develop and maintain mapping of all floodprone areas in the Town to support land-use decision making	TT to update mitigation strategy and hazard profiles accordingly.
6	Plan Maintenance and Update Procedures - Committee noted that several names have changed for the current/ongoing Planning Committee. Committee discussed and acknowledged specific procedures for an annual plan review process.	TT to update the ongoing Planning Committee membership in Section 7 accordingly.
7	Public Outreach: Committee discussed posting the final draft plan for public review (current draft has already been posted).	Town to continue to update the mitigation website as draft sections are updated.

This Appendix provides documentation of public and stakeholder outreach conducted during the development of the Town of East Fishkill Hazard Mitigation Plan, and includes:

- Screenshots of the Public Hazard Mitigation Website
- Agenda, Sign-In Sheet, Homeowner Notice of Voluntary Interest Form, and PowerPoint Presentation for April 2012 public meeting
- Property Information Survey for Flood Vulnerable Residents, and Cover Letter for same
- Public Preparedness and Mitigation Survey (Survey Monkey) and summary of responses
- Stakeholder Surveys and responses

Public and stakeholder involvement in this planning process has been broad and productive as discussed in Section 3 (Planning Process). This input has been incorporated throughout this Plan document as identified in the references, as well as within specific mitigation initiatives identified in Section 6.

The Town continues to work with those residents who have expressed interest in mitigating their properties, including those who completed the Homeowner Notice of Voluntary Interest Form, and will be assisting eligible property owners with submitting LOIs under the Sandy HMGP and subsequent grant opportunities.

Search this site: Search

East Fishkill Summer Camp late registration is Monday, June 24th 9am - 2pm at the Recreation Park.

read more

East Fishkill Hazard Mitigation Plan

East Fishkill Hazard Mitigation Plan

East Fishkill Hazard Mitigation Plan - Background

East Fishkill residents are well aware of their vulnerability to natural hazards such as flooding, severe storms and severe winter storms. Hazard mitigation planning is a step toward addressing these hazards by reducing their impacts to our residents, business and public property. Residents and businesses benefit from comprehensive hazard mitigation planning by using a sustained, pro-active approach to reduce or eliminate long term risk to people and property from hazards. By utilizing mitigation planning, communities assess risks and identify actions to reduce their vulnerability and increase sustainability.

A Hazard Mitigation Plan (HMP) is a living document that communities use to reduce their vulnerability to hazards. HMPs form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction and repeated damage. They create a framework for risk-based decision making to reduce damages to lives, property and the economy from future disasters.

Further, communities must have an approved HMP to apply for and receive Federal Mitigation Grant Funding (http://www.fema.gov/government/grant/hma/index.shtm). Grant funding is available for projects to mitigate risk to both public and private property. For example, projects such as structural elevation, stormwater management improvements and local flood mitigation projects are eligible for funding. Ultimately, these action reduce vulnerability, and communities are able to recover more quickly from disasters.

The Town of East Fishkill was recently awarded a grant from FEMA to prepare an HMP for the Town. Through a FEMA Mitigation Planning Grant, the Town has established a Hazard Mitigation Planning Committee to support the development of the Town's HMP.

Public Presentation

The public attended a presentation at the April 12, 2012 Town Board Workshop at the East Fishkill Town Hall. The planning consultant hired by the Town for this project explained the purpose, process and benefits of mitigation planning, and explained how the public can continue to participate in this effort. Vulnerable property owners learned about funding that may be available to help mitigate their property.

Here are the links to the Presentation Slides (http://eastfishkillny.org/sites/default/files/East Fishkill - Town Board Public Workshop Presentation - 041212_0.pdf) from the workshop and a Homeowner "Notice of Voluntary Interest" Form (http://eastfishkillny.org/sites/default/files/Town of East Fishkill - Notice of Voluntary Interest - 041212_0.pdf) that was handed out.

What is Hazard Mitigation?

Hazard Mitigation is any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and/or man-made). (http://www.fema.gov/plan/mitplanning/ (http://www.fema.gov/plan/mitplanning/))

It is often considered the first of the four phases of emergency management: mitigation, preparedness, response and recovery.

Mitigation measures fall into the following six general catagories, and address both public and private property:

Prevention: Measures such as planning and zoning, open space preservation, development regulations, building codes, stormwater management, fire fuel reduction, soil erosion and sediment control.

Property Protection: Measures such as acquisition relocation, storm shutters, rebuilding, barriers, flood-proofing, insurance and structural retrofits for high winds and earthquake hazards.

Public Education and Awareness: Measures such as outreach projects, real estate disclosure, hazard information centers, technical assistance and school age and adult education programs.

Natural Resource Protection: Measures such as erosion and sediment control, stream corridor protection, vegetative management and wetlands preservation.

Emergency Services: Measures such as hazard threat recognition, hazard warning systems, emergency response, protection of critical facilities and health and safety maintenance.

Structural Projects: Measures such as dam, levees, seawalls, bulkheads revetments, high flow diversions, spillways, buttresses, debris basins, retaining walls, channel modifications, storm sewers, retrofitted buildings and elevation roadways (seismic protection).

2012 East Fishkill Hazard Mitigation Plan - DRAFT

Draft sections (PDF files) of the 2012 East Fishkill Hazard Mitigation Plan may be downloaded at the bottom of this page as they become available. Please note that these sections are considered "works in progress", and may be edited and updated at any time. We welcome and encourage your input be forwarded to the project contacts.

How can I get involved?

Take the online Citizen Hazard Preparedness Survey (http://www.surveymonkey.com/s/P8FSYT6) **.**

Attend public outreach activities that will be announced on the Town's homepage, or through other local media. The project was originally presented to the public at the April 12, 2012 Town Board Work Session. Download the April 12, 2012 PowerPoint presentation here (http://eastfishkillny.org/sites/default/files/East Fishkill - Town Board Public Workshop Presentation - 041212_0.pdf) .

Review the 2012 East Fishkill Hazard Mitigation Plan - DRAFT (*links are at the bottom of this page*) and provide input.

Reach out to the Project Contacts if you are interested in learning more about how you can mitigate your residential, commercial or public property.

Project Contacts

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Town of East Fishkill Supervisor's Office

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e-Mail: grippog@eastfishkillny.org (mailto:grippo@eastfishkillny.org)

Mr. Rick Witt

Town of East Fishkill Engineering Department

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Mr. Jonathan Raser

Hazard Mitigation Planning Contractor

Tetra Tech EM, Inc.

1000 The American Road, Morris Plains, NJ 07950

Phone: (973) 630-8042

e-Mail: jonathan.raser@tetratech.com (mailto:jonathan.raser@tetratech.com)

Resources and Links

Agencies / Organizations

Fishkill Creek Watershed Association (http://www.fishkillcreekwatershed.org/)

Dutchess County Department of Emergency Services (http://www.co.dutchess.ny.us/CountyGov/EmergencyServicesIndex.htm)

New York State Office of Emergency Management (SOEM) - Mitigation Section (http://www.dhses.ny.gov/oem/mitigation/)

New York State Department of Environmental Conservation (http://www.dec.ny.gov/)

Federal Emergency Management Agency (FEMA) - Home Page (http://www.fema.gov)

FEMA Hazard Mitigation (http://www.fema.gov/mitigation)

FEMA - Region II (http://www.fema.gov/region-ii)

Mitigation Planning

FEMA Hazard Mitigation Planning Page (http://www.fema.gov/plan/mitplanning/)

FEMA Mitigation Planning Guidance Documents (http://www.fema.gov/plan/mitplanning/guidance.shtm)

Flood Insurance and Grant Programs

National Flood Insurance Program (http://www.fema.gov/business/nfip/index.shtm)

FEMA Mitigation Grant Programs (http://www.fema.gov/government/grant/hma/index.shtm)

Hazard Information

Dutchess County All Hazards Information (http://www.co.dutchess.ny.us/Community/15510.htm)

FEMA Hazard Support (http://www.fema.gov/hazard/index.shtm)

National Weather Service (http://www.nws.noaa.gov/)

National Weather Service Forecast Office - Albany, NY (http://www.erh.noaa.gov/er/aly/)

Hazard Mitigation Plan Sections:

Attachment	Size
Section 1 - Introduction (http://eastfishkillny.org/sites/default/files/Section 1 - Introduction - 050113.pdf)	21.47 KB
Section 2 - Plan Adoption (http://eastfishkillny.org/sites/default/files/Section 2 - Plan Adoption - 041913.pdf)	19.95 KB
Section 3 - Planning Process (http://eastfishkillny.org/sites/default/files/Section 3 - Planning Process - 050113.pdf)	257.98 KB
Section 4 - Town Profile (http://eastfishkillny.org/sites/default/files/Section 4 - DRAFT Town Profile - 110612.pdf)	1.15 MB
Section 5 - Risk Assessment Introduction (http://eastfishkillny.org/sites/default/files/Section 5 - Risk Assessment Introduction - 083112.pdf)	17.96 KB

Attachment	Size
Section 5.1 - Risk Assessment Methodology and Tools (http://eastfishkillny.org/sites/default/files/Section 5.1 - Risk Assessment Methodology and Tools - 101812.pdf)	36.65 KB
Section 5.2 - Hazards of Concern Identification (http://eastfishkillny.org/sites/default/files/Section 5.2 - DRAFT Hazards of Concern - 111212.pdf)	103.32 KB
Section 5.3 - Hazard Ranking (http://eastfishkillny.org/sites/default/files/Section 5.3 - DRAFT Hazard Ranking - 101912.pdf)	57.59 KB
Section 5.4.1 - Dam Failure Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.1 - DRAFT Dam Failure Profile - 110912.pdf)	407.2 KB
Section 5.4.2 - Earthquake Hazard Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.2 - DRAFT Earthquake Hazard Profile - 110912.pdf)	4.57 MB
Section 5.4.3 - Extreme Temperatures Hazard Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.3 - DRAFT Extreme Temperatures Hazard Profile - 110912.pdf)	443.3 KB
Section 5.4.4 - Flood Hazard Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.4 - DRAFT Flood Hazard Profile - 110512.pdf)	1.64 MB
Section 5.4.5 - Severe Storm Hazard Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.5 - DRAFT Severe Storm Hazard Profile - 110512.pdf)	2.26 MB
Section 5.4.6 - Severe Winter Storm Hazard Profile (http://eastfishkillny.org/sites/default/files/Section 5.4.6 - DRAFT Severe Winter Storm Hazard Profile - 110612.pdf)	669.48 KB
Section 6 - Mitigation Strategy (http://eastfishkillny.org/sites/default/files/Section 6 - DRAFT Mitigation Strategy - 050113.pdf)	256.14 KB
Section 7 - Plan Maintenance (http://eastfishkillny.org/sites/default/files/Section 7 - Plan Maintenance 050113.pdf)	55.84 KB

TOWN BOARD
WORK SESSION
APRIL 12TH, 2012 @ 7:00 PM

PLEDGE OF ALLEGIANCE

SUPERVISOR'S ANNOUNCEMENTS

Presentation:

Hazardous Mitigation Presented by Tetra Tech

Discuss:

REPORTS FROM TOWN BOARD MEMBERS

Next Town Board Meeting: April, 26th, 2012
Next Work Session: May 10th, 2012

All Agendas are posted on the web www.eastfishkillny.org

EAST FISHKILL ALL HAZARDS MITIGATION PLAN
TOWN BOARD WORKSHOP – PUBLIC HEARING ON PROJECT
MEETING DATE: April 12, 2012

Name	Address (optional)	E-mail (optional)
Eileen Korzeniecki	11 Warren Drive, Hopewell Jct.	EKorz845-@yahoo.com
Geo + MaryAnne SpieLvogel	35 Pullbridge Drive, "	GSpielvo@cablevision.com
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JANET & Robert Criollo	2784 Rt 52 Hopewell Jct	Dakota4553@AOL.com
McMurl	Carol DR H J.	
Pat + Donna Frawley	18 Warren DR. Hopewell Jct	frawlsco@optonline.net
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John Timberlake	7 WARREN DR HOPEWELL JCT	
Rebecca Parr	12 Warren Dr. Hopewell Jct.	becca_7177@yahoo.com
Carmine Derrico	11 Creek Bend RD Hopewell Jct	Chefderrico@hotmail.com
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EAST FISHKILL ALL HAZARDS MITIGATION PLAN
TOWN BOARD WORKSHOP – PUBLIC HEARING ON PROJECT
MEETING DATE: April 12, 2012

Name	Address (optional)	E-mail (optional)
BILL DUFFY	38 CREEKSIDE RD HOPEWELL	
PETER BERASI	9 ALPINE DR.	BERASI@FRONTIERNET.NET
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DAVID REBL	40 Warren Dr	
Joe Neils	43 Warren Drive	JJN0411@AOL.COM
Lee Baker	Nh P. W	
Diane & Keith Coultas	215 Oak Ridge Rd., Hopewell Jct	dcoulti@optonline.net
Stephen Stephanie Vitolano	7 CREEK BEND RD HOPEWELL JCT	SJVITOLANO@HOTMAIL.COM
Rick + Toni Scalia	47 Circle Dr. Hope Jct	RNT523@optonline.net
Keith DiMaso	202 S. Main Rd (Hillside Lake)	
Joe DeMaro	11 Bari's Ln.	
JOHN MAGNOTTA	36 EAST VACATION DR HILLSIDE LAKE	
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EAST FISHKILL ALL HAZARDS MITIGATION PLAN
TOWN BOARD WORKSHOP – PUBLIC HEARING ON PROJECT
MEETING DATE: April 12, 2012

Name	Address (optional)	E-mail (optional)
Stephen Haysradt	43 Harrigan Rd	Haysradt@Aol.Com
Constance Haysradt	"	"
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D. Minall	N. Hillside Rd	
Ed Crocco	18 Lenart Place	CrcEric@Aol.com
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DAVID QUAGLIO	100 OLD STATE ROAD	DAVIDQ@LUMINATECOM.com
KEVIN DRURY	14 MEADOW WAY 12533	

Town of East Fishkill
Supervisor's Office
330 Route 376 Phone: (845) 221-4303
Hopewell Junction, NY 12533

Town of East Fishkill
Floodprone Property Acquisition and Elevation Projects
Homeowner Interest Sign-up Sheet and Voluntary Notice

Please complete this form if you are interested in exploring further your options for reducing your flood losses. Signing this does not commit you to any action.

Property Address: ____

Owner(s) Mailing Address: ______________________________________

Owner(s) Name(s): ____

Contact Phone Number: ____

Email Address: ____

I am interested in the following (check one): ________ Acquisition

________ Structural Elevation

________ Other (please specify)

The local government is required by FEMA to inform you that your participation in this project for open-space acquisition is *voluntary*. Neither the *State* nor the *Local Government* will use its eminent domain authority to acquire the property for open-space purposes if you choose not to participate, or if negotiations fail.

______________________ ______________
Owners Signature Date

______________________ ______________
Owners Signature Date

______________________ ______________
Owners Signature Date

Town of East Fishkill Hazard Mitigation Plan

Hazard Mitigation Plan -
Presentation to the East Fishkill Town Board and Public

April 12, 2012

Presented by Tetra Tech EM Inc.

Town of East Fishkill Hazard Mitigation Plan

What is Mitigation Planning?

Mitigation -

"Sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event"

-or –

"Any action taken to reduce future disaster losses"

Town of East Fishkill Hazard Mitigation Plan

FEMA (the "Feds" – that means us, the taxpayer) and States have found themselves cleaning up the same mess over and over

"Natural hazard events are an act of god…
…natural disasters are largely an act of man…"

Communities are not sustainable if they are vulnerable to crippling losses when the inevitable occurs

"Building in the floodplain is like pitching your tent on the highway when no cars are coming"

Mitigation is how we break the cycle of loss – it is a wise investment in the future of our communities

$ 1 spent on mitigation ~ $3-7 in avoided losses

Town of East Fishkill Hazard Mitigation Plan

Why are we Preparing these Plans?

- To reduce our losses from natural and non-natural hazards
- To make our communities more "disaster resistant"
- To maintain our eligibility for federal funds for pre-disaster mitigation planning
  - Hazard Mitigation Grant Program (HMGP)
  - Hazard Mitigation Assistance (HMA) Grant Program
    - Pre-Disaster Mitigation (PDM) Program
    - Flood Mitigation Assistance (FMA) Program
    - Repetitive Flood Claims (RFC) Program
    - Severe Repetitive Loss (SRL) Program

A *Local Mitigation Plan* demonstrates the jurisdiction's commitment to reducing risks from natural hazards and serves as a guide for decision makers as they commit resources to minimize the effects of natural hazards.

Town of East Fishkill Hazard Mitigation Plan

What does the All-Hazards Plan provide?

- A comprehensive, factual assessment of risk to support why proposed mitigation strategies are appropriate
- A detailed action plan the jurisdiction will implement to reduce risk to natural hazards

"provides the blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and local ability…" (CFR).

- Access to Federal Mitigation funding
- Support of other programs and initiatives (e.g. MS4, open space)
- Coordination of mitigation efforts with other local, county, regional, state and federal entities

Town of East Fishkill Hazard Mitigation Plan

What this All-Hazards Plan does NOT Provide

- Means to obtain compensation for past or future losses (insurance payments, and public and private assistance after a declared disaster, are not dependent on this HMP)
- Access to other than Stafford funding sources for eligible pre-disaster mitigation activities
- Immediate or guaranteed funding for eligible projects
  - Each municipality must submit applications for their projects when grant funding is available
  - Programs are regionally or nationally competitive

Town of East Fishkill Hazard Mitigation Plan

Planning Process

Town of East Fishkill Hazard Mitigation Plan

Assess the Risk

- Identify the Hazards of Concern
- Profile the Hazards of Concern
  - Where do they occur? Location
  - How often? Frequency
  - How bad can they get? Magnitude
  - Historic Events and Losses
- Identify what is at risk (inventory)
- Conduct a Risk Assessment
  - Exposure (location with respect to hazard area)
  - Vulnerability (estimated losses)

Town of East Fishkill Hazard Mitigation Plan

Hazards of Concern

- Hazards of Concern - Those hazards that pose significant risk to the Planning Area – and we can address through mitigation rather than only through preparedness, response and recovery
- Our effort should be proportional to the risk the hazards pose
- DMA 2000 only requires us to natural hazards, however man-made and technological hazards may be addressed as well.

Preliminary Hazards of Concern

- Flooding
- Severe Storms (incl. high winds, tornado, lightning, hail)
- Severe Winter Storms (incl. blizzards and ice storms)
- Extreme Temperatures
- Dam Failure
- Utility Failure (incl. as an impact of other hazards – e.g. high winds, ice storm)

Town of East Fishkill Hazard Mitigation Plan

Assess the Risk – Hazard Profiling

- Hazards are profiled (characterized) according to:
  - Designated and Known Hazard Areas
  - Background and local conditions
  - Historic frequency and probability of occurrence

Assess the Risk - Inventory of Assets

What is at risk? People, Property, Economy, Environment

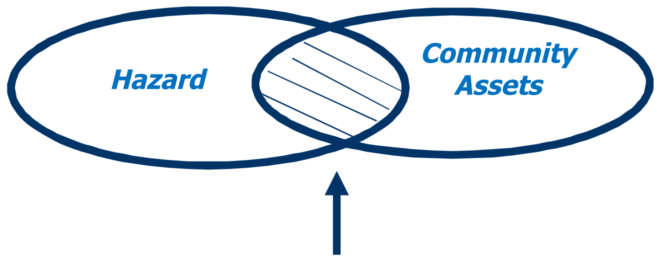
Critical Facilities (essential facilities, utilities, transportation features, high-potential loss facilities and user-defined facilities)

- Police, Fire, Emergency Services
- Hospitals and Medical Care Facilities
- Academic Facilities
- Sheltering Facilities
- Infrastructure (Transportation Systems, Utilities)
- High-Potential Loss Facilities (Dams, Hazardous Materials)

Town of East Fishkill Hazard Mitigation Plan

Assess the Risk – Vulnerability Assessment

What do we predict our suffering to be if we do nothing further to mitigate our risk?



Exposure / Vulnerability

Often expressed based on the return interval of events – e.g. 100-year Flood (1% Chance Flood)

Town of East Fishkill Hazard Mitigation Plan

Identification and Analysis of Mitigation Actions

- Mitigation strategies need to be realistic, achievable and action-oriented.
- Will address both public and private property.
- For each proposed mitigation strategy, the following will be identified:
  - Estimated Cost
  - Mitigation Benefits (i.e. losses and costs avoided)
  - Potential funding sources
  - Lead agency or department
  - Supporting agencies
  - Implementation timeline
  - Priority (what do we do first, next…)

Town of East Fishkill Hazard Mitigation Plan

Mitigation Actions? Like What?

- ***Prevention.*** Measures such as planning and zoning, open space preservation, land development regulations, building codes, storm water management.
- ***Property Protection***. Measures such as acquisition, relocation, storm shutters, rebuilding, barriers, floodproofing, insurance, and structural retrofits for high winds.
- ***Public Education and Awareness***. Measures such as outreach projects, real estate disclosure, hazard information centers, technical assistance.
- ***Natural Resource Protection***. Measures such as erosion and sediment control, stream corridor protection, vegetative management, and wetlands preservation.
- ***Emergency Services***. Measures such as hazard threat recognition, hazard warning systems, emergency response, protection of critical facilities, and health and safety maintenance.
- ***Structural Projects***. Measures such as dams, levees, seawalls, bulkheads, retaining walls, channel modifications, storm sewers, and retrofitted buildings and elevated roadways.

Town of East Fishkill Hazard Mitigation Plan

Acquisitions and Elevations

Acquisition –
eliminates exposure

Elevation -
reduces vulnerability

"At the first sign of a flood, you just push this little button."

Town of East Fishkill Hazard Mitigation Plan

Public Education and Awareness

- Hazard Insurance and the NFIP
- Elevations and Acquisitions
- Backup Utilities
- Preservation of Valuables
- Structural Retrofits (site grading, wet and dry flood-proofing, roof clips, non-combustible roofs)
- Evacuation or In-Place Sheltering Plans
- Defensible Space (Wildfire)
- Early-Warning and Alerts
- Communications

Town of East Fishkill Hazard Mitigation Plan

Integration with Other Plans and Programs

The Hazard Mitigation Plan should complement and support other Plans and Regulatory Mechanisms

- Comprehensive Emergency Management Plans (CEMP)
- Comprehensive / Master Plans (regional and local) – these plans guide and direct land use and development
- Stormwater Management Plans (flood problem areas and potential solutions identified)
- Capital Improvement Plans (some of these projects are grant eligible)
- Higher Regulatory Standards (e.g. increased free-board, cumulative substantial damages)

Town of East Fishkill Hazard Mitigation Plan

Plan Implementation

- Your mitigation strategy section provides a "blueprint" to follow for progressively reducing your community's natural hazard risk.
- It will includes two type of initiatives/projects – those that your community can "self fund", and those that will require outside (e.g. grant) funding.
- Mitigation grant opportunities open regularly:
  - The annual HMA grant window opens in June of each year.
  - HMGP funding comes in the wake of Declared Disasters in the State.
- County Hazard Mitigation Coordinators will continue to alert planning partners of grant opportunities as they arise, including all guidance and instructions provided by PEMA and FEMA.

Town of East Fishkill Hazard Mitigation Plan

Mitigation Grant Programs – General

- Can fund projects on both public and private property
- Generally require a 25% non-Federal "local match"
- The State is the "applicant" to FEMA, while the local government is the "sub-applicant"…private property owners may not apply on their own
- Private property mitigation projects generally include –
  - Flood-proofing and retrofits
  - Structural Elevations
  - Acquisitions
- Acquisitions the preferred option in the case of the most flood vulnerable properties as it completely eliminates flood risk for that structure.
- Elevation and flood-proofing reduces vulnerability but not exposure…there is always some level of flood severity after which damage will occur.
- Public projects (e.g. stormwater management, drainage improvements) may be the preferred alternative where property-specific projects are not feasible or cost-effective

Town of East Fishkill Hazard Mitigation Plan

Grant Award Requirements and Criteria

- Project must be identified in your HMP.
- Project must be an "eligible" activity under the specific grant programs.
- Project must meet State priorities if established (HMGP).
- Project must be "cost-effective", as either:
  - Documented through a formal Benefit-Cost Analysis.
  - Assumed based on certain criteria (e.g. "Substantially Damaged" and located in the NFIP SFHA).

Town of East Fishkill Hazard Mitigation Plan

Here's how it works…

Example: Consider a $200,000 storm water improvement project in your 5-year Capital Budget for FY13

	No Grant	With Grant
Base Project Cost:	$ 200,000	
Project cost with grant support:		$ 220,000
Less 75% FEMA reimbursement:		($ 165,000)
Net Project cost to Town:	$ 200,000	$ 55,000
Savings:	$ 145,000 (73%)	

…and this doesn't consider long term cost benefits

Town of East Fishkill Hazard Mitigation Plan

Current HMGP Opportunity

On December 22, 2011, NYSOEM announced a combined HMGP opportunity resulting from four declared disasters, starting with Irene and ending with the Oct. 29 severe winter storm and snowstorm.

The State has established the following priorities –

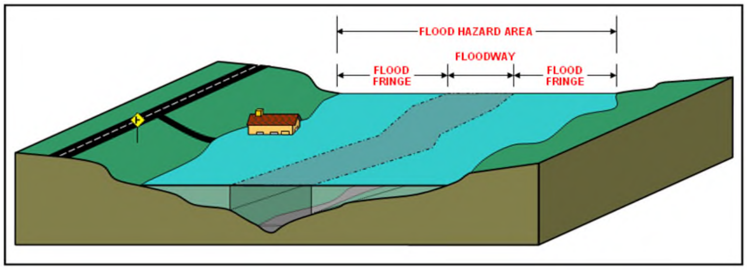
- Projects located in the counties most impacted by the four disasters, particularly focused on flooding
- Projects that realize permanent flood mitigation solutions (e.g. removing properties from a floodplain)
- Projects that significantly reduce a property's risk from flooding (e.g. structural elevation)

Town of East Fishkill Hazard Mitigation Plan

Current HMGP Opportunity – Project Funding

After Planning Grants, the State will use remaining HMGP funds for projects in the following three categories –

- Acquisition Projects that demolish (or relocate) **"substantially damaged"** properties from a 100-year floodplain (the NFIP Special Flood Hazard Area or "SFHA")
- Elevation Projects that raise properties in the 100-year floodplain
(note: the State will not fund elevations in the regulatory floodway)



- All other project types, if funds remain after acquisition and elevation requests are addressed.

Town of East Fishkill Hazard Mitigation Plan

Benefits of Mitigation Planning

Effective mitigation projects reduce your longterm costs to hazard events:

- Emergency and Protective Services (road closures, evacuations)
- Cleanup costs (roads, storm sewer, debris management)
- Costs to repair damaged infrastructure
- Increased maintenance costs (road resurfacing, lift stations)

Public Assistance defrays some of these costs, but:

- Only after a Declared Disaster
- Only to the extent that you document and apply for
- Only when and how much FEMA chooses to pay

Losses to residences and businesses damage ratables (SBA: 50% of small businesses which close because of natural disasters never reopen)

Town of East Fishkill Hazard Mitigation Plan

More Benefits – Community Rating System (CRS)

An Incentive Program under the National Flood Insurance Program (NFIP)

- By doing things ("activities") that go beyond the minimum requirements of the NFIP, policyholders benefit from premium discounts
- Discounts scale up to 45%
- Many of the crediting activities are things you are already doing
- This Plan will count towards CRS activity credit
- CRS participation can be a factor in securing project grant funding

NFIP Statistics in East Fishkill:

135 NFIP policies, insuring $32 million in property, with premiums of $110,000

We recommend a planning process designed to maximize CRS Credit

This is an opportunity to examine all aspects of East Fishkill's NFIP program, including evaluating the benefits vs. effort of joining CRS

Town of East Fishkill Hazard Mitigation Plan

More Benefits - MS4
Municipal Separate Storm Sewer Systems

- Projects that must be done to help meet your MS4 requirements may be grant eligible under the mitigation grant programs
- Conversely, mitigation projects may help provide MS4 benefits (reduce siltation, lower phosphorus loading)
- Some of the MS4 benefits can count towards the cost-effectiveness of projects as defined by the mitigation grant programs
- The Outreach and Education programs for MS4, NFIP, and Mitigation share many common elements, and are mutually supportive

Town of East Fishkill Hazard Mitigation Plan

Further Information:

Jonathan Raser, CFM
Tetra Tech, Inc.
1000 The American Road
Morris Plains, NJ 07950

Email: jonathan.raser@tetratech.com

Phone: (973) 630-8042
Fax: (973) 630-8304

TETRA TECH

Jonathan Raser
Hazard Mitigation Program Manager

August 17, 2012

Property Owner Interested in FEMA Mitigation
Town of East Fishkill
Hopewell Junction, NY 12533

Subject: Property Information Survey for Flood Vulnerable Residents

Dear East Fishkill Resident:

You are receiving this letter and survey form because you provided the Town and/or Tetra Tech with a "Homeowner Interest Sign-Up Sheet and Voluntary Notice" form indicating that you were interested in options that may be available to mitigate your flood vulnerable property (e.g. acquisition, elevation).

In order for us to start to evaluate your property for project cost-effectiveness, we will need certain information on your structure and flood loss history. Please complete the attached survey form to the best of your ability, and return in person, mail, fax or email by August 31, 2012 to either:

- Town of East Fishkill Supervisor's Office, 330 Route 376, Hopewell Junction, NY 12533

- Jonathan Raser, Tetra Tech, 1000 The American Road, Morris Plains, NJ 07950
  Fax: (973) 630-8042 Email: jonathan.raser@tetratech.com

If you have any questions, please feel free to contact me at (973) 630-8042. Thank you.

Sincerely,
Tetra Tech EM Inc.

Jonathan Raser
Hazard Mitigation Program Manager

Tetra Tech EM Inc.
1000 The American Way
Morris Plains, NJ 07950
Tel 973-630-8042
www.tetratech.com

Please complete this form as soon as possible and return to either:

Town of East Fishkill - Supervisors Office; 330 Route 376; Hopewell Junction, NY 12533

Jonathan Raser, Tetra Tech, 1000 The American Road, Morris Plains, NJ, 07950

Fax: (973) 630-8304 Email: jonathan.raser@tetratech.com Questions???: (973) 630-8042

Property and Contact Information

Property Owner Name: ______________________

Property Address (incl. municipality): ______________________

Phone: __________ Email: ______________________

What do you believe is the appraised or fair market value of your:

Structure: __________ Land: __________

Structure Information

Year Built:

Years and type of any major renovation, repair, elevation:

Foundation Type (check those that apply):

_____ Slab on Grade _____ Pier _____ Pile _____ Post

_____ Crawl Space _____ Basement _____ Walk-Out Basement

Building Type (check one):

_____ 1-story w/basement _____ 1-story w/o basement

_____ 2-story w/basement _____ 2-story w/o basement

_____ Split-level w/basement _____ Spilt Level w/o basement

National Flood Insurance Program (NFIP) Information:

Are you Located in an NFIP Special Flood Hazard Area (SFHA),
otherwise referred to as the "100-year Flood Zone" (Yes, No, Unsure)? __________

Do you carry NFIP Flood Insurance (Yes, No)? __________

Do you have an NFIP Elevation Certificate (EC) for your property (Yes, No, Unsure)? __________

Flood Damage Information:

For each time that your property has suffered significant flood damage, please provide (use additional sheets if necessary)

Date of Event: ______________________

Depth of water above what floor:

Types of Damage (foundation, floors, walls, framing, utilities, etc.):

Total costs of damages (repairs, contents replacement) that you can <u>document</u>:

FISHKILL CREEK
WATERSHED
ASSOCIATION
of Dutchess and Putnam Counties

June 3, 2013

Mr. Jonathan Raser
Tetra Tech
1000 The American Road
Morris Plains, New Jersey 07950

Re: Town of East Fishkill Hazard Mitigation Plan

Dear Mr. Raser:

Members of the Fishkill Creek Watershed Association (FCWA) have reviewed the Draft Hazard Mitigation Plan as posted on the Town of East Fishkill's web site.

The FCWA believes that maintenance of the Fishkill Creek, such as the removal of downed trees, branches and trash to improve the natural flow path of the Creek, resulting in a measure of alleviation of localized flooding in numerous locations, should be addressed in the Plan.

In addition, the Town must continue to require developers to address stormwater quality and quantity issues onsite, as is mandated by New York's Environmental Conservation Law and regulated by the New York State Department of Environmental Conservation, which assists in mitigating flooding, as well as help improve the general health of the Fishkill Creek and the Hudson River.

At this time the FCWA has no additional comments regarding the Plan, and fully supports its implementation.

Very truly yours,

FISHKILL CREEK WATERSHED ASSOCIATION

Rick Witt

President

cc: File

BEEKMAN GOLF LLC
Corporate Office
63 Washington Street
Poughkeepsie, NY 12602-0509

Direct Telephone: (845) 486-6880

RECEIVED
MAR - [illegible] [illegible]3

March 1, 2013

Town of East Fishkill
Building Department
330 Route 376
Hopewell Junction, NY 12533

RE: Our File No. 1395-0003

Dear Sir/Madam:

Enclosed find completed Town of East Fishkill Hazard Mitigation Plan Update Survey for Utilities.

Very truly yours,

BEEKMAN GOLF LLC

Phillip Shatz

PHILLIP SHATZ

PS/dmf
enc.

Town of East Fishkill Hazard Mitigation Plan Update
Survey for Utilities

Name: Phillip Shultz pres **Utility Name:** _**Beekman Water Co.**___________

Hazard Mitigation: *Any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and man-made). It is often considered the first of the four phases of emergency management: mitigation, preparedness, response, and recovery.*

Background

The Town of East Fishkill developing a Hazard Mitigation Plan (HMP) as required by the Federal Emergency Management Agency (FEMA) in order to become eligible for federal mitigation grant funding. The HMP must provide a "blueprint" by which local governments can make coordinated, cost-effective efforts towards reducing losses from natural hazards (flooding, severe weather, utility outages, etc.). More information about this planning process may be found at the East Fishkill Hazard Mitigation Plan website by going to:

http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan

Purpose

The following survey is designed to help identify general needs for mitigation within the Town of East Fishkill and the surrounding areas from your perspective, as well as to identify specific projects that may be included in the update to the mitigation plan.

Directions

Please review and answer the following questions regarding potential mitigation that affects businesses and commercial interests in the Town of East Fishkill and surrounds. Please check "Yes", "No" or "Unsure". **If you indicate "No", please tell us why.** Provide as much detail as possible to support your choice in the Comments box. Feel free to attach extra sheets if necessary. Where possible, identify specific areas (locations, facilities, programs, policies, etc.) that need to be improved, and your suggestions for possible improvements. **If there are other important issues that you feel are not covered by the survey questions, please let us know.**

Survey

1) Do you believe that your facilities and infrastructure are disaster-resistant (e.g. are properly located, constructed, and protected from damage from natural hazards)?

YES NO UNSURE

Comments:

2) Do you believe that your facilities and infrastructure have sufficient redundancy and/or are sufficiently networked to provide a minimal level of service to your customers (esp. critical and essential services such as police, fire, hospitals) in the event that you suffer damage/loss to your equipment?

YES NO UNSURE

Comments:

3) Do you think that local public education and awareness programs are effective at informing the public on what they should do to be prepared for and reduce their personal risk to natural disasters, so as to reduce their reliance on your services during hazard events?

YES NO UNSURE

Comments:

4) Do you think that announcements of utility outages and service restoration schedules are sufficiently accurate and available to support the needs of emergency management, as well as owners/operators of critical and essential facilities?

YES NO UNSURE

Comments:

5) Do you think that the public is aware of, understands, and takes advantage of emergency warning and notification systems and services (reverse 911, audible alerts, cell and text services, NYAlert)?

YES NO UNSURE

Comments:

6) Do you think that vegetation management programs (e.g. tree trimming and removal) are sufficient to manage the risk of utility outages during natural hazard events?

YES NO UNSURE

Comments:

7) Do you think that emergency response planning, services, and equipment are adequate to manage and respond properly to natural disasters in your community?

YES NO UNSURE

Comments:

8) Do you think that local government understands, supports, and possess the resources for natural hazard risk reduction efforts in the community?

YES NO UNSURE

Comments:

9) Is your agency covered by a COOP / COG plan? (Continuity of Operations / Continuity of Government plans examine an agency's ability to perform minimum essential functions during any situation. COOP activities support the continuance of agency *functions*, while COG activities support the continuance of agency *governance*.)

YES NO UNSURE

Comments: I dont Think This is relevant to our company

Town of East Fishkill Hazard Mitigation Plan Update:
Survey for School Districts and Higher Education

Name: Ronald Broas **School/District Name:** Wappingers Central School District

Hazard Mitigation: *Any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and man-made). It is often considered the first of the four phases of emergency management: mitigation, preparedness, response, and recovery.*

Background

The Town of East Fishkill developing a Hazard Mitigation Plan (HMP) as required by the Federal Emergency Management Agency (FEMA) in order to become eligible for federal mitigation grant funding. The HMP must provide a "blueprint" by which local governments can make coordinated, cost-effective efforts towards reducing losses from natural hazards (flooding, severe weather, utility outages, etc.). More information about this planning process may be found at the East Fishkill Hazard Mitigation Plan website by going to:

http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan.

Purpose

The following survey is designed to help identify general needs for mitigation within the Town of East Fishkill and the surrounding areas from your perspective, as well as to identify specific projects that may be included in the update to the mitigation plan.

Directions

Please review and answer the following questions regarding potential mitigation that affects businesses and commercial interests in the Town of East Fishkill and surrounds. Please check "Yes", "No" or "Unsure". **If you indicate "No", please tell us why.** Provide as much detail as possible to support your choice in the Comments box. Feel free to attach extra sheets if necessary. Where possible, identify specific areas (locations, facilities, programs, policies, etc.) that need to be improved, and your suggestions for possible improvements. **If there are other important issues that you feel are not covered by the survey questions, please let us know.**

Survey

1) Do you believe that your facilities and associated infrastructure are disaster-resistant (e.g. are properly located and constructed, and have back-up power as appropriate)?

YES ☐ NO ☒ UNSURE ☐

Comments: The District Buildings Have No Backup Power

2) Do you think that the transportation infrastructure serving your facilities (e.g. roads and bridges) are properly designed to withstand closures and/or damage due to natural hazards?

YES ☒ NO ☐ UNSURE ☐

Comments:

3) Do you think that the utility infrastructure (spec. electricity and communications) is sufficiently disaster-resistant to support school functions during and after natural hazard events?

YES ☒ NO ☐ UNSURE ☐

4) If your facilities are ARC-designated shelters, do you believe they are adequately designed and equipped to support sheltering during and after natural hazard events?

YES ☐ NO ☒ UNSURE ☐

Comments: NO BACK UP POWER

5) Do you think that weather forecasts and announcements of road closures and pending road closures are sufficiently accurate and available to support school operation and student transportation decisions in the event of natural hazard events?

YES ☒ NO ☐ UNSURE ☐

Comments:

6) Do you believe that emergency response planning, services, and equipment are adequate to manage and respond properly to natural disasters in your community?

YES ☒ NO ☐ UNSURE ☐

Comments:

7) Do you believe that local government understands, supports, and possess the resources for natural hazard risk reduction efforts in the community?

YES ☒ NO ☐ UNSURE ☐

Comments:

8) Is your agency covered by a COOP / COG plan? (Continuity of Operations / Continuity of Government plans examine an agency's ability to perform minimum essential functions during any situation. COOP activities support the continuance of agency *functions*, while COG activities support the continuance of agency *governance*.)

YES ☐ NO ☐ UNSURE ☒

Comments:

Thank you! Please return your completed survey to:

Mr. Rick Witt, Engineering Aide
Town of East Fishkill
330 Route 376
Hopewell Junction, NY 12533
Fax: 845-227-6725
wittr@eastfishkillny.org

Town of East Fishkill Hazard Mitigation Plan Update
Survey for Business/Commerce

Name: R. Newhard **Business Name:** IBM HVRP

Hazard Mitigation: *Any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and man-made). It is often considered the first of the four phases of emergency management: mitigation, preparedness, response, and recovery.*

Background

The Town of East Fishkill developing a Hazard Mitigation Plan (HMP) as required by the Federal Emergency Management Agency (FEMA) in order to become eligible for federal mitigation grant funding. The HMP must provide a "blueprint" by which local governments can make coordinated, cost-effective efforts towards reducing losses from natural hazards (flooding, severe weather, utility outages, etc.). More information about this planning process may be found at the East Fishkill Hazard Mitigation Plan website by going to:

http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan

Purpose

The following survey is designed to help identify general needs for mitigation within the Town of East Fishkill and the surrounding areas from your perspective, as well as to identify specific projects that may be included in the update to the mitigation plan.

Directions

Please review and answer the following questions regarding potential mitigation that affects businesses and commercial interests in the Town of East Fishkill and surrounds. Please check "Yes", "No" or "Unsure". **If you indicate "No", please tell us why.** Provide as much detail as possible to support your choice in the Comments box. Feel free to attach extra sheets if necessary. Where possible, identify specific areas (locations, facilities, programs, policies, etc.) that need to be improved, and your suggestions for possible improvements. **If there are other important issues that you feel are not covered by the survey questions, please let us know.**

Survey

1) Do you believe that your facilities are disaster-resistant (e.g. are properly located and constructed, and have back-up power as appropriate)?

YES NO UNSURE

Comments:

- Major buildings and infrastructure are out of flood areas.
- Critical systems have back-up emergency generators.
- Some #6 fuel oil storage that could be used to operate Central Utility Plant in the event of a natural gas interruption.
- The Ammonia Treatment Plant distillation system was built to building code requirements for earthquakes and wind loads.

2) Do you think that the transportation infrastructure (e.g. roads and bridges) is properly designed to withstand damage due to natural hazards, and thus provides longterm support for your business and commercial needs?

YES NO UNSURE

Comments:

Location of site at I-84 Lime Kiln Road Exit should provide continued access to the site.

3) Do you think that the utility infrastructure (spec. electricity and communications) are sufficiently disaster-resistant to support your business and commercial needs?

YES NO UNSURE

EFK's electrical infrastructure is designed & operated with a high level of redundancy to allow for a first contingency equipment or feeder failure while minimizing IBM's manufacturing impact. Throughout the site, building life-safety and critical processes are powered by UPS & emergency power systems. Critical communications for high priority systems are powered by UPS & emergency power systems.

4) Do you believe that natural hazard risks (e.g. flood zones) are considered when developing or expanding commercial or industrial areas?

YES NO UNSURE

Comments:

- No comment.

5) Do you believe that business organizations/associations, chambers of commerce, etc., are a valuable resource in helping business owners protect themselves pre-disaster, and /or recover post-disaster?

YES NO UNSURE

Comments:

- IBM would most likely rely on internal programs / resources more than local / community resources.

6) Do you believe that businesses are aware and take appropriate advantage of flood insurance and other resources to help them recover from disasters?

YES NO UNSURE

Comments:

- No comment.

7) Do you think that emergency response planning, services, and equipment are adequate to manage and respond properly to natural disasters that may impact your business or commercial interests?

YES NO UNSURE

Comments:

IBM maintains current emergency response plans which are reviewed and tested with trained personnel on an annual basis. Appropriate equipment is also maintained on IBM premises.

8) Do you think that local government understands, supports, and possess the resources for natural hazard risk reduction efforts in the community?

YES NO UNSURE

Comments:

- No comment.

Thank you! Please return your completed survey to:

Mr. Rick Witt, Engineering Aide
Town of East Fishkill
330 Route 376
Hopewell Junction, NY 12533
wittr@eastfishkillny.org

Town of East Fishkill Hazard Mitigation Plan Update
Survey for Business/Commerce

Name: ____________________ **Business Name:** _____________________________

Hazard Mitigation: *Any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and man-made). It is often considered the first of the four phases of emergency management: mitigation, preparedness, response, and recovery.*

Background

The Town of East Fishkill developing a Hazard Mitigation Plan (HMP) as required by the Federal Emergency Management Agency (FEMA) in order to become eligible for federal mitigation grant funding. The HMP must provide a "blueprint" by which local governments can make coordinated, cost-effective efforts towards reducing losses from natural hazards (flooding, severe weather, utility outages, etc.). More information about this planning process may be found at the East Fishkill Hazard Mitigation Plan website by going to:

http://eastfishkillny.org/content/east-fishkill-hazard-mitigation-plan

Purpose

The following survey is designed to help identify general needs for mitigation within the Town of East Fishkill and the surrounding areas from your perspective, as well as to identify specific projects that may be included in the update to the mitigation plan.

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Survey

1) Do you believe that your facilities are disaster-resistant (e.g. are properly located and constructed, and have back-up power as appropriate)?

YES NO UNSURE

Comments:

2) Do you think that the transportation infrastructure (e.g. roads and bridges) is properly designed to withstand damage due to natural hazards, and thus provides longterm support for your business and commercial needs?

YES NO UNSURE

Comments:

3) Do you think that the utility infrastructure (spec. electricity and communications) are sufficiently disaster-resistant to support your business and commercial needs?

YES NO UNSURE

4) Do you believe that natural hazard risks (e.g. flood zones) are considered when developing or expanding commercial or industrial areas?

YES NO UNSURE

Comments:

5) Do you believe that business organizations/associations, chambers of commerce, etc., are a valuable resource in helping business owners protect themselves pre-disaster, and /or recover post-disaster?

YES NO UNSURE

Comments:

6) Do you believe that businesses are aware and take appropriate advantage of flood insurance and other resources to help them recover from disasters?

YES NO UNSURE

Comments:

7) Do you think that emergency response planning, services, and equipment are adequate to manage and respond properly to natural disasters that may impact your business or commercial interests?

YES NO UNSURE

Comments:

8) Do you think that local government understands, supports, and possess the resources for natural hazard risk reduction efforts in the community?

YES NO UNSURE

Comments:

Thank you! Please return your completed survey to:

Mr. Rick Witt, Engineering Aide
Town of East Fishkill
330 Route 376
Hopewell Junction, NY 12533
wittr@eastfishkillny.org

Town of East Fishkill Hazard Mitigation Plan Update:
Survey for Hospitals and Health Care Facilities

Hazard Mitigation:	*Any action taken to reduce the loss of life and property by lessening the impact of disasters (natural, technological and man-made). It is often considered the first of the four phases of emergency management: mitigation, preparedness, response, and recovery.*

Background

The Town of East Fishkill developing a Hazard Mitigation Plan (HMP) as required by the Federal Emergency Management Agency (FEMA) in order to become eligible for federal mitigation grant funding. The HMP must provide a "blueprint" by which local governments can make coordinated, cost-effective efforts towards reducing losses from natural hazards (flooding, severe weather, utility outages, etc.). More information about this planning process may be found at the East Fishkill Hazard Mitigation Plan website by going to:

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Survey

1) Do you think that critical and essential facilities (incl. EMS facilities, hospitals and medical centers) are disaster-resistant (e.g. are properly located and constructed, and have back-up power as appropriate)?

YES NO UNSURE

Comments:

2) Do you think that the transportation infrastructure serving your facilities (e.g. roads and bridges) is properly designed to withstand damage due to natural hazards?

YES NO UNSURE

Comments:

3) Do you think that utility infrastructure (spec. electricity and communications) are sufficiently disaster-resistant to support hospital functions during natural hazard events?

YES NO UNSURE

4) Do you think that local public education and awareness programs are effective at informing the public on what they should do to be prepared for and reduce their personal risk to natural disasters, so as not to increase the need for hospitals during hazard events?

YES NO UNSURE

Comments:

5) Do you think that announcements of road closures and pending road closures are sufficiently accurate and available to support hospital functions during natural hazard events?

YES NO UNSURE

Comments:

6) Do you think that the public is aware of, understands, and takes advantage of emergency warning and notification systems and services (reverse 911, audible alerts, cell and text services)?

YES NO UNSURE

Comments:

7) Do you think that your hospital works to inform your constituents of how they can better manage their risk to natural hazards?

YES NO UNSURE

Comments:

8) Do you think that emergency response planning, services, and equipment are adequate to manage and respond properly to natural disasters in your community?

YES NO UNSURE

Comments:

9) Do you think that local government understands, supports, and possess the resources for natural hazard risk reduction efforts in the community?

YES NO UNSURE

Comments:

10) Is your agency covered by a COOP / COG plan? (Continuity of Operations / Continuity of Government plans examine an agency's ability to perform minimum essential functions during any situation. COOP activities support the continuance of agency *functions*, while COG activities support the continuance of agency *governance*.)

YES NO UNSURE

Comments:

1. Town of East Fishkill Hazard Mitigation - Citizen Survey

CITIZEN PREPAREDNESS QUESTIONNAIRE - A hazard mitigation team has recently been established to address natural hazards that may occur in the Town of East Fishkill. In order to identify and plan for future natural disasters, we need assistance from local residents. This questionnaire is designed to gauge the level of knowledge local citizens have about natural-disaster issues and potential areas of vulnerability in our community to any type of natural disaster. The information you provide will help coordinate activities to reduce the risk of injury or property damage in the future.

You will be asked if your home is located in a floodplain. If you do not know, or are not sure, please check the following sources:

National Flood Insurance Program (NFIP) Website: http://www.floodsmart.gov
The "One-Step Flood Risk Profile" provides a quick indication of your location with respect to delineated floodplains.

NFIP Flood Mapping is also available at the municipal building.

This survey consists of 22 questions and will take approximately 10-15 minutes to complete.

East Fishkill Survey

2. General Household Information

The following requested demographic information will aid the planning committee in determining the hazard mitigation needs of our various communities.

The answers provided in this section will be treated as CONFIDENTIAL and will be used solely for the preparation of this plan and will not be provided to any other group or interest.

1. Please indicate your age range:

- ◯ 18 to 30
- ◯ 31 to 40
- ◯ 41 to 50
- ◯ 51 to 60
- ◯ 60 or over

2. How long have you lived in East Fishkill?

- ◯ Less than 1 year
- ◯ 1 to 5 years
- ◯ 6 to 9 years
- ◯ 10 to 19 years
- ◯ 20 years or more

3. Do you own or rent your place of residence?

- ◯ Own
- ◯ Rent

4. What is your zip code?

____

5. What is your home address? (optional, will be kept confidential - only used to identify localized hazard areas such as flooding)

____

East Fishkill Survey

3. Natural Hazard Information

6. Please rank how prepared you feel you and your household are for the probable impacts of natural hazard events likely to occur within East Fishkill. Rank on a scale of 1 to 5, with 5 representing the most prepared.

- ○ 1 (least)
- ○ 2
- ○ 3
- ○ 4
- ○ 5 (Most)

7. In what ways do you believe you are prepared for the probable impacts from natural hazard events that may occur within East Fishkill? (Please check all that apply)

- ☐ I have taken precautionary measures to protect my property though retrofits or when constructed
- ☐ I have a preparedness kit consisting of basic supplies and materials for my family and myself
- ☐ I have identified the location of the nearest severe weather shelter
- ☐ I have a personal family emergency preparedness plan, and have discussed it with my family and others for whom I have responsibility
- ☐ I have at least two methods for receiving emergency notifications and for information during severe weather or other potential emergency situations
- ☐ Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)
- ☐ Locally provided news or other media information
- ☐ Schools and other academic institutions
- ☐ I have attended meetings that have dealt with disaster preparedness
- ☐ Other (please specify)

8. In the past 10 years, which of the following types of hazard events have you or someone in your household experienced or sustained damage as a result of within East Fishkill, and how concerned are you about the following natural hazards impacting the area? (In the first column indicate if you have experienced the hazard, then indicate your level of concern).

	Have Experienced	Not Concerned	Somewhat Concerned	Very Concerned	Extremely Concerned
Dam Failure	☐	☐	☐	☐	☐
Drought	☐	☐	☐	☐	☐
Earthquake	☐	☐	☐	☐	☐
Epidemic/Pandemic	☐	☐	☐	☐	☐
Extreme Temperatures	☐	☐	☐	☐	☐
Flooding - Property	☐	☐	☐	☐	☐
Flooding - Basement	☐	☐	☐	☐	☐
Flooding - 1st Floor	☐	☐	☐	☐	☐
Flooding - Above 1st Floor	☐	☐	☐	☐	☐
Flooding - Street	☐	☐	☐	☐	☐
Hail	☐	☐	☐	☐	☐
Hurricane\Tropical Storm	☐	☐	☐	☐	☐
Ice Storm	☐	☐	☐	☐	☐
Infestation	☐	☐	☐	☐	☐
Land Subsidence/Sinkholes	☐	☐	☐	☐	☐
Landslide	☐	☐	☐	☐	☐
Severe Storms	☐	☐	☐	☐	☐
Severe Winter Storms (Blizzard, Heavy Snow, Ice)	☐	☐	☐	☐	☐
Tornado	☐	☐	☐	☐	☐
Utility Failure	☐	☐	☐	☐	☐
Wildfire	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

9. Information on the impacts of and how to prepare for a natural disaster can be disseminated to the public in various ways. 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 hazard events.

- ☐ Newspaper - ___________
- ☐ Newspaper - ____________
- ☐ Newspaper - ___________
- ☐ County and/or Local Gov't. Websites
- ☐ Local Government E-Mail
- ☐ Police, Fire, EMS, 9-1-1
- ☐ Telephone Book
- ☐ Informational Brochures
- ☐ Public Meetings
- ☐ Workshops
- ☐ Schools
- ☐ TV News
- ☐ TV Advertising
- ☐ Radio News
- ☐ Radio Advertisements
- ☐ Outdoor Advertisements
- ☐ Internet
- ☐ Chamber of Commerce
- ☐ Fire Department/EMS Agency
- ☐ Academic Institutions
- ☐ Public Awareness Event
- ☐ Books
- ☐ Public Library
- ☐ Other (please specify)

10. To the best of your knowledge is your property located in a designated floodplain?

- ○ Yes
- ○ No
- ○ Not Sure

11. Do you have flood insurance?

- ○ Yes
- ○ No

12. If you do NOT have flood insurance, what is the primary reason?

- ○ I don't need it/my property has never flooded
- ○ Don't need it/located on high ground
- ○ It is too expensive
- ○ Not familiar with it/don't know about it
- ○ Insurance company will not provide
- ○ My homeowners insurance will cover me
- ○ It is not worth it

13. Do you or did you have problems getting homeowners/renters insurance due to risks from natural hazards?

- ○ Yes
- ○ No

14. If you answered "yes" to the previous question, please identify the natural hazard risk that caused you to have problems obtaining homeowners/renters insurance.

4. Natural Hazard Mitigation

The term mitigation means to make something become less harsh or severe, to alleviate. Mitigation activities are those types of actions you can take to protect your home and property from natural hazard events such as floods and severe storms. The Town of East Fishkill is in the process of developing a local Hazard Mitigation Plan. This process is designed to formulate and document mitigation strategies that will aid our municipality in protecting life and property from the impacts of future natural disasters. The following section will attempt to determine the level of knowledge citizens have about their options to protect their property from natural disasters.

15. Did you consider the impact a natural disaster could have on your home before you purchased/moved into your home?

- ◯ Yes
- ◯ No

16. Was the presence of a natural hazard risk zone (i.e. flood zone) disclosed to you by a real estate agent, seller, or landlord before you purchased/moved into your home?

- ◯ Yes
- ◯ No

17. Would the disclosure of this type of information influence your decision to purchase/move into a home?

- ◯ Yes
- ◯ No

18. How much money would you be willing to spend on your current home to retrofit it from the impacts of potential future natural disasters within our community? Examples of retrofitting are: Elevating a flood-prone home; elevating utilities in flood-prone basements; installing a tornado safe room or shelter; retrofitting your roof, siding or windows to withstand high winds.

- ◯ $5,000 or above
- ◯ $2,500 to $4,999
- ◯ $1,000 to $2,499
- ◯ $500 to $999
- ◯ $100 to $499
- ◯ Less than $100
- ◯ Nothing
- ◯ Don't know

19. If available, which of the following incentives would help to encourage you to spend money to retrofit your home from the possible impacts of natural disasters? (Please check all that apply)

- [ ] Building permit fee waiver
- [ ] Insurance premium discount
- [ ] Low interest rate loan
- [ ] Property tax break or incentive
- [ ] Mortgage discount
- [ ] Grant funding that requires a "cost-share"
- [ ] None
- [ ] Other (please specify)

20. If your property were located in a designated "high hazard" area, or had received repeated damages from a natural hazard event, would you consider a "buyout", elevation of the structure, or relocation offered by a public agency should it be made available?

- ( ) Yes
- ( ) No

21. What types of projects do you believe local, county, state or federal government agencies should be doing in order to reduce the damage and disruption of natural hazards in East Fishkill? Rate these by importance on a scale of H (high), M (medium), or L (low):

	H	M	L
Retrofit and strengthen essential facilities such as police, schools, hospitals	◯	◯	◯
Retrofit infrastructure, such as elevating roadways and improving drainage systems	◯	◯	◯
Work on improving the damage resistance of utilities (electricity, communications, etc.)	◯	◯	◯
Install or improve protective structures, such as floodwalls or levees	◯	◯	◯
Replace inadequate or vulnerable bridges and causeways	◯	◯	◯
Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	◯	◯	◯
Acquire vulnerable properties and maintain as open-space	◯	◯	◯
Inform property owners of ways they can mitigate damage to their properties	◯	◯	◯
Provide better information about hazard risks and high-hazard areas	◯	◯	◯
Assist vulnerable property owners with securing funding to mitigate their properties	◯	◯	◯

Other (please specify)

22. Other Comments:

East Fishkill Survey

1. Please indicate your age range:

	Response Percent	Response Count
18 to 30	19.0%	4
31 to 40	28.6%	6
41 to 50	9.5%	2
51 to 60	**33.3%**	**7**
60 or over	9.5%	2
	answered question	**21**
	skipped question	**1**

2. How long have you lived in East Fishkill?

	Response Percent	Response Count
Less than 1 year	4.8%	1
1 to 5 years	9.5%	2
6 to 9 years	23.8%	5
10 to 19 years	28.6%	6
20 years or more	**33.3%**	**7**
	answered question	**21**
	skipped question	**1**

3. Do you own or rent your place of residence?

	Response Percent	Response Count
Own	**95.2%**	**20**
Rent	4.8%	1
	answered question	**21**
	skipped question	**1**

4. What is your zip code?

	Response Count
	21
answered question	**21**
skipped question	**1**

5. What is your home address? (optional, will be kept confidential - only used to identify localized hazard areas such as flooding)

	Response Count
	8
answered question	**8**
skipped question	**14**

6. Please rank how prepared you feel you and your household are for the probable impacts of natural hazard events likely to occur within East Fishkill. Rank on a scale of 1 to 5, with 5 representing the most prepared.

	Response Percent	Response Count
1 (least)	14.3%	2
2	0.0%	0
3	**35.7%**	**5**
4	**35.7%**	**5**
5 (Most)	14.3%	2
	answered question	**14**
	skipped question	**8**

7. In what ways do you believe you are prepared for the probable impacts from natural hazard events that may occur within East Fishkill? (Please check all that apply)

	Response Percent	Response Count
I have taken precautionary measures to protect my property though retrofits or when constructed	46.2%	6
I have a preparedness kit consisting of basic supplies and materials for my family and myself	61.5%	8
I have identified the location of the nearest severe weather shelter	7.7%	1
I have a personal family emergency preparedness plan, and have discussed it with my family and others for whom I have responsibility	46.2%	6
I have at least two methods for receiving emergency notifications and for information during severe weather or other potential emergency situations	**84.6%**	**11**
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	23.1%	3
Locally provided news or other media information	61.5%	8
Schools and other academic institutions	30.8%	4
I have attended meetings that have dealt with disaster preparedness	23.1%	3
Other (please specify)	0.0%	0
	answered question	**13**
	skipped question	**9**

8. In the past 10 years, which of the following types of hazard events have you or someone in your household experienced or sustained damage as a result of within East Fishkill, and how concerned are you about the following natural hazards impacting the area? (In the first column indicate if you have experienced the hazard, then indicate your level of concern).

	Have Experienced	Not Concerned	Somewhat Concerned	Very Concerned	Extremely Concerned	Rating Count
Dam Failure	0.0% (0)	**83.3% (10)**	8.3% (1)	8.3% (1)	0.0% (0)	12
Drought	33.3% (4)	**50.0% (6)**	41.7% (5)	8.3% (1)	0.0% (0)	12
Earthquake	16.7% (2)	**66.7% (8)**	16.7% (2)	8.3% (1)	0.0% (0)	12
Epidemic/Pandemic	0.0% (0)	**50.0% (6)**	25.0% (3)	16.7% (2)	8.3% (1)	12
Extreme Temperatures	18.2% (2)	27.3% (3)	**54.5% (6)**	18.2% (2)	0.0% (0)	11
Flooding - Property	16.7% (2)	**66.7% (8)**	25.0% (3)	8.3% (1)	0.0% (0)	12
Flooding - Basement	0.0% (0)	**66.7% (8)**	25.0% (3)	8.3% (1)	0.0% (0)	12
Flooding - 1st Floor	0.0% (0)	**91.7% (11)**	8.3% (1)	0.0% (0)	0.0% (0)	12
Flooding - Above 1st Floor	0.0% (0)	**100.0% (11)**	0.0% (0)	0.0% (0)	0.0% (0)	11
Flooding - Street	16.7% (2)	**58.3% (7)**	33.3% (4)	0.0% (0)	8.3% (1)	12
Hail	**50.0% (6)**	33.3% (4)	41.7% (5)	8.3% (1)	0.0% (0)	12
Hurricane\Tropical Storm	38.5% (5)	7.7% (1)	**61.5% (8)**	23.1% (3)	0.0% (0)	13
Ice Storm	25.0% (3)	8.3% (1)	**75.0% (9)**	8.3% (1)	0.0% (0)	12
Infestation	0.0% (0)	41.7% (5)	**50.0% (6)**	8.3% (1)	0.0% (0)	12
Land Subsidence/Sinkholes	0.0% (0)	**75.0% (9)**	25.0% (3)	0.0% (0)	0.0% (0)	12
Landslide	0.0% (0)	**100.0% (12)**	0.0% (0)	0.0% (0)	0.0% (0)	12
Severe Storms	**46.2% (6)**	7.7% (1)	30.8% (4)	38.5% (5)	7.7% (1)	13
Severe Winter Storms (Blizzard, Heavy Snow, Ice)	**46.2% (6)**	7.7% (1)	38.5% (5)	30.8% (4)	15.4% (2)	13
Tornado	8.3% (1)	33.3% (4)	**41.7% (5)**	8.3% (1)	16.7% (2)	12
Utility Failure	**46.2% (6)**	0.0% (0)	38.5% (5)	23.1% (3)	23.1% (3)	13

Wildfire	0.0% (0)	**63.6% (7)**	27.3% (3)	0.0% (0)	9.1% (1)	11
Other	0.0% (0)	**87.5% (7)**	0.0% (0)	12.5% (1)	0.0% (0)	8
					answered question	**13**
					skipped question	**9**

9. Information on the impacts of and how to prepare for a natural disaster can be disseminated to the public in various ways. 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 hazard events.

	Response Percent	Response Count
Newspaper - Poughkeepsie Journal	38.5%	5
Newspaper - Southern Dutchess News	15.4%	2
Municipal Website and Local Cable	30.8%	4
County and/or Local Gov't. Websites	30.8%	4
Local Government E-Mail	7.7%	1
Police, Fire, EMS, 9-1-1	15.4%	2
Telephone Book	7.7%	1
Informational Brochures	7.7%	1
Public Meetings	23.1%	3
Workshops	7.7%	1
Schools	7.7%	1
TV News	30.8%	4
TV Advertising	0.0%	0
Radio News	30.8%	4
Radio Advertisements	7.7%	1

Outdoor Advertisements	0.0%	0
Internet	**69.2%**	**9**
Chamber of Commerce	0.0%	0
Fire Department/EMS Agency	7.7%	1
Academic Institutions	7.7%	1
Public Awareness Event	15.4%	2
Books	0.0%	0
Public Library	0.0%	0
Other (please specify)	7.7%	1
	answered question	**13**
	skipped question	**9**

10. To the best of your knowledge is your property located in a designated floodplain?

	Response Percent	Response Count
Yes	0.0%	0
No	**92.3%**	**12**
Not Sure	7.7%	1
	answered question	**13**
	skipped question	**9**

11. Do you have flood insurance?

	Response Percent	Response Count
Yes	7.7%	1
No	**92.3%**	**12**
answered question		**13**
skipped question		**9**

12. If you do NOT have flood insurance, what is the primary reason?

	Response Percent	Response Count
I don't need it/my property has never flooded	8.3%	1
Don't need it/located on high ground	**66.7%**	**8**
It is too expensive	8.3%	1
Not familiar with it/don't know about it	8.3%	1
Insurance company will not provide	0.0%	0
My homeowners insurance will cover me	8.3%	1
It is not worth it	0.0%	0
answered question		**12**
skipped question		**10**

13. Do you or did you have problems getting homeowners/renters insurance due to risks from natural hazards?

	Response Percent	Response Count
Yes	0.0%	0
No	**100.0%**	**13**
	answered question	**13**
	skipped question	**9**

14. If you answered "yes" to the previous question, please identify the natural hazard risk that caused you to have problems obtaining homeowners/renters insurance.

	Response Count
	0
answered question	**0**
skipped question	**22**

15. Did you consider the impact a natural disaster could have on your home before you purchased/moved into your home?

	Response Percent	Response Count
Yes	41.7%	5
No	**58.3%**	**7**
	answered question	**12**
	skipped question	**10**

16. Was the presence of a natural hazard risk zone (i.e. flood zone) disclosed to you by a real estate agent, seller, or landlord before you purchased/moved into your home?

		Response Percent	Response Count
Yes		0.0%	0
No		**100.0%**	**12**
		answered question	**12**
		skipped question	**10**

17. Would the disclosure of this type of information influence your decision to purchase/move into a home?

		Response Percent	Response Count
Yes		**100.0%**	**12**
No		0.0%	0
		answered question	**12**
		skipped question	**10**

18. How much money would you be willing to spend on your current home to retrofit it from the impacts of potential future natural disasters within our community? Examples of retrofitting are: Elevating a flood-prone home; elevating utilities in flood-prone basements; installing a tornado safe room or shelter; retrofitting your roof, siding or windows to withstand high winds.

	Response Percent	Response Count
$5,000 or above	16.7%	2
$2,500 to $4,999	**25.0%**	**3**
$1,000 to $2,499	8.3%	1
$500 to $999	0.0%	0
$100 to $499	8.3%	1
Less than $100	0.0%	0
Nothing	16.7%	2
Don't know	**25.0%**	**3**
	answered question	**12**
	skipped question	**10**

19. If available, which of the following incentives would help to encourage you to spend money to retrofit your home from the possible impacts of natural disasters? (Please check all that apply)

	Response Percent	Response Count
Building permit fee waiver	41.7%	5
Insurance premium discount	**75.0%**	**9**
Low interest rate loan	50.0%	6
Property tax break or incentive	66.7%	8
Mortgage discount	25.0%	3
Grant funding that requires a "cost-share"	41.7%	5
None	16.7%	2
Other (please specify)	0.0%	0
answered question		**12**
skipped question		**10**

20. If your property were located in a designated "high hazard" area, or had received repeated damages from a natural hazard event, would you consider a "buyout", elevation of the structure, or relocation offered by a public agency should it be made available?

	Response Percent	Response Count
Yes	**81.8%**	**9**
No	18.2%	2
answered question		**11**
skipped question		**11**

21. What types of projects do you believe local, county, state or federal government agencies should be doing in order to reduce the damage and disruption of natural hazards in East Fishkill? Rate these by importance on a scale of H (high), M (medium), or L (low):

	H	M	L	Rating Count
Retrofit and strengthen essential facilities such as police, schools, hospitals	**72.7% (8)**	18.2% (2)	9.1% (1)	11
Retrofit infrastructure, such as elevating roadways and improving drainage systems	**75.0% (9)**	25.0% (3)	0.0% (0)	12
Work on improving the damage resistance of utilities (electricity, communications, etc.)	**91.7% (11)**	8.3% (1)	0.0% (0)	12
Install or improve protective structures, such as floodwalls or levees	**50.0% (6)**	33.3% (4)	16.7% (2)	12
Replace inadequate or vulnerable bridges and causeways	**66.7% (8)**	25.0% (3)	8.3% (1)	12
Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	**41.7% (5)**	33.3% (4)	25.0% (3)	12
Acquire vulnerable properties and maintain as open-space	33.3% (4)	**50.0% (6)**	16.7% (2)	12
Inform property owners of ways they can mitigate damage to their properties	**75.0% (9)**	8.3% (1)	16.7% (2)	12
Provide better information about hazard risks and high-hazard areas	**75.0% (9)**	25.0% (3)	0.0% (0)	12
Assist vulnerable property owners with securing funding to mitigate their properties	**66.7% (8)**	16.7% (2)	16.7% (2)	12
			Other (please specify)	0
			answered question	**12**

skipped question	10

22. Other Comments:

	Response Count
	1
answered question	1
skipped question	21

Page 2, Q4. What is your zip code?		
1	12533	May 30, 2013 10:16 PM
2	12590	May 21, 2013 9:17 PM
3	12533	May 13, 2013 3:22 PM
4	12533	May 12, 2013 1:47 AM
5	12533	May 10, 2013 10:44 AM
6	12590	May 10, 2013 10:12 AM
7	12533	May 9, 2013 7:55 AM
8	12533	Apr 28, 2013 8:57 PM
9	12590	Apr 16, 2013 11:40 AM
10	12533	Apr 6, 2013 9:50 PM
11	12582	Mar 11, 2013 11:48 PM
12	12533	Mar 6, 2013 5:41 PM
13	12533	Feb 25, 2013 11:47 AM
14	12533	Feb 24, 2013 4:58 PM
15	12533	Feb 12, 2013 11:19 PM
16	12590	Jan 15, 2013 2:05 PM
17	12582	Jan 12, 2013 5:56 PM
18	12533-6048	Jan 9, 2013 9:14 PM
19	12533	Dec 23, 2012 8:48 PM
20	12533	Dec 1, 2012 12:12 PM
21	12533	Oct 22, 2012 3:01 PM

Page 2, Q5. What is your home address? (optional, will be kept confidential - only used to identify localized hazard areas such as flooding)

1	217 hillside lake rd	May 21, 2013 9:17 PM
2	130 Creamery Road	Apr 6, 2013 9:50 PM
3	3250 Rt. 52, stormville, ny	Mar 11, 2013 11:48 PM
4	Tina Lane	Feb 25, 2013 11:47 AM
5	libby court	Feb 12, 2013 11:19 PM
6	224 west sunset drive	Jan 15, 2013 2:05 PM
7	20 Creekside Rd	Jan 9, 2013 9:14 PM
8	204 Creamery Road	Oct 22, 2012 3:01 PM

Page 3, Q9. Information on the impacts of and how to prepare for a natural disaster can be disseminated to the public in various ways. 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 withs...

1	FEMA information	Mar 6, 2013 5:46 PM

Page 4, Q22. Other Comments:

1	Town should concentrate less on all of the recreational spending and devote more funds to infrastructure.	May 10, 2013 10:22 AM

This appendix includes FEMA 386-4 Guidance worksheets to facilitate plan maintenance and review by the Town East Fishkill Hazard Mitigation Planning Committee.

Worksheet #1 Progress Report step 2

Progress Report Period: ________________ 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: ______________________________

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**

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 or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: ______________________________

____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: ______________________________

____

☐ Cost underrun*

*explain: ______________________________

____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

____

____

____

____

B. What obstacles, problems, or delays did you encounter, 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?

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 3

Project Name and Number: ______________________________

Project Budget: ______________________________

Project Description: ______________________________

Associated Goal and Objective(s): ______________________________

Indicator of Success (e.g., losses avoided): ______________________________

Insert location map.

Include before and after photos if appropriate.

Was the action implemented? ☐ **YES** ☐ **NO**

IF NO

Why not?	**YES**	**NO**
Was there political support for the action?	☐	☐
Were enough funds available?	☐	☐
Were workloads equitably or realistically distributed?	☐	☐
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	☐	☐
Was the estimated time of implementation reasonable?	☐	☐
Were sufficient resources (for example staff and technical assistance) available?	☐	☐

IF YES

What were the results of the implemented action? ______________________________

	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 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.

Worksheet #1 Progress Report

Page 1 of 3

Progress Report Period: October 1, 2003 (date) to December 31, 2003 (date)

Project Title: Raging River Views Park Flood Acquisition Project Project ID#: HVMP-2003-01

Responsible Agency: Hazardville Department of Planning

Address: 1909 Burnham Way

City/County: Hazardville, Emergency

Contact Person: Eunice Euclid Title: Grants Administrator

Phone #(s): (555) 555-8473 email address: eeuclid@town.hazardville.em

List Supporting Agencies and Contacts:

Hazardville Department of Housing: Noah Hudson (555) 555-8465

Hazardville Habitat for Humanity: Carter Goodman (555) 555-9432

Total Project Cost: $360,000

Anticipated Cost Overrun/Underrun: $N/A

Date of Project Approval: July 21, 2003 Start date of the project: November 15, 2003

Anticipated completion date: Summer 2005

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase):

Acquire and demolish 14 structures located at the Raging River Views Park. Work with Habitat for Humanity and the Department of Housing to construct new housing or rehabilitate existing housing for displaced low-income residents. The Department of Housing will also provide funds for temporary housing to displaced residents.

Milestones	Complete	Projected Date of Completion
Conduct surveys of ground and first-floor elevations	✓	
Obtain Notices of Intent by owners	✓	
Conduct structure appraisals	✓	
Send letters of offer to homeowners		1/31/04
Perform title work		3/30/04
Acquire structures		6/30/04
Begin construction of new housing or reconstruction of existing housing for relocated residents		6/30/04
Send payment for relocation to renters		9/30/04
Finalize contract for demolition		1/12/05
Demolish structures		4/26/05
Landscape open parcels		6/30/05

Plan Goal(s)/Objective(s) Addressed:

Goal: Minimize losses to existing and future structures within hazard areas.

Objective: Reduce potential damages to the manufactured home park in the floodplain.

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.

Losses Avoided. After a major flood (100-year), the Department of Economic Development will assist the Planning Department in calculating the losses avoided.

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

- [x] Project on schedule
- [ ] Project completed
- [ ] Project delayed*

*explain: __________

- [ ] Project canceled

Project Cost Status

- [x] Cost unchanged
- [ ] Cost overrun*

*explain: __________

- [ ] Cost underrun*

*explain: __________

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

The Department of Planning contacted the owners of the properties vulnerable to floods to determine their willingness to sell their properties. Of the 14 property owners contacted, 10 agreed to have their homes acquired. An appraiser contracted by the Department of Planning estimated the value of the 10 properties.

B. What obstacles, problems, or delays did you encounter, if any?

The owners of four properties refused to sell. There has been some limited neighborhood opposition to various suggestions for the community open space created by the acquisitions.

C. How was each problem resolved?

The Department of Planning has proposed to the residents a design charrette to develop alternatives for the open space that would be created, with the understanding that no permanent structures can be constructed on the open parcels after acquisition and demolition has been completed. Recreational activities will be limited to passive uses such as trails and bike paths.

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

1. Send offer letters to homeowners.
2. Do title work.
3. Work with the Department of Housing and Habitat for Humanity to identify existing housing for rehabilitation and viable vacant parcels to construct new housing for the displaced residents.

Other comments:

None

Adapted from the North Carolina HMGP Progress Report Form at http://www.dem.dcc.state.nc.us/mitigation/document_index.htm.

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: NA		
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: Hazardville Habitat for Humanity has been invaluable in assisting the relocation of former Raging River Views Park residents. The organization should be invited to participate in THORR.		
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: It is essential that the Department of Public Works be represented at each meeting because so many mitigation actions involve them. However, representatives from the department have been unable to attend meetings consistently since the development of the plan. THORR will work with the departments director to find consistent, active representation.		
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: Again, the Department of Public Works has been unable to provide timely progress reports of its mitigation actions. Administrative duties and paperwork have fallen through the cracks since the department has been assigned numerous new duties in Hazardville's mitigation efforts. Perhaps the department, in partnership with THORR, should approach the Town Council for funding for more department staff.		
Are there ways to gain more diverse and widespread cooperation?	✓	
Comments/Proposed Action: THORR members believe that better publicity about mitigation actions will garner more interest from the public, affected/interested organizations, and state agencies.		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?	✓	
Comments/Proposed Action: THORR has learned about new PDM funding. The state has asked that local jurisdictions submit applications for brick and mortar projects and risk assessments studies.		

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

Project Name and Number:

Raging River Views Park Flood Acquisition Project (HVMP-2003-01)

Project Budget:

$360,000

Project Description:

Acquisition and demolition of 14 flood-prone structures

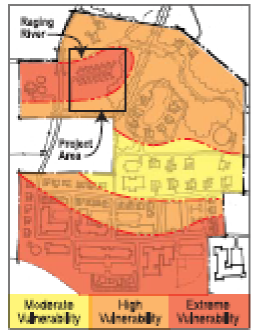
Associated Goal and Objective(s):

Goal: Minimize losses to existing and future structures within hazard areas

Objective: Reduce potential damages to the manufactured home park in the floodplain

Indicator of Success (e.g., losses avoided):

Losses avoided by acquisition and demolition of flood-prone structures



Town of Hazardville Composite Loss Map developed previously during risk assessment (see FEMA 386-2).

Was the action implemented? ☑ YES ☐ NO

IF NO

Why not?

	YES	NO
Was there political support for the action?	☐	☐
Were enough funds available?	☐	☐
Were workloads equitably or realistically distributed?	☐	☐
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	☐	☐
Was the estimated time of implementation reasonable?	☐	☐
Were sufficient resources (for example staff and technical assistance) available?	☐	☐

IF YES

What were the results of the implemented action?

Of the 14 proposed properties, 10 were acquired. The benefit-cost ratio is 2.19, based on project benefits of $789,000 and costs of $360,274. Benefits are based on the net present value of the avoided damages over the project life. Furthermore, about 40 people are no longer in the path of a potential flood, making emergency rescue operations in that area less likely and evacuation easier.

	YES	NO
Were the outcomes as expected? If No, please explain:		✓
The project originally set out to acquire 14 properties. Four of the 14 owners did not want to participate in the buyout program.		
Did the results achieve the goal and objective(s)? Explain how:	✓	
Despite four properties still in harm's way, the objective has been largely met. See additional comments.		
Was the action cost-effective? Explain how or how not:	✓	
The FEMA Limited Data module was used to perform the benefit-cost analysis. Data for the analysis was collected from historical flood data and used as benchmarks in the before mitigation section of the analysis. The damages after mitigation section was left blank, due to the properties being permanently acquired, and the economic risk removed completely. The analysis resulted in a benefit-cost ratio of 2.19, with benefits totaling $789,000 for 10 properties.		
What were the losses avoided after having completed the project?		
Total avoided losses are $789,000 over the lifetime of the project (estimated at 100 years).		
If it was a structural project, how did it change the hazard profile?		
N/A		
Additional comments or other outcomes:		
The Planning Department has agreed to work with the remaining four homeowners in evaluating other flood-proofing options.		

Date: October 12, 2005

Prepared by: Hazardville Department of Economic Development
Hazardville Department of Planning

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?	✓		Recently completed maps and studies showing vulnerability of the new coastal development to erosion and tidal surge are 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?	✓		The Planning Department is preparing a coastal development plan to ensure that any future development is set back far enough to be outside the erosion zones and the coastal high hazard areas. Current and future road configurations will also be studied to ensure adequate evacuation times before hurricane events.
	Are there any new special high-risk populations?	✓		Coastal residents and business owners.
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.

This appendix provides a summary of available federal programs that relate to mitigation planning and may provide possible sources of funding or technical support for mitigation initiatives.

This appendix provides a summary of available federal programs that relate to mitigation planning and may provide possible sources of funding or technical support for mitigation initiatives.

Program/Activity	Type of Assistance	Agency and Contact
Basic and Applied Research/Development		
Center for Integration of Natural Disaster Information	**Technical Assistance**: Develops and evaluates technology for information integration and dissemination	Department of Interior (**DOI**) –US Geological Survey (**USGS**), The Center for Integration of Natural Hazards Research: (703) 648-6059 hazinfo@usga.gov
Hazard Reduction Program	**Funding** for research and related educational activities on hazards.	National Science Foundation (**NSF**), Directorate for Engineering, Division of Civil and Mechanical Systems, Hazard Reduction Program: (703) 306-1360
Decision, Risk, and Management Science Program	**Funding** for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)	**NSF** – Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision, Risk, and Management Science Program (DRMS): (703) 306-1757 www.nsf.gov/sbe/drms/start.htm
Societal Dimensions of Engineering, Science, and Technology Program	**Funding** for research and related educational activities on topics such as ethics, values, and the assessment, communication, management and perception of risk	**NSF** – Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program: (703) 306-1743
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	**Research** into basic and applied earth and building sciences.	**NSF** – Directorate for Geosciences, Division of Earth Sciences: (703) 306-1550
Technical and Planning Assistance		
Planning Assistance to States	**Technical and planning assistance** for the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.	Department of Defense (**DOD**) US Army Corps of Engineers (**USACE**) Contact the Floodplain Management Staff in the Appropriate USACE Regional Office North Atlantic: (212) 264-7813 South Atlantic: (404) 331-4441 Great Lakes and Ohio River: (513) 684-6050 Mississippi Valley: (601) 634-5827 Northwestern: (503) 808-3853 Southwestern: (214-767-2613 South Pacific: (415) 977-8164 Pacific Ocean: (808) 438-8863
Disaster Mitigation Planning and Technical Assistance	**Technical and planning assistance** grants for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces.	Department of Commerce (**DOC**), Economic Development Administration (**EDA**): (800) 345-1222 **EDA**'s Disaster Recovery Coordinator: (202) 482-6225 www.doc.gov/eda

Program/Activity	Type of Assistance	Agency and Contact
Watershed Surveys and Planning	**Surveys and planning studies** for appraising water and related resources, and formulating alternative plans for conservation use and development. Grants and advisory/counseling services to assist w/ planning and implementation improvement.	US Department of Agriculture (**USDA**) – National Resources Conservation Service (**NRCS**) Watersheds and Wetlands Division: (202) 720-4527 Deputy Chief for Programs: (202) 690-0848 www.nrcs.usda.gov
National Flood Insurance Program	**Formula grants to States** to assist communities to comply with NFIP floodplain management requirements (Community Assistance Program).	**FEMA**
Emergency Management / Mitigation Training	**Training** in disaster mitigation, preparedness, planning.	**FEMA**
National Dam Safety Program	**Technical assistance,** training, and grants to help improve State dam safety programs.	**FEMA**
National Earthquake Hazards Reduction Program	**Training, planning and technical assistance** under grants to States or local jurisdictions.	**FEMA; DOI-USGS** **USGS** Earthquake Program Coordinator: (703) 648-6785
Volcano Hazards Program	**Technical assistance**: Volcano hazard warnings and operation of four volcano observatories to monitor and assess volcano hazard risk.	**DOI-USGS** Volcanic Hazards Program Coordinator: (703) 648-6708 (650) 329-5228
Floodplain Management Services	**Technical and planning assistance** at the local, regional, or national level needed to support effective floodplain management.	**DOD-USACE** North Atlantic: (212) 264-7813 South Atlantic: (404) 331-4441 Great Lakes and Ohio River: (513) 684-6050 Mississippi Valley: (601) 634-5827 Northwestern: (503) 808-3853 Southwestern: (214-767-2613 South Pacific: (415) 977-8164 Pacific Ocean: (808) 438-8863
Watershed Protection and Flood Prevention Program	**Technical and financial assistance** for installing works of improvement to protect, develop, and utilize land or water resources in small watersheds under 250,000 acres.	**USDA-NRCS** Director, Watersheds and Wetlands Division: (202) 720-3042 (202) 690-4614 www.nrcs.usda.gov
Environmental Quality Incentives Program (EQIP)	**Technical**, educational, and limited **financial assistance** to encourage environmental enhancement.	**USDA-NRCS** NRCS County Offices Or NRCS EQUIP Program Manager: (202) 720-1834 www.nrcs.usda.gov

Program/Activity	Type of Assistance	Agency and Contact
National Earthquake Hazard Reduction Program	**Technical and planning assistance** for activities associated with earthquake hazards mitigation.	FEMA, DOI-USGS Earthquake Program Coordinator: (703) 648-6785
HAZARD Identification and Mapping		
National Flood Insurance Program: Flood Mapping	**Flood insurance rate maps** and flood plain management maps for all NFIP communities;	FEMA
National Flood Insurance Program: Technical Mapping Advisory Council	**Technical guidance and advice** to coordinate FEMA's map modernization efforts for the National Flood Insurance Program.	**DOI-USGS** **USGS** – National Mapping Division: (573) 308-3802
National Digital Orthophoto Program	Develops **topographic quadrangles** for use in mapping of flood and other hazards.	**DOI-USGS** **USGS** – National Mapping Division: (573) 308-3802
Stream gauging and Flood Monitoring Network	Operation of a **network of over 7,000 stream gauging stations** that provide data on the flood characteristics of rivers.	**DOE-USGS** Chief, Office of Surface Water, **USGS:** (703) 648-5303
Mapping Standards Support	**Expertise in mapping and digital data** standards to support the National Flood Insurance Program.	**DOI-USGS** USGS – National Mapping Division: (573) 308-3802
Soil Survey	**Maintains soil surveys** of counties or other areas to assist with farming, conservation, mitigation or related purposes.	**USDA-NRCS** NRCS – Deputy Chief for Soil Science and Resource Assessment: (202) 720-4630
National Earthquake Hazards Reduction Program	**Seismic mapping for U.S.**	**DOI-USGS** USGS Earthquake Program Coordinator: (703) 648-6785
Project Support		
Aquatic Ecosystem Restoration	**Direct support** for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.	**DOD-USACE** Chief of Planning @ appropriate USACE Regional Office North Atlantic: (212) 264-7111 South Atlantic: (404) 331-4580 Great Lakes and Ohio River Chicago: (312) 886-5468 Cincinnati: (513) 684-3008 Mississippi Valley Division: (601) 634-7880 Northwestern Division Portland: (503) 808-3850 Omaha: (402) 697-2470 Southwestern Division: (214) 767-2314 South Pacific Division: (415) 977-8171 Pacific Ocean Division: (808) 438-3850

Program/Activity	Type of Assistance	Agency and Contact
Beneficial Uses of Dredged Materials	**Direct assistance** for projects that protect, restore, and create aquatic and ecologically related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	**DOD-USACE** Same as above
Wetlands Protection – Development Grants	**Grants** to support the development and enhancement of State and tribal wetlands protection programs.	US Environmental Protection Agency (**EPA**) EPA Wetlands Hotline: (800) 832-7828 Or EPA Headquarters, Office of Water Chief, Wetlands Strategies and State Programs: (202) 260-6045
Clean Water Act Section 319 Grants	**Grants to States** to implement non-point source programs, including support for non-structural watershed resource restoration activities.	**EPA** Office of Water Chief, Non-Point Source Control Branch: (202) 260-7088, 7100
Coastal Zone Management Program	**Grants** for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration.	Department of Commerce **DOC** National Oceanic and Atmospheric Administration (**NOAA**) National Ocean Service Office of Ocean and Coastal Resource Management Chief, Coastal Programs Division: (301) 713-3102
Community Development Block Grant (CDBG) State Administered Program	**Grants to States** to develop viable communities (e.g., housing, a suitable living environment, expanded economic opportunities) in non-entitled areas, for low- and moderate-income persons.	US Department of Housing and Urban Development **(HUD)** State CDBG Program Manager Or State and Small Cities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-3587
Community Development Block Grant Entitlement Communities Program	**Grants** to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons.	**HUD** City and county applicants should call the Community Planning and Development staff of their appropriate HUD field office. As an alternative, they may call the Entitlement Communities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-1577, 3587
Emergency Watershed Protection Program	Provides **technical and financial assistance** for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.	**USDA – NRCS** National Office – (202) 690-0848 Watersheds and Wetlands Division: (202) 720-3042
Rural Development Assistance -- Utilities	Direct and guaranteed rural economic **loans and business enterprise grants** to address utility issues and development needs.	**USDA**-Rural Utilities Service (RUS) Program Support: (202) 720-1382 Northern Regional Division: (202) 720-1402 Electric Staff Division: (202) 720-1900 Power Supply Division: (202) 720-6436

Program/Activity	Type of Assistance	Agency and Contact
Rural Development Assistance – Housing	**Grants, loans, and technical assistance** in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	**USDA**-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Single Family Housing: (202) 720-3773 Multi Family Housing: (202) 720-5177
Project Impact: Building Disaster Resistant Communities	**Funding and technical assistance** to communities and States to implement a sustained pre-disaster mitigation program.	**FEMA**
Flood Mitigation Assistance	**Grants to States** and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.	**FEMA**
Hazard Mitigation Grant Program	**Grants to States and communities** for implementing long-term hazard mitigation measures following a major disaster declaration.	**FEMA**
Public Assistance Program (Infrastructure)	**Grants to States and communities** to repair damaged infrastructure and public facilities, and help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.	**FEMA**
National Flood Insurance Program	Makes available **flood insurance** to residents of communities that adopt and enforce minimum floodplain management requirements.	**FEMA**
HOME Investments Partnerships Program	**Grants to States, local government** and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	**HUD** Community Planning and Development, Grant Programs, Office of Affordable Housing, HOME Investment Partnership Programs: (202) 708-2685 (202) 708 0614 extension 4594 1-800-998-9999
Disaster Recovery Initiative	**Grants** to fund gaps in available recovery assistance after disasters (including mitigation).	**HUD** Community Planning and Development Divisions in their respective HUD field offices or HUD Community Planning and Development: (202) 708-2605

Program/Activity	Type of Assistance	Agency and Contact
Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	**Direct planning and construction grants** for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods or coastal storms. $9 million FY99	**DOD-USACE** Emergency Management contact in respective **USACE** field office: North Atlantic: (718) 491-8735 South Atlantic: (404) 331-6795 Great Lakes and Ohio River: (513) 684-3086 Mississippi Valley: (601) 634-7304 Northwestern: (503) 808-3903 Southwestern: (214) 767-2425 South Pacific: (415) 977-8054 Pacific Ocean: (808) 438-1673
Partners for Fish and Wildlife	**Financial and technical assistance** to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	Department of Interior (**DOI**) – Fish and Wildlife Service (**FWS**) National Coordinator, Ecological Services: (703) 358-2201 A list of State and Regional contacts is available from the National Coordinator upon request.
Project Modifications for Improvement of the Environment	Provides for **ecosystem restoration** by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area.	**DOD-USACE** Chief of Planning @ appropriate USACE Regional Office North Atlantic: (212) 264-7111 South Atlantic: (404) 331-6270 Great Lakes and Ohio River Chicago: (312) 886-5468 Cincinnati: (513) 684-3008 Mississippi Valley Division: (601) 634-5762 Northwestern Division Portland: (503) 808-3850 Omaha: (402) 697-2470 Southwestern Division: (214) 767-2310 South Pacific Division: (415) 977-8171 Pacific Ocean Division: (808) 438-8880
Post-Disaster Economic Recovery Grants and Assistance	**Grant funding** to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	Department of Commerce (**DOC**) – Economic Development Administration (**EDA**) EDA Headquarters Disaster Recovery Coordinator: (202) 482-6225
Public Housing Modernization Reserve for Disasters and Emergencies	**Funding** to public housing agencies for modernization needs resulting from natural disasters (including elevation, flood proofing, and retrofit).	**HUD** Director, Office of Capital Improvements: (202) 708-1640
Indian Housing Assistance (Housing Improvement Program)	**Project grants and technical assistance** to substantially eliminate sub-standard Indian housing.	Department of Interior (**DOI**)-Bureau of Indian Affairs (**BIA**) Division of Housing Assistance, Office of Tribal Services: (202) 208-5427
Land Protection	**Technical assistance** for run-off retardation and soil erosion prevention to reduce hazards to life and property.	**USDA-NRCS** Applicants should contact the National NRCS office: (202) 720-4527

Program/Activity	Type of Assistance	Agency and Contact
North American Wetland Conservation Fund	**Cost-share grants** to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.	**DOI-FWS** North American Waterfowl and Wetlands Office: (703) 358-1784
Land Acquisition	**Acquires or purchases easements** on high-quality lands and waters for inclusion into the National Wildlife Refuge System.	**DOI-FWS** Division of Realty, National Coordinator: (703) 358-1713
Federal Land Transfer / Federal Land to Parks Program	**Identifies, assesses, and transfers available Federal real** property for acquisition for State and local parks and recreation, such as open space.	**DOI-NPS** General Services Administration Offices Fort Worth, TX: (817) 334-2331 Boston, MA: (617) 835-5700 Or Federal Lands to Parks Leader **NPS** National Office: (202) 565-1184
Wetlands Reserve Program	**Financial and technical assistance** to protect and restore wetlands through easements and restoration agreements.	**USDA-NRCS** National Policy Coordinator NRCS Watersheds and Wetlands Division: (202) 720-3042
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for **conservation** purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Department of Agriculture (**USDA**) – Farm Service Agency (**FSA**) Farm Loan Programs National Office: (202) 720-3467, 1632
Financing and Loan Guarantees		
Physical Disaster Loans and Economic Injury Disaster Loans	**Disaster loans** to non-farm, private sector owners of disaster damaged property for uninsured losses. Loans can be increased by up to 20 percent for mitigation purposes.	Small Business Administration (**SBA**) National Headquarters Associate Administrator for Disaster Assistance: (202) 205-6734
Conservation Contracts	**Debt reduction** for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	**USDA-FSA** Farm Loan Programs FSA National Office: (202) 720-3467, 1632 or local FSA office
Clean Water State Revolving Funds	**Loans** at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	**EPA** EPA Office of Water State Revolving Fund Branch Branch Chief: (202) 260-7359 A list of Regional Offices is available upon request
Section 108 Loan Guarantee Program	**Loan guarantees** to public entities for community and economic development (including mitigation measures).	**HUD** Community Planning and Development staff at appropriate HUD field office, or the Section 108 Office in HUD Headquarters: (202) 708-1871

Program/Activity	Type of Assistance	Agency and Contact
Section 504 Loans for Housing	**Repair loans, grants and technical assistance** to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards.	US Department of Agriculture (**USDA**) – Rural Housing Service (**RHS**) Contact local RHS Field Office, or RHS Headquarters, Director, Single Family Housing Direct Loan Division: (202) 720-1474
Section 502 Loan and Guaranteed Loan Program	Provides **loans, loan guarantees, and technical assistance** to very low and low-income applicants to purchase, build, or rehabilitate a home in a rural area.	**USDA-RHS** Contact the Local RHS Field Office, or the Director, Single Family Housing Guaranteed Loan Division, RHS: (202) 720-1452
Rural Development Assistance -- Utilities	Direct and guaranteed **rural economic loans and business enterprise grants** to address utility issues and development needs.	**USDA**-Rural Utility Service (**RUS**) Contact Rural Development Field Offices, or RHS, Deputy Administrator, Community Programs Division: (202) 720-1490
Farm Ownership Loans	**Direct loans, guaranteed / insured loans, and technical assistance** to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other necessary improvements.	**USDA-FSA** Director, Farm Programs Loan Making Division, FSA: (202) 720-1632