HAZARD MITIGATION PLAN

Warren County, New York

VOLUME I

2023

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SECTION 1. INTRODUCTION

1.1 BACKGROUND

Communities, residents, and businesses have been faced with continually increasing costs associated with both natural and man-made hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards. Warren County and all of the jurisdictions (13) located therein, participated in the development of the 2023 Warren County Multi-Jurisdictional Hazard Mitigation Plan (HMP, also referred herein as the "Hazard Mitigation Plan" or the "plan") update, which is a multi-hazard mitigation plan. The HMP includes countywide analysis and assessment of hazards, risk, and capabilities. The plan has been prepared following the requirements of the federal Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 amends the Stafford Act and is designed to improve planning for, response to, and recovery from, disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for the development of multi-jurisdictional hazard mitigation plans, and the New York State Division of Homeland Security and Emergency Services (DHSES) also supports plan development for jurisdictions in New York State.

Hazard Mitigation

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

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

Warren County has been included in 19 FEMA (major and emergency) declarations since 1954.

Specifically, DMA 2000 requires that states, with support from local governmental agencies, update hazard mitigation plans on a five-year basis to prepare for and reduce the potential impacts of natural hazards. DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning will better enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

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

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than simply reacting whenever disasters strike communities, the federal government began encouraging communities to first assess their vulnerability to various disasters and proceed to take actions to

reduce or eliminate potential risks. The logic is simply that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost and more quickly. Moreover, other costs associated with disasters, such as the time lost from productive activity by business and industries, are minimized.

DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). This section sets forth the requirements that communities evaluate natural hazards within their respective jurisdictions and develop an appropriate plan of action to mitigate those hazards, while emphasizing the need for state, tribal and local governments to closely coordinate mitigation planning and implementation efforts.

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

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

1.1.2 Benefits of Mitigation Planning

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

- An increased understanding of hazards faced by Warren County communities
- 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

Source: FEMA 2018; Mitigation Saves Fact Sheet

- Reduced costs associated with response and recovery efforts, including repairs

1.1.3 Organizations Involved in the Mitigation Planning Effort

Warren County and the participating jurisdictions have prepared this hazard mitigation plan with full coordination and participation of county and local government, relevant organizations, and groups, as well as state and federal agencies and the general public. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and mitigation actions included in Section 6 and in the jurisdictional annexes in Section 9. Warren County and its 13 municipal governments participated in the planning process as indicated in Table 1-1 below.

Table 1-1. Participating Jurisdictions in Warren County

Participating Jurisdictions		
Warren County	Horicon (T)	Queensbury (T)
Bolton (T)	Johnsburg (T)	Stony Creek (T)
Chester (T)	Lake George (T)	Thurman (T)
Glens Falls (C)	Lake George (V)	Warrensburg (T)
Hague (T)	Lake Luzerne (T)	

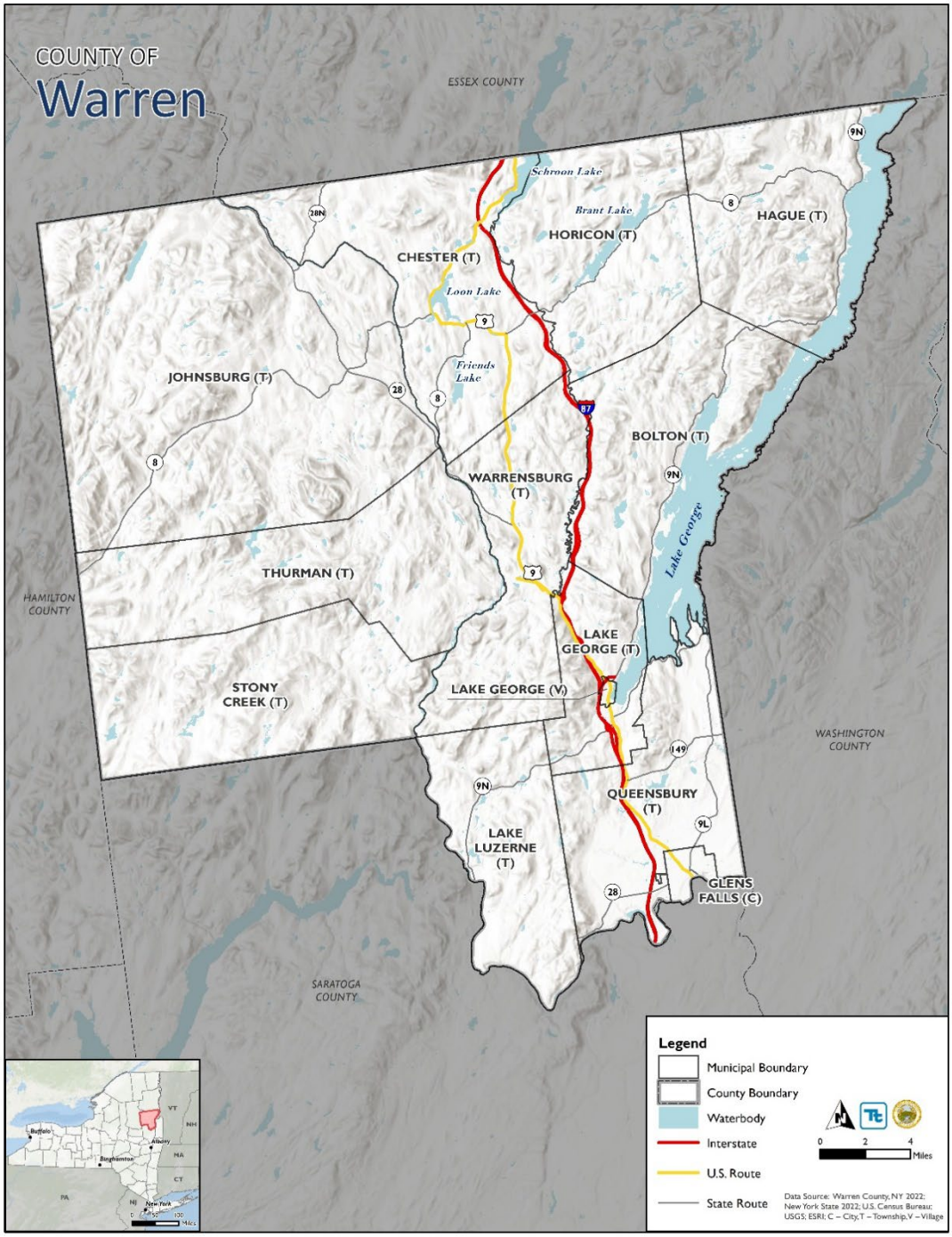
Multiple Agency Support for Hazard Mitigation

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

Additional input and support for this planning effort was obtained from a range of agencies and through public involvement (as discussed in Section 3). The Warren County Department of Emergency Services managed the project with the support of the Warren County Soil & Water Conservation District and oversight provided by a Steering Committee consisting of representatives from the Warren County Department of Emergency Services, the Warren County Soil & Water District and a broad range of agencies and stakeholders including four municipalities (the City of Glens Falls; Village and Town of Lake George; Town of Queensbury), Warren County Office of the Administrator, County GIS, County Planning, Adirondack/Glens Falls Transportation Council, and Glens Falls Hospital to provide both county and local perspectives to guide the planning process. The Steering Committee engaged additional, diverse stakeholders through outreach and surveys.

The 13 participating municipalities provided significant input into the preparation of the plan, in particular the preparation of the annexes included in Section 9 for each municipality. Details regarding the roles and responsibilities of the various committees and other participants are further discussed in Section 3.

Figure 1-1. Warren County, New York Mitigation Plan Area



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

- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- Local *Mitigation Plan Policy Guide*, FP 206-21-0002, effective April 19, 2023.
- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 Code of Federal Regulations (CFR) Parts 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004 Interim Final Rules).
- FEMA *How-To Guide for Using HAZUS-MH for Risk Assessment* FEMA Document No. 433, February 2004.
- FEMA *Mitigation Planning How-to Series* (FEMA 386-1 through 4, 2002), available at: http://www.fema.gov/fima/planhowto.shtm.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.
- NYS DHSES *Hazard Mitigation Planning Standard*, 2023.

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

Table 1-2. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Section 2.0; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 3.0
Documentation of opportunity for involvement of neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies, and other private and non-profit interests (44 CFR §201.6(b)(2))	Section 3.0
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Sections 5.2
Profiling Hazards: §201.6(c)(2)(i)	Section 5.4
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 5.4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 4.0 Section 5.4
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 5.4
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 4.0; Section 9 Annexes
Mitigation Strategy	
Existing authorities, policies, programs, and resources and ability to expand on and improve these existing policies and programs (44 CFR §201.6(c)(3))	Section 6; Section 9 Annexes
Participation in the NFIP and continued compliance with NFIP requirements, as appropriate (44 CFR §201.6(c)(3)(ii))	

Plan Criteria	Primary Location in Plan
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 6.0 Section 9 Annexes
Comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure (44 CFR §201.6(c)(3)(ii))	Section 6.0; Section 9 Annexes
Multi-Jurisdictional Mitigation Actions: : §201.6(c)(3)(iii)	Section 6.0; Section 9 Annexes
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7.0
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7.0; Section 9 Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7.0
Plan Update	
Revised to reflect changes in development? (44 CFR § 201.6(d)(3))	Section 4; Annexes
Revised to reflect changes in priorities and progress in local mitigation efforts? (Requirement 44 CFR § 201.6(d)(3))	Section 6; Annexes

Organization

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

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

Hazard Mitigation Plan Mission Statement, Goals, and Objectives

Mission Statement

In order to provide a guiding principle to describe the overall duty and purpose of the planning process and in accordance with FEMA guidance (386-1), the Warren County Hazard Mitigation Plan Steering Committee chose to develop a Mission Statement for this plan. The intent of this statement is to focus the range of goals and objectives identified to support the over-arching purpose of the plan.

As a result of the committee deliberations, the 2023 Warren County Hazard Mitigation Mission Statement is as follows:

> *The mission of the Warren County Hazard Mitigation Plan is to create communities whose daily activities reflect a comprehensive commitment by government, business, non-profit organizations, and the public to eliminate or reduce risks and adverse impacts from natural hazards.*

Goals and Objectives

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

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

While mitigation priorities have not significantly changed, the steering committee made minor updates in the goals and objectives to align with County priorities more closely.

2023 Warren County Hazard Mitigation Plan Goals

Goal 1: Protect Life and Property.

Goal 2: Increase Public Awareness

Goal 3: Provide for Emergency Services

Goal 4: Support comprehensive county and local mitigation through the integration of hazard mitigation planning into related state, regional, county, and local plans, and programs.

Goal 5: Encourage the development and implementation of long-term, cost-effective, and resilient mitigation projects to preserve or restore the functions of natural systems.

Goal 6: Address Long-Term Vulnerabilities from High Hazard Dams

Hazards of Concern

Warren County and participating jurisdictions reviewed the natural hazards that caused measurable impacts based on events, losses, and information available since the development of the 2017 Warren County HMP. Warren County and participating jurisdictions evaluated the risk and vulnerability due to each of the hazards of concern on the assets of each participating jurisdiction. Although the resulting hazard risk rankings varied for each jurisdiction, the summary risk rankings corresponded with that of Warren County and are indicated in each jurisdictional annex. The hazard risk ranks were used to focus and prioritize individual jurisdictional mitigation strategies.

Warren County HMP Hazards of Concern

Disease Outbreak/Pandemic

Earthquake

Extreme Temperatures

Flood (riverine, dam failure, flash, ice jam, beaver dam)

Dam Failure

Infestation/Invasive Species

Severe Storm (thunderstorm, hail, wind, tornado)

Severe Winter Weather

Wildfire

Plan Integration into Other Planning Mechanisms

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

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

1.1.4 Implementation of Prior and Existing Local Hazard Mitigation Plans

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

1.1.5 Implementation of the Planning Process

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

- Developed a Steering Committee and countywide planning partnership with municipalities and stakeholders,
- Reviewed the 2017 "Warren County Hazard Mitigation Plan",
- Identified/reviewed hazards that are of greatest concern to the community (hazards of concern) to be included in the update,
- Profiled these hazards,
- Estimated the inventory at risk and potential losses associated with these hazards,
- Developed appropriate hazard mitigation goals,
- Reviewed mitigation strategies identified in prior and existing local HMPS to indicate progress,
- Developed new mitigation actions to address reduction of vulnerability of hazards of concern,
- Involved a wide range of stakeholders and the public in the plan update process,
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NYS DHSES and FEMA.

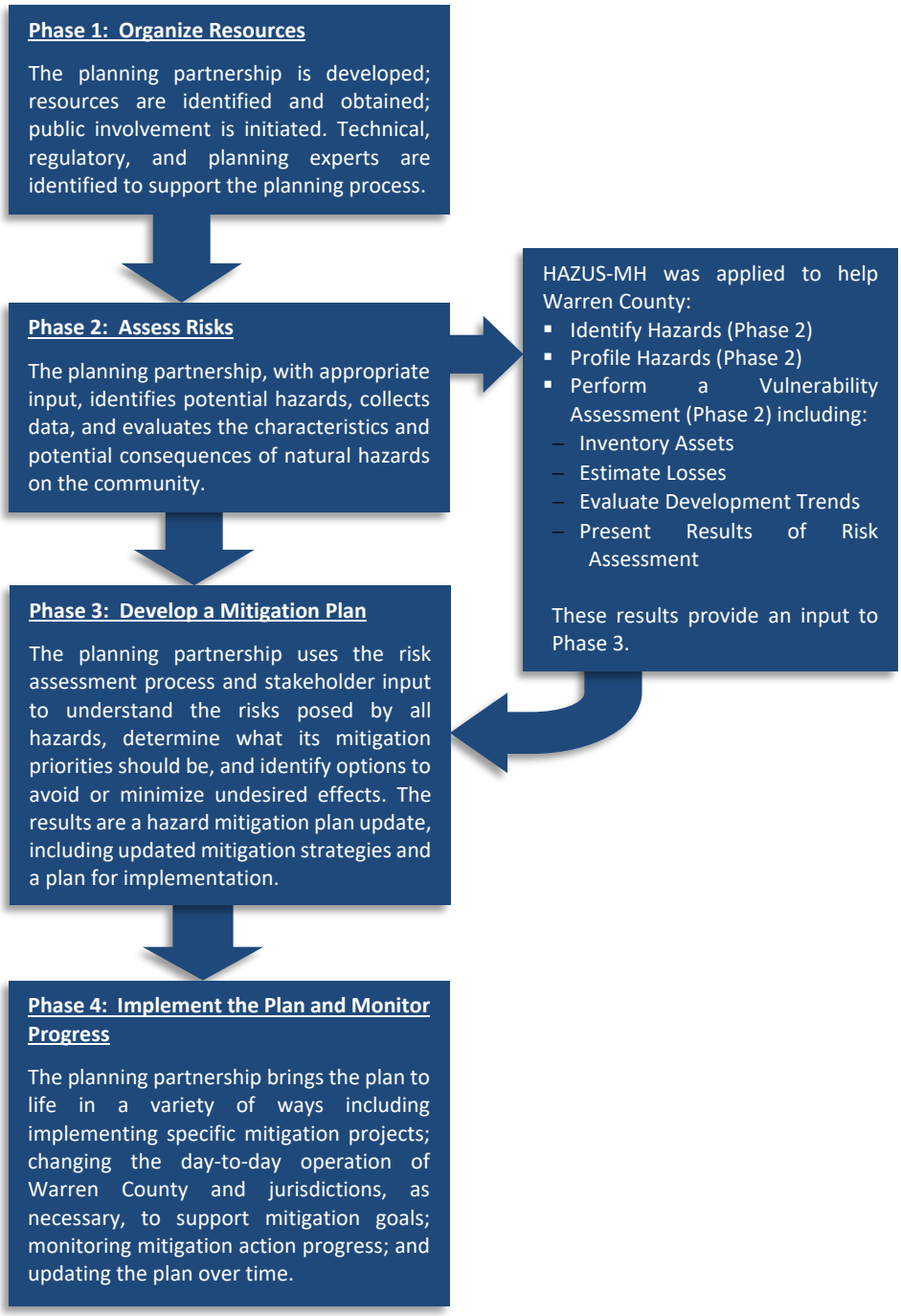
As required by DMA 2000, Warren County and participating jurisdictions have informed the public and provided opportunities for public comment and input. In addition, numerous agencies and stakeholders have participated as core or support members, providing input and expertise throughout the planning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

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

1.1.6 Organization of This Mitigation Plan

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

Figure 1-2. Warren County Hazard Mitigation Planning Process



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

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

Section 1: Introduction: Overview of participants and planning process.

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

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

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

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

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

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

Volume II of this plan includes the following sections:

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

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

Appendices include:

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

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

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

Appendix D: Participation Matrix

Appendix E: Action Worksheet Template and Instructions

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

Appendix G: Critical Facility Inventory

Appendix H: County Profile and Risk Assessment Supplementary Data: Details regarding past hazard events since those documented in the 2017 plan.

Appendix J: NYS DHSES Planning Standards: Includes planning standards and guidelines for hazard mitigation planning.

1.2 THE PLAN UPDATE – WHAT IS DIFFERENT?

FEMA approved Warren County's previous HMP in 2017 and all participating jurisdictions adopted the plan the same year. The 2023 update builds on the 2017 plan and specifically includes the following changes or enhancements. This plan differed from its predecessor for a variety of reasons:

1. This plan was prepared in accordance with the 2023 FEMA Hazard Mitigation and NYS DHSES guidance which provided a framework for a more concise and focused mitigation plan.
2. Updated data and tools provided for a more detailed and accurate risk assessment. Building footprint data was now available to provide a more accurate flood vulnerability assessment. The risk assessment was prepared to better support future grant applications by providing risk and vulnerability information that would directly support the measurement of "cost-effectiveness" required under FEMA mitigation grant programs.
3. The plan identified implementable actions rather than strategies, with enough information to serve as the basis for policy and funding decisions and represent measurable impacts on

resiliency and mitigation progress. Strategies provide direction, but actions are fundable under grant programs.

Table 1-3. Plan Changes Crosswalk

44 CFR Requirement	2017 Plan	2023 Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*	The 2017 plan followed an outreach strategy utilizing multiple media developed and approved by the Steering Committee. This strategy involved the following: • Public participation on an oversight Steering Committee. • Establishment of a plan informational website. • Press releases. • Use of a public information survey. Stakeholders were identified and coordinated with throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.	Building upon the success of the 2017 plan, the 2023 planning effort deployed the same public engagement methodology. The plan included the following enhancements: • Using social media. • Web-deployed survey. • Informational brochure. • After plan adoption, a Storymap will provide enhanced online accessibility for the public. • Public website specific to the HMP planning process. As with the 2017 plan, the 2023 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2017 plan included a comprehensive risk assessment of hazards of concern. Risk was defined as (probability x impact), where impact is the impact on people, property, and economy of the planning area. All planning partners ranked risk as it pertains to their jurisdiction. The potential impacts of climate change are discussed for each hazard.	A similar methodology, using new, updated data, was employed for the 2023 plan update. The 2023 risk ranking included the addition of two additional factors to provide a relative risk ranking of the hazards. These included climate change sensitivity and adaptive capacity.
§201.6(c)(2)(i): [The risk assessment] shall include a] description of the … location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2017 plan presented a risk assessment of each hazard of concern. Each section included the following: • Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability. • Impact and vulnerability on life, health, safety, general building	The same format, using new and updated data, was used for the 2023 plan update. Each section of the risk assessment includes the following: • Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability using the best available data for New York State.

44 CFR Requirement	2017 Plan	2023 Updated Plan
	stock, critical facilities, and economy. • Impact on people, property, critical facilities, and environment. • Future growth and development. • Additional data and next steps. • Overall vulnerability assessment.	• Vulnerability assessment includes impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. • The vulnerability assessment also includes changes in vulnerability since the 2017 plan. • Identified issues have been documented in each hazard profile.
§201.6(c)(2)(ii): [The risk assessment] shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.	Vulnerability was assessed for all hazards of concern. The HAZUS-MH computer model was used for the severe storm, earthquake, and flood hazards. These were Level 2 analyses using county data. Site-specific data on county-identified critical facilities were entered into the HAZUS-MH model. HAZUS-MH outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from HAZUS-MH-MH.	The same methodology was deployed for the 2023 plan update, using new and updated data.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.	A summary of NFIP insured properties including an analysis of repetitive loss property locations was included in the plan.	New and updated aggregate data is included in the 2023 plan. Due to privacy restrictions, locations of repetitive loss property locations have not been mapped..
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" for the planning area, and these were inventoried by exposure. Each hazard profile provides a discussion on future development trends.	The same methodology was deployed for the 2023 plan update using new and updated data and enhanced with the identification of lifeline facilities.
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern. These were generated by HAZUS-MH for the severe storm, earthquake, and flood hazards. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset	The same methodology was deployed for the 2023 plan update using new and updated data.

44 CFR Requirement	2017 Plan	2023 Updated Plan
	inventory. The asset inventory was the same for all hazards and was generated in HAZUS-MH.	
Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is an overview of anticipated development in the County profile. Each annex includes a listing of development since 2010 as well as projected development int eh next 5 years.	The same methodology was deployed for the 2023 plan update using new and updated data.
§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2017 plan contained a mission statement, goals, objectives, and actions. The mission statement, goals and objectives were regional and covered all planning partners. Each planning partner identified actions that could be implemented within their capabilities. The actions were jurisdiction-specific and strove to meet multiple objectives. All objectives met multiple goals and stand alone as components of the plan. Each planning partner completed an assessment of its planning, regulatory, technical, and financial capabilities.	The 2023 plan includes an updated mission statement goals and objectives. The Steering Committee reviewed and updated the mission statement, goals, and objectives for the plan. Each planning partner used the progress reporting from the plan maintenance and evaluated the status of actions identified in the 2017 plan. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2023 plan, and in some cases, new actions were added to the action plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Steering Committee identified goals, and objectives targeted specifically for this hazard mitigation plan. These planning components supported the actions identified in the plan.	The same methodology for setting goals, objectives, and actions was applied to the 2023 plan update. The Steering Committee reviewed and updated the mission statement, goals, and objectives for the plan to include a focus on increased resiliency. This resulted in the finalization of six goals and 21 objectives to frame the plan.
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	Concerted efforts were made to assure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013). Members of the Planning Committee and contract consultants worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their	A focused process was used to provide step-wise review of a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard. Each partner was mentored by the contracted planner and the County to review and enhance carry-over actions from the 2017 plan to provide a better foundation for funding and implementation. In addition, projects in all mitigation categories (Plans and Regulations, Structure and Infrastructure

44 CFR Requirement	2017 Plan	2023 Updated Plan
	annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).	Projects, Natural Systems Protection, and Education and Awareness actions were reviewed and considered when addressing problem statements identified by the partners or via public and stakeholder feedback. *Additional data regarding problem areas are included in annex mapping to support identification of effective mitigation actions.*
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners that participate in the NFIP identified an action stating their commitment to maintain compliance and good standing under the program.	Ongoing participation in the NFIP for municipalities is included in ongoing capabilities.
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each recommended action was prioritized using a methodology based on the STAPLEE criteria for the 2017 plan.	The same methodology based on the STAPLEE criteria but using new and updated data was used for the 2023 plan update.
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2017 plan details steps for monitoring, evaluating, and updating the mitigation plan set forth in *44 CFR § 201.6*.	The 2023 plan details a plan maintenance strategy enhancing that of the initial plan by use of a web-based proprietary progress reporting tool.
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2017 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2023 plan details recommendations for incorporating the plan into other planning mechanisms such as the following: • Comprehensive Plan. • Emergency Response Plan. • Capital Improvement Programs. • Municipal Code.
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2017 plan details a strategy for continuing public involvement.	The 2017 plan maintenance strategy was carried over to the 2023 plan. In addition, the County will use a proprietary online tool to support the annual progress reporting of mitigation actions.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body	The County and 13 planning partners participated in the 2017 planning process.	The 2023 plan achieves DMA compliance for the County and 13 planning partners. A list of partners who met the planning criteria for

44 CFR Requirement	2017 Plan	2023 Updated Plan
of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).		DMA compliance are included in Section 8 (Planning Partnership) of this plan. Resolutions for each partner adopting the plan will be in Appendix A of this volume.

SECTION 2. PLAN ADOPTION

2.2 OVERVIEW

This section contains information regarding adoption of the 2023 Warren County Multi-Jurisdictional Hazard Mitigation Plan by Warren County and each of its participating jurisdictions.

2.1 PLAN ADOPTION BY LOCAL GOVERNING BODIES

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

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

A sample resolution is included as Appendix A, Resolution of Plan Adoption. Subsequent to plan adoption, the resolutions of jurisdictions adopting the plan will also be included in Appendix A.

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

It lends authority to the plan to serve as a guiding document for all local and state government officials;

It gives legal status to the plan in the event it is challenged in court;

It certifies the program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' citizens; and

It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

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

SECTION 3. PLANNING PROCESS

3.1 INTRODUCTION

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

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

- The plan will be multi-jurisdictional, with the intention of including all municipalities in the county. Warren County invited all jurisdictions in the county to join with them in the planning process. All of the 13 local municipal governments in the County participated in the 2023 plan update process as indicated in Table 3-1 below.

Table 3-1. Participating Warren County Jurisdictions

Participating Jurisdictions		
Warren County	Hague (T)	Lake Luzerne (T)
	Horicon (T)	Queensbury (T)
Bolton (T)	Johnsburg (T)	Stony Creek (T)
Chester (T)	Lake George (T)	Thurman (T)
Glens Falls (C)	Lake George (V)	Warrensburg (T)

- The plan considers all-natural hazards facing the area, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000.
- The plan was developed following the process outlined by DMA 2000, FEMA regulations, and prevailing FEMA and NYS DHSES guidance. Following this process ensures that all the requirements are met and support the Plan review.
- The Warren County HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from municipal and regional agencies and staff as well as stakeholders, federal and state agencies, and the residents of the county. The HMP Steering Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events. In addition, the committees took into consideration planning and zoning codes, ordinances, and recent land use planning decisions. The hazard mitigation

strategies identified in this HMP have been developed through an extensive planning process involving local, county and regional agencies, residents, and stakeholders.

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

3.2 ORGANIZATION OF PLANNING PROCESS

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

3.2.1 Organization of Planning Partnership

Warren County applied for and was awarded a multi-jurisdictional planning grant under the HMPG Grant Program (EMN-2020-BR-063-0019), which has supported the development of this HMP.

Project management and grant administration has been the responsibility of the Warren County Department of Emergency Services – Office of Emergency Management with support from the Warren County Soil & Water Conservation District. A contract planning consultant (Tetra Tech) was tasked with:

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

In April 2022, the County notified all municipalities within the County of the pending planning process and invited them to formally participate. Jurisdictions were asked to formally notify the county of their intent to participate (via a Letter of Intent) and to identify planning points of contact to facilitate municipal participation and represent the interests of their respective communities.

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

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

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

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

The municipal planning partnership was charged with the following:

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

- Report on progress of integration of prior or existing HMPs into other planning processes and municipal operations;
- Develop and author a jurisdictional annex for their jurisdiction;
- Review, amend, and approve all sections of the plan update; and
- Adopt, implement and maintain the plan update.

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

Table 3-2. Warren County Hazard Mitigation Planning Partnership Members

Organization	Name	Title	Steering Committee Representative	POC	Alternate POC
Warren County	Ann Marie Mason	Director, Emergency Services	x	x	-
Warren County	Tammie DeLorenzo	Assistant to the County Administrator	x	x	-
Warren County	Ashley Rivers	Emergency Services Coordinator	x	x	-
Warren County	Sara Frankenfeld	GIS Coordinator	x	x	-
Warren County	Ethan Gaddy	WC Planner/Climate Smart	x	x	-
Warren County	Kevin Hajos	Superintendent, Department of Public Works	x	x	-
Finch Paper	Sandy LeBarron	Director of Environmental Health and Safety	x	x	-
Warren County Soil & Water Conservation District	Jim Lieberum, CPESC	District Manager/County Hazard Mitigation Coordinator	x	x	-
Town of Queensbury	Laura Moore	Planner, Town of Queensbury	x	x	-
Adirondack/Glens Falls Transportation Council	Aaron Frankenfeld	Staff Director. Adirondack/Glens Falls Transportation Council	x	x	-
Bolton, Town	Joshua Westfall, AICP	Planner		x	
	Richard Roman	Code Enforcement			x
Chester, Town	Craig Leggett	Supervisor		x	
	Larry Turcotte	Councilman			x
	Jeremy Little	Zoning Administrator			
	Jessica Leerkes	Town Engineer			
Glens Falls, City	Justin Reckner	Code Enforcement Officer		x	
	William Norton	Superintendent, Water & Sewer			x
	Kris Vanderzee	Code Enforcement Officer			

Organization	Name	Title	Steering Committee Representative	POC	Alternate POC
Hague, Town	Edna A. Frasier	Town Supervisor		x	
	Matthew Coffin	Deputy Highway Superintendent			x
	Matthew Magee	Zoning Administrator			
Horicon, Town	Michael N. Geraci	Supervisor		x	
	Darian Granger	Highway Superintendent			x
	Matthew Magee	Zoning Administrator			
Johnsburg, Town	Danae Tucker	Bookkeeper		x	
	Fred Comstock	Highway Superintendent			x
	Ernie Dunkley				
	Mike Dunkley	Deputy Highway Superintendent			
Lake George, Town	Dan Barusch	Planning and Zoning	x	x	
	Rob Lanfear	Highway Department			x
	Dan Barusch	Planning and Zoning		x	
Lake George, Village	Ray Perry	Mayor			x
	Keith Lanfear	Superintendent of Public Works			
	John Helms	DPW Foreman			
Lake Luzerne, Town	Eugene J. Merlino	Town Supervisor		x	
	Ronnie Deuel	Highway Superintendent			x
	Karen Putney	Zoning Officer			
Queensbury, Town	Laura Moore	Land Use Planner			
	John Strough	Town Supervisor		x	
	Craig Brown	Director of Planning and Zoning			x
	Dave Duell	Highway Superintendent			
	John O'Brien	Director of Building and Codes			
Stony Creek, Town	Frank E. Thomas	Supervisor		x	
	Ed Lowell, Jr.	Councilman			x
Thurman, Town	Deb Runyon	Supervisor		x	
	Patrick Wood	Highway Superintendent			x
	Thurman Town Board	Town Board			
Warrensburg, Town	James S. Hull	Code Enforcement Officer		x	
Warrensburg, Town	Kevin B. Geraghty	Town Supervisor			x

Notes: POC = Point of Contact; WC = Warren County

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

the jurisdictions, and the provision of additional and alternative mechanisms to meet the purposes and intent of mitigation planning.

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

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

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

3.2.2 Planning Activities

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

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

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

Table 3-3 presents a summary of planning activities and general project planning efforts conducted during the plan development process. It also identifies which DMA 2000 requirements the activities

satisfy. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) may be found in Appendix C.

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

Date	DMA 2000 Requirement	Description of Activity	Participants
-	1b, 2	County approves resolution to apply for FEMA mitigation planning grant	-
-	1b, 2	County conducts procurement process for contract planning support	-
9/16/2022	2	Project Start Up Meeting: Discuss proposed planning process and scope of work including documenting participation, schedule, and public and stakeholder outreach and involvement.	See Appendix C
	2	All municipalities invited to participate in the planning process.	-
	2, 3c	GIS data collection meeting	See Appendix C
Bi-weekly	-	B-weekly project status meeting to discuss action items in support of the expedited planning process	Ann Marie Mason, Jim Lieberum, Ashley Rivers
	1c, 2	Interested jurisdictions submit Letters of Intent to Participate in this planning process, acknowledging municipal participation requirements and identifying planning point(s) of contact.	See Appendix C
10/27/2022	1b, 2, 3a, 3b, 3c, 4a, 5c	Steering Committee Meeting #1: Review project schedule; review municipal participation, discuss municipal Kick Off meeting and local data collection; review and discuss sources and availability of county and regional data; discuss public and stakeholder outreach efforts.	See Appendix C
11/2/2022	1b, 2, 3a, 3b, 3c, 4a	Municipal Kick-Off Planning Partnership #1 Meeting: Complete overview of planning process, plan participant expectations, review of hazards and hazards of concern identification, discussion of data needs and data collection process explaining all provided worksheets (hard copy and on resource CD), discussion of public and stakeholder outreach efforts	County and municipal representatives and stakeholders. See Appendix C
11/16/2022		Municipal Homework Support Meeting: The purpose of the meeting was to provide an overview of information needed to update the local information for the Warren County Hazard Mitigation Plan (HMP) update.	County and municipal representatives See Appendix C
	2	Media Release	Public and Stakeholders
	2	Public project website developed: https://www.warrencountynewyorkhmp.com	Core Planning Team, Contract Planner
	2	Online Public Hazard Preparedness and Mitigation survey developed	Core Planning Team, Contract Planner

Date	DMA 2000 Requirement	Description of Activity	Participants
	2	Online Stakeholder Hazard Mitigation surveys developed	Core Planning Team, Contract Planner
12/14/2023		Steering Committee Meeting #2 Goals and Objectives Meeting: Purpose to confirm Hazards of Concern, Update Mission Statement, Goals and Objectives, and facilitate a SWOO.	See Appendix C
2/10/2023	1a, 3a, 3b, 3c, 3d	Steering Committee Meeting #3 Risk Assessment Meeting:	See Appendix C
2/15/2023	1a, 3a, 3b, 3c, 3d	Planning Partnership Meeting #2 Risk Assessment Meeting:	See Appendix C
3/8/2023		Steering Committee Meeting #4: Purpose to provide a brief progress report and address pending action items.	
3/15/2023	1a, 2, 4a, 4b, 4c	Mitigation Strategy Workshop	See Appendix D
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input- Bolton (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input- - Chester (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input-- Glens Falls (C)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input- - Hague (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input- - Horicon (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Johnsburg (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Lake George (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Lake George (V)	See Appendix D
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Lake Luzerne (T)	See Appendix C

Date	DMA 2000 Requirement	Description of Activity	Participants
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Queensbury (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Stony Creek (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Stony Creek (T)	See Appendix C
Via email and telecon – March/May, 2023	1b, 2, 3a-c, 3e	Local annex input - Warrensburg (T)	See Appendix D
6/2/2023	1b, 2, 3a-c, 3e	County Annex Meeting	AnnMarie Mason, Jim Lieberum, Tammy DeLorenzo, Ashley Rivers
6/7/2023	All requirements	Steering Committee Meeting	Steering Committee; Contract Planner See Appendix D
6/7/2023	All requirements	Steering Committee Meeting- Plan Maintenance, Draft Plan Review	Steering Committee; Contract Planner See Appendix D
	2	Draft Plan posted to public project website	Public and Stakeholders
	1b, 2	Public and stakeholder comments to Draft Plan received and incorporated in to Final Plan.	Public and Stakeholders
	All requirements	Final plan submitted to NYS DHSES and FEMA Region II	NYS DHSES, FEMA Region II
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating municipalities	All plan participants

Note: TBD = to be determined.

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

1a – Prerequisite – Adoption by the Local Governing Body

1b – Public Participation

2 – Planning Process – Documentation of the Planning Process

3a – Risk Assessment – Identifying Hazards

3b – Risk Assessment – Profiling Hazard Events

3c – Risk Assessment – Assessing Vulnerability: Identifying Assets

3d – Risk Assessment – Assessing Vulnerability: Estimating Potential Losses

3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends

4a – Mitigation Strategy – Local Hazard Mitigation Goals

4b – Mitigation Strategy – Identification and Analysis of Mitigation Measures
4c – Mitigation Strategy – Implementation of Mitigation Measures
5a – Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan
5b – Plan Maintenance Procedures – Implementation through Existing Programs
5c – Plan Maintenance Procedures – Continued Public Involvement

3.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

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

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

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

Federal Agencies

FEMA Region II: Provided updated planning guidance; provided summary and detailed NFIP data for planning area; attended meetings; conducted a Mitigation Strategy Workshop; conducted plan review.

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

National Weather Service (NWS): Source of data and information,.

National Oceanic and Atmospheric Agency (NOAA) – Coastal Resources Center: Source of data and information.

State Agencies

New York State Department of Homeland Security and Emergency Services (NYS DHSES: Headquarters and Region II): Administered planning grant and facilitated FEMA review; provided

updated planning guidance; attended meetings; attended workshops (e.g., hazard mitigation planning, updating mitigation strategies), provided review of Draft and Final Plan.

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

County and Regional Agencies, Commissions and Non-Profits

Warren County Soil and Water Conservation District (WC SWCD): Secured and administered FEMA planning grant, managed project, arranged and attended meetings, served on Steering Committee, provided data and information, facilitated, and supported public and stakeholder outreach, identified ongoing and potential mitigation projects and initiatives, reviewed draft and final plan sections.

Warren County Office of Emergency Services (WCOES): Supported WC SWCD with project management, served on Steering Committee, arranged and attended meetings, provided data and information, facilitated and supported public and stakeholder outreach, identified ongoing and potential mitigation projects and initiatives, reviewed draft and final plan sections.

Warren County Department of Planning and Community Development (WCDPCD): Served on Steering Committee, provided critical data and information, conducted GIS vulnerability assessment analysis and provided GIS mapping, reviewed progress on original mitigation strategy, identified new projects/initiatives, reviewed and provided input on draft and final plan sections.

Warren County Board of Supervisors: Project presented to the Board; various Board members provided direct input to the project, including potential mitigation projects and initiatives.

Warren County Department of Public Works (WCDPW): Provided data and information, reviewed progress on original mitigation strategy, identified new projects/initiatives, reviewed and provided input on draft and final plan sections.

Warren County Department of Parks, Recreation and Railroad (part of WCDPW): Surveyed for data on infestation events in the County

Warren County Department of Information Technology: Provided data and information; reviewed and provided input on specific hazard profiles; identified possible mitigation actions.

Warren County Sheriff's Office: Provided data and information; reviewed and provided input on specific hazard profiles.

Warren County Health Services: Provided data and information; reviewed and provided input on specific hazard profiles; identified possible mitigation actions.

Warren County Emergency Preparedness and Response Committee: Provided data and information; reviewed and provided input on specific hazard profiles; identified mitigation actions

Regional and Local Stakeholders

Please see Appendix B (Participation Matrix) for further details regarding regional and local stakeholder agencies. The stakeholders listed below were directly contacted by Warren County Soil and Water Conservation District / Warren County Office of Emergency Services to take a stakeholder survey which included the identification of specific mitigation actions/projects. Results of the surveys can be found in Appendix D (Public and Stakeholder Outreach). Stakeholders included a wide range of organizations and agencies including those who serve socially vulnerable and underrepresented populations.

Academia (School districts and other academic institutions): Municipalities directly involved school district representatives in the planning process, as identified in Appendix B. All school districts, higher education and many technical/vocational institutions were provided the stakeholder survey and invited to provide input, while some have identified specific mitigation actions/projects included in the County or local mitigation strategies. The following have provided direct input to the planning process:

- Lake George School District– Completed Survey
- Glens Falls City School District– Completed Survey
- Center for Disability Services , Prospect School– Completed Survey

Law Enforcement: Many municipalities directly involved police and other law enforcement representatives in the planning process, as identified Appendix B. Further, through the Warren County OES, all police departments and law enforcement agencies in the County were notified of the Stakeholder survey and invited to provide input, while some have identified specific mitigation actions/projects included in the County or local mitigation strategies. The following have provided direct input to the planning process:

- Warren County Sheriff's Office- Completed survey
- Glens Falls Police Department – Completed survey (multiple responses)

Hospitals and Health-Care Agencies/Facilities: The following hospitals and health-care facilities in the county were provided the stakeholder survey and invited to provide input, while some have identified specific mitigation actions/projects included in the County or local mitigation strategies. The following have provided input to the planning process:

- Warren County Health Services
- NYS Department of Health Glens Falls District Office
- Southern Adirondack Independent Living
- Glens Falls Hospital

Business and Commercial Interests (including Camps): Businesses and commercial interests in the county were provided the stakeholder survey and invited to provide input. The following have provided input to the planning process:

- Lake George Regional Chamber of Commerce & CVB– Completed survey
- Greater Glens Falls Transit– Completed survey

Private Non-Profit Organizations: The following private non-profit organizations have provided input to the planning process:

- Silver Bay, YMCA

Other:

- Warren/Hamilton Counties Office for Aging
- Warren County Parks Recreation & Railroad

Transportation

Adirondack / Glens Falls Transportation Council: Steering Committee member. Provided vulnerability information and supported update of mitigation strategy.

Public Works:

The following have provided input to the planning process via the stakeholder survey:

- Glens Falls Common Council– Completed survey

Vulnerable Populations:

The below listed agencies that work with and represent the vulnerable populations in Warren County were contacted to provide input to the planning process, to review the plan, and to utilize the plan as an ongoing resource.

Agency/Entity	Vulnerable Populations Served
Lake George School District	Youth
Glens Falls City School District	Youth
Center for Disability Services	Youth
Warren County Health Services	Elderly, Disabled, Low-Income, Non-English Speaking
NYS Department of Health Glens Falls District Office	Elderly, Disabled, Low-Income, Non-English Speaking
Southern Adirondack Independent Living	Elderly, Low Income

Glens Falls Hospital	Elderly, Disabled, Low-Income, Non-English Speaking
Adirondack / Glens Falls Transportation Council	Non-Car owners
Warren/Hamilton Counties Office for Aging	Elderly, Disabled, Low-Income, Non-English Speaking
Silver Bay, YMCA	Youth, Elderly, Disabled, Low-Income, Non-English Speaking

Adjacent Jurisdictions:

The County has made an effort to keep surrounding jurisdictions appraised of the project, and allowed the opportunity to provide input to this planning process via a survey and a request to review the draft plan. Specifically, the following adjoining county and state representatives were contacted in September 2022 to inform them about the availability of the project website, draft plan documents and surveys, and invited to provide input to the planning process:

- Essex County (NY)
  - Emergency Services
- Hamilton County (NY)
  - Department of Emergency Management
- Saratoga County (NY)
  - Sheriff's Office of Emergency Management
- Washington County (NY)
  - Department of Public Safety

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

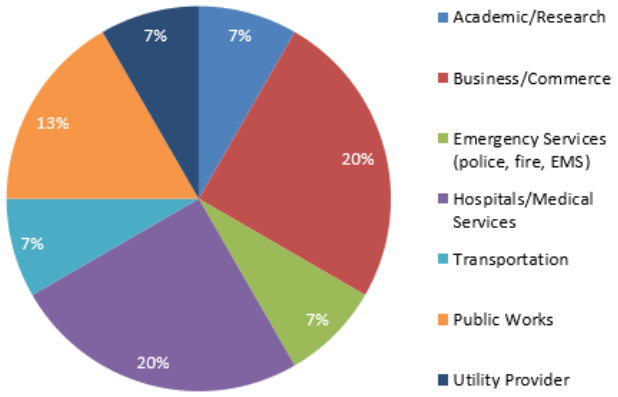
3.3.1 Stakeholder and Neighboring County Survey Summaries

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

Stakeholder Survey

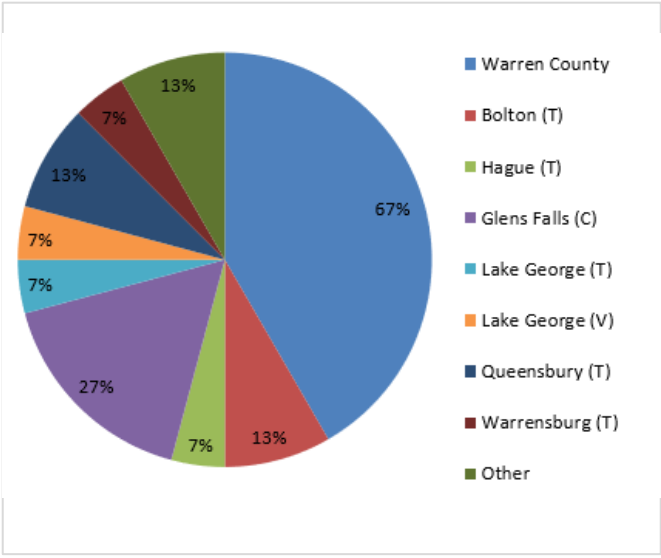
The stakeholder survey was designed to help identify general needs for hazard mitigation and resiliency within Warren County from the perspective of stakeholders, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including the various county and municipal departments and agencies in the County. On January 5, 2023, an email was transmitted to 132 county-identified stakeholders to gather information on hazard risks and to identify mitigation actions to increase resilience across the county. As of July 31, 2023, 15 stakeholders completed the survey, with 20% of respondents associated with the Business and Commerce sector and 20% of respondents associated with the Hospital and Medical Services sector as shown in Figure 3-1. Figure 3-2 details the service areas for the survey respondents, with 67 percent of the respondents from Warren County followed by 27% of respondents from the City of Glens Falls. Eight other communities also provided survey feedback.

Figure 3-1. Stakeholder Types



The Stakeholder Survey was broken down into 3 sections: Hazard and Damage Identification, Community Preparedness, and Project Identification, each detailed below. Survey results were shared with the Steering Committee and Planning Partnerships in scheduled meetings for consideration in the development of mitigation strategies.

Figure 3-2. Stakeholder Service Areas



Hazard and Damage Identification

39 percent of survey respondents indicated that buildings, facilities, or structures related to their organization have been impacted by a natural hazard.

In addition to providing feedback as to whether or not their facilities were damaged, stakeholders provided input as to which areas are believed to be the most vulnerable to natural hazards. The respondents identified the following hazards and impacts:

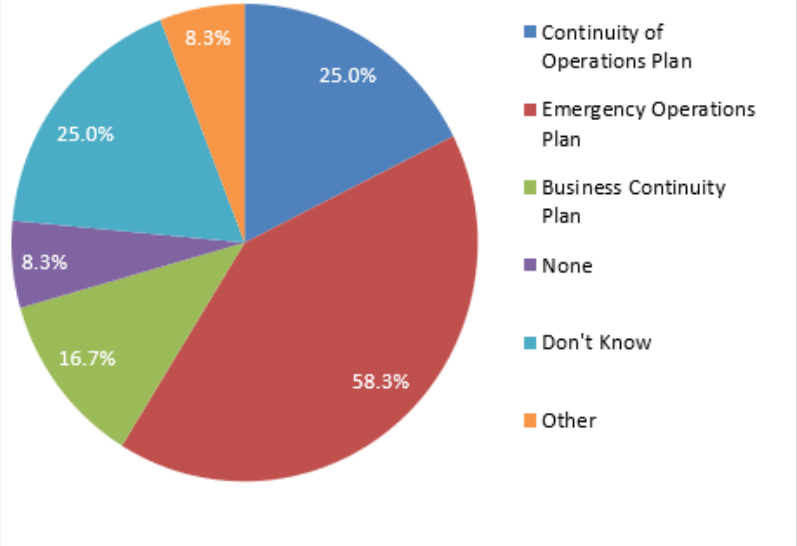
- Electric Substations and gas regulating stations. As we've all seen in the news with the recent vandalism with electric utility equipment, it is high on the priority list for our security teams.
- Salt mitigation to protect the lake. We currently use sand on the backside of our building/parking area and salt/sand mixture on the front. No other hazards as of this writing.
- Reliance on pre-identified municipal buildings and locations that are owned and maintained by City/Town municipalities for many of our activities.
- Our hub is the County Municipal Center. Vulnerabilities include fire, severe weather impacting the facility, loss of internet and utilities caused by weather or man-made factors
- Road hazards - downed trees, winter driving conditions
- Industry along the river and watershed
- Issues with downed trees blocking the bikeway.
- Ice jams and flooding impact the Fish Hatchery every spring.
- Severe storms
- Lake George has concerns with power outages, fallen trees, water supply concerns, and stormwater causing damage to roadways.
- The northern areas of the county near bodies of water are vulnearable to significant snow storms, wind storms, and rainfall.
- The administrative offices on Quade Street, West Notre Dame, and Shippey Avenue regularly have standing stormwater.

39% of respondents that believe their facilities are equipped to withstand natural disasters, while 8% of respondents do not believe that their facilities are equipped to withstand natural disasters. The remaining 53% stated that their facilities may be properly equipped, or they do not know.

Planning

Regarding continuity of operations, respondents were polled to identify which types of preparedness and continuity plans covered their facilities. The majority, 58.3% of respondents indicated that their organization has developed an emergency operations plan, while only 25% are covered by a continuity of operations plan and/or a business continuity plan as shown in Figure 3-4.

Figure 3-3. Types of Existing Plans



On respondent questions whether NYS Department of Health is making the impacts of climate change a priority in public health emergency preparedness planning and indicated a desire to

understand what steps are being taken to identify populations within Warren County to identify populations with access and functional needs so planning considerations can be made and gaps filled as funding becomes available.

Project Identification

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

- Tree Trimming program - each of our circuits are trimmed on 5-year cycles, that means every 5 years ""Main St in Queensbury"" will be inspected for danger trees and trimmed by one of our tree contractors.
- ***"Computapole"*** program - This is a program that has us inspect and get eyes on every piece of National Grid electric infrastructure throughout our territory. We identify potential hazards like rotting poles, broken or unbonded guy wires, blown lightening arrestors, or broken cross arms. Once they are reported, the issues are then sent to the field workers for repairs. This is also done in 5-year cycles for each of our circuits.
- We have a similar program for our gas distribution system regarding our Leak Prone Pipe program where we are replacing old cast iron mains and services with plastic. We have a gas corrosion team that inspects our pipelines to make sure they are still in spec.
- We were able to take advantage of the second round of PPP funding because of our 501c6 corporate status that helped us through the pandemic financially. Other strategies in the past have been to cut programs and not people to stay financially stable as an organization.
- Upgrading work from home opportunities if the facility is unusable, ensuring a suitable secondary location is available for staff that have to be in the office, providing funding to ensure IT and other equipment necessary to maintain operations is provided.
- Sewage treatment plant power project
- We have an emergency plan in place for fire, natural disasters and manmade disasters and we conduct drills.
- Frequent inspections of facilities and regular maintenance
- Improved stormwater management, additional power generators,

The respondents identified the below-listed projects recently implemented that were recently implemented to reduce vulnerability to hazard events:

- We are reworking our strategic plan and have begun a five-year financial look-back and a five-year forecast CAGR - (compound annual growth rate).
- None at a County level. Public Health initiatives to mitigate the impacts of a disaster have been undertaken as a requirement of the NYSDOH Office of Health Emergency Preparedness annual core deliverables which must be completed to receive funding from NYSDOH for the Warren County Public Health Emergency Preparedness program.
- SAIL has an internal emergency preparedness plan that we will exercise in the event of an emergency.
- Installation of an emergency back-up generator

- Storm water and sewage decoupling projects
- Frequent inspections of facilities and regular maintenance
- Installed manmade wetland to help manage stormwater and installed a limited number of generators to offset power losses.
- The Warren County Continuity of Operations Plan was implemented.

Neighboring County Survey

The neighboring county survey was sent to the surrounding counties of Warren due to their proximity to the county and because the effects of hazard events that impact Warren County would be similar to that of their neighbors. Saratoga County submitted 2 responses to the survey.

Emergency Operations and Continuity of Operations Planning

Saratoga County provided responses to the survey and provided the following information. They indicated that Warren County is involved in its community's comprehensive emergency operations planning, such as by participating on a planning team, or providing resources during an emergency. Specifically, they noted that Warren County was instrumental in helping Saratoga County develop many of its plans and that Warren County is a partner that could be asked for assistance in a variety of disasters.

Regarding emergency operations and disaster response, Saratoga County indicated that emergency Managers work together to respond to incidents and may work together to mitigate against incidents along shared vulnerabilities.

Regarding evacuations, the county noted that they collaborate with Warren County on establishing evacuation routes and alternate evacuation routes. The counties consult one another before making evacuation decisions that would impact one another (recommending evacuation routes into neighboring jurisdictions.

Regarding sheltering, the county noted that they consult one another before making sheltering decisions that would impact one another (recommending shelters in neighboring communities), and share spaces suitable for temporary housing including locations suitable to place temporary housing units to house residents displaced by a disaster.

Risk and Vulnerability

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

- Flooding along the Hudson - which serves as the boundary between a good portion our counties. Additionally, various incidents along the Northway. Also, large scale incidents (eg brush fire) along our rural border.

- The hazard mitigation plan, intercommunity communication often by the highway department leadership.
- Risks due to dams on common border.

Shared Hazards of Concern

Respondents provided comments about their answer to cross-collaboration projects and indicated that Warren County and Saratoga County share information regarding mitigation shared during the planning and implementation phases of the projects.

3.3.3 Public Outreach

In order to facilitate better coordination and communication between the Planning Committee and citizens and to involve the public in the planning process, it was determined that draft documents will be made available to the public through a variety of venues including printed and online format. Warren County engaged several agencies which provide support to a wide range of vulnerable populations including youth, elderly, low income, and socially vulnerable populations. In this manner the County deemed the public outreach to vulnerable populations effective as agencies that work with and represent the vulnerable populations in Warren County were contacted to provide input to the planning process, to review the plan, and to utilize the plan as an ongoing resource. This overall public outreach effort is intended to increase the likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of Warren County.

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

- The public was informed of the hazard mitigation planning effort commencement at the kick-off meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- The Warren County Office of Public Information distributed a media release to local news sources on December 9, 2022.
- An article was published in the Post Star on December 13, 2022.
- To inform the public and county agencies of the ongoing plan update effort, updates regarding the mitigation planning process have been made at county-wide meetings including those of the Local Emergency Preparedness Working Group.
- A public website is being maintained as another way to facilitate communication between the Steering Committee, planning partnership, public and stakeholders (https://www.warrencountynewyorkhmp.com). The public website contains a project overview, County and local contact information, access to the citizens survey and various stakeholder surveys, and sections of the HMP for public review and comment.

- All participating municipalities have been encouraged to distribute press releases on the project, including links to the project webpage and citizen and stakeholder surveys. Municipalities posting information and supporting online outreach include:
    - To be advised.
- The Warren County Office of Public Information included a request for public input in the weekly Warren County Update (via email).

Figure 3-5. Warren County HMP News Article (December 12, 2023)

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Warren County seeks input to update hazard mitigation plan

Post-Star staff report Dec 13, 2022 0

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Warren County is looking for public input as it updates its Multi-Jurisdictional Hazard Mitigation Plan, a document that details the potential hazards, such as storm-related conditions, that could affect residents and visitors.

The plan is an opportunity to detail a variety of potential hazards that might affect those who live in and visit Warren County. Ann Marie Mason, Warren County's director of emergency services, said that updating the plan allows the county and participating jurisdictions to be eligible for future mitigation funding from the Federal Emergency Management Agency.

"Public participation and feedback are a vital part of the hazard mitigation planning process," Mason said in a news release. "We ask that those who live in or visit Warren County take the brief online survey to detail any instances where they have experienced disaster or noted vulnerabilities, and their thoughts on changes that should be made."

- In order to facilitate coordination and communication between the Planning Committee and citizens and involve the public in the planning process, the Plan Update will be available to the public through a variety of venues.
- An on-line natural hazards preparedness citizen survey was developed to gauge household preparedness that may impact Warren County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. The questionnaire asks quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asks several demographic questions to help analyze trends.
- The survey questionnaire was posted on the County website on https://www.warrencountynewyorkhmp.com on December 9, 20, 22, 2022 and January 7, 12, and March 9, 2023 was available through June 6, 2023 for public input. All participating municipalities were requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (e.g. Facebook, Twitter, email blasts, etc.). The audience reach for Facebook, alone, was over 960 subscribers. Over 80 responses

were collected. A summary of survey results is provided later in this Section with full results provided in Appendix C of this plan.

- Specific stakeholder surveys were distributed to Academia, Fire Departments, EMS, Hospitals and Healthcare Organizations, Business and Commercial interests, Utilities and Law Enforcement stakeholders as detailed in the Stakeholder outreach subsection of this chapter. summary of survey results is provided later in this Section and full results provided in Appendix C of this plan.

- The Draft Plan was posted to the public website as of August 1, 2023, for public review and comment. All public comments were directed to the Warren County Planning Department for collection and review by the Steering Committee. All public comments received were forwarded to the appropriate jurisdiction and/or agency and incorporated into the final plan as appropriate.
- Once submitted to NYS DHSES/FEMA, the Final Plan will be available for public review and comment in the same manner and format as the Draft Plan, as well as in hard-copy format at the following as identified in Section 7, "Plan Maintenance".

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

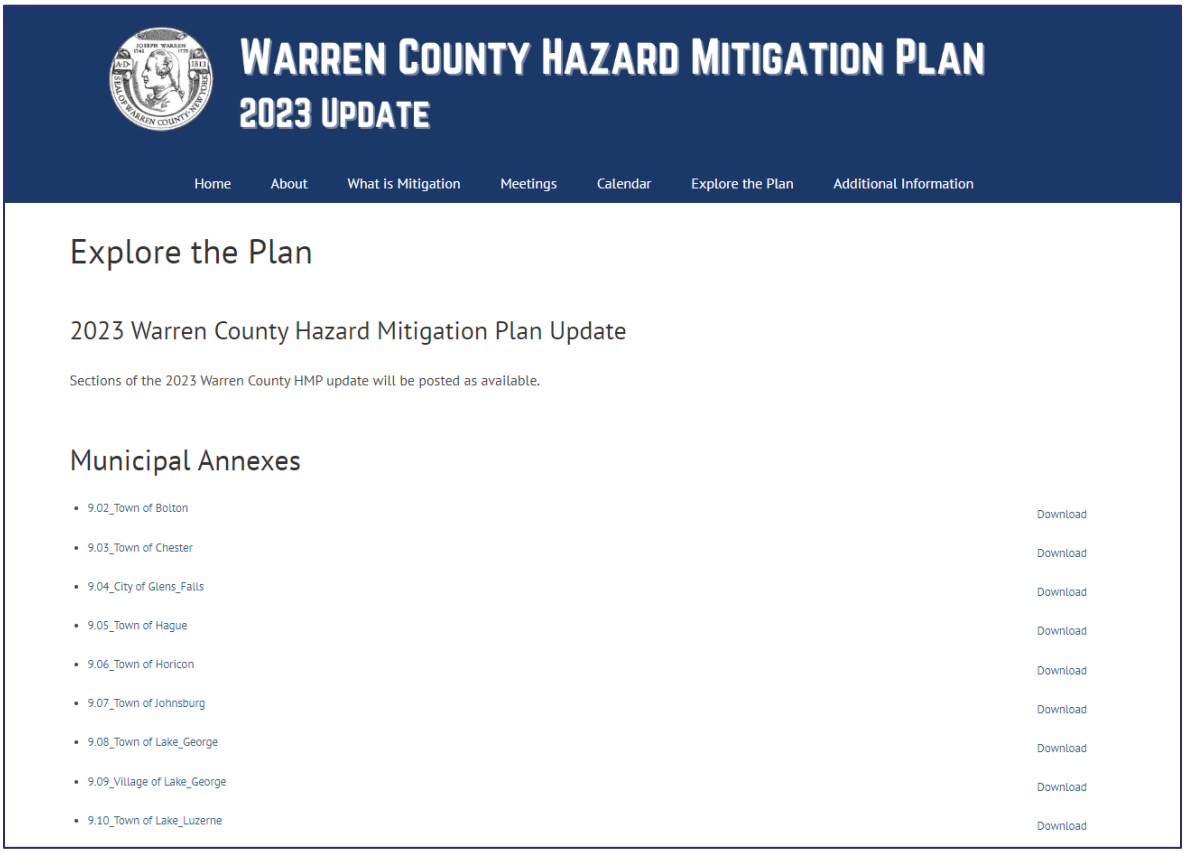
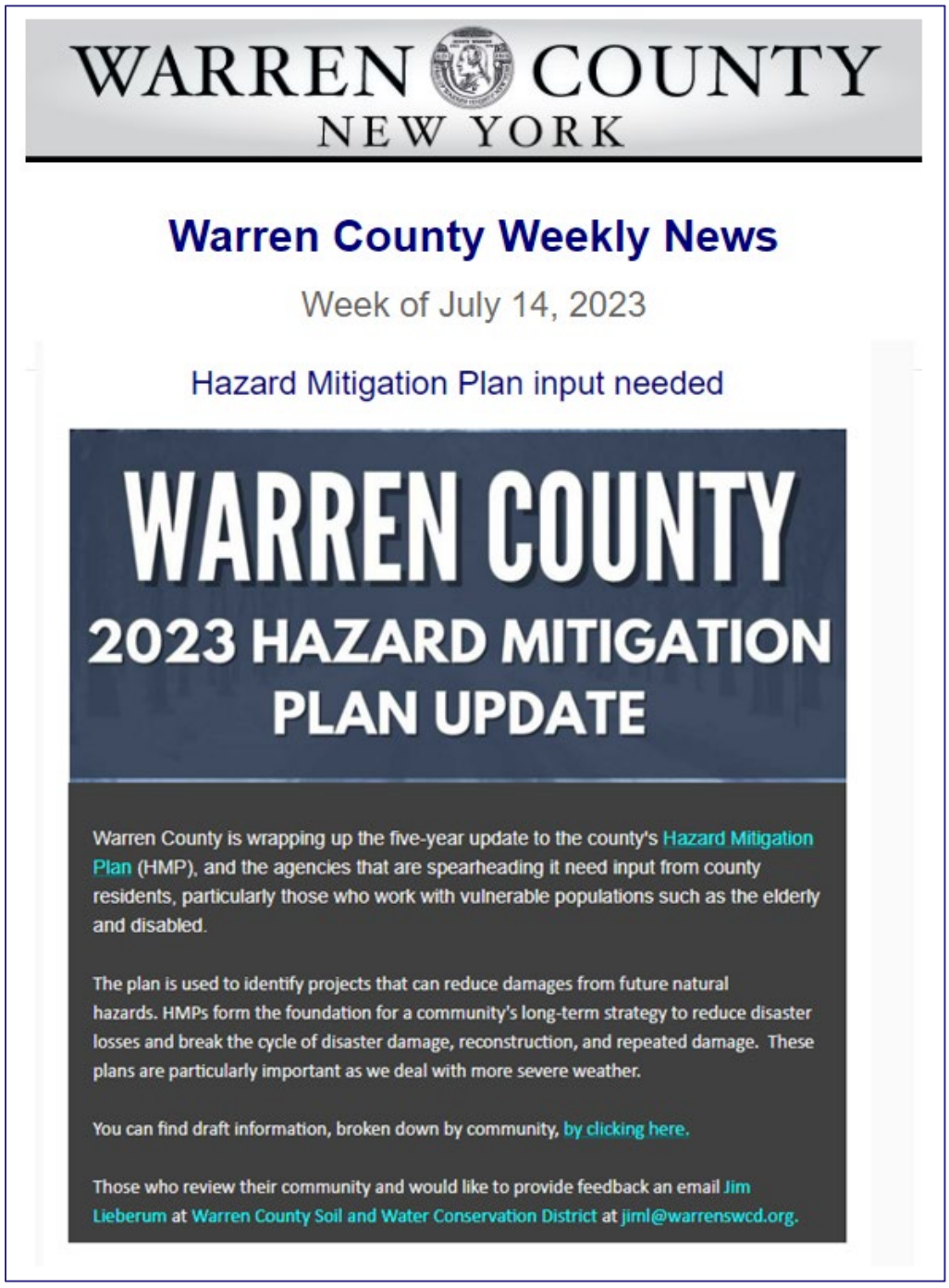


Figure 3-7. Warren County Newsletter – July 15, 2023



WARREN COUNTY
NEW YORK

Warren County Weekly News

Week of July 14, 2023

Hazard Mitigation Plan input needed

WARREN COUNTY
2023 HAZARD MITIGATION PLAN UPDATE

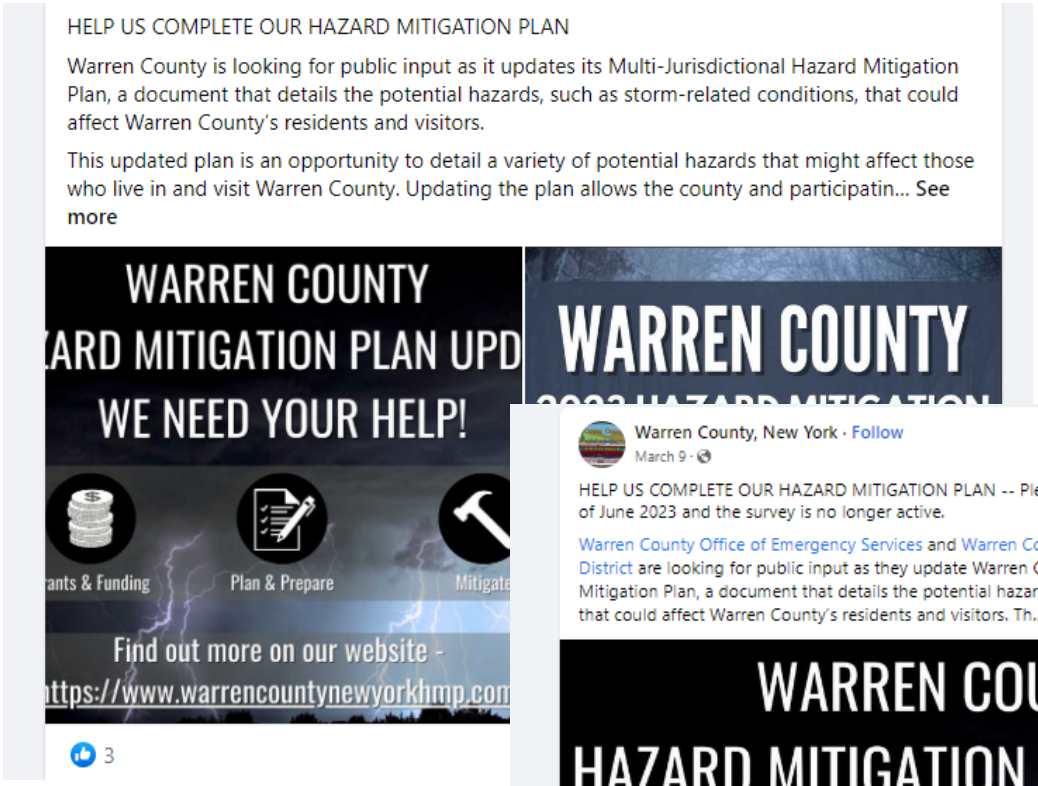
Warren County is wrapping up the five-year update to the county's Hazard Mitigation Plan (HMP), and the agencies that are spearheading it need input from county residents, particularly those who work with vulnerable populations such as the elderly and disabled.

The plan is used to identify projects that can reduce damages from future natural 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. These plans are particularly important as we deal with more severe weather.

You can find draft information, broken down by community, by clicking here.

Those who review their community and would like to provide feedback an email Jim Lieberum at Warren County Soil and Water Conservation District at jiml@warrenswcd.org.

Figure 3-8. Warren County Social Media Posts



Citizen Survey Summary

Those that live and work in Warren County were given the opportunity to be involved in the planning process. One opportunity was the citizen survey. As stated above, the survey was developed to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. It asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The County advertised the survey on their website and social media accounts. As of June 6, 2023, the survey received 81 responses.

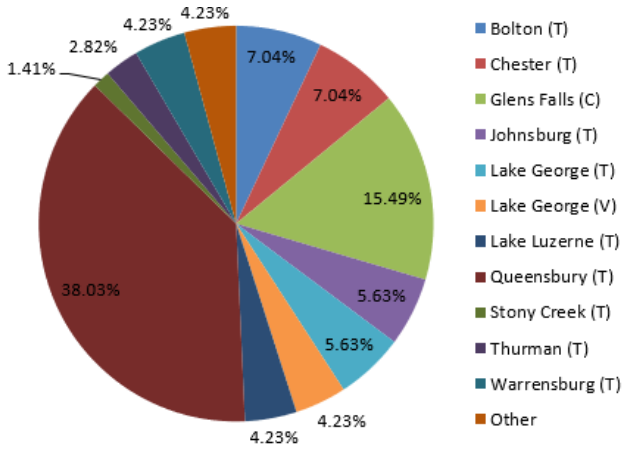
Most residents receive information concerning natural hazards through TV news (70.9%) or the internet (68.4%). 49% or respondents indicated that they receive hazard information from the county website.

Demographically, survey respondents were from 11 municipalities within Warren County, as seen in Figure 3-8, with 51.4% having lived in the county for 20 years or more, and the vast majority (85.9) in their own home. The most common (44.3%) age of respondents was over the age of 61. The majority (70.9%) of residents receive information concerning a natural hazard through television news. A similar number (68.4% receive information through the internet, and only (13.9%) receive information through Town/Village email.

Survey respondents identified the following as the top 5 most frequently occurring natural hazard events within Warren County in the past 10 years, as shown in Figure 3-3. Furthermore, respondents identified the highest hazards of concern (20% or more respondents reporting very concerned) as noted below.

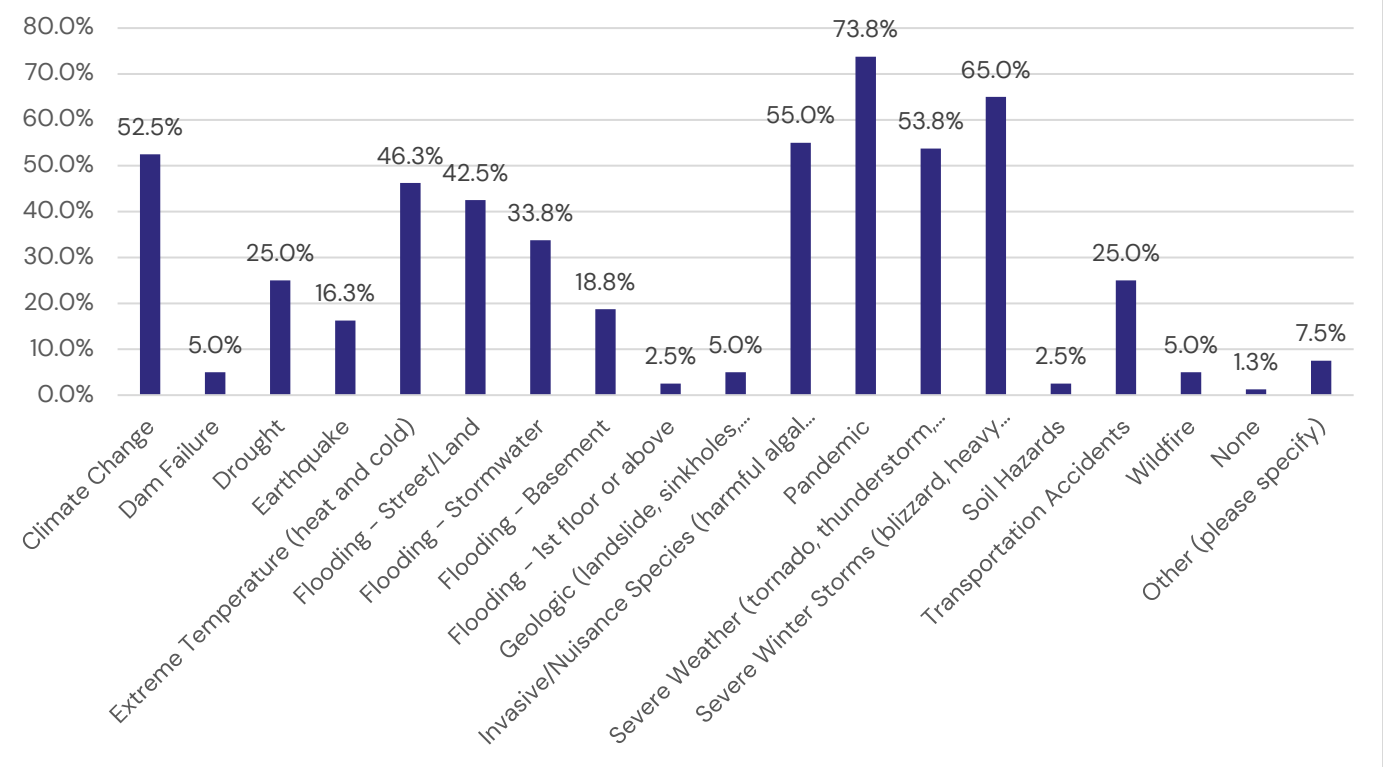
- Climate Change – (24%)
- Severe Storms – wind, lightning, hail (32.1%)
- Extreme temperature – heat and cold (23.7%)
- Flooding – urban flooding / stormwater issues (20.0%)
- Severe winter storms – blizzard, heavy snow, ice (28.2%)

Figure 3-8. Survey Respondent Municipalities



The highest hazards of concern (20% or more respondents reporting very concerned) include: Climate Change, Extreme Temperatures, Stormwater Flooding, Severe Weather, and Severe Winter Storms.

Figure 3-9. Most frequently experienced natural hazard events in Warren County



Respondents identified the following concerns regarding natural hazards:

- Inadequate shelters in case of emergencies.
- Removal of tree limbs that hang over NYS Route 9L.
- Receipt of real time alerts from Warren County similarly to FEMA.
- Requirement for each municipal government should be required to participate in this process to assess their community for potential hazards and develop a mitigation plan.
- Warren County needs to address and fix the drainage issues.
- Address climate change and algae blooms.
- Implement more projects that focus on climate change and taking care of our environment, such as adopt a highway and stream clean up days.
- Annual preparedness training at senior centers, at schools and in locations that citizens are encouraged to attend. create a citizen team to work with Emergency Management for Warren County.
- Improve accessibility for disabled people and Disaster Planning to include input from disabled people with various disabilities, including respiratory.
- Adjustment of on-site work and schedules requirements at county office buildings during severe winter storms to accommodate employees travel long distances to get to Warren County Municipal Center and should not have to use personal time in case of extreme weather.
- Review of runoff areas due to increase of extreme weather (heavy downpours and sudden storms).

Regarding investment in projects to reduce the impact of natural hazards, the three priority project categories are the following:

- Improve the damage resistance of utilities (electricity, communications, water/wastewater facilities etc.) (74.6%)
- Retrofit infrastructure, such as elevating roadways and improving drainage systems (65.7%)
- Replace inadequate or vulnerable bridges (55.2%)

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

3.4 INCORPORATION OF EXISTING PLANS, STUDIES, REPORTS AND TECHNICAL INFORMATION

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

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

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

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

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

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

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

Table 3-4. Record Review (Municipalities) - Record of the review of existing programs, policies, and technical documents for participating jurisdictions

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Lake Watershed Management Plan Addendum	August 2019	Regional
Lake Champlain Watershed Roadside Erosion Assessment and Inventory Update	2012	Regional

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Upper Hudson River Watershed Management Plan	March 2020	Regional
Friends Lake Watershed Assessment	October 2017	Regional
Lake Champlain Nonpoint Source Pollution Sub-Watershed Assessment and Management Plan	March 2018	Regional
Lake George HAB Plan 2022 Update	August 2022	Regional
Adopted Budget	2022	Warren County
Uniform Fire & Building Code	2007	Warren County
Comprehensive Emergency Management Plan	2022	Warren County
Climate Smart Report	Bronze Certified 5/28/2022	Warren County
MS4 Annual Report	2018	Warren County
Hazardous Materials Response Plan	21-Oct	Warren County
Hazardous Weather Annex	21-May	Warren County
Mass Care Plan Annex	2020	Warren County
CDBG 2021 Annual Report and COMP Plan	2021	Warren County
Warren County Soil & Water Conservation Districts 2021 Annual Report	2021	Warren County
Comprehensive Plan	*Currently under development*	Warren County
Excessive Heat Plan	2022	Warren County

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Upper Hudson River Watershed Management Plan	20-Mar	Warren County
LC Nonpoint Source Pollution Watershed Assessment and Management Plan	18-Mar	Warren County
Warren County - Dam Risk into Local HMG Plans	2021	Warren County
Building Code	-	Town of Bolton
Flood Prevention	-	Town of Bolton
2023 Budget	2023	Town of Bolton
Waterfront Review Law	2018	Town of Bolton
Water Dept Rules and Regulations	2010	Town of Bolton
Comprehensive Plan 2003	2003	Town of Bolton
Zoning, Subdivision of Land. Stormwater Regulations	-	Town of Bolton
Lake Champlain Watershed Roadside Erosion Assessment	2012	Bolton (T), Hague (T), Lake George (T), Queensbury (T)
Lake George HAB Plan 2022 Update	August 2022	Lake George (T), Bolton (T)
Budget 2022	2022	Town of Chester
Community Forest Master Plan	-	Town of Chester
Flood Damage Prevention	-	Town of Chester
Floodplain Development Permit	-	Town of Chester
Loon Lake Watershed Report 2021	2021	Town of Chester
Master Plan	2002	Town of Chester
Pedestrian Improvement Plan	June 2021	Town of Chester
Shoreline Cutting Restrictions	-	Town of Chester

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Shoreline Regulations	2005	Town of Chester
Subdivision Regulations	2012	Town of Chester
Zoning Law	2019	Town of Chester
Schroon Lake Watershed Management Plan Addendum	2019	Town of Chester
Friends Lake Watershed Assessment	17-Oct	Town of Chester
Loon Lake Watershed Report	21-Nov	Town of Chester
2020-2024 CDBG Con Plan & Action Plan	2020	City of Glens Falls
Building Code Admin	-	City of Glens Falls
Climate Smart Report	2021	City of Glens Falls
Flood Damage Prevention	-	City of Glens Falls
Sewer and Water Regulations	-	City of Glens Falls
Site Alteration Regulations	-	City of Glens Falls
Subdivision of Land	-	City of Glens Falls
Trees Regulations	-	City of Glens Falls
Zoning	-	City of Glens Falls
Building Construction	-	Town of Hague
Drainage Ditches	1990	Town of Hague
Flood Damage Prevention	1996	Town of Hague
Subdivision of Land	1977	Town of Hague
Zoning	1977	Town of Hague
2023 Budget	2023	Town of Hague
2010 Comprehensive Plan	2010	Town of Hague
Environmental Assessment Form	2012	Town of Horicon
First Wilderness Plan 2019	2019	Town of Horicon

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Subdivision Regulations	1989	Town of Horicon
Zoning Law 2016	2016	Town of Horicon
2021 Water Quality Report	2021	Town of Johnsburg
Comprehensive Plan	2005	Town of Johnsburg
North Creek Sewer District Report	-	Town of Johnsburg
Water District Regulations	2010	Town of Johnsburg
Zoning Law	2007	Town of Johnsburg
2005 Lake George Recreation Study Plan	2005	Town of Lake George
2009 LG Watershed Stream Assessment Plan	2006	Town of Lake George
2013 A GFTC Transportation Plan	2013	Town of Lake George
2013 LG Aquatic Invasive Species Plan	2013	Town of Lake George
2015 Fate of the Lake Plan	2015	Town of Lake George
2015 Stormwater Plan	2015	Town of Lake George
2018 LG Economic Development Plan	2018	Town of Lake George
2020 MS4 Report	2020	Town of Lake George
Climate Smart Report - Web Site	-	Town of Lake George
Comprehensive Plan Appendices	2016	Town of Lake George
Comprehensive Plan	2016	Town of Lake George
Environmental & Historic Preservation	1972	Town of Lake George
Fire Prevention & Building Construction	1984	Town of Lake George
Flood Damage Prevention	1996	Town of Lake George
Solid Waste Regulations	1990	Town of Lake George
Subdivision of Land	1978	Town of Lake George

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Water Regulations	1988	Town of Lake George
Water District Improvements Report	-	Town of Lake George
Zoning	2018	Town of Lake George
Building Construction	2018	Village of Lake George
Climate Smart Report	-	Village of Lake George
Development Moratorium	2010	Village of Lake George
Fire Prevention	1977	Village of Lake George
Flood Damage Prevention	1996	Village of Lake George
MS4 Annual Report	2022	Village of Lake George
Property Maintenance	2009	Village of Lake George
Sewers	1973	Village of Lake George
Storm Sewer System	2016	Village of Lake George
Stormwater Management Plan	2014	Village of Lake George
Streets and Sidewalks	2011	Village of Lake George
Tree Regulations	2021	Village of Lake George
Water Regulations	1992	Village of Lake George
Water Report	-	Village of Lake George
Zoning	2005	Village of Lake George
Adopted Budget	2022	Town of Queensbury
Building Requirements	-	Town of Queensbury
Capital Projects	2022	Town of Queensbury
Climate Smart Report	-	Town of Queensbury
Comprehensive Plan	2007	Town of Queensbury
Flood Damage Prevention	1996	Town of Queensbury
Freshwater Wetlands	1976	Town of Queensbury
Local Law Water, Sewer	1970	Town of Queensbury
MS4 Annual Report	2022	Town of Queensbury
Queensbury Sewer Consolidation	2021	Town of Queensbury
Stormwater Management Plan	2012	Town of Queensbury

Existing plan, program or technical documents	Date of Document	Jurisdictional Applicability
Subdivision of Land	2010	Town of Queensbury
Water Regulations	1970	Town of Queensbury
Zoning - Subdivision Review	1992	Town of Queensbury
Zoning	2009	Town of Queensbury
2023 Budget	2023	Town of Stony Creek
2022 Budget	2022	Town of Thurman
Subdivision Regulations	-	Town of Thurman
Comprehensive Plan	2012	Town of Warrensburg
Annual Drinking Water Quality Report	2021	Town of Warrensburg
Town Code 2014 Section 1	2014	Town of Warrensburg
Town Code 2014 Section 2	2014	Town of Warrensburg
Town Code 2014 Section 3	2014	Town of Warrensburg
Town Code 2014 Section 4	2014	Town of Warrensburg
River Street Streetscape Revitalization Plan	2015	Town of Warrensburg

Notes: T = Town, V = Village

3.5 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

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

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

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

3.6 CONTINUED PUBLIC INVOLVEMENT

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

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

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

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

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

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

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

Jim Lieberum, District Manager of the Warren County Soil & Water District has been identified as the ongoing County All-Hazard Mitigation Plan Coordinator (see Section 7), and is responsible for receiving, tracking, and filing public comments regarding this Plan Update.

Contact information:

Mailing Address: 394 Schroon River Road, Warrensburg NY 12885

Email Address:	jiml@warrenswcd.org
Telephone:	518.623.3119

SECTION 4. COUNTY PROFILE

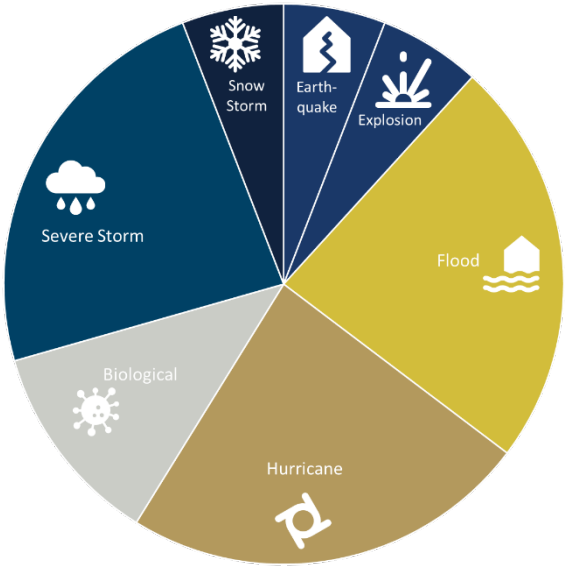
This profile describes the general information of the County (physical setting, population and demographics, general building stock, and land use and population trends) as well as critical facilities located within Warren County. In Section 5, specific profile information is presented and analyzed to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

4.1 GENERAL INFORMATION

Warren County is located in the northeastern part of New York State. It is bounded on the east by Lake George and Washington County, to the west by Hamilton and Saratoga Counties, to the north by Essex and Hamilton Counties, and to the south by Saratoga County (Warren County 2016).

Warren County was formed in 1813 from Washington County. The County is included in the Glen Falls Metropolitan Statistical Area. Warren County consists of 13 municipalities, covering 932 square miles and estimated population of 65,737 (Census 2020). The County is one of the 62 counties in New York State and is comprised of one city, 11 towns, and one incorporated village. As of the 2020 Census, Warren County is the 38th most populated County in the State and ranks 25 in total land area.

The County contains 11 town governments, 1 city government, 1 village government, and the County government. State and federal government statutes and regulations control how the local governments operate. Local governments include the city of Glen Falls; the towns of Bolton, Chester, Hague, Horicon, Johnsburg, Lake George, Lake Luzerne, Queensbury, Stony Creek, Thurman, and Warrensburg; and the village of Lake George. The County and each municipality operate under the limits prescribed by various rules and laws of New York State. Each government entity has various responsibilities, funding sources, staffing levels, elected positions, and administrative capacities (Warren County 2016).



4.2 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A

presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 4-1 lists the Federal Emergency Management Agency (FEMA) disaster declarations that included Warren County through December 2022 (records date back to 1954).

Table 4-1. Federal Disaster Declarations in Warren County, New York (1954 to 2022)

Disaster Number	Event Date(s)	Declaration Date	Incident Type	Title
DR-515-NY	July 21, 1976	July 21, 1976	Flood	Severe Storms & Flooding
EM-3107-NY	March 13-17, 1993	March 17, 1993	Snowstorm	Severe Blizzard
DR-1095-NY	January 19-30, 1996	January 24, 1996	Flood	Severe Storms and Flooding
DR-1296-NY	September 16-18, 1999	September 19, 1999	Hurricane	Hurricane Floyd Major Disaster Declarations
EM-3155-NY	May 22 - November 1, 2000	October 11, 2000	Other	West Nile Virus
DR-1391-NY	September 11, 2001	September 11, 2001	Fire	Fires and Explosions
DR-1415-NY	April 20, 2002	May 16, 2002	Earthquake	Earthquake
EM-3186-NY	August 14-16, 2003	August 23, 2003	Other	Power Outage
DR-1534-NY	May 13 – June 17, 2004	August 3, 2004	Severe Storm	Severe Storms and Flooding
DR-1564-NY	August 13 - September 16, 2004	October 1, 2004	Severe Storm	Severe Storms and Flooding
EM-3262-NY	August 29 - October 01, 2005	September 30, 2005	Hurricane	Hurricane Katrina Evacuation
DR-1899-NY	March 13-31, 2010	April 16, 2010	Severe Storm	Severe Storms and Flooding
DR-1993-NY	April 26 - May 8, 2011	June 10, 2011	Flood	Severe Storms, Flooding, Tornadoes, and Straight-Line Winds
DR-4020-NY	August 26 - September 5, 2011	August 31, 2011	Hurricane	Hurricane Irene
EM-3351-NY	October 27 - November 8, 2012	October 28, 2012	Hurricane	Hurricane Sandy
DR-4129-NY	June 26 - July 10, 2013	July 12, 2013	Flood	Severe Storms and Flooding
DR-4472-NY	October 31 - November 1, 2019	December 19, 2019	Severe Storm	Severe Storms, Straight-Line Winds, and Flooding
EM-3434-NY	January 20, 2020 - May 11, 2023	March 13, 2020	Biological	Covid-19
DR-4480-NY	January 20, 2020 - May 11, 2023	March 20, 2020	Biological	Covid-19 Pandemic

Source: FEMA 2023

4.3 PHYSICAL SETTING

This section presents the physical setting of Warren County, including its location, topography, hydrography and hydrology, climate, and land use and land cover.

4.3.1 Location

Warren County is located in the mountainous Adirondack Region of New York State, with 96-percent of the County is within the Adirondack State Park. It is a popular tourist destination due to its many lakes and recreational activities. The County's largest population centers include the City of Glens Falls and the Town of Queensbury.

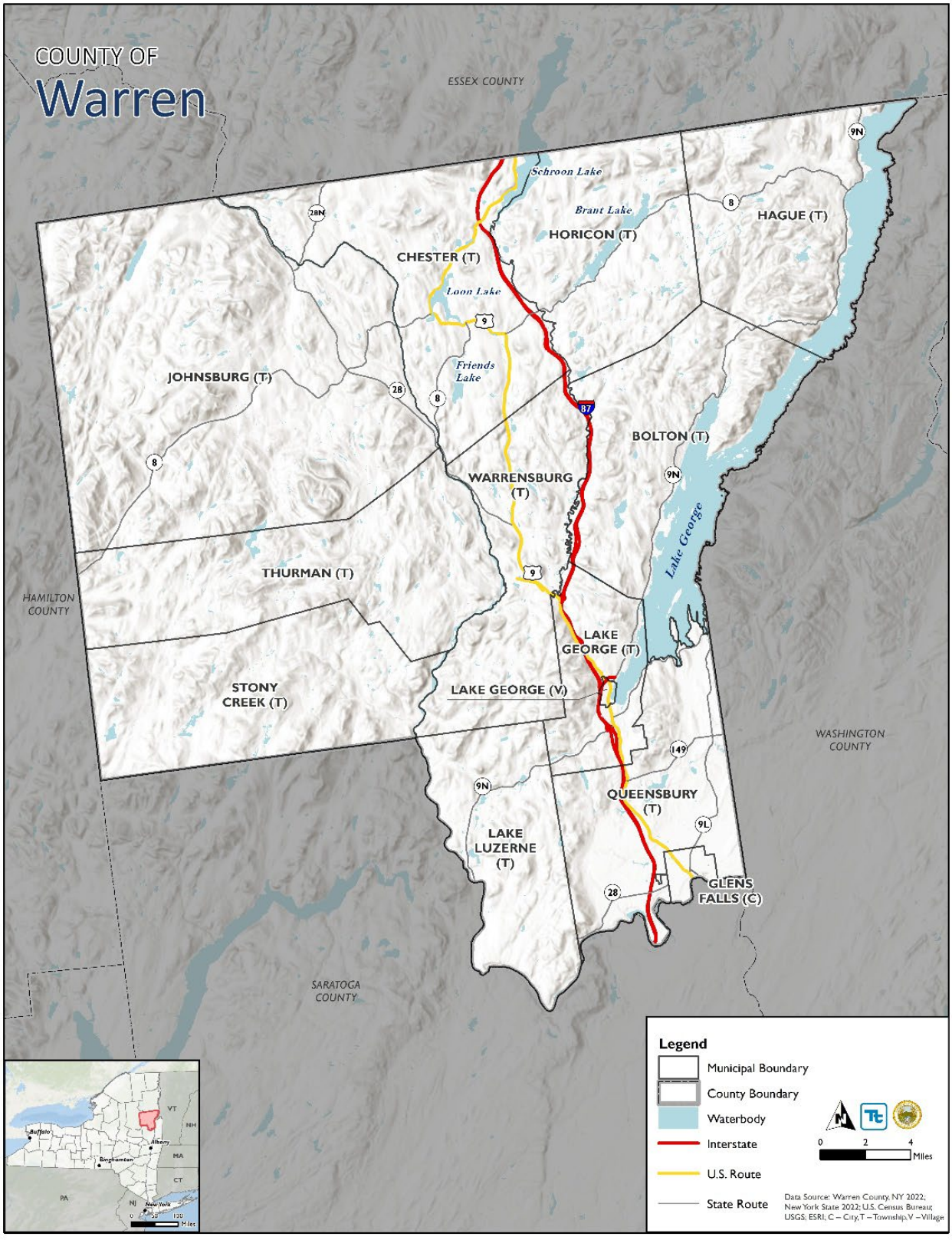
4.3.2 Topography and Geology

. . The County lies mainly within the Adirondack physiographic province, though the far southeast corner does lie within the Ridge and Valley province (CARA 2002). The two provinces are distinguished by the sharp contrast in topography and bedrock. The contrast was caused by down-faulting of the mountains to the north and erosion of the limestone in the south (USDA SCS 1989). Elevations in the mountainous areas of the County typically range from 1,200 to 2,500 feet above sea level, with the top of Gore Mountain (the highest point in the County) reaching 3,583 feet. The lowland areas typically vary by less than 100 feet in elevation (USDA SCS 1989).

Geology in the Ridge and Valley province consists of sandstone and sedimented carbonates (e.g., limestone, dolomite), formed by an advancing sea and subsiding continental margin between the Paleozoic and Ordovician ages (USDA SCS 1989). The Adirondack province consists mostly of pre-Cambrian metamorphic rock, generally quartzofeldspathic gneiss (quartz and feldspar) overlain by marble, quartzite, and anorthosite (USDA SCS 1989).

The topography, soils, and drainage of the County have been significantly influenced by repeated periods of glaciation during the Pleistocene Epoch (USDA SCS 1989). Glaciers advanced through the valleys, gouging them and increasing the topographic relief. As the ice thickened, it covered the hills and rounded the County's peaks and ridges. The several-thousand-feet-thick ice created sag in the Earth's crust, which resulted in the land tilting to the north. This, in turn, impacted the formation of lakes and the County's drainage system.

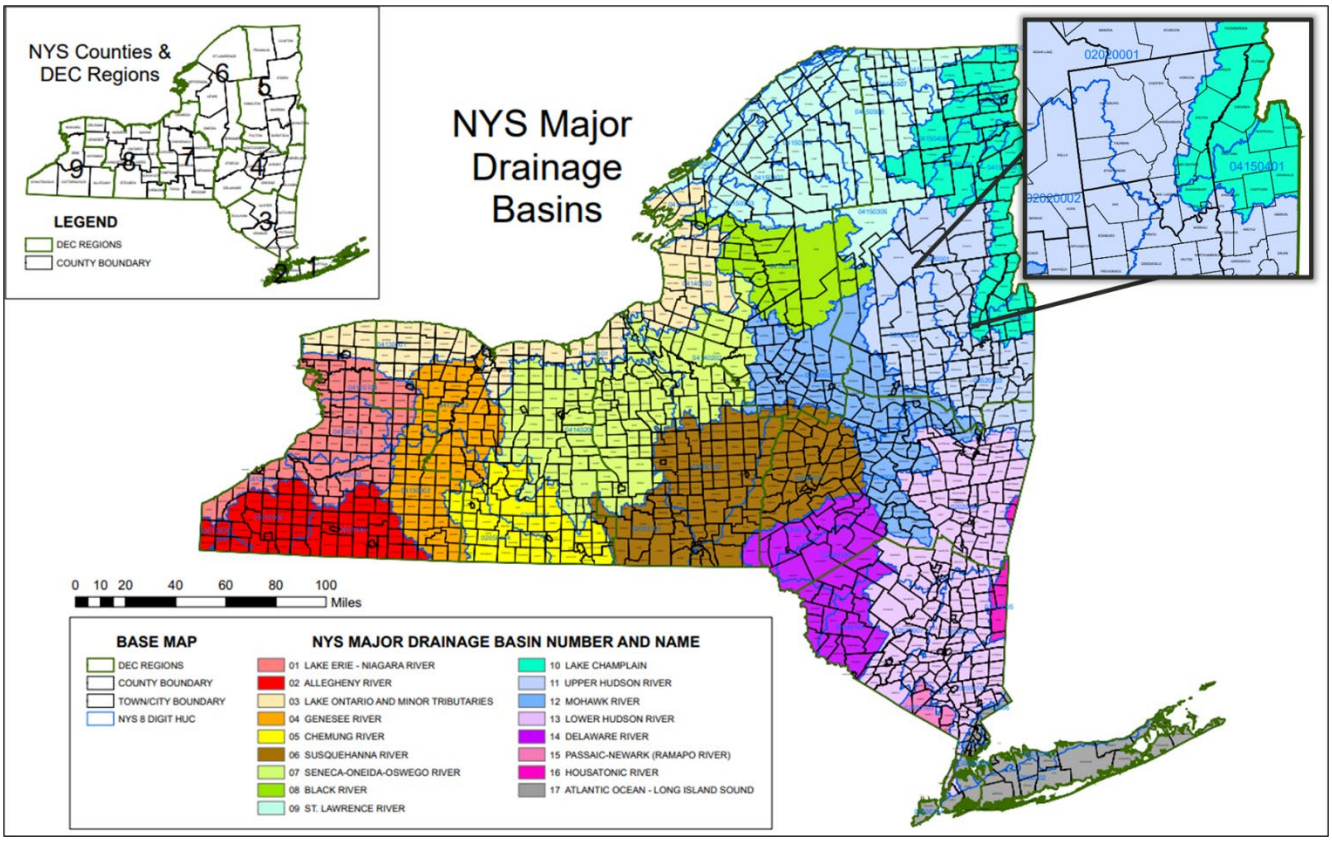
Figure 4-1. Site Location Map of Warren County



4.3.3 Hydrography and Hydrology

Numerous ponds, lakes, creeks, and rivers make up the waterscape of Warren County. The major waterways within the County include Lake George, Schroon Lake, Hudson River, Brant Lake, Schroon River, Loon Lake, Glen Lake, 13th Lake, Garnet Lake, Trout Lake, Harrisburg Lake, Lake Luzerne. The County border also goes around Schroon Lake in the north. Figure 4-2 shows the drainage basins and watersheds located in New York State, and Warren County's location.

Figure 4-2. Location of Warren County in Relation to Drainage Basins in New York State



Source: NYSDEC 2012
Note: Warren County's approximate location is shown by the red oval.

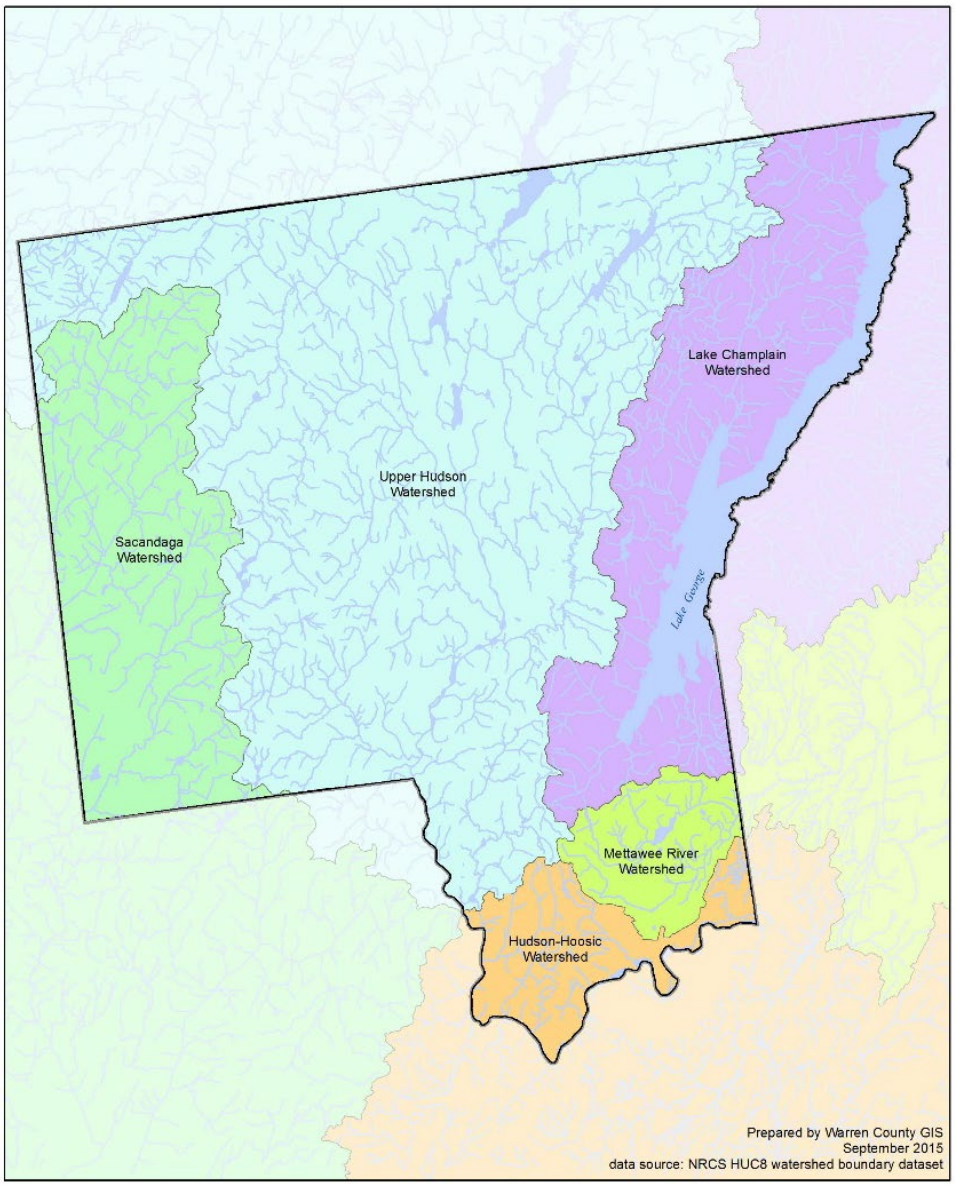
The County lies within the Upper Hudson River and Lake Champlain drainage basins as described below.

- Upper Hudson Drainage Basin makes up approximately one-third of the larger Hudson River Basin, which also includes the Mohawk River Watershed. The Upper Hudson Drainage Basin begins in the Adirondack Mountains and drains to the Troy Dam at the confluence of the Mohawk River. This watershed covers 4,620 square miles of land in New York State and contains 7,140 miles of freshwater rivers and streams. There are 229 significant freshwater lakes, ponds and reservoirs located within the Drainage Basin that include: the Great Sacandaga Lake, Indian Lake, Schroon Lake, and Saratoga Lake (NYSDEC 2015).

- Lake Champlain Drainage Basin drains over 8,200 square miles (3,050 square miles in New York) of land between the Adirondack Mountains in New York and the Green Mountains in Vermont. It contains nearly 4,900 miles of freshwater rivers and streams. There are 235 significant freshwater lakes, ponds, and reservoirs located within the Drainage Basin that include: Lake George, Upper Saranac Lake, Lower Saranac Lake, and Lake Placid (NYSDEC 2015).

The drainage basins are further divided into watersheds. Figure 4-3 shows the watersheds within Warren County. The Sacandaga Watershed, Upper Hudson Watershed, and Hudson-Hoosic Watershed are within the Upper Hudson Drainage Basin. The Mettawee River Watershed is within the Lake Champlain Drainage Basin.

Figure 4-3. Watersheds in Warren County



4.3.4 Climate

Warren County has a continental climate. Airflow and weather systems that affect the area are primarily of continental origin. The climate also is designated as humid because the major circulation patterns of the atmosphere carry generous quantities of moisture toward the northeastern U.S. (NRCS 2004). The climate of Warren County is one of long summers and short winters. The average annual temperature is approximately 40-48°F, with extremes varying from -35°F to 100°F. The average annual precipitation for the County is approximately 38-47 inches.

4.3.5 Land Use and Land Cover

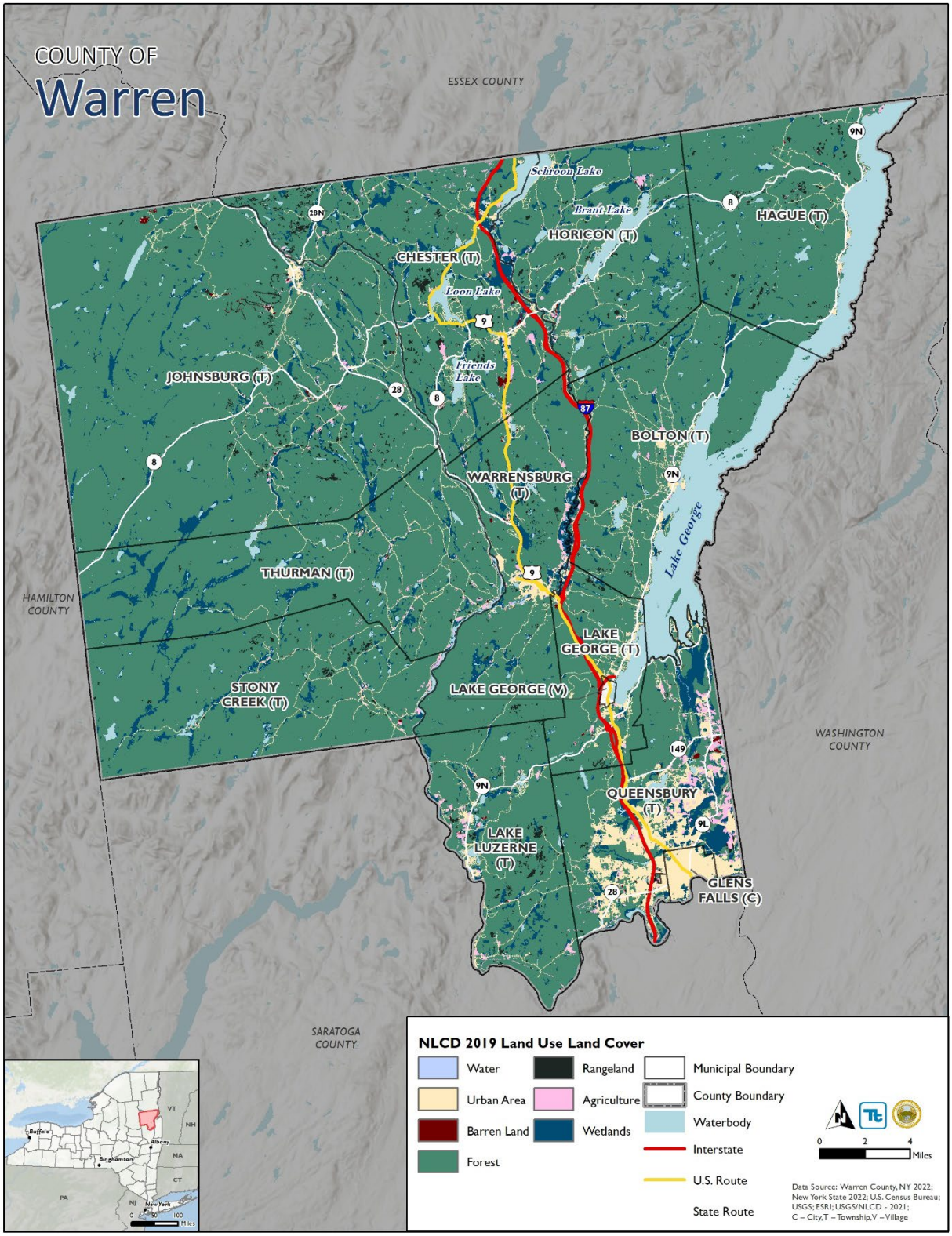
According to the United States Geological Survey (USGS), the greatest share of land use/land cover in Warren County is deciduous forest, covering 78.8-percent of and in the county. The next highest land use is urban, with a little over 5-percent of the land area. Commercial and industrial land uses are found in and around the villages of the County and along Interstate 87, US-9, and State Routes 8, 9N, and 28. Industrial uses are scattered throughout the County and include the hospital, government buildings, non-profit affiliated facilities, and schools. Table 4-2 shows the distribution of land use throughout the County (USGS 2019). Figure 4-4 illustrates the land use categories in the County.

Table 4-2. Warren County Land Use Classification Table

Land Use Category	2019 Data	
	Acreage	Percent of County
Agriculture	7,012	1.2%
Barren Land	908	0.2%
Forest	469,192	78.8%
Rangeland	7,031	1.2%
Urban Area	34,590	5.8%
Water	40,270	6.8%
Wetlands	36,560	6.1%

Source: USGS/NLCD 2019

Figure 4-4. Land Use Land Cover for Warren County



4.4 POPULATION AND DEMOGRAPHICS

An understanding of the planning area population characteristics provides context to determine the impacts of natural hazards in the County. As noted in Section 5.1 (Methodology) of this plan, modeling of the impacts of natural hazards on the population was performed using FEMA's Hazards U.S. Multi-Hazard (HAZUS-MH) in which the available population information includes the 2010 U.S. Decennial Census data, which indicates a county population of 62,259. However, more current data, according to U.S. Decennial Census Bureau in 2020 indicates a county population of approximately 65,737, which is an increase in population since 2010. Table 4-3 shows the 2020 Census Data for Warren County and also includes the American Community Survey (ACS) 5-year Population Estimates from 2021. The information presented in this table is the best available population data available during the HMP update.

Various Census Bureau products were used as sources for the population trends section. The Decennial Census is the official population count taken every 10 years. American Community Survey 5-Year Estimates are used to show annual population changes, but it is not an official population count. 5-Year Estimates are used because they are the most accurate form of American Community Survey with the largest sample size, which allows for greater accuracy at smaller geographic areas. The American Community Survey 5-Year Estimate products were used to establish annual changes in population. The numbers provided are not official census counts but are official estimates provided to communities so that they may have a greater understanding in population changes within their jurisdictions.

It is important to note that as a year-round tourist destination, the County's population fluctuates greatly as a result of many visitors, particularly during the summer months. Lake George and the Great Escape theme park are major attractions and mass gathering locations. There is a notable aging population in Warren County (Warren County Emergency Services 2022).

Table 4-3. Warren County Population Statistics

	2020 Population		American Community Survey 5-Year Population Estimates (2021)***									
Jurisdiction	Total	% County Total	Over 65	% Population Over 65	Under 5	% Population Under 5	Non-English Speaking	% Population Non-English Speaking	Disability	% Population with Disability	Poverty Level	% Population Below Poverty Level
Bolton (T)	2,012	3.1%	578	28.7%	57	2.8%	0	0.0%	444	22.1%	116	5.8%
Chester (T)	3,086	4.7%	748	24.2%	51	1.7%	60	1.9%	396	12.8%	219	7.1%
Glens Falls (C)	14,830	22.6%	2,135	14.4%	899	6.1%	86	0.6%	2,362	15.9%	1,697	11.4%
Hague (T)	633	1.0%	264	41.7%	24	3.8%	0	0.0%	57	9.0%	116	18.3%
Horicon (T)	1,471	2.2%	424	28.8%	33	2.2%	24	1.7%	175	11.9%	96	6.5%
Johnsburg (T)	2,143	3.3%	585	27.3%	85	4.0%	0	0.0%	396	18.5%	104	4.9%
Lake George (T)	2,494	3.8%	674	27.0%	184	7.4%	0	0.0%	199	8.0%	113	4.5%
Lake George (V)*	1,008	1.5%	216	21.4%	33	3.3%	0	0.0%	230	22.8%	33	3.3%
Lake Luzerne (T)	3,079	4.7%	807	26.2%	79	2.6%	0	0.0%	559	18.2%	203	6.6%
Queensbury (T)	29,169	44.4%	7,040	24.1%	1,134	3.9%	183	0.6%	3,956	13.6%	1,970	6.8%
Stony Creek (T)	758	1.2%	195	25.7%	26	3.4%	0	0.0%	190	25.1%	50	6.6%
Thurman (T)	1,095	1.7%	309	28.2%	32	2.9%	0	0.0%	155	14.2%	108	9.9%

Jurisdiction	2020 Population Total	% County Total	Over 65	% Population Over 65	Under 5	% Population Under 5	Non-English Speaking	% Population Non-English Speaking	Disability	% Population with Disability	Poverty Level	% Population Below Poverty Level
	American Community Survey 5-Year Population Estimates (2021)***											
Warrensburg (T)	3,959	6.0%	779	19.7%	213	5.4%	0	0.0%	795	20.1%	326	8.2%
Warren County (Total)	**65,737**	**100.0%**	**14,754**	**22.4%**	**2,850**	**4.3%**	**354**	**0.5%**	**9,914**	**15.1%**	**5,151**	**7.8%**

**Lake George (V) is 100% within Lake George (T). Subtracted village totals from town to assign correct town totals.*

***Source: U.S. Census Bureau 2020 Decennial Total Population*

****Source: U.S. Census Bureau 2021 ACS Vulnerable Population Totals*

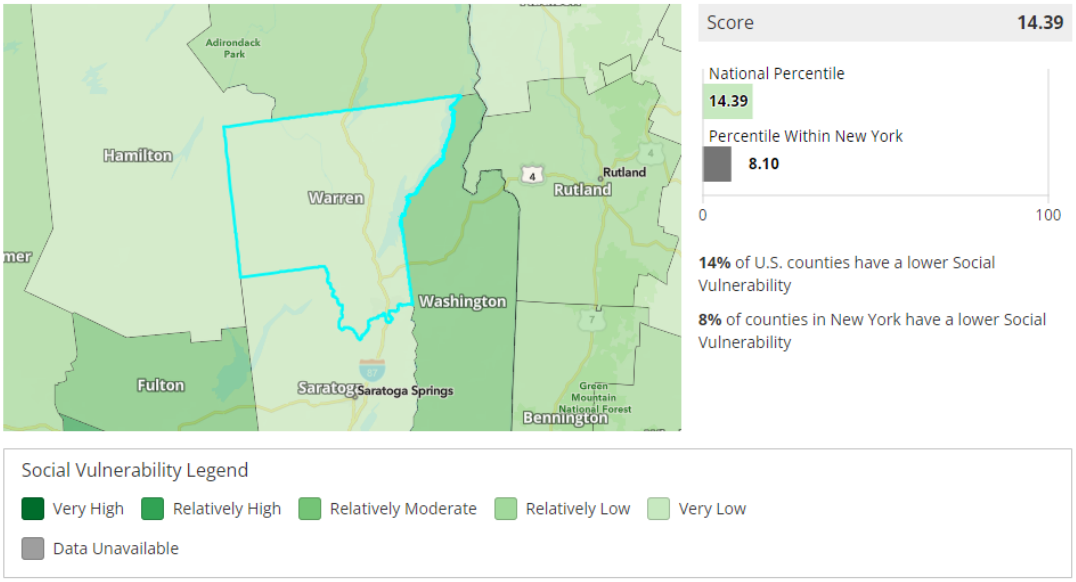
4.4.1 Vulnerable Populations

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. The vulnerable populations identified for the purposes of this plan include (1) the elderly (persons aged 65 and over) and (2) those living in low-income households. Identifying concentrations of vulnerable populations can assist communities in targeting preparedness, response, and mitigation actions.

Populations with a higher level of vulnerability can be more seriously affected during the course of an emergency or disaster. Vulnerable populations have unique needs that need to be considered by public officials to help ensure the safety of demographics with a higher level of risk. Additionally, different types of vulnerable populations are impacted by different types of hazard events. For example, those with limited access or no access to a vehicle may be more impacted by a hazard event as they will likely have more issues evacuating if necessary.

Figure 4-5. Warren County Social Vulnerability Index (FEMA NRI)

Additionally, the FEMA National Risk Index (NRI) was utilized to determine risk index, social vulnerability, and community resilience scores of Warren County. The NRI indicated that Warren County



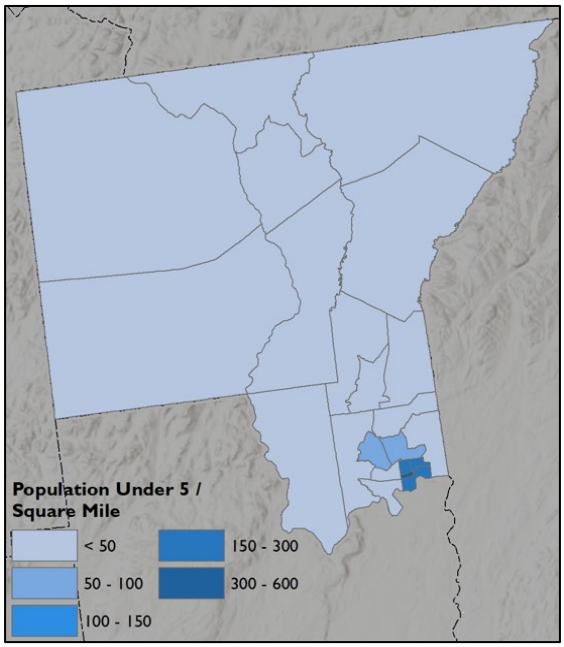
has a low social vulnerability score with a score of 14.39 out of 100, which notes that the county has a very low susceptibility to the impacts of natural hazards when compared to the rest of the U.S.

Due to the low social vulnerability, additional community outreach to vulnerable populations was not required above and beyond engaging agencies that work with and represent the residents of Warren County.

Age

Children are considered vulnerable to hazard events because they are dependent on others to safely access resources during emergencies and may experience increased health risks from hazard exposure. The elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences. Those living on their own may have more difficulty evacuating their homes. The elderly also are more likely to live in senior care and living facilities where emergency preparedness occurs at the discretion of facility operators. According to the 2020 U.S. Census, the median age in Warren County was 47.5 years. In order to protect the older population during hazard events, the plan supports adopting more resilient and efficient building and land use standards, avoiding siting senior housing and facilities near hazard-prone areas, reducing the risk to community lifelines, and ensuring that critical facilities and services have alternate power sources.

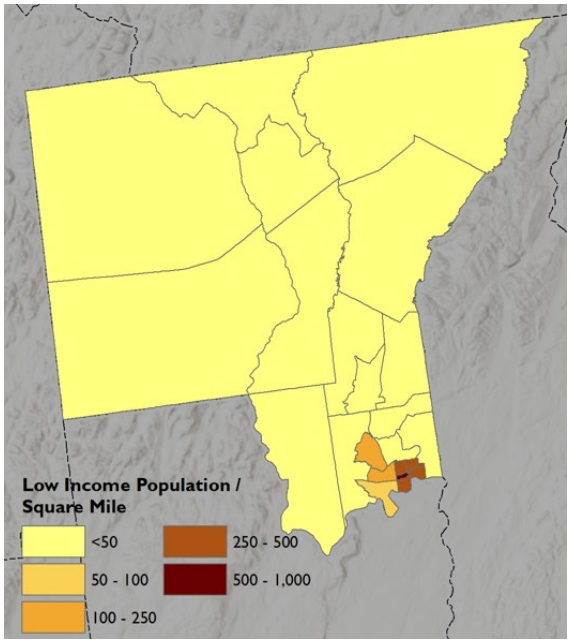
Figure 4-6. Warren County Population Under 5 (per square mile)



The 2020 U.S. Census reports that 4.1% of the County's total population is under the age of 5 and 24.4% of the County's total population is over the age of 65. Figure 4-6 shows density of the Warren County population under age 5.

Income

Figure 4-7. Warren County Low-Income Population (per square mile)



The 2020 U.S. Census median household income in Warren County was $68,765, and the per capita income was $41,247. The U.S. Census Bureau identifies households with two adults and two children with an annual household income below $27,479 per year as *low income* (U.S. Census 2023). The 2020 U.S. Census indicates 10.2-percent of the population in Warren County lives below the poverty level. Figure 4-7 shows the distribution of low-income population in Warren County.

The spatial U.S. Census data for household income provided in HAZUS-MH includes two ranges (less than $10,000 and $10,000-$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 2020 U.S. Census data. This difference is not believed to be significant for the purposes of this planning effort; therefore, for the exposure and loss estimations in the risk assessment, the 2020 U.S. Census data in HAZUS-MH is reported.

While age and income have been traditional indicators of vulnerable populations, the CDC Social Vulnerability Index (SVI) is a recent tool used to identify socially vulnerable populations. The CDC defines socially vulnerable population using factors such as poverty, lack of access to transportation, and crowded housing. These factors may weaken a community's ability to prevent human suffering and financial loss in a disaster. The SVI uses U.S. Census data to determine the social vulnerability of every census tract. The SVI ranks each tract on 16 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Maps of the four themes are shown in the figure below. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking.

Social Vulnerability Index (SVI)

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four themes are shown in the figure below. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking.

Figure 4-8. Warren County Overall Social Vulnerability Index

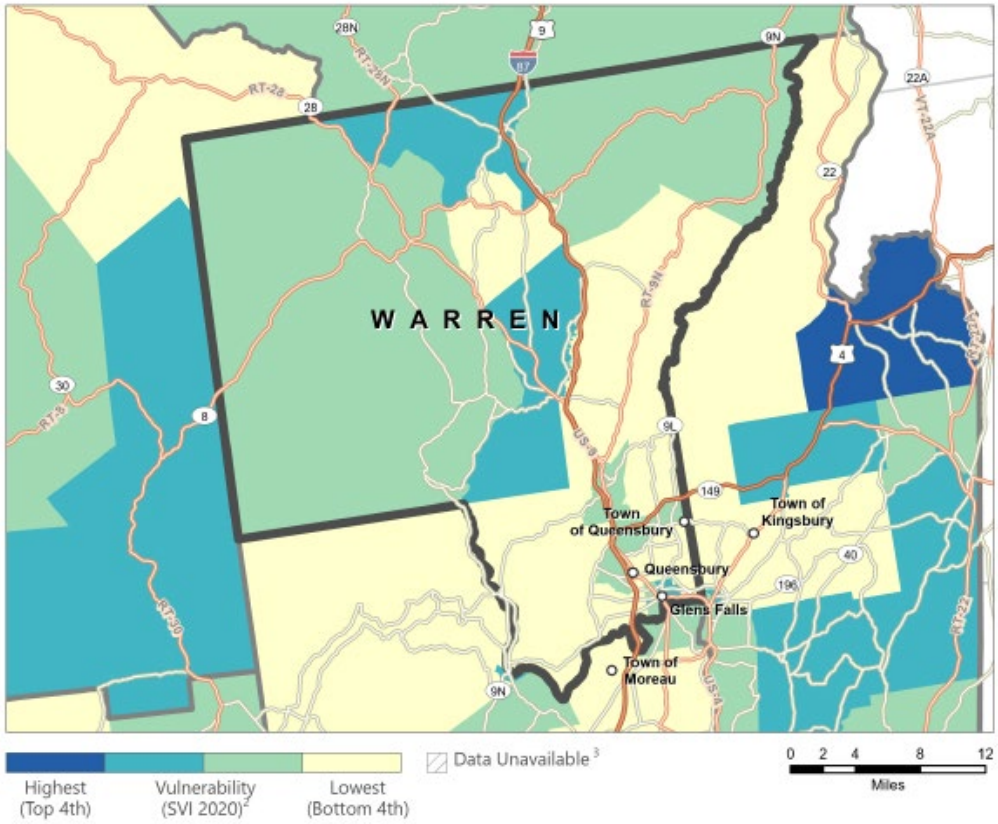
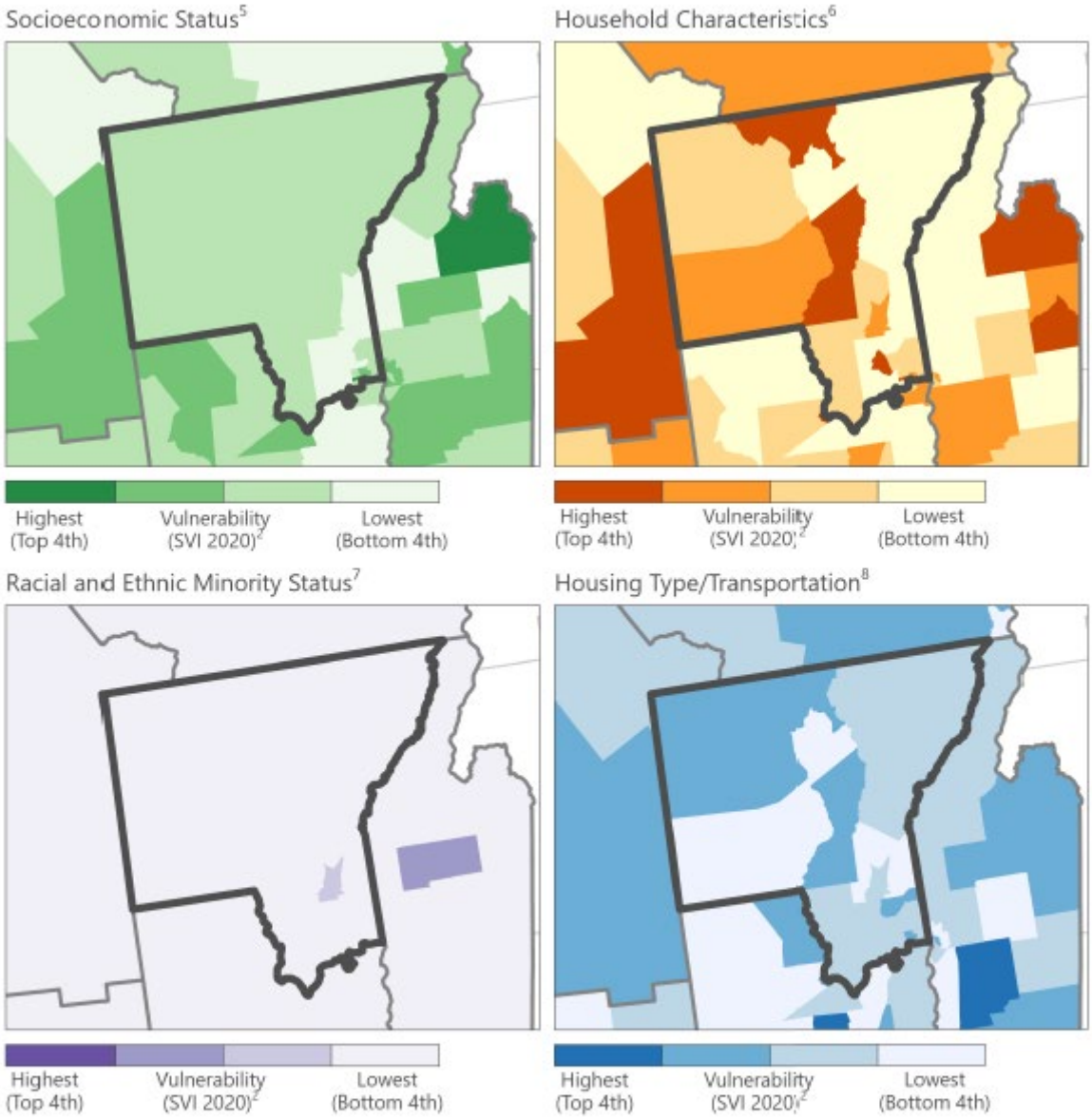


Figure 4-9. **Warren County SVI Themes**



Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 16 variables. [3]Census tracts with 0 population. [4]The CDC/ATSDR SVI combines percentile rankings of US Census American Community Survey (ACS) 2016-2020 variables, for the state, at the census tract level. [5]Socioeconomic Status: Below 150% Poverty, Unemployed, Housing Costs Burden, No High School Diploma, No Health Insurance. [6]Household Characteristics: Aged 65 and Older, Aged 17 and Younger, Civilian with a Disability, Single-Parent Household, English Language Proficiency. [7]Race/Ethnicity: Hispanic or Latino (of any race); Black and African American, Not Hispanic or Latino; American Indian and Alaska Native, Not Hispanic or Latino; Asian, Not Hispanic or Latino; Native Hawaiian and Other Pacific Islander, Not Hispanic or Latino; Two or More Races, Not Hispanic or Latino; Other Races, Not Hispanic or Latino. [8]Housing Type/Transportation: Multi-Unit Structures, Mobile Homes, Crowding, No Vehicle, Group Quarters.
Projection: New York NAD 1983 UTM Zone 18N, CM shifted to -76.
References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 2011. 8(1).
CDC/ATSDR SVI web page: https://www.atsdr.cdc.gov/placeandhealth/svi/index.html.

The maps indicate that majority of population in the county have social vulnerability a theme index in the lower half of the spectrum. Regarding the household characteristics theme, the highest index is seen in the center portion of the County. For the racial and ethnic minority theme the majority of the County reflects the lowest vulnerability with a small area in the southeast portion of the County indicating some vulnerability. The housing/transportation theme shows a range of

vulnerability from the highest index in the northwest and central areas of the County. This analysis can inform planning and financial policy regarding social equity in the future. . For each hazard type identified in the plan, there are different types of socially vulnerable population groups that may be more impacted. Considerations for improving outcomes for vulnerable populations will include increased outreach and public education, increased preventative measures, and strengthened local plans and policies. In order to protect low-income populations during a hazard event, the plan supports investment in underserved areas, assessing social vulnerability indicators, and considering impacts before a mitigation project to ensure that it helps at-risk populations.

Other Vulnerability Factors

Additional vulnerability factors impact a community or group's ability to prepare, respond, or recover from a hazard event. These factors can increase vulnerability. Physical barriers, such as a lack of vehicle access or transportation options, can be a challenge. Warren County has 8.65% of households without a vehicle, a low rate per the FEMA Resilience Analysis and Planning Tool (RAPT). The percentage of households with limited English language can also be a challenge. Warren County has a very low rate of households with limited English language skills at a rate of 0.55% (RAPT). Another vulnerability factor is related to educational attainment. In Warren County, 8.49% of the population does not have a high school diploma (RAPT). Lastly, Warren County also has a low rate of the population with a disability rate of 15.26%. To protect against transportation related vulnerabilities, network drainage, transit system resilience, evacuation routes, and critical roadways should be considered and prioritized. To protect those with disabilities, accessibility must be a component of implemented resilience measures. Universal design is important to building far reaching resilience and mitigation projects.

4.4.2 General Building Stock

According to 2021 ACS, 39,902 housing units are located in Warren County. A household includes all the people who occupy a housing unit as their usual residence. A housing unit is a house, apartment, mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters (or if vacant, intended for occupancy as separate living quarters). A majority of the units (72-percent) are one-unit detached homes. The median price of a single-family home in the County was estimated at $214,300 based on the 2021 ACS (U.S. Census Bureau 2023).

For this update, the general building stock inventory was developed using NYSERDA 2022 building footprint data, 2022 RS Means values, and supplemented with 2021 NYS Tax assessor data. For the purposes of this plan, approximately 40,309 structures were identified by the tax data and spatial data available. These structures account for a replacement cost value of approximately $14 billion. Approximately 91.7 percent of the total buildings in the county are residential, which make up approximately 96 percent of the total building stock value.

Table 4-4 presents building stock statistics by occupancy class for Warren County.

Table 4-4. Building Stock Count and Replacement Cost Value (RCV) by Occupancy Class

Jurisdiction	All Occupancies				Residential		Commercial		Industrial	
	Building Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value (Structure + Contents)	Building Count	Total Replacement Cost Value (Structure + Contents)	Building Count	Total Replacement Cost Value (Structure + Contents)	Building Count	Total Replacement Cost Value (Structure + Contents)
Bolton (T)	2,873	$931,617,917	$577,428,351	$1,509,046,268	2,708	$1,087,858,813	97	$149,979,016	1	$23,811,750
Chester (T)	3,227	$1,072,965,827	$721,557,475	$1,794,523,301	2,964	$1,086,330,410	115	$321,934,595	10	$26,499,870
Glens Falls (C)	5,988	$2,097,137,421	$1,630,986,695	$3,728,124,116	5,464	$1,709,741,165	426	$1,368,937,188	48	$281,337,871
Hague (T)	1,313	$464,337,547	$334,872,741	$799,210,288	1,204	$394,038,388	56	$286,665,366	0	$0
Horicon (T)	2,188	$651,548,444	$371,057,345	$1,022,605,789	2,096	$829,587,388	46	$98,386,857	4	$13,682,171
Johnsburg (T)	2,625	$851,272,550	$642,583,642	$1,493,856,193	2,338	$684,796,167	101	$312,016,635	32	$78,539,281
Lake George (T)	2,494	$1,337,335,145	$831,627,641	$2,168,962,785	2,311	$1,545,696,612	152	$500,131,324	2	$47,623,500
Lake George (V)	609	$468,778,342	$301,379,173	$770,157,514	523	$491,573,427	69	$212,674,183	0	$0
Lake Luzerne (T)	2,173	$576,673,966	$376,993,951	$953,667,917	2,076	$626,182,439	65	$185,937,703	5	$35,709,930
Queensbury (T)	12,193	$4,157,000,379	$2,957,031,205	$7,114,031,584	11,106	$3,881,108,658	917	$2,343,387,455	55	$254,298,642
Stony Creek (T)	807	$555,501,480	$440,494,852	$995,996,331	729	$349,627,550	14	$128,404,541	0	$0
Thurman (T)	1,061	$305,089,463	$192,896,329	$497,985,792	1,008	$345,862,394	7	$91,534,070	3	$12,455,728
Warrensburg (T)	2,758	$813,583,143	$611,873,715	$1,425,456,857	2,432	$689,794,423	167	$365,393,133	39	$117,512,116
Warren County (Total)	**40,309**	**$14,282,841,623**	**$9,990,783,115**	**$24,273,624,737**	**36,959**	**$13,722,197,834**	**2,232**	**$6,365,382,067**	**199**	**$891,470,859**

Figure 4-10. Distribution of Residential Building Stock and Value Density in Warren County

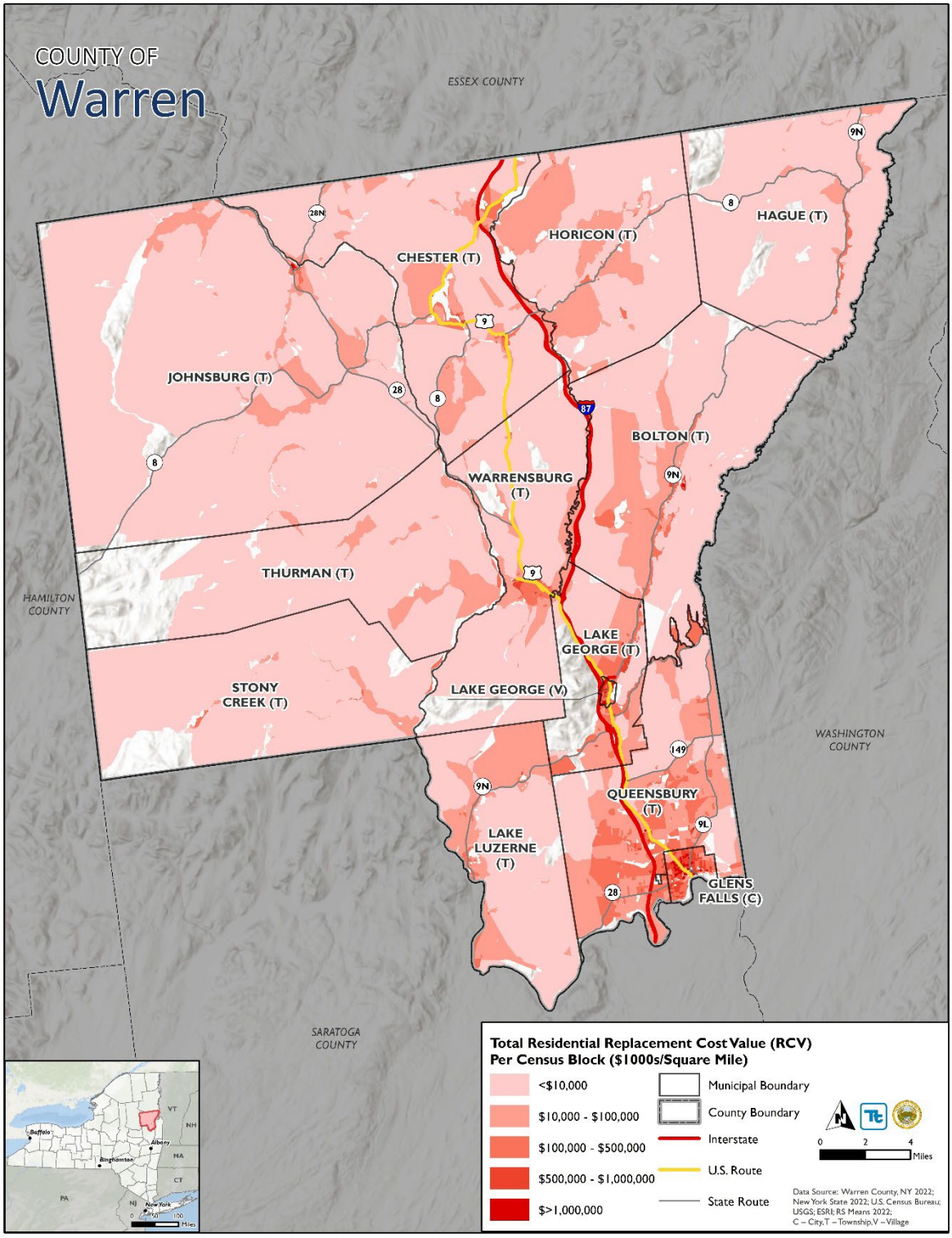


Figure 4-11. Distribution of Commercial Building Stock and Value Density in Warren County

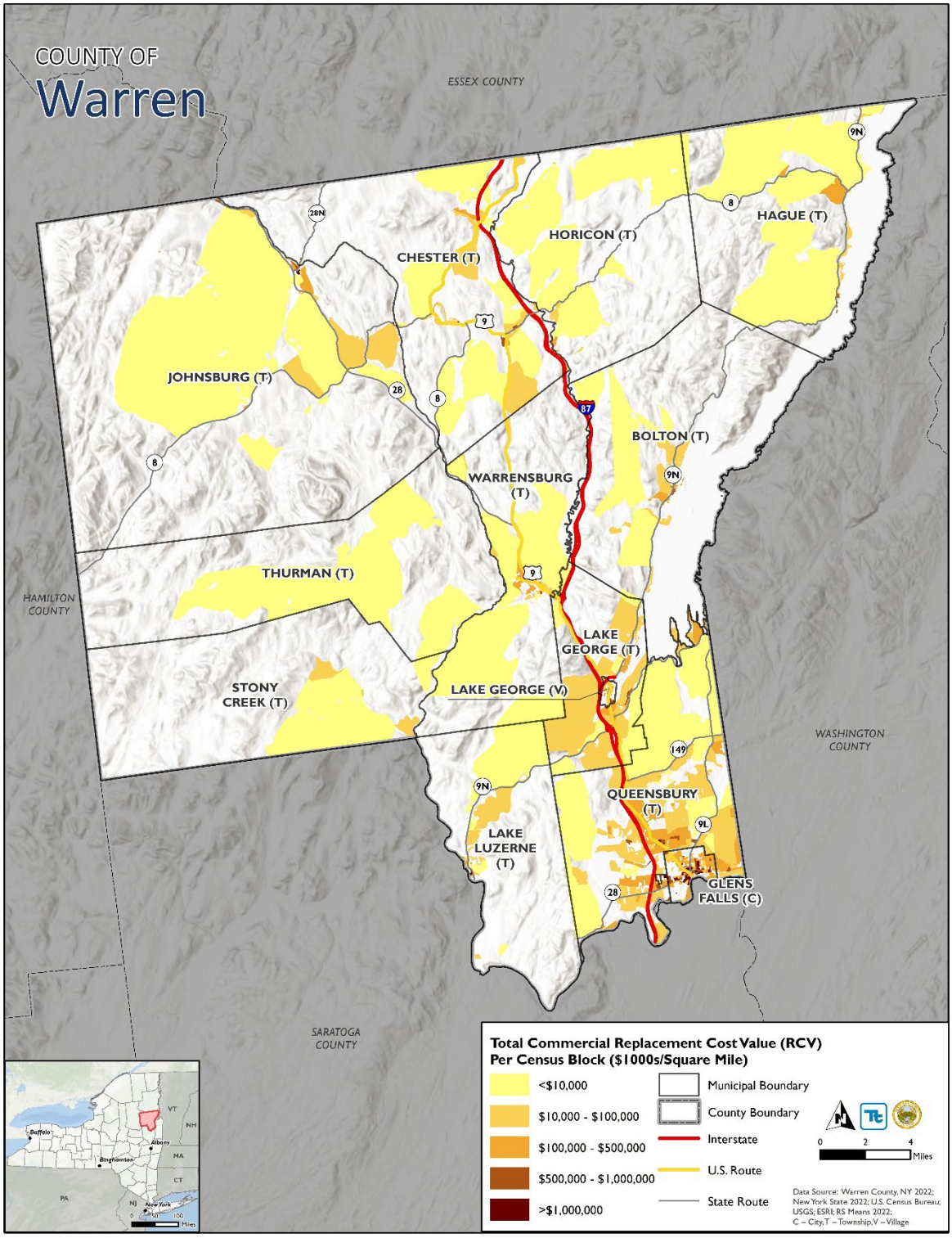
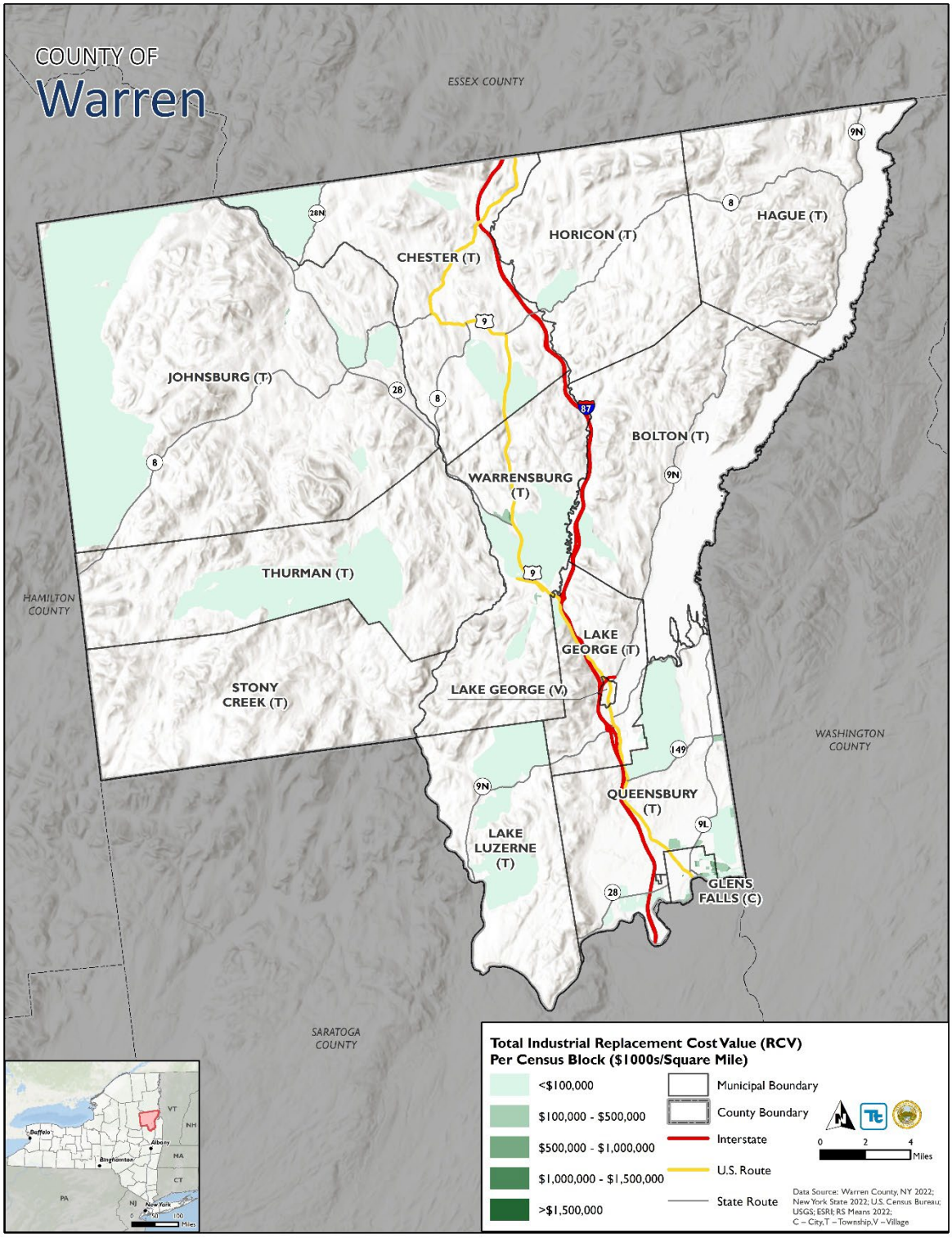


Figure 4-12. Distribution of Industrial Building Stock and Value Density in Warren County



4.5 LAND USE AND POPULATION 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 prioritization 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 population, land use, and types of development occurring within the study area. 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.

4.5.1 Land Use Trends

Warren County's population has risen in recent decades, but a decline is anticipated. The Warren County Department of Planning and Community Development is in the process of developing a County Comprehensive. This plan will become a tool used for guiding the growth, redevelopment, and overall improvement of the County.

Agriculture

The Warren County Agricultural Environmental Management Plan 2021-2025 notes that Warren County likely reached its peak in traditional agriculture during the mid to late 1800's and from that point, agriculture continued to decline within the county. According to the most recent USDA Census of Agriculture data, in 2012 Warren County had 112 farms but decreased to 80 farms in 2017Farms in Warren County have average sales of $23,949 per farm in the county. Agriculture bolsters the county's economy, helps maintain the county's rural landscape, attracts visitors, maintains community character, and contributes to the health of the county's residents. The more developed and populated southern portion of Warren County is primarily commercial and industrial businesses, leaving a majority of the farmland to be on the outskirts of the urbanized area and spread sporadically across the northern end of the County. While overall the county is seeing fewer, larger farms, there has been a growth in the number of specialty agricultural producers. Today, the primary farm types include dairy, cattle, poultry, and specialized producers such as pumpkin patches, market farms, and mushroom farms.

Since 1971, Article 25AA of the Agriculture and Markets Law (AML) outlining Agricultural Districts has supported state- and county-level efforts to preserve, protect, and encourage the development and improvement of agricultural land to produce food and other agricultural products. The Warren County Soil & Water Conservation District provides technical natural resource management and conservation assistance to residents and municipal governments of Warren County.

The 2017 Census of Agriculture notes that the number of farms has decreased by 32 percent since 2012, however the total farm acreage in the County has increased 6% during that time. Between 2012 and 2017, the average size of farms has increased 55 percent to 126 acres. In that period, the market value of products sold has decreased to $1,916,000 in 2017.

Economy

Warren County is located in the Capital Region and is in close proximity to all major markets in the northeast. The location provides access to many world-renowned academic and research institutions and immense recreational and tourism destinations (Regional Economic Development Councils, Capital Region). Tourism is one of the largest industries in the county, bringing in an estimated $628 million dollars annually. Some of the tourist attractions are the Sagamore Resort, Six Flags Great Escape, Lake George Steamboat Co., Gore Mountain Skiing, the Adirondack Park, and West Mountain Skiing (Warren County Economic Development Corporation).

The 2020 U.S. Census Bureau's County Business Patterns data identified 2,186 business establishments employing approximately 30,940 people in Warren County. The accommodation and food services industry has the highest number of establishments in the county, with 399. This is followed by the retail trade industry with 377 establishments and the health care and social assistance industry with 271 establishments (U.S. Census 2020). The wide variety of products manufactured in the county includes paper products, silver refining and fabrication, medical devices, and plastic products. Other major employers include insurance companies, colleges, healthcare facilities, and retailers. The regional economy benefits from many employers such as BD Becton Dickinson, Glens Falls Hospital, Finch Paper, AngioDynamics, Sagamore Resort, Hudson Headwaters Health Network, and others (Warren County Economic Development Corporation).

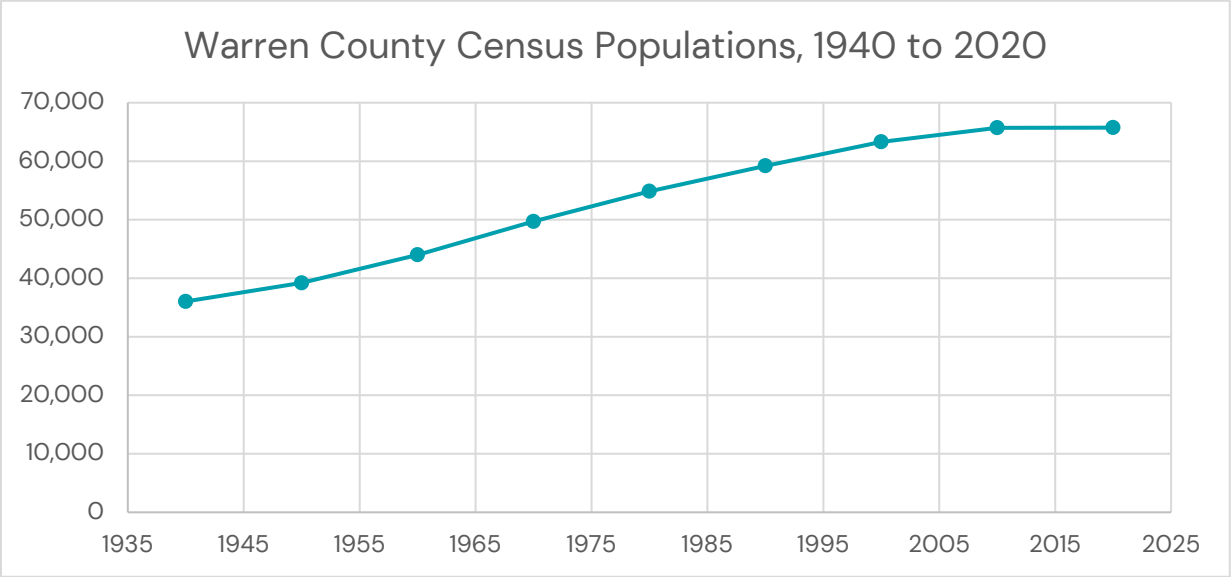
4.5.2 Population Trends

This section discusses population trend information used to estimate future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to be considered and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

While the overall population of Warren County has increased by approximately 0.05-percent since 2010, this slight increase is not geographically uniform throughout the county, with some areas, particularly in Queensbury, having experienced growth and other areas, including many of the northern municipalities, seeing a more severe decline in population.

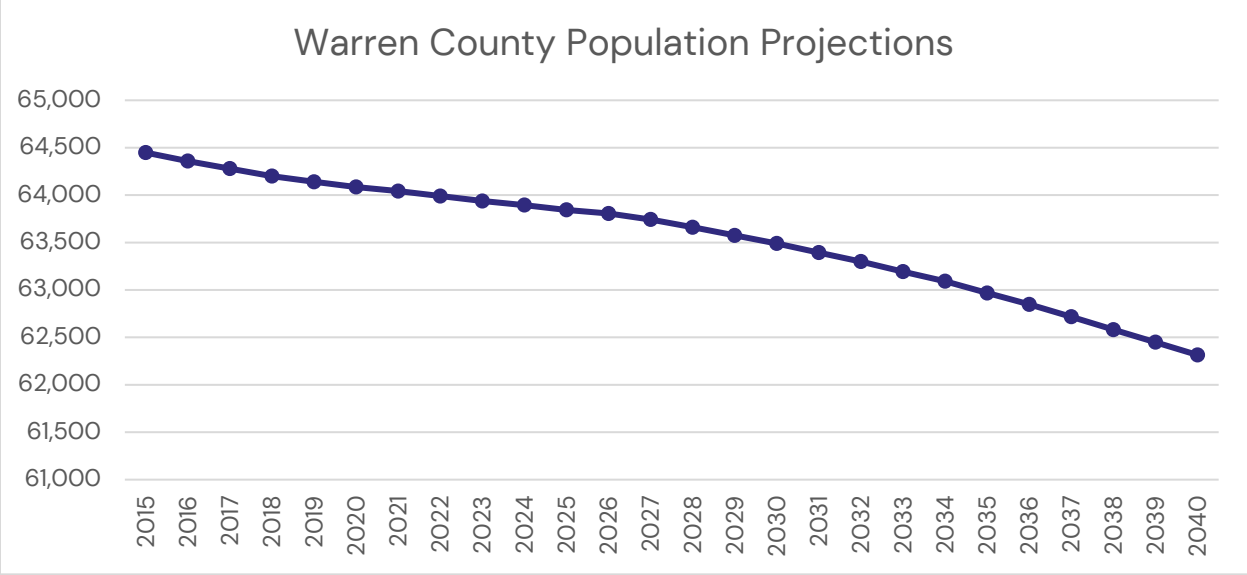
According to both the 2010 and the 2020 U.S. Census, Warren County experienced a 0.04 percent increase in population, from 65,707 in 2010 to 65,737 in 2020. Warren County's population has increased every decade since 1950. From 2000 to 2020, the County's population increased 3.7-percent (Figure 4-13); however, future population projections show an expected decrease in population, as shown in Figure 4-14.

Figure 4-13. Census Populations, 1940 to 2020



Source: Cornell Program on Applied Demographics 2023

Figure 4-14 . Population Projections



Source: Cornell University 2018

4.5.3 Future Growth and Development

A summary of development planned within Warren County is illustrated in Table 4-5 below. Details regarding development specific to each participating municipality is provided in Section 9 (Jurisdictional Annexes). Locations of development are indicated on the Hazard Area Extent and Location Maps included in Section 9 (Jurisdictional Annexes).

Table 4-6 Planned Development in Warren County, New York

Jurisdiction	Type	Details/Location	Located in a Known Hazard Area
Town of Bolton	No major development identified or anticipated.		
Town of Chester	No major development identified or anticipated.		
City of Glens Falls	No major development identified or anticipated.		
Town of Hague	No major development identified or anticipated.		
Town of Horicon	No major development identified or anticipated.		
Town of Johnsburg	No major development identified or anticipated.		
Town of Lake George	Commercial- Route 9L Laundromat	N/A – 14,000 gpd commercial maximum capacity; 264.11-1-4.2	None identified
	Residential-Lamondo 9L Rentals	7 rentals (3 bd units) – assume 21 bedrooms; 264.08-2-28, 264.08-2-29	None identified
	Residential- English Brook Village	251.10-2-31.2	None identified
	Residential- McGowan/Schermerhorn Senior Living	264.12-1-7	None identified
	Mixed Use- Gross PUD (Ramada)	99 apartments (2/3 bd units) – assume 250 bedrooms; and 5,000 SF commercial space; 264.03-2-2	None identified
	Residential- LG Community Partners (Bloody Pond)	64 apartments (2/3 bd units) – assume 160 bedrooms; 264.12-1-61, 264.12-1-62, 264.12-1-58.12	None identified
	Residential- Schermerhorn 9L project	16 apartments (2/3 bd units) – assume 40 bedrooms; 264.11-1-40	None identified
	Residential- Ellsworth Magic Forest Apartments	90 apartments (1/2/3 bd units) – assume 180 bedrooms; 264.04-1-35, 264.04-1-36, 264.04-1-37	None identified
Village of Lake George	Multi-family residential - English Brook Village	16 units / 4 structures; 511 Canada Street	Adjacent to English Brook. Final engineering review, permits pending.
Town of Lake Luzerne	Lake Luzerne Woods- residential	17 lots; Sagamore Drive	None identified
	Evergreen Estates- residential	11 lots; Call Street	None identified
	TBD, proposed subdivision- residential	8-10 lots; Hidden Valley Road	None identified
	TBD, proposed subdivision- residential	TBD; Route 9N	None identified
Town of Queensbury	Tim Barber	40,000 sq ft building; 23 Native Drive	None identified
	Tim Barber	25000 sq ft building; 32 Native Drive	None identified

Jurisdiction	Type	Details/Location	Located in a Known Hazard Area
	Schermerhorn	40 units two buildings; End of Walker Lane	None identified
	FHB	19 lots; Jenkensville Road	None identified
	Schermerhorn	60 Units two buildings; 575 Bay Road	None identified
	Legacy/Habitat for Humanity	27 unit; Baybridge Drive	None identified
Town of Stony Creek	No major development identified or anticipated.		
Town of Thurman	No major development identified or anticipated.		
Town of Warrensburg	Commercial	3940 Main Street	None identified
	Commercial	3760 Main Street	None identified

* Only location-specific hazard zones or vulnerabilities identified.

4.6 CRITICAL FACILITIES AND COMMUNITY LIFELINES

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

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.

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

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

- Safety and Security
- Food, Water, Shelter
- Health and Medical

- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

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

A comprehensive inventory of critical facilities in Warren County was developed from various sources, including Warren County and input from the Steering and Planning Committees. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the draft HMP and used for the risk assessment in Section 5 (Risk Assessment). The number and type of critical facilities and infrastructure identified for this plan are indicated in Table 4-7 below.

Table 4-7. Number and Type of Critical Facilities and Lifelines in Warren County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction
Bolton (T)	44	30
Chester (T)	57	44
Glens Falls (C)	93	62
Hague (T)	23	17
Horicon (T)	30	25
Johnsburg (T)	66	52
Lake George (T)	36	28
Lake George (V)	22	14
Lake Luzerne (T)	50	41
Queensbury (T)	202	156
Stony Creek (T)	20	18
Thurman (T)	20	16
Warrensburg (T)	74	56
Warren County (Total)	**737**	**559**

4.6.1 Safety and Security

Safety and security community lifelines include facilities related to law enforcement/security, fire service, search and rescue, government service, and community safety facilities. For the purpose of this plan, safety and security facilities include police departments, fire departments, emergency services, and dams. This is shown in Figure 4-15.

The Warren County Office of Emergency Services is responsible for aiding communities in emergency preparedness (including emergency planning and providing training for the County's first

responders), response, recovery, and mitigation. Additionally, the Sheriff's Office operates a 24-hour Emergency Communications Center.

All of the County's municipalities are serviced by fire departments within their borders, supported by mutual aid departments throughout the County. Police enforcement and public safety is maintained by the New York State Police Department, the Warren County Sheriff's Office, and local departments.

Police Departments

There are 7 local police stations located in Warren County.

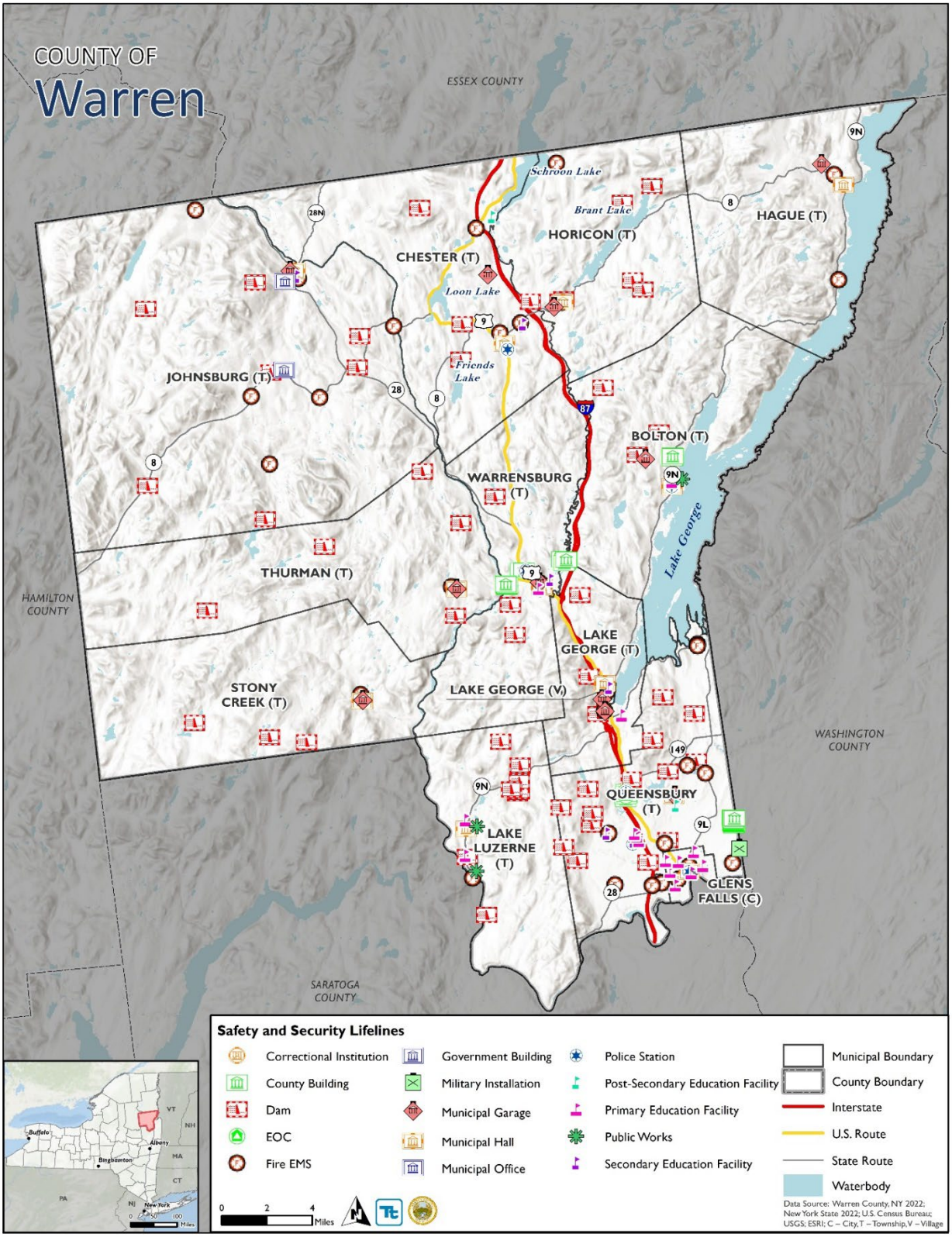
Fire Departments

There are 26 fire departments/stations located throughout Warren County, many of which are volunteer departments.

Emergency Services

Warren County Office of Emergency Services is dedicated to the safety of the residents and visitors through the provision of training for volunteers, development of emergency plans that incorporate mitigation, preparedness, response and recovery for all types of major disasters that occur within Warren County. Warren County maintains an Emergency Services Mutual Aid Plan. In accordance with the New York State Department of Health, every certified ambulance or EMS provider signs, and operates in accordance with, a mutual aid plan. Each EMS provider in Warren County must adopt the County plan or write one of their own and obtain approval through both the County and State. There are seven EMS facilities located in Warren County.

Figure 4-15. Safety and Security Lifelines in Warren County



Dams

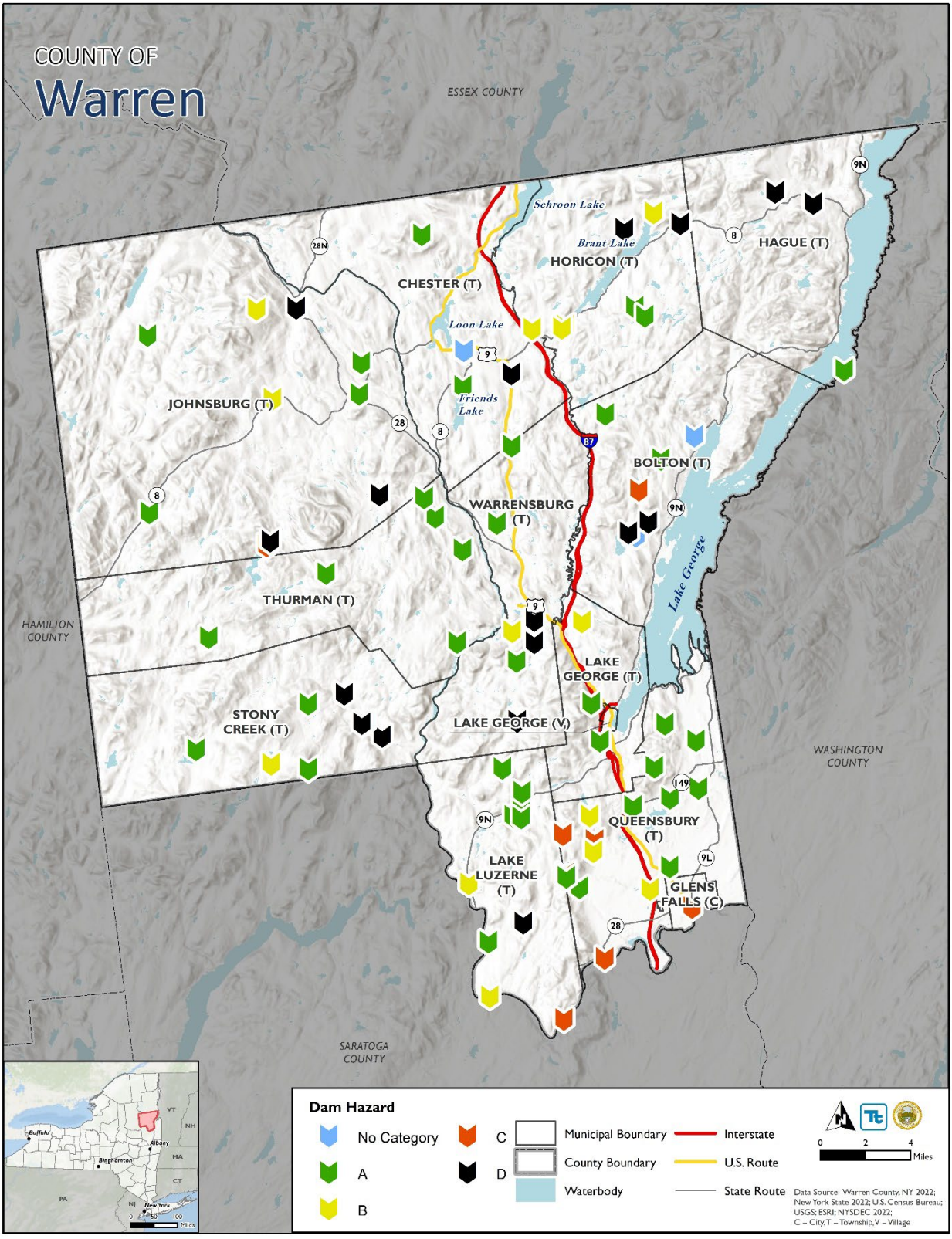
For the purpose of this hazard mitigation plan, dams and levees are considered community lifelines. A summary of the dams in the county is presented in this section to provide an awareness of the number and types of these structures within the county.

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

- *Low Hazard (Class A)* is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or operation problems 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 could damage isolated homes, main highways, and minor railroads; interrupt the use of relatively important public utilities; and cause significant economic loss or serious environmental damage. Failure or operation problems would result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Class B dams often are located in predominantly rural or agricultural areas but also can be located in areas with population and significant infrastructure.
- *High Hazard (Class C)* is a dam located in an area where failure might cause loss of human life; serious damage to homes, industrial, or commercial buildings; important public utilities; main highways or railroads; and extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure.

According to NYS DEC, there are 85 dams located in Warren County. Of the 85 dams located in Warren County, 7 are high hazard dams (Class C). These dams are located in the Town of Bolton, Town of Chester, Town of Johnsburg, and Town of Queensbury. Figure 4-16 indicates the location of dams in Warren County.

Figure 4-16. Dams Located in Warren County



4.6.2 Food, Water, and Shelter

Food, water, and shelter community lifelines include facilities related to food services, water supply, sheltering facilities, and agriculture. For the purpose of this plan, food, water and shelter facilities include schools, shelters, potable water, and wastewater facilities. This is shown in Figure 4-18

Schools

A total of 23 primary and secondary public and private schools are located throughout the County. There are two post-secondary schools also located in Warren County. In times of need, schools can function as shelters and are an important resource to the community.

Shelters

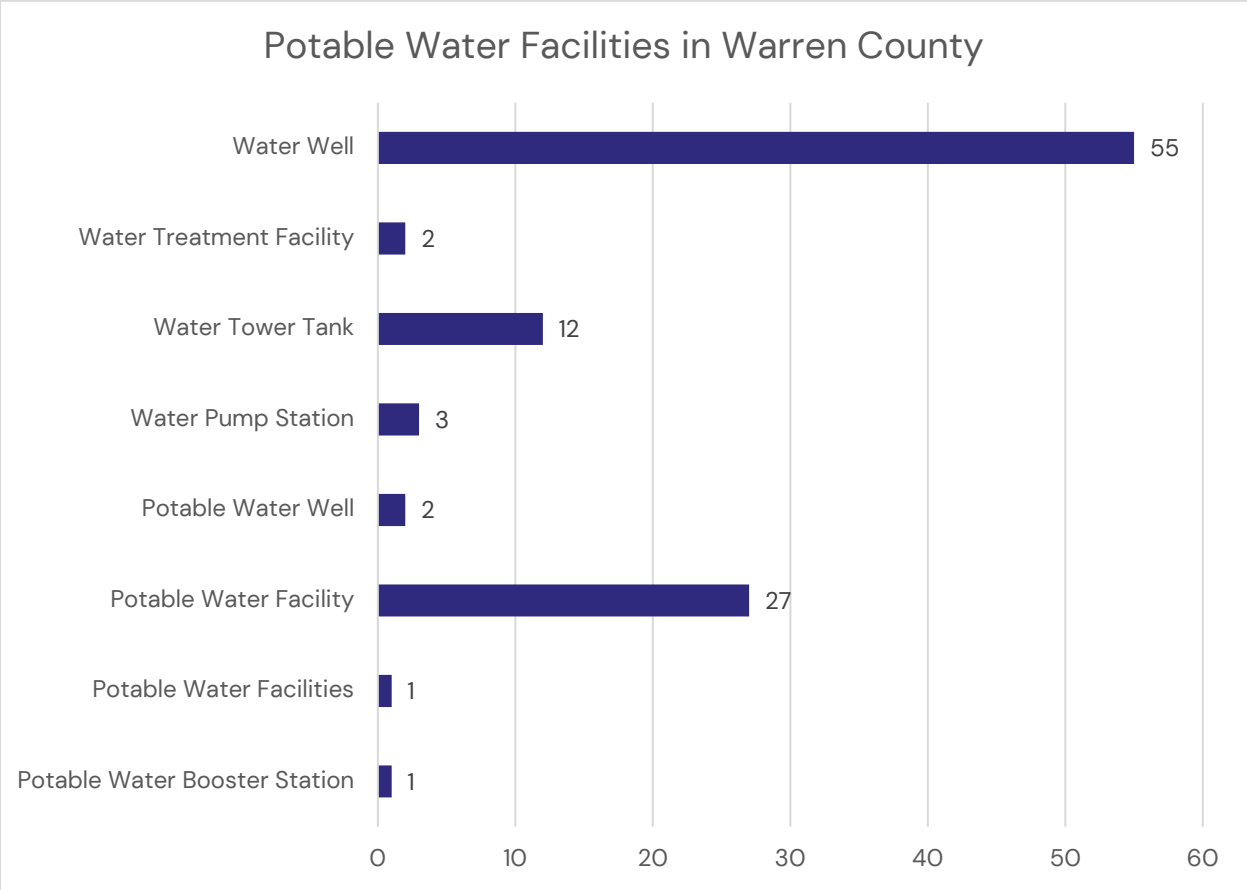
With support and cooperation of the American Red Cross and local jurisdictions, the County references an inventory of suitable shelter locations and can assist with the coordination and communication of shelter availability as necessitated by the execution of local municipal emergency operation plans. County-wide sheltering policies and procedures are documented in the Warren County Comprehensive Emergency Management Plan (CEMP) and Mass Care Annex-ESF #6. The County Animal Response Plan (CARP) identifies a list of pet-friendly hotels. Figure 4-18 displays the location of American Red Cross/cooling shelters within the County.

Potable Water

In Warren County, water is provided from various facilities as a public service or through private supplies, such as wells. Approximately 45% of the land parcels in Warren County are located within a water district, serving approximately 63% of the County population (WCDPCD 2016).

There are 103 potable water supply infrastructure located in Warren County, located in Bolton, Chester, Glens Falls, Hague, Horicon, Johnsburg, Lake George, Lake Luzerne, Queensbury, Stony Creek, Thurman, and Warrensburg. Infrastructure includes potable water booster stations, potable water stations, potable water facilities, potable water wells, water pump stations, water tower tanks, water treatment facilities, and water wells.

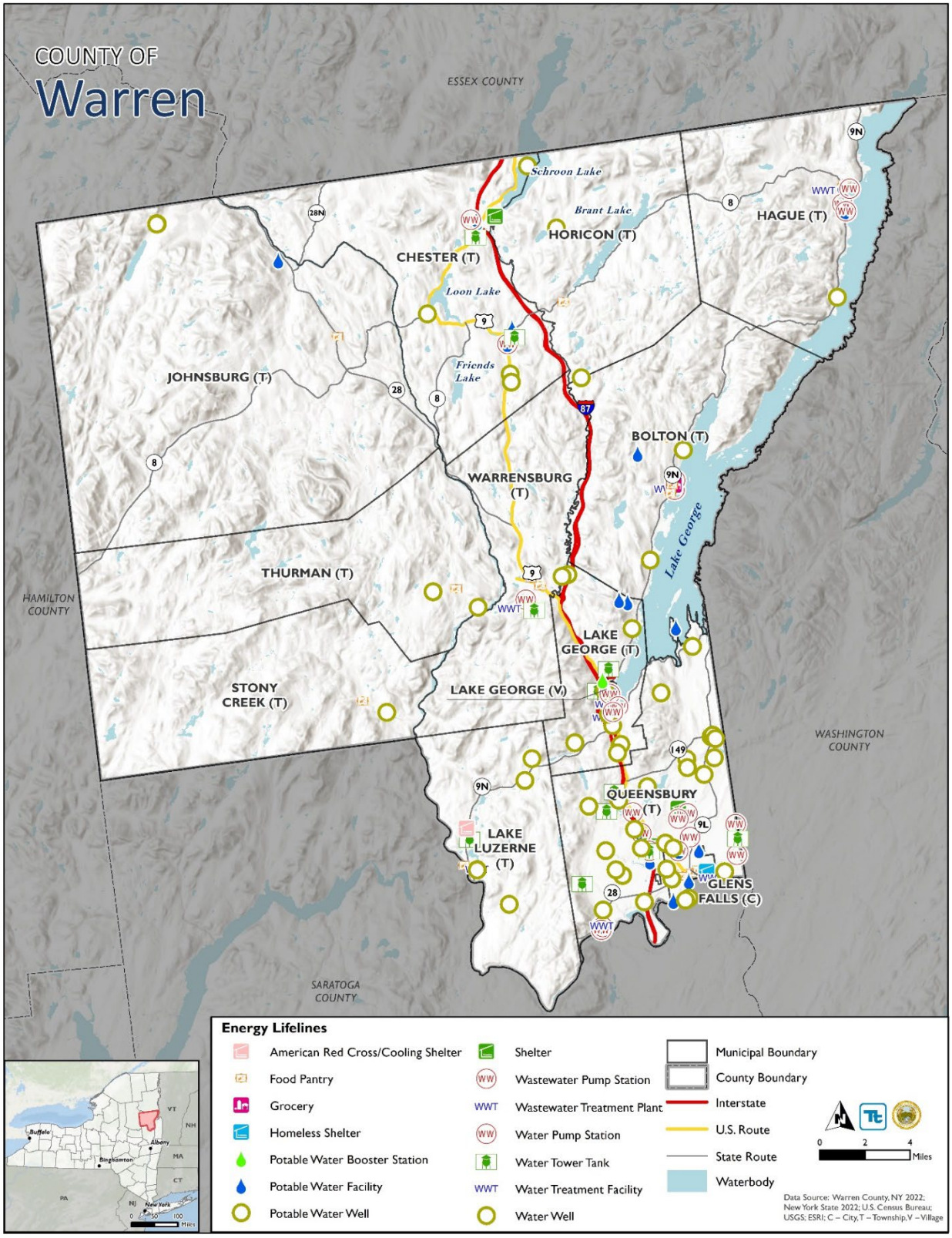
Figure 4-17. Potable Water Facilities, by Type



Wastewater Facilities

Approximately 27% of the land parcels in Warren County are located within a sewer district, serving approximately 33% of the County population (WCDPCD 2016). Wastewater treatment facilities are located in Bolton, Glens Falls (includes a number of pump stations), Hague, Lake George (town) and Queensbury.

Figure 4-18. Food Water and Shelter Lifelines in Warren County



4.6.3 Health and Medical

Health and medical community lifelines include facilities related to medical care, patient moving, public health, fatality management, and medical supply chain. For the purpose of this plan, health and medical facilities include hospitals and medical facilities. Refer to Figure 4-19 for the location of these facilities.

Hospitals and Medical Facilities

The County has one hospital (Glen Falls Hospital) and multiple health care facilities. There are 12 healthcare facilities that provide urgent walk-in care in the County. The Glens Falls Hospital has a heli-pad to service medical emergencies.

4.6.4 Energy (Power and Fuel)

Energy community lifelines include facilities related to power and fuel. For the purpose of this plan, energy facilities include energy resources. Energy lifelines are indicated in Figure 4-20.

Energy Resources

Power in Warren County is transmitted and distributed by National Grid. Homes in the county are heated by many different sources, with a majority using utility gas from National Grid, or fuel oil. There are 19 electric substations in Warren County.

4.6.5 Communications

Communications community lifelines include facilities related to infrastructure; alerts, warnings and messages; 911 and dispatch; responder communications; and finance. For the purpose of this plan, communication facilities include telephone and wireless communication services and public alert systems. Figure 4-21 shows communication community lifelines within the County.

Communication Services

Warren County is served by a variety of communications systems, including traditional land line, fiber optic, and cellular provided by multiple companies, such as Verizon, and AT&T. There are 13 communication facilities in Warren County identified as critical facilities. Each carrier has individual plans for emergency situations during hazard events and post disaster recovery efforts. In addition to land line, fiber optic and cellular communications systems, Warren County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations.

Figure 4-19. Health and Medical Lifelines in Warren County

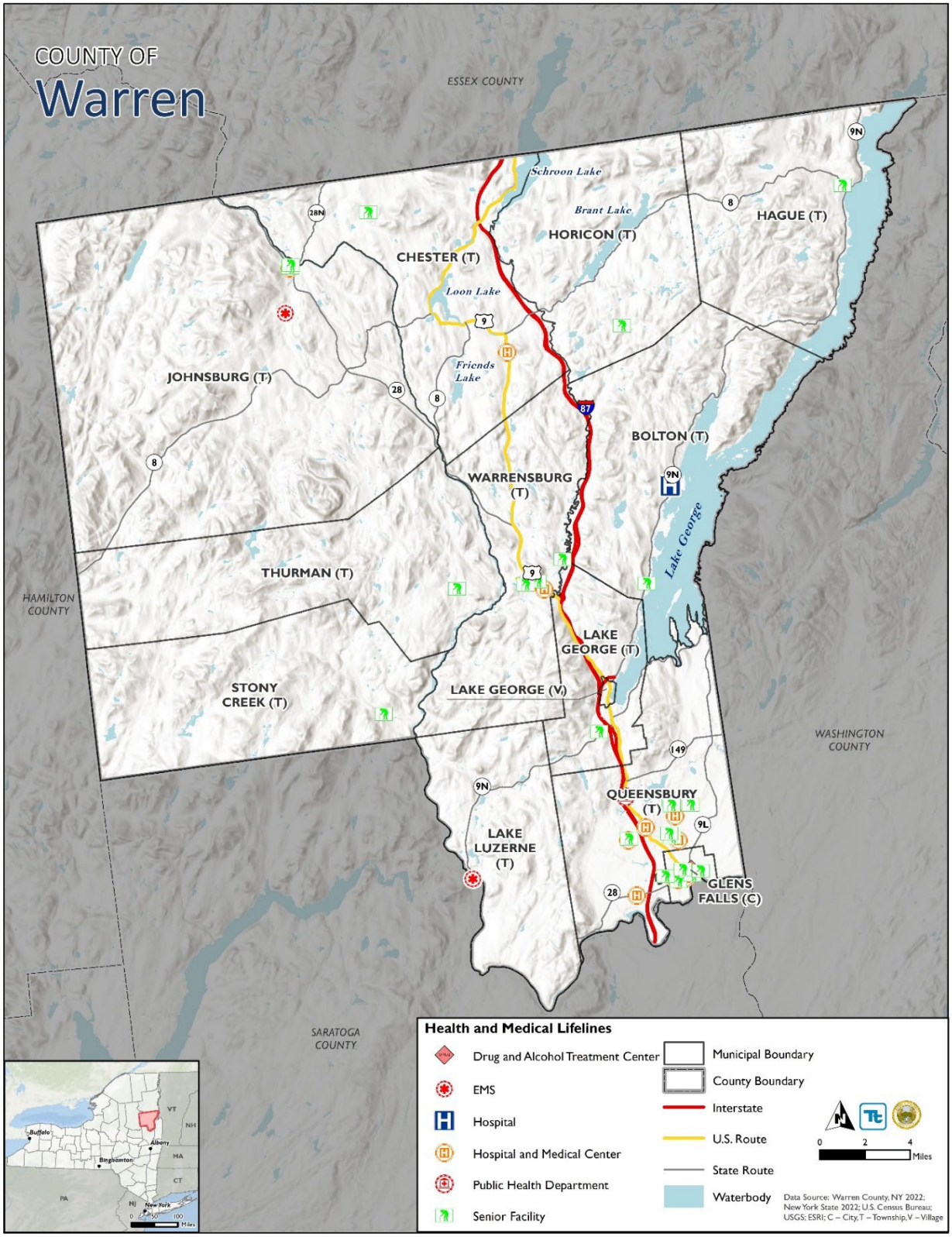


Figure 4-20. Energy Lifelines in Warren County

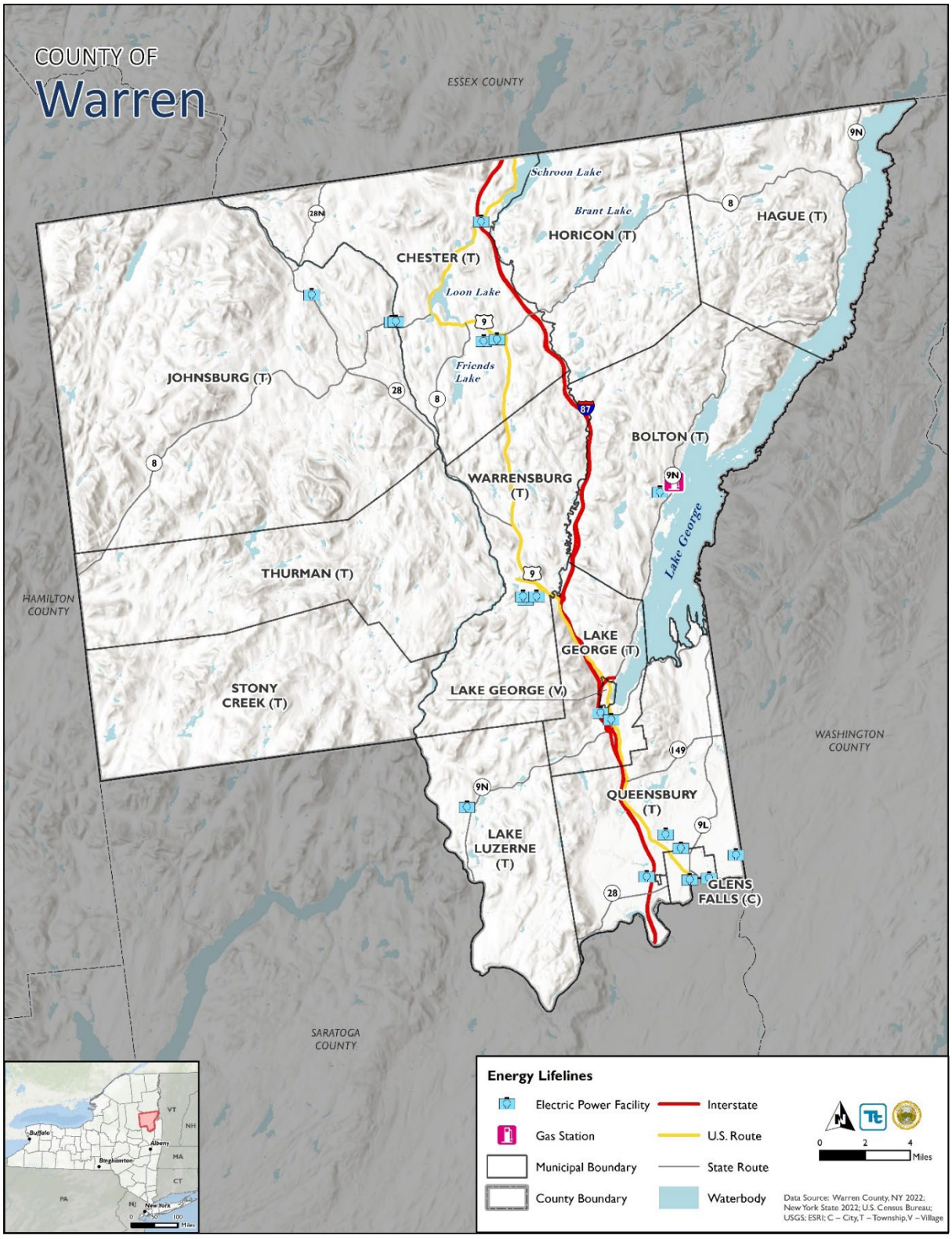
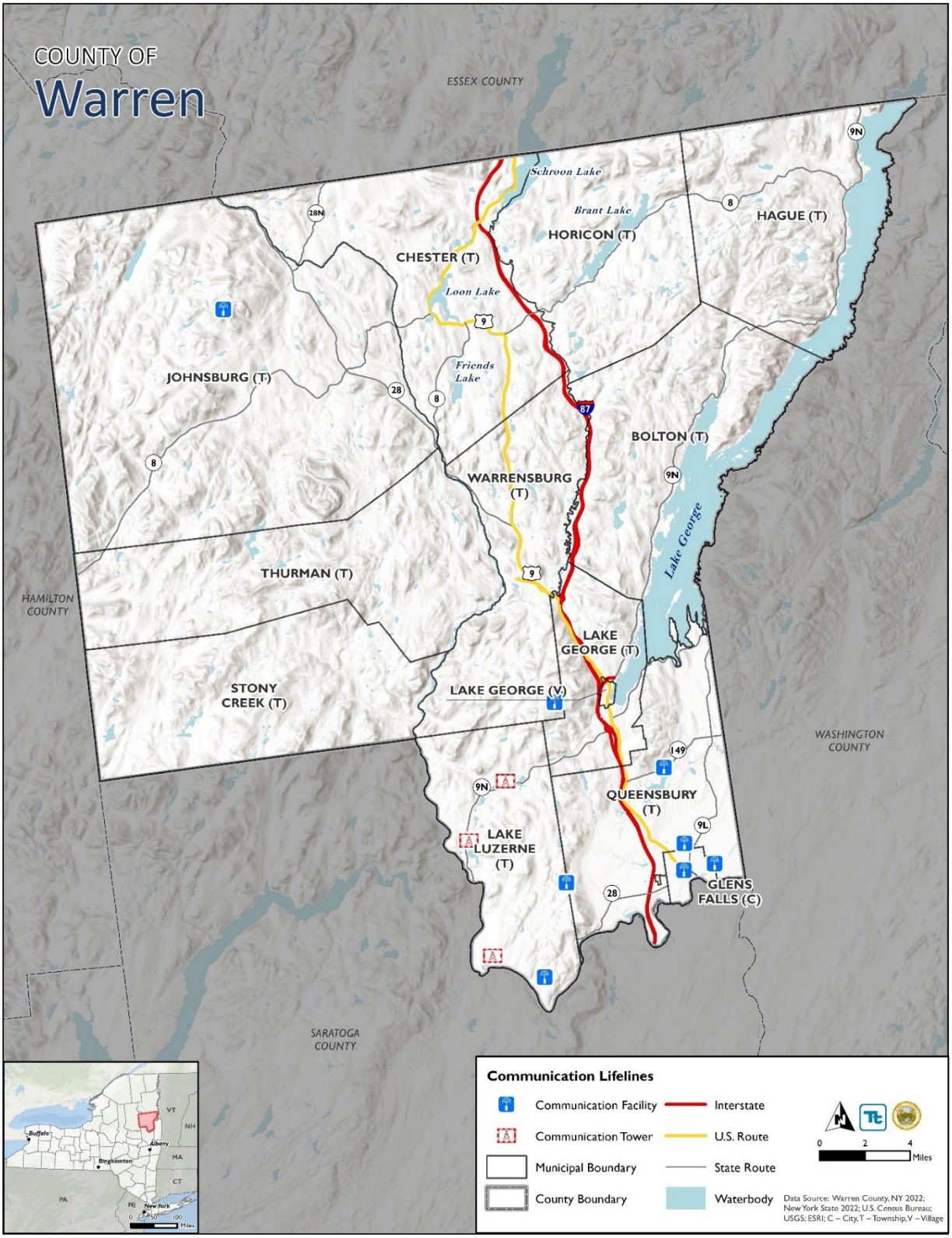


Figure 4-21. Communications Lifelines in Warren County



4.6.6 Transportation

Transportation community lifelines include facilities related to highway/roadways, mass transit, railway, aviation, and maritime. For the purpose of this plan, transportation facilities include highways, roadways, airports, heliports, bus and other transit facilities, and railroads. These facilities are shown in Figure 4-22.

Highway, Roadways and Associated Systems

One thousand, two hundred forty-six miles of road traverse Warren County. US Route 87, the Adirondack Northway, is the only interstate highway and runs north-south between the 'local' population centers of Plattsburgh (north) and Albany (south), and beyond - Montreal, Canada to the north and New York City to the south. The Northway and NYS Route 9 are "north-south" routes within the county, as are NYS Routes 28 and 9N. East-west roads serve as connecting roads to the interstate, state routes, and local population centers, and are dispersed in heavily forested and mountainous rural sections of the county. The City of Glens Falls has a network of state, and local roadways.

Airports and Heliports

The Floyd Bennet Memorial Airport (Warren County 2017) is located three miles northeast of downtown Glens Falls, off of State Route 254. There are two runways at the airport- one 5,000 feet long and the other 4,000 feet long. The airport can serve aircraft as large as a C-5A Galaxy. There is also a private, grass-runway airport known as Bennetts Airport in North Creek.

The Glens Falls Hospital has a heli-pad to service medical emergencies. The County DPW Parks and Recreation Division Fish Hatchery facility (Warrensburg) has a helicopter landing area which can support emergency management functions and is thus considered a county critical facility.

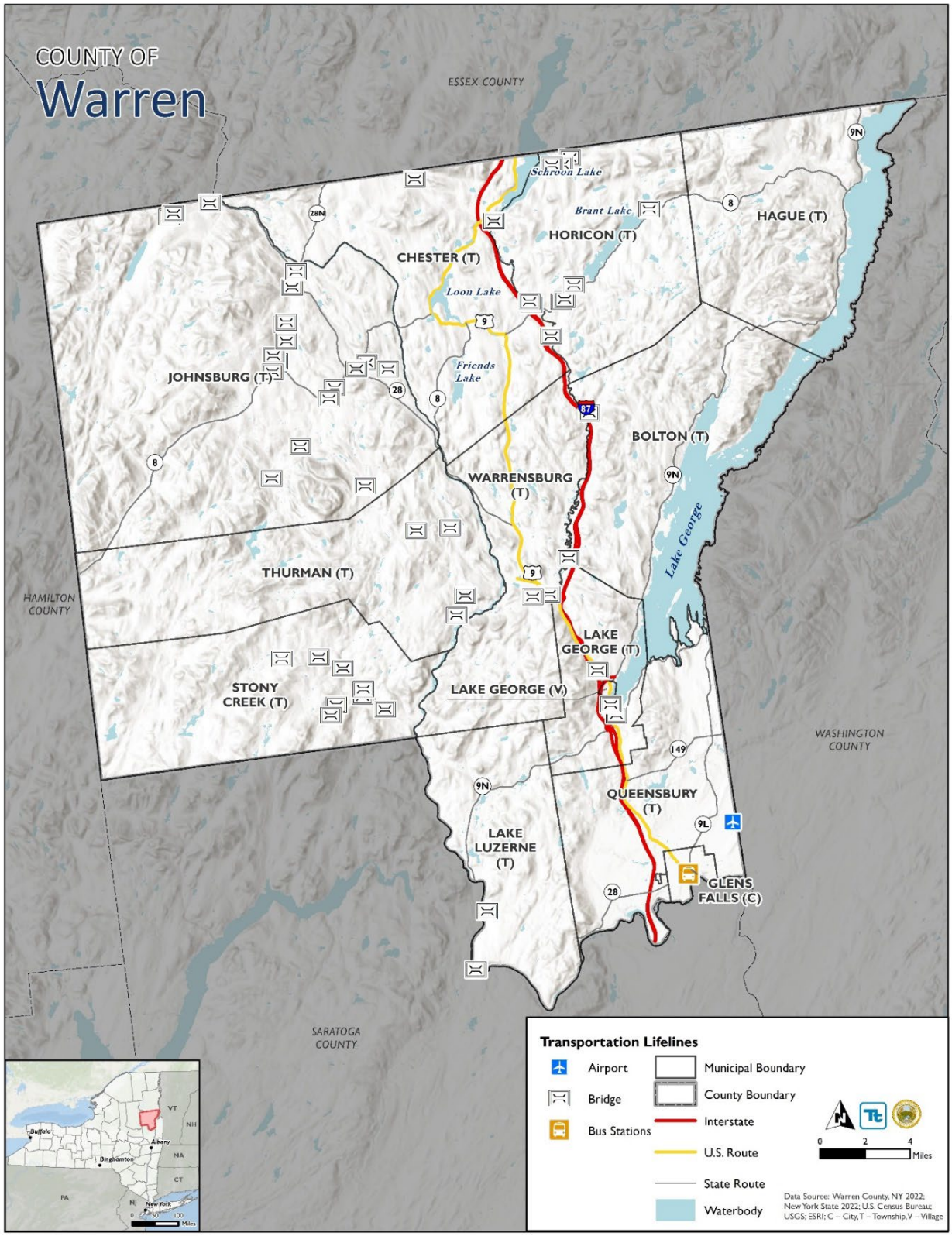
Bus and Other Transit Facilities

There are three main bus services available in Warren County. Adirondack Trailways and Greyhound Lines operate from a bus station in Glens Falls, connecting to destinations throughout New York and beyond. Greater Glens Falls Transit operates year-round, fixed route public transit services to the greater Glens Falls area. Routes span portions of Warren, Washington and Saratoga counties and include Glens Falls, Queensbury, South Glens Falls, Lake George, Hudson Falls, Kingsbury, Fort Edward and Moreau. GGFT began operation in 1984 and on an annual basis transports over 320,000 riders.

Railroad Facilities

There are currently limited rail freight, and no passenger rail services in Warren County. The now defunct Saratoga & North Creek Railway, previously running from Saratoga Springs up the western side of the County is no longer in service and is currently only used recreationally for rail bikes. Limited freight rail is located the City of Glens Falls.

Figure 4-22. Transportation Lifelines in Warren County



4.6.7 Hazardous Materials

Hazardous material community lifelines include facilities related to hazardous material facilities or any type of hazardous materials, pollutants or contaminants. For the purpose of this plan, this includes facilities that contain hazardous materials.

HAZMAT Facilities

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

According to the EPA Envirofacts, there are 552 EPA-regulated facilities in Warren County. This includes the following:

Table 4-8. EPA-Regulated Facilities in Warren County

Program	Description	Number of Facilities in County
ICIS-AIR	Information on air releases is contained in ICIS-AIR, a computer-based repository for information about air pollution in the United States. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce.	44
Assessment, Cleanup and Redevelopment Exchange System (ACRES)	ACRES captures grantee reported data on environmental activities and accomplishments (assessment, cleanup and redevelopment), funding, job training, and details on cooperative partners and leveraging efforts - a central objective of the Brownfields Program.	38
Biennial Report (BR)	Detailed hazardous waste information is collected on the generation of hazardous waste from large quantity generators and data on waste management practices from treatment, storage, and disposal facilities. This information is compiled into a Biennial Report and is useful for trend analysis.	42
Superfund Enterprise Management System (SEMS)	Superfund is a program administered by the EPA to locate, investigate, and clean up uncontrolled hazardous waste sites throughout the United States.	1
GHG	The Greenhouse Gas Reporting Program requires annual reporting of greenhouse gas (GHG) data and other relevant information from large direct emissions sources and suppliers of certain fossil fuels and industrial gases in the United States.	2
ICIS-NPDES	The Permit Compliance System (PCS) and Integrated Compliance Information System (ICIS) databases provide information on companies which have been issued permits to discharge wastewater into rivers.	132

Program	Description	Number of Facilities in County
RCRAInfo	Hazardous waste information is contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies.	376
TRI (Tier II)	The Toxics Release Inventory (TRI) tracks the management of over 650 toxic chemicals that pose a threat to human health and the environment.	44
TSCA	The Toxic Substances Control Act provides EPA with the authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures.	6

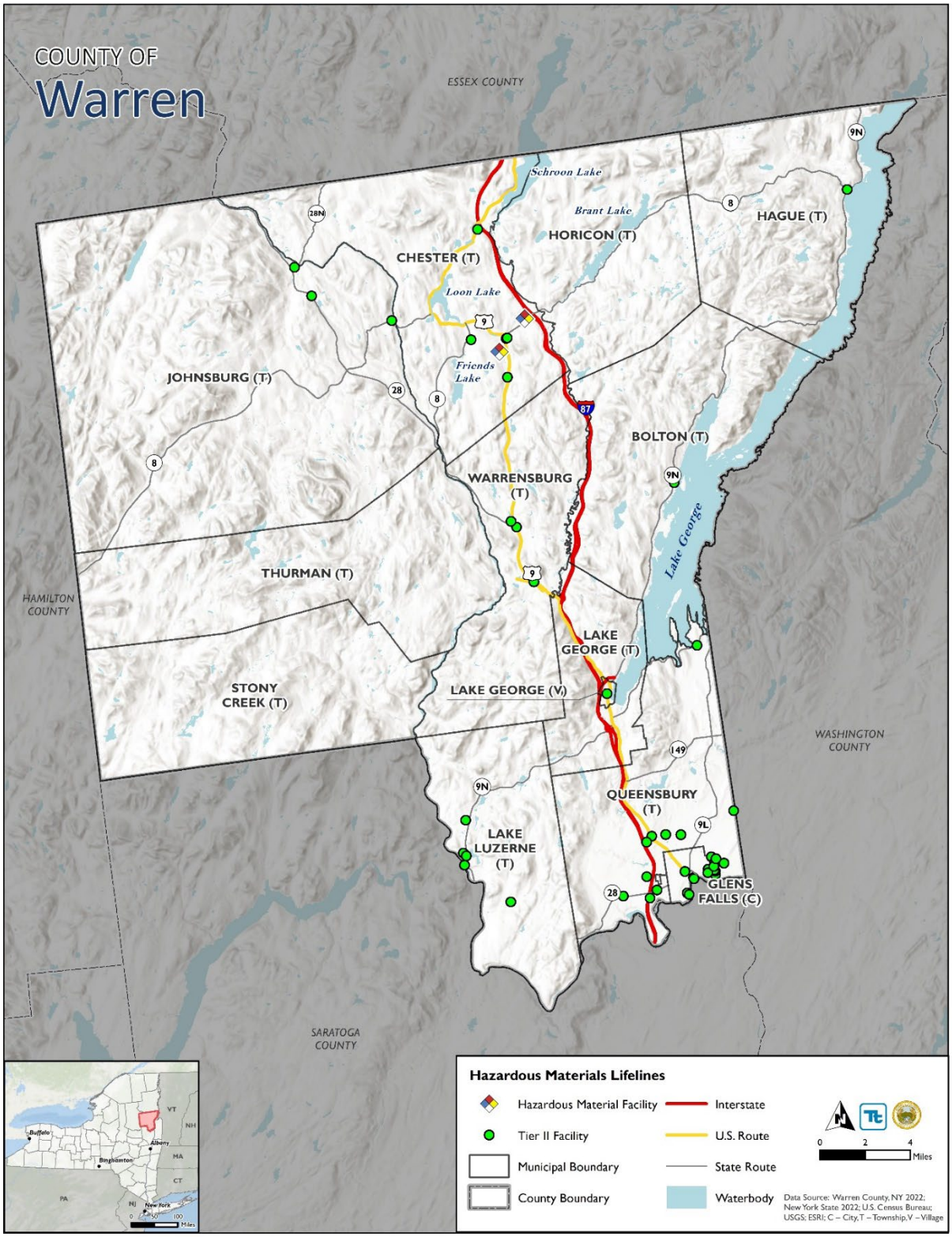
Sources: U.S. EPA 2023; U.S. EPA 2023

In addition to the EPA-regulated facilities, there are numerous hazardous facilities in Warren County cataloged by the NYSDEC's Bulk Storage Program Database. The Bulk Storage Program includes three types of facilities; Petroleum Bulk Storage (PBS), and Chemical Bulk Storage (CBS) that require registration with NYSDEC for all facilities with a total storage capacity of petroleum products of the following:

- PBS—1,100 gallons or more
- CBS underground tanks and all stationary aboveground tanks—185 gallons or more

As of May 2023, there are 417 sites listed in the NYSDEC's Bulk Storage Program Database in Warren County listed as petroleum bulk storage sites, of which 183 are active. There are 21 facilities listed as chemical bulk storage sites of which 8 are active (NYSDEC 2023).

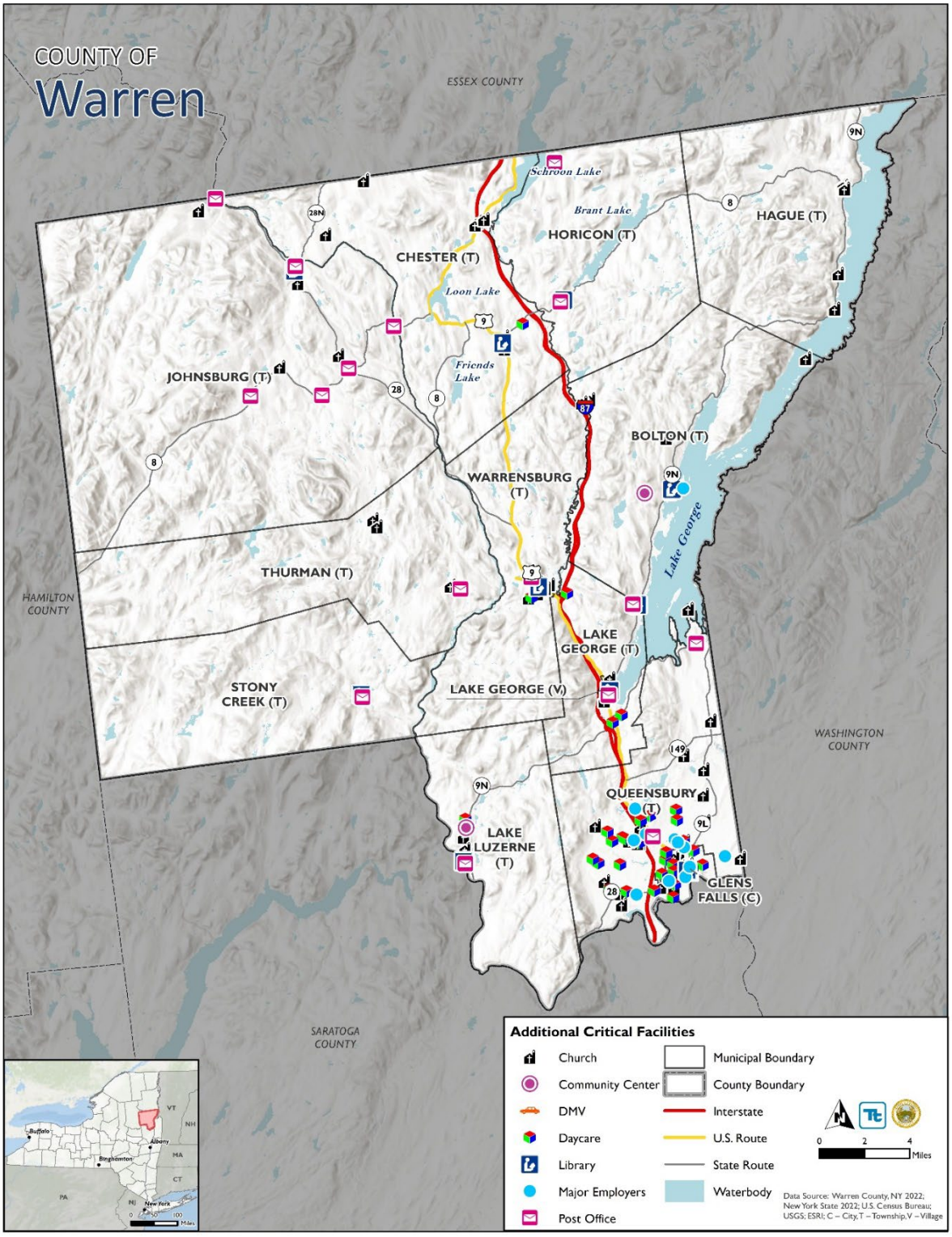
Figure 4-23. Hazardous Materials Lifelines in Warren County



4.6.8 Other Facilities

The Warren County Planning Committee identified 176 additional facilities (user-defined facilities) as critical including municipal buildings and other government facilities. These facilities were included in the risk assessment conducted for the county. Figure 4-24 shows the locations of these facilities in the county.

Figure 4-24. Other Critical Facilities in Warren County



SECTION 5. RISK ASSESSMENT

5.1 METHODOLOGY AND TOOLS

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

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

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

- An updated building stock inventory was created using NYSERDA's 2022 building footprint data using 2022 RS Means values and supplemented with 2021 NYS Tax assessor data.
- 2017-2021 American Community Survey 5-year Population Estimates were utilized.
- A critical facility was generated and reviewed by the Planning Partnership and County jurisdictions.
- Lifelines were identified in the critical facility inventory to align with FEMA's lifeline definition.
- Hazus was used to estimate potential impacts to the flood, wind, and seismic hazards.
- Best available hazard data was used as described in this section.

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

5.1.1 Asset Inventories

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

Population

Total population statistics from the 2017-2021 American Community Survey (ACS) 5-year estimate were used to estimate the exposure and potential impacts to the County's population in place of the 2010 U.S. Census block estimates. To determine population statistics for village and towns, the population of villages was subtracted from the total town population. Please note one distinct population feature for this updated HMP:

The risk assessment included the collection and use of an expanded and enhanced asset inventory to estimate hazard exposure and vulnerability.

1. Any results reported for the Town of Lake George are the results of the Village of Lake George subtracted from the initially reported Town of Lake George statistics.

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

Regarding vulnerable population data, the FEMA Resilience Analysis and Planning Tool (RAPT) was utilized to evaluate certain vulnerability characteristics of communities within Warren County. Census tract data for each municipality was evaluated and reported in municipal annexes as the most appropriate data unit available in the RAPT tool.

Buildings

The building stock inventory developed for the 2023 HMP was updated using NYSERDA 2022 building footprint data, 2022 RS Means values, and supplemented with 2021 NYS Tax assessor data. The occupancy classes available in Hazus were condensed into the following categories (residential, commercial, industrial, agricultural, religious, governmental, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single-family dwellings. Replacement cost value (RCV) is the current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials. Total replacement cost value consists of both the structural cost to replace a building and the estimate value of contents of a building. Structural and content RCV were calculated for each building utilizing RS Means 2022 values. A regional location factor for Warren County was applied based on the individual building stock's zip code location:

- 128: Residential – .93/Non-Residential – .95

Critical Facilities and Lifelines

The County (Steering Committee and County jurisdictions) and its consultant updated the 2017 HMP critical facility inventory to include additional lifelines and user defined assets. The update involved a review for accuracy, additions, or deletions of new/moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition; refer to Appendix E (Supplementary data). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

Environment and Land Use Area

National Hydrography data from NHD was used to assess waterbody coverage of the County. This dataset was used to calculate total acreage of land coverage within Warren County, as well as total land acreage that falls within Flood 100-yr and Flood 500-yr hazard areas.

New Development

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

In addition to assessing the vulnerability of the built environment, Warren County examined recent development over the last 5 years and anticipated new development in the next 5 years. Each jurisdiction provided a list of major development that has taken place within these timeframes. New development was identified as 1) anticipated in the next five years and 2) recently developed over the last five years.

Identifying these changes and integrating new development into the risk assessment provides communities information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future (one tool in the Mitigation Toolbox discussed in Section 6 – Mitigation

Strategy). The new development is summarized in Section 4 (County Profile) and presented in Section 9 (Jurisdictional Annexes) as a table in each annex.

5.1.2 Methodology

To address the requirements of the DMA 2000 and to better understand potential vulnerability and losses associated with hazards of concern, Warren County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Three different levels of analysis were used depending upon the data available for each hazard as described below. Table 5.1-1 summarizes the type of analysis conducted by hazard of concern.

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

Table 5.1-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Disease Outbreak	Q	Q	Q	Q
Earthquake	E, H, Q	E, H, Q	E, H, Q	Q
Extreme Temperature	Q	Q	Q	Q
Flood	E, H, Q	E, H, Q	E, H, Q	Q
Hazmat Rail	E	E	E	Q
Hazmat Roads	E	E	E	Q
Dam Failure	E,Q	E,Q	E,Q	Q
Hurricane	H	H	H	Q
Infestation	Q	Q	Q	Q
Severe Storm	H, Q	H, Q	H, Q	Q
Severe Winter Storm	Q	Q	Q	Q
Wildfire	E	E	E	Q

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

Hazards U.S. – Multi-Hazard (Hazus)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or Hazus. Hazus was developed in response to the need for more effective national-

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

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

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

Table 5.1-2. Summary of Hazus Analysis Levels

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

Dam Failure

Assets that fall with dam inundation hazard areas within Warren County are at greatest risk of impacts from dam failure events. A quantitative assessment was conducted for the dam failure hazard for dams with available digital inundation boundaries available. The analysis aggregated the high hazard dam inundation areas for rainy day scenarios. Inventory such as Critical Facilities and

General Building Stock, as well as Population estimates that are geographically located in the aggregate high hazard dam inundation were considered exposed.

Additionally, an exposure analysis for the individual dams was conducted. This included the same inventory data: Critical Facilities, General Building Stock, as well as Population estimates. Those inventory points within the individual dam inundation hazard areas were considered exposed. Because of the sensitive nature of the dam failure inundation zones, potential losses have not been presented in the vulnerability assessment but are provided in a confidential appendix.

Disease Outbreak

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

Earthquake

Probabilistic assessment was conducted for Warren County for the 500-year and 2,500-year mean return periods (MRPs) through a Level 2 analysis in Hazus v5.1 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations, and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

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

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

An exposure analysis was conducted for the County's assets (population, building stock, critical facilities, and new development) using NEHRP soil data provided by New York State and the national landslide susceptibility data where landslide susceptibility was listed as high susceptibility. The exposure analysis focused on soil types that would experience amplified ground motion during an earthquake (i.e., Class D and E). Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to these soil types.

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

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

Extreme Temperatures

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

Flood

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

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

- Warren County georeferenced FIRM maps from the 1980's and 1990's
- The depth grid was developed for the 2023 Warren County HMP using a combination of data from the State of New York's 1-meter Resolution Digital Elevation Model, USGS's 10-meter Resolution Digital Elevation Model, and FEMA's 2-meter Resolution Digital Elevation Model.

FEMA has not developed digital DFIRM flood data for Warren County. Warren County previously georeferenced and digitized the hardcopy FIRM maps from the 1980's and 1990's and this digital data was used to evaluate exposure for the 1- and 0.2-percent annual chance flood events, as well as determine potential future losses for the 1-percent annual chance event.

The digital georeferenced Flood data that Warren County created was used to evaluate exposure and determine potential future losses. The depth grid generated for the 2023 HMP was integrated into the Hazus riverine flood model used to estimate potential losses for the 1-percent annual chance flood event.

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

Hazardous Materials

Hazardous materials data, including hazmat rail and roads were analyzed during our exposure assessment to determine what population, critical facilities and general building stock are located within a ½ buffer of the rail lines and roads. Railroads were analyzed in Glens Falls (C) and Queensbury (T) only as the additional rail lines are currently non-functioning. Pipe data was not available and therefore not analyzed during this assessment.

Infestation and Invasive Species

A qualitative analysis was conducted for the infestation and invasive species hazard. All of Warren County is considered exposed due to the historical existence and evidence of invasive species in New York State and Warren County. Data from the United States Department of Agriculture, New York Department of Environmental Conservation, the New York State Invasive Species Program, and the Cornell Cooperative Extension of Warren County was used to develop the hazard profile and to determine risk and exposure.

Severe Storm

A Hazus probabilistic analysis was performed in Hazus v5.1 to analyze the wind hazard losses for Warren County for the 100- and 500-year MRP events. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Warren County. Hazus contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. A Hazus historical analysis was performed in Hazus v5.1 to analyze the historical severe storm event of 1938 for Warren County. The historical Hazus hurricane model activates a database with the historical storm track and intensities including peak gust data. Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damages are estimated at the census tract level, results were presented at the municipal level. Since there are multiple census tracts that contain more than one jurisdiction, a density analysis was used to extract the percent of building structures that fall within each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Severe Winter Storm

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

Wildfire

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

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

Considerations for Mitigation and Next Steps

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

- All Hazards
  - Create an updated user-defined general building stock dataset with first floor elevation and more detailed Residential Occupancy Classifications.
  - Utilize updated and current demographic data.
- Flood
  - The general building stock inventory can be updated to include attributes regarding more detailed Residential Occupancy classifications and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10 and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Utilize FEMA DFIRM data should it become available.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts at these properties can be developed.
- Extreme Temperatures
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at risk areas.
- Hazardous Materials
  - Utilize Pipe data to create a Hazmat Buffer if data is available, to include in exposure analysis.
- Severe Storm
  - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
  - Integrate evacuation route data that is currently being developed.
- Wildfire
  - General building stock inventory can be updated to include attributes such as roofing material or fire detection equipment or integrate distance to fuels as another measure of vulnerability.

5.1.3 Data Source Summary

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

Table 5.1-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2020; 2021	Excel format; Digital (GIS) format
Building Inventory	NYSERDA 2022 Building Footprints, NYS 2021 Tax Assessor Data, RS Means	2022; 2021; 2022	Digital (GIS) format
Wildfire Fuel Hazard	University of Wisconsin - Madison	2010	Digital (GIS) format
Critical Facilities	Warren County GIS; Warren County Planning Partners	2022;	Digital (GIS) format
Digitized FIRM maps	Warren County GIS	2022;	Digital (GIS) format
NEHRP Soil	NYS	n.d.	Digital (GIS) format
1-meter, 2-meter and 10-meter Resolution Digital Elevation Model	New York State; FEMA; USGS-NYSDEC/CUGIR	2022	Digital (GIS) format
Dam Inundation Areas	Warren County GIS	2022	Digital (GIS) Format

Limitations

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

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

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Warren County will work to collect additional data, update and refine existing inventories, to assist in estimating potential losses. Related to dam failure analysis and inundation mapping, there were specific limitations to the exposure assessments as spatial data was not available for all of the high hazard dams. Four of the high hazard dams were assessed using previously developed inundation maps. For future improvements, spatial data for all of the high hazard dams is needed to decrease uncertainties in the exposure assessments.

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

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

> ***Hazards of Concern*** are those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.
>
> ***Natural Hazards*** are those hazards that are a source of harm or difficultly created by a meteorological, environmental, or geological event.

Warren County reviewed a full range of hazards that could impact the area and then identified and ranked those hazards that presented the greatest concern to provide a strong foundation for mitigation actions considered in Sections 6 (Mitigation Strategy) and 9 (Jurisdictional Annexes). The hazard of concern identification process incorporated input from the county and participating jurisdictions; review of the New York State Hazard Mitigation Plan (NYS HMP 2019); review of the 2017 Warren County HMP; 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 (not manmade) hazards and the perceived vulnerability of the study area's assets to them. Table 5.2-1 provides the natural hazards reviewed with respect to the history of impacts in the county to identify the hazards of concern in the county. Profiles of these hazards are included in the plan.

5.2.1 Changes from 2017 Hazard Mitigation Plan

The 2017 Warren County Hazard Mitigation Plan identified earthquake, disease outbreak, flood, infestation, landslide, severe storm, severe winter storms and wildfire as individual natural hazards of concern. The 2017 plan also identified cyber-security and hazardous materials as non-natural hazards of concern. During the 2023 Hazard Mitigation Plan Update planning process, the Steering Committee elected to include those hazards with the exception of the landslide, hazardous materials, and cyber-security hazards and with the addition of the extreme temperature hazard. The 2023 Warren County Hazard Mitigation Plan Update includes best available data throughout the plan to present an updated understanding of Warren County's risk.

5.2.2 Hazard Groupings

As per the 2017 Warren County HMP, the Steering and Planning Committees maintained the grouping of hazards based on the similarity of hazard events, typical concurrence or impacts, consideration of how hazards have been grouped in Federal Emergency Management Agency (FEMA) guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy*; *Local Mitigation Planning Handbook*), and consideration of hazard grouping in the NYS HMP.

The *Disease Outbreak* hazard profile addresses mosquito-borne, tick borne, and communicable respiratory diseases that occurred in Warren County or had a considerable impact on the county.

The Earthquake hazard profile includes events associated with an earthquake that may affect resident's normal activities such as surface faulting and ground shaking. The profile provides a description, extent, location, previous occurrences and losses, climate change projections, and the probability of future occurrences of the earthquake hazard.

The *Extreme Temperature* hazard profile specifically addresses periods of extreme temperature that occurred in Warren County or had a considerable impact on the county.

The *Flood* hazard includes riverine flooding, flash flooding, shallow 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 and the NYS HMP.

The Dam Failure profile addresses dam failure flooding. The profile includes the description, location, extent, previous occurrences and losses, probability of future occurrences, impact of climate change, and vulnerability assessment for the hazards posed by dams in Warren County.

The *Infestation and Invasive Species* hazard profile specifically addresses invasive species that affect Warren County and the surrounding region.

The *Severe Storm* hazard includes windstorms that often entail a variety of other influencing weather conditions, including thunderstorms, hail, lightning, and tornadoes. Tropical disturbances (hurricanes, tropical storms, and tropical depressions) are often identified as a type of severe storm. For this HMP update *Severe Storm* includes thunderstorms, hail, lightning, tornadoes, hurricanes, tropical storms, and Nor'Easters.

The *Severe Winter Storm* hazard includes heavy snowfall, blizzards and freezing rain/sleet. This grouping is consistent with the NYS HMP.

The *Wildfire* hazard profile specifically addresses effects of wildfire that could have a considerable impact on the county.

Technological (e.g., hazardous material incidents) and some man-made hazards (e.g., terrorism) have not been addressed in this planning process. The DMA 2000 regulations do not require consideration of such hazards, and due to limited funding, these were not chosen for inclusion in this plan by Warren County and planning participants. The county can expand the scope of this HMP to include other less frequent natural, technological, and more man-made hazards as resources permit.

Table 5.2-1. Identification of Hazards of Concern for Warren County

Hazard	Is this a hazard that may occur in Warren County?	If yes, does this hazard pose a significant threat to Warren County and is this included as a Hazard of Concern?	Why was this determination made?	Source(s)
Avalanche	No	No	• The NYS HMP identifies avalanche as a hazard of concern; however, the daily probability of an avalanche for the state is 0.02 percent. • Avalanches can occur in any situation where snow, slope and weather conditions combine to create proper conditions. About 90 percent of all avalanches start on slopes of 30 to 45 degrees and about 98 percent of all avalanches occur on slopes of 25 to 50 degrees. • 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 1998 and 2020. • Avalanche was identified as a hazard in the NYS HMP and there have been occurrences in the state; however, the daily probability of an avalanche in the state is 0.02 percent. In addition, there have been no known occurrences in Warren County. The Steering Committee does not consider the hazard to be a significant concern.	• NYS DHSES • NAC-AAA • NY HMP • NOAA-NCEI
Coastal Erosion	No	No	• The NYS HMP identifies coastal erosion as a hazard of concern for New York State. Erosion can impact all the state's coastal counties along: Lake Erie and the Niagara River, Lake Ontario and the St. Lawrence River, Atlantic Ocean and Long Island Sound, Hudson River south of the federal dam in Troy, the East River, the Harlem River, the Kill van Kull and Arthur Kill, and all connecting waterbodies, bays, harbors, shallows, and wetlands. • As stated above, coastal erosion is limited to the state's coastal counties. Warren County is not a coastal county; therefore, the Steering Committee does not consider the hazard to be a significant concern.	• NYS DHSES • Input from Steering and Planning Committees •
Dam Failure	Yes	Yes	• The 2019 NYS HMP identifies dam failure as a hazard of concern for New York State and includes it in the Flood hazard profiles. • According to the New York Dam Safety Inspection 68 dams are within Warren County, as shown in Section 4. Of these 68 dams, 38 are low hazard, 16 are intermediate hazard and 7 are high hazard (County, 2022).	• NYS DHSES • Warren County Emergency Services Input from Steering and Planning Committees • NYSDEC • NYS GIS
Disease Outbreak	Yes	Yes	• The 2019 NYS HMP does not identify disease outbreak as a hazard of concern for New York State.	• NYS DHSES • NYS DEC

Hazard	Is this a hazard that may occur in Warren County?	If yes, does this hazard pose a significant threat to Warren County and is this included as a Hazard of Concern?	Why was this determination made?	Source(s)
			• According to the 2020 Warren County CEPA, the pandemic hazard is ranked medium. • The County has been impacted by the COVID-19 pandemic (DR-4480). • The County has been impacted by various diseases (COVID-19, West Nile Virus, Lyme disease); therefore, the Steering Committee identified disease outbreak as a hazard of concern for Warren County.	• Input from Steering and Planning Committees
Drought	Yes	No	• The NYS HMP identifies drought as a hazard of concern for the state with a daily probability of a drought for the state is 0.38 percent. • Warren County has been impacted by two drought events that have occurred in New York State. • Drought conditions can cause shortages in water for human consumption, impact agricultural production, and lead to reduced local firefighting capabilities. • New York State was included in one FEMA drought-related disaster declaration, which did not include Warren County. • Warren County entered two droughts in 1999. • According to the 2020 Warren County CEPA, the drought hazard is ranked low. • Based on previous occurrences and input from the Steering Committee, drought was not identified as a hazard of concern for Warren County.	• NYS DHSES • FEMA • USDA • Input from Steering and Planning Committees • NOAA-NCEI • NRCC
Earthquake	Yes	Yes	• The 2019 NYS HMP identified earthquake as a hazard of concern for the state however, the daily probability of an earthquake for the state is 0 percent. • According to the 2015 NYS HMP, between 1973 and 2012, there have been 189 earthquakes epicentered in the State. Of those 189 events, four had an epicenter in Warren County. • There have been several earthquakes with epicenters located in close proximity to Warren County. New York State was included in one FEMA earthquake-related disaster declaration (DR-1415); Warren County was not included in this declaration. • Based on the existence and location of faults in the County, despite the lack of significant historical impacts the Steering Committee identified earthquake as a hazard of concern for Warren County.	• NYS DHSES • Input from Steering and Planning Committees • USGS – Earthquake Hazards Program, Review of USGS Seismic Maps
Extreme Temperature	Yes	Yes	• The NYS HMP identified extreme temperatures as a hazard of concern for New York State.	• NYS DHSES

Hazard	Is this a hazard that may occur in Warren County?	If yes, does this hazard pose a significant threat to Warren County and is this included as a Hazard of Concern?	Why was this determination made?	Source(s)
			○ Warren county has experienced 4 extreme heat events (NY HMP). ○ Warren County has experienced 18 extreme cold events • The Steering Committee identified extreme temperature as a hazard of concern for Warren County.	• Input from Steering and Planning Committees • NOAA-NCEI • USDA
Flood (riverine, ice jam, dam failure and flash)	Yes	Yes	• The NYS HMP identified flooding as a hazard of concern for New York State and the daily probability of a flood for the state is 21.75 percent. • Between 2000 and 2022, Warren County was included in 2 FEMA flood-related declarations. ○ FEMA-DR-1993(Severe Storms Tornadoes, Winds and Flooding) – April 26, 2011 ○ FEMA-DR-4129 (Severe Storms, and Flooding) – July 2013. • Based on the history of flooding and its impacts on Warren County and input from the Steering and Planning Committees identified flooding as a hazard of concern for the county.	• NYS DHSES • Input from Steering and Planning Committees • FEMA • NOAA-NCEI USACE CRREL Ice Jam Database
Hailstorm	Yes	Yes	Please see Severe Winter Storm	
Hurricane	Yes	Yes	Please see Severe Storm	
Ice Jams	Yes	Yes	Please see Flood	
Ice Storm	Yes	Yes	Please see Severe Winter Storm	
Infestation	Yes	No	Please see Invasive Species	
Invasive Species	Yes	Yes	• The 2019 NYS HMP does not identify invasive species as a hazard of concern for New York State. • New York State has been affected by various instances of invasive ticks and mosquitos. • There are many identified invasive species that are present in Warren County and are a threat to natural forests, therefore the Steering Committee identified infestation and invasive species as a hazard of concern.	• NYS DEC • Input from Steering and Planning Committees
Land Subsidence	Yes	No	• The 2019 NYS HMP indicates 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 Steering Committee did not identify land subsidence as a hazard of concern for Warren County.	• NYS DHSES • Input from Steering and Planning Committees • USGS
Landslide	Yes	No	• The 2019 NYS HMP includes landslide as a hazard of concern for New York State however, the daily probability of a landslide for the state is 0.04 percent.	• NYS DHSES

Hazard	Is this a hazard that may occur in Warren County?	If yes, does this hazard pose a significant threat to Warren County and is this included as a Hazard of Concern?	Why was this determination made?	Source(s)
			• According to the 2019 NYS HMP, Warren County has experienced 0 landslide event from 1996-2017. • Between 1954 and 2020 New York State has included in one landslide-related disaster declaration. • Based on previous occurrences and input from the Steering Committee,, the landslide hazard was not identified as a hazard of concern for Warren County.	• Input from Steering and Planning Committees • FEMA
Nor'Easters	Yes	Yes	Please see Severe Storm	
Severe Storm (Windstorms, thunderstorms, hurricanes / tropical storms, Nor'Easters, hail and tornados)	Yes	Yes	• The NYS HMP identified severe storm as a hazard of concern for New York State; however, for the state HMP, the hazards were profiled in individual sections thunderstorms, lightning, hail, tornadoes, high winds, and hurricanes/tropical storms. For the Warren County HMP, the hazards were combined into subheadings under one profile. • Between 2016 and 2022, Warren County was included in 1 FEMA severe storm-related declarations. ○ FEMA-DR-4472 (Severe Storms, Straight-line Winds and Flooding) – October 2019 • According to the NOAA, 5 tornado events took place in Warren County between 1950 and 2022. • Based on previous occurrences and input from the Steering Committee, severe storms are identified as a hazard of concern for Warren County.	• NYS DHSES • FEMA • NOAA-NCEI • SPC • Input from Steering and Planning Committees
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	• The NYS HMP identified severe winter storm as a hazard of concern for New York State. • FEMA included Warren County in one winter storm-related disaster declarations: ○ FEMA-EM-3107 (Severe Blizzard) – March 1993 • Based on previous occurrences and input from the Steering Committee, severe winter storms are identified as a hazard of concern for Warren County.	• NYS DHSES • FEMA • NOAA-NCEI • Input from Steering and Planning Committees
Tornado	Yes	Yes	Please see Severe Storm	
Tsunami	No	No	• Tsunami is identified as a hazard of concern in the NYS HMP; however, while rare, tsunamis impact the coastal areas of the State and have a daily probability of .13 percent of occurring.	• NYS DHSES • Input from Steering and Planning Committees

Hazard	Is this a hazard that may occur in Warren County?	If yes, does this hazard pose a significant threat to Warren County and is this included as a Hazard of Concern?	Why was this determination made?	Source(s)
			• Due to its more inland location and based on input from the Steering Committee, tsunamis are not identified as a hazard of concern for Warren County.	
Volcano	No	No	• The NYS HMP did not identify volcano as a threat for New York State and, therefore, the Steering Committee does not consider volcano to be a hazard of concern for Warren County.	• NYS DHSES • Input from Steering and Planning Committees
Wildfire	Yes	Yes	• The NYS HMP identified wildfire as a hazard of concern for New York State, however the daily probability of a wildfire breakout for the state is .09 percent. • Warren County was included in one FEMA fire declaration; however, it was a manmade terrorist attack. • According to the 2020 Warren County CEPA, the wildfire hazard is ranked medium. • Based on available data, the Steering Committee identified wildfire as a hazard of concern for Warren County.	• NYS DHSES • Input from Steering and Planning Committees • FEMA
Windstorm	Yes	Yes	Please see Severe Storm	

CEPA *Warren County Emergency Preparedness Assessment (2020)*
CRREL *Cold Regions Research and Engineering Laboratory*
DR *Presidential Disaster Declaration Number*
EM *Presidential Disaster Emergency Number*
FEMA *Federal Emergency Management Agency*
NCEI *National Centers for Environmental Information*
NOAA *National Oceanic and Atmospheric*
NRCC *Northeast Regional Climate Center*
NYS DEC *New York State Department of Environmental Conservation*
NYS DHSES *New York State Division of Homeland Security and Emergency Services*
NYS HMP *New York State Hazard Mitigation Plan*
PGA *Peak ground acceleration*
SPC *Storm Prediction Center*
USDA *U.S. Department of Agriculture*
USGS *United States Geologic Survey*

5.2.3 Summary of Hazards of Concern

In summary, a total of 9 natural hazards of concern were identified as significant hazards affecting the entire planning area, to be addressed at the county level in this plan (shown here in alphabetical order):

- Disease Outbreak/Pandemic
- Earthquake
- Extreme Temperatures
- Flood (riverine, dam failure, flash, ice jam, beaver dam)
- Dam Failure
- Infestation/Invasive Species
- Severe Storm (thunderstorm, hail, wind, tornado)
- Severe Winter Weather
- Wildfire

Other natural hazards of concern that might have occurred in Warren County but have a low potential to occur or result in significant impacts can be considered in future updates to this plan.

5.3 HAZARD RANKING

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

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

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Warren County is described below. Estimates of risk for the county were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's HAZUS-MH risk assessment tool, and input from Warren County and participating jurisdictions. The ranking includes a factor to evaluate capacity of the participating jurisdiction regarding ability to address the hazard through plans, policies, and mitigation strategies. For example, a community with strong codes and ordinances to discourage development in hazard areas has a high capacity to address and mitigate potential impacts due to natural hazards and this is reflected in the ranking benchmark. In addition to benchmarks addressing probability, impacts and capabilities, a factor addressing the degree of climate change impact is also included in the methodology to adjust rankings for hazards expected to be significantly impacted by climate change. Table 5.3-1 shows the four risk assessment categories' values for each of Warren County's hazards. Details for each category are further described below.

Table 5.3-1. Summary of Hazard Ranking Approach

Category	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.	0	30%
	Rare	Between 1 and 10% annual probability of a hazard event occurring.	1	

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		Occasional	Between 10 and 100% annual probability of a hazard event occurring.	2	
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14% or less of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	1	30%
		Medium	15% to 29% of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	2	
		High	30% or more of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14% or less of the total number of structures for community.	1	
		Medium	Property exposure is 15% to 29% of the total number of structures for community.	2	
		High	Property exposure is 30% or more of the total number of structures for community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9% or less of the total replacement cost for community.	1	
		Medium	Loss estimate is 10% to 19% of the total replacement cost for community.	2	
		High	Loss estimate is 20% or more of the total replacement cost for community.	3	
Capability		Weak	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	-1	30%
		Moderate	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	0	
		Strong	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	1	
Climate Change		Low	No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well-documented and acceptable methods).	3	

Probability of Occurrence

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

Table 5.3-2. Probability of Occurrence Ranking Factors

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

Impact

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

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

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

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

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

Additional Impacts

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

Capability

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

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

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

Climate Change

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

Table 5.3-5. Numerical Values and Definitions for Changing Future Conditions

Category	Low Impact	Medium Impact	High Impact
Climate Change	No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well-documented and acceptable methods).

Risk Ranking Value

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

Example Risk Ranking Equation

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

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

5.3.2 Hazard Ranking Results

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

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

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

Table 5.3-6. Probability of Occurrence Ranking for Hazards of Concern for Warren County

Hazard of Concern	Probability	Numeric Value
Earthquake	Rare	1
Extreme Temperature	Occasional	2
Flood	Frequent	3
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Wildfire	Occasional	2
Infestation	Occasional	2
Dam Failure	Rare	1
Disease Outbreak	Occasional	2

Table 5.3-7 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the county level. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide. Jurisdictional ranking results are presented in each local annex in Section 9 (Jurisdictional Annexes) of this plan. The weighting factor results and a total impact for each hazard also are summarized.

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

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	
Earthquake	Medium	2	6	High	3	6	Low	1	1	13
Extreme Temperature	Medium	2	6	Low	1	2	Medium	2	2	10
Flood	Low	1	3	Low	1	2	Low	1	1	6
Severe Storm	High	3	9	High	3	6	Low	1	1	16
Severe Winter Storm	High	3	9	High	3	6	Low	1	1	16
Wildfire	High	3	9	High	3	6	High	3	3	18
Infestation	Medium	2	6	Medium	2	4	Medium	2	2	12
Dam Failure	High	3	9	High	3	6	High	3	3	18
Disease Outbreak	Medium	2	6	Low	1	2	Medium	2	2	10

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

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

Hazard of Concern	Capability	Numeric Value	Climate Change	Numeric Value
Earthquake	Moderate	0	Low	1
Extreme Temperature	Moderate	0	High	3
Flood	Moderate	0	High	3
Severe Storm	High	-1	High	3
Severe Winter Storm	High	-1	Medium	2
Wildfire	Moderate	0	High	3
Infestation	Moderate	0	High	3
Dam Failure	Moderate	0	High	3
Disease Outbreak	Moderate	0	Medium	2

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

Table 5.3-9. Total Hazard Ranking Values for the Hazards of Concern for Warren County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Capability x 30%	Climate Change x 10%	Total Risk Ranking Value
Earthquake	0.3	3.9	0	0.1	4.3
Extreme Temperature	0.6	3	0	0.3	3.9
Flood	0.9	1.8	0	0.3	3
Severe Storm	0.9	4.8	-0.3	0.3	5.7
Severe Winter Storm	0.9	4.8	-0.3	0.2	5.6
Wildfire	0.6	5.4	0	0.3	6.3
Infestation	0.6	3.6	0	0.3	4.5
Dam Failure	0.3	5.4	0	0.3	6
Disease Outbreak	0.6	3	0	0.2	3.8

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

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

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

calculated rankings presented to each jurisdiction. Each jurisdiction was able to review the rankings and adjust as necessary. Refer to Section 9 (Jurisdictional Annexes) for the adjusted rankings.

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

Warren County Municipality	Earthquake	Extreme Temperature	Flood	Severe Storm	Severe Winter Storm	Wildfire	Infestation	Dam Failure	Disease Outbreak
Bolton (T)	Low	Medium	Low	High	High	Medium	Medium	High	Medium
Chester (T)	Low	Medium	Low	High	High	Low	Medium	High	Low
Glens Falls (C)	Medium	Medium	Low	High	High	High	Medium	Medium	Low
Hague (T)	Low	Medium	Low	High	High	Low	Medium	Medium	Medium
Horicon (T)	Low	Medium	Low	High	High	Low	Medium	Medium	Medium
Johnsburg (T)	Low	Medium	Low	High	High	Low	Medium	High	Medium
Lake George (T)	Low	Medium	Low	High	High	High	Medium	Medium	Medium
Lake George (V)	Low	Medium	Low	High	High	High	Medium	Low	Low
Lake Luzerne (T)	Medium	Medium	Low	High	High	Medium	Medium	Medium	Low
Queensbury (T)	Medium	Medium	Low	High	High	High	Medium	Medium	Low
Stony Creek (T)	Medium	Low	Low	High	High	Low	Medium	Medium	Low
Thurman (T)	Low	Medium	Low	High	High	Low	Medium	Medium	Medium
Warrensburg (T)	Medium	Medium	Low	High	High	High	Medium	Medium	Low
Warren County	Medium	Medium	Medium*	High	High	High	Medium	High	Medium*

**Values adjusted per Steering Committee input to reflect county-wide risk.*

5.4 HAZARD PROFILES

5.4.1 Dam Failure

Hazard Profile

Hazard 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 2007). Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water (FEMA 2007). Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity due to uncontrolled release or exceedance of design);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;
- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;
- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance and upkeep;
- Failure of upstream dams on the same waterway; or
- Earthquake (liquefaction / landslides) (FEMA 2018).

A break in a dam can produce extremely dangerous flood situations because of the high velocities and large volumes of water released by such a break. Sometimes they can occur with little to no warning. Breaching of dams often occurs within hours after the first visible sign of dam failure, leaving little or no time for evacuation (FEMA 2007).

A levee is a physical barrier constructed to protect areas from rising floodwaters. Similar to dam failure, a levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. However, there are no recognized levees present in Warren County (USACE 2023).

Location and Extent

According to the NYSDEC Division of Water Bureau of Flood Protection and Dam Safety, the hazard classification of a dam is assigned according to the potential impacts of a dam failure pursuant to

New York Codes, Rules, and Regulations (NYCRR) Part 673.3 (NYS DEC 2009). Dams are classified in terms of potential for downstream damage if the dam were to fail. It is important to note the classification is based on the consequences of dam failure and not the condition, probability or risk of failure itself. These hazard classifications are identified and defined below:

- *Low Hazard (Class A)* is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property
- *Intermediate Hazard (Class B)* is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- *High Hazard (Class C)* is a dam located in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure.
- *Negligible or No Hazard (Class D)* is (1) a dam that has been breached or removed, or has failed or otherwise no longer materially impounds waters, or (2) a dam that was planned but never constructed. Class "D" dams are considered to be defunct dams posing negligible or no hazard. The department may retain pertinent records regarding such dams (NYS DEC 2009).

NYSDEC maintains an inventory of dam failure data. Hazard classification, location, volume, elevation, and condition information for each dam in Warren County that has a federal identification number is included in the inventory.

According to NYS DEC, there are 85 dams located in Warren County. Of the 85 dams located in Warren County, 7 are high hazard dams (Class C). These dams are located in the Town of Bolton, Town of Chester, Town of Johnsburg, and Town of Queensbury as shown in Table 5.4.1-1.

Table 5.4.1-1. Dams in Warren County

Dam Name	Classification	Municipality
Loon Lake Dam	High Hazard Dam	Town of Chester
Butler Storage Reservoir Dam	High Hazard Dam	Town of Queensbury
Edgecomb Pond Dam	High Hazard Dam	Town of Bolton
Feeder Dam At Glens Falls	High Hazard Dam	Town of Queensbury

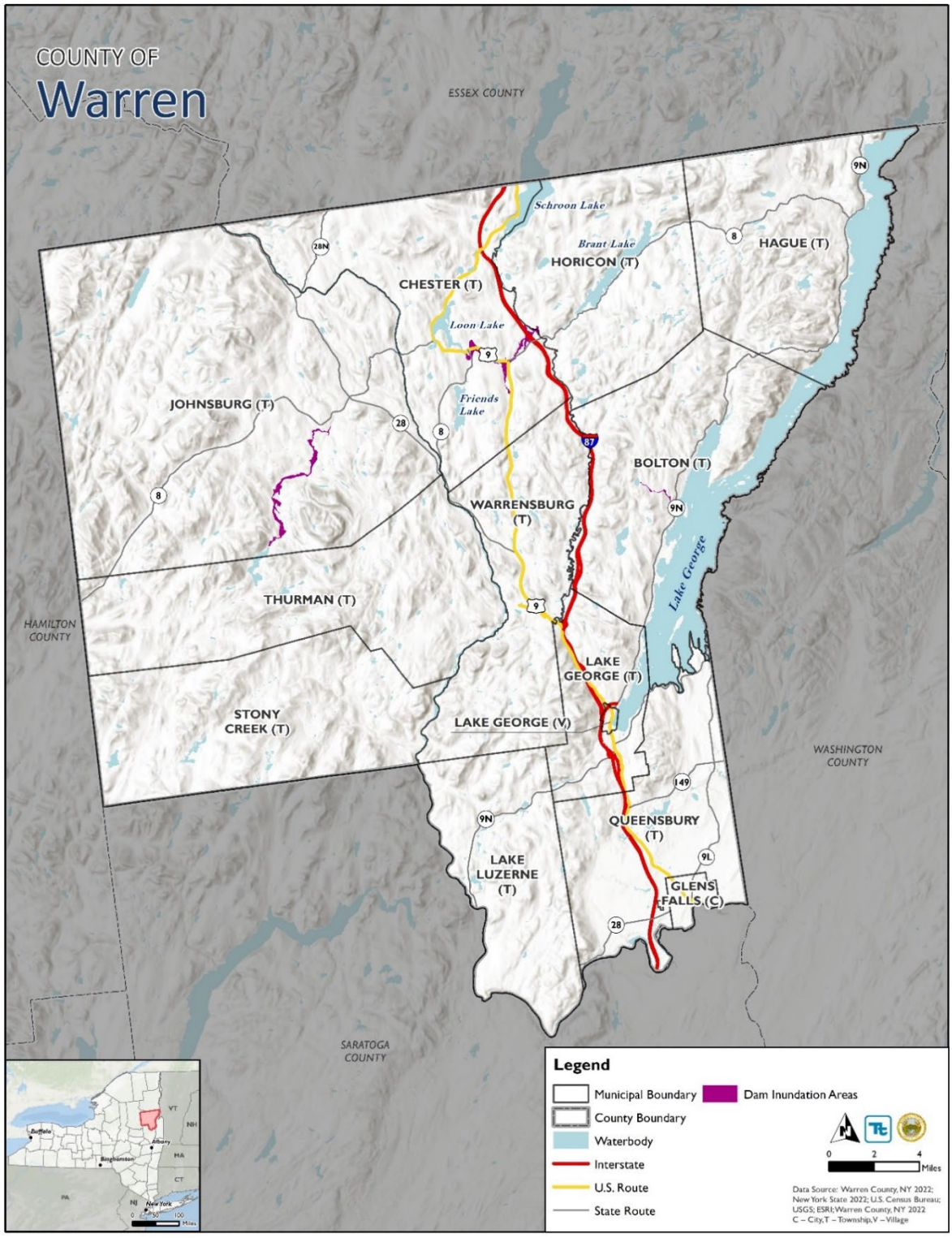
Dam Name	Classification	Municipality
Keenan Reservoir Dam	High Hazard Dam	Town of Queensbury
Wilkie Reservoir Dam	High Hazard Dam	Town of Queensbury
Garnet Lake Dam	High Hazard Dam	Town of Johnsburg
Crandall Brook Dam	Intermediate Hazard Dam	Town of Lake George
Brant Lake Upper Dam	Intermediate Hazard Dam	Town of Horicon
Curtis S Read Scout Reservation Dam	Intermediate Hazard Dam	Town of Horicon
Starbuckville Dam	Intermediate Hazard Dam	Town of Chester, Town of Horicon
Brant Lake Lower Dam	Intermediate Hazard Dam	Town of Horicon
Warrensburg Dam	Intermediate Hazard Dam	Town of Warrensburg
Gore Mt Reservoir Dam	Intermediate Hazard Dam	Town of Johnsburg
Lens Lake Dam	Intermediate Hazard Dam	Town of Stony Creek
Halfway Brook Reservoir Dam	Intermediate Hazard Dam	City of Glens Falls
Butler Pond Dam	Intermediate Hazard Dam	Town of Queensbury
Wilkie Intake Reservoir Dam	Intermediate Hazard Dam	Town of Queensbury
Lake Luzerne Dam	Intermediate Hazard Dam	Town of Lake Luzerne
Big Hollow Dam	Low Hazard Dam	Town of Lake George
Gage Brook Dam	Low Hazard Dam	Town of Lake George
Ed Grant Pond Dam	Low Hazard Dam	Town of Queensbury
Top O'world Upper Dam	Low Hazard Dam	Town of Queensbury
Dream Lake Dam	Low Hazard Dam	Town of Queensbury
Hidden Pond Dam	Low Hazard Dam	Town of Horicon
Alder Brook Dam	Low Hazard Dam	Town of Bolton
Salamida Pond Dam	Low Hazard Dam	Not Found
Murphy Saw Mill Dam	Low Hazard Dam	Town of Johnsburg
Antler Lake Dam	Low Hazard Dam	Town of Johnsburg
Hidden Lake Dam	Low Hazard Dam	Town of Chester
Bear Pond Dam	Low Hazard Dam	Town of Thurman
Wechgelaer Dam	Low Hazard Dam	Town of Stony Creek
Borman Dam	Low Hazard Dam	Town of Stony Creek
Friends Lake Dam	Low Hazard Dam	Town of Chester
Number Nine Brook Dam	Low Hazard Dam	Town of Thurman
Stewart Lake Dam	Low Hazard Dam	Town of Lake Luzerne
Warrensburg Auxiliary Dam	Low Hazard Dam	Town of Warrensburg
Windover Lake Dam	Low Hazard Dam	Town of Johnsburg
Barton Mines Pond Dam	Low Hazard Dam	Town of Johnsburg
Livingston Lake Dam	Low Hazard Dam	Town of Stony Creek
Harrisburg Lake Dam	Low Hazard Dam	Town of Stony Creek
Wilbur E Dow Jr Wildlife Pond Dam	Low Hazard Dam	Town of Thurman
Keenan Intake Reservoir Dam	Low Hazard Dam	Town of Queensbury
French Mountain Pond Dam	Low Hazard Dam	Town of Queensbury
Hovey Pond Dam	Low Hazard Dam	Town of Queensbury
Glen Lake Dam	Low Hazard Dam	Town of Queensbury
Bolton Conservation Club Fish Pond Dam	Low Hazard Dam	Town of Bolton
Sagamore Golf Course Dam	Low Hazard Dam	Town of Bolton
Little Pond Dam	Low Hazard Dam	Town of Thurman
Dippikill Pond Dam	Low Hazard Dam	Town of Thurman
Ferguson Dam	Low Hazard Dam	Town of Lake Luzerne
Rhodes & Johnson Dam	Low Hazard Dam	Town of Lake Luzerne
Lake Vanare Dam	Low Hazard Dam	Town of Lake Luzerne
Daggett Pond Dam	Low Hazard Dam	Town of Thurman

Dam Name	Classification	Municipality
Erwin M Fullerton Pond Dam	Low Hazard Dam	Town of Thurman
Pack Forest Lake Dam	Low Hazard Dam	Town of Warrensburg
Tripp Pond Dam	Low Hazard Dam	Town of Warrensburg
Dingman Dam	Low Hazard Dam	Town of Lake Luzerne
Lake Forest Dam	Low Hazard Dam	Town of Lake Luzerne
Clendon Brook Dam	Low Hazard Dam	Town of Queensbury
Lake Allure Dam	Low Hazard Dam	Town of Lake Luzerne
Hudnut Pond Dam	Low Hazard Dam	Town of Johnsburg
Scholl Pond Dam	No Hazard Dam	Town of Horicon
Clear Brook Dam	No Hazard Dam	Town of Horicon
(205-0481)	No Hazard Dam	Town of Stony Creek
(205-0491)	No Hazard Dam	Town of Stony Creek
(205-0492)	No Hazard Dam	Town of Stony Creek
(205-0508)	No Hazard Dam	Town of Stony Creek
Swimming Pool North Creek Dam	No Hazard Dam	Town of Johnsburg
Quiet Brook Dam	No Hazard Dam	Town of Chester
Warrensburg Mill Dam	No Hazard Dam	Town of Warrensburg
Viele Pond Dam	No Hazard Dam	Town of Warrensburg
Warrensburg Lower Reservoir Dam	No Hazard Dam	Town of Warrensburg
Middle Flow Dam	No Hazard Dam	Town of Stony Creek
(222-1021)	No Hazard Dam	Town of Bolton
(222-1037)	No Hazard Dam	Town of Bolton
Shallow Pond Dam	No Hazard Dam	Town of Johnsburg
Mongue Pond Dam	No Hazard Dam	Town of Hague
Delarm Dam	No Hazard Dam	Town of Hague
Santucci Dam	No Hazard Dam	Town of Lake Luzerne
Mill Creek Dam	No Hazard Dam	Town of Johnsburg
Loon Lake Upper Dam	Hazard Classification Not Assigned	Town of Chester
Beckers Dam	Hazard Classification Not Assigned	Town of Bolton
Wing Pond Dam	Hazard Classification Not Assigned	Town of Bolton
STONES POND DAM	Hazard Classification Not Assigned	Town of Lake Luzerne

Source: NYS DEC 2022

The Indian Lake, Chestertown, Bolton, Inlet, Chazy Lake, Garnet Lake, Ticonderoga, and Peck Lake areas all contain dams that are in need of repair and could result in impacts to life and property upon dam failure. These dams of concern consist of ten high and immediate hazard dams that are located within the Adirondack Park area (New York State Dam Inventory). Dam failure inundation area mapping is available for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam. Table 5.4.1-1 shows the dam failure inundation areas for these dams.

Figure 5-1. High Hazard Dam Inundation Areas in Warren County



Notes: The dam inundation area for this assessment only includes dam failure inundation areas for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam.

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was not included in any disaster (DR) or emergency (EM) declarations for dam failure-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2023). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was not included in any dam failure-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known dam failure events that impacted Warren County between 2017 and 2023 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Probability of Future Occurrences

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. As noted, dam failures typically occur in New Jersey as a result of heavy rains or other precipitation. There is a "residual risk" associated with dams. Residual risk is the risk that remains after safeguards have been implemented. For dams, the residual risk is associated with events beyond those that the facility was designed to withstand. However, the probability of any type of dam failure is low in today's dam safety regulatory and oversight environment (New Jersey State HMP 2019).

No dam failure events have been recorded in Warren County. Based on historical occurrences, the probability of a dam or levee failure event occurring is considered rare (between 1 and 10% annual probability of occurrence.). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

The climate of Warren County is already changing and will continue to change in the future. Climate change is beginning to affect both people and resources of the State and County and the impacts of climate change will continue. Impacts related to increasing temperatures are already being felt in the County. 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.

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Warren County is part of Region 7 (Figure 5-2), Adirondack Mountains. Some of the issues in this region, affected by climate change, include loss of high elevation plants, animals, and ecosystem types; decline in winter recreation; decline in milk production, etc. (NYSERDA 2014).

Figure 5-2. Climate Regions of New York State

Source: NYSERDA 2014

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Regional precipitation across New York State is projected to increase by approximately one to eight percent by the 2020s, three to 12-percent by the 2050s, and four to 15-percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State.

In Region 7, it is estimated that temperatures will increase by 3.7°F to 7.4°F by the 2050s and 4.2°F to 11.8°F by the 2080s (baseline of 39.9°F). Precipitation totals will increase between 2 and 15-percent by the 2050s and 3 to 17-percent by the 2080s (baseline of 40.8 inches) (NYSERDA 2014).

Climate change affects flooding more than other hazards because the frequency of extreme precipitation events in the Northeast has increased in recent years. Severe storms projected in the 1950s to occur only once in 100 years are now expected to occur once every 60 years. Other climate change influences include the following:

- Spring breakup, snowmelt, and winter rains
  - Warmer spring temperatures that lead to earlier and more rapid snow melt; more late-winter precipitation likely to fall as rain, rather than as snow
- Cyclonic disturbances
  - Increasing frequency of severe cyclonic events, which may permit more northward tracking of hurricanes
- Localized summer outburst events
  - Increase formation of conditions conducive to summer outbursts and flash flooding
- Human uses and development of land
  - Development leads to increased amounts of impervious surfaces such as roads, parking lots, and buildings and can increase rainwater runoff. Development in floodplains or wetlands can potentially result in an increased floodplain level (New York State 2019).

Assumptions about a river's flow behavior, expressed as hydrographs are influences for dam design. Changes in weather patterns can significantly affect the hydrograph used for the design of a dam. If the hygrograph changes, the dam conceivably could lose some or all of its designed margin of safety, also known as freeboard. Loss of designed margin of safety increases possibility that floodwaters would overtop the dam or create unintended loads, which could lead to a dam failure.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The dam failure hazard is of significance to Warren County because 85 dams are present across Warren County, 7 of which are classified as high hazard by NYS DEC. Dam failure events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard.

To assess Warren County's risk to dam failure, a quantitative assessment was conducted using available dam failure inundation area mapping for the following high hazard dams:

- Loon Lake Dam
- Edgecomb Pond Dam
- Garnet Lake Dam

Dam failure inundation mapping was not available for the following high hazard dams in Warren County:

- Butler Storage Reservoir Dam
- Feeder Dam At Glens Falls
- Keenan Reservoir Dam
- Wilkie Reservoir Dam

As not all high hazard dams in Warren County had data available to support this vulnerability assessment, this assessment underrepresents the risks associated with dam failure in Warren County.

Impact on life, Health, and Safety

The impact of dam and levee failure on life, health, and safety is dependent on several factors such as the class of dam/levee, the area that the dam/levee is protecting, the location of the dam/levee, and the proximity of structures, infrastructure, and critical facilities to the dam or levee structure. The level of impact that a failure would have can be predicted based upon the hazard potential classification as rated by the United States Army Corps of Engineers (USACE n.d.). Table 5.4.1-2 outlines the recommended hazard classifications.

Table 5.4.1-2. United States Army Corps of Engineers Hazard Potential Classification

Hazard Category(a)	Direct Loss of Life (b)	Lifeline Losses (c)	Property Losses (d)	Environmental Losses (e)
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss-of-life potential is based on inundation mapping of area downstream of the project. Analyses of loss-of-life potential should take into account the population at risk, time of flood wave travel, and warning time.

c. Lifeline losses include indirect threats to life caused by the interruption of lifeline services from project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Property losses include damage to project facilities and downstream property and indirect impact from loss of project services, such as impact from loss of a dam and navigation pool, or impact from loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: USACE n.d.

The entire population residing within a dam failure inundation zone is considered exposed and vulnerable to an event. Table 5.4.1-3 displays the population located in the high hazard dam inundation area. In total, 216 people are located in the high hazard dam inundation area in the towns of Bolton, Chester, and Johnsburg.

Table 5.4.1-3. Population Located in the High Hazard Dam Inundation Area in Warren County

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	Estimated Population Located in High Hazard Dam Inundation Area	
		Number of People	Percent of Total
Bolton (T)	2,012	22	1.1%
Chester (T)	3,086	163	5.3%
Glens Falls (C)	14,830	0	0.0%
Hague (T)	633	0	0.0%
Horicon (T)	1,471	0	0.0%
Johnsburg (T)	2,143	30	1.4%
Lake George (T)	2,494	0	0.0%
Lake George (V)	1,008	0	0.0%
Lake Luzerne (T)	3,079	0	0.0%
Queensbury (T)	29,169	0	0.0%
Stony Creek (T)	758	0	0.0%
Thurman (T)	1,095	0	0.0%
Warrensburg (T)	3,959	0	0.0%
Warren County (Total)	65,737	216	0.3%

Source: U.S. Census Bureau 2020; Warren County, NY 2022

Notes: High Hazard Dam Inundation Areas were analyzed on Rainy day scenarios
The dam inundation area for this assessment only includes dam failure inundation areas for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam.

The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living within these areas. Those most at risk include the economically disadvantaged and the population over the age of 65. These populations are more at risk during a dam failure event because economically disadvantaged populations are likely to evaluate their risk and make the decision to evacuate based upon the net economic impact to their family, while elderly populations are likely to seek or need medical attention. The availability of medical attention may be limited due

to isolation during a flood event and other difficulties in evacuating. There is often limited warning time for a dam failure event. Populations without adequate warning of the event are highly vulnerable.

Dam failure can cause persons to become displaced if flooding of structures occurs. Dam failure may mimic flood events, depending on the size of the dam reservoir and breach. Understanding potential outcomes of flooding for each dam in Warren County would require intensive hydraulic modeling.

Impact on General Building Stock

Buildings located downstream of a dam are at risk to damages should there be a failure. Properties located closest to the dam inundation area have the greatest potential to experience the largest, most destructive surge of water. The overall impact of flooding damages caused by dam failure will vary depending on the depth of flooding and velocity of the surge.

Dam failure can cause severe downstream flooding and may transport large volumes of sediment and debris, depending on the magnitude of the event. Widespread damage to buildings and infrastructure affected by an event would result in large costs to repair these locations. In addition to physical damage costs, businesses can be closed while flood waters retreat, and utilities are returned to a functioning state.

Table 5.4.1-4 presents the number of buildings located in the high hazard dam inundation area in Warren County. In total, 254 buildings are located in the high hazard dam inundation area.

Table 5.4.1-4. Buildings Located in the High Hazard Dam Inundation Area in Warren County

Jurisdiction	Total Number of Buildings	Number of Buildings Located in High Hazard Dam Inundation Area	
		Number of Buildings	Percent of Total
Bolton (T)	2,873	32	1.1%
Chester (T)	3,227	189	5.9%
Glens Falls (C)	5,988	0	0.0%
Hague (T)	1,313	0	0.0%
Horicon (T)	2,188	0	0.0%
Johnsburg (T)	2,625	33	1.3%
Lake George (T)	2,494	0	0.0%
Lake George (V)	609	0	0.0%
Lake Luzerne (T)	2,173	0	0.0%
Queensbury (T)	12,193	0	0.0%
Stony Creek (T)	807	0	0.0%
Thurman (T)	1,061	0	0.0%
Warrensburg (T)	2,758	0	0.0%
Warren County (Total)	**40,309**	**254**	**0.6%**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft; RS Means 2022
Notes: High Hazard Dam Inundation Areas were analyzed on Rainy day scenarios
The dam inundation area for this assessment only includes dam failure inundation areas for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam.

Impact on Critical Facilities and Community Lifelines

Dam failures may also impact critical facilities and infrastructure located in the downstream inundation zone. Consequentially, dam failure can cut evacuation routes, limit emergency access, and/or create isolation issues. Dam failure can cause severe downstream flooding and may transport large volumes of sediment and debris, depending on the magnitude of the event. Further, 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.

Table 5.4.1-5 displays the number of community lifeline facilities located in the high hazard dam inundation area in Warren County. In total, nine lifelines are located in the high hazard dam inundation area.

Table 5.4.1-5. Lifelines Located in the High Hazard Dam Inundation Area in Warren County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in High Hazard Dam Inundation Area
Communications	16	0
Energy	20	0
Food, Water, Shelter	163	2
Hazardous Materials	46	1
Health and Medical	43	0
Safety and Security	211	2
Transportation	60	4
Warren County (Total)	**559**	**9**

Source: Warren County, NY 2022
Notes: High Hazard Dam Inundation Areas were analyzed on Rainy day scenarios
The dam inundation area for this assessment only includes dam failure inundation areas for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam.

Impact on the Economy

Severe flooding that follows an event like a dam failure can cause extensive structural damage and withhold essential services. The cost to recover from flood damages after a surge will vary depending on the hazard risk of each dam.

Severe flooding that follows an event like a dam failure can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking

water and wastewater treatment facilities can become temporarily out of operation. Debris from surrounding buildings can accumulate should the dam mimic major flood events, such as the 1-percent annual chance flood event that is discussed in Section 5.4.5 (Flood).

Table 5.4.1-6 displays the replacement cost of buildings located in the high hazard dam inundation area. 0.5-percent of Warren County's total replacement cost value is located in the high hazard dam inundation area.

Table 5.4.1-6. Replacement Cost of Buildings Located in the High Hazard Dam Inundation Area in Warren County

Jurisdiction	Total Replacement Cost Value (RCV)	Total Replacement Cost of Buildings Located in High Hazard Dam Inundation Area	Percent of Total
Bolton (T)	$1,509,046,268	$7,425,773	0.5%
Chester (T)	$1,794,523,301	$115,512,000	6.4%
Glens Falls (C)	$3,728,124,116	$0	0.0%
Hague (T)	$799,210,288	$0	0.0%
Horicon (T)	$1,022,605,789	$0	0.0%
Johnsburg (T)	$1,493,856,193	$6,897,627	0.5%
Lake George (T)	$2,168,962,785	$0	0.0%
Lake George (V)	$770,157,514	$0	0.0%
Lake Luzerne (T)	$953,667,917	$0	0.0%
Queensbury (T)	$7,114,031,584	$0	0.0%
Stony Creek (T)	$995,996,331	$0	0.0%
Thurman (T)	$497,985,792	$0	0.0%
Warrensburg (T)	$1,425,456,857	$0	0.0%
Warren County (Total)	**$24,273,624,737**	**$129,835,400**	**0.5%**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft; RS Means 2022

Notes: High Hazard Dam Inundation Areas were analyzed on Rainy day scenarios
The dam inundation area for this assessment only includes dam failure inundation areas for Loon Lake Dam, Edgecomb Pond Dam, and Garnet Lake Dam.

Impact on the Environment

The environmental impacts of a dam failure can include significant water-quality and debris-disposal issues or severe erosion that can impact local ecosystems. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals may get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside,

contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties.

Future Changes That May Impact Vulnerability

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

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

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County.

Any areas of growth could be potentially impacted by a dam failure event if the structures are located within the flood protection area and mitigation measures are not considered. Therefore, it is the intention of the County and all participating municipalities to discourage development in vulnerable areas or to encourage higher regulatory standards at the local level.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). Even though the population has not significantly increased overall, changes in population density within county communities should be evaluated to determine if high population densities can create issues for local residents during an evacuation.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual precipitation. An increase in annual precipitation amounts in the region, primarily in the form of heavy rainfalls, will have the potential to increase the potential for dam failure events. Increases in precipitation may stress the dam wall. Further, existing dams may not be able to retain and manage increases in water flow from more frequent, heavy rainfall events. Heavy rainfalls may result in more frequent overtopping of these dams and flooding of the County's assets in adjacent inundation areas. However, the probable maximum flood used to design each dam may be able to accommodate changes in climate.

Change of Vulnerability Since the 2017 HMP

Overall, the County's vulnerability has not significantly changed since the 2017 HMP and the County will continue to be exposed and vulnerable to dam failure events, especially those located within or near downstream inundation zones.

5.4.2 Disease Outbreak

Hazard Profile

Hazard Description

An outbreak or an epidemic exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause (CDC 2016). There are other diseases that impact Warren County which includes foodborne illness, vaccine-preventable disease, and vector-borne diseases (tick-borne and mosquito-borne). However, for the disease outbreak profile, the County identified pandemic influenza, COVID-19, the Zika virus, and the Ebola virus as the main diseases that may lead to a pandemic outbreak.

Pandemic Influenza

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

Pandemic influenza, or influenza A, is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza, as the human population will have little to no pre-existing immunity to the new influenza virus (WHO 2010). In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (CDC 2019).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provided international outbreak investigation assistance (CDC 2020).

COVID-19

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. People with COVID-19 have had a wide range of symptoms reported – ranging from mild symptoms to severe illness. Symptoms may appear 2-14 days after exposure to the virus. Anyone can have mild to severe symptoms. Possible symptoms include fever or chills, cough, shortness of breath or difficulty breathing, sore throat, loss of taste or smell, muscle and body aches, among others (CDC 2022).

COVID-19 spreads when an infected person breathes out droplets and very small particles that contain the virus. These droplets and particles can be breathed in by other people or land on their eyes, noses, or mouth. In some circumstances, they may contaminate surfaces they touch. Vaccination, past infection, or timely access to testing and treatment can help protect you from getting very sick if you get COVID-19. However, some people are more likely than others to get very sick if they get COVID-19. This includes people who are older, are immunocompromised, have certain disabilities, or have underlying health conditions (CDC 2022).

In an effort to maintain the slow spread of the virus, the federal government and States have urged the public to continue avoid touching of the face, properly wash hands often, wear face masks, and use various social distancing measures.

Zika

Zika is a flavivirus related to dengue, West Nile, yellow fever and Japanese encephalitis. It was first isolated in 1947 from a Rhesus monkey in the Zika region of Uganda and in 1968 from a human in Nigeria. Since that time, serologic evidence of human infections has been reported in several countries in tropical Africa and parts of Southeast Asia (Hayes 2009). In addition, Zika virus has been implicated as the cause of three mosquito-borne disease outbreaks outside of Africa and Asia, including Micronesia in 2007, French Polynesia in 2013 (WHO 2018). There last cases of local Zika transmission in continental United Stated were in 2016-2017 in Florida and Texas (CDC 2022).

Many people infected with Zika virus won't have symptoms or will only have mild symptoms. The most common symptoms of Zika are fever, rash, headache, joint pain, conjunctivitis, and muscle pain (WHO 2018). Zika is usually mild with symptoms lasting for several days to a week. People usually don't get sick enough to go to the hospital, and they very rarely die of Zika. For this reason, many people might not realize they have been infected. Symptoms of Zika are similar to other viruses spread through mosquito bites, like dengue and chikungunya. Zika virus usually remains in the blood of an infected person for about a week (CDC 2019). Zika virus can be passed from a pregnant woman to her fetus, an infection during pregnancy can cause a birth defect called microcephaly and other severe fetal brain defects (CDC 2019).

Ebola

Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. Scientists think people are initially infected with Ebola virus through contact with an infected animal, such as a fruit bat or nonhuman primate. This is called a spillover event. After that, the virus spreads from person to person through direct contact (such as through broken skin or mucous membranes in the eyes, nose, or mouth) potentially affecting a large number of people.

Symptoms may appear anywhere from 2 to 21 days after contact with the virus, with an average of 8 to 10 days. The course of the illness typically progresses from "dry" symptoms initially (such as fever, aches and pains, and fatigue), and then progresses to "wet" symptoms (such as diarrhea and vomiting) as the person becomes sicker; other symptoms may include red eyes, skin rash, and hiccups (late-stage) (CDC 2022).

According to the CDC, the 2014-2016 Ebola epidemic was the largest in history affecting multiple countries in West Africa. In the United States, 11 total Ebola cases occurred, of those 11 cases, 2 individuals died and the remaining 9 recovered. CDC and partners are taking precautions to prevent the further spread of Ebola in the United States (CDC 2019).

At the time of writing, there is a current epidemic of Ebola occurring in several African countries, but it is mostly affecting Uganda. The CDC issued a Health Alert Network message on October 06, 2022 about the outbreak in central Uganda. The United States is screening all passengers on flights in from the Ugandan region (CDC 2022).

Location

Warren County is vulnerable to importation and spread of infectious diseases due to its geographic location and demographic characteristics. Additionally, as the County is a year-long tourist destination, it is susceptible to the spread of diseases due to the influx of tourists from diverse locations. Disease outbreaks pose serious threats to the County and could strain the capacity of hospitals, clinics and other healthcare facilities to respond to those seeking medical attention (Warren County 2017).

Extent

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness (Warren County 2017).

The CDC and public health officials will use the Pandemic Severity Assessment Framework (PSAF) to determine the impact of the pandemic, or how "bad" the pandemic will be; the PSAF replaced the Pandemic Severity Index (PSI) in 2014. There are two main factors that can be used to determine the impact of a pandemic. The first is clinical severity, or how serious is the illness associated with infection. The second factor is transmissibility, or how easily the pandemic virus spreads from person-to-person. These two factors combined are used to guide decisions about which actions CDC recommends at a given time during the pandemic.

The framework is divided into two parts. The first part is the initial assessment, which happens early during a pandemic. At this time, activity may be detected in pockets or certain communities across the country so information and understanding about the pandemic virus will be limited. By studying the information that is available, CDC can produce a preliminary assessment of the potential impact of the pandemic (e.g., low to moderate transmissibility and moderate to high clinical severity). However, that assessment may change as the pandemic evolves and more information is known. The second part, or refined assessment, happens later in the pandemic when more information is available. This additional information helps to provide a more refined and accurate picture of pandemic impact, including assessments of the pact by age group.

The results of these assessments can be compared to past pandemics (or even seasonal influenza epidemics), creating a quick comparative snapshot of the potential impact of the pandemic. For example, using the PSAF, the 1918 pandemic can be characterized as one with very high transmissibility and very high clinical severity whereas the 2009 H1N1 pandemic can be characterized as one with moderate transmissibility and clinical severity for the overall population. The results help public health officials and health care professionals make timely and informed decisions, and to take appropriate actions (CDC 2016).

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2005 to redefine these phases. This schema is designed to provide guidance to the international community and to national governments on preparedness and response for pandemic threats and pandemic disease. Compared with the 1999 phases, the new definitions place more emphasis on pre-pandemic phases when pandemic threats may exist in animals or when new influenza virus subtypes infect people but do not spread efficiently. Because recognizing that distinctions between the two interpandemic phases and the three pandemic alert phases may be unclear, the WHO Secretariat proposes that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2009). The WHO pandemic phases are outlined in Table 5.4.X-1.

Table 5.4.2-1. WHO Global Pandemic Phases

Phase	Description
Preparedness	

Phase	Description
Phase 1	No viruses circulating among animals have been reported to cause infections in humans
Phase 2	An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortment virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.
Response and Mitigation Efforts	
Phase 4	Human infection(s) are reported with a new subtype, but no human-to-human spread or at most rare instances of spread to a close contact.
Phase 5	Characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
Phase 6	The pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.

Sources: (WHO 2009)

Additionally, NYSDOH and the State EOC have their own activation levels in response to a pandemic event. Multiple waves of pandemic can be anticipated throughout the life cycle of an event. Refer to https://www.health.ny.gov/diseases/communicable/influenza/pandemic/ for information regarding the various levels in New York State (Warren County 2017).

Previous Occurrences

Each year, cases of seasonal influenza have been reported in Warren County; there have been no cases of influenza A, or the pandemic influenza. As for Ebola and Zika, there have been no reported cases in the County. COVID-19 infections have been reported in Warren County, yearly total infections can be found in Table 5.4.2-1.

Table 5.4.2-2. COVID-19 Infection Cases in Warren County (2020 to 2022)

Disease	2020	2021	2022
COVID-19	1,143	8,329	14,518

Sources: (Warren County 2022)

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was included in 2 disaster (DR) or emergency (EM) declarations for disease outbreak events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster

declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was included in 0 disease outbreak-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known disease outbreak events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Table 5.4.2-2. Hazard Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
01/20/2020 - 5/11/2023	Pandemic	DR-4480-NY	Yes	FEMA determined the emergency conditions in the State of New York, and consequently all its Counties, were of sufficient severity and magnitude to warrant a major disaster declaration. The declaration authorized Individual Assistance limited to the Crisis Counseling Program and assistance for emergency protective measures (Category B), including direct Federal assistance, under Public Assistance throughout the State.
01/20/2020 - continuing	Pandemic	EM-3434-NY	Yes	FEMA determined the emergency conditions in the State of New York, and consequently all its Counties, were of sufficient severity and magnitude to warrant a major disaster declaration. The declaration authorized Individual Assistance limited to the Crisis Counseling Program and assistance for emergency protective measures (Category B), including direct Federal assistance, under Public Assistance throughout the State.

Sources: (NOAA 2022), (USDA FSA 2022), (FEMA 2022) (New York State 2019) (Warren County 2017)

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of disease outbreak events for the County. Information from NOAA-NCEI storm events database, the 2019 State of New York HMP, and the 2017 Warren County HMP were used to identify the number of disease outbreak events that occurred between 1950 and 2022. Table 5.4.2- presents the probability of future events for the disease outbreak hazard in the County.

Table 5.4.2-3. Probability of Future Disease Outbreak Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year
Influenza A (H1N1)	1	1.4%
Influenza A (H2N2)	0	0%
Influenza A (H3N2)	0	0%
Influenza A (H5N1)	0	0%
COVID-19	3	4.1%
Zika	0	0%
Ebola	0	0%

Sources: *(Warren County 2017) (Warren County 2022) (CDC 2022) (CDC 2018) (Standforth 2010)*

Note: *Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected disease outbreak events since 1968. Due to limitations in data, not all disease outbreak events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.*

A total of 4 disease outbreak events have been recorded in Warren County. Based on historical occurrences, the probability of a disease outbreak event occurring is considered occasional (between 10 and 100% annual probability of occurrence). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge.

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Warren County is part of Region 7, Adirondack Mountains. Some of the issues in this region, affected by climate change, include loss of high elevation plants, animals, and ecosystem types; decline in winter recreation; decline in milk production, etc.

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State

by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State.

In Region 7, it is estimated that temperatures will increase by 3.7°F to 7.4°F by the 2050s and 4.2°F to 11.8°F by the 2080s (baseline of 39.9°F). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 17% by the 2080s (baseline of 40.8 inches). While annual precipitation and temperature projections are more certain than seasonal results, much of this additional precipitation is expected to occur during the winter months, which may result in greater annual snowfall in Warren County (NYSERDA 2014).

Milder winters, warmer summers, and fewer days of frost make it easier for infectious diseases to expand into new geographic areas and infect more people. The warmer temperatures are giving mosquitoes and ticks more time to reproduce, spread diseases, and expand their habitats throughout the United States. The geographic ranges where ticks spread Lyme disease, anaplasmosis, ehrlichiosis, and spotted fever rickettsiosis have expanded, and experts predict that tickborne diseases will continue to increase and perhaps worsen. Longer, warmer summers have also given mosquitoes more time to reproduce and spread diseases. In 2012, a mild winter, early spring, and hot summer set the stage for an outbreak of West Nile virus disease in the United States, resulting in more than 5,600 illnesses and 286 deaths.

Climate change has forced some animal species into new habitats as their natural habitats disappear, and it has expanded the habitats of other animals. This movement of animals into new areas increases opportunities for contact between humans and animals and the potential spread of zoonotic diseases, as these examples show:

- Wildlife carrying the rabies virus are expanding to new geographic areas of the country.
- Arctic temperatures are rising more than twice as rapidly as the rest of the world.
- As global temperatures rise, deadly diseases that are a threat in other countries – like Ebola, Lassa, Rift Valley fever, and monkeypox – will increase along with the risk of them being imported into the United States.

Rising temperatures have allowed certain disease-causing fungi to spread into new areas that previously were too cold for them to survive. As the difference between environmental temperatures and human body temperatures narrows, new fungal diseases may emerge as fungi become more adapted to surviving in humans. Climate change also increases the risk for natural disasters and flooding, which can increase the risk for mold to grow in people's homes.

Scientists predict that climate change will have devastating effects on freshwater and marine environments. For example, we could see more frequent and more severe instances of harmful algal blooms, which are the rapid growth of algae or cyanobacteria in lakes, rivers, oceans, and bays. Harmful algal blooms can look like foam, scum, paint, or mats on the surface of water and can be

different colors. They endanger our health when we eat contaminated shellfish. They also can harm pets, livestock, wildlife, and the environment (CDC 2022).

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The following discusses Warren County's vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on life, Health, and Safety

The entire population of Warren County is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020). Population data from the 2021 5-year American Community Survey indicates that there are 14,754 persons over 65 years old in Warren County. This age group would be considered at risk for getting severely ill from the COVID-19 virus. While the statistics of this virus are subject to change during the publication of this HMP, the New York Department of Health dashboard shows that there is a higher percent of illnesses within the mentioned age group.

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.

Impact on Critical Facilities and Community Lifelines

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients which may cause interruption of services, but it is unlikely that there will be damages to the facilities. Large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020-2021 coronavirus pandemic has led to overwhelmed hospitals in numerous locations across New York State, including Warren County.

Impact on the Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs implemented by the County to address this hazard are described below, all of which could impact the local economy.

Within New York State the pandemic led to the closure of businesses, strained the healthcare systems, stressed nonprofits and educational institutions, and stretched public budgets (Association 2020).

Smaller-scale disease outbreaks can also cause negative economic impacts, though the extent of impact is variable. For example, an outbreak in mosquito or tick-borne diseases can impact Westchester County's local economies associated with tourism and the use of parks and waterbodies.

Impact on the Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and the New York Department of Environmental Conservation. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. As a result, pesticides must be registered before they can be sold, distributed, or used in the state (New York Department of Environmental Conservation 2020).

Future Changes That May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed and vulnerable. Additional development of structures in areas with high population density are at an increased risk. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan

Projected Changes in Population

According to the 2020 decennial census, the population of the County has experienced a slight increase of less than 0.1-percent since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). Changes in the density of population when households move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed earlier in this section, the relationship between climate change and increase in infectious diseases is difficult to predict with certainty, however there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease.

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Change of Vulnerability Since the 2017 HMP

This vulnerability assessment has been expanded on the 2017 plan to include the Coronavirus. In addition the Ebola virus and pandemic influenzas, tick-borne diseases including Lyme and West Nile Virus as well as coronavirus are included in this section. Updated data regarding the extent of these diseases is included to provide a better understanding of the potential impacts caused by the disease outbreak hazard.

5.4.3 Earthquake

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

Hazard Profile

Hazard Description

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

Any sudden shaking of the ground caused by seismic waves through the Earth's rocks constitutes an earthquake. Seismic waves are produced when some form of energy stored in Earth's crust is suddenly released, usually when masses of rock straining against one another suddenly fracture and "slip." Earthquakes occur most often along geologic faults, narrow zones where rock masses move in relation to one another. The major fault lines of the world are located at the fringes of the huge tectonic plates that make up Earth's crust (NYS DHSES, 2019).

Certain saturated soft soil can take on the characteristics of a fluid when shaken by an earthquake, resulting in a state called liquefaction. Amplified shaking also results in areas of "soft soils" which includes fill, loose sand, waterfront, and lakebed clays (NYS DHSES, 2019).

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 & Pakiser, 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter.

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

- *Surface faulting*: Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.

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

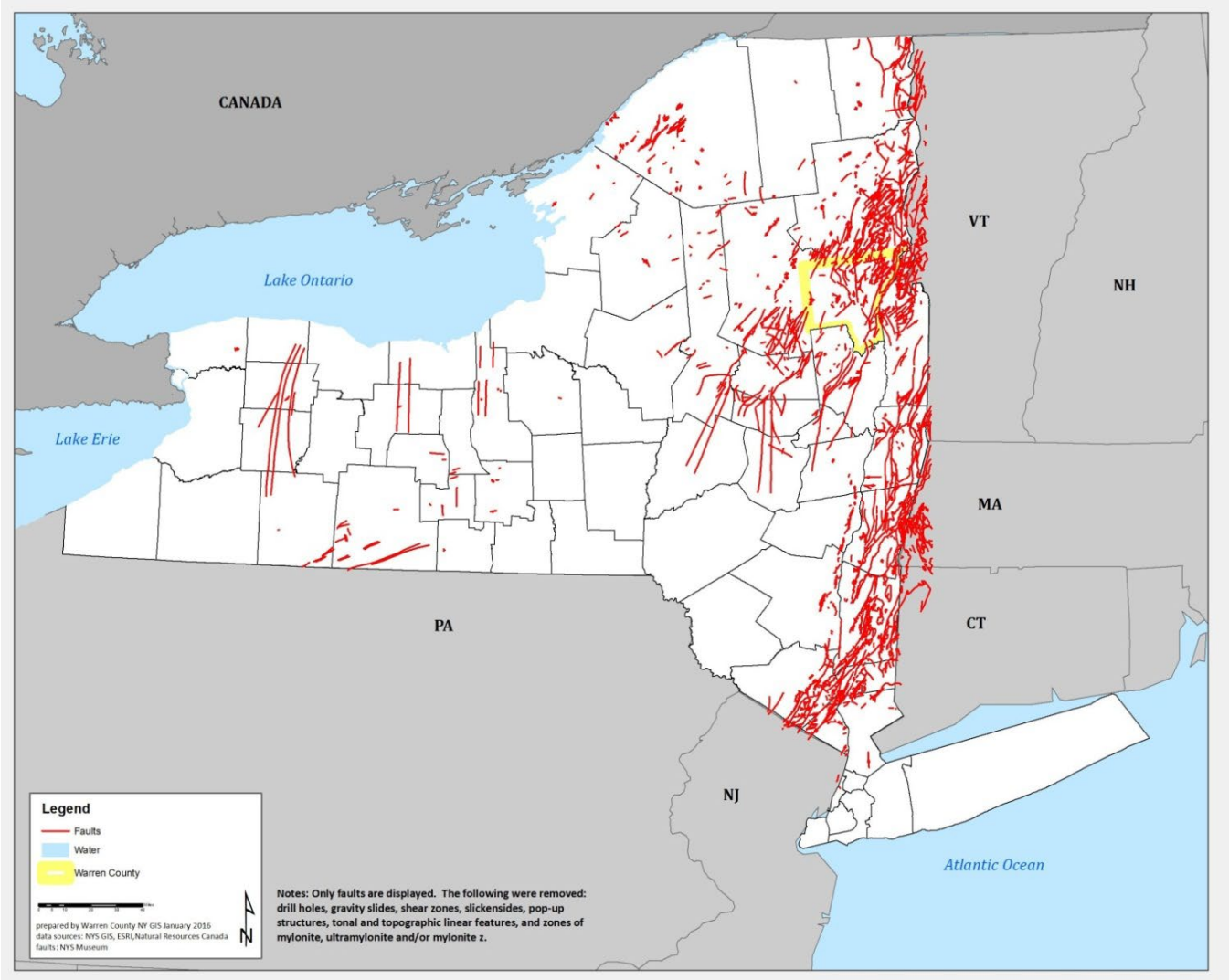
Location

As noted in the 2019 New York State Hazard Mitigation Plan (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 hurricanes and floods have occurred more recently than a major earthquake event (NYS DHSES, 2019). However, the potential for earthquakes exists across all of New York State and the entire northeastern United States. 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, 2003)

Three general regions in New York State have a higher seismic risk than other parts of the state. These regions are: (1) the north and northeast third of the state, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region; (2) the southeast corner, which includes the greater New York City area and western Long Island; and (3) the northwest corner, which includes Buffalo and its surrounding area. Overall, these three regions are the most seismically active areas of the state, with the north-northeast portion having the higher seismic risk, and the northwest corner of the state having the lower seismic risk (NYS DHSES, 2014).

Fractures or fracture zones along with rocks on adjacent sides have broken and moved upward, downward, or horizontally are known as faults (Volkert & Witte, 2015). Movement can take place at faults and cause an earthquake. There are numerous faults throughout New York State, and Figure 5.4.3-1 illustrates the faults relative to Warren County (New York State Museum, 2012).

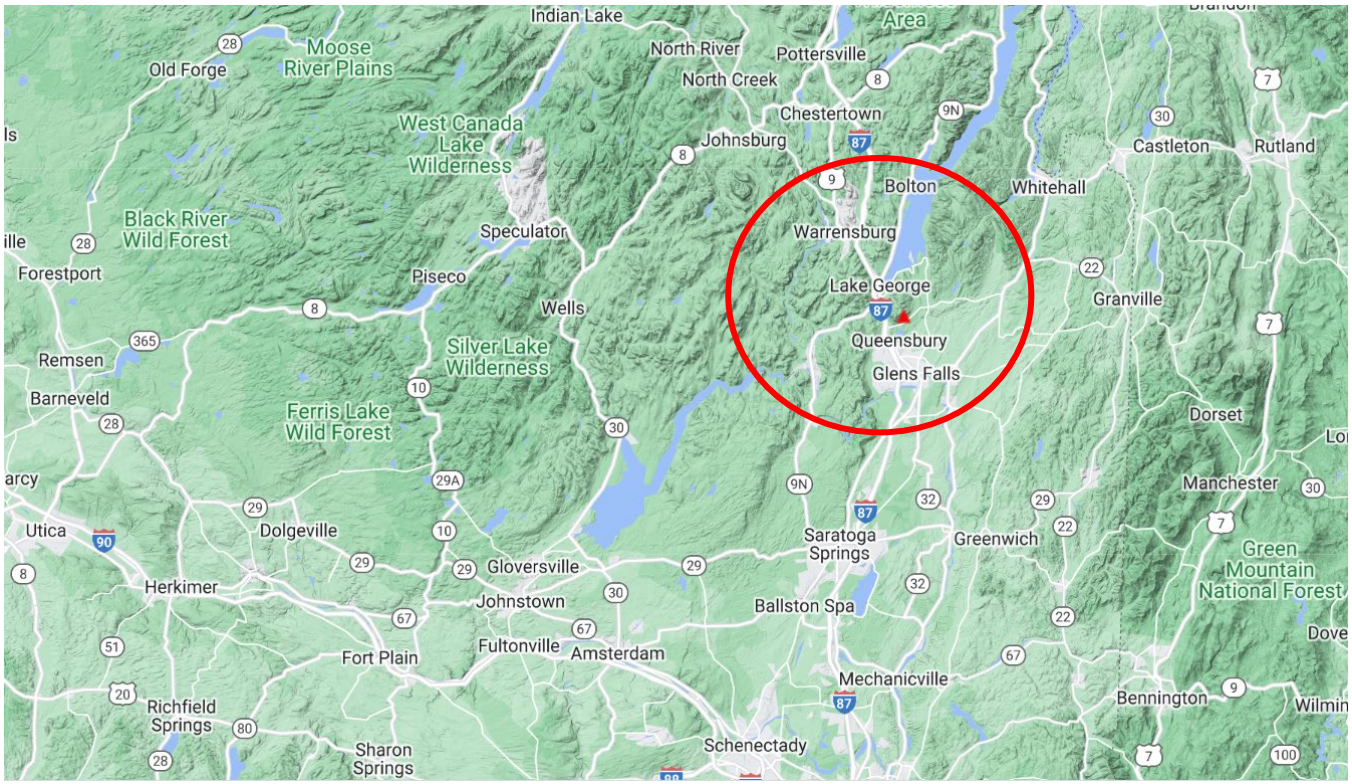
Figure 5.4.3-1. Faults in New York State



Source: Warren County, 2015. Note: Warren County is outlined in yellow

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goals of the monitoring project are to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 40 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. One seismographic station is located in Warren County at the Adirondack Community College in Queensbury, NY. Figure 5.4.3-2 shows the location of this station.

Figure 5.4.3-2. Lamont-Doherty Seismic Station Location in Warren County



Source: FDSN, 2023

Note: The red triangle indicates the seismic station, and the red circle indicates the approximate location of Warren County.

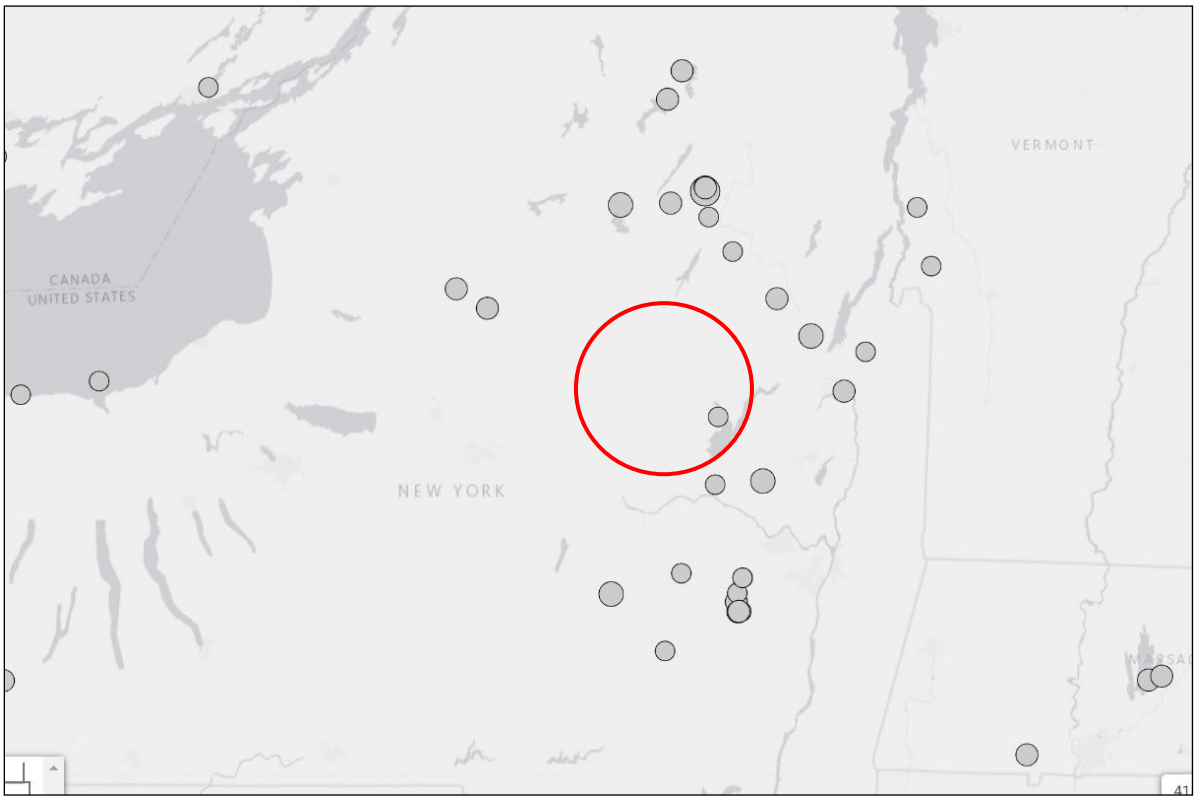
In addition to the Lamont-Doherty Seismic Stations, the USGS operates a global network of seismic stations to monitor seismic activity. While no seismic stations are located in New York State, nearby stations are positioned in State College, Pennsylvania, and Oak Ridge, Massachusetts. Figure 5.4.3-3 shows the locations of USGS seismic stations near New York State.

Figure 5.4.3-3. USGS Seismic Stations near New York State

Source: USGS 2015
Note: The red circle indicates the approximate location of Warren County.

Figure 5.4.3-4 illustrates historic earthquake epicenters across the northeast United States and in New York State between 1914 and 2022. There have been multiple earthquakes originating outside New York's borders that have been felt within the state. These quakes have come from Quebec, Canada; and Massachusetts. According to the NYS HMP, such events are considered significant for hazard mitigation planning because they could produce damage within the state in certain situations.

Figure 5.4.3-4. Earthquake Epicenters in the Northeast U.S., 1914 to 2022



Source: USGS 2022
Note: The red circle indicates the approximate location of Warren County.

Extent

An earthquake's magnitude and intensity are used to describe the severity and size of the event. intensity describes the overall felt severity of shaking during the event and magnitude describes the size at the focus of an earthquake. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale. It is now most commonly expressed using the moment magnitude (Mw) scale. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows:

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

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in

Table 5.4.3-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region. This shaking depends on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 5.4.3-2 displays the MMI scale and its relationship to the areas peak ground acceleration.

Table 5.4.3-1. Modified Mercalli Intensity Scale

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

Source: USGS 2014

Table 5.4.3-2. Modified Mercalli Intensity (MMI) and PGA Equivalents

Modified Mercalli Intensity	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

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
VIII	34 – 65	Severe	Moderate to Heavy
IX	65-124	Violent	Heavy
X	>124	Extreme	Very Heavy

Source: Freeman et al. (Purdue University) 2004
Note: PGA- Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (percent g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a period of interest. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5.4.3-3.

PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes, or accelerates, in a given geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 1.0%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. 10%g PGA means that the ground acceleration is 10% that of gravity (NJOEM, 2013). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5.4.3-3.

Table 5.4.3-3. Damage Levels Experienced in Earthquakes

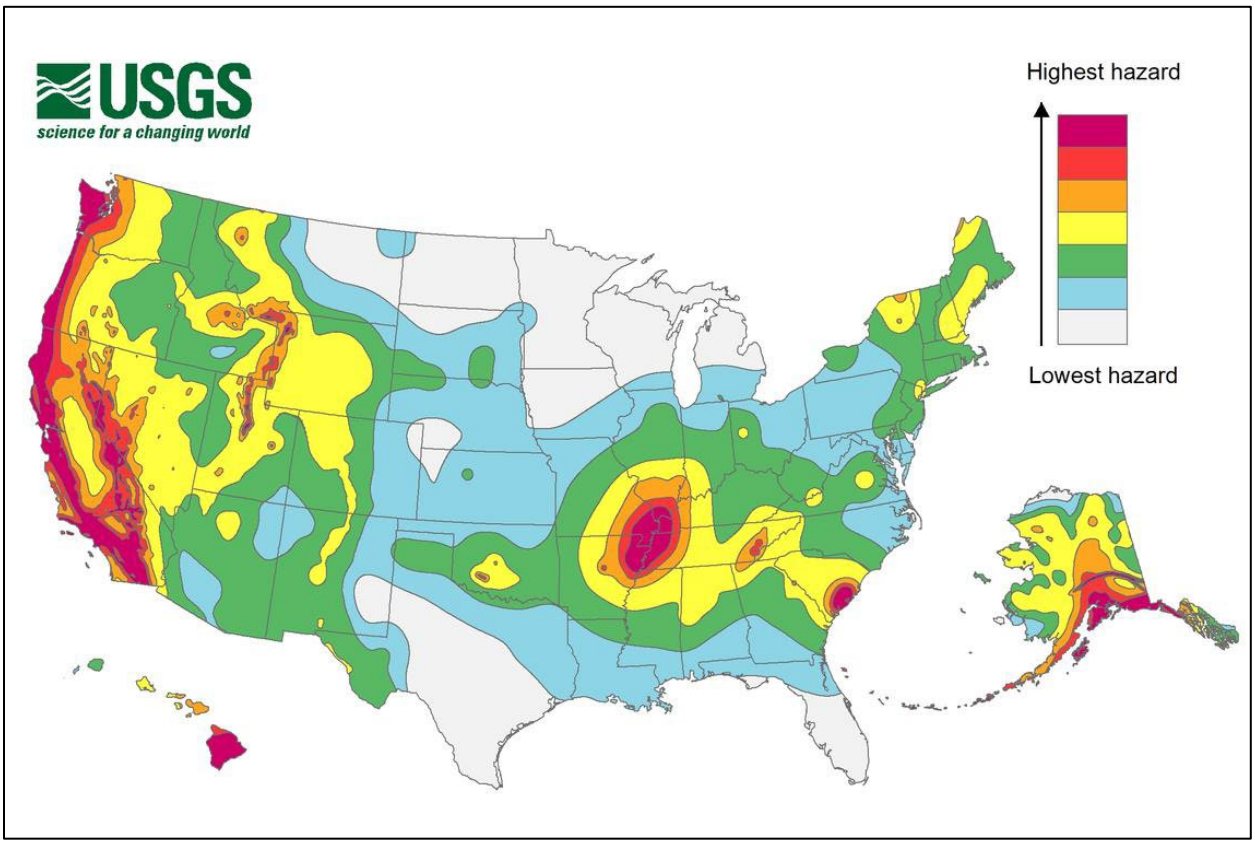
Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate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

Source: NJOEM 2011
Note: %g=Peak Ground Acceleration

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown, 2001) The USGS updated the National Seismic Hazard Maps in 2018. New seismic,

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

Figure 5.4.3-5. 2018 Long-Term National Seismic Hazard Map



Source: USGS 2018

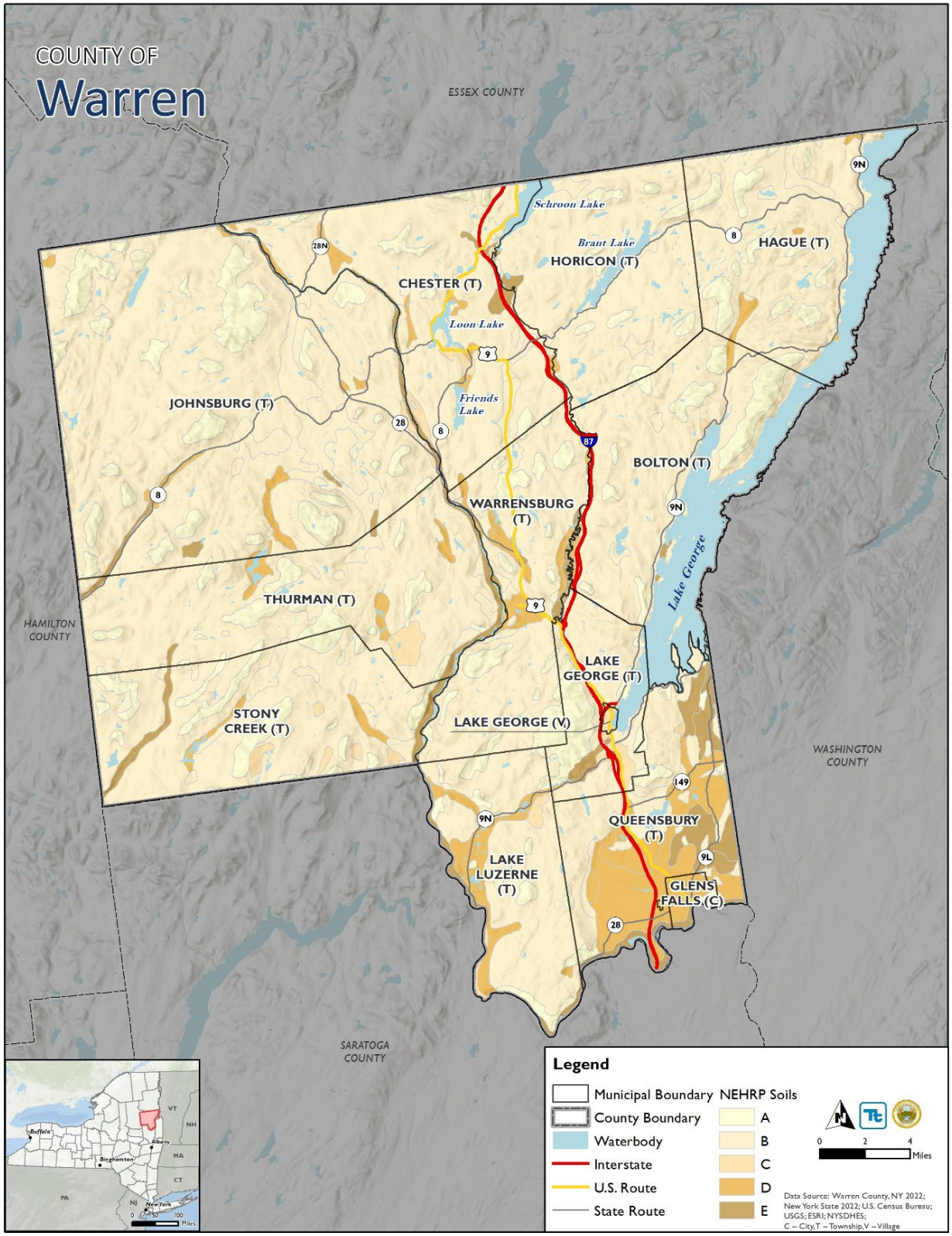
The New York State Geological Survey conducted seismic shear-wave tests of the state's surficial geology (glacial deposits). Based on these test results, the surficial geologic materials of New York State were categorized according to the National Earthquake Hazard Reduction Program's (NEHRP) Soil Site Classifications Table 5.4.3-4 The NEHRP developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from Class A to Class E, as noted in Table 5.4.3-4, where Class A represents hard rock that reduces ground motions from an earthquake and Class E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class E soils include water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type. Seismic waves travel faster through hard rock than through softer rock and sediments. As the waves pass from harder to softer rocks, the waves slow down, and their amplitude increases. Shaking tends to be stronger at locations with softer surface layers where seismic waves move more slowly. Ground motion above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock for small ground motions (FEMA, 2013).

Table 5.4.3-4. NEHRP Soil Classifications

Soil Classification	Description
A	Hard rock
B	Rock
C	Very dense soil and soft rock
D	Stiff soils
E	Soft soils

Source: FEMA 2013

Figure 5.4.3-6. NEHRP Soils in Warren County



As illustrated in Figure 5.4.3-6, Warren County is primarily comprised of NEHRP Soil Classes A, B, C, D, and E with the majority of the County comprised of Soil Class A (Hard rock).

A probabilistic assessment was conducted for the 500- and 2500-year mean return periods (MRP) through a Level 2 analysis using the HAZUS-MH, Version 5.1 (HAZUS-MH) probabilistic model to analyze the earthquake hazard for Warren County. The Level 2 HAZUS analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 500-year MRP event is an earthquake with a 1 percent chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 2500-year MRP, there is a 0.2 percent chance the mapped PGA will be exceeded in any given year.

Figure 5.4.3-7 and Figure 5.4.3-8illustrate the geographic distribution of PGA (*g*) across Warren County for 500- and 2500-year MRP events at the census tract level.

Figure 5.4.3-7. Peak Ground Acceleration Modified Mercalli Scale for a 500-Year MRP Earthquake Event

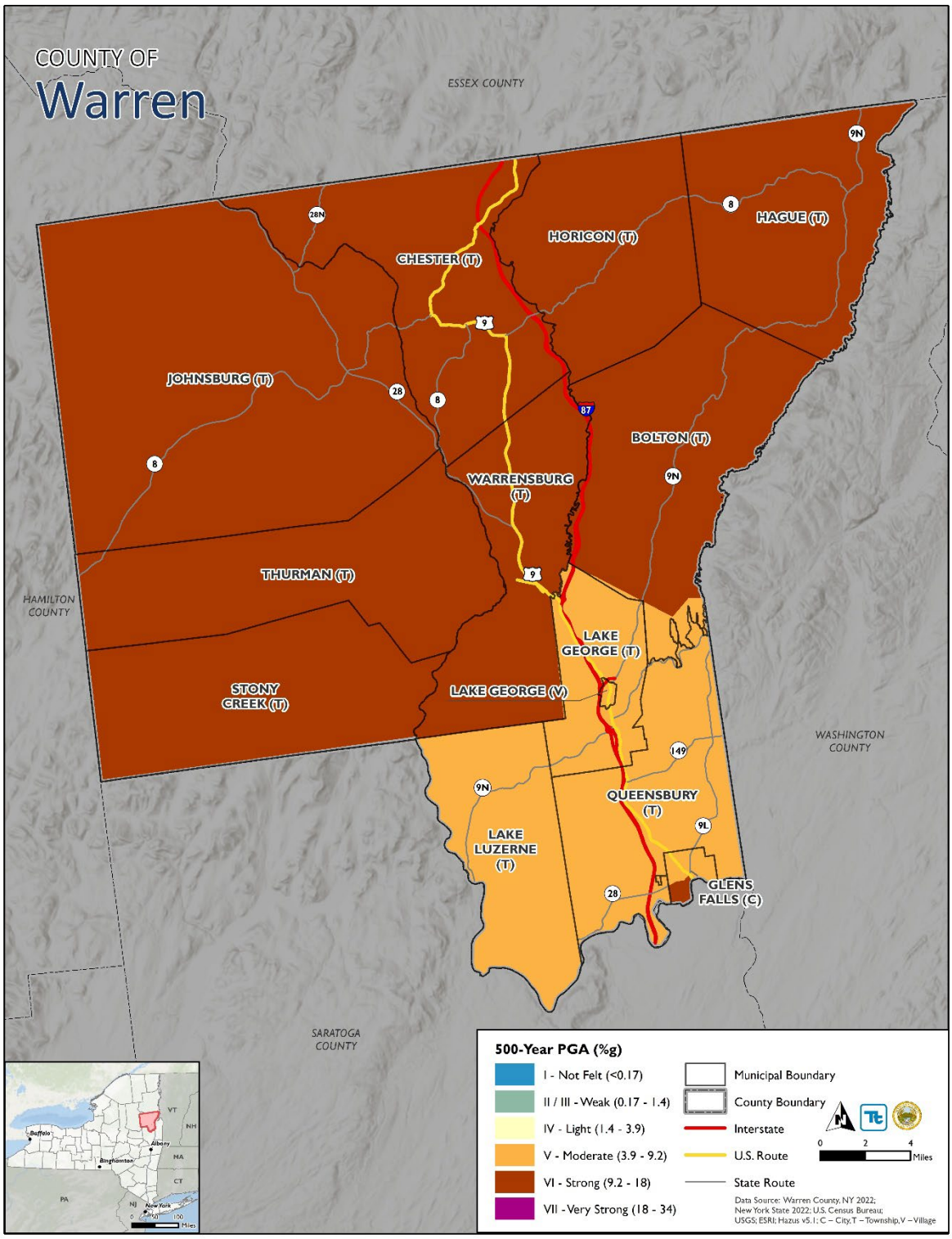
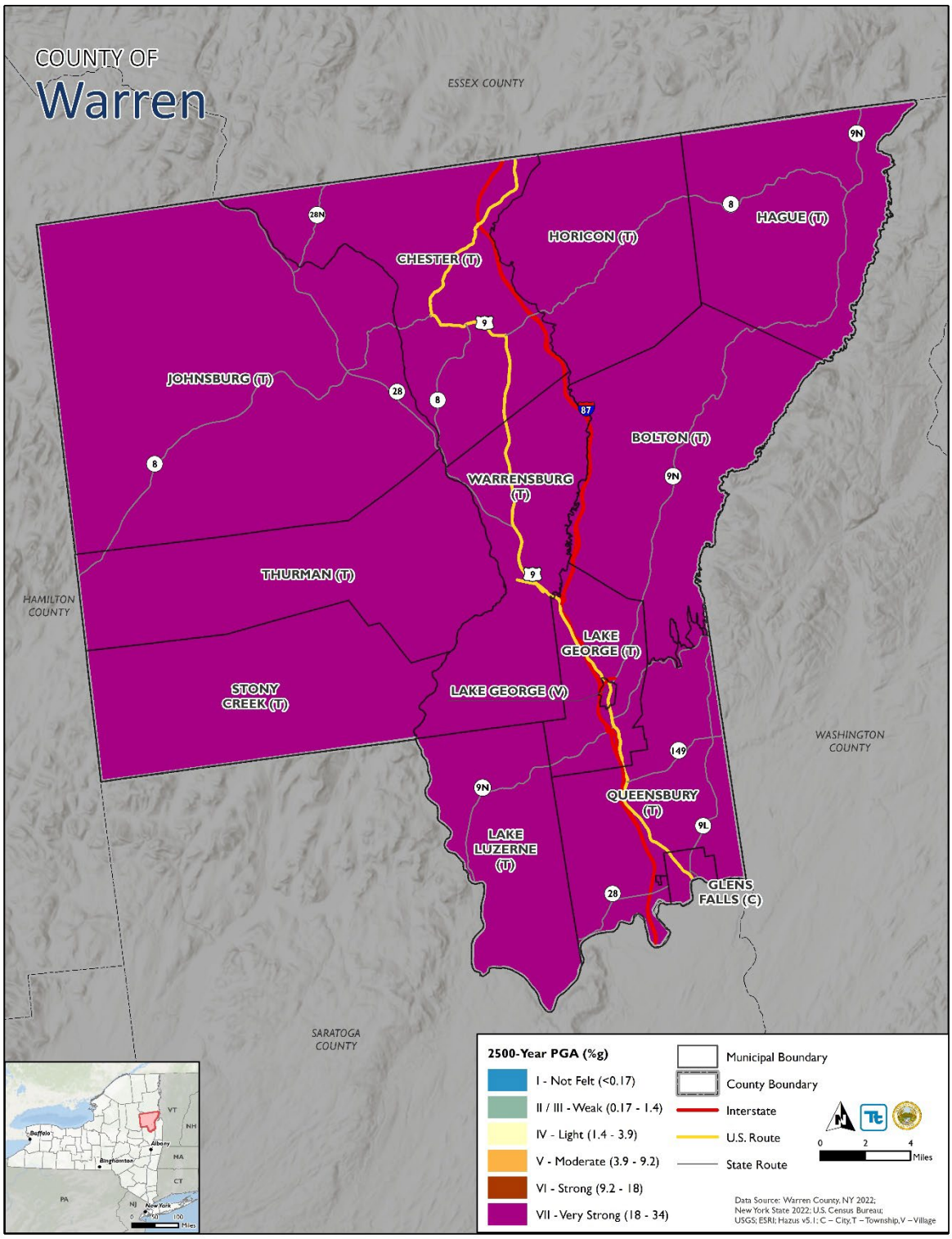


Figure 5.4.3-8. Peak Ground Acceleration Modified Mercalli Scale for a 2500-Year MRP Earthquake Event



Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was included in no disaster (DR) or emergency (EM) declarations for earthquake-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA, 2022). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was not included in earthquake-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known earthquake events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Table 5.4.3-5. Earthquake Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
March 11, 2020	Earthquake	N/A	N	A 3.1 magnitude earthquake struck South Glens Falls at approximately 6:43 AM. Effects were lightly felt in Warren County.

Sources: USGS 2022
Notes:

Probability of Future Occurrences

The NYSDPC indicates that the earthquake hazard in New York State is often understated because other natural hazards occur more frequently (such as hurricanes, tornadoes, and flooding) and are much more visible. However, the potential for earthquakes does exist across the entire northeastern United States, including New York State and Monroe County (NYS DHSES, 2019).

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of earthquake events for the County. Information from FEMA, USGS, the 2019 State of New York HMP, and the 2017 Warren County HMP were used to identify the number of earthquake events that occurred between 1950 and 2022. Table 5.4.3-6 presents the probability of future events for the earthquake event in the County.

Table 5.4.3-6. Probability of Future Hazard Name Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year
Earthquake	19	27.77

Sources: *FEMA 2022, USGS 2022, NYS HMP 2019, Warren County HMP 2017,*

Note: *Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all earthquake events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated*

Between 1950 and 2022, total of 19 earthquake events were recorded in Warren County, with one recorded since 2017. Based on historical occurrences, the probability of an earthquake event occurring is considered rare (between a 1% and 10% annual probability of occurrence). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

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

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

Vulnerability Assessment

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

Impact on life, Health, and Safety

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

According to the 2020 decennial population estimates, Warren County had a population of 65,737 people. Overall, risk to public safety and loss of life from an earthquake in the County is minimal for low magnitude events. However, there is a higher risk to public safety for those inside buildings due

to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake.

Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry construction. Of these most vulnerable populations, socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the poverty threshold, are most susceptible. Factors leadings to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. According to the 2021 5-year ACS estimates, there are approximately 5,151 persons living below the poverty level and 14,754 persons over the age of 65 years in Warren County.

As noted earlier, NEHRP Soil Classes D and E can amplify ground shaking to damaging levels even during a moderate earthquake, and thus increase risk to the population. Populations within municipalities located on NEHRP Class D and E soils were estimated and are listed in Table 5.4.3-1. Approximately 43,104 residents (4.9 percent of the County's population) are located on NEHRP Class D and E soils. The Town of Queensbury has the greatest proportion of its population residing on NEHRP Class D and E soils (i.e., 83 percent).

Table 5.4.3-7. Estimated Population Located on NEHRP Class D or Class E Soil Types

Jurisdiction	Total Population (2020 Decennial Census)	Estimated Population Located Within the NEHRP Soils Class D and E Hazard Area	
		Number of People in the NEHRP Soils Class D and E Hazard Area	Percent of Total
Bolton (T)	2,012	98	5%
Chester (T)	3,086	408	13%
Glens Falls (C)	14,830	14,173	96%
Hague (T)	633	40	6%
Horicon (T)	1,471	18	1%
Johnsburg (T)	2,143	154	7%
Lake George (T)	2,494	66	3%
Lake George (V)	1,008	0	0%
Lake Luzerne (T)	3,079	1,677	54%
Queensbury (T)	29,169	24,205	83%
Stony Creek (T)	758	234	31%
Thurman (T)	1,095	133	12%
Warrensburg (T)	3,959	1,898	48%
Warren County (Total)	65,737	43,104	66%

Source: U.S. Census Bureau 2020

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

Table 5.4.3-8. Estimated Displaced Households and Number of Persons Requiring Sheltering

Jurisdiction	500-Year Mean Return Period Earthquake Event		2500-Year Mean Return Period Earthquake Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Bolton (T)	0.0	0.0	0.5	0.2
Chester (T)	0.1	0.0	1.9	1.1
Glens Falls (C)	0.4	0.2	8.3	4.5
Hague (T)	0.0	0.0	0.1	0.1
Horicon (T)	0.0	0.0	0.2	0.1
Johnsburg (T)	0.0	0.0	1.6	0.9
Lake George (T)	0.0	0.0	1.2	0.6
Lake George (V)	0.0	0.0	0.3	0.1
Lake Luzerne (T)	0.0	0.0	0.3	0.2
Queensbury (T)	0.3	0.1	8.9	4.4
Stony Creek (T)	0.0	0.0	0.1	0.0
Thurman (T)	0.0	0.0	0.1	0.1
Warrensburg (T)	0.0	0.0	2.0	1.1
Warren County (Total)	**<1.0**	**<1.0**	**25.5**	**13.4**

Sources: Hazus v5.1; NYSDHES

According to the 1999-2003 NYCEM Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), a strong correlation exists between structural building damage and number of injuries and casualties from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, Hazus considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial, and industrial sectors are at their maximum at 2:00 p.m., with peak commute time at 5:00 p.m. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that

suffered no direct damage from an event itself. Overall, Hazus estimates that there are no injuries or casualties caused by the 100-year MRP event. Table 5.4.3-9 and Table 5.4.3-10 summarize the estimated number of injuries or casualties caused by the 500-year and 2,500-year MRP events.

Table 5.4.3-9. Estimated Number of Injuries and Casualties Caused by the 500-Year MRP Earthquake Event

Level of Severity	Time of Day - 500-year		
	2:00 AM	2:00 PM	5:00 PM
Injuries	3	6	3
Hospitalization	0	1	0
Casualties	0	0	0

Sources: Hazus v5.1; NYSDHES

Table 5.4.3-10. Estimated Number of Injuries and Casualties Caused by the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day - 2500 year		
	2:00 AM	2:00 PM	5:00 PM
Injuries	19	55	31
Hospitalization	2	10	5
Casualties	0	2	1

Sources: Hazus v5.1; NYSDHES

Impact on General Building Stock

The entire County's general building stock is considered at risk and exposed to this hazard. As stated earlier, soft soils (NEHRP Soil Classes D and E) can amplify ground shaking to damaging levels even during a moderate earthquake (NYCEM 2003). Therefore, buildings located on NEHRP Classes D and E soils are at increased risk of damage from an earthquake. Table Table 5.4.3-11 summarizes the number and replacement cost value of buildings in Warren located on NEHRP Class D and E soils. Overall, approximately 48.7 percent of Warren County's buildings are built on NEHRP Class D and E soils.

Table 5.4.3-11. Estimated Building Stock Located on NEHRP Class D or Class E Soil Types

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Number and Total Replacement Cost Value of Structures Located Within the NEHRP Soils Class D and E Hazard Area			
			Number of Buildings in the NEHRP Soils Class D and E Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the NEHRP Soils Class D and E Hazard Area	Percent of Total
Bolton (T)	2,873	$1,509,046,268	137	4.8%	$48,440,347	3.2%
Chester (T)	3,227	$1,794,523,301	428	13.3%	$286,738,653	16.0%
Glens Falls (C)	5,988	$3,728,124,116	5,655	94.4%	$3,177,716,320	85.2%
Hague (T)	1,313	$799,210,288	78	5.9%	$25,001,334	3.1%
Horicon (T)	2,188	$1,022,605,789	33	1.5%	$54,007,097	5.3%
Johnsburg (T)	2,625	$1,493,856,193	185	7.0%	$132,907,360	8.9%
Lake George (T)	2,494	$2,168,962,785	78	3.1%	$101,016,765	4.7%
Lake George (V)	609	$770,157,514	0	0.0%	$0	0.0%
Lake Luzerne (T)	2,173	$953,667,917	1,223	56.3%	$636,856,332	66.8%
Queensbury (T)	12,193	$7,114,031,584	10,112	82.9%	$5,718,177,935	80.4%
Stony Creek (T)	807	$995,996,331	250	31.0%	$258,145,982	25.9%
Thurman (T)	1,061	$497,985,792	123	11.6%	$70,835,195	14.2%
Warrensburg (T)	2,758	$1,425,456,857	1,344	48.7%	$757,814,139	53.2%
Warren County (Total)	**40,309**	**$24,273,624,737**	**19,646**	**48.7%**	**$11,267,657,461**	**46.42%**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft, NYSDHES; RS Means 2022

There is a strong correlation between PGA and damage a building might undergo (NYCEM, 2019). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Warren County.

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

Potential building damage was evaluated by Hazus across the following damage categories: none, slight, moderate, extensive, and complete. Table provides definitions of these five categories of damage for a light wood-framed building. Definitions for other building types are included in the Hazus technical manual documentation. The results of potential damage states for buildings in Warren County categorized by general occupancy classes (i.e., residential, commercial, industrial, etc.) from Hazus are summarized in Table 5.4.3-12 for the 500-year and 2,500-year MRP events. Hazus estimates that there are zero damages to structures caused by the 100-year MRP event.

Table 5.4.3-12. 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.

Building damage as a result of the 100-year, 500-year, and 2,500-year MRP earthquakes were estimated for each municipality using Hazus. Hazus estimates that zero damages will occur to buildings or contents during the 100-year MRP event. Table 5.4.3-13 and Table 5.4.3-14 summarize estimated total building and content losses caused by the 500-year and 2,500-year MRP events by jurisdiction, respectively. These tables also summarize losses for structures categorized as residential, commercial, and all other occupancy classes. Less than one-percent of the County's structures are impacted by the 500-year MRP event (i.e., approximately $55 million in replacement cost value) and approximately two-percent of the County's structures are impacted by the 2,500-year MRP event (i.e., $471 million in replacement cost value). Majority of the losses are estimated to occur in the City of White Plains

Table 5.4.3-13. Estimated Building Damages (Structure and Contents) from the 500-year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	Warren County 500-Year MRP				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Bolton (T)	$1,509,046,268	$3,118,510	0.2%	$2,109,007	$386,061	$623,442
Chester (T)	$1,794,523,301	$5,842,762	0.3%	$3,240,819	$1,180,371	$1,421,571
Glens Falls (C)	$3,728,124,116	$7,060,889	0.2%	$2,392,446	$3,186,882	$1,481,561
Hague (T)	$799,210,288	$1,722,433	0.2%	$1,087,234	$428,910	$206,288
Horicon (T)	$1,022,605,789	$2,870,284	0.3%	$1,811,781	$714,741	$343,762
Johnsburg (T)	$1,493,856,193	$5,030,319	0.3%	$2,067,434	$1,230,404	$1,732,481
Lake George (T)	$2,168,962,785	$4,503,230	0.2%	$2,863,743	$1,255,825	$383,662
Lake George (V)	$770,157,514	$1,100,011	0.1%	$699,526	$306,797	$93,689
Lake Luzerne (T)	$953,667,917	$1,624,737	0.2%	$955,171	$313,945	$355,621
Queensbury (T)	$7,114,031,584	$15,074,924	0.2%	$6,796,411	$5,863,797	$2,414,716
Stony Creek (T)	$995,996,331	$1,534,578	0.2%	$636,926	$239,544	$658,108
Thurman (T)	$497,985,792	$2,017,580	0.4%	$837,396	$314,940	$865,244
Warrensburg (T)	$1,425,456,857	$3,390,394	0.2%	$1,394,845	$1,009,347	$986,202
Warren County (Total)	**$24,273,624,737**	**$54,890,651**	**0.2%**	**$26,892,740**	**$16,431,564**	**$11,566,347**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft, NYSDHES; RS Means 2022

Table 5.4.3-14. Estimated Building Damages (Structure and Contents) from the 2,500-year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	Warren County 2500-Year MRP				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Bolton (T)	$1,509,046,268	$27,405,975	1.8%	$18,810,913	$3,341,237	$5,253,826
Chester (T)	$1,794,523,301	$48,648,824	2.7%	$27,985,891	$9,409,303	$11,253,629
Glens Falls (C)	$3,728,124,116	$60,943,202	1.6%	$20,961,873	$28,101,446	$11,879,883
Hague (T)	$799,210,288	$14,754,316	1.8%	$9,400,249	$3,609,748	$1,744,320
Horicon (T)	$1,022,605,789	$24,586,781	2.4%	$15,664,695	$6,015,330	$2,906,757
Johnsburg (T)	$1,493,856,193	$42,822,793	2.9%	$18,680,896	$10,161,703	$13,980,193
Lake George (T)	$2,168,962,785	$40,233,958	1.9%	$26,003,897	$11,089,518	$3,140,543

Jurisdiction	Total Replacement Cost Value (RCV)	Warren County 2500-Year MRP				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Lake George (V)	$770,157,514	$9,828,184	1.3%	$6,352,095	$2,709,197	$766,893
Lake Luzerne (T)	$953,667,917	$13,938,803	1.5%	$8,340,441	$2,817,292	$2,781,071
Queensbury (T)	$7,114,031,584	$126,669,083	1.8%	$56,428,297	$50,947,684	$19,293,101
Stony Creek (T)	$995,996,331	$13,476,609	1.4%	$5,740,196	$2,168,610	$5,567,803
Thurman (T)	$497,985,792	$17,718,318	3.6%	$7,546,900	$2,851,171	$7,320,247
Warrensburg (T)	$1,425,456,857	$29,565,314	2.1%	$12,219,531	$8,985,558	$8,360,225
Warren County (Total)	**$24,273,624,737**	**$470,592,161**	**1.9%**	**$234,135,875**	**$142,207,796**	**$94,248,490**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft, NYSDHES; RS Means 2022

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

Impact on Critical Facilities and Community Lifelines

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

The number of critical facilities and lifelines built on NEHRP Class D and Class E soil types was assessed. Overall, there are 263 lifeline facilities located on soils prone to ground shaking during an earthquake event. Refer to Table 5.4.3-15 which summarizes the number of facilities categorized by FEMA lifeline categories located on NEHRP Class D and Class E soil types.

Table 5.4.3-15. Estimated Number of Critical Facilities and Lifelines Located on NEHRP Class D and Class E Soil Types

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines in the NEHRP Soils Class D and E Hazard Area
Communications	16	4
Energy	20	8
Food, Water, Shelter	163	75
Hazardous Material	46	22
Health and Medical	43	27
Safety and Security	211	112
Transportation	60	15

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines in the NEHRP Soils Class D and E Hazard Area
Warren County (Total)	**559**	**263**

Sources: Warren County, NY 2022; NYSDHES

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

As a result of a 500-year MRP event, Hazus estimates that 15 critical facilities will incur severe damages. However, for the 2,500-year MRP event, 273 lifeline facilities are estimated to incur severe damages. Table 5.4.3-16Table and Table 5.4.3-17 summarize the damage state probabilities for critical facilities during the 500-year and 2,500-year MRP events, respectively.

Table 5.4.3-16. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Warren County for the 500-Year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	36,942	NONE	35,330	95.6%
		MINOR	1,383	3.7%
		MODERATE	220	0.6%
		SEVERE	10	0.0%
		DESTRUCTION	0	0.0%
Commercial Buildings	2,249	NONE	2,094	93.1%
		MINOR	118	5.3%
		MODERATE	33	1.5%
		SEVERE	3	0.1%
		DESTRUCTION	0	0.0%
Industrial Buildings	199	NONE	178	89.5%
		MINOR	14	7.2%
		MODERATE	6	2.9%
		SEVERE	1	0.4%
		DESTRUCTION	0	0.0%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year	
			Building Count	Percent Buildings in Occupancy Class
Government, Religion, Agricultural, and Education Buildings	919	NONE	859	93.5%
		MINOR	48	5.2%
		MODERATE	11	1.2%
		SEVERE	1	0.1%
		DESTRUCTION	0	0.0%

Sources: Hazus v5.1; NYSDHES

Table 5.4.3-17. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Warren County for the 2,500-Year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 2500-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	36,942	NONE	28,740	77.8%
		MINOR	6,247	16.9%
		MODERATE	1,764	4.8%
		SEVERE	187	0.5%
		DESTRUCTION	4	0.0%
Commercial Buildings	2,249	NONE	1,403	62.4%
		MINOR	486	21.6%
		MODERATE	290	12.9%
		SEVERE	61	2.7%
		DESTRUCTION	9	0.4%
Industrial Buildings	199	NONE	118	59.1%
		MINOR	39	19.7%
		MODERATE	32	16.2%
		SEVERE	9	4.3%
		DESTRUCTION	1	0.7%
Government, Religion, Agricultural, and Education Buildings	919	NONE	600	65.3%
		MINOR	208	22.7%
		MODERATE	93	10.1%
		SEVERE	16	1.7%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 2500-Year	
			Building Count	Percent Buildings in Occupancy Class
		DESTRUCTION	2	0.3%

Sources: Hazus v5.1; NYSDHES

Impact on the Economy

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 5.4.3-18.

Table 5.4.3-18. Economic Losses for Earthquake Mean Return Period Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Wages Losses	Rental Losses	Capital-Related Loss
500-year	$397,900	$3,067,900	$1,648,200	$2,175,800	$747,100
2500-year	$3,176,600	$306,951,000	$17,698,100	$20,147,000	$9,955,400

Sources: Hazus v5.1; NYSDHES

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

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

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

For the 500-year and 2,500-year MRP events, Hazus estimates a total of 7,663 tons and 62,978 tons of debris will be generated county-wide, respectively. Table 5.4.3-19 summarizes the estimated debris generated as a result of these events by municipality.

Table 5.4.3-19. Estimated Debris Generated by the 500-Year and 2,500-Year MRP Earthquake Events

Jurisdiction	Estimated Debris Created During the 500-Year Mean Return Period Earthquake Event**		Estimated Debris Created During the 2500-Year Mean Return Period Earthquake Event**	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Bolton (T)	199	44	1,400	588
Chester (T)	479	134	3,371	1,745
Glens Falls (C)	1,093	449	5,915	5,411
Hague (T)	97	51	755	662
Horicon (T)	161	84	1,259	1,104
Johnsburg (T)	316	149	2,622	2,210
Lake George (T)	270	120	1,925	1,672
Lake George (V)	66	29	470	409
Lake Luzerne (T)	217	51	1,183	492
Queensbury (T)	1,822	735	10,950	9,868
Stony Creek (T)	186	43	1,176	524
Thurman (T)	244	57	1,546	689
Warrensburg (T)	382	185	2,546	2,484
Warren County (Total)	**5,531**	**2,132**	**35,119**	**27,858**

Sources: Hazus v5.1; NYSDHES

Impact on the Environment

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

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

Future Changes That May Impact Vulnerability

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

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

According to the NYS Hazard Mitigation Plan, the frequency of damaging earthquakes within and adjacent to New York State has been relatively low. However geologists predict that an earthquake of magnitude 5.0 [some sources describe 5.0 as moderately destructive] or above on the Richter scale has a 2% probability of occurring in the New York area within the next 50 years.

Projected Development

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

Additionally, persons that move into older buildings may increase their overall vulnerability to earthquakes. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

Refer to Section 4, and Volume II Section 9 for more information about the potential new development in Warren County.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). Even though the population has not significantly increased overall, changes in population density within county communities should be evaluated to determine if high population densities can create issues for local residents during an event.

Climate Change

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

Change of Vulnerability Since the 2017 HMP

Since the 2017 HMP was drafted, updated inventory data has become available to assess the earthquake in Warren County. This data includes the 5-Year 2021 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Hazus v5.1 was also used to assess the losses in the County to the earthquake 500-year and 2500-year mean return period events. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the earthquake hazard.

5.4.4 Extreme Temperatures

Hazard Profile

Hazard 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 (such as burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience.

Extreme Cold

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered "extreme cold" in regions relatively unaccustomed to winter weather. Conversely, "extreme cold" might be used to describe temperatures below 0° F in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to approximately 0 degrees Fahrenheit (°F) or below (National Weather Service n.d.). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. 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 most susceptible to the effects of extreme changes in temperatures and are particularly at risk, but anyone can be affected (Center for Disease Control and Prevention [CDC] 2012).

In New York State, extreme cold days are defined to reflect the State's regional climate variations. Extreme cold days in the State are individual days with minimum temperatures at or below 32° F or individual days with minimum temperatures at or below 0°F (NYSERDA 2014).

Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia.

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion

Extreme Heat

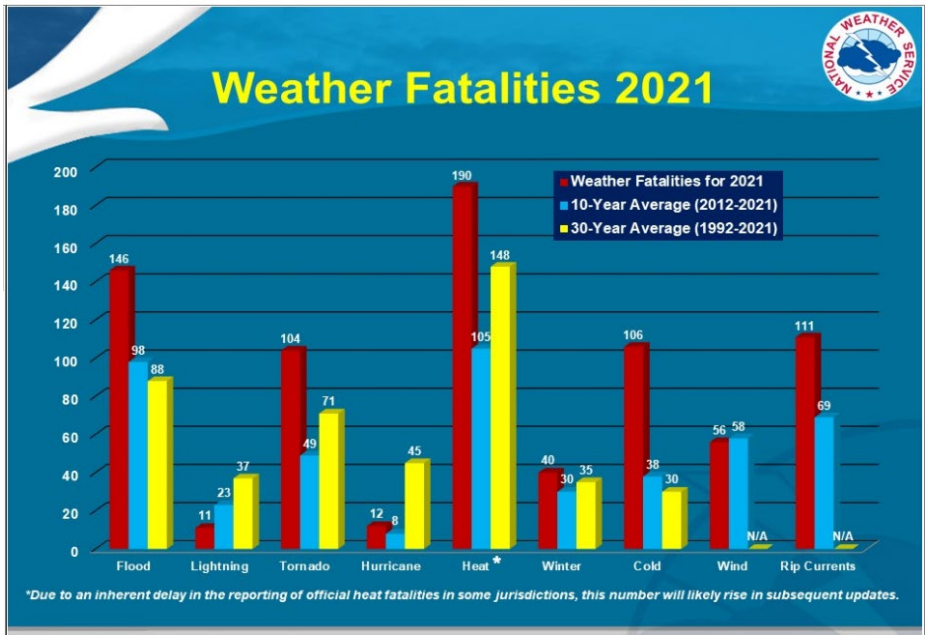
Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (Center for Disease Control and Prevention [CDC] 2012). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA 2009).

In New York State, high temperatures and heat waves are defined in several ways to reflect the diversity of conditions experienced across the State. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90° F or 95°F. Heat waves are defined as three consecutive days with maximum temperatures above 90° F (NYSERDA 2014).

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. These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or an 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 (NYS DHSES 2019).

Extreme heat is the number one weather-related cause of death in the U.S. On average, nearly 150 people die each year in the United States from excessive heat (NWS 2021). Figure 5.4.4-1 shows the number of weather fatalities based on a 10-year average and a 30-year average. Heat caused the highest average of weather-related fatalities between 2012 and 2021.

Figure 5.4.4-1. Average Number of Weather-Related Fatalities in the U.S.

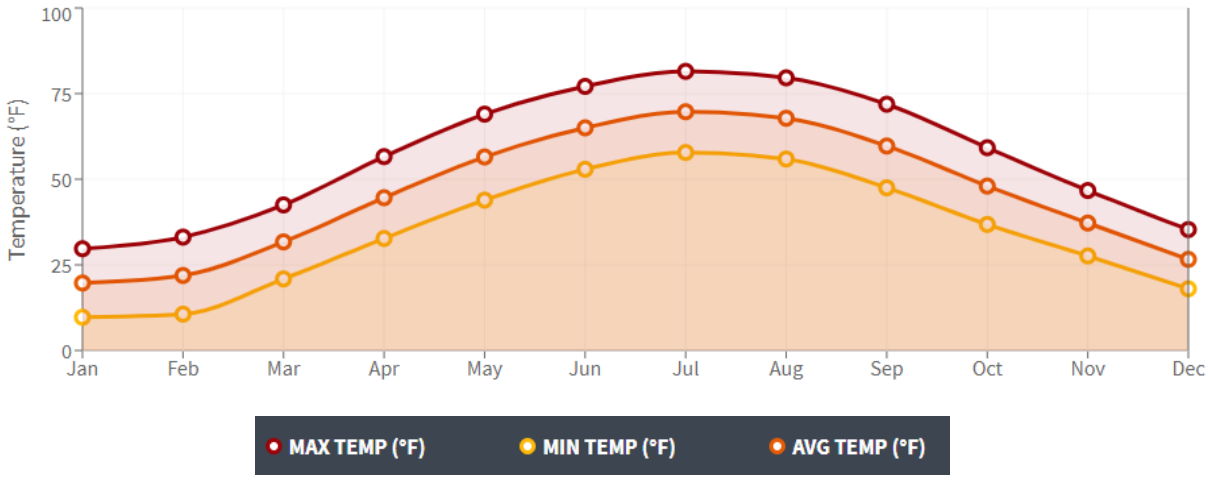


Source: NWS 2021

Location

Varying land elevations, character of the landscape, and proximity to large bodies of water play a significant role in the state's temperatures. Warren County is susceptible to both extreme cold and extreme heat temperature events. Figure 5.4.4-2 shows the average low and high temperatures each month at the Glens Falls Airport station located in Warren County.

Figure 5.4.4-2. Average Temperatures at Glens Falls Airport



Source: NOAA NCEI 2023

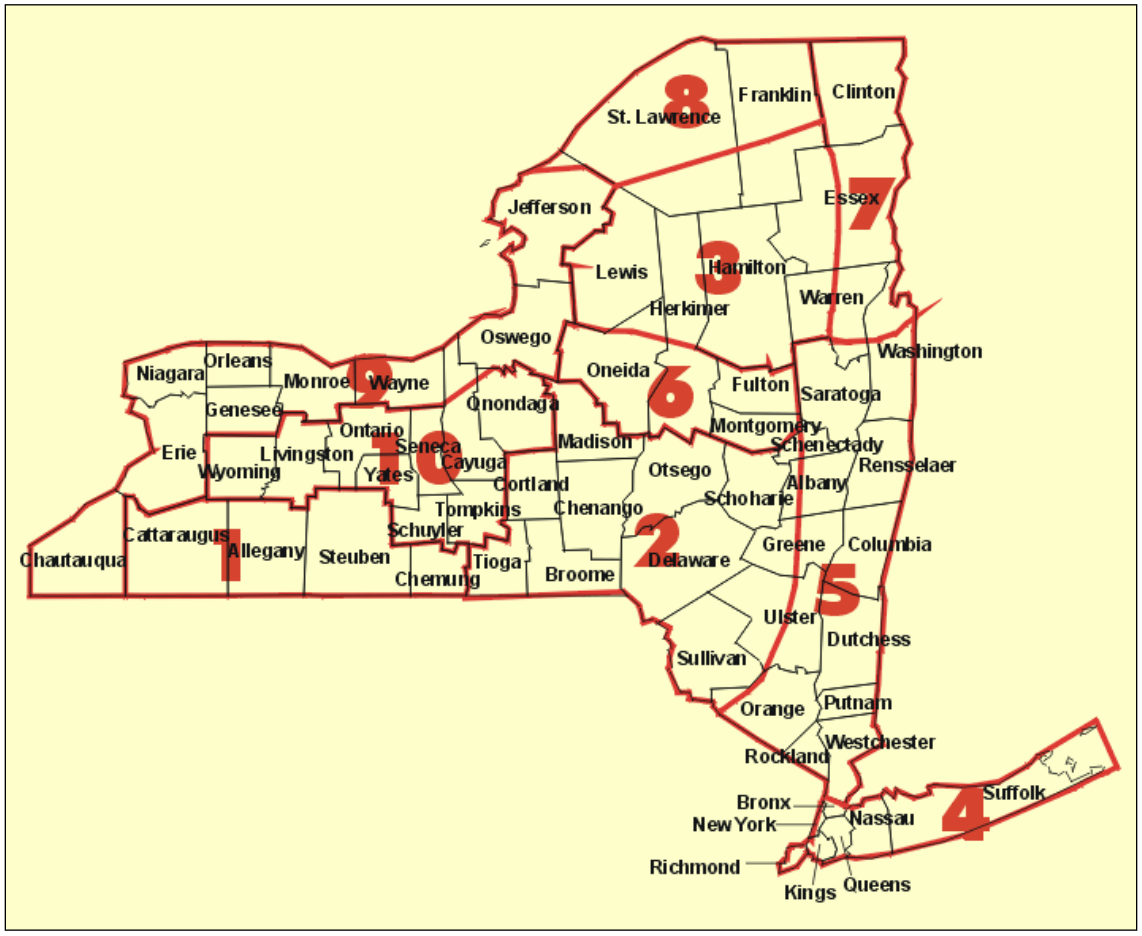
Extensive periods of extreme cold temperatures are a result from movement of great high-pressure systems into and through the eastern United States. Under higher-than-normal atmospheric pressures when arctic air masses are present, extreme winter temperatures hover over New York. New York State's location in the northeast makes it highly susceptible to extreme cold that can cause impact to human life and property (NYS DHSES 2019). 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 (Cornell University n.d.).

Excessive heat can occur anywhere, and occurrences of excessive heat are generally widespread and will cover an entire county. However, there can be spot locations that are somewhat cooler (e.g., a shady park near a stream) or hotter (e.g., urban areas because of their built environment holds the heat) (NYS DHSES 2019). Extreme heat temperatures of varying degrees exist throughout the state for most of the summer season, except for areas with high altitudes (Cornell University n.d.).

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau (Catskill Mountains), Northern Plateau (Adirondack Mountains), 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" (NOAA 2012). Warren County is located within three divisions. The western portion of the County is located in the Northern Plateau (Division 3). The eastern portion of the County is located in the Champlain Valley (Division 7). The southern portion of the County is located in the Hudson Valley (Division 5). Figure 5.4.4-3 depicts the climate divisions in New York State.

Figure 5.4.4-3. New York State Climate Divisions



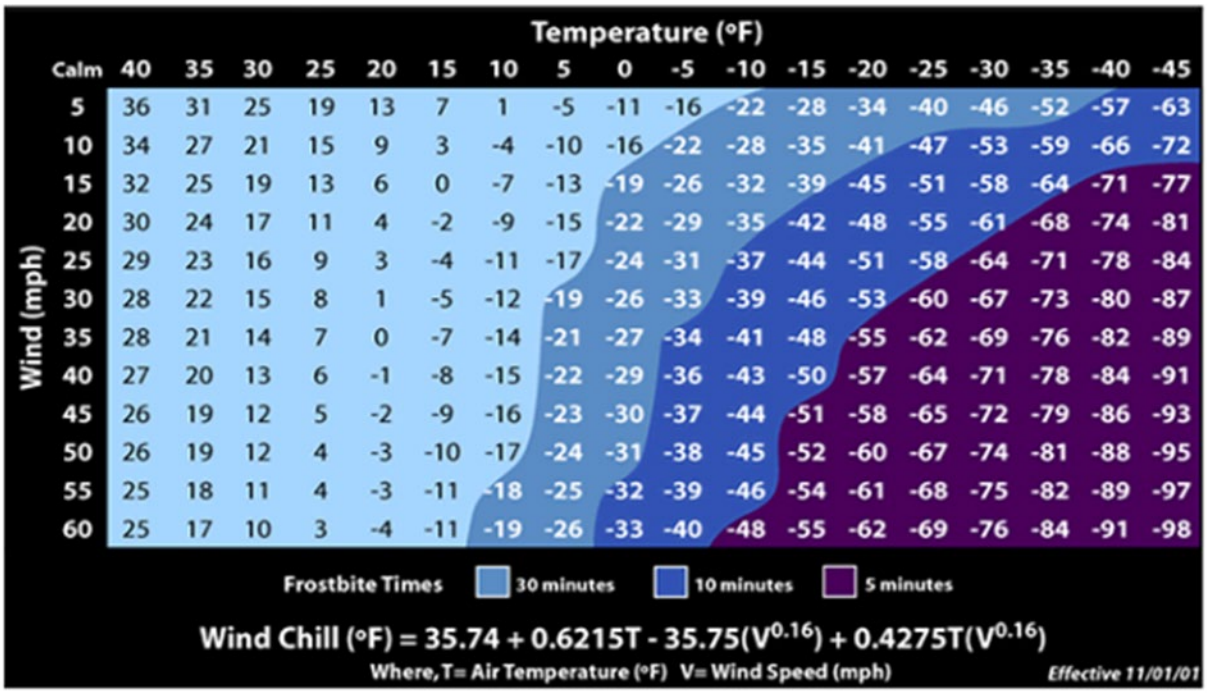
Source: NOAA 2012
Notes: (1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Mohawk Valley; (7) Champlain Valley; (8) St. Lawrence Valley; (9) Great Lakes; and (10) Central Lakes

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT, refer to: Winter (weather.gov). The WCT is presented in Figure 5.4.4-4.

Figure 5.4.4-4. Wind Chill Index

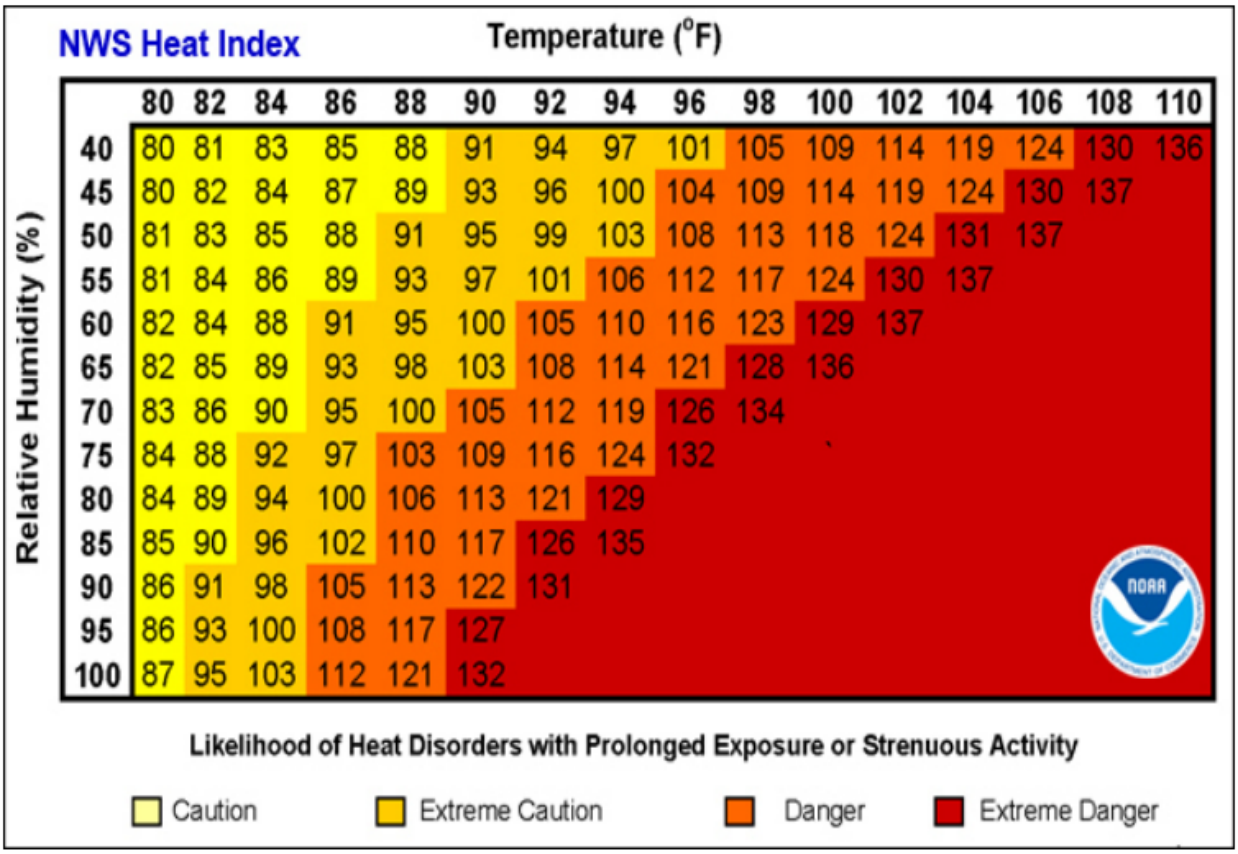


Source: NWS 2001

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 5.4.4-5. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values (as seen in Figure 5.4.4-5). This index provides a measure of how temperatures actually feel; however, the values are devised for shady, light wind conditions. Figure 5.4.4-5 shows the heat index value for shaded areas. Exposure to full sun can increase the index by up to 15 degrees (NYSDHSES n.d.).

Figure 5.4.4-5. NWS Heat Index Chart – Shaded Areas



Source: NWS

Table 5.4.4-1 describes the adverse effects of prolonged exposure to direct sunlight on an individual.

Table 5.4.4-1. Adverse Effects of Prolonged Exposure to Direct Sunlight

Category	Heat Index	Effects on the Body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: NWS

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.4-2 explains these alerts. In the event of an extreme heat advisory, the NWS does the following:

- Includes Heat Index values and city forecasts
- Issues special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and Heat Index values
- Provides assistance to state and local health officials in preparing Civil Emergency Messages in severe heat waves (NYSDHSES n.d.).

Table 5.4.4-2. National Weather Service Alerts

Alert	Criteria
Heat Advisory	Issued 12 hours of the onset of the following conditions: maximum daytime heat index values are to reach between 100°F to 104°F for at least 2 consecutive hours
Excessive Heat Watch	Issued when conditions are favorable for excessive heat in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following conditions: maximum heat index temperature is expected to be 105°F or higher for at least 2 days and nighttime air temperatures will not drop below 75°F

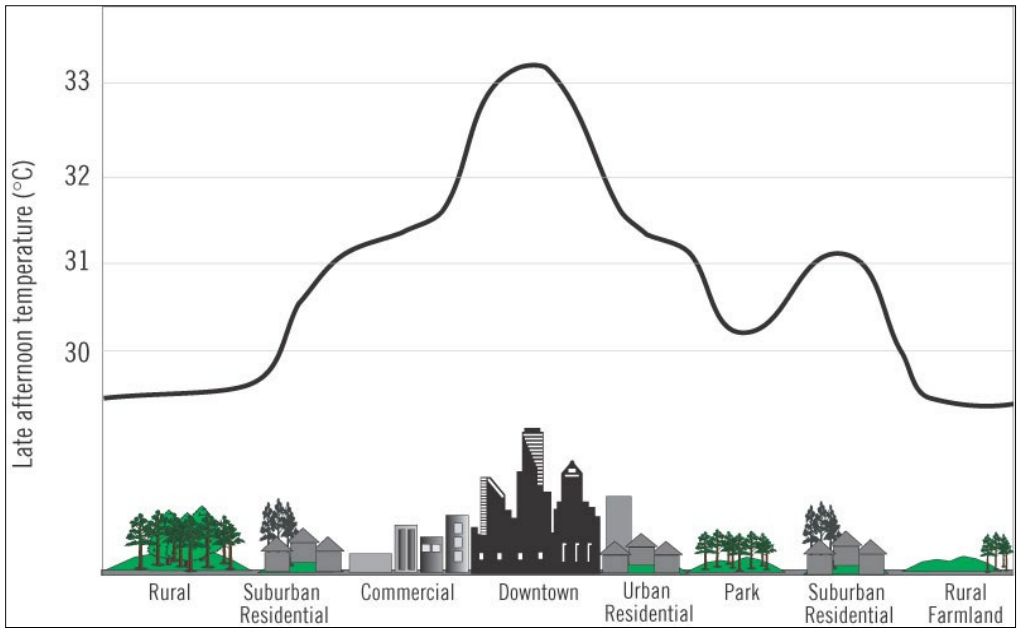
Source: NYSDHSES n.d.

Urbanized areas and urbanization create an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. 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 (EPA 2022). The centralized developed areas of the County that may be subject to urban heat island effect are focused in the southeastern areas of the County, though urban heat island can occur anywhere with extensive developed surfaces.

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 1 million people can be between 1.8 °F and 5.4°F warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22°F. 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°F to 90°F hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer; thereby escalating air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (EPA 2022).

Figure 5.4.4-6 below illustrates an urban heat island profile. The graphic demonstrates that heat islands are typically most intense over dense urban areas. Further, vegetation and parks within a downtown area may help reduce heat islands (U.S. EPA 2019).

Figure 5.4.4-6. Urban Heat Island Profile



Source: EPA 2019
°C degrees Celsius

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was not included in any disaster (DR) or emergency (EM) declarations for extreme temperature-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2023). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was included in two extreme temperature-related agricultural disaster declarations.

- 2012: S3249 for frosts and freezes
- 2016: S4052 for unseasonable warmth followed by frosts and freezes

Previous Events

For this 2023 HMP update, known extreme temperature events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Table 5.4.4-3. Extreme Temperature Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
December 27, 2017	Extreme Cold/Wind Chill, Cold/Wind Chill	N/A	N/A	A frigid Arctic air mass poured into the region Wednesday, December 27th along with gusty northwesterly winds. Despite gusty winds, low temperatures fell to as low as zero to 23 degrees below zero over the high terrain of eastern New York on Wednesday night. This resulted in wind chill values as low as 35 degrees below zero late Wednesday night into early Thursday morning. Bitterly cold wind chills continued through Thursday and into Friday morning.
December 31, 2017	Cold/Wind Chill	N/A	N/A	A bitterly cold air mass in place allowed temperatures to plummet several degrees below zero on New Years Eve into New Years Day. Temperatures ranged from zero degrees to 28 degrees below zero in the high terrains of New York. These cold temperatures resulted in dangerous wind chills ranging from one below to 31 degrees below zero during the early morning hours of New Years day.
January 1-2, 2018	Extreme Cold/Wind Chill	N/A	N/A	A frigid airmass combined with northwesterly winds up to 15 miles per hour resulted in dangerously cold wind chills on the first and second days of 2018. Wind chills fell as low as 15 to 35 below zero in many locations across the region on New Year's morning.
January 5-7, 2018	Extreme Cold/Wind Chill	N/A	N/A	A deep upper level trough swept across the southern US and turned northeastward offshore of the east coast from the morning of January 3 through the morning of January 4, 2018. The interaction between the cold upper trough and the relatively warmer Atlantic waters resulted in tremendous intensification of a surface low pressure system that tracked from around Miami, FL to just offshore of Cape Cod on January 3 and 4. A good deal of moisture wrapped into this system and was lifted across much of the East Coast, resulting in a broad area of moderate to heavy snowfall. A heavy band of snow impacted portions of the Taconics from the late morning through the afternoon hours of January 4, resulting in snowfall rates up to 3 per hour and total snowfall amounts mainly in the 7 to 15 inch range. To the west of the heavy snowband across the Hudson, Mohawk, and Schoharie Valleys, a widespread 3 to 7 inches of snowfall occurred. Gusty northerly winds occurred with this system as well, with gusts of 30-45 mph recorded. The winds and falling snow contributed to reduced visibility and blowing and drifting of snow. The snowfall tapered off in the evening of January 4. As the system pulled away, brutally cold Arctic air rushed southward into New York, resulting in an extended period of extremely cold conditions from January 5 through January 7. The coldest wind chills occurred during the mornings of January 6 and 7, when frigid air combined with westerly winds gusting to 30-40 mph resulted in

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				widespread wind chills as low as 20 to 40 degrees below zero. High temperatures on January 6 were mainly in the single digits above and below zero. One confirmed fatality from hypothermia resulted from the stretch of cold weather as a 46-year old woman was found dead in front of her home in Glens Falls. Many warming shelters were opened across the state.
January 13-14, 2018	Cold/Wind Chill	N/A	N/A	Tropical moisture was lifted over a sharp cold front as it moved into eastern New York in the evening of Friday, January 12, causing rain to turn to sleet and snow and become heavy from Friday evening into Saturday morning. Despite warm temperatures in the 50s during the day, snowfall accumulated 6 to 12 inches over northern Herkimer County as temperatures fell into the 20s and 30s. Temperatures continued to plummet behind the cold front, with frigid wind chills as low as -25F by the morning of Sunday, January 14.
June 18, 2018	Heat	N/A	N/A	A hot and humid airmass was in place across the region with temperatures in the 90s and dew points in the 60s and 70s. This resulted in heat index values reaching 100 to 110 degrees during the afternoon hours in valley areas.
June 30, 2018	Heat	N/A	N/A	A hot and humid airmass invaded eastern New York beginning on June 30th. It would be the beginning of a heat wave that would last through the Independence Day holiday, and marked the first of several days of 90 degree heat. Combined with dewpoints in the mid-70s, heat indices reached around 100 degrees. The impending heat wave prompted the opening of numerous cooling centers throughout the region.
July 1-5, 2018	Excessive Heat	N/A	N/A	A hot and humid airmass brought excessively high heat indices to eastern New York from the beginning of July through the Independence Day holiday. Temperatures soared as high as 99 degrees on July 1st, the hottest day of the stretch. Combined with dewpoints in the mid-70s, heat indices reached near 110 degrees in the warmest valleys. July 5th marked the sixth consecutive day reaching a temperature of 90 degrees at Albany and Glens Falls, and a seventh consecutive day at Poughkeepsie. In addition to the hot daytime temperatures, overnight low temperatures only falling into the 70s was common, which exacerbated heat-related problems. The extensive heat prompted the opening of many cooling centers across the region.
July 16, 2018	Heat	N/A	N/A	It was hot and humid on July 16th as temperatures soared into the low to mid-90s with dewpoints in the upper 60s to low 70s in the Hudson and Mohawk Valleys. This resulted in heat indices reaching the mid to upper 90s.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
September 3-5, 2018	Heat	N/A	N/A	A late-season heat wave impacted eastern New York during the first week of September. A persistent warm and moist airmass characterized by daytime highs in the 90s and dewpoints in the 70s resulted in heat index values reaching 95-105 degrees during the afternoon hours. Daily record high temperatures were set or tied at Albany on the 5th and 6th, and a daily record high minimum temperature was set on the 3rd. This heat wave coincided with the first week of school for many, and the heat prompted some schools to dismiss classes early and postpone or cancel sports practices.
November 22, 2018	Cold/Wind Chill	N/A	N/A	A frigid airmass arrived in the wake of an Arctic cold front on the 22nd, resulting in one of the coldest Thanksgivings on record for eastern New York. Wind chill values fell to -15 to -20 degrees Fahrenheit during the morning of the 22nd, while high temperatures only reached the single digits and teens.
January 20-22, 2019	Extreme Cold/Wind Chill	N/A	N/A	The largest snowstorm to date in the 2018-19 winter occurred on January 19th and 20th across eastern New York. Low pressure formed over the lower Mississippi Valley and lifted northeast across the Tennessee Valley during the night of the 19th before moving along the Mason-Dixon line on the 20th. Snowfall totals were heaviest from the central Mohawk Valley into the southern Adirondacks and Lake George-Saratoga region where 1.5 to 2 foot totals were common. Three to six inches of snow and sleet along with some ice occurred over the Mid- Hudson Valley, while the remainder of the region saw between 6 and 18 inches. The snowfall resulted in the cancellation of many weekend activities along with all flights from Albany International Airport scheduled to leave the morning and afternoon of the 20th. The governor of New York banned buses and tractor trailers from nearly the entire New York State Thruway and most interstate highways during the storm. States of emergency were declared for Albany and Saratoga Counties. Also, around 200 customers lost power due to the freezing rain in Ulster and Dutchess Counties. Frigid temperatures followed the snow for Monday and Tuesday, January 21st-22nd, with wind chills falling to -20 to -40F across most of the region. The cold weather prompted the closing of schools and the opening of warming shelters across the region.
January 30-31, 2019	Cold/Wind Chill	N/A	N/A	An arctic cold front tracked through eastern New York during the afternoon of the 30th, accompanied by a heavy snow squall. Frigid air poured in behind this front along with strong westerly winds. Wind chills the morning of the 31st fell to 15 to 35 degrees below zero. The wind chills prompted many schools to close or delay opening, and there were several reports of water main breaks due to the cold.||In addition to the frigid

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				temperatures, a heavy band of lake effect snow developed off of Lake Ontario and impacted far northern portions of Herkimer County from the evening of the 30th through the late evening of the 31st. Snowfall amounts of 8 to 12 inches occurred in this band.
February 1, 2019	Cold/Wind Chill	N/A	N/A	An arctic airmass that had infiltrated the region during the last two days of January persisted into the morning of February 1st. Wind chills fell to 15 to 35 degrees below zero. The wind chills prompted many schools to close or delay opening.
July 19-20, 2019	Heat	N/A	N/A	A heat wave gripped eastern New York from July 19th through the 21st. Temperatures soared into the low to mid-90s with dewpoints in the low to mid-70s. This resulted in heat index values in the 100 to 110 range in the warmest spots of the Hudson Valley. Saturday, July 20th was the hottest day for most areas. Due to the excessive heat, area cities extended hours for pools and cooling centers. The hot and humid airmass provided fuel for thunderstorms that formed along the Lake Ontario shoreline during the late afternoon of the 20th. Two clusters of storms moved from the Mohawk Valley through the Capital District and into the Taconics during the evening, resulting in several reports of wind damage.
December 18-19, 2019	Cold/Wind Chill	N/A	N/A	In the wake of an arctic frontal boundary, dangerously cold air filtered into the region. This arctic air combined with northerly winds, resulted in wind chills ranging from 10 degrees to 25 degrees below zero. The coldest wind chills occurred in the southern Adirondacks.
July 9, 2020	Heat	N/A	N/A	A hot and humid airmass was in place over the Hudson and Mohawk Valleys on July 9th. Heat indices ranged from 90 to 100 degrees Fahrenheit over most of the area.
July 11, 2020	Heat	N/A	N/A	A hot and humid airmass resulted in heat indices around 95 degrees during the afternoon and evening of July 11th in the Hudson Valley. A severe thunderstorm developed in this airmass and moved through the Mid-Hudson Valley during the evening, resulting in a couple of wind damage reports.
July 19-20, 2020	Heat	N/A	N/A	Temperatures soared into the 90s throughout much of eastern New York on July 19th, reaching as high as the mid to upper 90s in the Hudson and Mohawk Valleys. The combination of the heat and a humid airmass brought heat indices into the 95 to 105 degree range. The heat prompted the opening of cooling centers and pools, but with reduced capacity due to the ongoing coronavirus pandemic. In addition, a line of thunderstorms moved in from the west during the evening, resulting in a few reports of wind damage in the Schoharie and Mid-Hudson Valleys. Heat indices exceeded 95

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				degrees again in some of the lower elevations of the Hudson Valley again on July 20th, but were not quite as high as the previous day.
July 27, 2020	Heat	N/A	N/A	Another hot and humid airmass impacted portions of eastern New York on July 27th and 28th. Heat indices reached 95 to 105 degrees on the 27th in the Hudson and Mohawk Valleys. In addition, a severe thunderstorm caused an isolated wind damage report during the evening. Some areas saw relief from the heat on the 28th, but heat indices exceeded 95 degrees again for portions of the Mid-Hudson Valley. At Poughkeepsie, there were 17 days where the temperature reached 90 degrees during the month of July, tying a record. With an average temperature of 77.8 degrees, July 2020 was the hottest month on record.
August 10-11, 2020	Heat	N/A	N/A	A hot and humid airmass was in place across the region. This resulted in scattered thunderstorms during the afternoon and evening of August 10th. Heat indices reached the 95 to 100 degree range across the advisory area on Monday, August 10th with heat indices of the same magnitude subdued further south during the afternoon hours of August 11th.
January 28-29, 2021	Cold/Wind Chill	N/A	N/A	A combination of an arctic airmass and gusty winds resulted in dangerously cold wind chills across much of eastern New York the night of January 28th into January 29th, 2021. Low temperatures ranged from 10 degrees below zero in the southern Adirondacks up to 10 degrees above zero in the mid-Hudson Valley. Wind chill values ranged from 28 degrees below zero in the southern Adirondacks up to 3 degrees above zero in the mid-Hudson Valley.
March 2, 2021	Cold/Wind Chill	N/A	N/A	A strong cold front moved across the region on Monday, March 1 advecting in a much colder air mass along with a prolonged period of strong to locally damaging winds which continued into the early part of Tuesday, March 2. Wind gusts between 40 and 60 mph were common across the region, which led to reports of downed trees and power lines, resulting in scattered power outages. The more concentrated areas without power included around the Capital District and into Ulster County in the mid-Hudson Valley. As colder air moved into the region, a few snow showers and squalls passed across the region during the evening hours of March 1. At the Albany International Airport, visibility dropped to one quarter of a mile with a peak wind gust of 46 mph within a snow squall, which lasted for about 17 minutes.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				Colder air continued to filter into the region during the overnight and early morning hours of March 2 with low temperatures mainly in the single digits and teens, but below zero in the typical colder spots in the higher elevations. This, combined with continued gusty winds, led to wind chill values falling to between 15 and 24 degrees below zero in some areas. Key Impacts: tree damage, power outages, road closures, transportation delays.
June 7, 2021	Heat	N/A	N/A	An area of high pressure across the western Atlantic Ocean advected in a hot and humid air mass into the region on Monday, June 7, 2021. The combination of heat and humidity led to heat index values peaking around 95 degrees for areas mainly along the Hudson River during the afternoon hours.
June 21, 2021	Heat	N/A	N/A	A lifting warm front across the region brought a hot and humid air mass into the region, leading to maximum heat indices reaching 95 to 98 degrees across some valley locations of eastern New York.||An approaching cold front from the west led to numerous showers and thunderstorms during the afternoon and evening hours. Some of these storms became severe with several reports of downed trees and power lines.
June 28-29, 2021	Heat	N/A	N/A	A hot and humid airmass developed over eastern New York on the 27th and persisted through the 30th. Heat indices of 95 to 105 degrees were common, with the highest values on the 28th and 29th. The high reached the 90s for all four days at Poughkeepsie, and three days at Albany and Glens Falls.
August 11, 2021	Heat	N/A	N/A	A dome of high pressure settled across eastern New York from Wednesday, August 11 to Friday, August 13 bringing high heat and humidity each day, mainly during the afternoon hours. Heat indices reached 95 to 104 degrees across parts of the area each of these days with areas along the Hudson River from Albany and points southward reaching 105 to 110 on Thursday, August 12. The Hudson Valley Regional Airport recorded an official heat wave with high temperatures all three days in the low to mid-90s.
August 26, 2021	Heat	N/A	N/A	A hot and humid air mass developed ahead of an approaching cold front across eastern New York on Thursday, August 26, 2021. Heat indices reached 95 to 101 degrees across most areas outside of the higher elevations during the afternoon hours.||The cold front slowly dropped southward during the day on Friday, August 27, 2021, but heat indices still reached 95 to 100 degrees across portions of the mid-Hudson Valley during the afternoon prior to the frontal passage.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
January 11, 2022	Cold/Wind Chill	N/A	N/A	The passage of an arctic cold front, arrival of arctic high pressure, gusty winds and very cold air led to wind chill values between -15 and -30 degrees Fahrenheit across portions of eastern New York during the overnight and early morning hours on Tuesday, January 11. In preparation for the arrival of cold air, a Code Blue was put in effect for the Capital Region which allowed for emergency overnight shelters to be open for anyone needing assistance.
January 14-15, 2022	Cold/Wind Chill	N/A	N/A	An Arctic high pressure system brought dangerously cold temperatures to eastern New York on January 14 and 15. Wind chills fell to -10 to -35 degrees over most areas on the morning of the 15th.
January 20-21, 2022	Cold/Wind Chill	N/A	N/A	In the wake of a strong cold front, Arctic air invaded the area. This combined with increased winds resulted in below zero wind chills across eastern New York January 20-21. Wind chills got as low as -15F to -25F.
January 29-30, 2022	Cold/Wind Chill	N/A	N/A	In the wake of a strong cold front, Arctic air invaded the area. This combined with increased winds resulted in below zero wind chills across eastern New York January 29-30. Wind chills got as low as -15F to -25F.
July 20, 2022	Heat	N/A	N/A	A prolonged period of hot and humid weather occurred across eastern New York during the second half of July. Both the Albany and Poughkeepsie climate sites had a stretch of six consecutive days with high temperatures of 90 degrees Fahrenheit or above spanning July 19 to July 24. The addition of humidity led to heat indices peaking between 95 and 103 degrees during the afternoon hours across the Hudson Valley on July 20, 21, 23 and 24. The heat prompted the opening of cooling centers throughout the region to assist those that needed relief.
August 4, 2022	Heat	N/A	N/A	A dome of high pressure brought a stretch of hot and humid weather resulting in multiple days of heat indices between 95F and 104F degrees across eastern New York between August 4-9, 2022. On August 4, record high temperatures were set at both Albany and Poughkeepsie, each reaching 99F degrees. Albany and Poughkeepsie also set a new record for the hottest 8-day start to August on record. The stretch of hot weather led to the opening of multiple cooling centers across the region.
August 6-8, 2022	Heat	N/A	N/A	A dome of high pressure brought a stretch of hot and humid weather resulting in multiple days of heat indices between 95F and 104F degrees across eastern New York between August 4-9, 2022.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				On August 4, record high temperatures were set at both Albany and Poughkeepsie, each reaching 99F degrees. Albany and Poughkeepsie also set a new record for the hottest 8-day start to August on record. The stretch of hot weather led to the opening of multiple cooling centers in Warren County on August 8. DHSES provides bottled water giveaways.

Sources: NOAA NCEI 2023, FEMA 2023

Notes: 2022 results do not include November or December 2022 due to data limitations

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of extreme temperature events for the County. Information from NOAA-NCEI storm events database, the 2019 State of New York HMP, the 2017 Warren County HMP, and FEMA were used to identify the number of extreme temperature events that occurred between 1950 and 2022. Table 5.4.4-4 presents the probability of future events for the extreme temperature event in the County.

Table 5.4.4-4. Probability of Future Hazard Name Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year (1950-2022)	Number of Occurrences Between 1996 and 2022	Percent Chance of Occurring in Any Given Year (1996-2022)
Cold/Wind Chill	39	54.17%	39	100%
Excessive Heat	4	5.56%	4	15.38%
Extreme Cold/Wind Chill	12	16.67%	12	46.15%
Heat	31	43.06%	31	100%
Total	**86**	**100%**	**86**	**100%**

Sources: NOAA NCEI 2023; FEMA 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all extreme temperature events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated

A total of 86 extreme temperature events were recorded in Warren County. Based on historical occurrences, the probability of an extreme temperature event occurring is considered Occasional (between 10 and 100% annual chance of occurrence). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and heavier precipitation are already being felt in the state. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change, Warren County is part of Region 7 (Indian Lake). In Region 7, it is estimated that temperatures will increase by 4.5°F to 6.4°F by the 2050s and 5.8°F to 10.1°F by the 2080s (baseline of 39.9°F). Average annual temperatures are projected to increase across New York State by 4.1° F to 6.8° F by the 2050s and 5.3° F to 10.1° F by the 2080s with an average rate of warming over the past century of 0.25° F per decade. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Extreme events are also projected to increase, as illustrated in Table 5.4.4-5. Extreme Event Projections for Region 7 below (NYSERDA 2014).

Table 5.4.4-5. Extreme Event Projections for Region 7

Event Type (2050s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	2	3 to 6	10
# Of Heat Waves (0.7 heat waves)	0.2	0.3 to 0.7	1
Duration of Heat Wave (4 days)	3	3 to 4	4
Days below 32 °F (133 days)	131	138 to 154	161
Days over 1" Rainfall (5 days)	7	8 to 9	10
Days over 2" Rainfall (0.6 days)	0.8	0.9 to 1	1

Source: NYSERDA 2014

Vulnerability Assessment

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

- Impact on Life, Health, and Safety
- Impact on General Building Stock
- Impact on Critical Facilities and Community Lifelines
- Impact on Economy
- Impact on the Environment
- Future Changes That May Impact Vulnerability
- Change of Vulnerability Since the 2017 HMP

Impact on Life, Health, and Safety

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 because of their age, health conditions, and limited mobility to access shelters; (2) infants and children up to 4 years of age; (3) individuals who are physically ill (such as with heart disease or high blood pressure), (4) low-income persons who cannot

According to NOAA's 2001 Winter Storms The Deceptive Killers, approximately 50 percent of the deaths related to extreme cold temperatures happen to people over 60 years old, more than 75 percent of those deaths are male, and about 20 percent occur in the home (NYS DHSES 2014).

afford proper heating and cooling; and (5) members of the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2006).

The entire population of Warren County is exposed to extreme temperature events. According to the 2020 U.S. Census, the County had a population of 65,737. Refer to Section 4 (County Profile) for a summary of population statistics for the County.

Impact on General Building Stock

Extreme heat generally does not affect buildings; however, losses may be associated with overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing and 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.

All of the building stock in the County is exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Refer to Section 4 (County Profile), which summarizes the building inventory in Warren County.

Impact on Critical Facilities and Community Lifelines

Similar to the general building stock, all critical facilities in the County are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Impacts to critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brown-outs," created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure.

Impact on the Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (pipes bursting), higher than normal utility bills, or business interruption caused by power failure (loss of electricity and telecommunications).

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

Based on the 2017 Census of Agriculture, 80 farms were present in Warren County, encompassing 10,086 acres of total farmland. The average farm size was 126 acres. Warren County farms had a total

market value of products sold of $1.9 million, averaging $23,949 per farm (USDA 2017). Table 5.4.4-6Table 5.4.4-6 lists the acreage of agricultural land exposed to extreme temperature hazards.

Table 5.4.4-6. Agricultural Land in Warren County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Total Pastureland (acres)	Acres Irrigated
80	10,086	908	706	20

Source: USDA 2017

In 2017, the top three agricultural products sold in Warren County were nursery, greenhouse, floriculture, and sod at $1.2 million, other crops and hay at $195,000, and vegetables, melons, potatoes, and sweet potatoes at $53,000 (USDA 2017).

If an extreme temperature event impacted 40 percent of the agricultural products sold from Warren County farms, based on 2017 market values, this would be a loss of $760,000. This figure does not include how the tourism industry and local jobs are impacted.

Impact on the Environment

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

Future Changes That May Impact Vulnerability

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

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

Projected Development

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

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). . Increases in the population throughout Warren County could increase the County's risk to extreme temperature events. Refer to section 4 (County Profile), which includes a discussion about population trends for the County.

Climate Change

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

Change of Vulnerability Since the 2017 HMP

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

5.4.5 Flood

Hazard Profile

Hazard Description

A flood is an overflow of water from oceans, rivers, groundwater, or rainfall that submerges areas that are usually dry. This natural phenomenon can be exacerbated by features of the built environment.

Flood is a natural hazard that can occur during any season. Flooding typically occurs during prolonged rainfalls over several days, intense rainfalls over a short period of time, or when an ice or debris jam causes a river or stream to overflow onto the surrounding area. The most common cause of flooding is due to rain or snowmelt that accumulates faster than soils can absorb it, or rivers can carry it away. Flooding can also result from the failure of a water control structure.

Flooding events are a common occurrence in Warren County. A variety of flood types, such as riverine, stormwater and urban, and saturated ground failure can cause widespread damage throughout rural and urban areas, causing loss of life, injury, and severe water damage to residential and commercial buildings, bridge and road closures, transit service disruptions, and damage to electrical and communication networks and agriculture.

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

For the purpose of this HMP and as deemed appropriate by the Warren County Steering Committee, riverine, flash flood, urban/stormwater, ice jam, and saturated ground failure are the main flood types of concern for the County. These types of flooding are further discussed below (New York State 2019) (Warren County 2017).

Riverine

Riverine Flooding, or fluvial flooding, is when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land (FEMA 2019). This occurs when the flow of a river exceeds the bank

sides and causes damage or obstruction to a nearby floodplain. Riverine flooding can turn into a flash flood if the river is at or above its flood stage and if the soil is saturated.

Flash

A flash flood is a rapid inundation of low-lying areas caused by heavy rain associated with severe thunderstorms, tropical systems, or melting water from ice or snow. Flash flooding also occurs far away from water bodies when a large volume of water cannot be absorbed by the soil or storm water systems and travels overland unimpeded.

Figure 5.4.5-1. Warren County March 2022 Ice Jam

Water rushes over County Route 418 near the Thurman Bridge separating Thurman and Warrensburg Sunday. Photo by Danielle Parker/DParker Photography

Huge ice jam closes Thurman bridge for 'indefinite period'

By Gordon Woodworth
Chronicle News Editor

An ice jam on the Hudson River stretching from the Thurman/Stony Creek border "up past Snake Rock" has closed County Route 418 "indefinitely," said Amy Hirsch, Warren County's emergency services coordinator.

"The ice jam is pretty solid beneath the Route 418 bridge. We were up there standing on it on Monday, and you can't hear anything. You can't hear any water moving underneath, so we're not super hopeful things are going to break anytime soon.

"It's an incredible amount of ice. From Saturday to Sunday, the ice jam grew, and from Sunday morning to Monday morn-

time. The video had been viewed more than 41,000 times Tuesday afternoon.

"It's been a busy week," Ms. Hirsch said. "The river hasn't changed a significant amount today [Tuesday] but from Friday through Monday, every day there were significant changes. But things have settled down.

"The flooding is doing down. You can see the rings on the trees where the ice was."

She said the forecast for warmer temperatures this weekend could help, but added "it's very hard to say. Up here it's supposed to be above freezing for two days and below freezing at night. In the spring, that's perfect weather to break up an ice jam. It may help us a little."

ice jam was close to seven miles long."

Ms. Hirsch said she was compiling information, including drone video footage, for the National Weather Service, so they could get a more accurate reading on how much of the river is choked with ice.

Much of Cronin's Golf Resort in Warrensburg was underwater after the river jumped its banks on Sunday. Cronin's Facebook page shows the ice diverting the river onto the course from a drone video camera they happened to have up at the

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The Chronicle - January 18, 2018

VILLAGE OF HUDSON FALLS, NY REPUBLICAN PARTY CAUCUS

The Republican Party Caucus for the Village of Hudson Falls, NY will be held at the Village of Hudson Fall, village hall meeting room on **January 27, 2018** beginning at **9:30 A.M.**

The purpose of the caucus is to nominate candidates for the following offices:

- **Village Trustee** –Four (4) year term of office
- **Village Trustee** –Four (4) year term of office

Only enrolled Republicans, registered as of January 2, 2018, are entitled to vote at the caucus, and no write-in or floor nominations will be accepted at the caucus.

Those wishing to seek any of the above offices should submit a letter of intent to Michael Mercure, Chairman, Town of Kingsbury Republican , P.O. Box 269, Hudson Falls, NY 12839. The letter must be postmarked no later than January 22, 2018.

By Order of the Village of Hudson Falls in the Town of Kingsbury, NY
Republican Committee, Michael Mercure, Chairman.

1 / 1

The AJ/NE Sun | March 5, 2022

www.suncommunitynews.com

Ice Jams and riverside flooding continue to be a concern in Thurman

BY Thom Randall
CONTRIBUTING WRITER

THURMAN | Ice jams along the Hudson and Schroon rivers continued to make the Thurman bridge and at least one other route into the rural town impassible this last week.

Through the week ending Feb. 26, Thurman residents reported the continued closure of the Thurman Bridge, which carries state Route 418 over the Hudson River. The bridge and the roadway have been blocked off to traffic near Thurman Station due to flooding and ice deposits caused by ice pileups emerging from the Hudson and Schroon rivers.

They also cited the intermittent closure of Thurman's River Road which follows the course of the Hudson.

On Feb. 26, Warren County spokesman Don Lehman said he

the closures being rescinded.

Many Thurman residents report the closures and the status of ice jams on the Hudson and Schroon rivers to their neighbors and friends on the "Thurman Happenings" Facebook webpage.

Ice jams started flowing down the rivers and piling up on shores and low-lying land and riverside roadways on Feb. 18 and Feb. 19.

Area officials reiterated that the threat of flooding and ice jams are expected to continue, as weather forecasts call for temperatures fluctuating between sub-freezing and relatively warm temperatures, as well as upcoming episodes of rain.

Warren County emergency and highway officials said they will be monitoring, on a continuing basis, the Hudson and Schroon Rivers for potential flooding and ice jams.

The Thurman Bridge (background) which carries Route 418 over the Hudson River continued to be closed last week due to ice jams flooding stretches of the roadway or the potential of the bridge being inundated with water and ice.

Photo by Rebecca Bradway

town public works employees who

Meanwhile, Thurman residents are continuing to post multiple daily reports of ice movement and pileups along the shores of the local rivers. ■

This photograph, taken Feb. 25 of River Road in Thurman near Snake Rock after one of several excavations of ice on the roadway, depicts the height of ice pileups that occurred on and

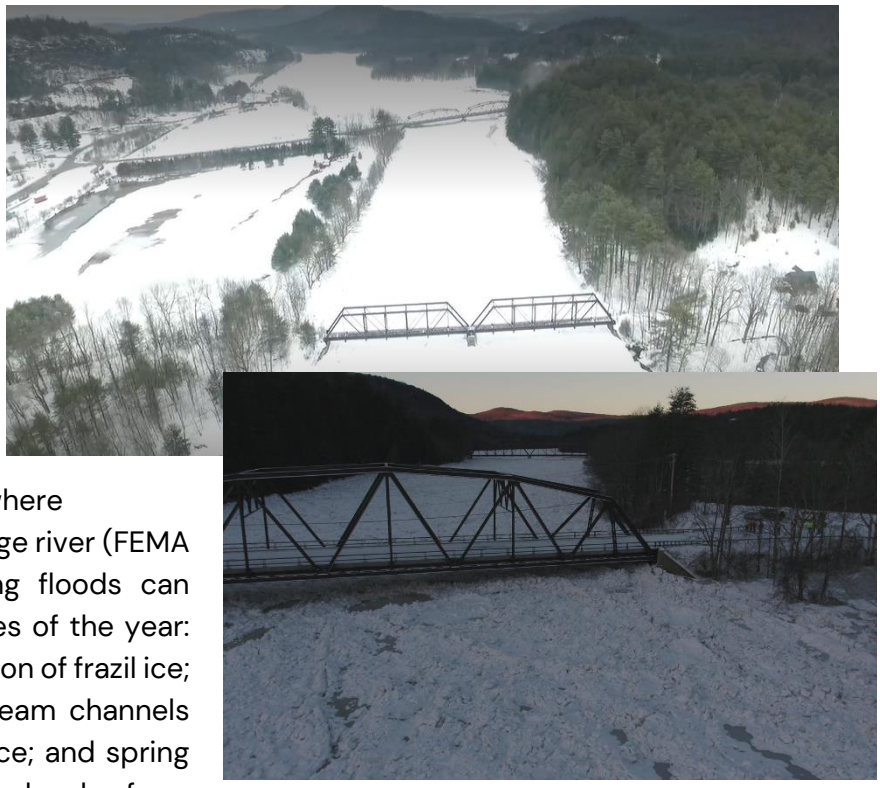
Local (urban) drainage systems collect groundwater from heavy rainfall in developed areas. Water that does not evaporate or become absorbed by the ground is carried by conduits to waterways such as creeks, rivers, or the ocean. These systems have two purposes: 1) to control storm water runoff during periods of heavy rainfall; and 2) to minimize disruption of activity from more frequently occurring, less significant storms. Flooding occurs when runoff exceeds system capacity, or because systems are blocked from lack of maintenance. Flooding which results from poorly designed or blocked drainage systems is categorized as flash flooding.

Urban/Stormwater

Ice Jam

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NESEC 2021).

Figure 5.4.5-2. Warren County January 2018 Ice Jam and Flood



The formation of ice jams depends on the weather and physical condition of the river and stream channels. Ice jams are common in locations where the channel slope changes from relatively steep to mild and where a tributary stream enters a large river (FEMA 2018). Ice jams and resulting floods can occur during at different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (New York State 2019).

There are two main types of ice jams: freeze-up and breakup. Freeze-up jams occur when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. 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 (FEMA 2018).

Saturated Ground Failure

High groundwater flooding occurs when heavy precipitation causes the water table to rise. As rainwater from high ground accumulates in low-lying areas, the water table rises to the surface, causing the ground to be completely saturated. When the water table rises through a slope, there may be a point at which the water table is above the ground level (see Figure 5.4.X-1). If this happens, the water will flow over the surface as it cannot seep into the ground – this is groundwater flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in

many areas, while elsewhere high groundwater occurs only after a long period of above-average precipitation.

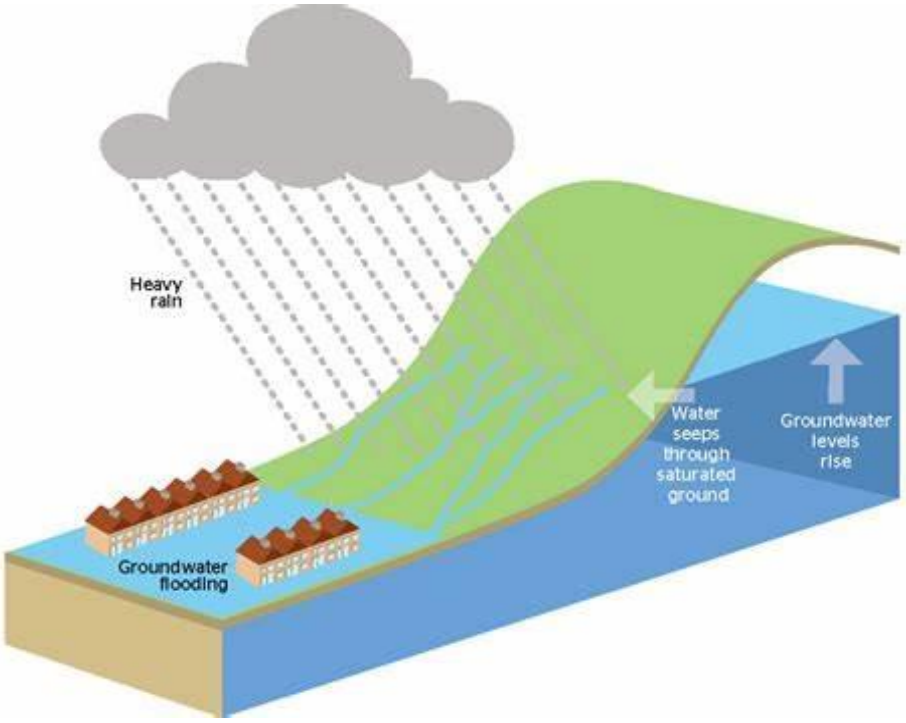


Figure 5.4.X-1: Groundwater Flooding Diagram Source: (Flood Guidance UK 2017)

Location

Flooding in Warren County occurs in two broad regions of the County: along the Schroon River in the Riverbank section and along the Hudson River where significant rainfall and rapid snowmelt lead to considerable flooding of roadways. Flooding in the County also occurs in areas of beaver dams. Heavy rainfall has the potential to force the destruction of beaver dams on lakes, rivers and streams which leads to cascading effects of downstream flooding of roadways.

Floodplain

A floodplain is flat land adjacent to a river, creek, or stream that is subject to periodic inundation. The floodplain describes the area inundated by the "100-year" flood, or a flood that has a 1% chance in any given year of being equaled or exceeded. A floodplain is designated when floodwater exceeds the capacity of the main channel, or water escapes the channel through bank erosion. During inundation, silt is deposited by retreating floodwater and trapped by vegetation, building up the floodplain. Buildup is greatest near the stream, forming natural levees in areas of stable banks. Floodplain deposits, which are coarsest near the stream, may show vertical size-graded stratification (sorting). The floodplain is an integral part of a stream system and is affected by adjustments the system makes to its sediment load and variable flow. The stream system is a network that collects fresh water from the land and carries it to the ocean. As such, floodplain deposits and floodplain development affect a larger natural structure than might first be appreciated (National Geographic 2022).

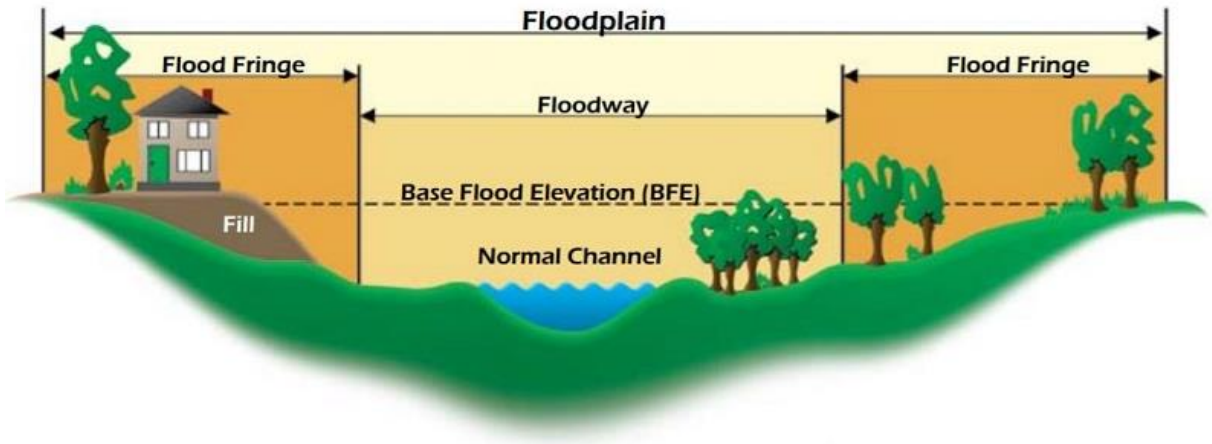


Figure 5.4.X-2: Characteristics of a Floodplain Source: (FEMA 2022)

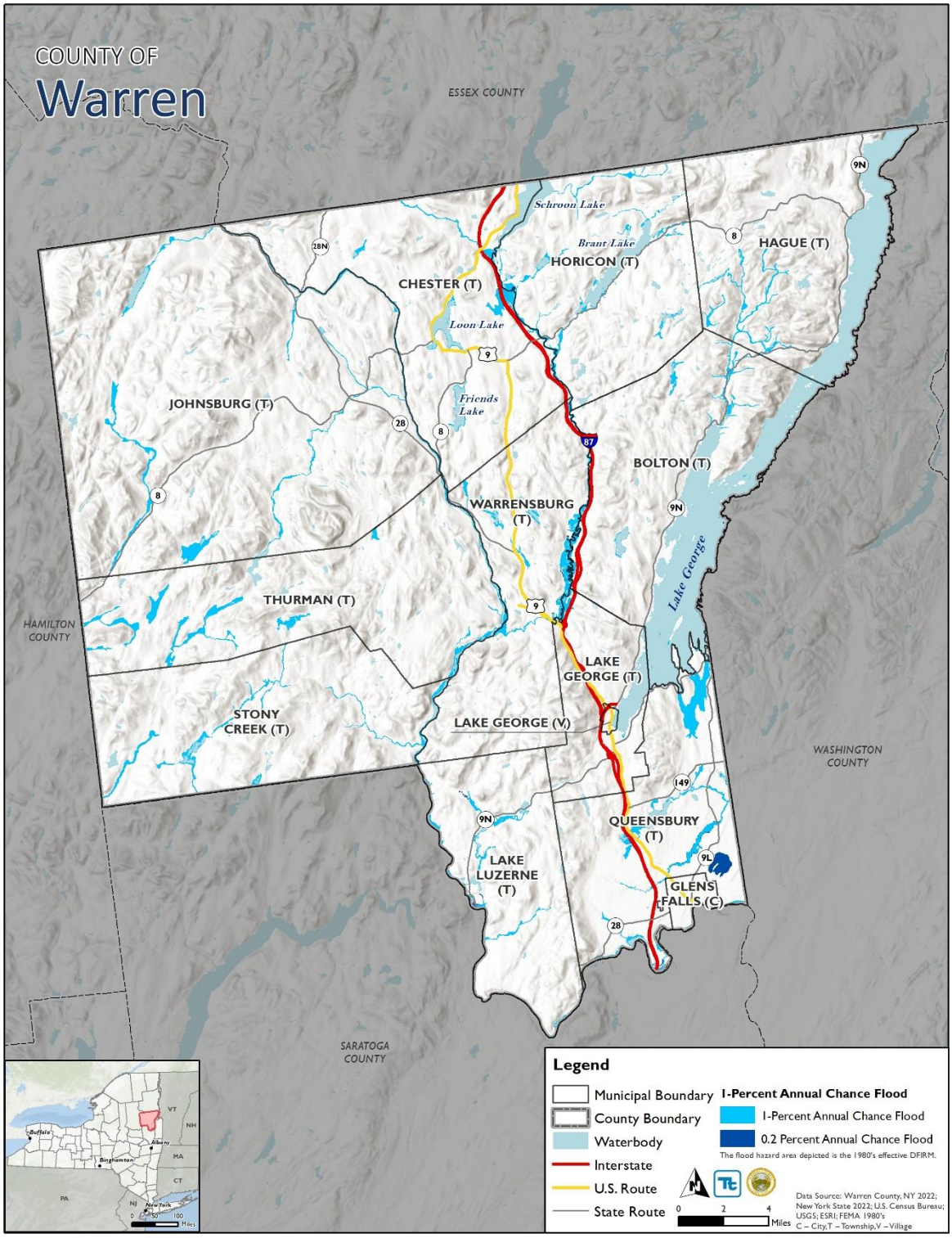
Floodplains serve multiple functions. They moderate flooding, maintain water quality, recharge groundwater, reduce erosion, redistribute sand and sediment, and support fish and wildlife habitat. Areas subject to flooding include the following:

- Locations that experience greater than the 1% annual chance flood, often referred to as the 100-year flood.
- Those subject to less extensive, more frequent, or repetitive flooding.
- Sites that experience shallow flooding, storm water flooding, or drainage problems that do not meet the National Flood Insurance Program (NFIP) mapping criteria.
- Twenty percent of flood insurance claims are from properties in these areas.
- Places affected by flood-related hazards such as riverine erosion.
- Locations that will flood in the future because of sea level rise and upstream

(National Geographic 2022) (FEMA 2022)

In Warren County, floodplains line the rivers and streams of the County. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques. Figure 5.4.5-3. FEMA Flood Hazard Zones in Warren County illustrates the FEMA flood hazard zones in Warren County. According to this figure, the 1% annual chance of flood hazard zones are located along the Sacandaga River, Schroon River, Hudson River, Stony Creek, and southern Lake George (Warren County 2017).

Figure 5.4.5-3. FEMA Flood Hazard Zones in Warren County



Extent

The strength or magnitude of a flood varies based on meteorological, environmental, and geological factors, including latitude, altitude, topography, and atmospheric conditions. Flood is also affected by seasonal variation, storm characteristics, warning time, speed of onset, and duration. Most floods are preceded by a warning period that allows emergency managers to communicate the need to prepare for the event. A flood may last from minutes to days (O'Connor, Grant and Costa 2002).

Warnings issued through official sources, such as the National Weather Service (NWS) and the Storm Prediction Center, provide the most reliable and timely preparedness information, but the exact flood location and depth depends on the amount, duration, and location of rainfall. Many floods, especially flash floods, occur outside of FEMA-designated flood zones.

In the case of riverine flood hazard, 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.

(NOAA 2021)

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. The size of rivers and streams in an area and infiltration rates are significant factors. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration rates decrease and any more water that accumulates must flow as runoff (Harris 2001).

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1% chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood) is used by the NFIP as the standard for floodplain management and to determine the need for flood insurance, as well as the regulatory flood boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing

vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the water elevation resulting from a given discharge level, which is one of the most important factors used in estimating flood damage. A structure located within a SFHA shown on an NFIP map has a 26% chance of suffering flood damage during the term of a 30-year mortgage.

The term "500-year flood" is the flood that has a 0.2% chance of being equaled or exceeded each year. The 500-year flood could occur more than once in a relatively short period of time. Statistically, the 0.2% (500-year) flood has a 6% chance of occurring during a 30-year period of time, the length of many mortgages. The 500-year floodplain is referred to as Zone X500 for insurance purposes on FIRMs. Base flood elevations or depths are not shown within this zone and insurance purchase is not required in this zone (FEMA 2022).

Previous Occurrences

The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center's (NCDC) Storm Events Database documented 79 flood events occurring locally between 1950 and 2022. Between January 01, 2017 and June 30, 2022, there were 9 "flash flood" events and 15 "flood" events. The number and types of events are described in Table 5.4.X-2 (NOAA 2022).

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was included in 1 disaster (DR) or emergency (EM) declarations for flood-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was included in 2 flood-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known flood events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Table 5.4.5-1. Flood Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
07/01/2017	Flash Flood, Heavy Rain	N/A	N/A	An upper-level disturbance interacted with a very moist atmosphere on July 1, generating several rounds of thunderstorms across areas mainly along and north

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				of I-90. These storms resulted in torrential rainfall and flash flooding in portions of Herkimer, Fulton, Warren, Washington, and Rensselaer Counties. It was the second straight day of heavy rainfall for some of these areas. Warren County estimated $1 million in flood damage.
01/13/2018	Flood, Ice Jam	N/A	N/A	After a frigid end of December and beginning of January, an unseasonably warm airmass was pumped into New York on January 12th on southerly winds. The temperatures reached the 50s and 60s during the day. Showers also developed in the warm airmass ahead of a cold front and were heavy at times, with some locations receiving one to three inches of rainfall. The combination of warm temperatures and heavy rainfall caused river ice to dislodge and resulted in ice jams in spots. Flooding occurred due to a combination of ice jam movement and heavy rainfall. Several roads were closed or damaged.
01/28/2018	Flood, Ice Jam	N/A	N/A	Minor flooding occurred in the vicinity of a long-lived ice jam along the Hudson River between The Glen and Warrensburg. River Road near Snake Rock in the Town of Thurman was closed due to ice jam flooding. There was four inches of water flowing across the road.
02/22/2018	Flood, Ice Jam	N/A	N/A	A large ice jam remained in place on the Mohawk River for much of the month of February. The ice jam stretched up to 17 miles from Rexford to Crane Hollow throughout the month in February. The ice jam mainly remained in place into late February. Temperatures skyrocketing into the 60s and 70s on February 20-21 coupled with around 0.50-1.00 rainfall on the 19th over the Mohawk basin allowed river levels to rise and flooding occurred by the 21st within the Stockade neighborhood of Schenectady and across the river in Scotia, as well as backwater flooding of the Alplaus Kill. A substantial

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				portion of the ice jam gave way during the early morning hours of the 22nd, leading to concern for flooding in the downstream communities, but it turned out that impacts were minimal. There were some road closures in the Rotterdam Junction and Schenectady area due to the ice jam movement and breakage. The remainder of the jam gradually broke up over the next week or so with little impact.
07/23/2018	Excess Precipitation	USDA, S4479	Yes	Excessive rains and flooding during the 2018 farming season influenced the Secretary of the USDA to declare a disaster designation for 20 New York Counties, including Allegany, Broome, Chautauqua, Cortland, Dutchess, Erie, Essex, Franklin, Herkimer, Livingston, Madison, Oneida, Ontario, Oswego, Putnam, Rensselaer, St. Lawrence, Saratoga, Schuyler, Tompkins, Ulster, Warren, Warren, Wyoming, and Yates Counties.
4/1/2019	Excess Precipitation	USDA, S4622	Yes	Severe weather, heavy flooding, and excessive rains during the 2019 farming season influenced the Secretary of the USDA to declare a disaster designation for 43 Upstate New York Counties, including Albany, Allegany, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuler, Seneca, Steuben, Sullivan, Tioga, Washington, Wyoming, and Yates Counties.
04/20/2019	Flood, Heavy Rain / Snow Melt	N/A	N/A	Heavy rain, combined with snow melt from the Adirondacks, caused the Schroon River at Riverbank to rise above flood stage for several days. River levels reached moderate flood stage on Saturday, April 20th and remained there through Thursday, April 25th. The high-water levels resulted in water making its way into

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				numerous homes and onto several roads across northern Warren County.
06/20/2019	Flash Flood, Heavy Rain	N/A	N/A	A low-pressure system tracked across the region on Thursday, June 20th, 2019, bringing periods of heavy rainfall throughout the day. This resulted in road closures in Warren County.
10/31/2019	Severe Storms and Flooding	FEMA, 4472-DR	Yes	A strengthening low-pressure system moving from Ohio to Lake Ontario drew anomalous warmth and moisture northward, with temperatures surging into the 60s and 70s over eastern New York and western New England. Showers across the southern Adirondacks and Mohawk Valley became steadier and heavier during the evening ahead of a strong cold front as the low continued to strengthen. Strong winds aloft mixed down to the surface as an intense line of showers developed along the front, resulting in sporadic wind damage and scattered power outages over eastern New York. A large swath of rainfall totaling 2-5 inches, with isolated areas as high as 7 inches, occurred over the Mohawk Valley and southern Adirondacks, resulting in reports of flash flooding. The runoff caused rapid rises on area creeks and streams, with river gauges reaching record levels along the Mohawk River at Little Falls, the West Canada Creek at Hinckley and Kast Bridge, and the Sacandaga River at Hope. Moderate flooding also occurred on the Hudson River at Fort Edward, Hadley, and North Creek; the Schroon River at Riverbank; and the Mohawk River at Delta Dam.
02/18/2022	Flood, Heavy Rain	N/A	N/A	A storm system pushed across the region during February 17-18, 2022. Warm air pushed northward into the region along with periods of rainfall before a cold front brought the return of windy and colder weather. A convective line of gusty showers also accompanied the cold frontal passage. Some locations picked up over 1 inch of rainfall which led to

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				minor flooding. The warm and rainy weather ahead of the cold front resulted in some snow melt as well as some ice to break up on area rivers and streams. As the colder weather returned, localized ice jams formed, some of which led to flooding.
02/28/2022	Flood, Ice Jam	N/A	N/A	An ice jam developed along the Hudson River in the Town of Thurman causing water and ice to flow over Route 418 (River Street) between River Road and Hickory Hill Road. Water began to flow over the road during the evening hours on Saturday, February 19 causing the road to close. The water and ice eventually receded on Monday, February 28, allowing the road to reopen.
04/08/2022	Flood, Heavy Rain	N/A	N/A	A slow-moving frontal system produced widespread heavy rainfall and flooding across eastern New York from April 7-8, 2022. Rainfall amounts between 1.50 and 3.00 inches were common, though a few localized areas received upwards of 4.50 inches. Several incidents of flooding occurred within Warren County, including the areas of Thurman, Warrensburg, Chestertown, Weavertown, and Lake George. Road closures and possible washouts were reported within the towns of Warrensburg and Thurman. In Lake George, severe damage occurred to a driveway and parking lot of the Lakeview Terrace Hotel and Fairview Association.

Sources: *(NOAA 2022), (USDA FSA 2022), (FEMA 2022) (New York State 2019) (Warren County 2017)*
Notes: *Warren County has been affected by several flooding events in the past 5 years (2017 to 2022). Three of these events were declared disasters, 1 declared by FEMA and 2 declared by the USDA.*

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of flood events for the County. Information from NOAA-NCEI storm events database, the 2019 State of New York HMP, and the 2017 Warren County HMP were used to identify the number of flood events that occurred between 1950 and 2022. Table 5.4.5-2 presents the probability of future events for the flood event in the County.

Table 5.4.5-2. Probability of Future Flood Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year
Flash Flood	35	48.6%
Flood	44	61%

Sources: *(NOAA 2022) (New York State 2019) (Warren County 2017)*

Note: *Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.*

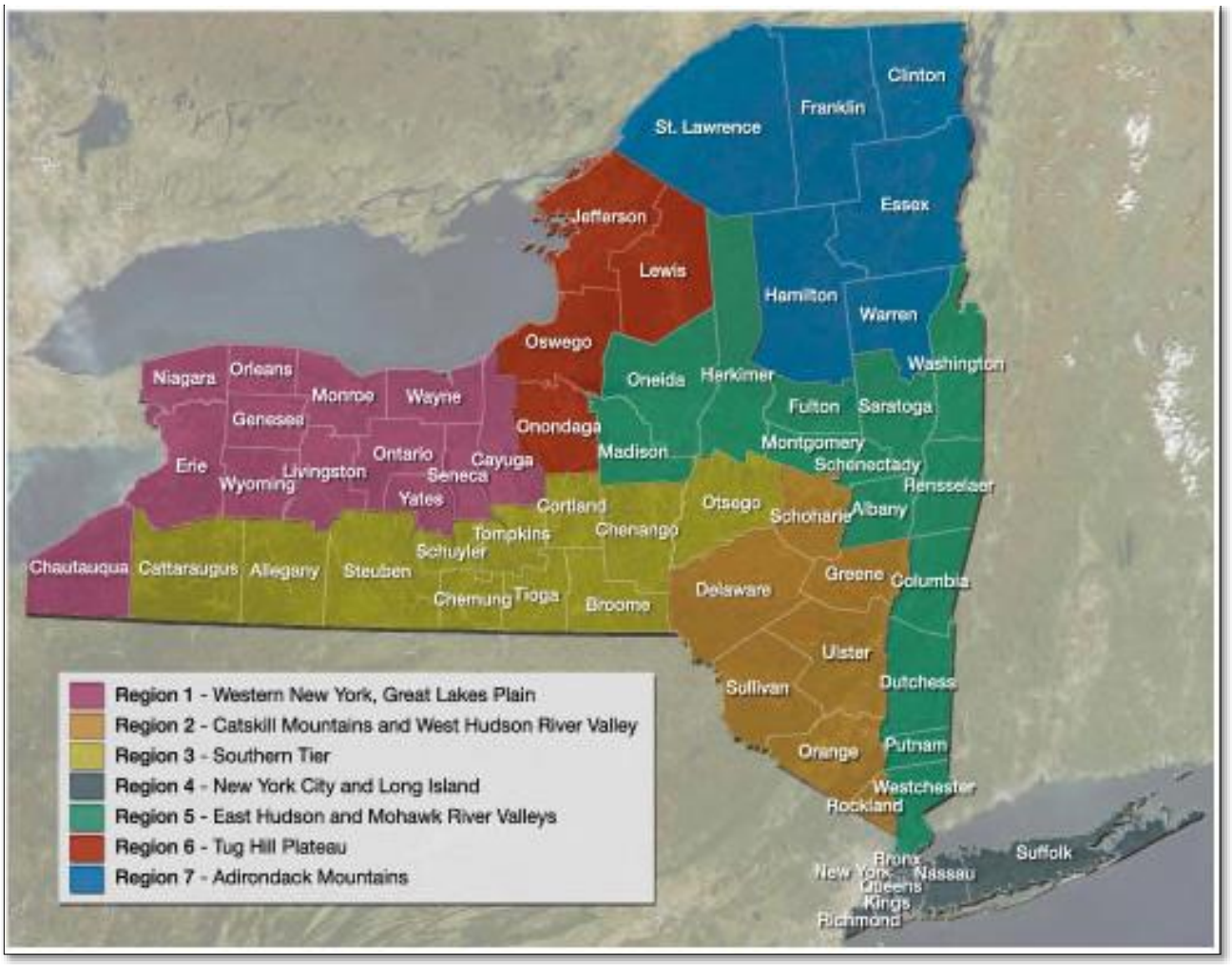
A total of 79 flood events were recorded in Warren County. Based on historical occurrences, the probability of a flood event occurring is considered frequent (100% annual probability; a hazard event may occur multiple times per year). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

The climate of Warren County is already changing and will continue to change in the future. Climate change is beginning to affect both people and resources of the State and County and the impacts of climate change will continue. Impacts related to increasing temperatures are already being felt in the County. 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.

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Warren County is part of Region 7 (see Figure 5.4.X-3), Adirondack Source: (NYSERDA 2014)

Figure 5.4.5-4. Figure 5.4.X-4: Climate Regions of New York State



Source: (NYSERDA 2014)

Mountains. Some of the issues in this region, affected by climate change, include loss of high elevation plants, animals, and ecosystem types; decline in winter recreation; decline in milk production, etc. (NYSERDA 2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Regional precipitation across New York State is projected to increase by approximately one to eight percent by the 2020s, three to 12-percent by the 2050s, and four to 15-percent by the 2080s. By

the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State.

In Region 7, it is estimated that temperatures will increase by 3.7°F to 7.4°F by the 2050s and 4.2°F to 11.8°F by the 2080s (baseline of 39.9°F). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 17% by the 2080s (baseline of 40.8 inches). Table 5.4.2-3 displays the projected seasonal precipitation change for the East Hudson and Mohawk River Valleys ClimAID Region (NYSERDA 2014).

Climate change affects flooding more than other hazards because the frequency of extreme precipitation events in the Northeast has increased in recent years. Severe storms projected in the 1950s to occur only once in 100 years are now expected to occur once every 60 years. Other climate change influences include the following:

- Spring breakup, snowmelt, and winter rains
    - Warmer spring temperatures that lead to earlier and more rapid snow melt; more late-winter precipitation likely to fall as rain, rather than as snow
- Cyclonic disturbances
    - Increasing frequency of severe cyclonic events, which may permit more northward tracking of hurricanes
- Localized summer outburst events
    - Increase formation of conditions conducive to summer outbursts and flash flooding
- Human uses and development of land
    - Development leads to increased amounts of impervious surfaces such as roads, parking lots, and buildings and can increase rainwater runoff. Development in floodplains or wetlands can potentially result in an increased floodplain level.

(New York State 2019)

Vulnerability Assessment

To assess Warren County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map products dated 1984-1996. The 1-percent annual chance flood event was further examined to estimate potential loss using the FEMA Hazus model. These results are summarized below. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess flood risk.

Impact on life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during

an event). The degree of that impact will vary and is not strictly measurable. The impacts from each flood hazard of concern is described below.

Riverine Flooding

To estimate population exposure to the 1-percent- and 0.2-percent annual chance flood events, the digitized flood boundaries were used. Based on the spatial analysis, there are an estimated 1,385 residents living in the 1-percent annual chance floodplain, or 2.3-percent of the County's total population. There are an estimated 1,508 residents living in the 0.2-percent annual chance floodplain, or 2.6-percent of the County's total population.

Table ***5.4.5-3*** summarizes the population exposed to the flood hazard by jurisdiction.

Table 5.4.5-3. Estimated Number of Persons in Warren County Living in the 1-percent and 0.2-percent Annual Chance Flood Event Hazard Areas

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Area	Percent of Total	Number of Persons Located in the 0.2-percent Area	Percent of Total
Bolton (T)	2,012	132	6.5%	132	6.5%
Chester (T)	3,086	262	8.5%	262	8.5%
Glens Falls (C)	14,830	0	0.0%	0	0.0%
Hague (T)	633	45	7.1%	45	7.1%
Horicon (T)	1,471	77	5.2%	77	5.2%
Johnsburg (T)	2,143	49	2.3%	49	2.3%
Lake George (T)	2,494	65	2.6%	65	2.6%
Lake George (V)	1,008	2	0.2%	2	0.2%
Lake Luzerne (T)	3,079	200	6.5%	245	7.9%
Queensbury (T)	29,169	376	1.3%	402	1.4%
Stony Creek (T)	758	23	3.0%	23	3.0%
Thurman (T)	1,095	8	0.7%	8	0.7%
Warrensburg (T)	3,959	147	3.7%	199	5.0%
Warren County (Total)	**65,737**	**1,385**	**2.1%**	**1,508**	**2.3%**

Sources: U.S. Census Bureau 2020; Warren County, NY 2022
Note: C = City; T = Town; V = Village; % = Percent

In addition, displaced populations were estimated for the 1-percent annual chance flood event. It is important to note that the impacts to the households in the FEMA flood hazard area are assessed using the riverine flood model in Hazus. Using 2020 U.S. Census data, Hazus estimates 8,460 people may seek short-term sheltering. These statistics, by jurisdiction, are presented in Table 5.4.5-4

Table 5.4.5-4. Estimated Population Seeking Short-Term Shelter from the 1-percent Annual Chance Flood Event

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	1-Percent Annual Chance Flood Event	
		Displaced Population	Persons Seeking Short-Term Sheltering
Bolton (T)	2,012	22	7
Chester (T)	3,086	80	25
Glens Falls (C)	14,830	0	0
Hague (T)	633	11	9
Horicon (T)	1,471	72	30
Johnsburg (T)	2,143	70	11
Lake George (T)	2,494	6	2
Lake George (V)	1,008	1	0
Lake Luzerne (T)	3,079	179	42

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	1-Percent Annual Chance Flood Event	
		Displaced Population	Persons Seeking Short-Term Sheltering
Queensbury (T)	29,169	298	145
Stony Creek (T)	758	36	12
Thurman (T)	1,095	8	2
Warrensburg (T)	3,959	173	34
Warren County (Total)	**65,737**	**956**	**319**

Sources: Hazus v5.1, Census 2020, Warren County NY 2022
Note: C = City; T = Town; V = Village

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2020).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Flash Flooding

Flash flooding events can displace populations along steep topography particularly in cases when flood waters surge into residential properties or alter the terrain into unsafe conditions requiring evacuation. Ther is no record of injuries reported from historical flash flood events that have occurred in Warren County.

Stormwater and Urban Flooding

Urban and stormwater flooding impacts are generally limited to roadways with underlying culverts. In various communities, poor drainage and rainstorms lead to localized flooding on various streets

and in residential developments. This type of flooding could cause persons to become isolated or displaced from their homes.

Ice Jam Flooding

According to the historical records in Warren County, there have been a number of ice jam flooding events. The impacts of these events includes road closure and detours ….

Dam Failure Flooding

Dam failure will have similar impacts to flood events on persons within the County. See Section 5.4.1 for further details regarding the dam failure hazard.

Impact on General Building Stock

After considering the population exposed and potentially vulnerable to the flood hazard, the built environment was evaluated. Exposure includes those buildings located in the flood hazard areas. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content replacement cost values.

Riverine Flooding

Table 5.4.5-5 and Table 5.4.5-6 summarize the number of structures located in the 1-percent and 0.2-percent annual chance flood events by jurisdiction. In summary, there are 1,252 buildings located in the 1-percent annual chance flood boundary with an estimated 721 million of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 3.1-percent of the County's total general building stock inventory. In addition, there are 1,337 buildings located in the 0.2-percent annual chance flood boundary with an estimated $783 million of building stock and contents exposed. This represents approximately 3.3-percent of the County's total general building stock inventory.

The Hazus flood model estimated potential damages to the buildings in Warren County at the structure level using the custom structure inventory developed for this HMP and the depth grid generated using the effective DFIRM data. The potential damage estimated by Hazus to the general building stock inventory associated with the 1-percent annual chance flood is approximately $92 million or 0.3-percent of the total building stock improvement value. The Town of Queensbury has the greatest amount of estimated building loss—approximately $26 million (i.e., 0.4-percent of the total replacement cost value). Refer to Table 5.4.5-6 for the estimated losses by jurisdiction.

Table 5.4.5-5. Estimated General Building Stock Located in the 1- and 0.2-Percent Annual Chance Flood Event

Jurisdiction	Estimated Number and Total Replacement Cost Value of Structures Located Within the Flood Hazard Area									
	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the 1-percent Area	Percent of Total	Total Replacement Cost of Buildings in the 1-percent Area	Percent of Total	Number of Buildings Located in the 0.2-percent Area	Percent of Total	Total Replacement Cost of Buildings in the 1- Area	Percent of Total
Bolton (T)	2,873	$1,509,046,268	191	6.6%	$98,407,104	6.5%	191	6.6%	$98,407,104	6.5%
Chester (T)	3,227	$1,794,523,301	265	8.2%	$136,906,097	7.6%	265	8.2%	$136,906,097	7.6%
Glens Falls (C)	5,988	$3,728,124,116	7	0.1%	$38,633,498	1.0%	7	0.1%	$38,633,498	1.0%
Hague (T)	1,313	$799,210,288	92	7.0%	$25,727,961	3.2%	92	7.0%	$25,727,961	3.2%
Horicon (T)	2,188	$1,022,605,789	113	5.2%	$73,470,929	7.2%	113	5.2%	$73,470,929	7.2%
Johnsburg (T)	2,625	$1,493,856,193	62	2.4%	$57,084,016	3.8%	62	2.4%	$57,084,016	3.8%
Lake George (T)	2,494	$2,168,962,785	62	2.5%	$20,674,796	1.0%	62	2.5%	$20,674,796	1.0%
Lake George (V)	609	$770,157,514	7	1.1%	$9,616,327	1.2%	7	1.1%	$9,616,327	1.2%
Lake Luzerne (T)	2,173	$953,667,917	137	6.3%	$33,879,914	3.6%	169	7.8%	$71,741,229	7.5%
Queensbury (T)	12,193	$7,114,031,584	173	1.4%	$147,862,914	2.1%	189	1.6%	$161,854,297	2.3%
Stony Creek (T)	807	$995,996,331	26	3.2%	$37,561,509	3.8%	26	3.2%	$37,561,509	3.8%
Thurman (T)	1,061	$497,985,792	9	0.8%	$2,463,186	0.5%	9	0.8%	$2,463,186	0.5%
Warrensburg (T)	2,758	$1,425,456,857	108	3.9%	$38,774,911	2.7%	145	5.3%	$49,091,972	3.4%
Warren County (Total)	**40,309**	**$24,273,624,737**	**1,252**	**3.1%**	**$721,063,162**	**3.0%**	**1,337**	**3.3%**	**$783,232,921**	**3.2%**

Source: Hardcopy FIRM Maps, 1980/1990; Warren County, NY 2022
Note: C = City; T = Town; V = Village; % = Percent

Table 5.4.5-6. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Loss for All Occupancies	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Bolton (T)	$1,509,046,268	$3,552,740	$1,606,047	$7,470	$1,939,224
Chester (T)	$1,794,523,301	$10,392,713	$10,002,163	$378,103	$12,447
Glens Falls (C)	$3,728,124,116	$4,989,907	$0	$1,363,338	$3,626,569
Hague (T)	$799,210,288	$3,071,058	$698,467	$1,657,285	$715,306
Horicon (T)	$1,022,605,789	$9,413,994	$9,393,536	$1,210	$19,248
Johnsburg (T)	$1,493,856,193	$13,268,896	$1,531,287	$11,737,609	$0
Lake George (T)	$2,168,962,785	$1,192,120	$1,192,120	$0	$0
Lake George (V)	$770,157,514	$1,079,756	$50,369	$1,029,387	$0
Lake Luzerne (T)	$953,667,917	$10,571,303	$10,062,444	$508,860	$0
Queensbury (T)	$7,114,031,584	$26,215,898	$7,274,420	$18,941,477	$0
Stony Creek (T)	$995,996,331	$682,066	$351,593	$330,473	$0
Thurman (T)	$497,985,792	$11,374	$7,020	$0	$4,355
Warrensburg (T)	$1,425,456,857	$7,486,940	$3,912,624	$3,338,283	$236,033
Warren County (Total)	**$24,273,624,737**	**$91,928,766**	**$46,082,089**	**$39,293,495**	**$6,553,181**

Sources: Hazus v5.1, Census 2020, Warren County NY 2022, RS Means 2022
Note: C = City; T = Town; V = Village; % = Percent

NFIP Statistics

FEMA provided a list of properties with NFIP policies, past claims, and multiple claims. According to FEMA, a repetitive loss (RL) property is a NFIP-insured structure that has had at least two paid flood losses of more than $1,000 in any 10-year period since 1978. A severe repetitive loss (SRL) property is a NFIP-insured structure that has had four or more separate claim payments made under a standard flood insurance policy, with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or at least two separate claims payments made under a standard flood insurance policy with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss (FEMA 2018).

Table 5.4.5-7,

Table 5.4.5-8, and

Table 5.4.5-9 summarize the NFIP policies, claims, and repetitive loss statistics for Warren County. The majority of the RL and SRL properties are single-family residences. This information is current as of March, 2023.

Table 5.4.5-7. Occupancy Class of Repetitive Loss Structures in Warren County

Occupancy Class	Total Number of Repetitive Loss Properties	Total Number of Severe Repetitive Loss Properties	Total (Repetitive Loss + Severe Repetitive Loss)
Single Family	6	0	6
Business	1	1	2

Source: *FEMA Region 2, 2023*
Note: *Policies, claims, repetitive loss and severe repetitive loss statistics provided by FEMA Region 2, and are current as of March 2023*
N/A *Not available*

Table 5.4.5-8 Occupancy Class of Repetitive Loss Structures in Warren County, by Municipality

Municipality	Repetitive Loss Properties		Severe Repetitive Loss Properties	
	Single Family	Business	Single Family	Business
Chester (T)	1	0	0	0

Municipality	Repetitive Loss Properties		Severe Repetitive Loss Properties	
	Single Family	Business	Single Family	Business
Johnsburg (T)	1	0	0	0
Lake George (T)	1	0	0	0
Lake George (V)	0	1	0	1
Lake Luzerne (T)	2	0	0	0
Queensbury (T)	1	0	0	0
Warren County (Total)	6	1	0	1

Source: FEMA Region 2, 2023

Table 5.4.5-9. NFIP Policies, Claims, and Repetitive Loss Statistics

Municipality	Number of Claims	Total Paid Claims	Number of NFIP Repetitive Loss Properties	Number of FMA Repetitive Loss Properties	Number of NFIP Severe Repetitive Loss Properties	Number of FMA Severe Repetitive Loss Properties
Bolton (T)	5	$40,328	0	0	0	0
Chester (T)	14	$90,426	1	0	0	0
Glens Falls (C)	0	0	0	0	0	0
Hague (T)	2	$8,021	0	0	0	0
Horicon (T)	5	$112,548	0	0	0	0
Johnsburg (T)	4	$56,870	1	0	0	0
Lake George (T)	7	$23,323	1	0	0	0
Lake George (V)	13	$503,746	1	1	1	1
Lake Luzerne (T)	31	$816,609	2	0	0	0
Queensbury (T)	13	$46,751	1	0	0	0
Stony Creek (T)	4	$2,355	0	0	0	0
Thurman (T)	5	$85,530	0	0	0	0
Warrensburg (T)	8	$11,649	0	0	0	0
Warren County (Total)*	**114**	**$1,801,542**	7	1	1	1

Source: RL and SRL: FEMA Region 2, 2023; Claims and policies: HUDEX,1/26 2023
**County Total includes 1 unknown claim location and 2 claims attributed to the Town of Corinth*

Flash Flooding

Flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam. Flash floods can roll boulders, tear out trees, trigger mud slides, destroy buildings and bridges, and scour out new channels. Because flash floods typically occur along rivers, coastlines, and low-lying, all structures located in and around these are susceptible to damages from flash floods. Secondary impacts of flash floods can also damage buildings and infrastructure outside the floodplain (Wyoming 2021) (NWS 2021) (Melina and Rowan 2010).

Stormwater and Urban Flooding

The impacts to the general building stock as a result of stormwater and urban flooding is similar to the impacts of other types of flooding as described above. Stormwater flooding can damage public and private properties, destroy stormwater infrastructure, and impact roadways and utilities (NOAA 2021). Stormwater and urban flooding can occur in areas outside of the floodplain, so public and private properties not in the floodplain area also vulnerable to stormwater and urban flooding.

Ice Jam Flooding

The water ice jams hold back can lead to riverine or flash flooding upstream from the ice jam. If the ice jam breaks, flash flooding can occur downstream (NOAA, Ice Jams & Flooding 2015). Structures located near rivers and streams are most at risk of flooding from ice jams (Consortium 2021).

Dam Failure Flooding

The dams located in Warren County can have a varying impact on the general building stock. Communities that contain high hazard dams are more at risk for building stock destruction from flooding. The amount of flooding that these structures can experience depends on many factors including the reservoir size, and the time of day and season the breach occurs. Structures that are at a lower elevation from the reservoir will be most vulnerable to flooding from dam failure.

Impact on Critical Facilities and Community Lifelines

It is important to determine the critical facilities and infrastructure that may be at risk to flooding, and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

Critical facility exposure to the flood hazard was examined. Table 5.3.2-22 lists the critical facilities and number of lifelines, within the 1-percent and 0.2-percent annual chance flood boundaries. Of the 511 critical facilities located in the 1-percent annual chance flood event boundary, the greatest number are food, water, or shelter facilities. Additionally, there are 599 critical facilities located in the 0.2-percent annual chance flood event boundary, 286 of which are food, water, or shelter

facilities. A majority of the critical facilities located in the 1-percent and 0.2-percent annual chance flood event boundaries are in Larchmont and Rye, shown in Table 5.3.2-23 and Table 5.3.2-24.

In cases where short-term functionality is impacted by flooding, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce flood impacts to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.

Table 5.4.5-10 Critical Facilities and Lifelines Located in the 1-Percent and 0.2-Percent Annual Chance Event Floodplain

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-percent Annual Chance Flood Event Hazard Area	Number of Lifelines Located in the 0.2-percent Annual Chance Flood Event Hazard Area
Communications	16	0	0
Energy	20	0	0
Food, Water, Shelter	163	11	11
Hazardous Materials	46	1	1
Health and Medical	43	2	3
Safety and Security	211	25	25
Transportation	60	33	33
Warren County (Total)	**559**	**72**	**73**

Source: Hardcopy FIRM Maps, 1980/1990; Warren County, NY 2022

5.4.5-11. Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bolton (T)	44	30	0	0.0%	0	0.0%
Chester (T)	57	44	6	10.5%	6	13.6%
Glens Falls (C)	93	62	2	2.2%	2	3.2%
Hague (T)	23	17	2	8.7%	1	5.9%
Horicon (T)	30	25	13	43.3%	11	44.0%
Johnsburg (T)	66	52	13	19.7%	13	25.0%
Lake George (T)	36	28	2	5.6%	2	7.1%
Lake George (V)	22	14	0	0.0%	0	0.0%
Lake Luzerne (T)	50	41	5	10.0%	5	12.2%
Queensbury (T)	202	156	10	5.0%	10	6.4%
Stony Creek (T)	20	18	6	30.0%	6	33.3%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Thurman (T)	20	16	2	10.0%	2	12.5%
Warrensburg (T)	74	56	14	18.9%	14	25.0%
Warren County (Total)	**737**	**559**	**75**	**10.2%**	**72**	**12.9%**

Source: Warren County, NY 2022
Note: C = City; T = Town; V = Village; % = Percent

Table 5.4.5-12 Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bolton (T)	44	30	0	0.0%	0	0.0%
Chester (T)	57	44	6	10.5%	6	13.6%
Glens Falls (C)	93	62	2	2.2%	2	3.2%
Hague (T)	23	17	2	8.7%	1	5.9%
Horicon (T)	30	25	13	43.3%	11	44.0%
Johnsburg (T)	66	52	13	19.7%	13	25.0%
Lake George (T)	36	28	2	5.6%	2	7.1%
Lake George (V)	22	14	0	0.0%	0	0.0%
Lake Luzerne (T)	50	41	6	12.0%	6	14.6%
Queensbury (T)	202	156	10	5.0%	10	6.4%
Stony Creek (T)	20	18	6	30.0%	6	33.3%
Thurman (T)	20	16	2	10.0%	2	12.5%
Warrensburg (T)	74	56	14	18.9%	14	25.0%
Warren County (Total)	**737**	**559**	**76**	**10.3%**	**73**	**13.1%**

Source: Warren County, NY 2022
Note: C = City; T = Town; V = Village; % = Percent

Flash Flooding

Information regarding the vulnerability to flash flooding is not available at this time.

Stormwater and Urban Flooding

Information regarding the vulnerability to stormwater and urban flooding is not available at this time.

Ice Jam Flooding

Similar to the impacts on general building stock, damage to critical facilities will vary for communities depending on the location of the ice jam and proximity of critical facilities to the ice jams. Major roadways can also be impacted because of inundation or debris carried by flooding, leading to road closures and disruption in services provided by or to critical facilities. Because ice jams occur in the colder months, recovery and repairs to damaged areas can take longer due to colder conditions.

Dam Failure Flooding

Similar to the impacts on the general building stock, damage to critical facilities will vary for communities depending on the distribution of their dams and proximity of critical facilities to these dams and their downstream inundation area. Major roadways within Warren County may also be impacted by dam failure because of standing floodwaters or debris carried by the flooding. Roadblocks in transportation corridors can create disruption in the services provided to or by critical facilities. This puts communities in the County at greater risk if proper warning time is not provided to the community if a dam failure were to occur.

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, impacts on tourism, and impacts on the tax base to Warren County. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the 'Impact on General Building Stock' subsection earlier which discusses direct impacts to buildings in Warren County. Other economic components such as loss of facility use, functional downtime and socio-economic factors are less measurable with a high degree of certainty.

Riverine Flooding

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation.

Debris management may also be a large expense after a flood event. Hazus estimates the amount of debris generated from the 1-percent annual chance event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.) and (3) foundations (concrete slab and block, rebar, etc.). The distinction is made because of the different types of equipment needed to handle the debris. Table 5.3.2-35 summarizes the debris Hazus estimates for these events. As a result of the 1-percent annual chance event, Hazus estimates approximately 214,778 tons of debris will be generated in total.

Table 5.4.5-13 Estimated Debris Generated from the 1-percent Annual Chance Flood Event

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Bolton (T)	381	126	150	106
Chester (T)	716	254	259	203
Glens Falls (C)	0	0	0	0
Hague (T)	77	32	25	20
Horicon (T)	418	186	125	107
Johnsburg (T)	603	156	246	201
Lake George (T)	17	6	6	5
Lake George (V)	32	30	2	1
Lake Luzerne (T)	784	295	267	222
Queensbury (T)	796	380	237	179
Stony Creek (T)	251	81	100	70
Thurman (T)	48	15	18	16
Warrensburg (T)	2,209	392	919	898
Warren County (Total)	**6,333**	**1,952**	**2,354**	**2,028**

Sources: Source: Hazus v5.1, Warren County NY 2022
Note: C = City; T = Town; V = Village

Flash Flooding

The economic impacts of flash floods are similar to the impacts of riverine floods; however, flash floods occur with little to no warning which prevents businesses and homeowners to prepare for flooding. Impacts of a flash flood can include damaged or closed roadways, utility failures, and structural damages. Overall economic impacts include loss of business function; damaged roads, bridges, buildings, and cars; utility interruptions; and expended resources to assist with recovery efforts (Wyoming 2021) (eSchoolToday 2021).

Stormwater and Urban Flooding

The economic impacts of stormwater and urban floods are similar to the impacts of riverine floods. In addition to damaging businesses and homes, this type of flooding can also lead to drinking water contamination, destroy septic system drainfields, impair tourism and recreational businesses, and disrupt critical infrastructure systems (Council 1999) (Environment 2021).

Ice Jam Flooding

Flooding from ice jams can have detrimental impacts on property and infrastructure, including damages to homes, bridges, roads, and businesses. Similar to other types of flooding, ice jam flooding can close roadways and cause power outages, limiting operations of businesses in the impacted areas. A significant ice jam flood event could cause millions of dollars in damages (Das, Reed and Lindenschmidt 2018).

Dam Failure Flooding

Dam failures have historically occurred in Warren County and can impact the local and regional economy. A failure of one of the 36 high hazard dams in the County could cause significant impacts. When Hurricane Floyd passed through Warren County in 1999, the Cortlandt Lake Dam failed due to the amount of rain and erosion (NPDP 2021). An event like Hurricane Floyd could lead to more failures, leaving the County or dam owners responsible for repairing damages and cleanup.

Impact on the Environment

Flood extents for the 1- and 0.2-percent annual flood events will continue to evolve alongside natural occurrences such as sea level rise, climate change, and/or severity of storms. Further, residents living in and around areas of wildfire may be at increased risk of flooding in the future due to changes in the natural landscape.

Riverine Flooding

Flood events will inevitably impact Warren County's natural and local environment. Severe flooding not only influences the habitat of these natural land areas, but it can also be disruptive to species that reside in these natural habitats.

Flash Flooding

Like riverine flooding, flash floods impact the natural and local environment. The surrounding environment may not be able to withstand and recover from flash flood events. Flash floods can destroy wildlife habitats, pollute rivers and streams, carry sediment and silt that can impact water quality, destroy crops and farms, uproot trees, and cause erosion of streambanks and other areas (Wyoming 2021), (eSchoolToday 2021) (New York City 2019).

Stormwater and Urban Flooding

Stormwater and urban flooding events can also impact the natural environment. Stormwater picks up and carries pollutants and other hazardous materials into waterways causing poor water quality, contaminated waters, and impacting fish and plants. Stormwater can also erode stream channels, increase sediment and debris in waterbodies, and destroy fish and wildlife habitats (Environment 2021).

Ice Jam Flooding

Like other types of flood, the environmental impacts of ice jams can include water quality issues, destroy wildlife habitats, pollution, uproot trees and vegetation, and cause erosion along streambanks and other areas.

Dam Failure Flooding

The environmental impacts of a dam failure can include significant water-quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks.

After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

Cascading Impacts on Other Hazards

Riverine, Flash, and Stormwater/Urban Flooding

Flood events can exacerbate the impacts of disease outbreak and landslides. After a flooding event, runoff can pick up and transport pollutants from wildlife and soils. Such organisms can then appear in water drinking facilities and transmit illnesses water-borne and vector diseases to the population (World Health Organization (WHO) 2020). Flooding can also put additional strain on dams, which may lead to dam failure. More information about these hazards of concern can be found in Section 5.4.1 (Dam Failure) and Section 5.4.2 (Disease Outbreak).

Ice Jam and Dam Failure Flooding

Dam failures and ice jams can cause severe downstream flooding, depending on the magnitude of the failure. Other potential impacts are landslides and erosion. They can also cause environmental impacts if floodwaters flow through hazardous material facilities and bring those materials to other areas.

Future Changes That May Impact Vulnerability

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

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

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. New development that has occurred in the last five years within the County, and potential future development in the next five years as identified by the County and each municipality, is included in Section 4, County Profile (Volume I) as well as the jurisdictional annexes in Section 9 (Volume II), along with an indication of proximity to known hazard zones.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). Changes in population density if flood hazard areas can affect the vulnerability of the population to flood impacts. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. It is anticipated that Warren County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

Change of Vulnerability Since the 2017 HMP

Since the 2017 HMP was drafted, updated inventory data has become available to assess additional flood hazard areas in Warren County. This data includes the 5-Year 2017-2021 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2022 general building stock data provided by the County, 2022 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Hazus v5.1 was also used to assess the losses in the County to the overall risk from 100-year and 500-year flood risk. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the flood hazard.

5.4.6 Infestation and Invasive Species

Hazard Profile

Hazard Description

An infestation is defined as an invasion or overrun by parasites that attack plants, animals, and humans. Insect, fungi, and parasitic infestations can result in destruction of various natural habitats and cropland, impact human health, and cause disease and death among native plants, wildlife, and livestock. An infestation is the presence of pest organisms within an area or field, on the surface of a host, or in soil at numbers or quantities large enough to harm, threaten, or otherwise negatively affect native plants, animals, and humans. Pests are any organisms (insects, mammals, birds, parasite/pathogen, fungi, non-native species) that threaten other living species within an environment. Pests compete for natural resources and can transmit diseases to humans, crops, and livestock. Human populations are generally affected by insect or animal infestations that can lead to epidemics or endemics.

Invasive species are non-native species that can harm the environment, the economy, or human health. They may come from anywhere in the world, and as international trade increases, so does the rate of invasive species introductions. Invasive species threaten nearly every aspect of the world and are one of the greatest threats to New York State's biodiversity (NYSDEC n.d.). They can cause or contribute to the following:

- Habitat degradation and loss
- Loss of native fish, wildlife, and tree species
- Loss of recreational opportunities and income
- Crop damage, and diseases in humans and livestock (NYSDEC n.d.)

The Adirondack Park Invasive Plant Program (APIPP) serves as the Adirondack Partnership for Regional Invasive Species Management (PRISM), one of eight PRISMs across New York. APIPP services the northeastern section of New York State, including Warren County. APIPP's mission is to work in partnership to minimize the impact of invasive species on the Adirondack region's communities, lands, and waters. APIPP is a partnership program founded in 1998 by The Nature Conservancy, New York State Department of Environmental Conservation (NYSDEC), New York State Department of Transportation and New York State Adirondack Park Agency, and it is housed under the Adirondack Chapter of The Nature Conservancy. Funding is provided via five-year contracts from the New York State Environmental Protection Fund as administered by NYSDEC. Since APIPP's founding, the program has grown to include more than 30 partner organizations and hundreds of volunteers (APIPP 2023).

The Adirondack PRISM has identified the following invasive plant species of concern in the region:

- Autumn olive
- Bittersweet
- Bush honeysuckles
- Common buckthorn
- Common reed grass
- Cup plant
- Curly-leaf pondweed
- Eurasian watermilfoil
- European frog-bit
- Fanwort
- Garlic mustard
- Giant hogweed
- Glossy buckthorn
- Hydrilla
- Japanese angelica tree
- Japanese barberry
- Japanese stiltgrass
- Japanese tree lilac
- Mile-a-minute
- Multiflora rose
- Norway maple
- Porcelain berry
- Purple loosestrife
- Reed canary grass
- Scotch broom
- Slender false brome
- Starry stonewort
- Swallow-wort spp.
- Tree of heaven
- Variable-leaf watermilfoil
- Water chestnut
- Wineberry
- Winged burning bush
- Yellow iris (APIPP 2023)

The Adirondack PRISM has identified the following invasive animal species of concern in the region:

- Asian clam
- Asian longhorned beetle
- Beech leaf disease nematode
- Chinese mystery snail
- Emerald ash borer
- Eurasian boar
- Fishhook waterflea
- Hemlock wooly adelgid (HWA)
- Jumping worm
- Quagga mussel
- Round goby
- Rusty crayfish
- Spiny waterflea
- Spotted lanternfly
- Zebra mussel (APIPP 2023)

New York State has been impacted by various past and present infestations, including high populations of mosquitoes, which can cause West Nile Virus (WNV); deer ticks, which can cause Lyme disease; and Asian longhorned beetles and hemlock woolly adelgid, which destroy trees. Other infestations that have affected the state include Eastern Equine Encephalitis, La Crosse Encephalitis, Powassan Virus, St. Louis Encephalitis, Western Equine Encephalitis, Emerald Ash Borer, and Sirex Woodwasp. Not all of these infestations have occurred in Warren County. The infestations listed below merit attention.

Emerald Ash Borer

Emerald Ash Borer (EAB) is an invasive beetle from Asia and kills North American ash species (*Fraxinus* sp.), all of New York's ash trees are susceptible to EAB. The first EAB infestation in New York State was discovered in Cattaraugus County 2009. As of the summer of 2022, the presence of EAB has been confirmed in all New York counties except; Essex, Hamilton, and Lewis (NYSDEC 2021). The EAB is a small and very destructive beetle. It has four stages: adult, egg, larva, and pupa. The adult beetle are roughly 3/8 to 5/8 inch long with metallic green wing covers and a coppery red or purple abdomen. They may be present from late May through early September but are most common in June and July. Signs of infection include tree canopy dieback, yellowing, and browning of leaves (NYSDEC 2021).

Hemlock Woolly Adelgid (HWA)

The adelgid uses long mouth parts to extract sap and nutrients from hemlock foliage, preventing free growth and causing needles to discolor from deep green to grayish green and to drop prematurely. Loss of new shoots and needles seriously impairs tree health. Infestation is usually fatal to the tree after several years. Wind, birds, other wildlife, and movement of infested host material (wood) by humans are all factors in dispersion of the adelgid (NYSDEC 2018). Hemlock wood is commonly used in barns and on farm building projects. Groves of hemlock trees provide habitat and cover for deer, ruffled grouse, turkey, rabbit, and snowshoe hare. Loss of hemlock groves can result in loss of cool, damp, and shaded microclimate that supports terrestrial plant communities. Losses can also result in warmer stream temperatures for fish and other aquatic species, thus harming them.

Spotted Lanternfly

The spotted lanternfly (*Lycorma deliculta*) is a planthopper native to China and Southeastern Asia. In the USA, spotted lanternfly is an invasive species that could be very devastating to some crops and hardwood trees. This insect *Spotted Lanternfly* Spotted lanternfly is a significant economic and lifestyle pest for residents, businesses, tourism, forestry, and agriculture. The greatest agricultural concern falls on grapes, hops, apples, blueberries, and stone fruits. Its presence has led to crop loss, exporting issues, and increased management costs (New York State Integrated Pest Management 2023).

Beaver

The beaver (*Castor canadensis*) is a native species whose behavior can cause hazardous conditions. It is unmistakable due to its large body size (26-65 pounds, 25-35 inches) and broad flattened tail (9-10 inches long, 6 inches wide), not to mention the characteristically altered habitat in which it resides. Possessing the unique ability to fell trees, they use this talent to not only get food. It is also a source of construction material for their lodges and the watertight dams they build to impound the area that they intend to inhabit (NYSDEC n.d.).

Regulations

The Invasive Species Council (Council) is a statutory body that was created in 2008 by Title 17, Section 9 of the Environmental Conservation Law (ECL). The Council was created to coordinate among multiple State entities and partners in addressing the environmental and economic threats of invasive species. The legislation defines invasive species as "a species that is (a) non-native to the ecosystem under consideration; and (b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (NYSDEC 2022).

The Council is co-led by the Department of Agriculture and Markets (AGM) and consist of nine members: the Commissioners of DEC, AGM, Transportation, Education, and Office of Parks Recreation and Historic Preservation (OPRHP), Secretary of State, the Chairperson of New York State Thruway Authority, the Director of the New York State Canal Corporation, and the Chairperson of the Adirondack Park Agency (APA) (NYSDEC 2022).

As of 2014, New York State has adopted regulations (6 New York Codes Rules and Regulations [NYCRR] Part 575) which identifies the regulations standards for selling and offering regulated species. Any persons who purchase a regulated invasive species is required to maintain all labels, signs and notices pertaining to invasive species in the given areas (New York Codes, Rules, and Regulations 2022).

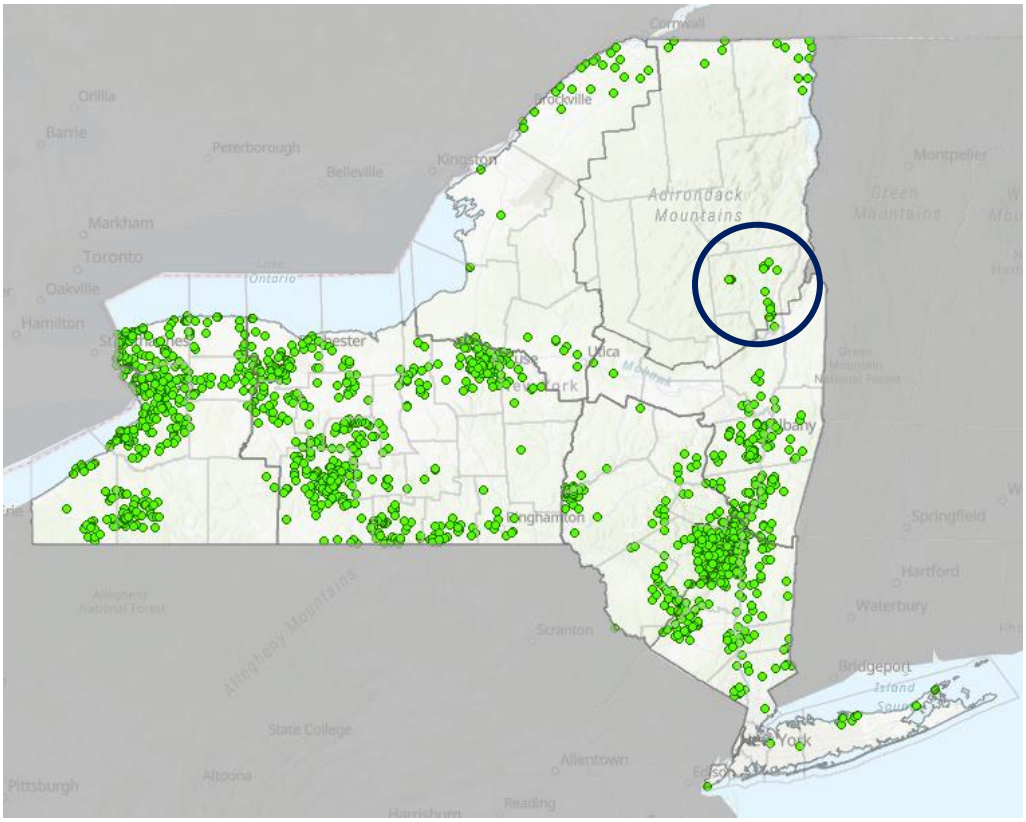
Location and Extent

The extent and location of an infestation or invasive species depend on the preferred habitat of the species, as well as the species' ease of movement and establishment. Each threat can impact most areas of New York State, including Warren County. Levels of threat from infestations and invasive species range from nuisance to widespread. The threat typically intensifies when the ecosystem or host species is already stressed, such as during periods of drought and increased periods of rainfall.

Emerald Ash Borer

All of New York's native ash trees are susceptible to EAB with nearly all counties reporting the presence of EAB. Signs of infestation in the tree canopy include dieback, yellowing, and browning of leaves. Most trees die within two to four years of becoming infested. Adult EABs typically fly less than ½ mile from their emergence tree. Most long-distance movement of EAB has been directly traced to ash firewood or ash nursery stock. New York State currently has a regulation restricting the movement of firewood to protect forests from invasive pests (NYSDEC n.d.).

Figure 5.4.6-1. Emerald Ash Borer New York Distribution Map

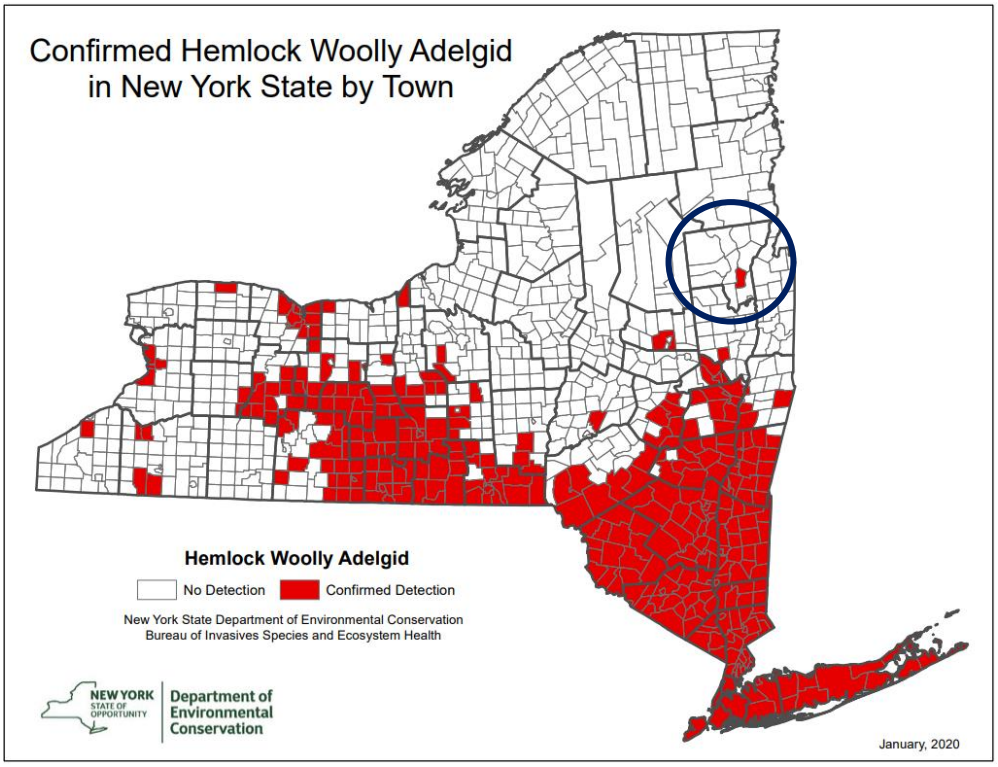


Source: New York Invasive Species Network 2019
Note: The black circle indicates the approximate position of Warren County

Hemlock Woolly Adelgid

HWA has been in North America for twenty years and has been spreading across New York State and to higher elevations at an alarming rate (Cornell Cooperative Extension 2018). Early detection is the key to successful management, HWA are recognized by white woolly masses produced on twigs in late winter. Figure 5.4.6-2 shows the distribution of HWA in New York State and Warren County as of January 2020. The dark blue circle indicates Warren County and shows Hemlock Woolly Adelgid has been found in Warren County in Lake George.

Figure 5.4.6-2. Confirmed Hemlock Woolly Adelgid in New York State by Town

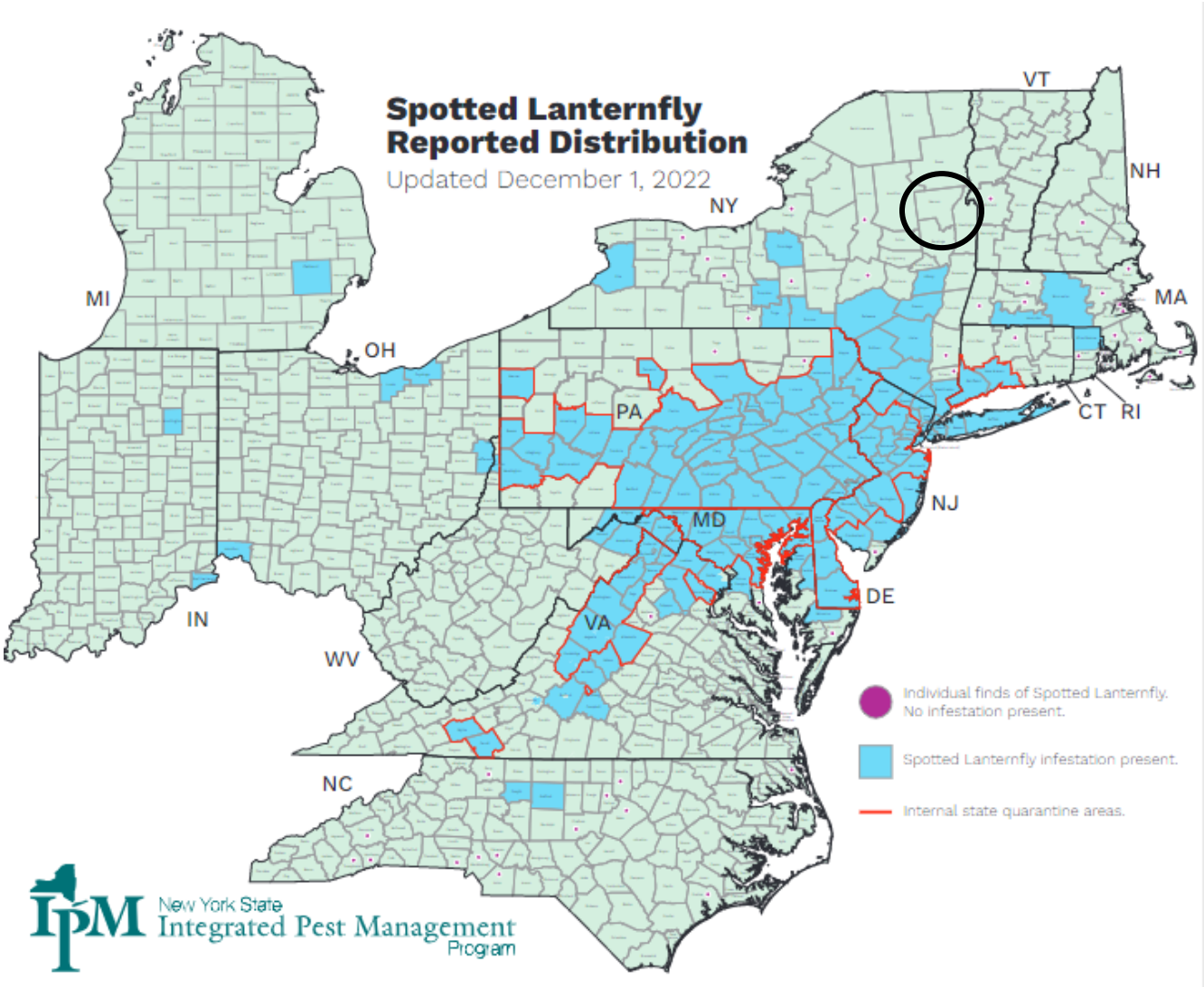


Source: NYSDEC 2020
Note: The black circle indicates the approximate position of Warren County

Spotted Lanternfly

The spotted lanternfly was accidentally introduced into Pennsylvania and was confirmed in September 2014. Since this time, the insect has spread throughout the mid-Atlantic As of December 2022, spotted lanternfly has not been found in Warren County but continues to move closer to the County. The spotted lanternfly can feed on more than 70 plant species including cultivated grapes, fruit trees, and hardwood trees. Key tree hosts include black walnut; red maple; and agricultural crops such as grapes, hops, apples, and peaches (New York State Integrated Pest Management 2023).

Figure 5.4.6-3 Spotted Lanternfly Reported Distribution



Source: New York State Integrated Pest Management 2023
Note: The black circle indicates the position of Warren County

Beaver

Dubbed "nature's finest wetland engineer", beaver activity has both disruptive and beneficial impacts on any body of water they colonize. Their dam-building activity can cause widespread flooding of forest and agricultural lands. Nuisance complaints regarding beaver activity are widespread across New York State. Flooding not only has the potential to change the ecology of a colonized area, but it can also cause hazards to human habitation by plugging culverts and flooding roads, railroad tracks, and agricultural lands. There are also general property damage concerns. New beaver dams or failure of established dams can lead to significant flooding events (NYSDEC n.d.).

Figure 5.4.6-4 Washout of Olmstead Road due to Beaver Dam Failure, March 2022

Source: The Post Star 2022

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was not included in any disaster (DR) or emergency (EM) declarations for infestation or invasive species-related events. However, Warren County was included in a West Nile Virus outbreak in 2000. Section 5.4.2 (Disease Outbreak) includes more information on this declaration. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was not included in any infestation and invasive species-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known infestation and invasive species events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix (Supplementary Data).

Table 5.4.6-1. Infestation and Invasive Species Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
2017	Hemlock Woolly Adelgid	N/A	N/A	Hemlock Woolly Adelgid was confirmed in Lake George by NYS DEC, the first confirmation of the insect in Warren County.
August 2020	Emerald Ash Borer	N/A	N/A	NYSDEC announced that emerald ash borer (EAB) was confirmed in Warren County, marking the first confirmed case of EAB within the Adirondack Park. The affected trees were identified by Department of Transportation personnel at the Warren County Canoe Launch on the Schroon River in the Town of Chester.
March 20, 2022	Beaver Dam Failure	N/A	N/A	Olmstedville Road also known as Route 19 in Chester was closed after a beaver dam broke and water flooded the area. The Warren County Department of Public Works and Office of Emergency Services responded to the area. Part of the road's shoulder and the nearby culvert were damaged.

Sources: *FEMA 2023; NOAA NCEI 2023; The Post Star 2022*
Notes:

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of infestation and invasive species events for the County. Based on historical documentation and given the overall impact of changing climate, New York State is expected to undergo increased incidences of infestation and invasive species. Warren County and all its jurisdictions will continue under threat of infestations and invasive species that may induce secondary hazards and health threats to the County population if infestations are not prevented, controlled, or eradicated.

Based on historical occurrences, the probability of an infestation and invasive species event occurring is considered occasional between 10 and 100% annual probability of occurrence). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change, Warren County is part of Region 7 (Indian Lake). In Region 7, it is estimated that temperatures will increase by 4.5°F to 6.4°F by the 2050s and 5.8°F to 10.1°F by the 2080s (baseline of 39.9°F). Average annual temperatures are projected to increase across New York State by 4.1° F to 6.8° F by the 2050s and 5.3° F to 10.1° F by the 2080s with an average rate of warming over the past century of 0.25° F per decade. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Figure 5.4.6-5. Projected Seasonal Precipitation Change in Region 7, 2050s (% change)

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

Source: NYSERDA 2011

Temperature and rainfall increases due to climate change are anticipated, and evidence exists that climate change may be a factor in expansion of infestation and infectious diseases in the United States. Warmer temperatures and changing rainfall patterns provide an environment where insects can remain active longer, greatly increasing the risk for animals and humans. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resource Defense Council 2015).

As temperatures increase and rainfall patterns change, these insects can remain active for longer seasons and within wider areas. The ability to predict the future distribution of invasive species in response to climate change is a difficult task due to the factors that influence local and short-term invasion patterns, and because invasive species and concurrent climate and land-use changes are dynamically linked (Finch, et al. 2021). Heavier rainfall events may also result in an increased likelihood of beaver dam failures, increasing the risk of flooding events.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. A qualitative assessment was conducted for infestations and invasive species in Warren County.

Impact on life, Health, and Safety

The entire population of Warren County is vulnerable to infestation and invasive species. According to the 2020 U.S. Census, Warren County had a population of 65,737. As discussed earlier, infestations can have an impact on agricultural commodities. This destruction of crop may include consumable resources that are sold to persons in the County. Warren County is home to 80 farms (USDA 2017). It is reasonable to assume that the farms in Warren County also experience losses in crops. This not only impacts the livelihood of the farmers; it also affects the community that relies on these crops for food or other commodities.

Impact on General Building Stock

Structures are not anticipated to be directly affected by infestation or invasive species; however, EAB may cause a catastrophic loss of ash trees throughout the County, which could result in stream bank instability, erosion, and increased sedimentation, impacting ground stabilization and possibly cause foundation issues for nearby structures. Additionally, with an increased number of dead trees, there is an increased risk of trees falling on roadways, power lines, and buildings.

Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings and septic systems. Other invasive plant species have been known to clog culverts and streams, increasing flooding risk.

Flooding associated with new beaver dams or beaver dam failure can result in damages to buildings, roadways, and other infrastructure.

Impact on Critical Facilities and Community Lifelines

Water treatment plants could be impacted by infestation and invasive species because of similar issues that the general building stock may experience. Water that becomes polluted due to increased sedimentation and erosion will require additional treatment. If the system becomes clogged with these pollutants, the ability of water treatment plants to operate may become impaired. Additionally, soil that becomes unstable due to decaying vegetation can impact critical facilities that are built on or around these soils.

Impact on the Economy

Impacts of infestation and invasive species on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with activities and programs implemented to conduct surveillance and address infestation have not been quantified in available documentation. Crop losses from invasive species may be significant. In 2017, there were 908 acres of cropland in Warren

County with $1.9 million in crops sold (USDA 2017). Therefore, it is reasonable to believe that Warren County farmers have experienced monetary losses from infestations.

EAB is the responsible for placing all three of New York's ash species in serious decline. The cost of removal for ash trees can be upwards of $1 million depending on the number of trees for removal and their location.

Flood repairs from beaver dam flooding can be costly and involve replacing washed out roads and culverts.

Impact on the Environment

As previously discussed, Warren County's parks, forests, landscaping, and agricultural areas are vulnerable to infestations and invasive species. Species that cause eventual destabilization of soil, such as invasive insects that destroy plants or invasive plants that outcompete native vegetation but have less effective root systems, can increase runoff into waterbodies. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope. Beavers can destroy existing habitat during dam building.

Future Changes That May Impact Vulnerability

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

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

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located within Warren County could be potentially impacted by invasive species and infestation. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). However, any increases in the density of population or communities or potential increased construction throughout the County could lead to increased infestation of homes and other structures. When building developments locate near wetlands, forested areas, or agricultural lands, it increases the possibility of infestation. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate change and invasive species are two of the top four drivers of global biodiversity loss, affecting production landscapes, reducing crop yields, and the provision of ecosystem services (Masters and Norgrove 2010). Land use changes because of climate change creates an empty niche for invasive species to occur so together these drivers have a greater impact. Climate change can facilities invasive species and infestation such as new species that become invasive entering regions due to climate change, species hierarchy in ecosystems will begin to shift, leading to new dominants that may portrait invasive behaviors, and climate induced stress in the ecosystem will facilitate invasive ecosystems (Masters and Norgrove 2010). Alternatively, invasive species and infestations can facilitate climate stress by increasing the ecosystems susceptibility to climatic disturbance, through reducing the number of species and their functional types within an ecosystem.

Change of Vulnerability Since the 2017 HMP

Overall, the County's vulnerability has not changed since the 2017 HMP, and exposure and vulnerability to infestation and invasive species will continue throughout Warren County.

5.4.7 Severe Storm

Hazard Profile

Hazard Description

Severe storm events are a common occurrence in Warren County. A variety of severe storm types, such as thunderstorms, lightning, hail, tornadoes, straight-line winds, and hurricanes have damaged property and infrastructure, disrupt power, downing trees and power lines, and causing injuries and fatalities. The following section describes the different severe storm types that impact Warren County.

Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS, National Weather Service Glossary 2021). A thunderstorm forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong winds, flash flooding, and lightning. The NWS considers a thunderstorm *severe* only if it produces damaging wind gusts of 58 mph or higher or large hail one inch (quarter size) in diameter or larger or tornadoes (NWS, National Weather Service Glossary 2021).

Lightning

Lighting is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm. Lightning can be cloud to air, cloud to cloud, and cloud to ground (New York State 2019).

Hail

Hail is a type of precipitation that is formed when drops of water freeze together in the cold upper regions of thunderstorm clouds, also referred to as hailstones. Hail can cause severe crop damage and may affect vehicles, roofs, landscaping, and other areas of the built environment. Hailstorm events can occur anywhere within New York State independently or during a tornado, lightning, or thunderstorm event.

Tornadoes

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground with an average forward speed of 30 miles per hour (mph). Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NWS, Thunderstorms, Tornadoes, Lightning…Nature's Most Violent Storms 2010).

Straight-Line Winds

High Winds (Straight Line) are not associated with rotation, like tornado winds. Damaging winds are often called "straight-line" winds to differentiate the damage they cause from tornado damage. High winds can cause flying debris or downed trees and power lines that pose a threat to safety and property. High winds combined with dry conditions increases the probability of wildfires. These events can cause significant damage to communities and infrastructure which has caused the state millions of dollars in damage (New York State 2019).

Figure 5.4.7-1. 2020 Warren County Tornado Event


THE SUNDAY POST★STAR
Est. 1904
The ultimate summer list of American beaches
LOOK INSIDE
better every week
Muzzle Mr. Met?
Mascots wonder why they are banned from MLB SPORTS, PAGE B1
PARTLY SUNNY 62 • 39 FORECAST, A10 | SUNDAY, MAY 31, 2020 | poststar.com | 2009 Pulitzer Prize winner
Tornado confirmed in region
NWS: Category EF1 tornado traveled nearly 9 miles; began in Lake Luzerne
THE POST★STAR
Est. 1904
Living history museum
Wrecked car left near Rush Pond Trail LOCAL, PAGE C1
Sports betting
Virus could lead more OK form of gambling
CLOUDS AND SUN 76 • 46 FORECAST, A6 | SATURDAY, MAY 30, 2020 | poststar.com | 2009 Pulitzer Prize
Storm strikes region
Portions of Northway shut down; downed trees across the area
LOCAL&REGION
TUESDAY, JUNE 2, 2020 | poststar.com/news/local | SECTION B
POLITICS WEEK IN REVIEW
Challenger questions bill to limit powers
Village mulls second well
Town officials drafting intermunicipal deal to buy water to fill needs
Cleanup continues following tornado
Hudson Pointe area residents recall wild weather Friday night

winds can roll over vehicles, collapse walls and blow over trees. The prevailing winds of a hurricane push a wall of water, called a storm surge, i n front of it. If the storm surge happens to coincide with high tide, it causes beach erosion and significant inland flooding.

Hurricanes deliver massive downpours of rain. A particularly large storm can dump dozens of inches of rain in just a day or two. That amount of rain can create flooding, potentially devastating large areas in the path of the hurricane. Additionally, hurricane winds often spawn tornadoes that cause more damage (New York State 2019).

Location

All of Warren County is exposed to high wind, lightning, windstorms, thunderstorms, hail, tornadoes, hurricanes, and tropical storms.

Thunderstorms

Thunderstorms an occur anywhere within New York State and Warren County and damages from thunderstorms and lightening is often underestimated. (New York State 2019)

Lightning

Lightning strikes can occur anywhere within New York State and Warren County (New York State 2019).

Hail

Hailstorm events can occur anywhere within New York State and Warren County, independently or during a tornado, thunder or lightning storm event and are usually localized in scale (New York State 2019).

Tornadoes

In New York State, tornadic destruction ranges from light to catastrophic depending on wind speed, width, and the distance traveled. Wind gusts of 3 seconds can range from 45 mph (F0 tornadoes) to over 250 mph (F5 tornadoes) (New York State 2019). They can occur anywhere in Warren County.

Straight-Line Winds

New York State and Warren County are located in a region highly susceptible to high wind events; this includes straight-line wind events (New York State 2019). In the National Risk Index, a Strong Wind Risk Index score and rating represent a community's relative risk for strong winds (exceeding 58 miles per hour). According to the National Risk Index, Warren County has a relatively low risk to strong winds (FEMA 2023).

Hurricanes/Tropical Storms

In New York State, Hurricanes can impact New York City, Long Island, and in some cases, the Catskills, Hudson Valley, and Upstate (New York State 2019).

Mean Return Period

In evaluating the potential for hazard events of a given magnitude, a 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 (Dinicola 2009).

Figure 5.4.7-2 through Figure 5.4.7-4 show the estimated maximum 3-second gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP events, and the historical 1938 storm. These peak wind speed projections were generated using FEMA's Hazus-MH v4.2 wind model. The maximum 3-second gust wind speeds for Warren County are 39-73 mph (Tropical Storm), for the 100-year MRP and 500-year MRP events and the 1938 storm. The associated impacts and losses from these MRP hurricane event model runs are discussed in the Vulnerability Assessment subsection.

Figure 5.4.7-2. Wind Speeds for the 100-Year Mean Return Period Event

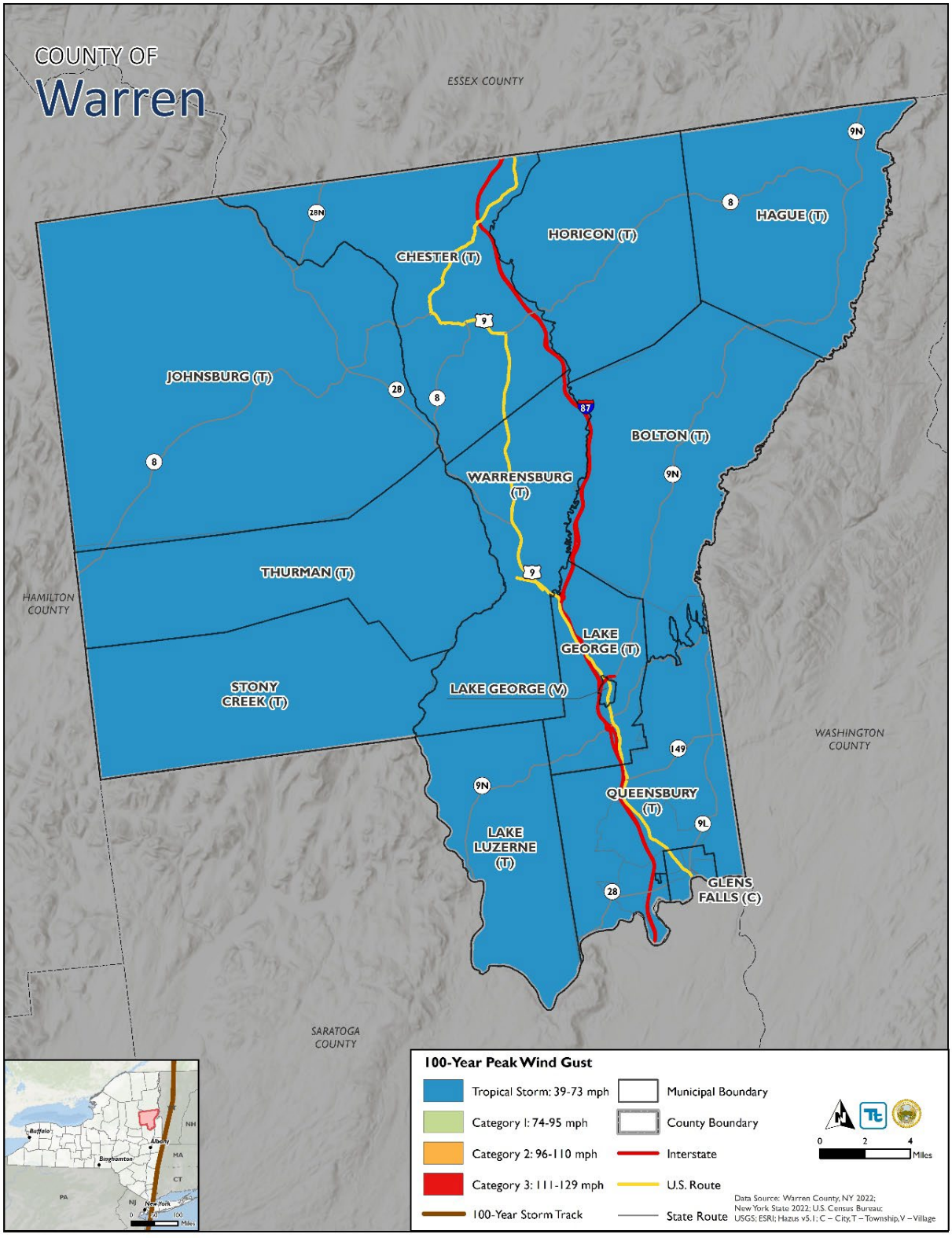


Figure 5.4.7-3. Wind Speeds for the 500-Year Mean Return Period Event

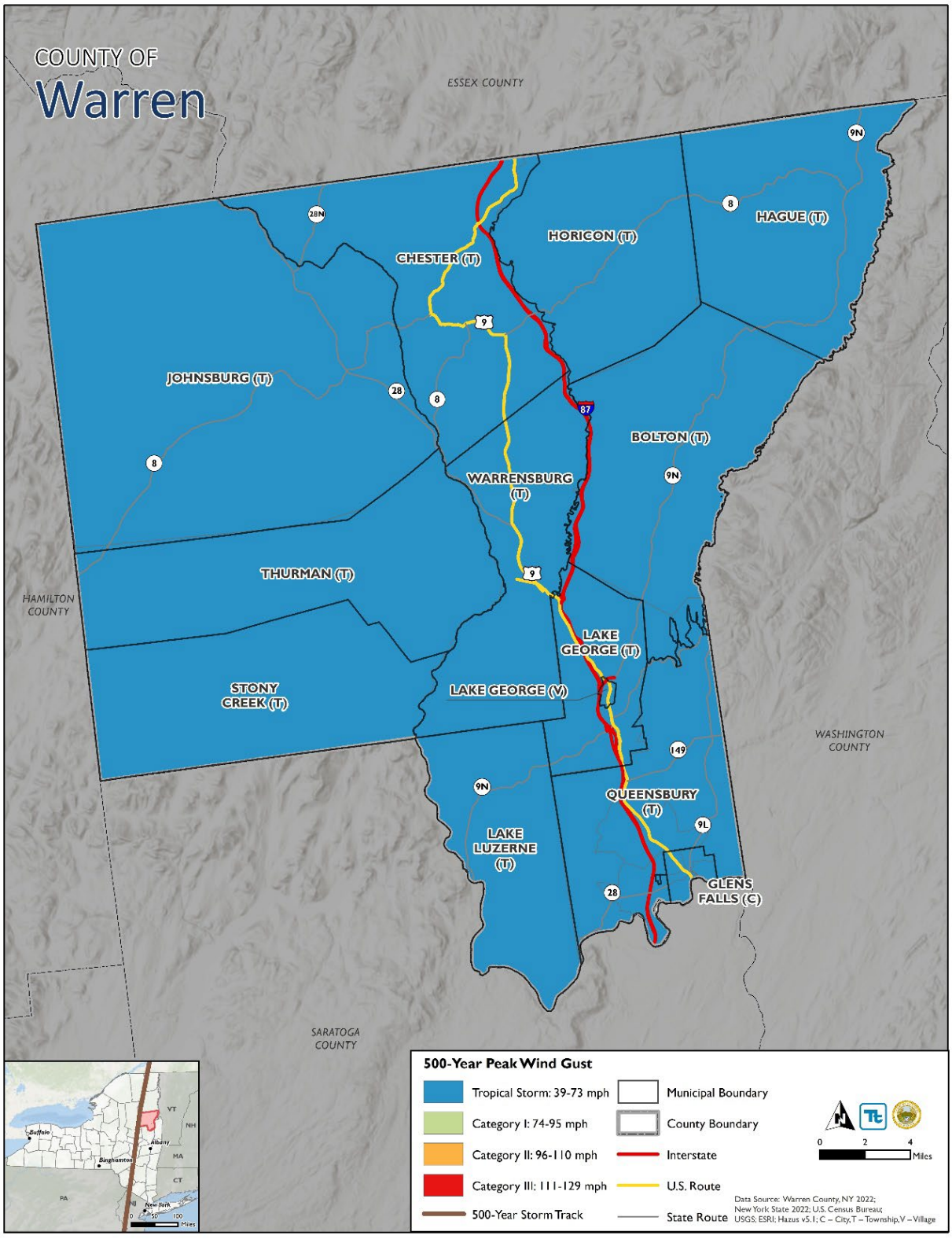
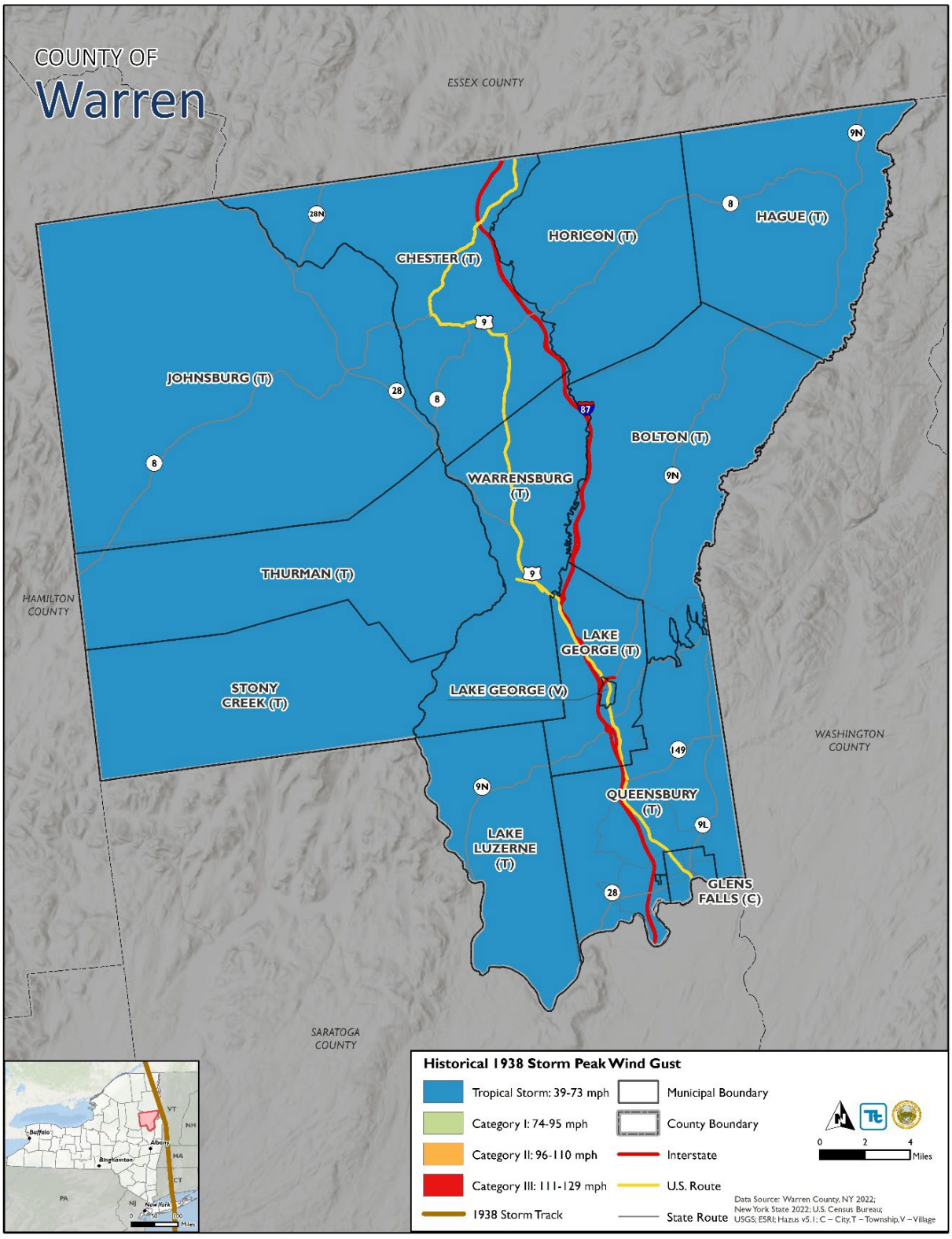


Figure 5.4.7-4. Wind Speeds for the Historical 1938 Storm



Extent

Thunderstorms

Thunderstorms include heavy rainfall and occasional, gusty winds, but often include hail and lightning. Damage from severe thunderstorm winds account for half of all severe storm reports in the lower 48 states and is more common than damage from tornadoes. Heavy rainfall produced by thunderstorms may result in several types of flooding including riverine, flash floods, and local drainage floods.

Lightning

Intra-cloud lightning is the most common type of discharge, occurring between oppositely charged centers within the same cloud. From the outside of the cloud, this looks like diffuse, flickering brightening in the cloud. The flash may exit the boundary of the cloud, and a bright channel of light, like cloud-to-ground flash, can be visible for miles.

Although less common, cloud-to-ground lightning is the more dangerous and damaging type. Most charges originate near the lower-negative charge center of the cloud and deliver a negative charge to earth, but many flashes carry a positive charge to earth.

Positive flashes commonly occur when a thunderstorm is dissipating. Positive charges are more common as a percentage of total ground strikes during the winter months. Positive charge lightning is dangerous because it strikes outside of the rain core, either behind or ahead of a thunderstorm. It can strike as far as five or 10 miles from the storm in areas not considered to be a lightning threat. Positive lightning strikes are of longer duration and more easily light fires. When positive lightning strikes, it carries a high peak electrical current, resulting in greater damage.

Lightning is monitored nationwide through a network of lightning detection systems. These record an average of 25 million strikes of cloud-to-ground lightning every year.

Hail

The National Weather Service (NWS) classifies hail by its diameter and compares it to everyday objects (i.e., size of a golf ball, tennis ball) to explain scope and severity to non-scientific audiences.

Table 5.4.1 – Hail Size Chart

Description	Diameter (inches)
Pea	025″
Penny/Dime	0.75″
Quarter	1.00″
Half Dollar	1.25″
Golf ball	1.75″
Tennis Ball	2.50″
Baseball	2.75″

Description	Diameter (inches)
Grapefruit	4.00”

Source: NWS

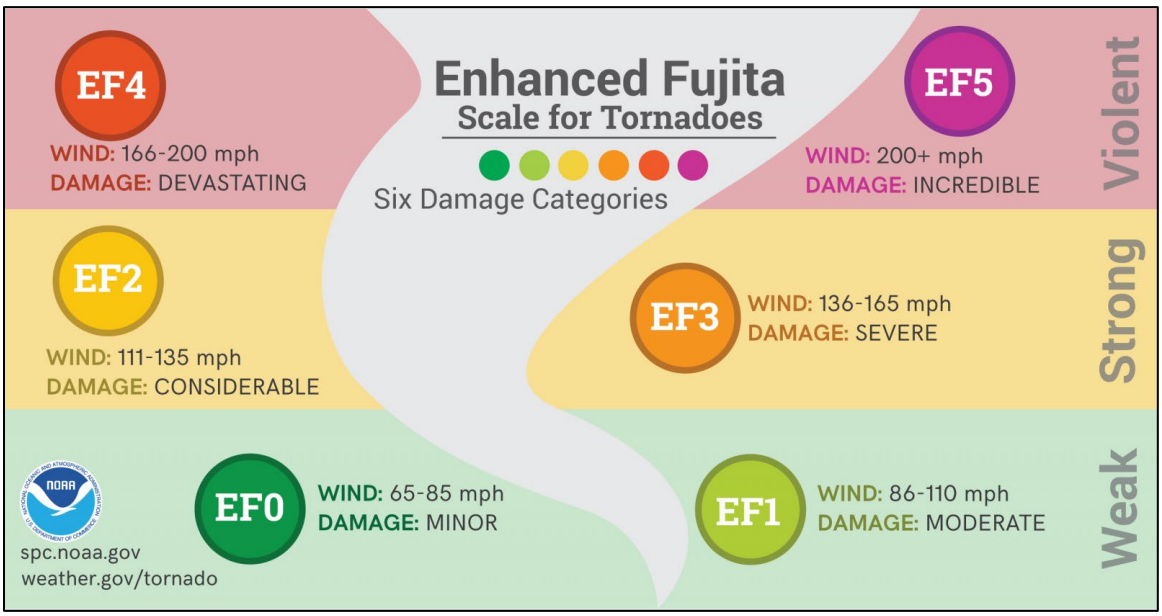
Tornadoes

Tornadoes the world’s most powerful storms. They are characterized by a funnel-shaped downward extension of a cumulonimbus cloud whirling at speeds of up to 300 miles per hour. They generally occur in the afternoon and evening, after the daily buildup of heat powers a violent “supercell” thunderstorm. A tornado can stay on the ground for an hour or longer and be a mile wide or larger. While rarely seen in the Planning Area, they have in recent years occurred more frequently in combination with several types of severe storms.

Practically speaking, it is nearly impossible to measure the actual wind speed inside a tornado because unprotected weather instruments would be destroyed. For this reason, the Fujita Scale was devised in 1971 as a system for estimating the intensity of tornadoes based on the type and severity of damage. The Fujita Scale used an “F” designator before the scale number and ranges from F0 to F5, with higher numbers indicating more severe storms.

In recent years, increased knowledge of wind forces and their effects on buildings led scientists to determine that wind speeds on the original scale were too high for categories F3 and higher. The scale was revised in 2007 as the Enhanced Fujita Tornado Intensity Scale. This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. The Enhanced Fujita Scale uses an “EF” designator before the scale number.

Figure 5.4.7-5. Enhanced Fujita Scale (EF Scale)



Source: NWS 2018

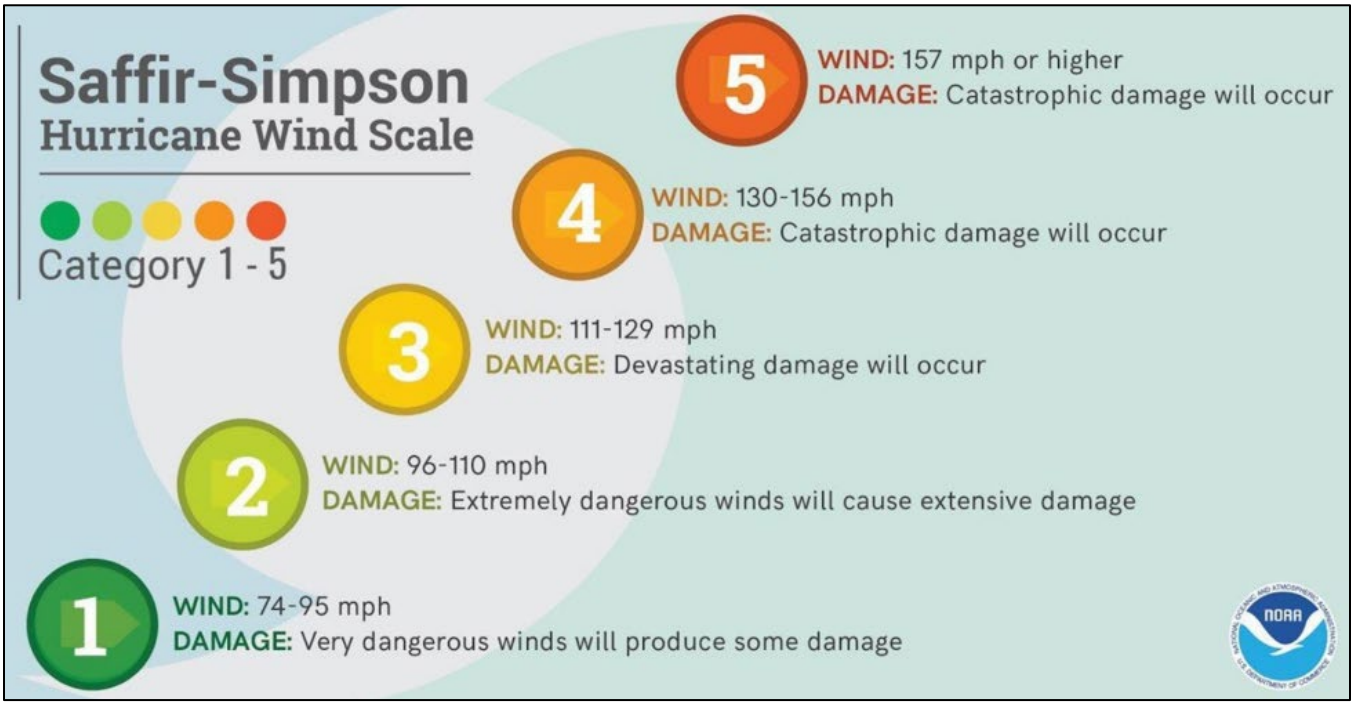
Straight-Line Winds

Winds are often termed straight-line winds to differentiate the damage they cause from that of a tornado. Most winds that cause damage at the ground level result from outflow generated by thunderstorm downdraft. The intensity of straight-line winds may be as intense as that of a tornado. Damaging winds are classified as those exceeding 50-60 mph. Thunderstorm wind damage is more common than tornado damage and accounts for half of all severe weather reports in the lower 48 states. Mobile home residents are especially at risk for injury and death. Even anchored mobile homes can be seriously damaged when straight-line winds gust to over 80 miles per hour (New York State 2019)

Hurricanes/Tropical Storm

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 categorization based on the hurricane's intensity at the indicated time; however, it does not take into account other potential hazards such as storm surge, rainfall flooding, and tornadoes. The scale estimates potential property damage.

Figure 5.4.7-6. Saffir-Simpson Hurricane Wind Scale



Source: NOAA 2017

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was included in eight disaster (DR) or emergency (EM) declarations for severe storm-related events. Generally, these disasters cover a wide region of the

State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2023). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2017 and 2022, Warren County was included in two severe storm-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known severe storm events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to previous Warren County HMP.

Figure 5.4.7-7. Severe Storm Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
January 10–11, 2017	Strong Wind	N/A	N/A	Strong wind gusts of 40 to 60 miles per hour were recorded in Warren County. These strong wind gusts resulted in many downed trees, power poles, and power lines. Overall, the County had approximately $5,000 in property damage from this event.
July–August 2018	Excessive Precipitation	USDA S4479	Yes	Excessive rainfall during this time led to a USDA declaration, which included Warren County.
April–December 2019	Excessive Rain	USDA S4622	Yes	Excessive rainfall during this time led to a USDA declaration, which included Warren County.
July 30, 2019	Thunderstorm Wind	N/A	N/A	On July 30, 2019, strong thunderstorms developed over Warren County, bringing strong winds and power outages. In Warren County, 1,900 customers were without power. One person was injured in the County when a tree fell on a trailer.
October 31 – November 1, 2019	Severe Storms, Straight-Line Winds, and Flooding	FEMA-DR-4472	Yes	A series of strong storms impacted the southern Adirondacks and Mohawk Valley of New York State, bringing rain, flash flooding, and strong winds. Rainfall totals ranged from two to five inches and resulted in flash flooding. The runoff caused rapid rises on area creeks and streams, with four river gauges reaching record levels. The flooding was extensive over portions of the area, damaging numerous roads and structures and resulting in water rescues. A state of emergency was declared for Dutchess, Herkimer, Hamilton, Saratoga, and Warren Counties, and boil water notices were issued in Herkimer, Hamilton, and Warren Counties due to floodwater inundation of private and public water systems.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
				In Warren County, many roads were closed, including 25 roads that washed out in Johnsburg. Wind gusts ranged from 30 miles per hour in Queensbury and 47 miles per hour in Chestertown (Town of Chester). Rainfall totals ranged from 2.8 inches in Lake Luzerne and 3.05 inches in Queensbury.
January 12, 2020	Strong Wind	N/A	N/A	Strong wind gusts of up to 54 miles per hour were reported in Warren County, downing trees and damaging buildings. Overall, the County had approximately $15,000 in property damage from this event.
July 20, 2021	Thunderstorms and Lightning	N/A	N/A	Severe thunderstorms impacted Warren County, bringing hail, damaging winds, and lightning strikes. This caused downed trees and power lines, and damage to homes and vehicles. A lightning strike hit a house near West Glen Falls that resulted in a fire. Overall, the County had approximately $20,000 in property damage from this event.

Sources: FEMA 2023; National Weather Service 2023; National Centers for Environmental Information 2023

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe storm events for the County. Information from NOAA-NCEI storm events database, FEMA, and the 2019 State of New York HMP were used to identify the number of severe storm events that occurred between 1950 and 2022. Figure 5.4.7-8 presents the probability of future events for the severe storm event in the County.

Figure 5.4.7-8. Probability of Future Severe Storm Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year
Thunderstorm	244	100%
Lightning	10	13.7%
Hail	50	68.5%
Tornado	5	6.9%
Wind	101	100%
Heavy Rain	18	24.7%
Hurricane/Tropical Storm	2	2.7%
Total	**430**	**100%**

Sources: *FEMA 2023; National Centers for Environmental Information 2023*

Note: *Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected severe storm events since 1968. Due to limitations in data, not all severe storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.*

A total of 430 severe storm events were recorded in Warren County. Based on historical occurrences, the probability of a severe storm event occurring is considered frequent (100% annual

probability; occurring multiple times per year). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Climate change is beginning to affect both people and resources in Monroe County, and these impacts are projected to continue growing. The Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Warren County is part of Region 5, East Hudson and Mohawk River Valleys. In Region 5, it is estimated that temperatures will increase by 3.0 °F to 5.5 °F by the 2050s and 4.0 °F to 8.0 °F by the 2080s (baseline of 50.0 °F, mid-range projection). Precipitation totals will increase between 0 and 5 percent by the 2050s and 5 to 10 percent by the 2080s (baseline of 38.0 inches, mid-range projection). Table 5.4.7-1 displays the projected seasonal precipitation change for ClimAID Region 5 (NYSERDA 2014).

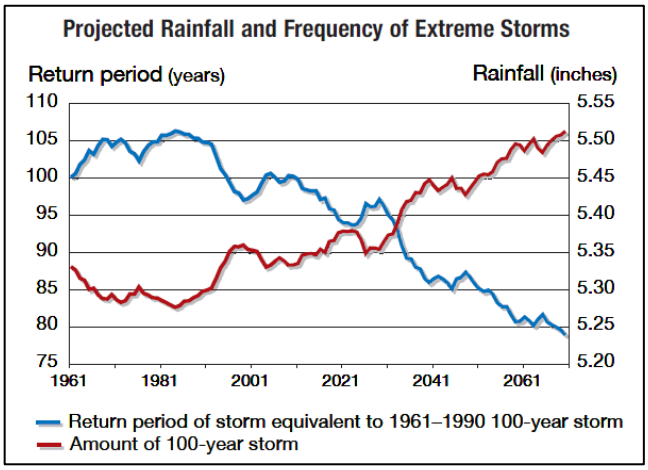
Table 5.4.7-1. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

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

Source: NYSERDA 2014

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity, a change which 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). 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 5.4.7-9. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2014

Figure 5.4.7-9 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall 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 2014).

Vulnerability Assessment

All assets in Warren County are at risk to hurricane and tropical storm events. Potential losses associated with high-wind events were calculated for two probabilistic wind events: the 100-year and 500-year MRP events. The impacts on population, existing structures, critical facilities, lifelines, and the economy are presented below.

Impact on life, Health, and Safety

The impact of a hurricane wind event on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time was provided to residents. All Warren County residents are at risk to the impacts caused by hurricane wind events (65,737 persons; 2020 Census).

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors including their physical and financial ability to react or respond during a hazard. Economically disadvantaged populations are vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate. The population over the age of 65 is also vulnerable and, physically, they may have more difficulty evacuating. Additionally, the elderly are considered vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention which may not be available due to isolation during a storm event. Please refer to Section 4 (County Profile) for the statistics of these populations.

Residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Hazus estimates there will be zero displaced households and no people will require temporary shelter or be displaced or will seek short-term sheltering due to 100-year and 500-year MRP events.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a coastal storm. Due to differences in construction, residential structures are generally

more susceptible to wind damage than commercial and industrial structures. Mobile/manufactured homes, and structures constructed of wood and masonry buildings, in general, tend to experience more damage than concrete or steel buildings.

To better understand these risks, Hazus was used to estimate the expected wind-related building damages. Specific types of wind damages are also summarized in Hazus at the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 5.4.7-2 summarizes the definition of the damage categories. summarizes the number and type of buildings and their estimated severity of expected damage.

Table 5.4.7-2. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or 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%	> one and ≤the larger of20% & 3	1 to 3panels	Typically 5 to 10impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3and ≤50%	>3 and≤25%	Typically 10 to 20impacts	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 >20impacts	Yes	Yes

Source: Hazus Hurricane Technical Manual

Table 5.4.7-3. Expected Severity of Damages from the 100-Year and 500-Year Mean Return Period Hurricane Wind Events

Occupancy Class	Total Number of Buildings Assessed in Occupancy	Severity of Expected Damage	100-Year Mean Return Period Hurricane		500-Year Mean Return Period Hurricane	
			Building Count	Percent of Buildings in Occupancy Class	Building Count	Percent of Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	36,942	NONE	36,942	100.0%	36,931	100.0%
		MINOR	0	0.0%	11	<0.1%
		MODERATE	0	0.0%	0	0.0%
		SEVERE	0	0.0%	0	0.0%
		DESTRUCTION	0	0.0%	0	0.0%
Commercial Buildings	2,249	NONE	2,247	99.9%	2,244	99.8%
		MINOR	2	0.1%	5	0.2%
		MODERATE	0	0.0%	0	0.0%
		SEVERE	0	0.0%	0	0.0%
		DESTRUCTION	0	0.0%	0	0.0%
Industrial Buildings	199	NONE	199	99.9%	198	99.6%
		MINOR	0	0.0%	1	0.4%
		MODERATE	0	0.0%	0	0.0%
		SEVERE	0	0.0%	0	0.0%
		DESTRUCTION	0	0.0%	0	0.0%
Government, Religion, Agricultural, and Education Buildings	919	NONE	919	100.0%	918	99.9%
		MINOR	0	0.0%	0	0.0%
		MODERATE	0	0.0%	0	0.0%
		SEVERE	0	0.0%	0	0.0%
		DESTRUCTION	0	0.0%	0	0.0%

Source: Hazus v5.1; Warren County GIS 2023; NYS GIS 2021;
Notes: % = Percent; < = Less Than

Table 5.4.7-4 summarizes the replacement cost value damage for all occupancies estimated for the 100-year and 500-year MRP wind-only events. Damage estimates are reported for the County's probabilistic Hazus model scenarios. The data shown indicates total losses associated with wind damage to the building only.

The total damage to buildings for all occupancy types across Warren County is estimated to be approximately $0.1 and $4.8 million for the 100- and 500-year MRP wind-only events, respectively. The majority of these losses are to residential buildings (refer to Table 5.4.7-5). Due to differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. The damage counts include buildings damaged at all severity levels from minor damage to destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level. The Town of Queensbury is estimated to experience the greatest damage, approximately $0.1 million in a 100-year MRP event and $1.9 million in a 500-year MRP event.

Table 5.4.7-4. Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane Wind Events

Jurisdiction	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane (All Occupancies)	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Commercial Structures Only	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for All Other Occupancies Structures Only
Bolton (T)	$0	$0	$0	$0
Chester (T)	$0	$0	$0	$0
Glens Falls (C)	$19,067	$19,067	$0	$0
Hague (T)	$0	$0	$0	$0
Horicon (T)	$0	$0	$0	$0
Johnsburg (T)	$0	$0	$0	$0
Lake George (T)	$0	$0	$0	$0
Lake George (V)	$0	$0	$0	$0
Lake Luzerne (T)	$0	$0	$0	$0
Queensbury (T)	$108,123	$108,123	$0	$0
Stony Creek (T)	$0	$0	$0	$0
Thurman (T)	$0	$0	$0	$0
Warrensburg (T)	$0	$0	$0	$0
Warren County (Total)	**$127,190**	**$127,190**	**$0**	**$0**

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021
Notes: C = City; T = Town; V = Village; % = Percent; < = Less Than

Table 5.4.7-5. Estimated Building Damages Caused by the 500-Year Mean Return Period Hurricane Wind Events

Jurisdiction	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane (All Occupancies)	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Commercial Structures Only	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for All Other Occupancies Structures Only
Bolton (T)	$316,434	$311,534	$1,342	$3,558
Chester (T)	$269,841	$257,551	$4,301	$7,989
Glens Falls (C)	$670,277	$605,948	$40,005	$24,324
Hague (T)	$137,577	$135,041	$1,899	$636
Horicon (T)	$229,260	$225,034	$3,165	$1,061
Johnsburg (T)	$207,945	$207,920	$5	$20
Lake George (T)	$285,666	$271,533	$8,636	$5,497
Lake George (V)	$69,747	$66,294	$2,110	$1,343
Lake Luzerne (T)	$284,595	$278,260	$1,084	$5,252
Queensbury (T)	$1,886,821	$1,796,324	$55,068	$35,429
Stony Creek (T)	$87,040	$80,219	$1,383	$5,438
Thurman (T)	$114,435	$105,468	$1,818	$7,150
Warrensburg (T)	$240,333	$221,128	$9,838	$9,367
Warren County (Total)	**$4,799,971**	**$4,562,253**	**$130,653**	**$107,065**

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021
Notes: C = City; T = Town; V = Village; % = Percent; < = Less Than

Impact on Critical Facilities and Community Lifelines

Critical facilities may experience structural damage directly from high winds or falling tree limbs/flying debris, which can also result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. The elderly population may be more vulnerable if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. Emergency personnel such as police, fire, and EMS may not be able to effectively respond and maintain the safety of its residents.

Hazus estimates the probability that critical facilities (i.e., medical facilities, fire/EMS, police, EOC, schools, and user-defined facilities such as shelters and municipal buildings) could sustain damage as a result of 100-year and 500-year MRP wind events. Additionally, Hazus estimates the loss of use for each facility in number of days. Due to the sensitive nature of the critical facility dataset, individual facility estimated loss is not provided.

Table 5.4.7-6 and Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021

Table 5.4.7-7 summarize the percent probability that each facility type may experience damage as a result of the 100-year and 500-year mean return period hurricane wind events, respectively.

Table 5.4.7-6. Estimated Impacts to Critical Facilities and Lifelines from the 100-Year Mean Return Period Hurricane Wind Event

Facility Type	Loss of Days	100-Year Mean Return Period Hurricane Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Emergency Response Centers	0	0.2%	0.0%	0.0%	0.0%
Fire Stations	0	0% - 0.2%	0.0%	0.0%	0.0%
Medical Care Facilities	0	0% - <0.1%	0.0%	0.0%	0.0%
Police Stations	0	0% - 0.2%	0.0%	0.0%	0.0%
Schools	0	0% - 0.1%	0.0%	0.0%	0.0%

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021

Table 5.4.7-7. Estimated Impacts to Critical Facilities and Lifelines from the 500-Year Mean Return Period Hurricane Wind Event

Facility Type	Loss of Days	500-Year Mean Return Period Hurricane Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Emergency Response Centers	0	0.4%	0.0%	0.0%	0.0%
Fire Stations	0	0.2%	0.0%	0.0%	0.0%
Medical Care Facilities	0	0.1% - 0.2%	0.0%	0.0%	0.0%

Facility Type	Loss of Days	500-Year Mean Return Period Hurricane Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Police Stations	0	0.3% - 0.4%	0.0%	0.0%	0.0%
Schools	0	0.1% - 0.2%	0.0%	0.0%	0.0%

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021

At this time, Hazus does not estimate losses to transportation lifelines and utilities as part of the hurricane model. Transportation lifelines are not considered particularly vulnerable to the wind hazard; they are more vulnerable to cascading effects such as flooding, falling debris etc. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs.

Impact on the Economy

Damage to structures from flooding and wind occur immediately; however, this damage can have long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. As evidenced by Hurricane Sandy, the State of New York, including Warren County, lost millions of dollars in wages and economic activity.

Hazus estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" subsection discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event. Refer to Table 5.4.7-8 for a summary of Hazus estimated economic losses for Warren County caused by the 100-year and the 500-year mean return period hurricane wind events.

Table 5.4.7-8. Estimated Economic Losses for the 100-Year and 500-Year Mean Return Period Hurricane Wind Events

Mean Return Period (MRP)	Income Loss	Relocation Loss	Building Losses	Wages Losses	Rental Losses
100-Year	$0	$0	$127,190	$0	$0
500-Year	$0	$180	$4,799,970	$0	$0

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021

Debris management can be costly. Hazus estimates the amount of debris that might be produced as result of the 100-year and 500-year mean return period hurricane wind events. Because the estimated debris production does not include debris generated by flooding, this is likely a

conservative estimate and could be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Refer to the User Manual for additional details regarding these estimates. Hazus does not estimate a significant amount of debris will be generated during a 100-year mean return period wind event. County-wide, it is estimated that approximately 32 tons of tree material will be generated during a 500-year event. Table 5.4.7-9 summarizes the estimated debris by municipality for the 500-year mean return period hurricane wind events, respectively, which should be considered a lower-bound analysis.

Table 5.4.7-9. Debris Production for the 500-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Bolton (T)	0	0	2,774	1,698
Chester (T)	0	0	2,781	1,742
Glens Falls (C)	5	0	165	1,186
Hague (T)	0	0	1,817	719
Horicon (T)	0	0	3,027	1,198
Johnsburg (T)	0	0	6,622	1,573
Lake George (T)	1	0	838	964
Lake George (V)	0	0	204	235
Lake Luzerne (T)	0	0	3,459	2,360
Queensbury (T)	6	0	2,724	4,928
Stony Creek (T)	0	0	2,428	554
Thurman (T)	0	0	3,192	728
Warrensburg (T)	1	0	2,076	1,143
Warren County (Total)	**13**	**0**	**32,107**	**19,027**

Source: Hazus v5.1; Warren County GIS 2020; NYS GIS 2021; RS Means 2021
Notes: C = City; T = Town; V = Village

Impact on the Environment

Extreme winds from hurricanes or tropical storms may create several tons of debris because the wind tears apart foliage and trees. Plants along waterways may be uprooted from surge causing even further instability and alterations of the shoreline. Consequentially, natural habitat that shelters the County from wind and storm surge can be destroyed, impacting future mitigation.

Cascading Impacts on Other Hazards

The impacts of hurricane related windstorms on the environment typically take place over a larger area. Where these events occur, widespread, severe damage to plant species is likely. This includes uprooting or destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Section 5.4.3 (Flood) provides additional environmental impacts due to flooding from heavy rainfalls.

Future Changes That May Impact Vulnerability

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

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

Projected Development

Understanding future changes that impact vulnerability in the Warren County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. It is anticipated that any new development and new residents will be exposed to the hurricane and tropical storm hazard. However, due to increased standards and codes, new development might be less vulnerable to wind-related hazards compared to the aging building stock. The tables and hazard maps included in the jurisdictional annexes contain additional information regarding the specific areas of development that would increase County vulnerability to a wind event.

Projected Changes in Population

According to the U.S. Census (2010 and 2020), Warren County experienced a 0.04 percent increase in population, from 65,707 in 2010 to 65,737 in 2020. Warren County's population has increased every decade since 1950. From 2000 to 2020, the County's population increased 3.7-percent; however, future population projections show an expected decrease in population. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. An increase in temperatures may also lead to an increase in the frequency and intensity of severe storm events. More frequent and severe storms will increase the County's vulnerability to both wind-related and storm surge impacts.

The northeast region of the United States has experienced a greater increase in extreme precipitation than any other region in the U.S. between 1958 and 2010, the Northeast experienced more than 70 percent increase in the amount of precipitation falling in rain events (Global Change 2014). Refer to Section 5.4.3 (Flood) for a discussion related to the impact of climate change due to increases in rainfall. With an increased likelihood of more frequent storm events and associated strong winds and tornado events, the County's assets continue to be at risk.

Change of Vulnerability Since the 2017 HMP

Since the 2017 HMP was drafted, updated inventory data has become available to assess the severe storm hazard in Warren County. This data includes the 5-Year 2017-2021 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2020 general building stock data provided by the County, 2021 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Additionally, Hazus version 5.1 was used to assess the County's overall risk to the 100-year and 500-year mean return period hurricane wind events. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the severe storm hazard.

5.4.8 Severe Winter Storm

Hazard Profile

Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and/or dangerous wind chills. There are three basic components needed to make a winter storm. Below freezing temperatures (cold air) in the clouds and near the ground are necessary to make snow and ice. Lift, something to raise the moist air to form clouds and cause precipitation, is needed. Examples of this is warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside. The last thing needed to make a winter storm is moisture to form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean (NOAA n.d.).

Some winter storms are large enough to immobilize an entire region while others may only affect a single community. Winter storms are typically accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and/or blocked roadways, downed utility lines, and power outages. In Warren County, winter storms include blizzards, snowstorms, and ice storms.

Blizzard

Blizzards can be classified under characteristics of snow. To be classified as a blizzard, there must be high winds and reduced visibility over an extended period. Some blizzards, called ground blizzards, have no falling snow. Instead, snow that had fallen before the blizzard is blown around or drifts in a way to create these conditions (Center for Science Education 2022).

Blizzard Classifications (WCVB 2022):

1. Sustained wind or frequent gusts to 35 mph or greater
2. Visibility reduced to 1/4 mile by falling OR blowing snow
3. Conditions 1 and 2 must last for at least three hours

Ice

Ice forms when freezing rain accumulates on surfaces and the ground. Freezing occurs when air warmer than the freezing mark above the ground moves over subfreezing air near the ground. When snow falls through the warmer layer it melts into rain. Then, as the rain droplets fall into the shallow layer of subfreezing air, the droplets freeze upon contact. This creates a glaze of ice.

An ice storm is a type of winter storm characterized by freezing rain. The U.S National Weather Service defines an ice storm as an event where a quarter inch of ice accumulation occurs, producing a significant and possibly damaging accumulation of ice (State 2019).

Snow

Snow originates in clouds when temperatures are below the freezing when water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into a snow crystal or snow pellet. The severity of a winter storm depends on temperature, wind speed, type of precipitation, accumulation rate (State 2019).

Additional characteristics of Snow include:

- Blowing Snow: Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- Snow Squalls: Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- Snow Showers: Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- Flurries: Light snow falling for short durations with little or no accumulation.
- Avalanche: A rapid downhill flow of a large mass of snow or ice dislodged from a mountainside.

Location

Blizzard

Blizzards can occur throughout the county, however, locations with higher elevations have the ability to encounter blizzard conditions more frequently than those with lower elevations.

Ice

The Midwest and Northeast United States are prime areas for freezing rain and ice storm events. These events can occur anytime between November and April, with most events occurring during December and January. Warren County has an average of five to six days with freezing rain (Previous HMP)

Figure 5.4.8-1. Warren County ice-covered Roadway, 2021

Snow

Due to the location of Warren County in the Northeastern part of the United States, the county receives significant snowfall in comparison to the rest of the Country. On average, Warren County receives 77 inches of snow per year and the US average is 28 inches of snow per year (Places n.d.).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatological 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.

Blizzard

Three things are needed to make a large snowstorm or blizzard:

1. Cold air (below freezing) is needed to make snow. For snow to fall to the ground, the temperature must be cold both up in the clouds where snowflakes form and down at ground level. If the air near ground level is too warm, the snow will melt on its way down, changing to rain or freezing rain.
2. Moisture is needed to form clouds and precipitation. Moisture in the air is called water vapor. Air blowing across a body of water, such as a large lake or the ocean, is an excellent source of water vapor. As wind moves air over the water, some water evaporates from the surface, putting vapor into the air. This is how lake effect snowstorms and nor'easters pick up so much moisture. However, cold air is not able to hold much water vapor. In fact, very cold air does not make very much snow.
3. Moist air needs to rise over very cold air, making clouds and snow. There are two ways that moist air might rise over cold air. Winds pull cold air toward the equator from the poles and bring warmer, moist air toward the poles from the equator. When warm air and cold air are brought together, a front is formed, and snow can form. Warm air can also rise to form clouds and blizzard snows as it flows up a mountainside.

Ice

The Sperry–Piltz Ice Accumulation Index, or SPIA Index, is a forward-looking, ice accumulation and ice damage prediction index that uses an algorithm of researched parameters that, when combined with National Weather Service forecast data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms. It is a tool to be used for risk management and/or winter weather preparedness (SPIA Index n.d.).

The SPIA Index uses three key parameters to formulate the algorithm:

- Storm total rainfall, converted to ice accumulation
- Wind
- Temperatures during the event period

These parameters, when used in conjunction with digital forecasts from local NWS Weather Forecast Offices (WFOs), have been shown to accurately predict the duration, intensity and damage capability of ice storms.

Figure 5.4.8-2: Sperry-Piltz Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: (Larson 2013)

Snow

The RSI is an evolution of the Northeast Snowfall Impact Scale (NESIS) which NCEI (then, NCDC) began producing operationally in 2005. While NESIS was developed for storms that had a major impact in the Northeast, it includes the impact of snow on other regions as well. It can be thought of as a quasi-national index that is calibrated to Northeast snowstorms. By contrast, the RSI is a regional index; a separate index is produced for each of the six NCEI climate regions in the eastern two-thirds of the nation. The indices are calculated in a fashion like NESIS but with modifications allowing the index to be tailored to the climatology of different regions using region-specific parameters and thresholds. Unlike NESIS, which includes snowfall amounts for the entire storm (even outside the Northeast), the RSI is calculated only with snow that falls within a region's borders. Therefore, RSI has a unique value for each region and storm. This allows the RSI to discriminate disruption between different regions for the same storm (Squires, et al. 2014).

Table 1: RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18.0+

Source: NOAA-NCDC 2011

Note: RSI = Regional Snowfall Index

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was included in 1 disaster (DR) or emergency (EM) declarations for severe winter storm-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was not included in severe winter storm-related agricultural disaster declarations.

Previous Events

For this 2023 HMP update, known severe winter storm events that impacted Warren County between 2017 and 2022 are discussed below. For events prior to 2017, refer to Appendix E (Supplementary Data).

Table 5.4.8-2. Severe Winter Storm Events in Warren County (2017 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
December 12, 2017–December 13, 2017	Heavy Snow	Not Applicable	Not Applicable	Snowfall totals ranged from 7.7 to 10.2 inches.
December 24, 2017–December 25, 2017	Heavy Snow	Not Applicable	Not Applicable	Snowfall totals ranged from 7 to 8.5 inches across the area.
February 6, 2020–February 7, 2020	Winter Weather	Not Applicable	Not Applicable	One-two inches per hour were recorded totaling up to a foot of snow. Nearly 22,000 people lost power and one person was injured.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Warren County included in Declaration?	Description
April 18, 2022-April 19, 2022	Winter Storm	Not Applicable	Not Applicable	A late nor'easter dumped 7-18 inches of snow and produced wind gusts of up to 50 mph.

Probability of Future Occurrences

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe winter storm events for the County. Information from NOAA-NCEI storm events database, the 2019 State of New York HMP, the 2017 Warren County HMP were used to identify the number of severe winter storm events that occurred between 1950 and 2022. Table 5.4.8-3 presents the probability of future events for the severe winter storm event in the County.

Table 5.4.8-3. Probability of Future Severe Winter Storm Events in Warren County

Hazard Type	Number of Occurrences Between 1950 and 2022	Percent Chance of Occurring in Any Given Year
Blizzard	2	2.74
Frost/Freeze	47	64.38
Heavy Snow	50	68.49
Ice Storm	6	8.22
Winter Storm/Weather	243	332.88

Sources: *NOAA NCEI 2022…*

Note: *Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all severe winter storm events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated*

A total of 348 severe winter storm events were recorded in Warren County. Based on historical occurrences, the probability of a severe winter storm event occurring is considered frequent or having a 100% annual probability of occurrence or occurring multiple times per year. . Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Although the Intergovernmental Panel on Climate Change (IPCC) has found that global average surface temperature has increased and that there has been a reduction of the annual duration of lake ice cover in the Northern Hemisphere, the impacts of this change on snowfall projections for New York State are unclear (State 2019).

Although winters are becoming warmer and somewhat milder overall, extreme weather events have also been increasing, especially in the Northeastern United States. From the winter of 2008-9 until 2017-18, there were 27 major Northeast winter storms, three to four times the totals for each of the previous five decades (Schwartz 2021).

Vulnerability Assessment

Severe winter storms are of significant concern to the County because of the frequency and magnitude of these events in the region, 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.

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 (NOAA n.d.).

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 (NOAA n.d.).

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 (NOAA n.d.).

For the purposes of this HMP, the entire population of Warren County (65,737 people) is exposed to severe winter storm events (U.S. Census, 2020). Snow accumulation and frozen/slippery road surfaces increase the frequency and impact of traffic accidents for the general population, resulting in personal injuries. Refer to Section 4 (County Profile) for population statistics for each participating municipality.

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, severe 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.

Impact on General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. At-risk residential infrastructures are presented in the flood hazard profile. Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with a 100-year flood.

Impact on Critical Facilities and Community Lifelines

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Impact on the Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources for employee time, fuel, supplies, and materials needed. Another impact on the economy includes impacts on commuting into, or out of, the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County.

Impact on the Environment

Due to the frigid temperatures that occur with winter storms, many people raise their house's temperature which uses more energy and contributes to enhancing the effects of climate change. Using salt and other snow melt practices can affect water quality in surrounding areas because of runoff into streams and rivers. Some people also leave vehicles on and running to try and warm it up before leaving to go somewhere which adds unnecessary emissions and air pollution (Beach 2022).

Future Changes That May Impact Vulnerability

Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. Areas targeted for potential future growth and development in the next five (5) years have been identified across the County at the municipal level. Current New York State land use and building codes incorporate standards that address and mitigate snow accumulation.

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County.

Any areas of growth could potentially create issues related to transportation during a winter weather event if mitigation and emergency management measures are not considered. Therefore, it is the intention of the County to provide current information to its agencies and the public related to forecasted winter weather events.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020). Even though the population has not significantly increased overall, changes in population density within county communities should be evaluated to determine if high population densities can create issues for local residents during a winter storm event.

Climate Change

According to In New York, winters have warmed three times faster than summers. Warmer winter temperatures, with fewer days below freezing, are bringing more winter precipitation to New York as rain, less snow, reduced snow cover, and earlier spring snowmelt. Less snowfall and earlier snowmelt are already having and will continue to have increasing economic impacts on New York's winter recreation industry. Reduced snow cover will increase the vulnerability of certain plants that depend on snow for insulation, and wildlife that depend on snow for protection from predators during the winter. Less snowfall in the winter can also cause drier summer soil conditions, increasing the risk of wildfires. Lake effect snow will increase snowfall amounts in the next few decades for parts of New York State, as warmer winters continue to cause less ice cover on Lake Erie, Lake Ontario, and the Finger Lakes.

Snowfall in New York is likely to decrease. Due to warming global temperatures, many regions are seeing a decrease in winter precipitation falling as snow and an increase in winter rain. The combination of less early winter snowfall and earlier snowmelt will lead to a shorter snow season. This results in fewer days with snow on the ground, decreased snow depth, and earlier snowmelt, impacting ecosystems and industries in New York that depend on snow.

The full extent of the effects of climate change are still unknown but it is expected that lake-effect snow will eventually decrease with continued global warming, as temperatures below freezing in New York become less frequent and more winter precipitation falls as rain (NY DEC 2023).

Change of Vulnerability Since the 2017 HMP

Although the Impacts of climate change including warmer temperature, lower snow pack, and earlier snowmelt may have decreased the vulnerability of New York State since 2017, the overall vulnerability of Warren County to severe winter storms has not noticeably decreased in that time period.

5.4.9 Wildfire

Hazard Profile

Hazard Description

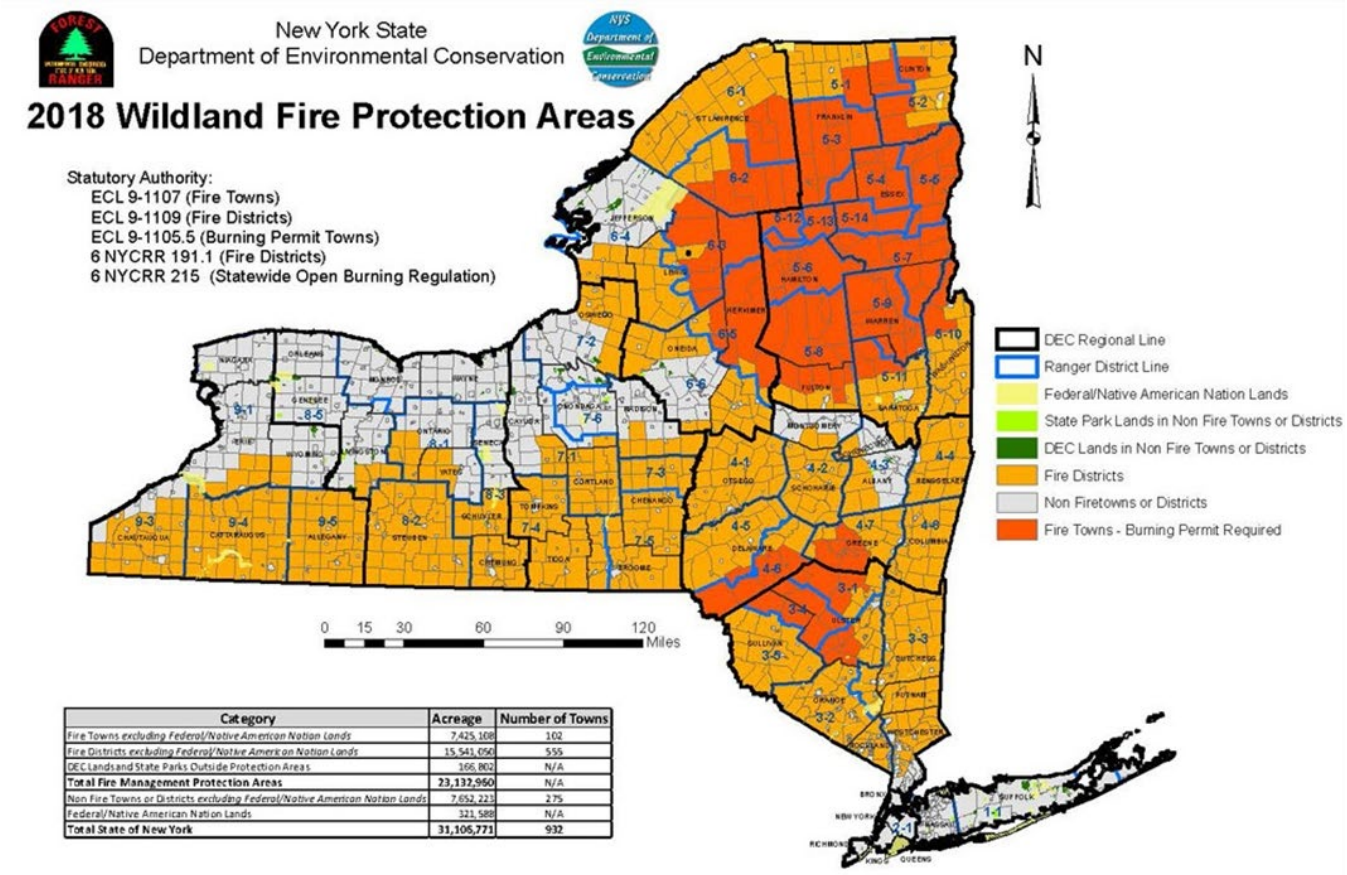
Wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that can threaten lives and property if not contained. Wildfires are commonly termed forest fires, brush fires, grass fires, wildland-urban interface fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS DHSES 2019). Although destructive fires do not occur annually, the State's fire history shows a cycle of outbreaks that have caused human death, property loss, forest destruction, and air pollution (NYS DHSES 2019).

Location

According to the U.S. Fire Administration (USFA), the fire problem in the United States varies from region to region. This variation often is a result of climate, poverty, education, demographics, and other causal factors (USFA 2022). Wildfires do occur in Warren County. Many areas in the County, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires (NYSDEC 2015).

In New York State, the NYSDEC's Division of Forest Protection (Forest Ranger Division) is designated as the state's lead agency for wildfire mitigation. The Forest Ranger Division has a statutory requirement to provide a forest fire protection system for 657 of the 932 jurisdictions throughout New York State. This jurisdiction includes cities and villages and covers 23.1 million acres of land, including all state-owned land outside of the jurisdictions. The Lake Ontario Plains and New York City-Long Island areas are the general areas not under the statutory requirement. Records on wildfires in this area are collected from fire department reports to evaluate any need to expand statutory responsibilities. displays the fire protection areas in New York State. Table 5.4.9-1 indicates that, as of 2018, Warren County is part of wildfire protection area 5-9.

Figure 5.4.9-1. Wildland Fire Protection Areas

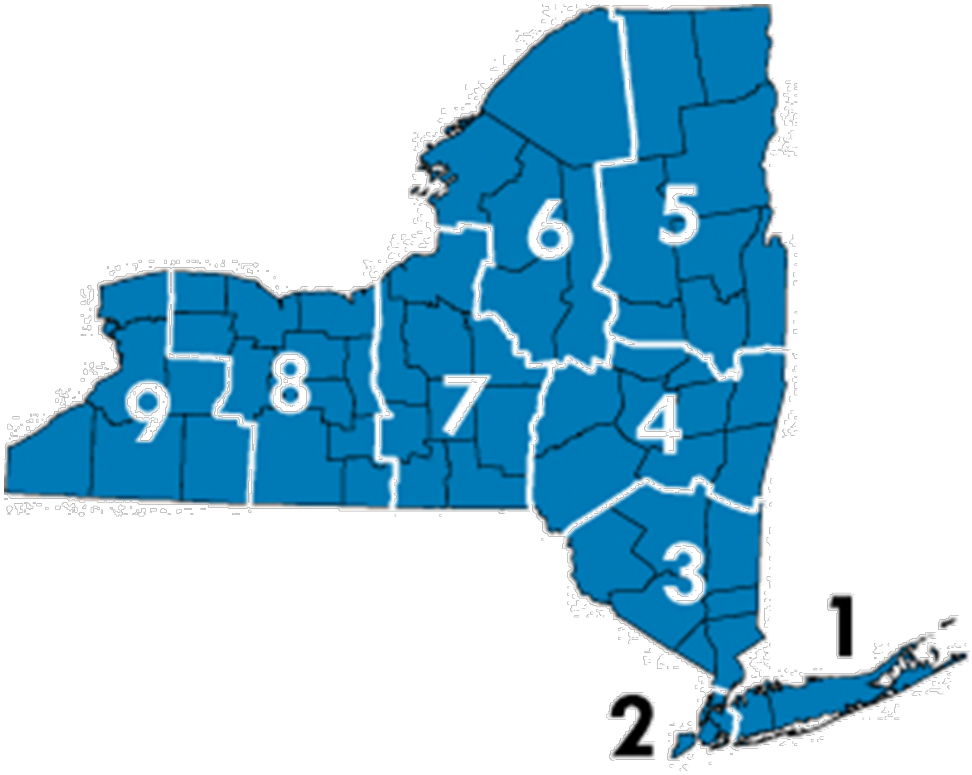


Category	Acreage	Number of Towns
Fire Towns excluding Federal/Native American Nation Lands	7,425,108	102
Fire Districts excluding Federal/Native American Nation Lands	15,541,050	555
DEC Lands and State Parks Outside Protection Areas	166,802	N/A
Total Fire Management Protection Areas	**23,132,960**	N/A
Non Fire Towns or Districts excluding Federal/Native American Nation Lands	7,652,223	275
Federal/Native American Nation Lands	321,588	N/A
Total State of New York	**31,106,771**	932

Source: NYSDEC 2018

Figure 5.4.9-2Table 5.4.9-2 shows the Forest Ranger Divisions in New York State. Warren County is part of Forest Ranger Division 5 (NYSDEC 2022).

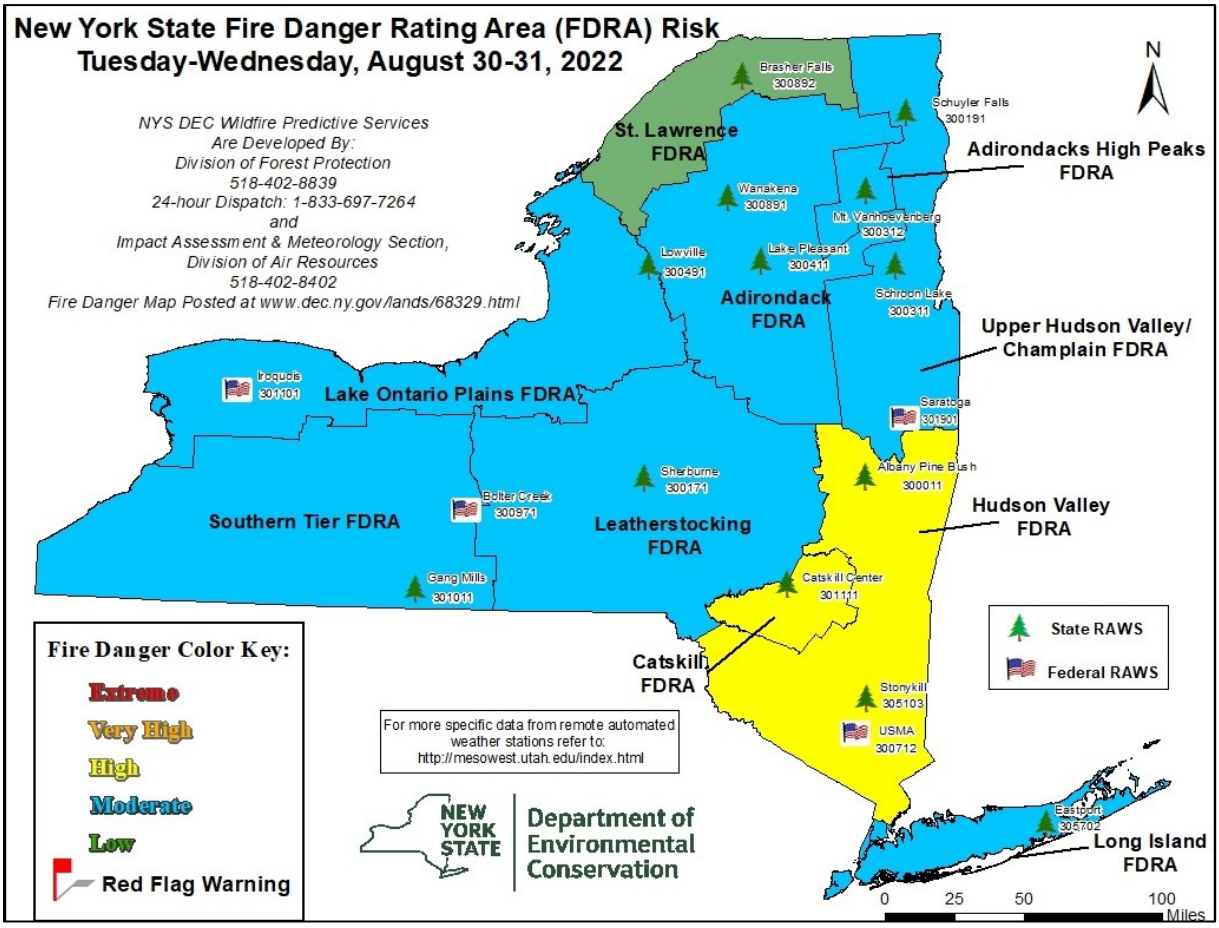
Figure 5.4.9-2. Forest Ranger Division Wildfire Protection Areas



Source: NYSDEC 2022

New York State is divided into 10 Fire Danger Rating Areas (FDRAs). FDRAs are defined as areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, NWS fire weather zones, political boundaries, fire occurrence history, and other influences. Warren County is part of the Upper Hudson Valley/Champlain FDRA. The Forest Ranger Division issues daily fire danger warnings when the fire danger rating within one or more FDRAs is at "high" or above. A current fire danger rating map is updated daily on the NYSDEC website. Figure 5.4.9-3 shows an example of this map.

Figure 5.4.9-3. New York State Fire Danger Rating Areas



Source: NYSDEC 2022

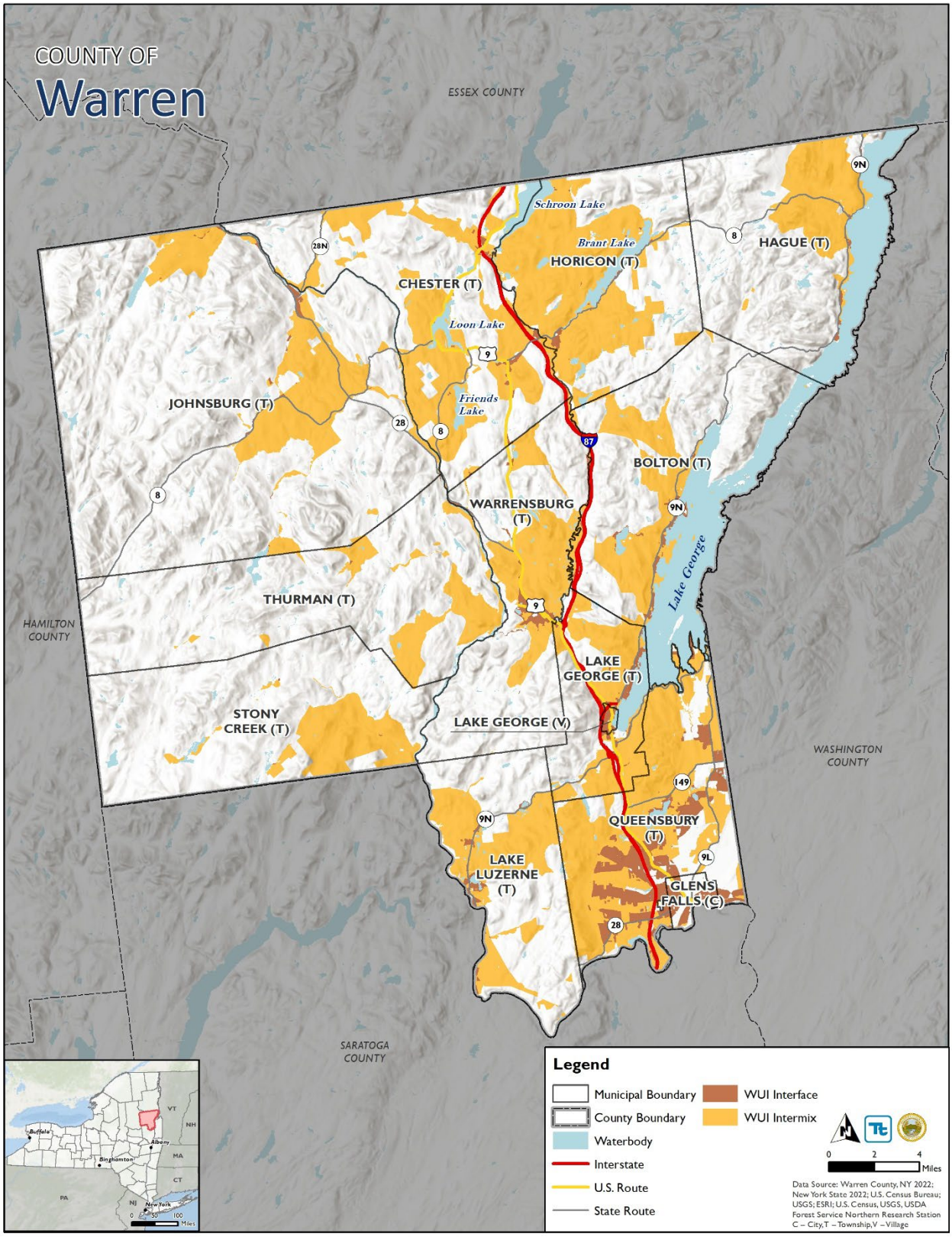
Wildland/Urban Interface (WUI) in New York State/Warren County

The wildland/urban interface (WUI) is any location where human structures and woodlands intermingle, allowing a wildland fire to reach beyond trees, brush, and other natural fuels to ignite homes and their immediate surroundings (NYSDEC n.d.). The WUI can also be subdivided into three categories: intermix, interface, and occluded/interior (Sustainable Defensible Space n.d.). The NYS HMP indicates that New York State has all three types of WUI interfaces. The Adirondack and Catskill Mountains contain large tracts of forests with the mixed, and to a lesser extent, the classic interface occurring throughout. The remainder of the state contains classic and mixed interfaces, with some major cities containing an occluded interface. Population migration from urban to suburban and rural living will continue, increasing the possibility of loss or damage to structures in the WUI, for a number of reasons. Many property owners are unaware that a threat from a wildfire exists or that their homes are not defensible from it. Water supplies at the scene in the WUI are often inadequate. Access by firefighting equipment is often blocked or hindered by driveways that are narrow, winding, dead-

ended, have tight turning radii, or have weight restrictions. Most wildland fire suppression personnel are inadequately prepared for fighting structural fires, and local fire departments are not usually fully trained or equipped for wildfire suppression. Furthermore, the mix of structures, ornamental vegetation, and wildland fuels may cause erratic fire behavior. These factors and others substantially increase risk to life, property, and economic welfare in the WUI. While many interface communities are present throughout New York State and Warren County, an official list that details the location, type of interface, and surrounding fuel makeup does not exist (NYS DHSES 2011).

A detailed WUI (interface and intermix) that also defines the wildfire hazard area was obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison**.** The California Fire Alliance determined that areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located within the forest are at risk from wildfire. This buffer distance, along with housing density and vegetation type, were used to define the WUI illustrated in Figure 5.4.9-1 below (Radeloff 2018). Each town contains significant areas of WUI intermix areas. The Town of Queensbury has the largest percentage of coverage by the WUI intermix and also includes large areas of WUI interface.

Figure 5.4.9-4. WUI in Warren County



Extent

Wildfire events can range in size and intensity. A wildfire's intensity depends significantly on both meteorological conditions and human activity.

Wildfire Behavior and Fire Ecology

Fire behavior is defined as the way fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. Fire behavior is one of the most important aspects of wildfires because almost all actions in response to a fire depend on how it behaves. The extent to which fire manages can understand and predict fire behavior relies on success in pre-suppression planning and actual suppression of wildfires.

Potential for wildfire and its subsequent development (growth) and severity are controlled by the three principal factors of topography, fuel, and weather, described as follows:

Topography – Topography can powerfully influence wildfire behavior. Movement of air over the terrain tends to direct a fire's course. A gulch or canyon can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread. Saddles on ridgetops tend to offer lower resistance to passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior. Slope is an important factor. If the percentage of uphill slope doubles, the rate the wildfire spreads will most likely double as well. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of a wildfire's rapid spread (FEMA 1997).

Fuel – Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading is used to describe the amount of vegetative material available. If this amount doubles, energy released can also double. Each fuel type is given a burn index—an estimate of amount of potential energy that may be released, effort required to ignite a fire in a given fuel and expected flame length. Different fuels have different burn qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread (FEMA 1997). According to the U.S. Forest Service (USFS), a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels):

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses; and any other combustible biomass between the top of surface fuels and bottom of overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consist mostly of live and dead fine material. When historically low-density forests become

overcrowded, tree crowns may merge and form a closed canopy. Tree canopies constitute the primary fuel layer in a forest crown fire (USFS 2013).

Weather / Air Mass – Weather is the most important factor influencing fire behavior, but it is always changing. Air mass, defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can affect wildfire through climatic factors that include temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere at the time of the fire (NWS 2009). Extreme weather leads to extreme events, and often a subsidence of severe weather marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that radically and suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA 1997).

Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

- The Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived "greenness" maps (USFS n.d.).
- The Fire Potential Index (FPI) is derived by combining information on daily weather and vegetation condition and can identify areas most susceptible to fire ignition (Burgan, Klaver and Klaver 2000).
- Fuel Moisture (FM) content is quantity of water in a fuel particle expressed as a percent of oven-dry weight of the fuel particle and is an expression of cumulative effects of past and present weather events, to help evaluate the effects of current or future weather on fire potential (Burgan, Klaver and Klaver 2000).
- The Keetch-Byram Drought Index (KBDI) is designed for fire potential assessment and is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.).
- The Haines Index, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures potential for existing fires to become large fires (USFS n.d.).
- The Buildup Index (BUI) is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant (North Carolina Forest Service 2009).

The Fire Danger Rating in New York is established using information from the National Fire Danger Rating System (NFDRS) and takes into account current and antecedent weather, fuel types, and both

live and dead fuel moisture. This information is provided by local station managers (USFS n.d.) in each of the ten regions of New York State. Warren County is part of the Upper Hudson Valley/Champlain FDRA. Table 5.4.9-1 lists fire danger ratings and color codes, also used by NYSDEC to update its fire danger rating maps, identified earlier in Figure 5.4.9-3.

Table 5.4.9-1. Description of Fire Danger Ratings in New York State

Adjective Rating Class and Color Code	Class Description
Red Flag	A short-term, temporary warning, indicating the presence of a dangerous combination of temperature, wind, relative humidity, fuel or drought conditions that can contribute to new fires or rapid spread of existing fires. A Red Flag Warning can be issued at any Fire Danger level.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.
Very High (orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
High (yellow)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Moderate (blue)	Fires can start from most accidental causes but, with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
Low (green)	Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.

Source: NYSDEC 2022

Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, Warren County was not included in any disaster (DR) or emergency (EM) declarations for wildfire-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2023). Detailed information about the declared disasters since 1954 is provided in Section 4 (County Profile).

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Warren County was not included in any wildfire-related agricultural disaster declarations (USDA 2023).

Previous Events

Known wildfire events that occurred in Warren County between 2008 and 2022 are noted in Table 5.4.9-2; locations of these events are depicted in Figure 5.4.9-3.

Table 5.4.9-2. Wildfire Events in Warren County (2008 to 2020)

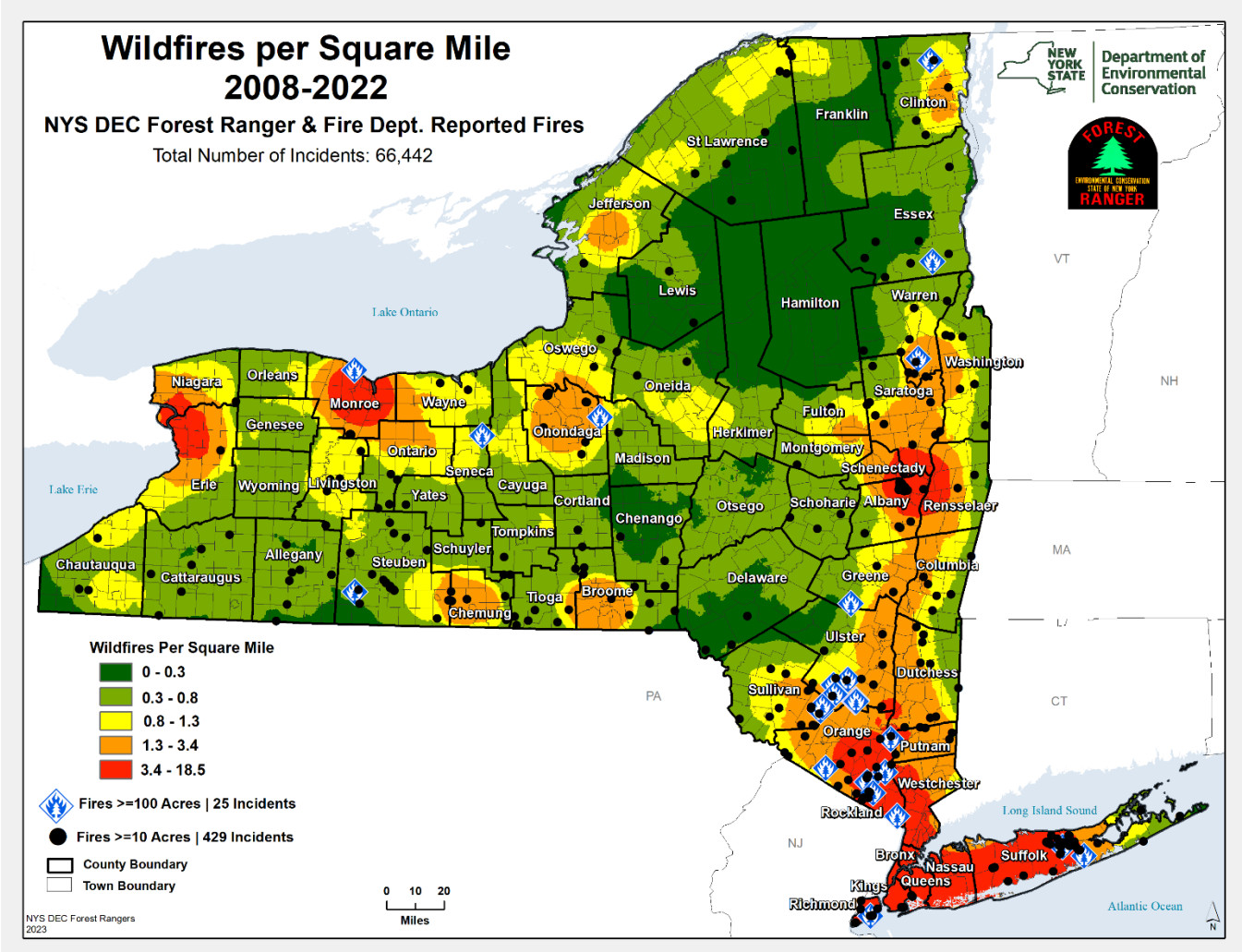
	Sum of Other Structures Lost	Sum of Fatalities	Sum of Injuries	Sum of Acreage	Sum of Homes Lost	Sum of Homes Threatened	Sum of Other Structures Threatened
Bolton	**0**	**0**	**0**	**15.8**	**0**	**0**	**1**
Chester	**0**	**0**	**0**	**62**	**0**	**0**	**0**
Hague	**0**	**0**	**0**	**20**	**0**	**0**	**0**
Horicon	**20**	**0**	**0**	**18.8**	**0**	**0**	**0**
Campfire	**0**	**0**	**0**	**5**	**0**	**0**	**0**
2016	0	0	0	5	0	0	0
Debris Burning	**20**	**0**	**0**	**8.4**	**0**	**0**	**0**
2013	20	0	0	3.4	0	0	0
2016	0	0	0	1	0	0	0
2021	0	0	0	4	0	0	0
Lightning	**0**	**0**	**0**	**0.3**	**0**	**0**	**0**
2010	0	0	0	0.3	0	0	0
Miscellaneous	**0**	**0**	**0**	**2.1**	**0**	**0**	**0**
2011	0	0	0	0.1	0	0	0
2016	0	0	0	2	0	0	0
Smoking	**0**	**0**	**0**	**3**	**0**	**0**	**0**
2010	0	0	0	3	0	0	0
Johnsburg	**0**	**0**	**0**	**9.6**	**0**	**10**	**0**
Lake George	**1**	**0**	**0**	**6.7**	**0**	**0**	**2**
Lake Luzerne	**0**	**0**	**1**	**106.3**	**0**	**0**	**0**
Queensbury	**0**	**0**	**2**	**210.8**	**0**	**2**	**4**
Campfire	**0**	**0**	**0**	**187.5**	**0**	**0**	**0**

	Sum of Other Structures Lost	Sum of Fatalities	Sum of Injuries	Sum of Acreage	Sum of Homes Lost	Sum of Homes Threatened	Sum of Other Structures Threatened
2009	0	0	0	0.8	0	0	0
2010	0	0	0	0.7	0	0	0
2011	0	0	0	2.5	0	0	0
2014	0	0	0	175	0	0	0
2015	0	0	0	0.5	0	0	0
2020	0	0	0	8	0	0	0
Children	**0**	**0**	**2**	**1.8**	**0**	**2**	**3**
2008	0	0	1	1.7	0	1	2
2009	0	0	1	0.1	0	1	1
Debris Burning	**0**	**0**	**0**	**2.3**	**0**	**0**	**0**
2008	0	0	0	2	0	0	0
2017	0	0	0	0.2	0	0	0
2020	0	0	0	0.1	0	0	0
Miscellaneous	**0**	**0**	**0**	**14.8**	**0**	**0**	**1**
2008	0	0	0	9.7	0	0	1
2009	0	0	0	0.5	0	0	0
2012	0	0	0	0.1	0	0	0
2020	0	0	0	4	0	0	0
2021	0	0	0	0.2	0	0	0
2022	0	0	0	0.3	0	0	0
Power line	**0**	**0**	**0**	**1**	**0**	**0**	**0**
2014	0	0	0	1	0	0	0
Smoking	**0**	**0**	**0**	**3.4**	**0**	**0**	**0**
2010	0	0	0	1	0	0	0
2012	0	0	0	2.4	0	0	0
Stony Creek	**0**	**0**	**0**	**6.4**	**0**	**0**	**0**
Thurman	**0**	**0**	**0**	**7.8**	**0**	**1**	**0**
Campfire	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**
2020	0	0	0	0.4	0	0	0
2022	0	0	0	0.1	0	0	0
Debris Burning	**0**	**0**	**0**	**2.1**	**0**	**0**	**0**
2013	0	0	0	2	0	0	0
2017	0	0	0	0.1	0	0	0
Equipment	**0**	**0**	**0**	**3**	**0**	**0**	**0**
2015	0	0	0	1	0	0	0
2020	0	0	0	2	0	0	0

	Sum of Other Structures Lost	Sum of Fatalities	Sum of Injuries	Sum of Acreage	Sum of Homes Lost	Sum of Homes Threatened	Sum of Other Structures Threatened
Miscellaneous	**0**	**0**	**0**	**1.6**	**0**	**1**	**0**
2008	0	0	0	0.1	0	1	0
2019	0	0	0	1.5	0	0	0
Power line	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**
2020	0	0	0	0.1	0	0	0
Railroad	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**
2012	0	0	0	0.5	0	0	0
Warrensburg	**0**	**0**	**0**	**83.1**	**0**	**1**	**0**
Grand Total	**21**	**0**	**3**	**547.3**	**0**	**14**	**7**

Source: NYDEC (2023)

Figure 5.4.9-3. Wildfire Events (2008 – 2022)



Source: NYDEC (2023)

Probability of Future Occurrences

According to the New York State Forest Ranger Division, wildfire occurrence data from 1993 to 2017 have shown that New York State, including Warren County, is susceptible to wildfires. Beginning in 2010, New York State enacted revised open burning regulations that ban brush burning statewide during this time period. Forest ranger data indicate that this new statewide ban resulted in 74 percent fewer wildfires caused by debris burning in upstate New York from 2010 to 2012. Forest ranger and fire department historical fire occurrence data recorded after the new burn ban regulations were enacted in 2010 will serve as a benchmark for analysis of wildfire occurrence (NYS DHSES 2014).

Fire probability depends on local weather conditions, outdoor activities (such as camping, debris burning, and construction) and the degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase the likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase the probability of wildfires by producing fuel in both urban and rural areas. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities (NVRC 2006).

Wildfire experts point to four reasons why wildfire risks are increasing:

- Fuel, in the form of fallen leaves, branches, and plant growth, has accumulated over time on the forest floor. Now, this fuel has the potential to "feed" a wildfire.
- Increasingly hot, dry weather has occurred and will occur within the United States.
- Weather patterns across the country are changing.
- More homes are built within areas of WUI, meaning that homes are built closer to wildland areas where wildfires can occur (NYS DHSES 2011).

Annual small wildfires likely will occur throughout New York State (as the state has regularly undergone in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should reduce the number of devastating fires in the future (NYS DHSES 2011).

Based on historical occurrences, the probability of a wildfire event occurring is considered occasional (between 10 and 100 percent annual chance of occurring). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Projections

Fire potential depends on climate variability, local topography, and human intervention. Climate change can affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create the highest fire risk. With temperatures increasing in New York State, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, the susceptibility of the forest to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

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 heavier precipitation are already being felt in the state. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25 °F per decade. Average annual temperatures are projected to increase across New York State by 2 °F to 3.4 °F by the 2020s, 4.1 °F to 6.8 °F by the 2050s, and 5.3 °F to 10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA 2014). The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase. In contrast, extreme cold events, defined both as the number of days per year with minimum temperature at or below 32 ˚F and those at or below 0 ˚F, are expected to decrease as average temperatures rise (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change, Warren County is part of Region 7 (Indian Lake). In Region 7, it is estimated that temperatures will increase by 4.5°F to 6.4°F by the 2050s and 5.8°F to 10.1°F by the 2080s (baseline of 39.9°F). Average annual temperatures are projected to increase across New York State by 4.1° F to 6.8° F by the 2050s and 5.3° F to 10.1° F by the 2080s with an average rate of warming over the past century of 0.25° F per decade. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Extreme events are also projected to increase, as illustrated in Table 5.4.9-4 below (NYSERDA 2014).

Table 5.4.9-4. Extreme Event Projections for Region 7

Event Type (2050s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	2	3 to 6	10

# Of Heat Waves (0.7 heat waves)	0.2	0.3 to 0.7	1
Duration of Heat Wave (4 days)	3	3 to 4	4
Days below 32 °F (133 days)	131	138 to 154	161
Days over 1" Rainfall (5 days)	7	8 to 9	10
Days over 2" Rainfall (0.6 days)	0.8	0.9 to 1	1

Source: NYSERDA 2014

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New York, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time wildfires can burn in a given year (USDA 2011).

Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture, which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half of the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (Lee 2014). Wildfire incidents are predicted to increase throughout the United States because of climate change, causing at least a doubling of areas burned within the next century (USDA 2011).

Climate change directly and indirectly affects growth and productivity of forests: directly as a result of changes in atmospheric carbon dioxide and climate, and indirectly through complex interactions within forest ecosystems. Climate also affects the frequency and severity of many forest disturbances, such as infestations, invasive species, wildfires, and storm events. As temperatures increase, the suitability of a habitat for specific types of trees changes. There is also evidence that prolonged heat waves are likely to lead to a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. An increase in rain and snow events primes forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The areas of the County located within the WUI have been identified as exposed for the wildfire events. The following text evaluates and estimates the potential impact of wildfire on Warren County, including:

- Impact on Life, Health, and Safety
- Impact on General Building Stock
- Impact on Critical Facilities and Community Lifelines

- Impact on Economy
- Impact on the Environment
- Future Changes That May Impact Vulnerability
- Change of Vulnerability Since the 2017 HMP

Impact on life, Health, and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. Given the immediate response times to reported wildfires, the likelihood of injuries and casualties is minimal. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. Table 5.4.9-5 summarizes the estimated population exposed to the wildfire hazard by jurisdiction.

Based on the analysis, an estimated 29,169 residents (44.4 percent of the County population) are located in the WUI interface hazard area and 25,583 residents (35.9 percent of the County's population) are located in the WUI intermix hazard areas. Overall, the Town of Queensbury has the greatest number of individuals located in the wildfire hazard areas (i.e., 16,087 persons in the WUI interface and 11,291 in the WUI intermix).

Table 5.4.9-5. Estimated Population within the WUI in Warren County

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
Bolton (T)	2,012	442	22.0%	1,269	63.1%
Chester (T)	3,086	433	14.0%	1,997	64.7%
Glens Falls (C)	14,830	7,206	48.6%	103	0.7%
Hague (T)	633	85	13.5%	439	69.4%
Horicon (T)	1,471	93	6.3%	1,235	84.0%
Johnsburg (T)	2,143	261	12.2%	1,221	57.0%
Lake George (T)	2,494	765	30.7%	1,577	63.2%
Lake George (V)	1,008	1,006	99.8%	0	0.0%
Lake Luzerne (T)	3,079	736	23.9%	1,930	62.7%
Queensbury (T)	29,169	16,087	55.2%	11,291	38.7%
Stony Creek (T)	758	6	0.8%	445	58.7%
Thurman (T)	1,095	8	0.7%	657	60.0%
Warrensburg (T)	3,959	2,041	51.6%	1,420	35.9%

Jurisdiction	Total Population (Census Bureau 2020 Decennial)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
Warren County (Total)	**65,737**	**29,169**	**44.4%**	**23,583**	**35.9%**

Source: U.S. Census Bureau 2020; USGS, USDA Forest Service Northern Research Station
Notes: (C) = City, (T) = Town, (V) = Village

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Warren County contains approximately 14,754 people over the age of 65 and 5,151 people below the poverty level (2020 Decennial Census; 2021 5-year ACS). Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating. Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Impact on General Building Stock

The most vulnerable structures to wildfire events are those located within the WUI areas. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, because of the high density of population and structures in these areas. Buildings constructed of wood or vinyl siding are generally more likely to be damaged by the fire hazard than buildings constructed of brick or concrete. The hazard areas were overlaid on the building inventory in the County to estimate the buildings exposed to the wildfire hazard. The replacement cost value of the structures with their center in the hazard area were totaled. Table 5.4.9-5 summarizes the number of buildings exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 35.9 percent of the County's buildings are located in the WUI interface hazard area, and approximately 43.5 percent of the County's buildings are located in the WUI intermix hazard area.

Table 5.4.9-6. Building Stock within the WUI in Warren County

Jurisdiction	Total Number of Buildings	Estimated Building Stock Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Fuel Hazard Areas			
		Number of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of Buildings in the WUI Intermix Wildfire Hazard Area	Percent of Total
Bolton (T)	2,873	663	23.1%	1,754	61.1%
Chester (T)	3,227	450	13.9%	2,031	62.9%
Glens Falls (C)	5,988	2,878	48.1%	38	0.6%
Hague (T)	1,313	184	14.0%	897	68.3%
Horicon (T)	2,188	143	6.5%	1,821	83.2%
Johnsburg (T)	2,625	351	13.4%	1,417	54.0%
Lake George (T)	2,494	778	31.2%	1,535	61.5%
Lake George (V)	609	600	98.5%	0	0.0%
Lake Luzerne (T)	2,173	543	25.0%	1,339	61.6%
Queensbury (T)	12,193	6,499	53.3%	4,641	38.1%
Stony Creek (T)	807	6	0.7%	463	57.4%
Thurman (T)	1,061	7	0.7%	620	58.4%
Warrensburg (T)	2,758	1,386	50.3%	964	35.0%
Warren County (Total)	**40,309**	**14,488**	**35.9%**	**17,520**	**43.5%**

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft; USGS, USDA Forest Service Northern Research Station; RS Means 2022

Notes: (C) = City, (T) = Town, (V) = Village

Impact on Critical Facilities and Community Lifelines

A number of critical facilities are within the wildfire hazard area, and are also vulnerable to the threat of wildfire. Many of these facilities are locations of vulnerable populations (schools and senior facilities) and agencies that respond to wildfire events (fire and police). Table 5.4.9-7 summarizes the number of lifeline facilities within the WUI Interface and Intermix hazard areas in Warren County. Overall, 137 lifeline facilities are located in the wildland-urban interface hazard area and 199 lifeline facilities are located in the wildland-urban intermix hazard area.

Table 5.4.9-7. Lifeline Facilities within the WUI (Intermix or Interface) in Warren County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildland-Urban Interface Wildfire Hazard Area	Number of Lifelines Located in the Wildland-Urban Intermix Wildfire Hazard Area
Communications	16	1	9
Energy	20	4	9
Food, Water, Shelter	163	41	63
Hazardous Materials	46	18	10
Health and Medical	43	18	8
Safety and Security	211	45	71
Transportation	60	10	29

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildland-Urban Interface Wildfire Hazard Area	Number of Lifelines Located in the Wildland-Urban Intermix Wildfire Hazard Area
Warren County (Total)	**559**	**137**	**199**

Source: Warren County, NY 2022; U.S. Census, USGS, USDA Forest Service Northern Research Station

Impact on the Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and decreases in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that provide employees with time off to volunteer to fight these fires.

Table 5.4.9-8 summarizes the estimated building stock inventory exposed by municipality. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate. Approximately 35.4 percent ($8.5 billion) of the County's replacement cost value is located in the WUI interface hazard area, and approximately 36.3 percent ($8.8 billion) of the County's replacement cost value is located in the WUI intermix hazard area.

Table 5.4.9-8. Building Stock Replacement Cost Value within the WUI in Warren County

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Building Stock Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Fuel Hazard Areas			
		Total Replacement Cost of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the WUI Intermix Wildfire Hazard Area	Percent of Total
Bolton (T)	$1,509,046,268	$373,808,209	24.8%	$653,747,425	43.3%
Chester (T)	$1,794,523,301	$222,245,314	12.4%	$970,228,975	54.1%
Glens Falls (C)	$3,728,124,116	$1,836,048,018	49.2%	$8,616,412	0.2%
Hague (T)	$799,210,288	$147,340,812	18.4%	$534,381,487	66.9%
Horicon (T)	$1,022,605,789	$48,706,161	4.8%	$803,539,400	78.6%
Johnsburg (T)	$1,493,856,193	$291,033,361	19.5%	$625,233,008	41.9%
Lake George (T)	$2,168,962,785	$716,671,406	33.0%	$1,224,603,321	56.5%
Lake George (V)	$770,157,514	$725,717,682	94.2%	$0	0.0%
Lake Luzerne (T)	$953,667,917	$244,119,343	25.6%	$493,852,239	51.8%
Queensbury (T)	$7,114,031,584	$3,238,453,339	45.5%	$2,374,480,041	33.4%
Stony Creek (T)	$995,996,331	$1,306,061	0.1%	$474,356,966	47.6%
Thurman (T)	$497,985,792	$3,213,402	0.6%	$256,760,808	51.6%
Warrensburg (T)	$1,425,456,857	$745,076,673	52.3%	$398,848,006	28.0%
Warren County (Total)	$24,273,624,737	$8,593,739,780	35.4%	$8,818,648,087	36.3%

Source: Hazus v5.1; Warren County, NY 2022; CIESIN, NYSERDA, Microsoft; USGS, USDA Forest Service Northern Research Station; RS Means 2022
Notes: (C) = City, (T) = Town, (V) = Village

Impact on the Environment

Wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding caused by the impacts of silt in local watersheds. According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life. Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USGS 2018). Wildfires that impact developed areas can exacerbate consequences on the environment because of the increased amount of chemicals and contaminants that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the stormwater, contaminate nearby streams, and impair aquatic life.

Future Changes That May Impact Vulnerability

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

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

Projected Development

Areas targeted for potential future growth and development within the next five years have been identified across Warren County at the jurisdiction level. Refer to the jurisdictional annexes in Volume II of this HMP. Any new development and new residents within the WUI are expected to be exposed to the wildfire hazard. Refer to the jurisdictional annexes in Volume II of this HMP for maps which include new development project areas and their proximity to the wildland-urban interface/intermix hazard areas.

Projected Changes in Population

Warren County has experienced a slight increase (less than 0.1-percent) in population since 2010 according to the U.S. Census Bureau (U.S. Census Bureau 2020) and is expected to experience a continued decline in the next decade. A stable or decreased population in the WUI in Warren County may not significantly change the County's risk to wildfire events. Refer to section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

According to the USDA Forest Service, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition (US EPA 2020). Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conductive to large, severe fires. Under a changing climate, wildfires exceeding 50,000 acres have increased over the past 30 years (USDA 2012a). Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species, and an increasing WUI.

As discussed earlier, average temperatures are anticipated to increase in New York; therefore, the suitability of habitats for specific types of trees will potentially change, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds may make it harder to contain fires and thus will increase the County's vulnerability to this hazard.

Change of Vulnerability Since the 2017 HMP

Overall, the entire County remains vulnerable to wildfires. While the occurrence of events has historically been low, the vulnerability of Warren County to damages from wildfires remains high due to exposure in the WUI.

SECTION 6. WARREN COUNTY CAPABILITIES AND MITIGATION STRATEGY

6.1 OVERVIEW

This section presents mitigation strategies for Warren County to reduce potential exposure and losses identified as concerns in the Risk Assessment portion of this plan. The Steering Committee reviewed the Risk Assessment to identify and develop these mitigation actions, which are presented herein.

This section includes:

1. Background and Past Mitigation Accomplishments
2. General Mitigation Planning Approach
3. Review and Update of Mitigation Goals and Objectives
4. Capability Assessment
5. Mitigation Strategy Development and Update

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

6.2 BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

In accordance with the requirements of the Disaster Mitigation Act of 2000, detailed on Page 1-1 in Section 1 (Introduction), a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this plan update. Warren County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- The County facilitated the development of the original 2017 "Warren County All Hazards Mitigation Plan Update". The current planning process represents the regulatory five-year plan update process, which includes participation of all municipal governments in the County, along with key county and regional stakeholders.
- All municipalities participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.
- The County has created an app to enable real time reporting of hazard events. This app called ReadyWarrenCountyNY and has been shared on social media including on the County

Facebook and local TV news station. The app provides information regarding hazards, including the location of cooling centers in the County. It also enables the publication of alerts for towns and villages and has the ability to geo-locate users for targeted outreach and messaging as needed. It can be used to support mitigation alerts and is linked to a storm reporter app to report storm observations, hazard areas, and photos. It is anticipated that the data gathered through this app will improve mitigation grant funding applications by providing information to support strong benefit cost analyses.

- The Warren County Soil & Water District consults USGS-maintained stream gauges on the Hudson River and its tributaries at North Creek, Hadley, and Fort Edward; at the tributaries on the Boreas river, the Indian River in Indian Lake, the Sacandaga at Hope and Hadley and the Schroon at Riverbank. Streams that flow to Lake George have had stream gauges and flow data since the 70's during the National Urban Runoff Program study, and by NYSDEC (90's), Darrin Freshwater Institute (2000's) and currently by IBM and RPI (Jefferson Project) in East Brook, West Brook, English Brook, Finkle Brook, Indian Brook, Shelving Rock Brook, Hague Brook and at the outlet of Lake George.
- The County and municipalities have implemented mitigation actions to protect critical facilities and infrastructure throughout the planning area. As an example, the Highway Department maintains a multi-year, rotating program of roadway and culvert (drainage) maintenance and improvements to help mitigate stormwater damage to county roads.
- The County Department of Public Works department has a maintenance program to reduce risk. It involves brushing and tree maintenance, ditching, clearing culvert pipes of debris and replacement and if needed upsizing damaged or deteriorated culvert pipes to a 1-percent change design capacity. Based on the program, a certain number of miles of roadway are checked, determine what work is needed and then perform the work. The average is about 20-30 miles in each shop per year. Areas mitigated include:
    - West Hague Road over Hague Brook (@ Fish and Game)
    - West Hague Road over Hague Brook (@ Macoy Rd.)
    - Moon Hill Road over unnamed stream (replaced round with squash prior to federal aid project)
    - 13th Lake Road (Twin Pipes @ Barton Mines)
    - CR 11 - Horicon Ave.(Bolton) over Finkle Brook
    - Call Street over Bennie Brook
    - Bay Road over Halfway Brook (was triple culverts but DOT considered it a bridge)
    - Bay Road over Glen Lake outlet
    - Warrensburg Road over Number 9 Brook (@ Cameron Road)
- The County awarded ARPA funding to the Warren County Soil & Water Conservation District to purchase and have installed data collection devices on Glen Lake and Lake Sunnyside, the two lakes listed in both the County and Town of Queensbury MS4 programs. Parameters monitored include air temperature, relative humidity, barometric pressure, rainfall, water level,

& water temperature at 15-minute or 30-minute intervals. This data will be publicly accessible through a dashboard.

- The County awarded ARPA funding to Warren County Soil & Water Conservation District to purchase and install a weather monitoring station at the Warren County Soil & Water Conservation District office which is operational.
- Numerous studies have been conducted by Federal, State, County, and local agencies/entities to examine natural hazards affecting Warren County and have been reviewed and incorporated into this plan update as appropriate (see Section 3 and References).
- Municipalities in Warren County have adopted regulatory standards regarding land-use and zoning that provide the communities with greater capability to manage development without increasing hazard risk and vulnerability. Examples of these standards are presented in the Capability Assessment subsection later in this chapter.
- The County has been incorporating flood risk reduction through stormwater management into its infrastructure and building improvement projects.
- Since 2017, the Warren County Planning Department has submitted funding applications and overseen the implementation of critical water quality projects in the Lake George and Schroon Lake watersheds. The county efforts include the Lake George Milfoil and Aquatic Invasive Efforts wherein the Warren County Planning Department provided ongoing administration and oversight of the milfoil eradication grant program in the Lake George Basin. The department developed a custom field data collection interface and online data dashboards so that milfoil harvesters could report their progress in a more accurate and timely manner than ever before. As part of the departments LWRP grant award for milfoil eradication efforts in Lake George, GIS staff met with the Lake George Park Commission, the Fund for Lake George, and the Lake George Association to determine a method for collecting more accurate and spatially located data for the 2021 milfoil harvest. The County GIS department created a field data collection app and trained the harvesters in its use as well as a dashboard that allows agency staff to monitor field data collection real time. The County gathered historic milfoil data and collated it to create a historic milfoil data dashboard. The apps will allow agency staff and the public to view progress from year to year and to more effectively target funding for eradication efforts.
- The County is gathering milfoil data for Brant and Shroon Lakes to support documentation and mitigation efforts.
- In November of 2018, the Warren County Soil and Water Conservation District purchased sandbagger machinery and developed a Memorandum of Agreement to enable community use of the machine to reduce flood losses in areas not protected by mitigation projects or flood reduction infrastructure.
- The County has 9 generators that are ready at any time for deployment via notification to the communications center by a municipality, fire department or individual. These

generators are purchased by grant funds. The County can obtain for additional generators, as needed vie a request to NY Responds.

- The County has experienced several power outages in the winter and early spring and typically works with EMS agencies and Fire Departments to open warming shelters, the warming shelters are listed on our website, social media, National Grid's website and local new stations. To date, the community has not needed to use arming shelter. National Grid maintains a list of critical customers, who they reach out to during a prolonged outage. Our Sheriff's dept will be called upon if NG is not able to contact one of these customers.
- The Warren County Public Health Department regularly participates in many educational events at schools, the mall, and at SUNY Adirondack.

6.3 GENERAL MITIGATION PLANNING APPROACH

The overall approach used to update the County and local hazard mitigation strategies are based on FEMA and NYS regulations and guidance regarding local mitigation plan development, including the following:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Local Mitigation Plan Review Guide*, October 1, 2011.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- FEMA *Mitigation Planning How-To Guide #3, Identifying Mitigation Actions, and Implementing Strategies* (FEMA 386-3), DATE.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.
- NYS DHSES *New York State Hazard Mitigation Planning Standards*, 2022.
- NYS DHSES *New York State Hazard Mitigation Planning Standards Guide*, 2022.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections:

- 6.3 Review and update mitigation goals and objectives.
- 6.4 Identify mitigation capabilities and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- 6.5 Prepare an implementation strategy, including:
  - Identify progress on previous county and local mitigation strategies.
  - Develop updated county and local mitigation strategies.
  - Prioritize projects and initiatives in the updated mitigation strategy.

6.4 REVIEW AND UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents the County's efforts to develop hazard mitigation goals and objectives that are established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.4.1 Mission Statement

The Warren County Hazard Mitigation Plan Steering Committee reviewed the plan Mission Statement to ensure that the guiding principle to describe the overall duty and purpose of the planning process and in accordance with FEMA guidance (386-1), The intent of this statement is to focus the range of goals and objectives identified to support the over-arching purpose of the plan.

As a result of the committee deliberations, the 2023 Warren County Hazard Mitigation updated the Mission Statement to include address equity concerns and to narrow the focus of the planning process to address impacts from natural and human-caused hazard. The mission statement is provided below.

To create communities whose daily activities reflect a comprehensive commitment by government, business, non-profit organizations, socially vulnerable populations, and the public to eliminate or reduce risks and adverse impacts from natural hazards.

6.4.2 Goals and Objectives

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

For the purposes of this plan, goals and objectives are defined as follows:

Goals are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

Objectives are short-term aims, which when combined form a strategy or course of action to meet a goal. Unlike goals, objectives are a stand-alone measurement of the

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.

effectiveness of a mitigation action, rather than as a subset for a goal. The objectives also are used to help establish priorities.

The goals and associated objectives for Warren County and municipalities included in the plan were developed based in part on a review of the hazard mitigation goals and objectives established in the 2019 NYS HMP, the 2017 Warren County HMP, as well as the current or expired municipal hazard mitigation plans within the county. Further, these goals were selected to be compatible with the needs and goals expressed in other available County and local community planning documents. Achievement of these goals helps to define the effectiveness of a mitigation strategy.

Table 6-1 presents the updated hazard mitigation planning goals and objectives established for this plan update. Bold font indicates additions or edits to the previous goals and objectives.

Table 6-1. Warren County Hazard Mitigation Plan Goals and Objectives

Goal	Objective
Goal 1: Protect Life and Property	1.1: Introduce mitigation **and adaptation** activities that will make homes, businesses and critical facilities and infrastructure more hazard resistant **and to increase resilience**.
	1.2: In areas vulnerable to hazards, encourage businesses and homeowners to take preventive actions when possible **and in an equitable manner**.
	1.3: Periodically review existing building codes, safety procedures, municipal and county ordinances to update recent standards for building protection.
	1.4: Immediately enforce existing building codes, **zoning ordinances, and floodplain development review and permitting** within the jurisdictions.
	1.5: Encourage owners of home and businesses and renters to purchase appropriate insurance coverage for potential damages from hazards.
Goal 2: Increase Public Awareness	2.1: Continue developing and integrating education and outreach programs in an effort to enhance public awareness of the hazards, and **availability of** information on specific activities for individuals in anticipation of a hazard event .
	2.2: Provide information on current government programs and funding resources to assist with mitigation **and resilience**.
	2.3: Strengthen communication and cooperation between public agencies, citizens, non-profit groups, and businesses to implement mitigation activities effectively.
Goal 3: Provide for Emergency Services	3.1: Coordinate hazard mitigation activities with existing local emergency plans.
	3.2: Identify and plan for acquiring any specific emergency services and equipment needed to improve response capabilities for specific hazards.
	3.3: Review emergency traffic routes, making changes as needed, and educating the public as to the routes **including use of mass notification systems and real-time storm and problem area reporting.**

Goal	Objective
Goal 4: Support comprehensive county and local mitigation through the integration of hazard mitigation planning into related state, regional, county and local plans and programs.	4.1: Promote land use planning to encourage resilient and sustainable efforts throughout statewide and regional programs that address zoning, building codes, capital improvement programs, open space preservation, nature-based solutions, and storm water management regulations. **Encourage integration of mitigation via review and update of local planning documents to be consistent with and relevant to the Hazard Mitigation Plan.**
	4.2: Continue to participate in state, regional and local programs and efforts that focus on practices that support or enhance resiliency.
	4.3: Improve hazard data through participation in studies, research, and mapping to enhance information related to the impacts of hazards and related risks, vulnerability, and losses.
Goal 5: Encourage the development and implementation of long-term, cost-effective, and resilient mitigation projects to preserve or restore the functions of natural systems.	5.1: Encourage the use of green and natural infrastructure, **low impact development, and** nature-based solutions.
	5.2: Provide technical assistance to communities and stakeholders in the application and implementation of mitigation projects that preserve or restore natural systems.
	5.3: Maintain and encourage ongoing relationships between state agencies and partners to play an active and vital role in preservation and restoration of vulnerable natural systems.
	5.4: Promote climate change adaption strategies that protect against long-term effects on the environment **and incorporate into a county-wide climate action plan.**
Goal 6: Address Long-Term Vulnerabilities from High Hazard Dams	**6.1: Ensure dam infrastructure is maintained**
	6.2: Ensure Emergency Action Plans are developed and updated
	6.3: Support the identification and access to funding to repair/replace dams

6.5 CAPABILITY ASSESSMENT

According to FEMA's *Mitigation Planning How-To Guide #3*, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation (FEMA 2013).

During the original planning process, the County and participating municipalities identified and assessed their capabilities in the areas of existing programs, policies, and technical documents. By completing this assessment, each jurisdiction learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions;

- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions;
- Action is currently outside the scope of capabilities;
- Types of mitigation actions that may be technically, legally (regulatory) administratively, politically, or fiscally challenging or infeasible;
- Opportunities to enhance local capabilities to support long term mitigation and risk reduction.

During the plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation, and identifying opportunities to enhance local capabilities.

County and municipal capabilities in the Planning and Regulatory, Administrative and Technical, and Fiscal arenas can be found in the Capability Assessment section of each jurisdictional annex in Section 9 (Jurisdictional Annexes). Within each annex, participating jurisdictions identified integration of hazard risk management into their existing planning, regulatory, and operational/administrative framework ("integration capabilities") and intended integration promotion (*integration actions*). A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 (Plan Maintenance).

A summary of the various federal, state, county, and local planning, and regulatory, administrative, and technical, and fiscal programs available to promote and support mitigation and risk reduction in Warren County are presented below.

6.5.1 Planning and Regulatory Capabilities - County and Local

Municipal Land Use Planning and Regulatory Authority

The County and municipalities have various land use planning mechanisms that can be leveraged to mitigate flooding and support natural hazard risk reduction. Specific County and local planning and regulatory capabilities are identified in their jurisdictional annexes in Section 9.

The Warren County Department of Planning and Community Development (WCDPCD) does not have any, or implement any, County-level land use plans. The County Planning Department does fulfil the General Municipal Law 239 review for Sections 239-l and 239-m of the law. The County does not review subdivisions as identified under Section 239-n of the law. With the exception of Thurman and Stony Creek, all municipalities within the County have some form of local land use regulations.

Adirondack Park Agency

The Adirondack Park ("Park") was created in 1892 by the State of New York amid concerns for the water and timber resources of the region. The boundary of the Park encompasses approximately 6 million acres,44.6 percent of which belongs to all the people of New York State as constitutionally protected "forever wild" forest preserve. The private lands within the 101 towns and villages include residential neighborhoods, commercial centers, farms, working forests, and camps comprise 49.4 percent, and the remaining 6 percent is water bodies.

The Adirondack Park Agency (APA) is a New York State government agency, consisting of 54 staff and an eleven-member board. In 1971 the APA was created by the State Legislature to develop long-range public and private land use plans for the largest park in the continental United States. The Agency prepared the State Land Master Plan, which was signed into law in 1972, followed by the Adirondack Park Land Use and Development Plan ("APLUDP") in 1973. The Agency strives to conserve the Park's natural resources and ensure that development is well-planned through administration of the Adirondack Park Agency Act (which includes the APLUDP), the New York State Freshwater Wetlands Act, and the New York State Wild, Scenic and Recreational Rivers System Act.

Town of Bolton, Town of Lake George, Lake George Village, Town of Hague, Town of Horicon, Town of Johnsburg, and the Town of Queensbury are communities in Warren County with Agency approved local land use programs. Within the Park, certain activities require a permit from the Agency under the Adirondack Park Agency Act; the Wild, Scenic and Recreational Rivers System Act; and the Freshwater Wetlands Act. For each of these laws, the permitting review criteria involves an analysis of potential impacts from the proposed activity on the natural, scenic, aesthetic, ecological, wildlife, historic, recreational, open space, and other resources of the Park, in addition to other standards. (Adirondack Park Agency unknown)

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).

All of municipalities in Warren County actively participate in the NFIP. As of January 2023, there were 173 NFIP policyholders in Warren County[1]. There have been 74 claims made to date, totaling approximately $1.8 million for damages to structures and contents. There are 7 NFIP Repetitive Loss (RL) properties, properties in the County[2]. Further details on the flood vulnerability within the County may be found in the flood hazard profile (Section 5.4.3).

Municipal participation in and compliance with the NFIP is supported at the federal level by FEMA Region II and the Insurance Services Organization (ISO), at the state-level by the New York State Department of Environmental Conservation (NYSDEC) and New York State Office of Emergency Management (NYS DHSES). Additional information on the NFIP program and its implementation throughout the county may be found in the flood hazard profile (Section 5).

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

Freeboard: By law, NYS requires Base Flood Elevation plus 2 feet (BFE+2) for all single- and two-family residential construction, and BFE+1 for all other types of construction. Communities may go beyond this requirement, providing for additional freeboard or requiring BFE+2 for all types of construction. Warren municipalities have supported property owners meeting and exceeding freeboard requirements through the site plan review and zoning board of approvals process; for instance, allowing overall structure heights to be determined from BFE+2 rather than grade within NFIP floodplains per NYS Uniform Code.

Cumulative Substantial Improvements/Damages: The NFIP allows improvements valued at up to 50% of the building's pre-improvement value to be permitted without meeting the flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

[1] As per HUDEX data extracted on 1/26/2023
[2] Per FEMA, 5/2023

NFIP Community Rating System (CRS)

As an additional component of the NFIP, the Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance (FEMA, 2012). Municipalities and the county as a whole could expect significant cost savings on premiums if enrolled in the CRS program.

Currently no communities in Warren County participate in the CRS program.

While communities within Warren County are aware of the benefits of participating in the CRS, the burden of administrating the program to obtain significant saving for NFIP insured property owners is a barrier to participation. To support improved floodplain management, the Warren County Soil & Water Conservation District (SWCD) will strive to provide continuing education to communicate the benefits of participation. As an alternative to participation in the program the SWCD will strive to develop a manual of best practices as an ongoing resource for local floodplain administrators to enable the implementation of practices to reduce flood impacts across the County.

Flood events comprise 90% of the damages to declared disasters in the United States (Insurance Information Institute, n.d.). Due to differing floodplain extents within their boundaries, communities in Warren County have varying degrees of vulnerability to flood events. Strong floodplain management can reduce or eliminate the impacts of flooding, which causes health, safety and economic impacts to residents, businesses, and visitors in the County.

However, CRS participation may not be appropriate for all communities, so each must evaluate the cost of staff time for administration versus the benefits of joining the program. Participation in the CRS is based on documented, programmatic activities, and therefore requires significant staff support to join and sustain required administration and activities. Participating communities must complete a full verification every five years thereafter. If a community cannot demonstrate that it continues to implement credited program activities and mandatory requirements, then it will no longer be eligible for NFIP premium discounts. Based on review of communities participating across the country and depending on the level of participation/class of a community, it is estimated that it requires approximately five hours a week to operate a community CRS program. This level of effort is inclusive of responding to resident inquiries, outreach, maintenance of records and data, and annual and cycle reporting.

The intent of this document would be to provide a primer to Warren County communities that are interested in reducing the risk of flood and associated physical and economic impacts of flooding.

Local Waterfront Revitalization Program

The Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) on a voluntary basis by preparing and adopting a Local Waterfront Revitalization Program (LWRP), providing more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review. The Town of Bolton is the one community within Warren County with a municipal LWRP. The towns of Lake Luzerne, Stony Creek, Thurman, Warrensburg, Johnsburg, Chester and Horicon have developed the First Wilderness multijurisdictional LWRP.

When an LWRP is approved by the New York State Secretary of State, State agency actions are required to be consistent with the approved LWRP to the maximum extent practicable. When the federal government concurs with the incorporation of an LWRP into the CMP, federal agency actions must be consistent with the approved addition to the CMP. Title 19 of NYCRR Part 600, 601, 602, and 603 provide the rules and regulations that implement each of the provisions of the Waterfront Revitalization of Coastal Areas and Inland Waterways Act including but not limited to the required content of an LWRP, the processes of review and approval of an LWRP, and LWRP amendments.

The Local Waterfront Revitalization Program (LWRP) serves as the Office of Planning and Development's primary program for working in partnership with waterfront communities across the State to address local and regional (coastal or inland) waterway issues, improve water quality and natural areas, guide development to areas with adequate infrastructure and services away from sensitive resources, promote public waterfront access, and provide for redevelopment of underutilized waterfronts.

A Local Waterfront Revitalization Program consists of a planning document prepared by a community, and the program established to implement the plan. An LWRP may be comprehensive and address all issues that affect a community's entire waterfront, or it may address the most critical issues facing a significant portion of its waterfront.

An LWRP follows a step-by-step process by which a community can advance community planning from a vision to implementation, which is described in the Making the Most of Your Waterfront Guidebook developed by the Department of State. Additionally, the Opportunities Waiting to Happen Guidebook, developed by the Department of State, provides help to assist all New Yorkers to redevelop abandoned buildings as part of the overall vision for their community.

In addition to landward development, water uses are subject to an ever-increasing array of use conflicts. These include conflicts between passive and active types of recreation, between commercial and recreational uses, and between all uses and the natural resources of a harbor. Increases in recreational boating, changes in waterfront uses, coastal hazards what to do with dredged materials, competition for space, climate change, and multiple regulating authorities, all

make effective harbor management complex. These conflicts and a lack of clear authority to solve them have resulted in degraded natural and cultural characteristics of many harbors, and their ability to support a range of appropriate uses. As part of an LWRP, a harbor management plan can be used to analyze and resolve these conflicts and issues.

An approved LWRP reflects community consensus and provides a clear direction for appropriate future development. It establishes a long-term partnership among local government, community-based organizations, and the State. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State Environmental Protection Fund Local Waterfront Revitalization Program (EPF LWRP) among other sources.

In addition, State permitting, funding, and direct actions must be consistent, to the maximum extent practicable, with an approved LWRP. Within the federally defined coastal area, federal agency activities are also required to be consistent with an approved LWRP. This "consistency" provision is a strong tool that helps ensure all government levels work in unison to build a stronger economy and a healthier environment.

Warren County Comprehensive Emergency Management Plan

This Plan results from the recognition on the part of Warren County government and New York State officials that a comprehensive plan is needed to enhance this County's ability to manage the range of emergency/disaster situations to which we are exposed. It was prepared by County officials working as a team in a planning process recommended by the New York State Office of Emergency Management (NYSOEM). This Plan constitutes an integral part of a statewide emergency management program and contributes to its effectiveness. Authority to undertake this effort is provided by both Article 2-B of State Executive Law and the New York State Defense Emergency Act.

The development process of this Plan included an analysis of potential hazards that could affect the County and an assessment of the capabilities existing in the County to manage potential hazards.

Preparing for and responding to disasters is an ongoing and complex undertaking. Through implementation of Risk Reduction measures before a disaster or emergency occurs; Preparedness efforts to include planning, training and exercises; timely and effective Response during an actual occurrence; and provision of both short- and long-term Recovery assistance after the occurrence of a disaster, lives can be saved, and property damage minimized. This process is called Comprehensive Emergency Management to emphasize the interrelationship of activities, functions, and expertise necessary to deal with emergencies.

This comprehensive plan is organized according to the recognized methodology of emergency management. It is organized according to the necessary "all hazard" response functions needed to

respond to any disaster. Accordingly, this plan addresses the four basic principles which include: mitigation, preparedness, response, and recovery operations.

The 2023 Comprehensive Emergency Management Plan addresses multiple hazards of concern as well as hazard mitigation planning. It includes integration recommendations with hazard mitigation plan through existing programs and supported by the Warren County Soil and Water Conservation District.

6.5.2 Planning and Regulatory Capabilities – State and Federal

New York State Floodplain Management

There are two departments that have statutory authorities and programs that affect floodplain management at the local jurisdiction level in New York State: the New York State Department of Environmental Conservation (NYSDEC) and the Department of State's Division of Code Enforcement and Administration (DCEA).

In 1992, the New York State Legislature amended an existing law, finding that "it is in the interests of the people of this state to provide for participation" in the NFIP (New York Laws, Environmental Conservation, Article 36). Although the Legislature recognized that "land use regulation is principally a matter of local concern" and that local governments "have the principal responsibility for enacting appropriate land use regulations," the law requires all local governments with land use restrictions over SFHAs to comply with all NFIP requirements. The law clearly advises local governments that failure to qualify for the NFIP may result in sanctions under Federal law and specifies that the State "will cooperate with the federal government in the enforcement of these sanctions."

The 1992 law that provides for local government participation in the NFIP also requires state agencies to "take affirmative action to minimize flood hazards and losses in connection with state-owned and state-financed buildings, roads and other facilities, the disposition of state land and properties, the administration of state and state-assisted planning programs, and the preparation and administration of state building, sanitary and other pertinent codes." In particular, the commissioner of the NYSDEC is to assist state agencies in several respects, including reviewing potential flood hazards at proposed construction sites.

The NYSDEC is charged with conserving, improving, and protecting the state's natural resources and environment, and preventing, abating, and controlling water, land, and air pollution. Programs that have bearing on floodplain management are managed by the Bureau of Flood Protection and Dam Safety, which cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion, and dam failures. These objectives are accomplished through floodplain management and both structural and nonstructural means.

The Coastal Management Section works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and nonstructural means. The Dam Safety Section is responsible for "reviewing repairs and modifications to dams and assuring [sic] that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning." The Flood Control Projects Section is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

The Floodplain Management Section is responsible for reducing flood risk to life and property through management of activities, such as development in flood hazard areas, and for reviewing and developing revised flood maps. The Section serves as the NFIP State Coordinating Agency and in this capacity is the liaison between FEMA and New York communities that elect to participate in the NFIP. The Section provides a wide range of technical assistance.

6.5.3 Administrative and Technical Capabilities - County and Local

Warren County Soil & Water Conservation District (WC SWCD)

The District's mission is to implement projects and programs to improve and protect the lakes, streams, and other natural resources of Warren County. The SWCD was created in 1956 to develop and carry out a program of soil, water and related natural resource conservation by providing technical assistance and programs to residents, landowners and units of government. Environmental planners and other WCDP staff provide support to the seven-member citizen Board of Directors. The SWCD has developed a program with a distinct urban/suburban conservation orientation and considers a wide range of soil and water resources conservation concerns.

Mitigation related services provided include:

- Technical assistance and site reviews for private and public properties that may include assistance with, but not limited to – erosion and sediment control, habitat improvement, stormwater, forestry, drainage, regulatory permits.
- Water/stormwater management though general assistance and grant programs
- Stream crossing assistance for proper permit requirements
- Agricultural assessments
- Soil survey interpretation and WebSoil survey assistance
- Pond site investigations
- Educational information and outreach on conservation and water quality
- Provide low-cost seedlings for the conservation purposes
- Organize and host the Warren County Envirothon
- The District instructs on the NYSDEC 4 Hour Contractor's Training for Erosion and Sediment Control

- The District instructs on the NYS Post-Flood Stream Intervention program
- The SWCD Manager is the current Hazard Mitigation Coordinator and MS4 Stormwater Management officer for Warren County.

The District assists both public and private landowners with identifying and addressing Hazard Mitigation issues through their conservation assistance programs and Hazard Mitigation Coordinator. The District has directly assisted communities with hazard mitigation through grants to reduce soil migration, stream corridor improvements and stormwater runoff reduction. In addition the District has assisted communities through the initial application of Letters of Intent for FEMA grant programs.

The District does not have a specific budget item for hazard mitigation projects. Projects that fall under the hazard mitigation umbrella have been funded from current natural resource grants that have been awarded to the SWCD and which are justifiable expenses from the grant requirements.

Warren County Office of Emergency Services (WC OES)

The Warren County OES manages and administrates a program of quality training for Fire and EMS agencies in accordance with State and Federal guidelines, manages an advanced life support system, maintains a stockpile of emergency supplies and equipment as may be required and oversees a variety of special response teams – who are prepared and equipped to respond to any situation of event.

The OES subcontracts with the Glens Fall Fire Department for hazardous material spill response.

Specific emergency management activities includes, but is not limited to:

- Emergency Planning - The OES plans for all large-scale emergencies within the County, such as snowstorms, floods, hurricanes, tornadoes, hazardous material incidents, and public health emergencies.
- Emergency Operations Center Activation – OES is responsible for activation and operation of the County Emergency Operations Center for long-term, large-scale emergencies to manage the emergency through coordination, communication and sharing of resources, all through the National Incident Management System.
- Presidential Disaster Declaration – The OES gathers documentation for submission to federal and state governments for monetary disaster relief.
- Weather Alerts for Schools and Public Officials – The OES relays severe weather alerts to The Queensbury school campus and notifies various county agencies, local governments and private organizations during other watches and warnings. Warren County is recognized as a NOAA StormReady County in 2022.

- Radio Amateur Civil Emergency Services (RACES) – The OES has a robust group of RACES volunteers that regularly meet, train and exercise.
- Dam Safety – The OES works with local dam owners to ensure dam safety and ensures the availability of copies of the Emergency Action Plans for all high hazard dams in Warren County.

Warren County Department of Planning and Community Development (WCDPCD)

The WCDPCD provides the following services:

General Planning:

- Providing 239-m planning board reviews as required by general municipal law.
- Providing technical services to local planning and zoning boards for matters related to community master plans, zoning ordinances and related land use regulations.
- Design and implementation of planning and economic development initiatives involving multiple county communities.
- Providing planning review and technical support for the Adirondack/Glens Falls Transportation Advisory Council and Policy Committee.

Community Development:

- Proposal development and funding requests for federal and state programs relating to housing, community facilities, and economic development projects and programs.
- Administration and management of programs that improve or develop public facilities within local communities.
- Special project planning and development as identified by the Warren County Board of Supervisors
- Project Coordination for the First Wilderness Heritage Corridor.
- Development and management of a county-wide "Main Street Program" consistent with the program objectives initiated by the National Trust for Historic Preservation.

Geographic Information Systems:

- Administration of the County's spatial data and "circuit rider" assistance to local communities that utilize geospatial technology.
- Management of the County's online mapping system
- E-911 Coordination, providing physical addresses and maintaining road information for emergency dispatch.
- Assistance to County Department managers with utilizing digital files and for project specific applications.

Warren County GIS is comprised of two full-time and one part-time staff, responsible for maintaining the County's GIS data sets and online GIS presence, including the Community Map, Imagemate Online, the Recreation Mapper and several other widely used applications. In addition, GIS staff has responsibility for assigning e-911 addresses and updating and maintaining the address point, road centerline, and district boundary data used in the County's e-911 Call Center, as well as in other applications. GIS staff also collate and provide demographic data on request in support of numerous projects and agencies.

Routine GIS maintenance of basemap data and applications accounts for approximately a quarter to a third of staff GIS time, with the remaining time spent in support of Planning Department projects and projects for other departments and agencies. Over the course of 2021, Warren County GIS provided assistance to Board of Elections, Building Code Enforcement, the County Administrator's office, DPW, Parks and Recreation, Emergency Services, Public Health, the Historian, Soil and Water, the Sheriff's Office, Tourism, and the Treasurer's office, as well as the towns and and the City of Glens Falls. In addition, Warren County GIS has contracts to provide technical support and mapping assistance to the Adirondack/Glens Falls Transportation Council, the Lake Champlain/Lake George Regional Planning Board, and the Lake George Park Commission. Providing analysis, custom mapping, and data development services.

Warren County Department of Public Works (WCDPW)

WCDPW responsibilities include overseeing all County highway and bridge construction, maintenance of all road machinery and snow removal as well as managing the following seven divisions: Floyd Bennett Memorial Airport, Sewer Administration, Parks & Recreation, Recycling, Highway & Traffic, Engineering, and Buildings and Grounds. The Department works closely with the town highway superintendents.

Warren County Health Services

The Goals of the Warren County Public Health are:

- Prevent epidemics and the spread of disease
- Protect against environmental hazards
- Prevent injuries
- Promote and encourage healthy behaviors
- Respond to disasters and assist communities in recovery
- Assure the quality and accessibility of Health Services

Warren County Fire Prevention and Building Codes Enforcement Department

The Warren County Fire Prevention and Building Codes Enforcement Department is responsible for the enforcement and administration of the New York State Uniform Code and the Energy Conservation Construction Code in Warren County (except in the Town of Queensbury and City of Glens Falls).

Duties and responsibilities include:

- Issuance of Building Permits (including manufactured homes)
- Issuance of Solid Fuel Burning Device Permits (woodstoves, fireplaces and pellet stoves)
- Issuance of Demolition Permits
- Conducting Plan Reviews for Code Compliance
- Conducting construction inspections
- Issuing Certificates of Occupancy, Completion, Compliance and Operating Permits
- Conducting Fire Safety Inspections
- Inspection of structures following fire or explosion
- Responding to fire safety and life safety complaints

While local floodplain management is the responsibility of local governments, the Warren County Fire Prevention and Building Codes Enforcement Department is responsible for building code reviews in compliance with the NYS Uniform Code for communities in the county with the exception of the Town of Queensbury and City of Glens Falls. Upon receipt of a signed zoning compliance certificate, as applicable, the county performs the code review. For the Town of Thurman, FIRM review is performed in the absence of zoning regulations.

Adirondack Glens Falls Transportation Council

The Adirondack Glens Falls Transportation Council consists of two principal working groups, the Planning Committee, and the Policy Committee. The Policy Committee members include the Chairs of the Board of Supervisors of Saratoga, Warren and Washington Counties, the Mayors of the City of Glens Falls and the Villages of South Glens Falls, Fort Edward, Lake George and Hudson Falls, Supervisors of the Towns of Moreau, Queensbury, Lake George, Fort Edward and Kingsbury, the Chair of the Lake Champlain / Lake George Regional Planning Board, and representatives of the New York State Department of Transportation and the New York State Thruway Authority. Additionally, one rural area Town Supervisor from each of Warren and Washington Counties is appointed to the committee. The Federal Highway Administration and Federal Transit Administration serve as advisory members. This Policy Committee is responsible for reviewing and approving all planning activities undertaken by A/GFTC and its staff, as well as the MPO Core Documents,

Adirondack Glens Falls Transportation Council can work with interested municipalities to identify and quantify transportation infrastructure, including bridges and culverts, that may be vulnerable to severe weather events related to climate change, and develop strategies to assist municipalities in pursuing related improvements. It can also provide access to transportation planning and engineering consultants for eligible municipal transportation projects and proposals at no cash expense to the municipality. Under this program, contracts with consultants (retained and reimbursed by A/GFTC) cannot exceed $20,000. This program has been used to fund a wide variety of types of projects, from intersection safety evaluations to concepts for pedestrian infrastructure. If you would like more information on this program, contact us at info@agftc.org.

6.5.4 Administrative and Technical Capabilities - State and Federal

New York State Division of Homeland Security and Emergency Services (NYS DHSES)

For more than 50 years, NYS DHSES (formerly New York State Office of Emergency Management – NYS DHSES) and its predecessor agencies have been responsible for coordinating the activities of all State agencies to protect New York's communities, the State's economic well-being, and the environment from natural and man-made disasters and emergencies. NYS DHSES routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance.

NYS DHSES administers the FEMA mitigation grant programs in the state and supports local mitigation planning in addition to developing and routinely updating the State Hazard Mitigation Plan. NYS DHSES prepared the current State Hazard Mitigation Plan working with input from other State agencies, authorities, and organizations. It was approved by FEMA in 2019 and it keeps New York eligible for recovery assistance in all Public Assistance Categories A through G, and Hazard Mitigation assistance in each of the Unified Hazard Mitigation Assistance Program's five grant programs. The 2019 New York State HMP was used as guidance in completing the Warren County HMP Update.

New York State Department of Environmental Conservation (NYSDEC) – Division of Water - Bureau of Flood Protection and Dam Safety

Within the NYSDEC – Division of Water, the Bureau of Flood Protection and Dam Safety cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion and dam failures through floodplain management and both structural and non-structural means; and provides support for information technology needs in the Division. The Bureau consists of the following Sections:

- Coastal Management: Works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and non-structural means.

- Dam Safety: Is responsible for reviewing repairs and modifications to dams and assuring that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning.
- Flood Control Projects: Is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.
- Floodplain Management: Is responsible for reducing flood risk to life and property through proper management of activities including, development in flood hazard areas and review and development of revised flood maps.

Grant funding is available to assist eligible dam owners with infrastructure repair costs. Funding is provided through the Federal Emergency Management Agency's (FEMA) High Hazard Potential Dam grant program. DEC accepts applications for grants to assist with technical, planning, design, and other pre-construction activities associated with the rehabilitation of eligible dams classified as High Hazard dams.

Department of State's Division of Building Codes and Standards

Technical Bulletins for the 2020 Codes of New York State

The Division of Building Codes and Standards (DBSC) publishes 14 technical bulletins including two recent bulletins with guidance related to flood hazard areas: Electrical Systems and Equipment in Flood-damaged Structures and Accessory Structures. One archived bulletin from October 31, 2017, Flood Venting in Foundations and Enclosures Below Design Flood Elevation, t provides clarification on the requirements for flood vents in foundations and enclosures located below the design flood elevation and in flood hazard areas.

Forms and Publications

The Department of State Division of Building Standards and Codes (DBSC) in conjunction with the Division of Homeland Security & Emergency Services – Office of Fire Prevention and Control (OFPC) has implemented a joint outreach program that is intended to guide and educate code users. The program will provide concise, easily digestible information on:

- New topics that code users must be aware of;
- Frequently overlooked or misunderstood code requirements; and
- Concerns relating to the administration and enforcement of the Uniform Code and Energy Code.

The DBSC and OFPC hope the program will continue to foster professional growth and support the efforts of the code enforcement community and provide helpful guidance to all code users.

The Code Outreach Program publications are expected to be distributed at the beginning of every month. If you have ideas for future topics to be addressed by the Code Outreach Program, email Cop.Codes@dos.ny.gov.

The DBSC posts several model reporting forms and related publications on its web page. The Building Permit Application requests the applicant to indicate whether the site is or is not in a floodplain and advises checking with town clerks or NYSDEC. The General Residential Code Plan Review form includes a reminder to "add 2' freeboard." Sample Flood Hazard Area Review Forms, including plan review checklists and inspection checklists for Zone A and Zone V, are based on the forms in Reducing Flood Losses through the International Code Series published by International Code Council and FEMA (2008).

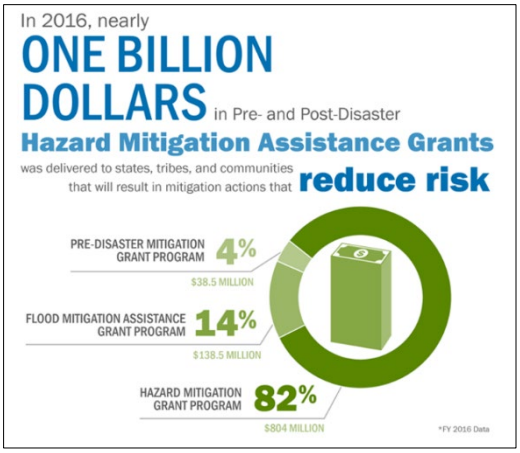
6.5.5 Fiscal Capabilities – County and Local

Municipal Fiscal Capabilities

Warren County municipalities are able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and through a variety of federal and state loan and grant programs. Many municipalities noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints and tax caps. In an effort to overcome these fiscal challenges, municipalities have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and inter-municipal cooperation are beneficial in obtaining grants.

Fiscal Capabilities – State and Federal

Federal Hazard Mitigation Funding Opportunities



Source: FEMA, 2018

The *NYS Capabilities* section of the 2019 New York State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to find mitigation actions. A list of funding opportunities can be accessed here: https://mitigateny.availabs.org/strategies/funding

As noted on the FEMA hazard mitigation assistance website (https://www.fema.gov/hazard-mitigation-assistance), FEMA administers five programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The programs are the Hazard Mitigation Grant Program (HMGP), and the HMGP

Post Fire Grant, the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the new Building Resilient Infrastructure & Communities (BRIC) Program.

HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. PDM provides funds for hazard mitigation planning and projects on an annual basis. FMA provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis. BRIC supports jurisdictions in hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program will replace the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency (FEMA 2020).

HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. PDM and FMA funding depends on the amount congress appropriates each year for those programs. BRIC is funded by a 6% ($500 million) set-aside from federal post-disaster grant funding.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2020).

Table 6-2 provides an overview of program funding eligibility and cost share.

Table 6-2. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP	75 / 25
FMA – insured properties and planning grants	75 / 25
FMA – repetitive loss property(2)	90 / 10
FMA – severe repetitive loss property(2)	100 / 0
BRIC (3)	75 / 25
BRIC – subrecipient is small and impoverished community (3)	90 / 10

Source: FEMA HMA Guidance 2015; Regulations.gov; FEMA 2020

(1) Sub applicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

(2) To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

(3) The proposed BRIC program is in the public comment period as of May 2020 and is expected to have an open grant period and be finalized by the Fall of 2020.

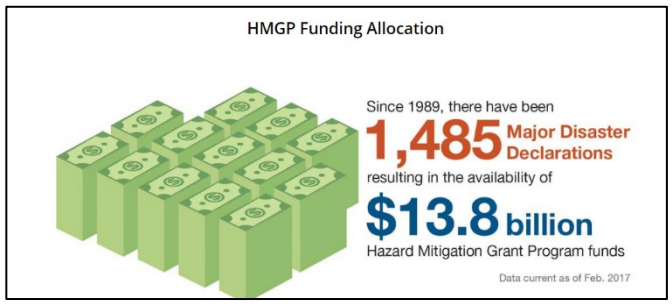
Federal Hazard Mitigation Funding Opportunities

Federal mitigation grant funding is available to all communities with a current HMP (this plan); however most of these grants require a "local share" in the range of 10-25 percent of the total grant amount. Details about grant programs and further descriptions of these opportunities can be found at: https://www.fema.gov/hazard-mitigation-assistance. The FEMA mitigation grant programs are described below.

Hazard Mitigation Grant Program (HMGP)

The HMGP is a post-disaster mitigation program. FEMA makes these grants available to states by after each federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures and can be used to fund cost-effective projects that will protect public or private property or that will reduce the likely damage from future disasters in an area covered by a federal disaster declaration. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing, or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved HMP (this plan).

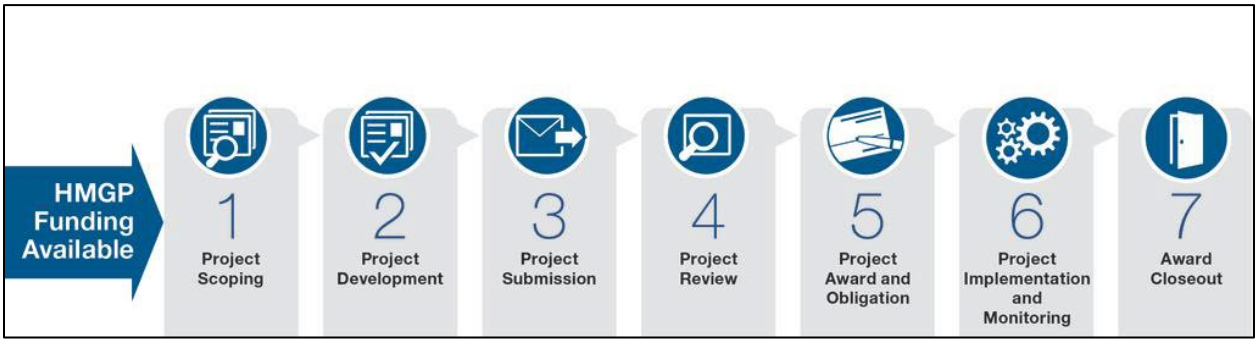
Figure 6-1. FEMA HMGP Funding Allocation



Source: FEMA 2018

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to NYS DHSES, placed in rank order for available funding, and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and could be considered as additional HMGP funding becomes available. Additional information regarding the HMGP is available on the FEMA website: https://www.fema.gov/hazard-mitigation-grant-program.

Figure 6-2. FEMA HMGP Applicant/Sub applicant Process



Source: FEMA 2018

Flood Mitigation Assistance (FMA) Program

The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. For the nom-federal share, at most 25 percent of the total eligible costs must be provided by a non-federal source; of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. The NYS DHSES serves as the grantee and program administrator for the FMA program.

The FMA program is detailed on the FEMA website: https://www.fema.gov/flood-mitigation-assistance-grant-program

Building Resilient Infrastructure and Communities (BRIC) Program

Building Resilient Infrastructure and Communities (BRIC) will support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program.

The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

For additional information regarding the BRIC program, please refer to: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities.

Rehabilitation of High Hazard Potential Dams (HHPD) Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

The HHPD Grant Program will provide assistance for technical, planning, design, and construction activities toward:

- Repair
- Removal
- Structural/nonstructural rehabilitation of eligible high hazard potential dams

For additional information regarding the HHPD program, please refer to: https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources.

Extraordinary Circumstances

For FMA project subawards, the FEMA Region might apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP, BRIC, and FMA, extraordinary circumstances exist when a determination is made by the applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the State (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for BRIC and FMA the region must coordinate and seek concurrence prior to granting an exception. The criteria are as follows:

- The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2 of HMA Unified Guidance).
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.

- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federally-recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or tribal mitigation plan.

For HMGP, BRIC, and FMA, the applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The recipient must provide a work plan for completing the local or tribal mitigation plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).

Federal and State Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance could be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. The following sections detail the general types of assistance that might be provided should the President of the United States declare the event a major disaster.

Individual Assistance (IA)

Individual Assistance (IA) provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses could be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals are allowed to borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans could be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Non-profit organizations, such as charities, churches, and private universities are eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster but are

restricted by law to small businesses only. IA is detailed on the FEMA website: https://www.fema.gov/individual-disaster-assistance.

Public Assistance (PA)

Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required. PA is detailed on the FEMA website: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit.

Small-Business Administration (SBA) Loans

SBA provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Homeowners could apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners could borrow up to $40,000 to replace or repair personal property-such as clothing, furniture, cars, and appliances that were damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. Additional information regarding SBA loans is available on the SBA website: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance.

Social Services Block Grant Program (SSBG)

To address the needs of critical health and human service providers and the populations they serve, the State of New York will receive a total of $235.4 million in federal Superstorm Sandy SSBG funding. The state will distribute $200,034,600 through a public and transparent solicitation for proposals and allocate $35.4 million in State Priority Projects, using the SSBG funding. Sandy SSBG resources are dedicated to covering necessary expenses resulting from Superstorm Sandy, including social, health, and mental health services for individuals, and for repair, renovation, and rebuilding of health care facilities, mental hygiene facilities, child care facilities, and other social services facilities. Additional information regarding the SSBG program is available on the website: https://www.acf.hhs.gov/ocs/programs/ssbg.

Department of Homeland Security Grant Program (HSGP)

The HSGP plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. The FY 2020 HSGP supports efforts to build and sustain core capabilities across the Prevention, Protection, Mitigation, Response, and Recovery mission areas. This includes two priorities: building and sustaining law enforcement terrorism prevention capabilities and maturation and enhancement of state and major urban area fusion centers (HSGP 2020). HSGP is comprised of three interconnected grant programs including the State Homeland Security Program (SHSP), Urban Areas Security Initiative (UASI), and the Operation Stonegarden (OPSG). Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. Additional information regarding HSGP is available on the website: https://www.fema.gov/homeland-security-grant-program.

Community Development Block Grants (CDBG)

CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, and planning and administration. Public improvements could include flood and drainage improvements. In limited instances and during the times of "urgent need" (e.g., post disaster) as defined by the CDBG National Objectives, CDBG funding could be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. Additional information regarding CDBG is available on the website: https://www.hudexchange.info/programs/cdbg-entitlement/. In 2018, the Community Development Block Grant Mitigation Program was created to fund resilience projects in qualifying areas struck by disaster in 2015-2017.

U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States. Through its Public Works Program, USEDA invests in key public infrastructure, such as traditional public works projects, including water and sewer systems improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities,

telecommunications facilities, and development facilities. Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base. Additional information is available on the USEDA website: https://www.eda.gov/.

Federal Highway Administration - Emergency Relief

The Federal Highway Administration Emergency Relief is a grant program that can be used for repair or reconstruction of Federal-aid highways and roads on Federal lands which have suffered serious damage as a result of a disaster. NYS is serving as the liaison between local municipalities and FHWA. The program is appropriated $100 million annually. For information regarding the FHWA Emergency Relief Program, please refer to: https://www.fhwa.dot.gov/programadmin/erelief.cfm

Federal Transit Administration - Emergency Relief

The Federal Transit Authority Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. Department of Transportation and directly allocated to MTA and Port Authority, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of $5.2 Billion has been allocated to NYS-related entities related to Hurricane Sandy. IN the wake of the COVID-19 outbreak in 2020, the program provided emergency-related capital and operating expenses to transit providers. Additional information regarding the FTA Emergency Relief Program is available on the website: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program.

State Hazard Mitigation Funding Opportunities

Empire State Development

Empire State Development offers a wide range of financing, grants, and incentives to promote business and employment growth and real estate development throughout the state. Several programs address infrastructure construction associated with project development, acquisition, and demolition associated with project development and brownfield remediation and redevelopment. Additional information regarding Empire State Development is available on the website: https://esd.ny.gov/.

New York State Department of Transportation (NYSDOT)

Damaged Roads and Signals

High winds, storm tidal surge and flooding caused significant damage to NYSDOT facilities, roads and local transportation infrastructure in the Hudson Valley, Long Island and New York City. Repair and replacement will be necessary for these facilities and infrastructure. In some cases, municipalities

will be direct applicants; therefore, not all FEMA-eligible costs are included for damaged infrastructure.

Scour Critical/Floodprone Bridge Program

The Scour Critical/Flood Prone Bridge Program is an initiative developed to harden New York State's at-risk bridges to withstand extreme weather events. In the past three years, the state has suffered 9 presidentially declared disasters due to extreme weather, many involving severe flooding (NYSDOT 2014).

For this initiative, 105 scour critical/flood prone bridges throughout New York State were identified as most at-risk from repeated flooding and are located in the Capital District, Long Island, Mid-Hudson, Mohawk Valley, North Country, Finger Lakes, Central/Western and Southern Tier regions. The locations encompass 78 communities within 30 counties across the State (NYSDOT 2014). Additional information of the list of bridges is available on the website: https://www.dot.ny.gov/main/business-center/cbow/repository/CBOW_list_2014.pdf.

All the bridges included in this program were built to the codes and standards of their time and remain safe and open for everyday traffic; however, due to a variety of natural severe weather events and the increasing frequency of major storms and floods, they are vulnerable to scour, and flooding caused by the intensity and velocity of water from extreme natural events. Bridge scour erodes and carries away foundation materials, such as sand and rocks from around and beneath bridge abutments, piers, foundations, and embankments (NYSDOT 2014).

This program encompasses a variety of bridge improvement work, including upgrading concrete bridge abutments and/or piers by adding steel or concrete pile foundations, increasing the size of waterway openings to meet 100-year flood projections, and reducing or eliminating the number of bridge piers in the water to prevent debris and ice jams that can flood surrounding areas. Completion of the program will ensure continual access to critical facilities and essential personnel during emergency events. Adverse impacts to travel throughout the state will be greatly reduced during severe weather events, as well (NYSDOT 2014).

This program aims to increase the state's resiliency and mitigate the risks of loss and damage associated with future disasters. The total cost of the program, including all 105 bridges across the state, is $518 million. It will be paid for with a mix of funding from FEMA and the U.S. Department of Housing and Urban Development. No state funding will be required (NYSDOT 2014).

Emergency Watershed Protection Program

The purpose of the Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters. The EWP Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) administers the EWP Program, EWP-

Recovery, and EWP–Floodplain Easement. Additional information regarding the EWP is detailed below and available on the website:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/.

EWP - Recovery

The EWP Program is a recovery effort program aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that must be a legal subdivision of the state, such as a city, county, township, or conservation district, and Native American Tribes or Tribal governments. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP work is not limited to any one set of measures. It is designed for installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report, which provides a case-by-case investigation of the work necessary to repair or protect a site.

Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

EWP - Floodplain Easement (FPE)

Privately-owned lands or lands owned by local and state governments might be eligible for participation in EWP-FPE. To be eligible, lands must meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years.
- Other lands within the floodplain are eligible, provided the lands would contribute to the restoration of the flood storage and flow, provide for control of erosion, or that would improve the practical management of the floodplain easement.
- Lands that would be inundated or adversely impacted as a result of a dam breach.

EWP-FPE easements are restored to the extent practicable to the natural environment and can include both structural and nonstructural practices to restore the flood storage and flow, erosion control, and improve the practical management of the easement.

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

New York State Department of Environmental Conservation Climate Smart Communities (CSC) Program

The CSC program is jointly sponsored by the following six New York State agencies: DEC; Energy Research and Development Authority; Public Service Commission; Department of State; NYSDOT; and the Department of Health. The program encourages municipalities to minimize the risks of climate change and reduce long-term costs through actions which reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical support on energy and climate and guidance tailored to New York State communities. As of April 2020, more than 303 communities, representing 8.7 million New Yorkers in every region of the state, have committed to acting on climate through New York State's Climate Smart Communities program.

Benefits of participating in the program include saving taxpayer dollars, improving operations and infrastructure, increasing energy independence and security, demonstrating leadership, and positioning for economic growth. Registered Climate Smart Communities receive notification of state and federal assistance that they can leverage to help adopt low-carbon technologies and of programs and support for efficiency improvements and energy conservation. Further, those communities receive an advantage in accessing some state assistance programs, can call on the help of other local governments that already have adopted climate smart practices and policies, and receive statewide recognition for their climate-smart accomplishments. Key elements of the Climate Smart Communities program are described below.

Additional information regarding the CSC program is available on the website: http://www.dec.ny.gov/energy/50845.html.

Climate Smart Communities Pledge

Any city, town, village, or county in New York can join the program by adopting the Climate Smart Communities Pledge. To become a registered Climate Smart Community, the municipality's governing body must adopt a resolution that includes all ten elements of the pledge and inform DEC of the passage of the resolution. The required ten elements of the pledge are as follows:

- Pledge to be a Climate Smart Community.
- Set goals, inventory emissions, plan for climate action.
- Decrease community energy use.
- Increase community use of renewable energy.
- Realize benefits of recycling and other climate-smart solid waste management practices.
- Reduce greenhouse gas emissions through use of climate-smart land-use tools.
- Enhance community resilience and prepare for the effects of climate change.
- Support development of a green innovation economy.
- Inform and inspire the public.
- Commit to an evolving process of climate action.

Climate Smart Communities Certification (CSC) Program

The CSC program enables high-performing registered communities to achieve recognition for their leadership. Designed around the existing ten pledge elements, the certification program recognizes communities achieving any on over 130 total possible actions through a rating system leading to four levels of award: Certified, Bronze, Silver, and Gold. Recertification of completed actions is required every five years. Details of the program and the specific documentation required for each action are described in the CSC Certification Manual at http://www.dec.ny.gov/docs/administration_pdf/certman.pdf. At the time of this plan update, no communities in the County have achieved certification.

Climate Smart Communities Grant Program

In April 2016, DEC announced an expansion of the Environmental Protection Fund to support communities ready to reduce greenhouse gas emissions and prepare for the effects of climate change. Climate Smart Community Implementation grants support mitigation and adaptation projects and range from $100,000 to $2 million. Competitive grants ranging from $25,000 to $100,000 will provide support for local governments to become certified Climate Smart Communities. All counties, cities, towns, and villages of the State of New York are eligible to receive funding. The CSC grant program will provide 50/50 matching grants for eligible projects in the following categories.

Funding is available for **implementation projects** that advance a variety of climate adaptation and mitigation actions, including the following:

- Construction of natural resiliency measures.
- Relocation or retrofit of climate-vulnerable facilities.
- Conservation or restoration of riparian areas and tidal marsh migration areas.
- Reduction of flood risk.
- Clean transportation.
- Reduction or recycling of food waste.

Funding is available for **certification projects** that advance several specific actions aligned with Climate Smart Communities Certification requirements, including the following:

- Right-sizing of government fleets.
- Developing natural resource inventories.
- Conducting vulnerability assessments.
- Developing climate adaptation strategies.
- Updating hazard mitigation plans to address changing conditions and reduce climate vulnerability.

In scoring grant applications, increasing points are awarded to communities who have already taken the CSC pledge and to those that have achieved certification status. All grant recipients must take the Climate Smart Communities Pledge within the term of their grant contract. For climate mitigation projects, grant recipients must provide a report of estimates of emissions reduction. Certification actions must adhere to the requirements and standards described in the Climate Smart Communities Certification Manual that is available on the website: http://www.dec.ny.gov/energy/96511.html. For implementation projects involving property (construction, improvements, restoration, rehabilitation), grant recipients that do not have ownership of the property must obtain a climate change mitigation easement.

The Climate Smart Communities Toolkit was developed to educate New York communities on recommended practices that will help to reduce greenhouse gas emissions and adapt to the effects of climate change, specifically in the areas of land-use, transportation policy, green buildings, infrastructure investment, green infrastructure, housing policy, adaptation, and resilience. The Climate Smart Communities Guide to Local Action contains overviews of possible community actions, how-to's and case studies to help communities implement the CSC pledge. The Climate Smart Communities Land Use Toolkit allows New York communities to find recommended practices that will help to reduce greenhouse gas emissions in the areas of land use, transportation policy, green building, infrastructure investment, green infrastructure, and housing policy.

New York State Department of Environmental Conservation (NYSDEC)

Water Quality Improvement Project (WQIP) Program

The WQIP program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. The competitive, statewide grant program is open to local governments and not-for-profit corporations. Grant recipients can receive up to 75 percent of the project costs for high priority wastewater treatment improvement, non-agricultural nonpoint source abatement and control, land acquisition for source water protection, aquatic habitat restoration, and municipal separate storm sewer system projects; up to 50 percent for salt storage projects; and up to 40 percent for general wastewater infrastructure improvement projects. Additional information regarding this program are available on the website: https://www.dec.ny.gov/pubs/4774.html. Eligible activities for the WQIP Program include the following:

- Wastewater treatment improvement.
- Non-agricultural nonpoint source abatement and control.
- Land acquisition for source water protection.
- Salt storage.
- Aquatic habitat restoration.
- MS4s.

New York State DEC/ Environmental Facilities Corporation (EFC) Wastewater Infrastructure Engineering Planning Grant (EPG)

The DEC, in conjunction with the New York State EFC, offers grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects.

The Wastewater Infrastructure EPG assists municipalities with the engineering and planning costs of CWSRF-eligible water quality projects. Eligible municipalities have a median household income (MHI) of $65,000 or less in the Regional Economic Development Council (REDC) regions of Capital District, Southern Tier, North Country, Mohawk Valley, Central NY, Finger Lakes, or Western NY OR an MHI of $85,000 or less in REDC regions of Long Island, New York City, or Mid-Hudson. Grants with a 20 percent required local match could finance activities, including engineering and consultant fees for engineering and planning services for the production of an engineering report.

The goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, WQIP program, or other funding entities to further pursue the identified solution. Details regarding this program can be found on the website: https://www.dec.ny.gov/pubs/81196.html. Funding priorities go to projects that have one of the following qualities:

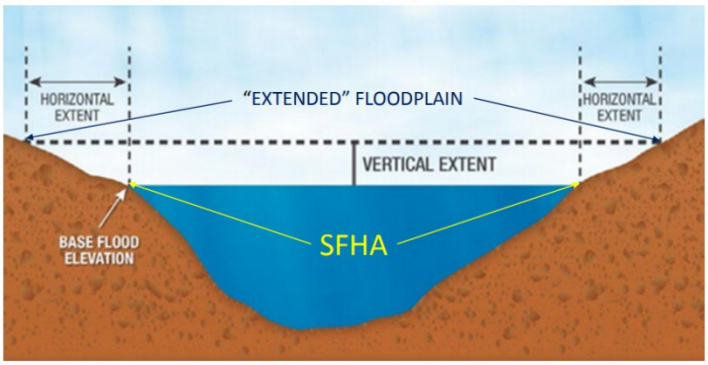
- Required by an executed Order on Consent.
- Required by a draft or final State Pollutant Discharge Elimination System (SPDES) permit.
- Upgrading or replacing an existing wastewater system.
- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems.
- Identified in a Total Maximum Daily Load (TMDL) Implementation Plan.

New York State Department of Transportation

BRIDGE NY

The BRIDGE NY program, administered by the NYSDOT, is open to all municipal owners of bridges and culverts. Projects are awarded through a competitive process and support all phases of project development. Projects selected for funding under the BRIDGE NY Initiative are evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; the significance and importance of the bridge, including traffic volumes, detour considerations, number and types of businesses served, and impacts on commerce; and the current bridge and culvert structural conditions. Information regarding the program can be found on the website: https://www.dot.ny.gov/BRIDGENY.

Community Risk and Resiliency Act (CRRA)



On September 22, 2014, Governor Andrew Cuomo signed bill A06558/S06617-B, the CRRA. The purpose of the bill is to ensure that certain state monies, facility-siting regulations, and permits include consideration of the effects of climate risk and extreme-weather events. According to NYSDEC (2018), CRRA's five major provisions include the following:

- Official Sea-level Rise Projections—CRRA requires the DEC to adopt science-based sea-level rise projections into regulation.
- Consideration of Sea-Level Rise, Storm Surge and Flooding—CRRA requires applicants for permits or funding in a number of specified programs to demonstrate that future physical climate risk due to sea-level rise, storm surge, and flooding have been considered and that DEC considered incorporating these factors into certain facility-siting regulations.
- Smart Growth Public Infrastructure Policy Act Criteria—CRRA adds mitigation of risk due to sea-level rise, storm surge, and flooding to the list of smart-growth criteria to be considered by state public-infrastructure agencies.
- Guidance on Natural Resiliency Measures—CRRA requires DEC, in consultation with the Department of State, to develop guidance on the use of natural resources and natural processes to enhance community resiliency.
- Model Local Laws Concerning Climate Risk—CRRA requires the Department of State, in cooperation with DEC, to develop model local laws that include consideration of future risk due to sea-level rise, storm surge, and flooding. These model local laws must be based on available data predicting the likelihood of extreme-weather events, including hazard-risk analysis.

CRRA requires NYSDEC, in consultation with the Department of State, to prepare guidance on implementation of the statute. To meet its obligation to develop guidance for the implementation of CRRA, DEC is proposing a new document, State Flood Risk Management Guidance (SFRMG). The SFRMG is intended to inform state agencies as they develop program-specific guidance to require that applicants demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations. The SFRMG incorporates possible future conditions, including the greater risks of coastal flooding presented by sea-level rise and enhanced storm surge and of inland flooding expected to result from increasingly frequent extreme-precipitation events (NYSDEC 2018). Additional details on the CRRA are provided on the website: https://www.dec.ny.gov/energy/102559.html.

Homeownership Repair and Rebuilding Fund

The Homeownership Repair and Rebuilding Fund provides grants of up to an additional $10,000 to eligible homeowners who have already qualified for FEMA housing assistance's maximum grant ($31,900) and will not receive other assistance from private insurance or government agencies that would duplicate the grant's funding. The HRRF includes $100 million dedicated to help homeowners affected by Sandy and was provided directly from the State of New York.

6.5.6 Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for each jurisdiction to help achieve the mitigation goals and objectives of the (HMP, it is also important to provide sources for funding to implement these strategies. The table below provides a list of programs, descriptions, and links for those seeking funding sources. Please note that this table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.

Table 6-2. Mitigation Funding Sources

Program	Description	Lead Agency	Website
Federal			
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, PDM	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program Grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Building Resilient Infrastructure and Communities (BRIC)	Replacement program for PDM that will invest in local mitigation projects and promote capacity-building	FEMA	https://www.fema.gov/bric
Public Assistance: Hazard Mitigation Funding Under Section 406	Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster	FEMA	https://www.fema.gov/news-release/2017/05/03/4309/fema-hazard-mitigation-grants-404-and-406
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants (AFG) is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage, and rental assistance	HUD	https://www.hud.gov/program_offices/public_indian_housing/publications/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low-income persons)	HUD	https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation)	HUD	https://www.hud.gov/info/disasterresources
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas	HUD	https://www.hudexchange.info/programs/section-108/
Smart Growth Implementation	The SGIA program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented	EPA	https://www.epa.gov/smartgrowth

Program	Description	Lead Agency	Website
Assistance (SGIA) program	development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.		
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Better Utilizing Investments to Leverage Development (BUILD)	Investing in critical road, rail, transit, and port projects across the nation	U.S. DOT	https://www.transportation.gov/BUILDgrants/about
Community Facilities Direct Loan & Grant Program	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.	USDA	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters, or quarantine	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities	U.S. DHS	https://www.fema.gov/emergency-management-performance-grant-program
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies)	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm

Program	Description	Lead Agency	Website
State			
Local Government Records Management Improvement Fund (LGRMIF) Disaster Recovery Grants	Grants for disaster recovery projects related to damage caused by a sudden, unexpected event involving fire, water, man-made or natural phenomena where a timely response is necessary to prevent the irretrievable loss of vital or archival records, or to ensure reasonable, timely access to vital records	New York State Archives / New York State Education Department	http://www.archives.nysed.gov/grants/grants_lgrmif.shtml
The New York State Emergency Services Revolving Loan	Repair of firefighting apparatus, ambulances, or rescue vehicles; Renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment	NYS DHSES	http://www.dhses.ny.gov/ofpc/services/loan/
Environmental Protection Fund (EPF)	Matching grants for the acquisition, planning, development, and improvement of parks, historic properties	New York State Parks, Recreation & Historic Preservation (NYSOPRHP)	https://www.dec.ny.gov/about/92815.html
Recreational Trails (RTP)	Program Matching grants for the acquisition, development, rehabilitation and maintenance of trails and trail-related projects	NYSOPRHP	https://parks.ny.gov/grants/recreational-trails/default.aspx
Environmental Protection & Improvement Grants	Competitive grants for environmental protection and improvement; available for municipalities, community organizations, not-for-profit organizations, and others	New York State Department of Environmental Conservation	https://www.dec.ny.gov/about/92815.html
Volunteer Fire Assistance Grants	The grant is a 50/50 matching funds program. Its purpose is to make funds available to rural fire companies for the purchase of wildland firefighting equipment such as portable backpack pumps, Nomex protective clothing, hand tools, hard hats, hose, portable radios, and dry hydrants.	NYSDEC	https://www.dec.ny.gov/regulations/2364.html
Clean Water Act Section 604(b) Water Quality Planning Grants	Provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. 604(b) funds are to be used for water quality management planning activities, including tasks to determine the nature, extent and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.	NYSDEC	https://www.dec.ny.gov/lands/53122.html
Water Quality Improvement Project (WQIP) Program	The Water Quality Improvement Project (WQIP) program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. Applications are typically available each spring through the Consolidated Funding Application.	NYSDEC	https://www.dec.ny.gov/pubs/4774.html
New York State DEC/EFC Wastewater	The New York State Department of Environmental Conservation (DEC), in conjunction with the New York State Environmental Facilities Corporation (EFC), will offer grants to municipalities to help	NYSDEC	https://www.dec.ny.gov/pubs/81196.html

Program	Description	Lead Agency	Website
Infrastructure Engineering Planning Grant (EPG)	pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects. The ultimate goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, Water Quality Improvement Project program, or other funding entities to further pursue the identified solution.		
Climate Smart Communities Grant Program	The CSC Grant program was established in 2016 to provide 50/50 matching grants to cities, towns, villages, and counties (or boroughs of New York City) of the State of New York for eligible climate adaptation and mitigation projects.	NYSDEC	https://www.dec.ny.gov/energy/109181.html
BRIDGE NY	The State is making funding available for local governments to rehabilitate and replace bridges and culverts statewide.	NYS DOT	https://www.dot.ny.gov/BRIDGENY

6.6 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

6.6.1 Update of Municipal Mitigation Strategies

To evaluate progress on local mitigation actions, each jurisdiction with actions in previous DMA2000 or related plans, was provided with a Mitigation Action Plan Review Worksheet. Each worksheet was pre-populated with those actions identified for their jurisdiction in the prior plan. For each action, municipalities were asked to indicate the status of each action ("No Progress/Unknown", "In Progress/Not Yet Complete", "Continuous", "Completed", "Discontinued") and provide review comments on each. Municipalities were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. Each jurisdictional annex provides a table identifying their prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as "Complete", and those actions identified as "Discontinued", have been removed from the updated strategies. Those local actions that municipalities identified as "No Progress/Unknown", "In Progress/Not Yet Complete" as well as certain actions/initiatives identified as "Continuous", have been carried forward in their local updated mitigation strategies. Municipalities were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

Certain continuous or ongoing strategies represent programs that are, or since prior and existing local hazard mitigation plans have become, fully integrated into the normal operational and administrative framework of the community. Such programs and initiatives have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.

At the Kick-Off and subsequent planning meetings, all participating municipalities were provided support in identifying mitigation activities completed, ongoing and potential/proposed. As new additional potential mitigation actions, projects or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process (see Section 3), communities were made aware of these either through direct communication (local meetings, email, phone) or via their draft municipal annexes.

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provides a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives, through review of available county and local plans and reports, and through the hazard profiling and vulnerability assessment process.

Members of the Planning Committee and contract consultants worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a

careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Concerted efforts were made to assure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- Local Plans and Regulations – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Project- These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA) and Firewise (NFPA) Communities.

In consideration of federal and state mitigation guidance, the Planning Committee recognized that municipalities would benefit from the inclusion of certain mitigation initiatives. These include initiatives to address vulnerable public and private properties, including RL and SRL properties; initiatives to support continued and enhanced participation in the NFIP; improved public education and awareness programs; and initiatives to support countywide and regional efforts to build greater local mitigation capabilities. Municipalities have included such initiatives as appropriate, typically amended with specific details to best meet the needs and interests of their community and promote implementation.

In October 2021, a mitigation strategy workshop was conducted by Tetra Tech staff with commentary provided FEMA Region II and NYSDHSES representatives for all participating jurisdictions to support the identification, evaluation, and prioritization of local mitigation strategies, as well as how to present and document this process within the plan. Based on FEMA's guidance and recommendations provided at this workshop and otherwise, the following significant modifications to the mitigation strategy identification and update process and documentation was made:

- An overarching effort has been made to better focus local mitigation strategies to clearly defined, readily actionable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation objectives have been eliminated from the updated strategy unless accompanied by discrete actions, projects, or initiatives.
- Certain continuous or ongoing strategies that represent programs that are, or since prior and existing plans have become, fully integrated into the normal operational and administrative framework of the community have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.
- Selected mitigation projects have been documented with an Action Worksheet, based on FEMA's Action Worksheet templates and recent guidance documents.

Action Worksheets have been included for selected priority physical projects identified by the County and participating municipalities. Physical projects being carried forward from the prior plan strategies are not necessarily documented on Action Worksheets as the project screening, identification and development, and prioritization process was accomplished during the last planning process. Whether or not the projects were new or "carry forward", and documented on Action Worksheets or not, all projects included in the updated County and local mitigation strategies have identified hazards addressed, project description, benefits, costs, responsible party, sources of funding, timeline and priority. Further, non-physical actions (e.g. integration actions, studies, etc.) are typically not documented on Action Worksheets.

As discussed within the hazard profiles in Section 5.4, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including extreme temperatures, flood, severe storm, severe winter storm and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

Municipalities included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. When determined to be feasible and practical, mitigation planning for critical facilities identified as previously sustaining flooding and/or being located in a FEMA floodplain will be developed to achieve protection to the 500-year flood event or the actual worst-damage scenario, whichever is greater.

It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, municipal discretion must be recognized. Further, it must be recognized that the County and municipalities have limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

6.6.2 Update of County Mitigation Strategy

The update of the County-level mitigation strategies included a review of progress on the actions/initiatives identified in the 2017 Warren County Hazard Mitigation Plan, using a process similar to that used to review municipal mitigation strategy progress. The County, through their various department representatives, were provided with a Mitigation Action Plan Review Worksheet identifying all of the county-level actions/initiatives from the 2017 plan. For each action, relevant county representatives were asked to indicate the status of each action ("No Progress/Unknown", "In Progress/Not Yet Complete", "Continuous", "Completed", "Discontinued"), and provide review comments on each.

Projects/initiatives identified as "Complete", as well as though actions identified as "Discontinued", have been removed from this plan update. Those actions the county has identified as "No Progress/Unknown", "In Progress/Not Yet Complete" or "Continuous" have been carried forward in the County's updated mitigation strategy.

Throughout the course of the plan update process, additional regional and county-level mitigation actions have been identified. These were identified through:

- Review of the results and findings of the updated risk assessment;
- Review of available regional and county plans, reports, and studies;
- Direct input from County departments and other county and regional agencies, including:
  - Department of Emergency Services – Office of Emergency Management
  - Soil & Water Conservation District
  - Department of Planning
  - Department of Public Works
  - GIS Program
  - Department of Information Technology
  - County Administrator
- Input from Regional Agencies
  - Adirondack/Glens Falls Transportation Council
  - Glens Falls Hospital
  - SUNY Adirondack
  - Climate Smart Communities
- Input from Business
  - Finch Paper
- Input received through the public and stakeholder outreach process.

As discussed within the hazard profiles in Section 5.4, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including extreme temperatures, flood, severe storm, severe winter storm and wildfire. As such, the County has included mitigation actions and initiatives, including continuing and long-term planning and emergency management support, to address these long-term implications and potential impacts.

Various County departments and agencies have included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. These actions have been proposed in consideration of protection against 500-year events, or worst-case scenarios. When determined to be feasible and practical, mitigation planning for critical facilities identified as previously sustaining flooding and/or being located in a FEMA floodplain will be developed to achieve protection to the 500-year flood event or the actual worst-damage scenario, whichever is greater. As an example, the County Department of Environmental Facilities (WC DEF) re-evaluated mitigation projects at their critical wastewater facilities throughout the County to provide 500-year levels of protection.

It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, local government authority must be recognized. Further, it must be recognized that the County has limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

6.6.3 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires an action plan describing how the actions identified will be prioritized.

Recent FEMA planning guidance (March 2013) identifies a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology that uses a set of 10 evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action. The March 2023 mitigation workshop presented by FEMA representatives further amplified these evaluation criteria and indicated that communities may want to consider other factors.

Based on this guidance, the Steering and Planning Committees have developed and applied an action evaluation and prioritization methodology which includes an expanded set of fourteen (14) criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards.

The fourteen (14) evaluation/prioritization criteria used in the 2014 update process are:

1. Life Safety – How effective will the action be at protecting lives and preventing injuries?
2. Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
3. Cost-Effectiveness – Are the costs to implement the project or initiative commensurate with the benefits achieved?
4. Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
5. Political – Is there overall public support for the mitigation action? Is there the political will to support it?
6. Legal – Does the municipality have the authority to implement the action?
7. Fiscal - Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
8. Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9. Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10. Administrative – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11. Multi-hazard – Does the action reduce the risk to multiple hazards?
12. Timeline - Can the action be completed in less than 5 years (within our planning horizon)?
13. Local Champion – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
14. Other Local Objectives – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to assist them in evaluating and prioritizing mitigation actions identified in the 2014 update. Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Further, jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results of this exercise were then used by each jurisdiction to help prioritize the action or strategy as "Low", "Medium," or "High." While this provided

a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions and initiatives from prior mitigation strategies that were prioritized using different, but not necessarily contrary, approaches. Mitigation actions in a number of the existing and prior Warren County municipal HMPs were prioritized according to the following criteria:

- **High Priority:** A project that meets multiple plan goals and objectives, benefits exceed cost, has funding secured under existing programs or authorizations, or is grant-eligible, and can be completed in 1 to 5 years (short-term project) once project is funded.
- **Medium Priority:** A project that meets at least one plan goal and objective, benefits exceed costs, funding has not been secured and would require a special funding authorization under existing programs, grant eligibility is questionable, and can be completed in 1 to 5 years once project is funded.
- **Low Priority:** A project that will mitigate the risk of a hazard, benefits exceed costs, funding has not been secured, and project is not grant-eligible and/or timeline for completion is considered long-term (5 to 10 years).

At their discretion, jurisdictions carrying forward prior initiatives were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed. Where communities have determined that their original priority ranking for "carry forward" initiatives remained valid, their earlier priority ranking is indicated on the prioritization table, however the plan update criteria ratings are indicated with a null "-" marking.

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives that have been well-vetted and are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. As such, many of the initiatives in the updated mitigation strategy were ranked as "High" or "Medium" priority, as reflective of the community's clear intent to implement, available resources not-withstanding. In general, initiatives that would have had "low" priority rankings were appropriately screened out during the local action evaluation process.

6.6.4 Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied in for the evaluation and prioritization of projects and initiatives in this plan update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action, or initiative.

Costs are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.

Benefits are the savings from losses avoided attributed to the implementation of the project, and may include life-safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When available, jurisdictions were asked to identify the actual or estimated dollar value for project costs and associated benefits. Having defined costs and benefits allows a direct comparison of benefits versus costs, and a quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified or may be impossible to quantitatively assess.

For the purposes of this planning process, jurisdictions were tasked with evaluating project cost-effectiveness with both costs and benefits assigned to "High", "Medium" and "Low" ratings. Where quantitative estimates of costs and benefits were available, ratings/ranges were defined as:

Low = < $10,000 Medium = $10,000 to $100,000 High = > $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the following definitions were used:

Table 6-2. Qualitative Cost and Benefit Ratings

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the Warren County initiatives identified, the Planning Committee may seek financial assistance under FEMA's HMGP or Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. The Planning Committee is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Committee reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

This section contains information regarding adoption of the 2023 Warren County Multi-Jurisdictional Hazard Mitigation Plan by the County and each participating jurisdiction.

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).

Plan Adoption by Local Governing Bodies

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

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

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

SECTION 7. PLAN MAINTENANCE

7.1 OVERVIEW

This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Partnership maintains their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below.

The overarching goal of the plan maintenance procedure is to ensure that all participating jurisdictions remain engaged in not only implementing the plan but in its continuous review and update, to ensure it is a relevant and living document. The county is committed to supporting municipalities in frequent communications regarding the status of mitigation projects and to communicating the mitigation successes amongst the county agencies and municipalities. This maintenance procedure is a springboard for each community to routinely use the plan as a resource and roadmap to fund and implement projects to increase the resiliency of their communities.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.	By April 1st or upon major update to Comprehensive Plan or major disaster	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to become an organic part of the ongoing county and municipal activities, the county will incorporate the	By April 1st, each year with interim email reminders to address integration in county and municipal activities.	HMP Coordinator and jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9	HMP Coordinator

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
	distribution of the safe growth worksheet (see 7.1.2 below) for annual review and update by all participating jurisdictions.		(Jurisdictional Annexes)	
Evaluation	Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by April 15th of each year	Steering Committee; Plan Maintenance element	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or major disaster	Warren County HMP Coordinator	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)

7.2 MONITORING, EVALUATING AND UPDATING THE PLAN

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the Planning Committee and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan.

The Planning Committee shall fulfill the monitoring, evaluation and updating responsibilities identified in this section which is comprised of a representative from each participating jurisdiction. Each jurisdiction is expected to maintain a representative on the Planning Committee throughout the plan performance period (five years from the date of plan adoption). As of the date of this plan, primary and secondary mitigation planning representatives (points-of-contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

Regarding the composition of the committee, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation. The HMP Coordinator will strive to keep the committee makeup as a uniform representation of planning partners and stakeholders within the planning area.

Currently, the Warren County HMP Coordinator is designated as:

Jim Lieberum, CPESC District Manager
Warren County SWCD
394 Schroon River Road
Warrensburg NY 12885
Phone: 518.623.3119
Email: jiml@warrenswcd.org

7.2.1 Monitoring

The Planning Committee shall be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, and documenting annual progress. Each year, beginning one year after plan development, Warren County and local Planning Committee representatives will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system, the BATool[SM] which will enable municipal and county representatives of directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. It is anticipated that all participating partners will be prompted by the tool to update progress on a quarterly basis, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. It is expected that this reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system which facilitates the sorting and prioritization of projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding; and obstacles or impediments to implementation of actions, the information that Planning Committee representatives shall be expected to document, as needed and appropriate include:

- Any grant applications filed on behalf of any of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction,
- Additional mitigation actions believed to be appropriate and feasible,
- Public and stakeholder input.

Plan monitoring for years 2 through 4 of the plan performance periods will be similarly addressed via the BATool[SM] or manually.

7.2.2 Integration Process of the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Warren County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Refer to Section 9 (Jurisdictional Annexes) for how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Partnership representatives will incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts;
2. The Hazard Mitigation Plan, Comprehensive Plans, Emergency Management Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of County residents.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Warren County HMP into their day-to-day operations and planning and regulatory processes. Additionally, each municipality will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report. The following checklist was adapted from FEMA's Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help municipalities identify areas that integrate hazard mitigation currently and where to make improvements and reduce vulnerability to future development. In this manner, the integration of mitigation into municipal activities will evolve into an ongoing culture within the county and its municipalities.

Table 7-2. Safe Growth Check List

Planning Mechanisms	Do you Do This? Yes	Do you Do This? No	Notes: How is it being done or how will this be utilized in the future?
Operating, Municipal and Capital Improvement Program Budgets			
• When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals.			
• Annually, during adoption process, the municipality will review mitigation actions when allocating funding.			
• Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
• Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
• Do budgets provide funding for hazard mitigation projects identified in the County HMP?			
Human Resource Manual			
• Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
• Prior to, zoning changes, or development permitting, the municipality will review the hazard mitigation plan and other hazard analyses to ensure consistent and compatible land use.			
• Does the zoning ordinance discourage development or redevelopment within natural areas including wetlands, floodways, and floodplains?			
• Does it contain natural overlay zones that set conditions			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
• Does the ordinance require developers to take additional actions to mitigate natural hazard risk?			
• Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
• Do the ordinances prohibit development within, of filling of, wetlands, floodways, and floodplains?			
Subdivision Regulations			
• Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
• Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
• Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
• Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Plan			
• Are the goals and policies of the plan related to those of the County HMP?			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
Land Use			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Transportation Plan			
• Does the transportation plan limit access to hazard areas?			
• Is transportation policy used to guide growth to safe locations?			
• Are transportation systems designed to function under disaster conditions (e.g. evacuation)?			
Environmental Management			
• Are environmental systems that protect development from hazards identified and mapped?			
• Do environmental policies maintain and restore protective ecosystems?			
• Do environmental policies provide incentives to development that is located outside protective ecosystems?			
Grant Applications			
• Data and maps will be used as supporting documentation in grant applications.			
Municipal Ordinances			
• When updating municipal ordinances, hazard mitigation will be a priority			
Economic Development			
• Local economic development group will take into account			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
information regarding identified hazard areas when assisting new businesses in finding a location.			
Public Education and Outreach			
• Does the municipality have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

7.2.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Committee, to be held either in person or via teleconference approximately one year from the date of local adoption of this update, and successively thereafter. At least two weeks before the annual plan review meeting, the Warren County HMP Coordinator will advise Planning Committee members of the meeting date, agenda and expectations of the members.

The Warren County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and Soliciting input regarding progress toward meeting plan goals and objectives.. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available.
- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- Changes in county, city, town or village resources impacted plan implementation (e.g., funding, personnel, and equipment)

- New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Committee will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Under/over spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Committee will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Committee should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix G – Plan Review Tools). Further, the Planning Committee should refer to any process and plan review deliverables developed by the county or participating jurisdictions as a part of the plan review processes established for prior or existing local HMPs within the county.

The Warren County HMP Coordinator shall be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local

Planning Committee members, information presented at the annual Planning Committee meeting, and other information as appropriate and relevant. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP on an annual basis, the Planning Committee will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report shall be posted on the Warren County Department of Planning and Development website to keep the public apprised of the plan's implementation (https://www.warrencountynewyorkhmp.com). Additionally, the website provides a general overview of the plan and its purpose and use in the community. For communities who might choose to join the NFIP CRS program, this report will also be provided to each CRS participating community in order to meet annual CRS recertification requirements. To meet this recertification timeline, the Planning Committee will strive to complete the review process and prepare an Annual HMP Progress Report by April 1st of each year.

The HMP will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damages or if data listed in the Section 5.4 (Hazard Profiles) of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.2.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under DMA 2000. It is the intent of the Warren County HMP Planning Committee to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the Warren County HMP Coordinator, with support of the Planning Committee, shall use the second annual Planning Committee meeting to develop and commence the implementation of a detailed plan update program. The Warren County HMP Coordinator shall invite representatives from NYS DHSES to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements.

At this meeting, the Planning Committee shall determine what resources will be needed to complete the update. The Warren County HMP Coordinator shall be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all planning group members and the New York State Hazard Mitigation Officer.

7.2.5 Grant Monitoring and Coordination

Warren County recognizes the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each municipal partner as part of their annual progress reporting. The Warren County HMP Coordinator will keep the planning partners apprised of Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Warren County intends to be a resource to the planning partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during open windows for grant applications. As part of grant monitoring and coordination, Warren County intends to provide the following:

- Notification to planning partners about impending grant opportunities.
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration.
- Notification about mitigation priorities for the fiscal year to assist the planning partners in the selection of appropriate projects.

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

7.3 IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

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

The "Capability Assessment" section of Section 6 (Mitigation Strategy) provides a summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation within the county. Within each jurisdictional annex in Section 9 (Jurisdictional Annexes), the county and each participating

jurisdiction identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework ("existing integration"), and how they intend to promote this integration ("opportunities for future integration").

It is the intention of Planning Committee representatives to incorporate mitigation planning as an integral component of daily government operations. Planning Committee representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Committee anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
2. The Hazard Mitigation Plan, Comprehensive Plans, Emergency Management Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community Wildfire Protection Plans
- Comprehensive Flood Hazard Management Plans
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/education plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Committee representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

7.4 CONTINUED PUBLIC INVOLVEMENT

Warren County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on-line (https://www.warrencountynewyorkhmp.com). In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability.
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms. Educate the public via the jurisdictional websites on how these applications can be used in an emergency situation.
- Development of annual articles or workshops on flood hazards to educate the public and keep them aware of the dangers of flooding.

Planning Committee representatives and the Warren County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The Warren County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. Additional meetings might also be held as deemed necessary by the planning group. The purpose of these meeting would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The Planning Committee representatives shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the Plan.

- Appropriate links to the Warren County Hazard Mitigation Plan website are included on municipal websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during Plan update cycles.

The Warren County HMP Coordinator shall be responsible to assure that:

- Public and stakeholder comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- The Warren County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities along with instructions to facilitate public input and comment on the plan.

Public notices, including media releases, are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.

Acronyms and Abbreviations

%	Percent
AAA	American Avalanche Association
ACRES	Assessment, Cleanup and Redevelopment Exchange System
ACS	American Community Survey
ADA	American Disabilities Act
AFG	Assistance to Firefighters Grants
AFPB	Agricultural and Farmland Protection Board
AGM	Department of Agriculture and Markets
AML	Agriculture and Markets Law
ANSS	Advanced National Seismic System
APA	Approval Pending Adoption
APIPP	Adirondack Park Invasive Plant Program
APLUDP	Adirondack Park Land Use and Development Plan
ARC	American Red Cross
ARPA	American Rescue Plan Act
BCA	Benefit Cost Analysis
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BOCA	Building Officials Code Administration
BR	Biennial Report
BRIC	Building Resilient Infrastructure and Communities Program
BUI	Buildup Index

BUILD	Better Utilizing Investments to Leverage Development
CAC	Community Advisory Committee
CAGR	Compound Annual Growth Rate
CARP	County Animal Response Plan
CAV	Community Assistance Visit
CBRN	Chemical, Biological, Radiological, and Nuclear
CBS	Chemical Bulk Storage
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control and Prevention
CDMS	Comprehensive Data Management System
CEHA	Coastal Erosion Hazard Areas
CEO	Chief Executive Officer
CEPA	County Emergency Preparedness Assessment
CEMP	Comprehensive Emergency Management Plan
CFM	Certified Floodplain Manager
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CMP	Coastal Management Program
COG	Continuity of Operations/Continuity of Government
COOP	Continuity of Operations Plan
CRRA	Community Risk and Resiliency Act
CRREL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System

CSC	Climate Smart Communities (NYSDEC)
CT	Connecticut
CWICNY	Champlain Watershed Improvement Coalition of New York, Inc.
CWSRF	Clean Water State Revolving Fund
CY	Cubic Yards
DBSC	Department of State Division of Building Standards and Codes
DCEA	Division of Code Enforcement and Administration
DHS	Department of Homeland Security
DFIRM	Digital Flood Insurance Rate Map
DHSES	Division of Homeland Security and Emergency Services
DMA 2000	Disaster Mitigation Act of 2000
DOT	Department of Transportation
DPW	Department of Public Works
DR	Major Disaster Declaration (FEMA)
EAP	Emergency Action Plan
ECL	Environmental Conservation Law
EF	Enhanced Fujita Scale
EFC	New York State Environmental Facilities Corporation
EHS	Extremely Hazardous Substances
EM	Emergency Declaration (FEMA)
EM	Emergency Management
EMPG	Emergency Management Performance Grants Program
EMS	Emergency Medical Services
EOC	Emergency Operation Center

EOP	Emergency Operation Plan
EPA	Environmental Protection Agency
EPF	Environmental Protection Fund
EPZ	Emergency Planning Zone
EWP	Emergency Watershed Protection Program
FD	Fire Department
FDRA	Fire Danger Rating Areas
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIA	Flood Insurance Administration
FIS	Flood Insurance Study
FM	Fuel Moisture
FMA	Flood Mitigation Assistance
FPA	Floodplain Administrator
FPE	Floodplain Easement
FPI	Fire Potential Index
GGFT	Greater Glens Falls Transit
GHGI	Greenhouse Gas Inventories
GIS	Geographic Information System
GSN	Global Seismographic Network
HAZMAT	Hazardous Material
HAZUS	Hazards U.S.

HHPD	Rehabilitation of High Hazard Potential Dams grant program
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HOC	Hazard of Concern
HRRF	Homeownership Repair and Rebuilding Fund
HSGP	Homeland Security Grant Program
HTFC	Housing Trust Fund Corporation
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IA	Individual Assistance
IBC	International Building Code
ICIS	Integrated Compliance Information System
IPCC	International Panel on Climate Change
ISO	Insurance Service Organization
IT	Information Technology
KBDI	Keetch-Byram Drought Index
LCSN	Lamon-Doherty Cooperative Seismographic Network
LEPC	Local Emergency Planning Committee
LGRMIF	Local Government Records Management Improvement Fund
LOIP	Letter of Intent to Participate
LWRP	Local Waterfront Revitalization Program
MARFC	Middle Atlantic River Forecast Center
MEF	Mission Essential Functions

MHI	Median Household Income
Mi	Mile
MMI	Modified Mercalli Intensity Scale
MMS	Moment Magnitude Scale
MNRR	Metro North Railroad
MOA	Memorandum of Agreement
Mph	Miles per Hour
MRCC	Midwestern Regional Climate Center
MRP	Mean Return Period
MSL	Mean Sea Level
MTA	Metropolitan Transportation Authority
N/A	Not Applicable
NA	Not Available
NASA	National Aeronautics and Space Administration
NAC-AAA	National Avalanche Center – American Avalanche Association
NAVD	North American Vertical Datum
NCDC	National Climate Data Center
NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NDSP	National Dam Safety Program
NEHRP	National Earthquake Hazard Reductions Program
NESEC	Northeast States Emergency Consortium
NESIS	Northeast Snowfall Impact Scale
NFDRS	National Fire Danger Rating System

NFIP	National Flood Insurance Program
NHC	National Hurricane Center
NHD	National Hydrography
NIC	National Influenza Centers
NID	National Inventory of Dams
NJAFM	New Jersey Association of Floodplain Managers
NJOEM	New Jersey Office of Emergency Management
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPCC	New York City Panel on Climate Change
NPDES	National Pollutant Discharge Elimination System
NPDP	National Performance of Dams Program
NPL	National Priorities List
NOUE	Notification of Unusual Event
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCC	Northeast Regional Climate Center
NRCS	Natural Resources Conservation Service
NSIDC	National Snow and Ice Data Center
NSSL	National Severe Storms Library
NVRC	Northern Virginia Regional Commission
NWS	National Weather Service
NY	New York
NYC	New York City

NYCEM	New York City Area Consortium for Earthquake Loss Mitigation
NYCDEP	New York City Department of Environmental Protection
NYC OEM	New York City Office of Emergency Management
NYCRR	New York Codes, Rule, and Regulations
NYS	New York State
NYS DHSES	New York State Division of Homeland Security and Emergency Services
NYS DEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSDPC	New York State Disaster Preparedness Commission
NYS GIS	New York State Geographic Information System
NYSGS	New York State Geologic Survey
NYS HCR	New York State Homes and Community Renewal
NYS OFP&C	New York State Office of Fire Prevention and Control
NYSOPRHP	New York State Parks, Recreation and Historic Preservation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYSHMP	New York State Hazard Mitigation Plan
NYSOEM	New York State Office of Emergency Management
NYS OFP&C	New York State Office of Fire Prevention and Control
OCR	Office of Community Renewal
OEM	Office of Emergency Management

OES	Office of Emergency Services
OFPC	Office of Fire Prevention and Control
OPRHP	Office of Parks Recreation and Historic Preservation
OPSG	Operation Stonegarden
PA	Public Assistance
PAG	Protective Action Guides
PSAF	Pandemic Severity Assessment Framework
PBS	Petroleum Bulk Storage
PCDA	Property Condition Disclosure Act
PCS	Permit Compliance System
PD	Police Department
PDM	Pre-Disaster Mitigation Program
PDR	Purchase of Development Rights
PE	Professional Engineer
PGA	Peak Ground Acceleration
PIO	Public Information Officer
POC	Point of Contact
Pop.	Population
PPP	Paycheck Protection Program
PRISM	Partnership for Regional Invasive Species Management
PSI	Pandemic Severity Index
PUD	Planned Unit Development
PW	Public Works
RACES	Radio Amateur Civil Emergency Services

RCRAInfo	Resource Conservation and Recovery Act Information
RCV	Replacement Cost Value
RDD	Radiological Dispersion Devices
REDC	Regional Economic Development Council
RL	Repetitive Loss
RSI	Regional Snowfall Index
RTE	Route
RSZ	Ramapo Seismic Zone
SAE	Site Area Emergency
SBA	Small Business Administration
SC	Steering Committee
SDI	State Drought Index
SEMS	Superfund Enterprise Management System
SEQRA	State Environmental Quality Review Act
SF	Square Feet
SFHA	Special Flood Hazard Area
SFMRG	State Flood Risk Management Guidance
SHELDUS	Spatial Hazard Events and Losses Database for the United States
SHSP	State Homeland Security Program
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SLR	Sea Level Rise
SPC	Storm Prediction Center
SPDES	State Pollutant Discharge Elimination System
Sq. Mi.	Square mile

SRL	Severe Repetitive Loss
SPIA	Sperry-Piltz Ice Accumulation Index
SSBG	Social Services Block Grant Program
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, Environmental
SVI	Social Vulnerability Index
SWCD	Soil and Water Conservation District
SWMP	Storm Water Management Plan
SWOO	Strengths, Weaknesses, Obstacles and Opportunities
TBD	To Be Determined
TD	Tropical Depression
TDR	Transfer of Development Rights
THIRA	Threat & Hazard Identification & Risk Assessment
TIGER	Transportation Investment Generating Economic Recovery
TMDL	Total Maximum Daily Load
TNT	Trinitrotoluene
TORRO	The Tornado and Storm Research Organization
TRI	Toxic Release Inventory
TS	Tropical Storm
TSCA	Toxic Substances Control Act
TV	Television
UASI	Urban Areas Security Initiative
UE	Unusual Event
USACE	U.S. Army Corps of Engineers
USEDA	U.S. Economic Development Administration

USD	U.S. Dollar
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEDA	U.S. Economic Development Administration
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VA	Vulnerability Assessment
VFD	Volunteer Fire District
WC	Warren County
WCDPCD	Warren County Department of Planning and Community Development
WCDPW	Warren County Department of Public Works
WCOES	Warren County Office of Emergency Services
WCSWCD	Warren County Soil and Water Conservation District
WCT	Wind Chill Temperature
WFAS	Wildland Fire Assessment System
WHO	World Health Organization
WMD	Weapons of Mass Destruction
WNV	West Nile Virus
WQIP	Water Quality Improvement Project
WUI	Wildland Urban Interface

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