Multi-Jurisdictional Hazard Mitigation Plan

Saratoga County

Final Plan

2019

HAGERTY

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Executive Summary

The Saratoga County Multi-Jurisdictional Multi-Hazard Mitigation Plan was prepared in response to the Disaster Mitigation Act of 2000 (DMA 2000) and updated to meet 44 Code of Federal Regulations (CFR) 201.6 requirements. DMA 2000 requires states and local governments to prepare hazard mitigation plans in order to remain eligible to receive pre-disaster mitigation funds that are made available in the wake of federally declared disasters. To restate, by not participating in this process and adopting the resulting plan, municipalities and other local governments will not be eligible to receive future pre-disaster mitigation funding. It is also important to remember that pre-disaster mitigation funds are separate and distinct from those federal and state funds used in direct post-disaster relief. The availability of those funds remains unchanged; if there is a federally declared disaster in Saratoga County, the affected municipalities will still receive immediate recovery assistance regardless of their participation in this plan.

However, DMA 2000 effectively improves the disaster planning process by increasing hazard mitigation planning requirements for hazard events and requiring participating municipalities to document their hazard mitigation planning process and identify hazards, potential losses, and mitigation needs, goals, and strategies.

Planning Process

DMA 2000 requires states to submit comprehensive hazard mitigation plans (HMP) for approval to the Federal Emergency Management Agency (FEMA) to be eligible for future pre-disaster mitigation funding. Local entities must also develop plans. To comply, Saratoga County and Plan participants (towns, cities, and villages in the County) have developed and adopted this Multi-Jurisdictional Multi-Hazard Mitigation Plan. To be considered a participating jurisdiction, that jurisdiction must meet all the FEMA and New York State (NYS) planning requirements, including the NYS requirement to complete and submit two mitigation project worksheets. Should a jurisdiction decide to complete these worksheets after this plan is finalized, the jurisdiction may elect to adopt this plan at that time. Once the mitigation plan is completed and approved, the participants will begin to work collaboratively to implement complementary mitigation actions.

To support the planning process for this HMP, Saratoga County and Plan participants accomplished the following:

- Developed a planning group (Planning Committee);
- Identified hazards of concern;
- Profiled and prioritized these hazards;
- Estimated inventory at risk and potential losses associated with these hazards;
- Developed mitigation goals, objectives and actions that address the hazards that impact the area;

- Developed mitigation plan maintenance procedures to be executed upon conditional approval of the plan from the New York State Division of Homeland Security and Emergency Services (NYS DHSES) and FEMA.

As required by DMA 2000, the participating municipalities and Saratoga County have informed the public about these efforts and provided opportunities for public comment and input on the planning process. In addition, numerous agencies and stakeholders were contacted, including those outside of Saratoga County, and some have participated as core or support members to provide input and expertise to the planning process. This HMP documents the process and outcomes of the participants' mitigation planning efforts.

Saratoga County and the participating municipalities intend to incorporate mitigation planning as an integral component of daily government operations through existing processes and programs. Announcements regarding the planning process were publicized through local channels, including a monthly electronic newsletter. Additionally, the plan was posted and available for review and comment on the Saratoga County website and at locations within each participating jurisdiction. Updates to the plan will be similarly announced after annual plan reviews and five-year updates. The County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this plan.

Plan Adoption

This mitigation plan has been reviewed and adopted by Saratoga County and participating jurisdictions. Copies of the adoption documentation is included in Appendix A.

County Profile

Saratoga County is in the northeastern section of New York State. The County has a total area of 844 square miles (810 square miles of land and 34 square miles of water) (U.S. Census Bureau, 2010; Seleen and Tabka, 2013). The County is in the Capital District Region of New York State (Capital District Regional Planning Commission, n.d.).

Saratoga County is bordered to the north by Warren County, to the south by Schenectady and Albany Counties, to the east by Washington and Rensselaer Counties, and to the west by Hamilton, Fulton and Montgomery Counties. The Hudson River forms the eastern and northern boundary and the Mohawk River forms the southernmost boundary of the county. The Adirondack Mountains, the Kayaderrossas and Sacandaga Rivers, numerous lakes and streams, and farmland make up the landscape of the County (Capital District Regional Planning Commission, n.d.; Wechsler, n.d.).

Saratoga County is located within the Capital District. This region refers to the four counties surrounding the New York State capital of Albany. These counties include Albany County, Schenectady County, Rensselaer County and Saratoga County. It is located in the east-central portion of the State, at the confluence of the Hudson and Mohawk Rivers. It covers a total land area of 2,200 square miles. The term "Capital District" was originated in the 1920s in an effort between the Albany Chamber of Commerce and the Albany Times Union (Capital District

Regional Planning Commission, n.d.; Saratoga Preserving Land and Nature (PLAN), n.d.-b; Wechsler, n.d.).

This combination of natural and developed features lays the foundation for Saratoga County's vulnerability to natural hazards, both in terms of exposure to hazard events and the potential impact of hazard events. The Saratoga County Multi-Jurisdictional Hazard Mitigation Plan provides a general overview of current and anticipated changes to population, demographics, and land use within the planning area. These community characteristics provide a basis for making decisions regarding the type of mitigation approaches to consider and the locations in which these approaches should be applied.

This information can also be used to support decisions regarding future development in vulnerable areas. For potential increases in vulnerability, the County can then plan ahead to mitigate those vulnerabilities early in the development process or can direct development to areas of lower risk. The Planning Committee will revisit the mitigation plan regularly to ensure that mitigation actions support sustainability in order to minimize increased risk and to support the implementation and targeting of specific mitigation actions to address the potential impacts of development over time.

Risk Assessment

A key component of a mitigation plan is the accurate identification of risks posed by a hazard and the corresponding impacts to the community. The process of identifying hazards of concern, profiling hazard events, and conducting a vulnerability assessment is known as a risk assessment. The risk assessment portion of the mitigation planning process included the steps summarized below.

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

Saratoga County focused on considering a full range of natural hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The following list of nine hazards of concern, in order of hazard ranking determined by the Planning Committee for Saratoga County, was selected for further evaluation in the mitigation plan:

1. Flood (riverine, flash, ice jam dam, beaver dam flooding, and elevated ground water)
2. Severe Storm (windstorms, thunderstorms, hail, tornadoes and hurricanes/tropical storms)
3. Extreme Temperatures
4. Ground Failure (landslides)
5. Severe Winter Storm (heavy snow, blizzards, ice storms, Nor'easters)
6. Wildfire
7. Invasive Species
8. Earthquake

9. Drought

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

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

Mitigation Strategy

The outcomes of the risk assessment, supplemented by Plan participant input, provided a basis to review past mitigation actions, future goals, and appropriate local mitigation actions. The mitigation strategy portion of the plan includes:

- A summary of past and current mitigation efforts;
- Local hazard mitigation goals and objectives;
- Identification and analysis of mitigation measures and projects being considered;
- Multi-jurisdictional mitigation strategy (goals and objectives); and
- Mitigation action plan (summary of specific actions).

Per FEMA guidance, a mission statement describes the overall purpose of the planning process and serves to identify the intended outcome of the plan (FEMA, 2013). Saratoga County's mission statement is broad in scope, and provided direction for the Plan:

Through partnerships and careful planning, identify and reduce the vulnerability to natural hazards in order to protect the general health, safety, welfare, quality of life, environment and economy of the residents and communities within Saratoga County.

The Planning Committee identified the following five over-arching mitigation goals that summarize the hazard reduction outcomes that the County and participating jurisdictions want to achieve:

1. Protect life and property
2. Increase public awareness and preparedness of natural hazards and their risks
3. Promote a sustainable economy
4. Protect open space, the environment and natural resources
5. Promote cooperation and county-wide partnerships

Objectives and Capability Assessment

The Planning Committee developed numerous objectives that meet multiple goals. The goals, along with their corresponding objectives, then guided the development and evaluation of specific mitigation actions.

A capability assessment was prepared by Saratoga County and each participating jurisdiction. This assessment is an integral part of the planning process. According to FEMA's Local Mitigation Planning Handbook, a capability assessment is an inventory of local and state programs, polices, regulations, funding and practices currently in place that may either facilitate or hinder mitigation.

By completing this assessment, Saratoga County and participating jurisdictions learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Types of mitigation actions that may be prohibited by law;
- Limitations that may exist on undertaking actions; and
- The range of local and/or state administrative, programmatic, regulatory, financial and technical resources available to assist in implementing their mitigation actions.

Identification, Prioritization, Analysis, and Implementation of Mitigation Actions

The Planning Committee reviewed information garnered from the risk assessment and the public involvement strategy, and reviewed the previous action plan to determine strengths, weaknesses, opportunities and obstacles in hazard mitigation within Saratoga County. This information was used to prepare the 2019 Mitigation Strategy, seen in their individual jurisdictional annexes.

All proposed mitigation actions were identified in relation to the Plan's goals and objectives. The County and participating jurisdictions identified and updated appropriate local mitigation actions, along with the hazards mitigated, goals and objectives met, lead agency, estimated cost, potential funding sources and the proposed timeline. These actions are identified in Section 9 for the County and each participating municipality.

The Planning Committee performed a qualitative benefit/cost review on the identified mitigation actions that weighed the estimated benefits of a project versus the estimated costs to establish a parameter to be used in the prioritization of a project. Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and were prioritized accordingly.

Plan Maintenance

Hazard mitigation planning is an ongoing process. Section 7 of this plan presents procedures for plan maintenance and updates. Therefore, the Planning Committee will continue ongoing mitigation efforts to implement the mitigation plan and revise and update the plan as necessary.

To monitor implementation of the mitigation plan, the Planning Committee members will meet annually to discuss the status of plan implementation and will prepare a summary report of the plan status and any needed updates. The mitigation evaluation will address changes as new hazard events occur, as the area develops, and as more is learned about hazards and their impacts. The evaluation will include an assessment of whether the planning process and actions have been effective, whether development or other issues warrant changes to the plan or its priorities, if the communities' goals are being reached, and whether changes are warranted. In addition, the mitigation plan will be updated at a minimum within the five-year cycle specified by DMA 2000.

Point of Contact

To request information or provide comments regarding this plan, contact Saratoga County Office of Emergency Services (OES).

Mailing Address:

Saratoga County Emergency Services
25 West High Street
Ballston Spa, New York 12020

Contact Name: Michael Stanley, Emergency Services Specialist

Telephone: 518-885-2243

Email: MStanley@saratogacountyny.gov

Section 1: Introduction

1.1 Background

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), Saratoga County and its cities, towns and villages have developed this Hazard Mitigation Plan (HMP). 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's (FEMA) guidelines for local HMPs were used to develop this plan. The New York State Division of Homeland Security and Emergency Services (NYS DHSES) also supports plan development for jurisdictions in New York State and issued additional local HMP guidelines in 2017 that were incorporated into this plan update.

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

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

1.1.1 Foundation for Hazard Mitigation Planning

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

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 an HMP (this plan).

The passage of the DMA 2000 created changes to the Code of Federal Regulations (CFR) through an Interim Final Rule, which established local hazard mitigation planning requirements and policies. The Interim Final Rule was formally adopted in 2007. As part of the local planning process, all hazard mitigation plans are required to meet the regulations set out in 44 CFR Section 201.6, which details requirements for plan content, process, review and documentation.

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.

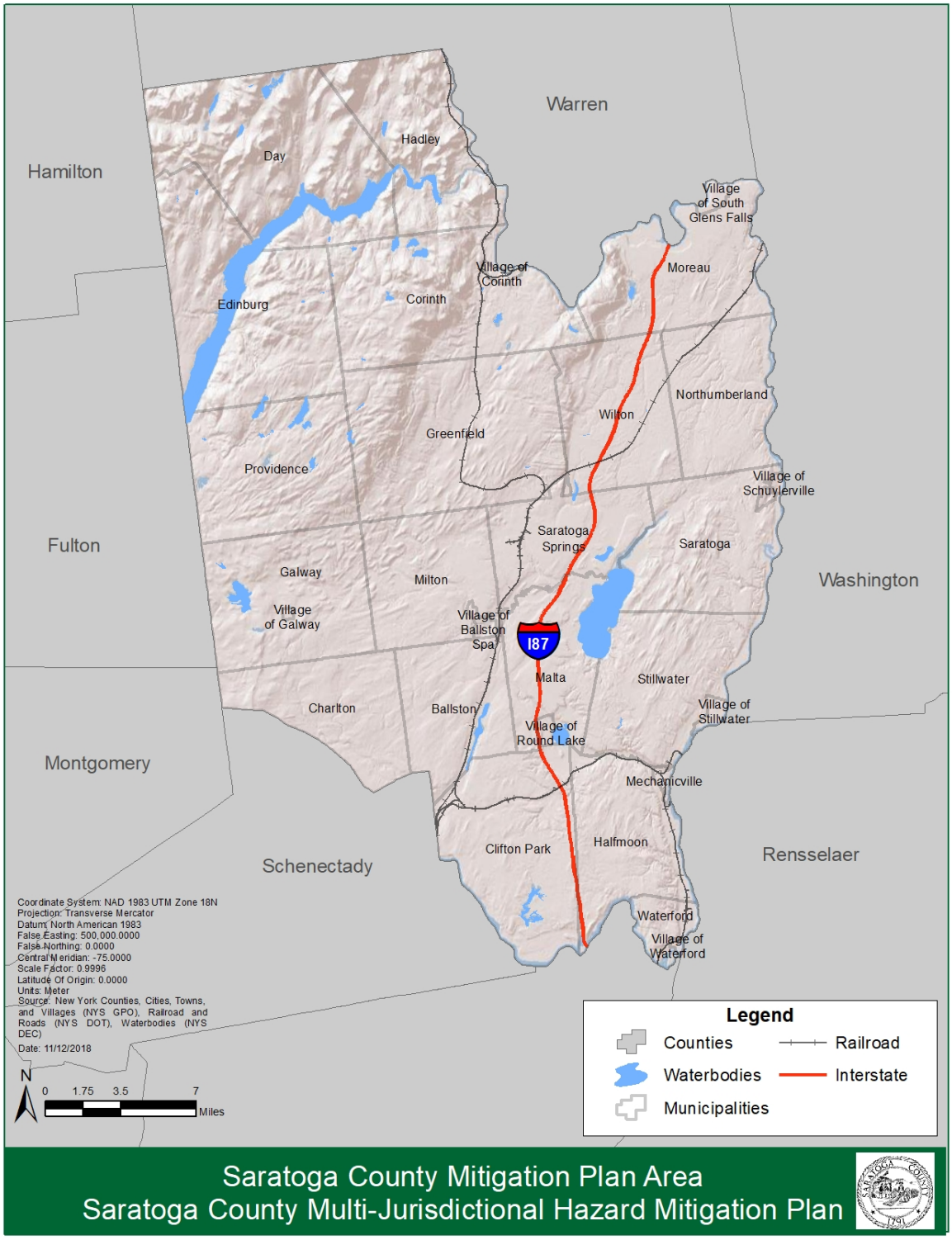
This HMP was prepared in accordance with the following regulations and guidance:

- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 CFR Parts 201 and 206
- FEMA. 2013. “Local Mitigation Planning Handbook”
- FEMA. 2011. “Local Mitigation Plan Review Guide”
- NYS DHSES, 2017. “New York State Hazard Mitigation Planning Standards”

1.1.2 Participation in the Planning Process

Saratoga County and the participating jurisdictions intend to implement this HMP with full coordination and participation of County and local departments, organizations and groups, as well as by coordinating with relevant State and Federal entities. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and mitigation actions included in Section 6 of this plan. As part of this process, jurisdictional stakeholders were essential in collecting information relative to current conditions and mitigation progress in their locality. Figure 1-1 shows the extent of the planning area for the Saratoga County Multi-Jurisdictional Hazard Mitigation Plan, which includes all cities, towns and villages within Saratoga County, New York.

Figure 1-1 Saratoga County Mitigation Plan Area



Information provided by the jurisdictions was incorporated into the Jurisdictional Annexes in Section 9. Information that was not provided has been identified at the beginning of each annex.

Table 1-1 summarizes the participation levels of all jurisdictions based on whether they are eligible or not to adopt the plan. This eligibility is determined based on whether the jurisdiction accurately completed and submitted two NYS DHSES project action worksheets. This table also summarizes the jurisdictions that attended meetings and submitted locality information but did not submit two NYS DHSES project action worksheets and are therefore considered "non-participating" and cannot adopt the Plan at this time.

If a non-participating jurisdiction submits the two action worksheets after this plan is finalized, the status of their participation will be revised, and the municipality will be eligible to adopt this Plan. The steps and procedures for becoming a participating jurisdiction are outlined further in Appendix G, Linkage Procedures. To make the "linkage procedures" easier in the future, all Jurisdictional Annexes included in the previous Plan were carried forward to this Plan update.

Table 1-1 Jurisdiction Participation

Participating Jurisdictions – Eligible to Adopt the Plan	**Non-Participating Jurisdictions – Not Eligible to Adopt the Plan**	
Full Participation	*Partial Participation*	*No Participation*
City of Saratoga Springs	City of Mechanicville	Village of Galway
Saratoga County	Town of Edinburg	Village of Victory
Town of Ballston	Town of Galway	
Town of Charlton	Town of Saratoga	
Town of Clifton Park	Town of Stillwater	
Town of Corinth	Village of Corinth	
Town of Day	Village of Round Lake	
Town of Greenfield	Village of Stillwater	
Town of Hadley		
Town of Halfmoon		
Town of Malta		
Town of Milton		
Town of Moreau		
Town of Northumberland		
Town of Providence		
Town of Waterford		
Town of Wilton		
Village of Ballston Spa		
Village of Schuylerville		
Village of South Glens Falls		
Village of Waterford		

1.1.3 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. NYS DHSES provides guidance to support mitigation planning. In addition, FEMA provides grants, tools, and training to support mitigation planning.

Additional input and support for this planning effort was obtained from a variety of agencies and some public involvement (as discussed in Section 3). Oversight for the preparation of this plan was provided by the Saratoga County Planning Team, which includes representatives from:

- County Departments
- Local Departments
- Local Utilities
- NYS DHSES
- FEMA

1.2 Implementation of the Planning Process

The planning process and findings are to be documented in local HMPs. To support the planning process to develop this HMP, Saratoga County and the participating jurisdictions have accomplished the following:

- Developed a Planning Team
- Identified hazards of concern
- Profiled these hazards
- Estimated the inventory at risk and potential losses associated with these hazards
- Developed mitigation goals and actions that address the various hazards that impact the area
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from NYS DHSES and FEMA
- Reviewed and incorporated existing plans, studies, reports, and technical information into the mitigation plan

Based on input from the Planning Team, and review of other available data, the Planning Team then proceeded to identify, rank and profile those hazards that are of greatest concern to the community (hazards of concern). The hazard profiles include location, extent, previous occurrences and losses, and the probability of future events. The process also included a vulnerability assessment to evaluate what County, town and village assets are exposed or vulnerable to the hazards.

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

As required by DMA 2000, Saratoga 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 Multi-Jurisdictional Hazard Mitigation Plan documents the process and outcomes of the County and jurisdictions' efforts. Additional information on the planning process is included in Section 3, Planning Process. Documentation that the prerequisites for plan approval have been met is included in Section 2, Plan Adoption.

1.2.1 Benefits of Mitigation Planning

The planning process will help prepare citizens and government agencies to better respond when disasters occur. Also, mitigation planning allows Saratoga County and city, town 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 include:

- An increased understanding of hazards faced by 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 and reduced repair costs

1.2.2 Plan Organization

This Plan was organized in accordance with FEMA and NYS DHSES guidance. The Plan is organized into nine sections and eight appendices (not including one redacted appendix).

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

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

Section 4: County Profile - An overview of Saratoga County, including: (1) general information, (2) population and demographics, (3) economy, (4) natural environment, (5) population trends, (6) land use trends, (7) general building stock inventory and (8) critical facilities.

Section 5: Risk Assessment - Documentation of the hazard identification and ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety and health, general building stock, critical facilities 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 Saratoga County in response to priority hazards of concern.

Section 7: Plan Maintenance Procedures - The system established by Saratoga County to monitor, evaluate, maintain and update the Plan.

Section 8: Planning Partnership - Description of the planning partnership, jurisdictional annexes and benefit /cost review process.

Section 9: Jurisdictional Annexes - A jurisdiction-specific annex for each participating jurisdiction and the County containing their hazards of concern, risk ranking, capability assessments, mitigation actions and action prioritization specific only to the County or that jurisdiction.

Appendices:

Appendix A: Example Resolution of Plan Adoption - Documentation that supports the Plan approval signatures included in Section 2 of this Plan, as well as a sample adoption resolution.

Appendix B: Planning Process Documentation - Meeting invitations, sign-in sheets, agendas, meeting notes, presentation decks, and templates and handouts (where applicable) for all meetings convened during the development of the Saratoga County Multi-Jurisdictional All-Hazards Mitigation Plan. Additionally, contains documentation for public and stakeholder outreach.

Appendix C: Risk Assessment - Result reports from the Hazus natural hazard loss analysis.

Appendix D: Mitigation Strategy - Comprehensive list of the previous HMP's mitigation action plan.

Appendix E: Mitigation Programs - A summary of available federal, state, and local programs that relate to mitigation planning and may provide possible sources of funding or technical support for mitigation initiatives.

Appendix F: Mass Care and Sheltering Annex - Annex to the Saratoga County Emergency Operations Guidelines that provides direction for coordinating and maximizing resources to support mass care and shelter operations across the county. Inside the Mass Care and Sheltering Annex, Appendix A reviews the temporary and permanent relocation options in the county, and Appendix B is a list of the American Red Cross shelters throughout the county.

Appendix G: Linkage Procedures - Specific procedures that currently non-participating jurisdictions within the County can implement towards achieving DMA 2000 coverage under this Plan.

Appendix H: New York State Hazard Mitigation Planning Standards - The requirements as they appear on the plan review tool used by NYS DHSES and FEMA Region II to determine whether or not a submitted plan meets federal and state requirements.

Appendix I: (Redacted) Critical Facilities and Infrastructure – This appendix is a series of tables, organized by facility sector (ex. Emergency Facilities, Transportation Systems, etc.), that summarize details related to critical facilities and infrastructure in Saratoga County. This appendix was compiled using the data collected in the previous planning process, Hazus default facility

data, as well as additions collected during this planning process from stakeholders. This appendix may be made available upon request to Saratoga County OES.

Section 2: Plan Adoption

This section contains information regarding adoption of the Plan by Saratoga County and each participating jurisdiction. In addition to being required by Disaster Mitigation Act of 2000 (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 (FEMA, 2003).

2.1 Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies demonstrates the commitment of Saratoga County and each participating jurisdiction to fulfil the mitigation goals and objectives outlined in the Plan. Adoption legitimizes the Plan and authorizes responsible agencies to execute their responsibilities. Each participating jurisdiction will proceed with formal adoption proceedings when NYS DHSES and FEMA provide conditional approval of this Plan. Each participating jurisdiction understands that a conditional approval of the Plan will be provided for those municipalities that meet the planning requirements.

Following adoption or formal action on the Plan, each participating jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the Plan to NYS DHSES. Appendix A contains an example of what the resolution that will be used. Completed resolutions will then be submitted to FEMA. Each participating jurisdiction understands that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the plan to the mitigation plan coordinator. The resolutions issued to support adoption of the plan by each jurisdiction will be collected and stored by Saratoga County OES.

Section 3: Planning Process

3.1 Introduction

This section describes the planning process used to develop the Saratoga County Multi-Jurisdictional Hazard Mitigation Plan, including the steps taken to prepare the plan and who was involved in this process, including stakeholder and public participation.

To ensure that the HMP met the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), an approach to the planning process and plan documentation was developed to achieve the following two goals:

1. The HMP will be multi-jurisdictional and consider natural hazards facing Saratoga County, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000. Saratoga County invited all municipalities in the county to join with them in the preparation of the Saratoga County Multi-Jurisdictional HMP.
2. The HMP will be developed following the process outlined by DMA 2000, FEMA regulations, and FEMA and NYS DHSES guidance. Following this process will ensure all the requirements are met and support HMP review.

This HMP was written using the best available information obtained from a wide variety of sources. Throughout plan development, a concerted effort was made to gather information from participating municipal and county agencies and staff as well as other local organizations and utilities, federal and state agencies, and the residents of the County. The Planning Team solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events, as well as considering planning and zoning codes, ordinances, and other recent planning decisions. The natural hazard mitigation strategies identified in this plan have been developed through an extensive planning process involving county and local agencies, municipal officials and staff, and the citizens of the County.

This section of the HMP describes the mitigation planning process, including the formation and membership of the Planning Team, the outreach strategy used to engage the public and broader stakeholder audiences, and the integration of existing data, plans, and information.

3.2 The Planning Process

3.2.1 Roles and Responsibilities

Saratoga County applied for, and was awarded, a FEMA Pre-Disaster Mitigation Grant (PDM) in fiscal year 2016 to update their multi-jurisdictional hazard mitigation plan through a comprehensive plan update process. The Saratoga County Office of Emergency Services (OES) led and managed the plan update process. Saratoga County OES established a point of contact, called the HMP Coordinator, who was responsible for communication between the jurisdictions and a hired consultant. The HMP Coordinator position is currently filled by Mr. Michael Stanley of

the Saratoga County OES. In their role, Saratoga County OES was charged with the following during this planning process:

- Establish HMP development goals and objectives;
- Establish a timeline for completion of the Plan;
- Ensure that the HMP meets the requirements of DMA 2000, FEMA, and NYS DHSES guidance;
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the HMP development process;
- Assist in gathering information for inclusion in the Plan, including the use of previously developed reports and data; and
- Organize and oversee the public involvement process.

Through an open bid process, Saratoga County OES selected a planning consultant (Hagerty Consulting) to facilitate the plan update process. A contract between Hagerty Consulting ("Hagerty") and Saratoga County was executed on June 25, 2018. The contract consultant was tasked with:

- Assisting with the development and implementation of a public and stakeholder outreach program;
- Data collection;
- Facilitating meetings;
- Identifying the hazards of concern and performing a risk assessment;
- Assisting with the development of mitigation planning goals and objectives;
- Assisting with the screening of mitigation actions and the identification of appropriate actions;
- Assisting with the prioritization of mitigation actions; and,
- Authoring of the Draft and Final HMP documents.

In June 2018, Saratoga County OES reviewed the Planning Team from the 2011 planning process to update points of contact for all thirty municipalities in the County and expand the team to include non-traditional stakeholders like local utility companies and the Local Emergency Planning Committee (LEPC). Then, the County invited the Planning Team to formally participate in the pending planning process through an electronic invitation using Google Form. The RSVPs received through this request, as well as future meeting attendance, were tracked in a participation matrix for the duration of the planning process (see *Table 3-2: 2019 HMP Update Participation Matrix* for the complete matrix).

The Planning Team notified the County of their intent to participate and identified a point of contact to serve on the Planning Team to represent the interests of their respective community or organization during the planning process. Table 3-1 shows the current members of the Planning Team, at the time of this Plan's publication. If an invited municipality did not respond to this initial invitation process, Saratoga County OES continued to invite that municipality to participate in subsequent Planning Team meetings and activities. Later in the planning process, the County conducted personalized outreach to each municipality by emailing and placing phone calls to

guide them through the process of developing mitigation action worksheets. This outreach was conducted for all municipalities, including those that had not participated to date.

On July 19, 2018, the Planning Team met for the first time at the Kickoff Meeting. The team continued to meet throughout the next six months during the duration of plan development. Throughout the plan update process, the Planning Team was responsible for:

- Identifying hazard events and losses within their jurisdiction;
- Ranking their jurisdiction's risk to the hazards of concern identified for this Plan;
- Developing a capability assessment for their jurisdiction;
- Identifying and prioritizing local mitigation actions; and,
- Developing, revising, adopting, and maintaining the Plan.

The Planning Team consisted of several members of the LEPC. The LEPC made announcements to stakeholders about the mitigation planning project status and asked for feedback about the assessment of risk during their regularly scheduled meetings. Notes from these LEPC meetings can be found in Appendix B.

After completing this plan's update, implementation and ongoing maintenance will become a function and responsibility of the Mitigation Planning Committee (MPC). While many Planning Team members will also participate on the MPC, some municipalities identified different individuals to serve on the MPC. This Committee will review the HMP and accept public comment as part of an annual review, and as part of five-year mitigation plan update requirement. Section 7 further explains the purpose of the MPC and identifies its members.

Table 3-1 Planning Team Members

First	Last	Title	Agency
Gil	Albert	Code Enforcement Officer	Town of Saratoga/Village of Schuylerville
Preston	Allen	Supervisor	Town of Day
Matt	Andrus	Emergency Manager	Town of Clifton Park
Dennis	Baker	Mayor	City of Mechanicville
David	Ball	Councilman	Town of Waterford
Walter	Barss	Highway Superintendent	Town of Greenfield
Eileen	Bennett	Director	Saratoga County Information Technology
Albert	Brooks	Code Enforcement Officer	Town of Corinth
Bill	Bryans	Highway Superintendent	Town of Halfmoon
Dahn	Bull	Highway Superintendent	Town of Clifton Park
Rebecca	Carman	Director of Policy and Community Development	Shenendehowa Central School District
Richard	Castle	Undersheriff	Saratoga County Sheriff's Office
John	Catone	Assistant Chief	City of Saratoga Springs Police
TJ	Changnon	Highway Superintendent	Village of South Glens Falls
Chet	Ciembronowicz	Code Enforcement Officer	Town of Galway
James	Clark	Engineering Technician	Saratoga County DPW
Tim	Collins	Emergency Manager	Village of Stillwater
Nicole	Colson	Clerk	Village of Corinth
David	Constanzo	Highway Superintendent	Town of Galway
John	Cooper	Emergency Manager	Town of Halfmoon
Ray	Cordani	Police Commissioner	Town of Stillwater Police
Roger	Crandall	Highway Superintendent	Town of Malta
Jim	DeAngelo	Senior Managing Associate	Hagerty Consulting
Robin	Decker	Highway Superintendent	Village of Schuylerville
Katelyn	DeCrescenzo	Security Assistant/EM Manager	Navy Installation, Saratoga Springs
Sherry	Doubleday	Emergency Manager	Town of Saratoga
Catherine	Duncan	Director of Public Health	Saratoga County Public Health
Shawn	Eggleston	Highway Superintendent	Town of Corinth
Stuart	Field	Chemical Engineer	Slack Chemical
David	Forbes	Highway Superintendent	Town of Milton
Jeffrey	Gawrys	Highway Superintendent	Village of Ballston Spa

First	Last	Title	Agency
Andrew	Gilbert	Highway Superintendent	Town of Hadley
Robert	Gizzi	Zoning Administrator & Building Inspector	Town of Charlton
Steven	Gordon	Director of Emergency Communications	Saratoga County Sheriff's Office
Tony	Gotti	Commissioner of Public Works	City of Mechanicville
Kurt	Haas	Emergency Manager	Town of Northumberland
John	Halland	Building / Code Enforcement Officer	City of Mechanicville
Richard	Harris	Director of Planning	Town of Halfmoon
Christa	Hay	Mitigation Planner	NYS DHSES
Glenn	Hebert	Building Inspector	Town of Waterford
Marshell	Heritage	Highway Superintendent	Town of Charlton
Cory	Heyman	Water Department	Village of Victory
Troy	Hilts	GIS Specialist	Saratoga County Planning
Tim	Hipwell	Emergency Manager	City of Mechanicville
Mark	Hodgkins	Town Councilman	Town of Charlton
Paul	Hoole	Mitigation Planning	FEMA
Peter	Hotaling	Assessor	Town of Ballston
Brenda	Howe	Assessor Clerk	Town of Milton
Beverly	Jacon	Assessors Secretary	Town of Corinth
James	Jenkins	Emergency Manager	Town of Hadley
Peggy	Jenkins	Assessor	Town of Moreau
Paul	Joseph	Highway Superintendent	Town of Moreau
Tia	Kilburn	911 Coordinator	Town of Northumberland
Kevin	King	Comptroller	Town of Malta
Theodore	Kusnierz	Supervisor	Town of Moreau
Ron	Ladd	Highway Superintendent	Town of Day
Bill	Lewis	Emergency Manager	Town of Milton
Maureen	Lewsey	Emergency Manager	Village of Victory
William	Llyod	Superintendent of DPW	Village of Victory
Arthur	Lozier III	Superintendent of DPW	Village of Corinth
Keith	Manz	Commissioner of Public Works	Saratoga County DPW
Harold	Martel	Highway Superintendent	Town of Waterford
Tammy	Martineau	Emergency Manager	Village of Corinth
Paul	McInerney	Assistant to Public Safety Commissioner	Town of Waterford

First	Last	Title	Agency
Sydney	McKenna	Managing Associate	Hagerty Consulting
Peter	McManus	Planner	NYS DHSES/OEM
Kenneth	Metzler	Code Enforcement Officer	Town of Day
Mark	Minick	Highway Superintendent	Town of Stillwater
Steven	Myers	Director of Building and Zoning	Town of Clifton Park
Mark	Mykins	Building Inspector /CEO	Town of Wilton
Patrick	O'Connell	Waterford PD Sergeant	Town of Waterford Police
Don	Ormsby Jr.	Highway Superintendent	Town of Saratoga
Thomas	Parks	Chief	Town of Charlton Police
Lou	Pasquarell	Director of Public Safety	Town of Clifton Park
Daniel	Pemrick	Supervisor	Town of Greenfield
John	Pingelski	Highway Superintendent	Town of Halfmoon
Lori	Prock	Emergency Preparedness Program Coordinator	Saratoga County Public Health
Ed	Prunier	Environmental Health & Safety Manager	Ball Corporation
Melany	Putnam	Outreach Manager	NYSEG
Sheryl	Reed	Fire Marshall	Town of Clifton Park
Matt	Rifenburg	DPW Foreman	Village of Stillwater
Tom	Rinaldi	Emergency Manager	Town of Stillwater
Marilyn	Rivers	Director of Risk and Safety	City of Saratoga Springs
Dave	Robbins	Town Councilman	Town of Charlton
Daniel	Rourke	Executive Director	Saratoga County Sewer
Alussa	Santagato	Emergency Manager	City of Mechanicville
Kim	Sheridan	Village Clerk	Village of Round Lake
Mike	Shudt	Waterford PD Sergeant	Town of Waterford Police
John	Solan	Lieutenant, Zone Supervisor	NYS DEC, Region 5 Forest Rangers
Barbara	Spaulding	Mitigation Planner	NYS DHSES
Michael	Stanley	Emergency Services Specialist	Saratoga County OES
John	Stevenson	Village Superintendent	Village of Round Lake
Tim	Szczepaniak	Supervisor	Town of Ballston
Brian	Theriault	Building Inspector	Town of Ballston
Ed	Tremblay	Fire Coordinator	Saratoga County OES
Bill	Valosin	Emergency Manager	Town of Stillwater
Harold	Vance Jr.	Highway Superintendent	Town of Northumberland
Emily	Votroubek	Associate	Hagerty Consulting

First	Last	Title	Agency
Timothy	Wales	City Engineer	City of Saratoga Springs
Sue	Wemple	Town Clerk	Town of Providence
Joe	Whalen	Highway Superintendent	Town of Ballston
George	Whitney	Highway Superintendent	Town of Providence
Rob	Williams	Chief	City of Saratoga Springs FD
Sandra	Winney	Supervisor	Town of Providence
Sue	Winslow	Emergency Manager	Village of Corinth
Larry	Wolcott	Code Enforcement Officer	Village of Victory
Larry	Wollbright	Emergency Manager	Village of Ballston Spa
Kirklin	Woodcock	Highway Superintendent	Town of Wilton
Judy	Wood-Zeno	Trustee Village Board and Emergency Manager	Village of Stillwater
Carl	Zeilman	Director	Saratoga County OES
Lindsay	Zepko	Director of Building and Planning	Town of Stillwater
Shelley	Zieske	Lieutenant	Saratoga County Sheriff's Office

3.2.2 Meetings

The Saratoga County Multi-Jurisdictional HMP consisted of three in-person meetings and one virtual meeting held as a webinar:

1. Kick-Off Meeting: July 19, 2018
2. Risk Assessment and Capability Review Meeting: October 11, 2018
3. Mitigation Strategies Meeting: November 15, 2018
4. Plan Review Webinar: January 10, 2019

Appendix B captures all related documentation from these meetings, including invitations, agendas, presentations, handouts, meeting notes, and attendance. The following sections summarize the outcomes of each of the planning process meetings.

Kick-Off Meeting

Saratoga County OES hosted the project Kick-Off Meeting was held on July 19, 2018. The Planning Team was presented an overview of the project goals, the planning process, and purpose of mitigation planning. During the meeting, the Planning Team reviewed the natural hazards from the previous plan and considered changes in hazard frequency and impacts. Based on this discussion, four new natural hazards were added to this HMP: drought, extreme temperatures, invasive species, and wildfire.

Risk Assessment and Capability Review Meeting

The Risk Assessment and Capability Review meeting was held on October 11, 2018. The Planning Team reviewed the results of the risk assessment to understand each of the hazards profiled. During this meeting, the Planning Team participated in an exercise to rank the natural hazards based on their frequency and impacts in their jurisdiction. Planning Team members used the Jurisdictional Annex and Capability Worksheet to review and update the capability assessment and community profile information in their jurisdiction's annex. This form and its instructions can be found in Appendix B.

Mitigation Strategies Meeting

The Saratoga County OES hosted the Mitigation Strategies meeting on November 15, 2018. During this meeting, the Planning Team discussed the Mitigation Strategy, including the proposed mitigation goals, objectives, and actions for this plan update. As part of this meeting, Hagerty facilitated an interactive exercise for local jurisdictions and Saratoga County to review and revise past mitigation actions and develop new mitigation actions. NYS Planning Standards require that each participating jurisdiction and the County develop two project action worksheets using a provided template. The Planning Team also worked on developing these worksheets during this meeting. The meeting handouts and worksheets, including the NYS DHSES Action Worksheet, can be found in Appendix B.

Plan Review Webinar

Hagerty presented an overview of the Draft HMP to the Planning Team on January 10, 2019 through an online webinar. During this presentation, Hagerty highlighted the main updates to the plan in order to guide the committee's review of the draft plan. Initial comments on the plan were discussed and collected during the meeting. The Planning Team spent the next two weeks after this webinar reviewing the plan and providing any recommended revisions to Hagerty in a review matrix.

3.2.3 Outreach

Saratoga County OES recognizes the need to engage as diverse an audience as possible in this planning process. The County developed an Outreach Strategy in coordination with the planning consultant, Hagerty, that provided a road map to engaging stakeholders and the public. Appendix B includes a copy of this strategy as well as copies of the engagement materials produced. One outreach technique employed during this plan update process was to distribute electronic newsletters to a wide and regional audience of stakeholders. Four newsletters were sent between August 2018 and January 2019. These newsletters highlighted information related to the natural hazards that can impact Saratoga County, identified strides and innovations in mitigation, and detailed next steps in the hazard mitigation plan update process. A copy of each newsletter is provided in Appendix B.

Another important part of the Outreach Strategy was to engage the public in the planning process. Public participation occurred primarily through reviewing the Draft 2019 HMP Update and

completing an online survey to submit feedback. Saratoga County OES posted the draft plan and a link to the survey online on the OES website on January 4, 2019. The public was given the opportunity to comment on the plan for 30 days, until February 6, 2019. Through this survey, the public was invited to share comments on the plan and provide insight on the utility of the plan's mitigation strategy (as per State Planning Standards requirement F10). The responses received from this survey indicated that the plan was comprehensive and adequately addressed all hazards facing the county. Responses from this survey can be found in Appendix B.

Saratoga County is committed to the continued involvement of the public in understanding hazard mitigation and participating in planning for a more resilient future. At the direction of the HMP Coordinator, the MPC will meet on an annual basis to review this plan, evaluate progress on mitigation actions, and perform interim updates on the plan. The public will be notified about these annual meetings and informed of where and how to access plan online to review. The public will be invited to comment on the plan during these annual review periods. Each jurisdiction's Supervisor/Mayor or Clerk will be responsible for receiving, tracking, and filing public comments regarding this Plan. Additional meetings may also be held as deemed necessary by the MPC. The purpose of these meetings will be to provide the public an opportunity to express concerns, opinions, and ideas about the HMP. Further details regarding continued public involvement are provided in Section 7.

3.2.4 Participation

A variety of stakeholders participated in the different parts of this plan update process. Their participation included providing information on hazard occurrences or critical facility locations, attending meetings, reviewing plan drafts, and developing NYS project action worksheets. The matrix on the next page summarizes this participation to date.

Table 3-2 2019 HMP Update Participation Matrix

Date	Activity	City of Mechanicville	City of Saratoga Springs	Town of Ballston	Town of Charlton	Town of Clifton Park	Town of Corinth	Town of Day	Town of Edinburg	Town of Galway	Town of Greenfield	Town of Hadley	Town of Halfmoon	Town of Malta	Town of Milton	Town of Moreau	Town of Northumberland	Town of Providence	Town of Saratoga	Town of Stillwater	Town of Waterford	Town of Wilton	Village of Ballston Spa	Village of Corinth	Village of Galway	Village of Round Lake	Village of Schuylerville	Village of South Glens Falls	Village of Stillwater	Village of Victory	Village of Waterford	Saratoga OES
6/13/18	Pre-Project Meeting																															x
7/19/18	Kickoff Meeting	x	x	x		X					x		x	x			x		x	x	x	x							x			x
8/1/18 - 8/31/18	Risk Assessment Hazard Worksheet		x	x									x									x										x
8/10/18 - 8/31/18	Critical Facility Input	x	x	x						x	x			x		x			x		x	x										x
10/11/18	Risk Assessment and Capability Review Meeting		x	x	x	X								x			x			x	x	x		x								x
10/25/18	Risk Assessment Review Feedback																																x
10/25/18	Hazard Ranking Form	x	x	x	x	X	x						x	x			x			x	x	x											x
10/25/18	Jurisdictional Annex Form - Capability Review	x	x	x	x	X	x		x				x	x			x	x		x	x	x	x			x			x		x	x
11/15/18	Mitigation Strategy Meeting	x	x	x	x	X							x		x	x	x			x	x												x

Date	Activity	City of Mechanicville	City of Saratoga Springs	Town of Ballston	Town of Charlton	Town of Clifton Park	Town of Corinth	Town of Day	Town of Edinburg	Town of Galway	Town of Greenfield	Town of Hadley	Town of Halfmoon	Town of Malta	Town of Milton	Town of Moreau	Town of Northumberland	Town of Providence	Town of Saratoga	Town of Stillwater	Town of Waterford	Town of Wilton	Village of Ballston Spa	Village of Corinth	Village of Galway	Village of Round Lake	Village of Schuylerville	Village of South Glens Falls	Village of Stillwater	Village of Victory	Village of Waterford	Saratoga OES
12/11/18	Review Previous Plan Mitigation Actions		x	x	x	X							x								x	x									x	x
12/11/18	Complete Two NYS Mitigation Action Worksheets		x	x	x	X	x	x			x	x	x	x	x	x	x	x			x	x	x				x	x			x	x
1/10/19	Plan Review Meeting			x	x	X							x	x				x			x											x
1/24/19	Draft Plan Review and Feedback		x	x	x	X							x	x		x	x				x	x	x			x	x		x		x	x

3.3 Coordination with Existing Planning Efforts and Programs

Local municipalities are charged with the development of local Hazard Mitigation Plans required under Section 322 of the Stafford Act by New York. Therefore, the Planning Team coordinated the development of this HMP. In New York, Article 2B Section 23 of State Executive Law authorizes local communities to prepare local disaster plans based on the contention that local municipalities are best equipped to assess their strengths and weaknesses, opportunities, and constraints. Local governments have intimate knowledge of the local geography, and in a disaster, local government personnel are on the front lines providing personnel and equipment to support the community. Saratoga County and the participating jurisdictions are involved in this above program, hence the development of this Plan.

Examples of other hazard mitigation-related programs that Saratoga County is involved with are the National Flood Insurance Program (NFIP) and the Hazard Mitigation Grant Program (HMGP). These programs assist the County in receiving funding for flood mitigation projects and flood insurance. The HMGP can also provide funds to mitigate other natural hazards. Section 5, Risk Assessment, includes details on the county and its municipalities' participation in the NFIP and where repetitive flood claims have been made. This information was also used to help identify mitigation projects in Section 6 and 9. Saratoga County has received limited HMGP grants in the past five years but plans to prioritize applications for grants in the future. Involvement in these grant programs will help to administer funds and resources to support this HMP.

3.3.1 Hazard Mitigation Assistance Grant Programs

FEMA offers annual hazard mitigation assistance grants, including the HMGP, PDM, and flood mitigation assistance grants (FMA). Participation in FEMA 404 HMGP may cover mitigation activities including raising, removing, relocating or replacing structures within flood hazard areas. PDM grants funding for activities, projects, and plans that seek to reduce risk and loss prior to disaster. FMA provides funding for projects that reduce the risk of long-term flooding damage prior to and following a disaster (this funding can also be used to cover project management costs).

3.3.2 National Flood Insurance Program

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

For a community to be eligible in NFIP, it must adopt and enforce a floodplain management ordinance to regulate proposed development in floodplains and officially designate a local floodplain coordinator/administrator. The purpose of the program is to protect structures by reducing the impact of flooding. To understand the extent of flooding in a community, FEMA

develops and publishes Flood Insurance Rate Maps (FIRMs) to show the location of floodways, 100-year flood zones, and 500-year flood zones.

At the time this plan was approved, all jurisdictions in Saratoga County participate in the NFIP except Town of Edinburg and the Village of Galway. Each municipality that participates in the NFIP also must designate a local floodplain manager. To the greatest extent possible, the floodplain managers have been informed of the planning process and were invited to share direct input to the Plan. Mitigation activities related to this program are included in Section 9 and data from FEMA Region II regarding NFIP insurance claims is summarized in the flood profile found under Section 5: Risk Assessment.

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

3.3.3 Community Rating System

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

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

CRS is a voluntary program designed to reward participating jurisdictions for their efforts to create more disaster-resistant communities using the principles of sustainable development and management. While none of the communities in Saratoga County are currently participating in the program, by enrolling in CRS, municipalities can leverage greater flood protection while receiving flood insurance discounts. Active involvement in this program is included as a mitigation activity in Section 9.

3.4 Data Sources

The Planning Team reviewed and incorporated existing data and plans to support the update of this hazard mitigation plan. A variety of plans, studies, reports and technical information were reviewed as part of this hazard mitigation plan update. Some examples of what this documentation is and how it was integrated include:

- Documentation of past mitigation actions and grant applications;
- Historic maps and local inventory data;
- Saratoga County Green Infrastructure Report;
- Maps and plans from the Capital District Regional Planning Commission referenced and incorporated into Section 4 of this plan to describe changes in land use, transportation and the local economy; and

- Growth and development data incorporated into the jurisdictional annexes in Section 9, where provided, to describe new projects that have been recently completed and the location of future planned development.

This local data supported efforts to develop the County Profile, Risk Assessment, Mitigation Strategy, and Jurisdictional annexes.

Federal and State data was also collected and used throughout the mitigation process including:

- The 2014 New York State Hazard Mitigation Plan (NYS HMP) was integrated throughout this local HMP. In Section 5, the NYS HMP provided valuable insight into hazard frequency and impacts in Saratoga County (see Table 5-2). The goals and objectives found in Section 6 of this HMP were also aligned with the state plan.
- United States (US) Census data;
- Hazards United States – Multi-Hazard (Hazus) provided data;
- FEMA Local Hazard Mitigation Handbook (2013);
- Public laws and other programs such as the NFIP; and
- New York State Geographic Information System (GIS) data.

A complete list of the existing data and plans used to support this HMP is included in the references section of this document. By incorporating data from existing programs into this mitigation plan, the County also was able to identify the relevance of mitigation planning to these existing programs.

Section 4: Saratoga County Profile

County profile information was collected and analyzed to develop a more thorough understanding of the study area, including the economic, structural, and population assets at risk and the particular concerns that may be present related to the natural hazards analyzed later in this plan. This section describes the location and historical context of Saratoga County, as well as the county's current and future conditions related to demographics, economy, infrastructure, and the natural environment.

4.1 Location and Historical Context

On February 7, 1791, Saratoga County was formed from Albany County in the northeastern section of New York State. Four towns originally made up Saratoga County, which included Ballston, Stillwater, Halfmoon and Saratoga (Saddlemire, n.d.). Saratoga County is now comprised of two cities, nineteen towns, and seven villages and has approximately 810 square miles of land and 34 square miles of water (US Census Bureau, 2010; Seleen and Tabka, 2013)

Saratoga County is bordered to the north by Warren County, to the south by Schenectady and Albany Counties, to the east by Washington and Rensselaer Counties, and to the west by Hamilton, Fulton and Montgomery Counties. The Hudson River forms the eastern and northern boundary and the Mohawk River forms the southernmost boundary. The Adirondack Mountains, the Sacandaga Reservoirs, numerous lakes and streams, and farmland all make up the landscape of the County (Saratoga PLAN, n.d.-b).

Saratoga County is located within the Capital District. This region refers to the four counties surrounding the New York State capital of Albany. These counties include Albany County, Schenectady County, Rensselaer County and Saratoga County. The region is located in the east-central portion of the State, at the confluence of the Hudson and Mohawk Rivers, and covers a total land area of 2,200 square miles. The term "Capital District" was originated in the 1920s in an effort between the Albany Chamber of Commerce and the Albany Times Union (Capital District Regional Planning Commission, n.d.-b.; Wechsler, n.d.).

4.2 Current Conditions

This section details the current demographics, economic assets, infrastructure, and natural environment conditions of Saratoga County. Understanding the current state of these conditions will inform the risk assessment.

4.2.1 Population

According to 2016 estimates, Saratoga County has an estimated population of 224,929 (U.S. Census Bureau, 2016h), with a population density of approximately 277.7 people per square mile.

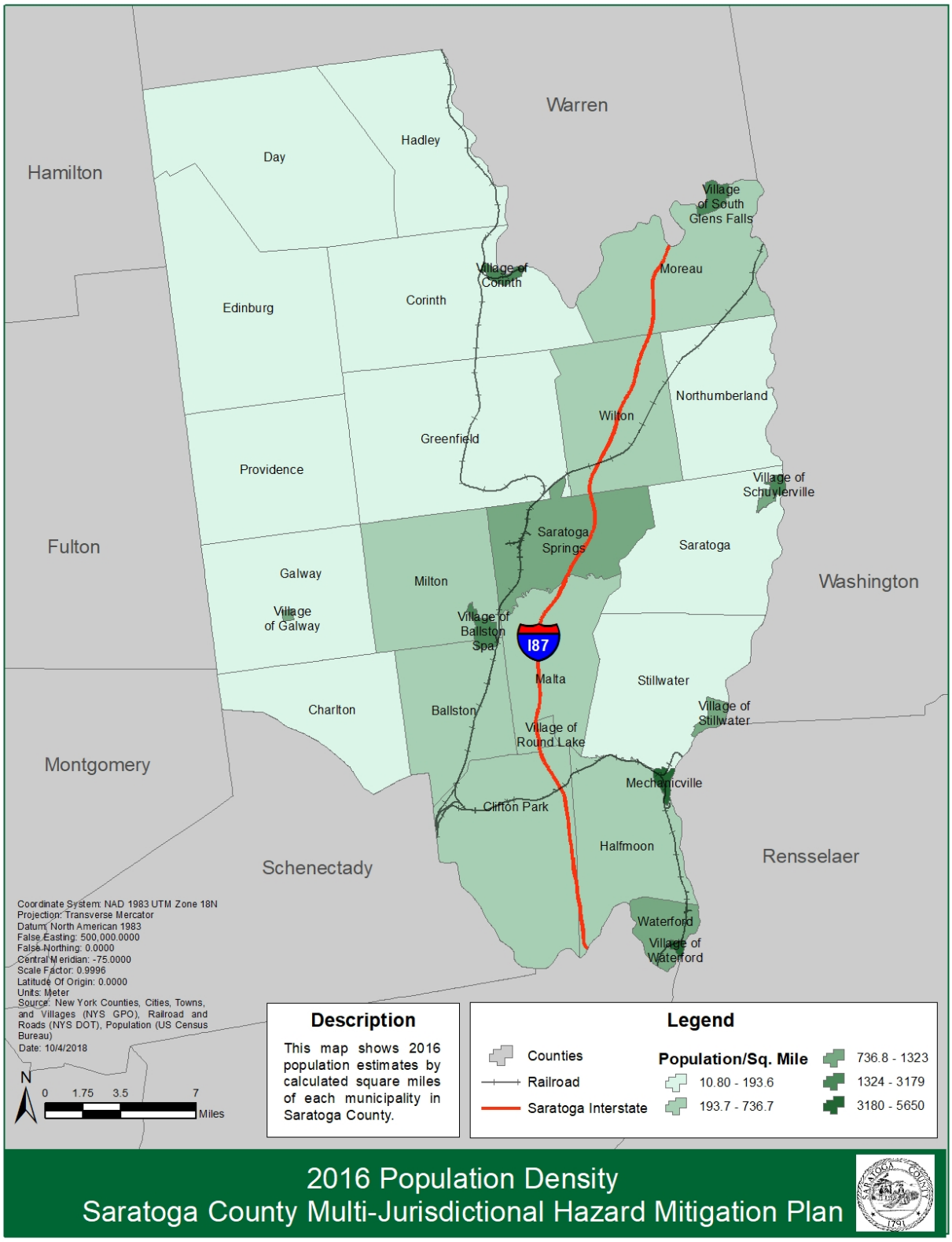
Table 4-1 illustrates the population comparison between Saratoga County's townships and cities. Figure 4-1 shows the population density in Saratoga County by municipalities.

Table 4-1 Saratoga County Population Estimates (2016)

Municipality	Population (2016 Estimates)
Town of Ballston	10,369
Village of Ballston Spa	5,134
Town of Charlton	4,181
Town of Clifton Park	37,001
Town of Corinth	6,475
Village of Corinth	2,632
Town of Day	752
Town of Edinburg	1,440
Town of Galway	3,535
Village of Galway	219
Town of Greenfield	7,772
Town of Hadley	1,750
Town of Halfmoon	23,219
Town of Malta	15,119
City of Mechanicville	5,169
Town of Milton	18,985
Town of Moreau	15,161
Town of Northumberland	5,151
Town of Providence	2,216
Village of Round Lake	585
Town of Saratoga	5,675
City of Saratoga Springs	27,447
Village of Schuyler	1,653
Village of South Glens Falls	3,591
Town of Stillwater	8,436
Village of Stillwater	1,910
Village of Victory	517
Town of Waterford	8,423
Village of Waterford	2,059
Town of Wilton	16,653

Source: ACS 5-Year 2016 Estimates, US Census Bureau, 2016

Figure 4-1 Saratoga County Population Density



4.2.2 Demographics

Population characteristics highlight the demographic composition of the state and are required as per Disaster Mitigation Act of 2000 (DMA 2000) due to their importance in identifying vulnerable populations in need of special planning.

Income diversity is important to analyze in hazard mitigation planning as certain populations may not have access to financial resources pre- and post-disaster. In Saratoga County, the average median household income is approximately $76,097, higher than both the average United States' median household income of $57,617 and New York's median household income of $60,741 (US Census Bureau, 2016a; US Census Bureau, 2016b; US Census Bureau 2016g).

Age is another consideration in hazard mitigation. Vulnerable ages, identified as those older than 65 and younger than 5, are at a higher risk following a disaster. Both populations can be largely dependent on caregivers. Elderly populations may also need extended medical care due to disease, aging health, and limited mobility, while young children may also be at higher risk if they are not able to communicate needs. This makes these particular age groups vulnerable if a disaster were to strike. Saratoga County has approximately 15.9% of their population over the age of 65 and approximately 5.2% of their population younger than the age of five (US Census Bureau, 2016c).

Mobility in regard to homeownership can impact how communities prepare for and recover from a disaster. Highly mobile populations, such as renters, may have fewer resources available to them before and after a disaster, and may be less aware of disaster preparedness education and procedures. In Saratoga County, approximately 24% of the total population is renters (US Census Bureau, 2016d). This is less compared to the national average of approximately 35%, and significantly less compared to the state average of approximately 43% (US Census Bureau 2016d).

An estimated 11.3% of the Saratoga County population has a disability, compared to the 12.5% of the United States' population, and 11.2% of the New York State Population (US Census Bureau 2016e). Persons with disabilities might have mobility issues, or require regular medical care, making disasters high risk events. Understanding the size and concentration of populations with disabilities can ensure that the county is prepared to serve those populations before and after a disaster.

Diversity is also an important characteristic to consider when identifying and mitigating hazard risk. Understanding the demographic composition of Saratoga County is crucial in identifying unique community needs, language barriers, and other specific vulnerabilities to hazards and mitigation actions. Saratoga County's population is approximately 93.6% White (Non-Hispanic), 1.6% Black, 0.2% Americana Indian and Alaska Native, 2.7% Asian, 0.02% Native Hawaiian and other Pacific Islander, 0.4% other, and 1.5% two or more races (US Census Bureau, 2016). Compared to national and state averages, Saratoga's white population is approximately 20% higher (US Census Bureau, 2016f). Table 4-2 summarizes Saratoga County's population with a disability, percent renter population, percent population under five and over 65, and median household income.

Table 4-2 Vulnerable Populations in Saratoga County Townships and Cities (2016 Estimates).

Municipality	% Disabled	% Under 5	% 65 Years or Older	Median Household Income	% Renter
Town of Ballston	9.3	5.5	17.5	$84,882	23.77
Village of Ballston Spa	9.2	5.6	19.9	$58,681	45.4
Town of Charlton	8.8	3.7	20.9	$80,135	3.5
Town of Clifton Park	7.7	5.4	16.7	$97,000	15.75
Town of Corinth	18.7	7.4	16.1	$52,349	20.47
Village of Corinth	22.5	8.5	14.3	$41,131	40.66
Town of Day	27.5	1.5	31.6	$48,333	12.63
Town of Edinburg	17.6	3.1	29	$51,298	6.53
Town of Galway	10.9	4.5	21	$63,086	11.53
Village of Galway	6.8	7.8	16.9	$58,750	3059
Town of Greenfield	15.4	5	20.2	$72,005	18.44
Town of Hadley	16.6	3.2	18.9	$56,313	18.05
Town of Halfmoon	10.4	4.9	15.6	$71,741	29.36
Town of Malta	9.6	4.8	15.1	$86,025	22.61
City of Mechanicville	18	6.2	14.7	$43,638	59.1
Town of Milton	13.1	6	12.3	$64,964	23.42
Town of Moreau	12	4.8	14.1	$63,326	24.87
Town of Northumberland	12.4	5.9	11.3	$72,372	9.42
Town of Providence	10.6	4.3	13.2	$67,969	14.98
Village of Round Lake	13.8	3.9	18.8	$76,750	13.68
Town of Saratoga	11.2	5.1	13.7	$70,205	20.79
City of Saratoga Springs	11.3	4.1	18.3	$73,661	37.73
Village of Schuylerville	12	9.7	10.8	$58,182	41.24
Village of South Glens Falls	15.7	4.7	15.9	$44,460	48.95
Town of Stillwater	13.3	4.1	15.5	$72,076	20.17
Village of Victory	15.5	3.5	10.4	$56,000	24.95
Town of Waterford	13.9	5.9	14.1	$60,977	34.84
Village of Waterford	18.5	5.8	12.1	$50,559	46.86
Town of Wilton	10.3	6.8	11.9	$81,130	19.92

Source: ACS 5-Year 2016 Estimates, US Census Bureau, 2016

4.2.3 Economy

Saratoga County is part of the Capital District of New York State. Employment in the Capital District has grown in the Region's major employment sectors. The Capital District Planning Commission projects that the district will experience growth in employment (Capital District Regional Planning Commission, 2009).

Major employers for Saratoga County include: GLOBALFOUNDRIES, Saratoga Hospital, Shenendehowa Central School District, US Navy - Kesselring Site, Saratoga County, Skidmore College, State Farm Insurance, Saratoga Springs City School District, and Momentive Performance Materials (Saratoga Economic Development Corporation, N.d.).

According to the New York State Department of Labor, government, retail, and the health and social services industry employs the greatest number of people in Saratoga County (New York State Department of Labor, 2016). Accommodation, food services, and drinking Places employs the second highest number of people, followed by the manufacturing industry.

In 2014, Saratoga County adopted the Economic Development Strategic Plan, which guides future economic development in the county. Some of the goals include creating more opportunities for Saratoga County residents and making a robust economy that remains dynamic (Saratoga County and TIP Strategies, Inc., 2014).

4.2.4 Natural Environment

Geology

Saratoga County is part of two physiographic provinces. The north-western portion of the County is located in the Adirondack Highlands physiographic province. The remainder of the County is located within the Hudson-Mohawk Lowlands province. The boundary between the two provinces is a series of northeast trending block faults. These faults are located primarily in the south-eastern section of the Adirondack Highlands and are marked by long, straight valleys. Sacandaga Reservoir and Lake George occupy two of these valleys. The areas to the northwest of the fault lines have been displaced upward. The amount of displacement varies at the different locations along the fault lines. The Saratoga/McGregor fault line passes through Saratoga Springs and controls the locations of many mineral springs found in this area (USDA, N.d.).

The topography of the Adirondack Highlands Province is characterized by old mountain ranges composed of bedrock that is highly resistant to erosion. The highest mountains in New York State, Mt. Marcy and Mt. Alogonquin, both occur in this province. Each of these mountains is over 5,000 feet. Elevations in the Saratoga County portion of this province range between 800 feet above sea level along the south-eastern side of the Kayaderosseras Range and to nearly 2,800 feet above sea level at Tenant Mountain in the north-eastern corner of the County (USDA, N.d.).

In the Kayaderosseras Range, elevation and relief is lower to the east and southeast of the Range in the Hudson-Mohawk Lowlands. It decreases to an elevation of approximately 20 feet above sea level at Waterford, located on the Hudson River (USDA, N.d.). Bedrock within Saratoga County is primarily crystalline in the Adirondack Highlands Region and of the sedimentary origin in the Hudson-Mohawk Lowlands. The crystalline rock is Precambrian in age and is the oldest rock in the country. The crystalline rock is composed of several different types of metamorphic and igneous rocks. Lower Ordovician to Cambrian-age sedimentary rocks border the Adirondack Highlands and extend eastward into the Hudson-Mohawk Lowlands near Saratoga Springs. These rocks are between 500 and 600 million years old. Further to the east, southeast and south, the underlying bedrock consists of Middle Ordovician shales and sandstones of the Canajoharie

and Schenectady Formations. These rocks are between 450 and 500 million years old (USDA, N.d.).

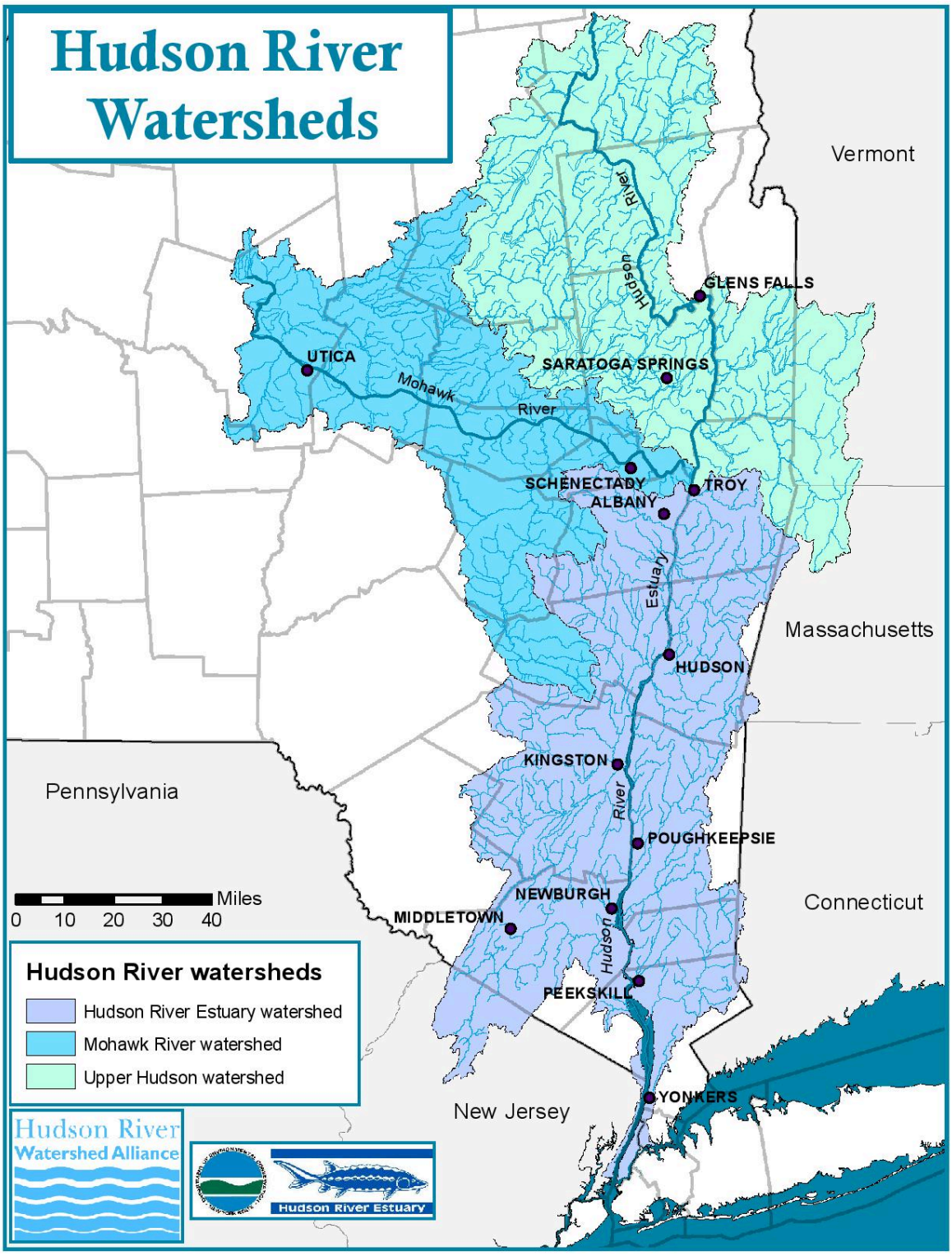
Hydrology and Hydrography

The major rivers of Saratoga County include the Hudson River, Mohawk River and the Sacandaga River. The Hudson River, for more than 70 miles of its course, sweeps along the eastern border of Saratoga County. The Mohawk River is found on the southern side of Saratoga County. The Sacandaga River also runs through Saratoga County as part of the Upper Hudson River Basin (NYSDEC, N.d.). Other waterbodies in the County include the Great Sacandaga Lake, Saratoga Lake, Galway Lake, Fish Creek, Kayaderosseras Creek, Hans Creek, and the North Chuctanunda Creek. The land area of the County drains into one major river basin, which contains four watersheds. A river basin is the portion of land drained by a river and its tributaries. It encompasses the entire land surface divided and drained by many streams and creeks that flow downhill into each other and eventually into one river. The final destination is either an estuary or an ocean.

A watershed is the area of land that catches rain and snow and drains or seeps into a marsh, stream, river, lake or groundwater. Watersheds come in all different shapes and sizes, with some covering millions of square miles while others cover only a few acres. They cross county, state and international boundaries. (US EPA, n.d.; Conservation Technology Information Center, N.d.)

Both river basins and watersheds are areas of land that drain to a particular waterbody, such as a lake, stream, river or estuary. In a river basin, all water drains into a large river. The term watershed is used to describe a smaller area of land that drains to a smaller stream, lake or wetland. There are smaller watersheds within a river basin.

Figure 4-2 Hudson River Watersheds



Source: Hudson River Watershed Alliance and Hudson River Estuary, N.d.

Hudson River Basin

The Hudson River Basin (shown in Figure 4-2) has an area of 13,400 square miles and lies almost entirely with New York State, with parts in Vermont, Massachusetts, New Jersey and Connecticut. The Basin is divided into three major subbasins: the upper and lower Hudson River and the Mohawk River. The upper Hudson River and the Mohawk River subbasins are partially located in Saratoga County. The source of the Hudson River is Lake Tear of the Clouds, a small lake in the Adirondack Mountains, 4,322 feet above sea level. The River flows south-southeast out of the mountain region through primarily forestland. At Hudson Falls, several tributaries flow into the River and the elevation drops to about 200 feet above sea level. From Hudson Falls to Albany, the River is maintained for commercial traffic at a depth of 12 feet. From Hudson Falls south, the River flows through forest and farmland to its confluence with the Mohawk River near Troy in Rensselaer County (Freeman, 1991).

The lower Hudson River begins at the Federal Dam in Troy, just downstream from the confluence with the Mohawk River. The lower Hudson River is tidal and can undergo a change in its flow direction four times a day. It has a total length of 154 miles. The lower Hudson River is maintained at a depth of at least 32 feet for commercial traffic from the Port of Albany to New York City. Some areas of the River can be as deep as 200 feet. The lower Hudson River flows south through farmland for about 60 miles but also passes through some industrial areas before entering the Hudson Highlands area. In this section, it flows through a deep, narrow channel with steep banks and forested mountain slopes. The River then widens near Haverstrow, where its width is 3.5 miles, then narrows as it passes the cliffs of the Palisades and continues south to upper New York Harbor (Freeman, 1991).

Upper Hudson River Subbasin

The upper Hudson River subbasin is comprised of the drainage area of Upper Hudson River, which is a tributary to the Hudson River. It is located above the River's confluence with the Mohawk River at the Troy Dam. The subbasin has a total drainage area of 4,620 square miles. It covers approximately one third of the Hudson River Basin and includes much of the middle portion of eastern New York State, a portion of southwestern Vermont and a small part of north-eastern Massachusetts. Major rivers in the upper Hudson River subbasin include the Hudson, Sacandaga, Schroon, Battenkill, and Hoosic Rivers. Approximately 76-percent of the subbasin is forest, 15-percent is farmed and only 3.4-percent is urban (Phillips and Hanchar, 1996; NYSDEC, 2007). In Saratoga County, the Upper Hudson River forms the eastern and northern boundary of the County. The Champlain Canal of the New York State Canal System extends through the County, parallel with the Hudson River.

Sacandaga Subbasin

The Sacandaga subbasin is comprised of seven branches, totaling 608.2 miles in waterbody size (NYSDEC, n.d.-c. It is found in four New York State Counties, which include: Fulton, Hamilton, Saratoga, and Warren (US EPA, n.d.-b).

Hudson-Hoosic Subbasin

The Hudson-Hoosic subbasin is comprised of 10 branches, totaling 383.6 miles in waterbody size (NYSDEC, n.d.-c). It is found in five New York State counties, which include: Albany, Rensselaer,

Saratoga, Warren and Washington. This subbasin is also found in Massachusetts and Vermont (US EPA, n.d-b).

Mohawk River Basin

The Mohawk River Basin is centrally located in New York State. The Mohawk River is the largest tributary to the Hudson River. It has a total drainage area of approximately 3,460 square miles and represents approximately 25-percent of the entire Hudson River Basin. The Mohawk River starts between the Adirondack Mountains and Tug Hill Plateau in north-central New York State. It flows toward the east, carving a wide valley between the Adirondacks to the north and the Central Appalachian Mountains to the south. The entire basin is located within the borders of the State. The Mohawk River Basin area includes all of Montgomery County, most of Schoharie County, large portions of Schenectady, Greene, Fulton, Herkimer and Oneida Counties, and parts of Albany, Saratoga, Delaware, Otsego, Hamilton, Madison and Lewis Counties (NYSDEC, n.d.). About 55-percent of the basin is forested, 40 percent is farmed, and only 6.2-percent is urban (Phillips and Hanchar, 1996). In Saratoga County, the Mohawk River forms the southernmost boundary of the County. The Eric Canal of the New York State Canal System, located within this Basin, extends through the County, parallel with the Hudson River.

Climate

The climate of New York State is very similar to most of the Northeast U.S. and is classified as 'Humid Continental'. Differences in latitude, character of topography, and proximity to large bodies of water all have an effect on the climate across New York State. Precipitation during the warm, growing season (April through September) is characterized by convective storms that generally form in advance of an eastward moving cold front or during periods of local atmospheric instability. Occasionally, tropical cyclones will move up from southern coastal areas and produce large quantities of rain. The cool season (October through March) is characterized by large, low-pressure systems that move northeastward along the Atlantic coast or the western side of the Appalachian Mountains.

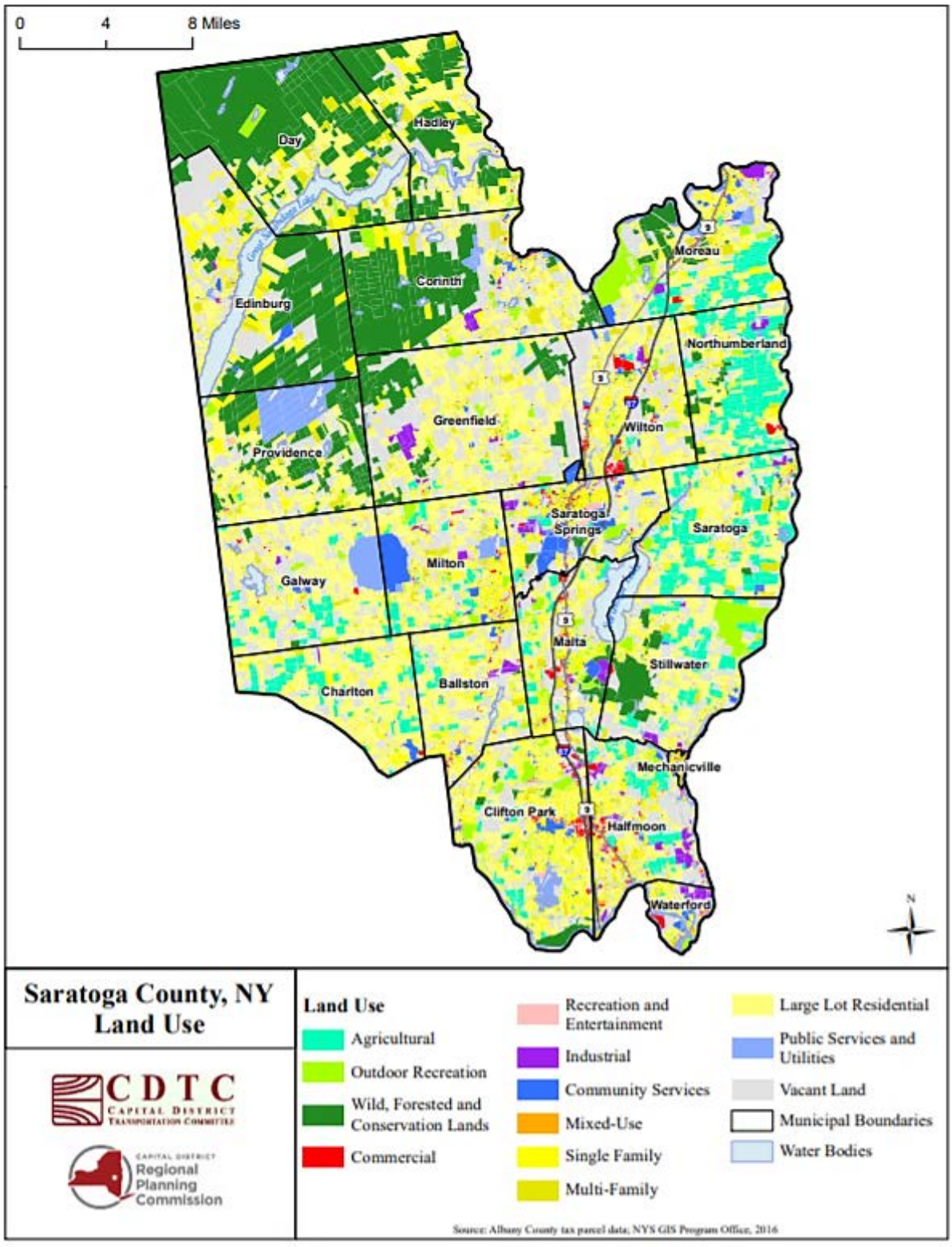
New York has a variety of air masses that come into the state and affect climate. These air masses include cold, dry air from the interior of continent, warm, human air from the Gulf of Mexico and subtropical areas, and an air mass from the North Atlantic (NOAA, N.d.). In winter, the average temperature in Saratoga County is 24.4 degrees Fahrenheit (°F) and with minimum temperature being 15.9 °F and maximum temperature being 34 °F (National Centers for Environmental Information, 2010). Average precipitation for the County is approximately 9.38 inches in the winter (National Centers for Environmental Information, 2010). Average snowfall for New York is approximately 40 inches per year (NOAA, N.d.). During the summer months, the average temperature is 69 °F and the average daily maximum temperature is 81.5 °F (National Centers for Environmental Information, 2010). The total annual precipitation during the summer for the County is approximately 13.06 inches. Average annual precipitation is 44.96 inches (National Centers for Environmental Information, 2010). Of this, approximately half of the rain falls between April and September. The growing season for most crops is within this period. Thunderstorms

occur mostly occurring during the summer months, occurring an average of 30 days of the year (USDA, n.d.; NOAA, N.d.).

Land Use and Land Cover

Saratoga County's land cover is comprised of a variety of uses, some of which are developed, and some are forested. Saratoga Preserving Land and Nature (PLAN) identifies the uses as "10.19% densely developed, 10.77% lightly developed, 10.77% agricultural, 3.4% water, 8% wetlands, and 57% uplands (woodland, shrubland)" (Seleen and Trabka, 2013). Several municipalities within Saratoga County have adopted comprehensive plans that summarize their community's land uses. All towns within Saratoga County, with the exception of the Town of Edinburg, Hadley, and Providence, have adopted or are in the process of adopting zoning ordinances which designate zones for specific development, or non-development, uses. Figure 4-3 shows the land use map for Saratoga County.

Figure 4-3 Land Use in Saratoga County



Source: Capital District Regional Planning Commission, 2016

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

The Green Infrastructure Plan for Saratoga County summarizes the County's priorities. The County has experienced growth and development from historic downtown revitalization in Saratoga Springs, economic development by the County's wastewater collection and treatment system, and initiatives toward creating the Luther Forest Technology Campus. The County has invested in their "grey infrastructure" (for example, highways, water systems) but also recognizes the importance of conserving natural and cultural resources and investing in the County's "green infrastructure" (Green Infrastructure for Saratoga County, 2006).

Other agencies/programs the County has in place include the Saratoga County Industrial Development Agency, Inter-Municipal Stormwater Management Program, the Saratoga County Trails Initiative, and the Farmland/Open Space Preservation Program. The Saratoga County Industrial Development Agency 'promote(s), develop(s), encourage(s), and assist(s) in the construction, expansion, and equipping of economically sound industrial and commercial facilities in order to advance the job opportunities, general prosperity, and economic welfare of the citizens of Saratoga County' (Saratoga County Industrial Development Agency, N.d.).

The Inter-Municipal Stormwater Management Program is a program started by Saratoga County in collaboration with the Cornell Cooperative Extension to implement a regional water management approach. This is done in an effort to meet the requirements of NYS Department of Environmental Conservation Municipal Separate Storm Sewer System (MS4) Permit Program. The program seeks to educate property owners, residents, and business owners about regulations surrounding water resources, management, and non-point source pollution. (Saratoga County Government and Cornell Cooperative Extension, N.d.)

The Saratoga County Trails Initiative was started in 2009 with the creation of the Trails Committee. The County owns approximately 3,000 acres of forestlands, and the initiative sought to identify areas of these public lands that would be suitable for trail systems. Currently, the Initiative oversees several ongoing trail projects. One of the most notable trails is the Louden Road in the Town of Wilton with a developed trail approximately 1.1 miles long. (Saratoga County Government, N.d.).

According to Saratoga County's webpage, in 2003, the County introduced a Farmland/Open Space Preservation Program. This program is '…one of only a few in the entire state.' The program's goal is to acquire federal, state, local and private matching funds to preserve thousands of acres of farmland and open space parcels within the County. At the program's onset, the County provided $333,000 in funding for the program; and in 2008, the Board of Supervisors increased the budget amount to $750,000. With the adoption of the Green Infrastructure Plan in

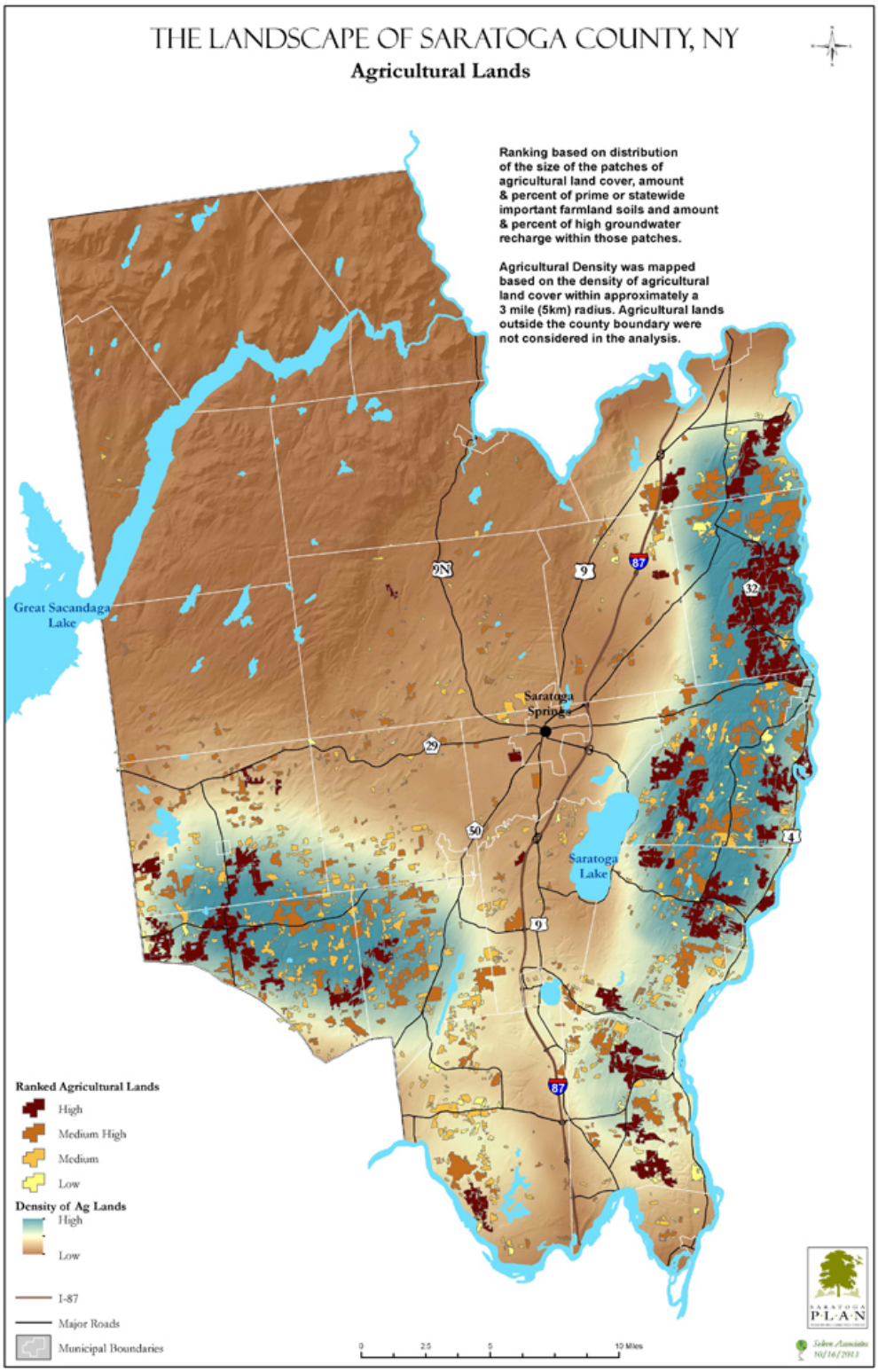
2006, interest in the grant program has increased. The County has assisted municipalities work toward preservation of farmland and open space and Planning staff are responsible for updating the County's two consolidated agricultural districts that comprise of approximately 111,000 acres of viable agricultural land (Saratoga County Government, N.d.).

Agricultural Land

Agriculture is one of the main industries in Saratoga County. In 2003, Saratoga County adopted the Farmland/Open Space Preservation Program in an effort to match funds to preserve agricultural and farm land (Saratoga County Government, N.d.). According to the 2012 Census of Agriculture, approximately 62% of farm operators reported farming as their principal occupation. The market value of agricultural products sold from County farms totaled approximately $80 million, with total sales averaging $137,167 per farm. Crop sales accounted for $19.5 million of total sales and livestock sales accounted for $60.5 million (76%) of total sales (United States Department of Agriculture, 2012).

The average value of farm land and buildings in 2012 was $647,986 per farm. Machinery and equipment were valued at $109,096 per farm. The total production expenses in 2012 were $82.6 million for an average of $141,766 per farm. According to the 2012 Census of Agriculture, Saratoga County had 583 farms and 78,849 acres of farms in 2012. The average size of a farm was 135 acres and the median size of a farm was 55 acres. The number of farms decreased between 2007 and 2012, but the amount of farm acres and the average size of a farm in Saratoga County increased by 4% and 14% respectively (United States Department of Agriculture, 2012). Figure 4-4 shows the distribution of agricultural land across Saratoga County.

Figure 4-4 Agricultural Land in Saratoga County



Source: Seleen Associates, 2013

The majority of the land is used for dairy farming and to raise crops for dairy farming. Nearly half of sales from farming in Saratoga County come from cow milk sales (Cornell Cooperative Extension, n.d.). Other crops include nursery and greenhouse, fruits and nuts, hay and other crops, and grains and dry beans. As of 2012, approximately 43,000 acres were cropland (54.5%), 18,000 are woodland (22.8%), and the remainder of the land (roughly 17,849 acres) was categorized as pastured cropland, permanent pasture or other (Cornell Cooperative Extension, N.d.). Table 4-3 summarizes how land use and farming has changed since 1940, showing a 50% decline in total woodland acres between 2007 and 2012.

Table 4-3 Number of Farms and Land Use in Saratoga County

Year	Number of Farms	Land in Farms (acres)	Total Cropland (Acres)	Permanent Pasture (Acres)	Total Woodland (acres)	Other lands (acres)
1940	2,591	247,091	N/A	N/A	62,319	N/A
1950	1,795	200,349	111,032	22,816	53,167	13,364
1959	1,151	161,686	90,007	17,815	41,740	12,124
1969	595	99,102	60,441	N/A	25,459	N/A
1978	541	92,166	57,011	6,030	21,801	7,321
1982	580	31,445	55,621	5,948	21,265	8,611
1987	590	85,700	54,100	4,500	20,000	7,100
1992	520	77,400	47,800	6,000	17,400	6,200
1993	530	76,500	47,200	5,800	17,000	6,500
1994	540	75,800	47,000	5,700	16,400	6,600
1995	545	77,000	47,600	6,100	16,300	7,000
1996	555	77,000	48,600	6,200	15,900	6,300
1997	565	78,400	48,500	6,500	15,800	7,600
1998	560	77,800	48,600	6,400	15,400	7,400
1999	570	78,100	49,400	6,100	15,100	7,500
2000	555	78,900	48,600	6,000	15,000	9,300
2001	550	77,600	N/A	N/A	N/A	N/A
2002	590	75,000	47,522	5,623	15,510	6,245
2003	590	74,900	N/A	N/A	N/A	N/A
2007	641	75,660	42,952	8,209	17,212	7,293
2012	583	78,849	43,840	18,293	8,752	7,964

Source: U.S. Department of Agriculture, New York Agricultural Statistical Service, 2005; 2007 Census of Agriculture, 2007; 2012 Census of Agriculture, 2012

* Totals were calculated using data provided by the 2007 Census of Agriculture and 2012 Census of Agriculture (rounded values)

4.3 Future Conditions

This plan provides a general overview of population and land use and types of development occurring within the study area. An understanding of these population and 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.

4.3.1 Population Trends

This section discusses population trends to use as a basis for estimating future changes 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 consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

The largest increase was seen between the years 1960 to 1970, when the County experienced a 26.78 percent (32,583 persons) population increase. The largest decrease was seen between the years 1910 and 1920, when the County experienced a 3.15 percent (-1,888 persons) population decrease. The smallest increase was seen between the years 1900 and 1910, when Saratoga County only experienced a 1.34 percent (828 persons) percent increase.

The County experienced an overall population increase from 2010 to 2016 with a 3.4% increase in population (Cropley, 2017), and has been identified as the fastest growing upstate county in New York (Kehoe, 2017). Most notably, Saratoga Springs is tied for the fastest growing city in New York with New York City, with a population increase of roughly 4.5% (Kehoe, 2017). Saratoga County is expected to continue growing. Table 4-4 displays the population trends for Saratoga County as prepared by the Capital District Region Planning Commission.

Table 4-4 Population Trends for Saratoga County and Municipalities

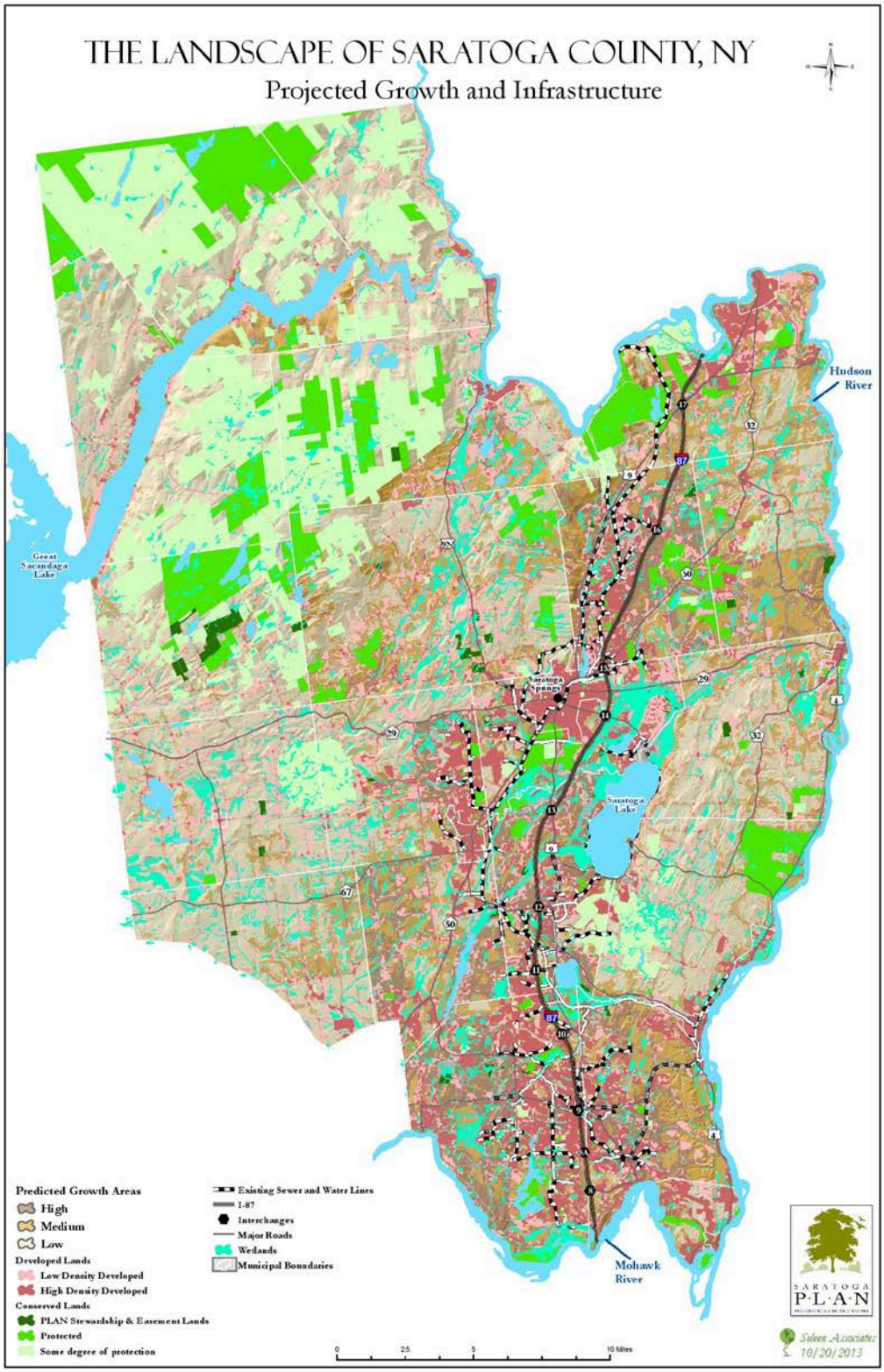
Municipalities (Towns Include Villages)	1990	2000	2010	2020	2030	2040	2050
Saratoga County	181,276	200,635	219,607	234,358	246,253	251,049	252,153
Village of Ballston Spa	5,194	5,556	5,409	5,536	5,578	5,531	5,489
Town of Ballston	8,078	8,729	9,776	10,446	11,141	11,445	11,508
Town of Charlton	3,984	3,954	4,133	4,291	4,376	4,395	4,357
Town of Clifton Park	30,117	32,995	36,705	39,155	41,252	42,088	42,189
Town of Corinth	5,935	5,985	6,531	6,845	7,015	7,165	7,203
Village of Corinth	2,760	2,474	2,559	2,620	2,640	2,655	2,633
Town of Day	746	920	856	893	940	964	941
Town of Edinburg	1,041	1,384	1,214	1,291	1,343	1,353	1,360
Town of Galway	3,266	3,589	3,545	3,696	3,755	3,693	3,714

Municipalities (Towns Include Villages)	1990	2000	2010	2020	2030	2040	2050
Village of Galway	151	214	200	203	203	204	201
Town of Greenfield	6,338	7,362	7,775	8,265	8,614	8,669	8,389
Town of Hadley	1,628	1,971	2,048	2,187	2,282	2,318	2,371
Town of Halfmoon	13,879	18,474	21,535	23,684	25,269	26,418	27,428
Town of Malta	11,709	13,005	14,765	16,146	17,151	17,612	17,743
Village of Round Lake	765	604	623	633	633	633	625
City of Mechanicville	5,249	5,019	5,196	5,309	5,402	5,493	5,446
Town of Milton	14,658	17,103	18,575	19,959	20,778	21,274	21,435
Town of Moreau	13,022	13,826	14,728	15,601	16,276	16,551	16,384
Village of South Glens Falls	3,506	3,368	3,518	3,627	3,748	3,762	3,724
Town of Northumberland	3,645	4,603	5,087	5,450	5,736	5,971	5,949
Town of Providence	1,360	1,841	1,995	2,175	2,306	2,367	2,355
Town of Saratoga	5,069	5,141	5,674	5,915	6,130	6,253	6,147
Village of Schuylerville	1,364	1,197	1,386	1,438	1,458	1,450	1,454
Village of Victory Mills	581	544	605	611	611	614	608
City of Saratoga Springs	25,001	26,186	26,586	27,862	29,027	28,555	28,532
Town of Stillwater	7,233	7,522	8,287	8,733	9,156	9,281	9,260
Village of Stillwater	1,531	1,644	1,738	1,784	1,834	1,844	1,827
Town of Waterford	8,695	8,515	8,423	8,546	8,652	8,605	8,423
Village of Waterford	2,370	2,204	1,990	1,994	1,988	1,932	1,861
Town of Wilton	10,623	12,511	16,173	17,909	19,652	20,579	21,019

Source: Capital District Regional Planning Commission, N.d.

Saratoga County's Economic Development Strategic Plan identifies three approaches for economic growth in the county: creative cluster expansion, strategic infrastructure investment, and entrepreneurial growth around innovative companies (TIP Strategies, Inc. and Saratoga County Government, 2014). All three of these approaches will have an impact on population growth and development across the county. The plan was developed to guide responsible growth in order to preserve the character of Saratoga County, while also addressing the slowing, but increasing population growth (TIP Strategies, Inc. and Saratoga County Government, 2014). Figure 4-5 below illustrates the potential development growth and grey infrastructure for the County.

Figure 4-5 Potential Growth and Grey Infrastructure in Saratoga County



Source: Seleen Associates, 2013a

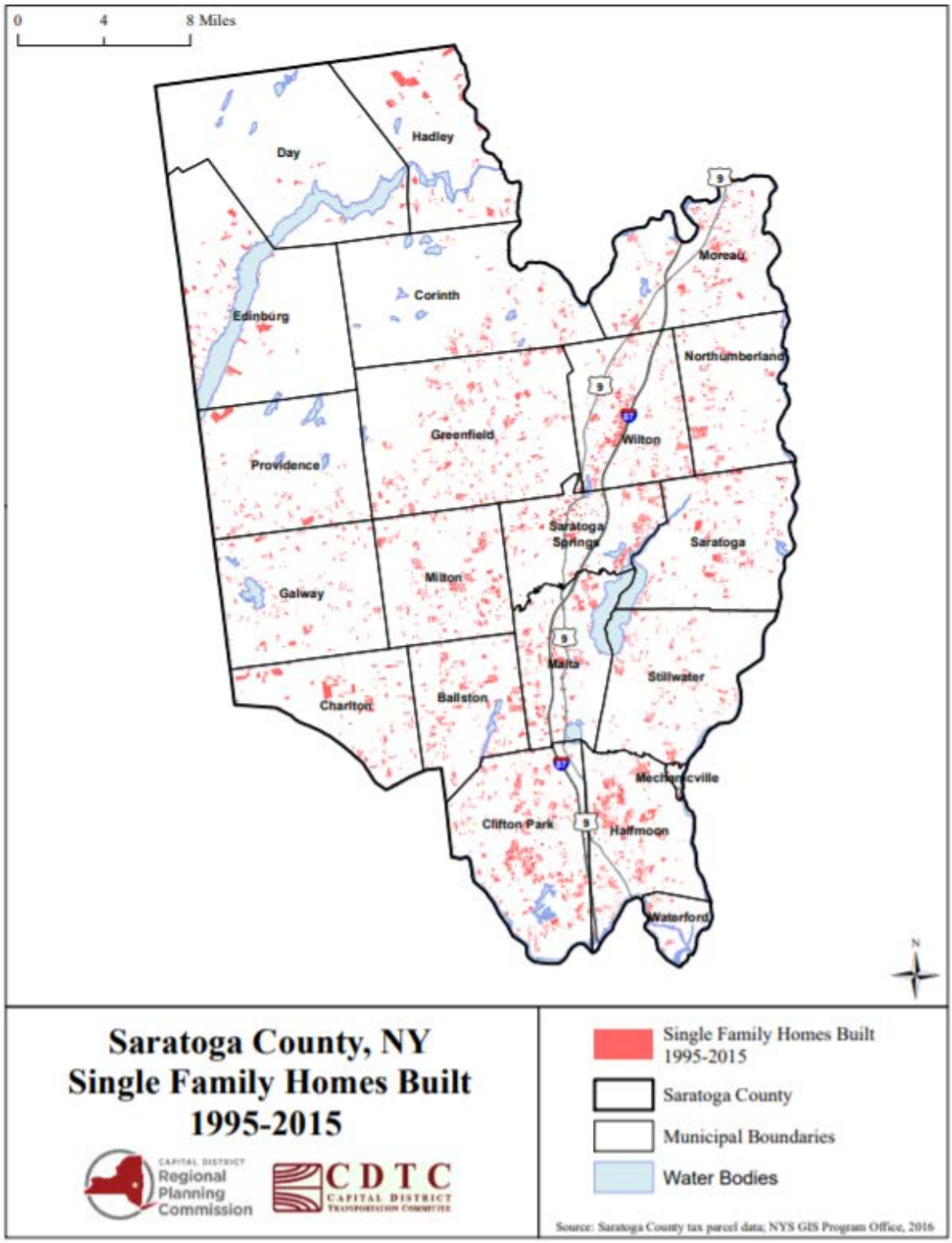
4.3.2 Land Use Trends

Saratoga County's continuous population growth is reflected in land use changes. The development of suburban homes has increased over the past 10 years, particularly in the towns of Halfmoon and Clifton Park (Cropley, 2018b). In the Capital District Region, there were more than 35,111 single family homes built in the last ten years, with approximately 49% of these homes being constructed in Saratoga County (Capital District Regional Planning Commission, 2016). Figure 4-6 shows the addition of residences between 1995 and 2015. Many land use trends and maps show the incorporation of more suburban development (Anderson, 2018). The population shifts have also caused congestion on major highways and road systems, particularly due to commuting (Anderson, 2016). This is also evident through new roads that have been constructed between 2005 and 2015, as shown in Figure 4-7 below.

Saratoga County is home to a large amount of farm land. There are many efforts to preserve agricultural and farm land, with one effort securing approximately 219.9 acres of farmland in July 2018 by Saratoga PLAN (Gonzales, 2018). Saratoga PLAN, a community-based organization, is one group dedicated to preserving the rural and natural character of Saratoga County (Saratoga PLAN, n.d.-a).

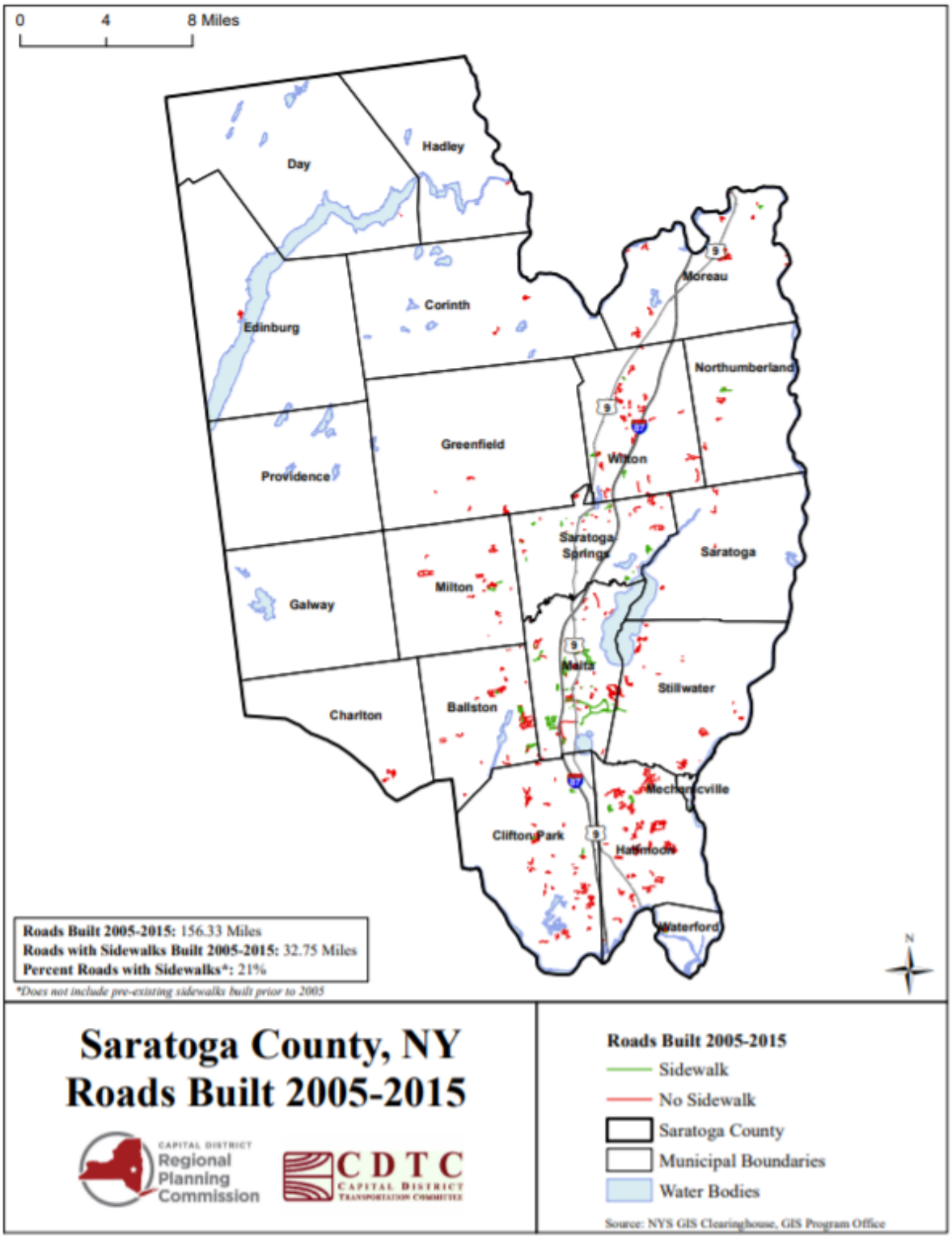
According to the Green Infrastructure Plan for Saratoga County Executive summary, the County plans to protect working farmlands and natural resources to ensure the 'character of the county, the sense of place, will be part of our economic prospect for current and future generations.' Figure 4-8 illustrates the vision for the County's 'green infrastructure network' (for example, rivers, wetlands, forests, etc.,): 1) farmland core hubs; 2) natural systems hubs; 3) green corridors and trails; 4) heritage hubs and 5) green infrastructure gateways (Green Infrastructure for Saratoga County, 2006).

Figure 4-6 Single Family Homes Built between 1995 and 2015



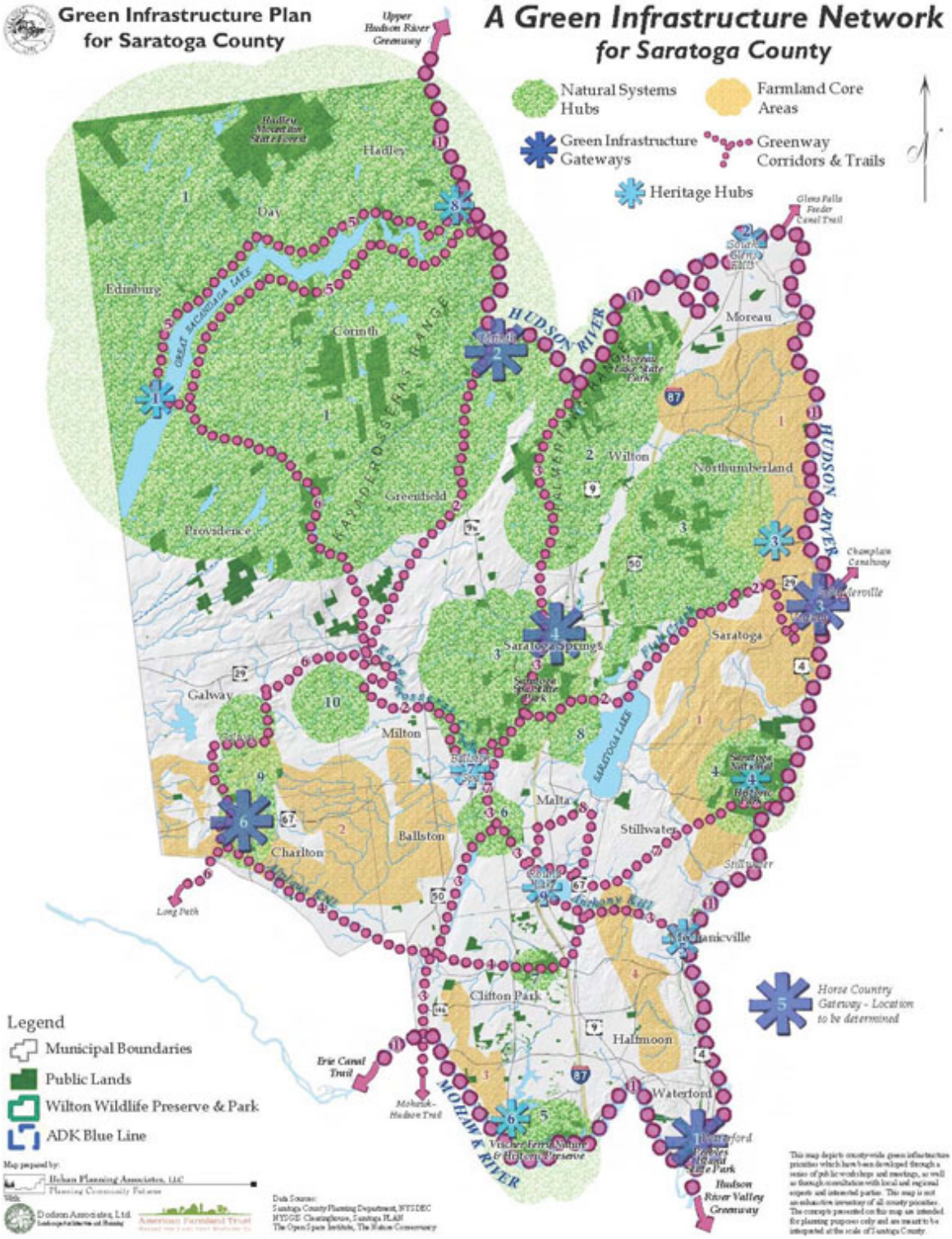
Source: Capital District Regional Planning Commission, 2016

Figure 4-7 New Roads Constructed 2005-2015



Source: Capital District Regional Planning Commission, 2016

Figure 4-8 Green Infrastructure Networks in Saratoga County



Source: Saratoga County Planning Department and Behan Planning and Design, 2006

4.4 General Building Stock

Saratoga County has experienced measurable growth in the last 15 years. The 2016 American Community Survey (ACS) estimates 101,985 housing units in Saratoga County, compared to 86,701 housing units in Saratoga County in 2000 (U.S. Census, 2000). The U.S. Census Bureau defines a household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, one housing unit can contain more than one household. The median value of owner-occupied units in Saratoga County was estimated at $238,600 in 2016. (U.S. Census Bureau, 2016i)

ACS 5-year 2016 estimates identify the majority of housing units (63.3%) in Saratoga County are single family detached units. The 2016 U.S. Census Bureau's County Business Patterns data identified 5,278 business establishments employing 69,665 people in Saratoga County. The majority (54.5%) of these establishments employed between one and four employees (United States Census Bureau, 2016L).

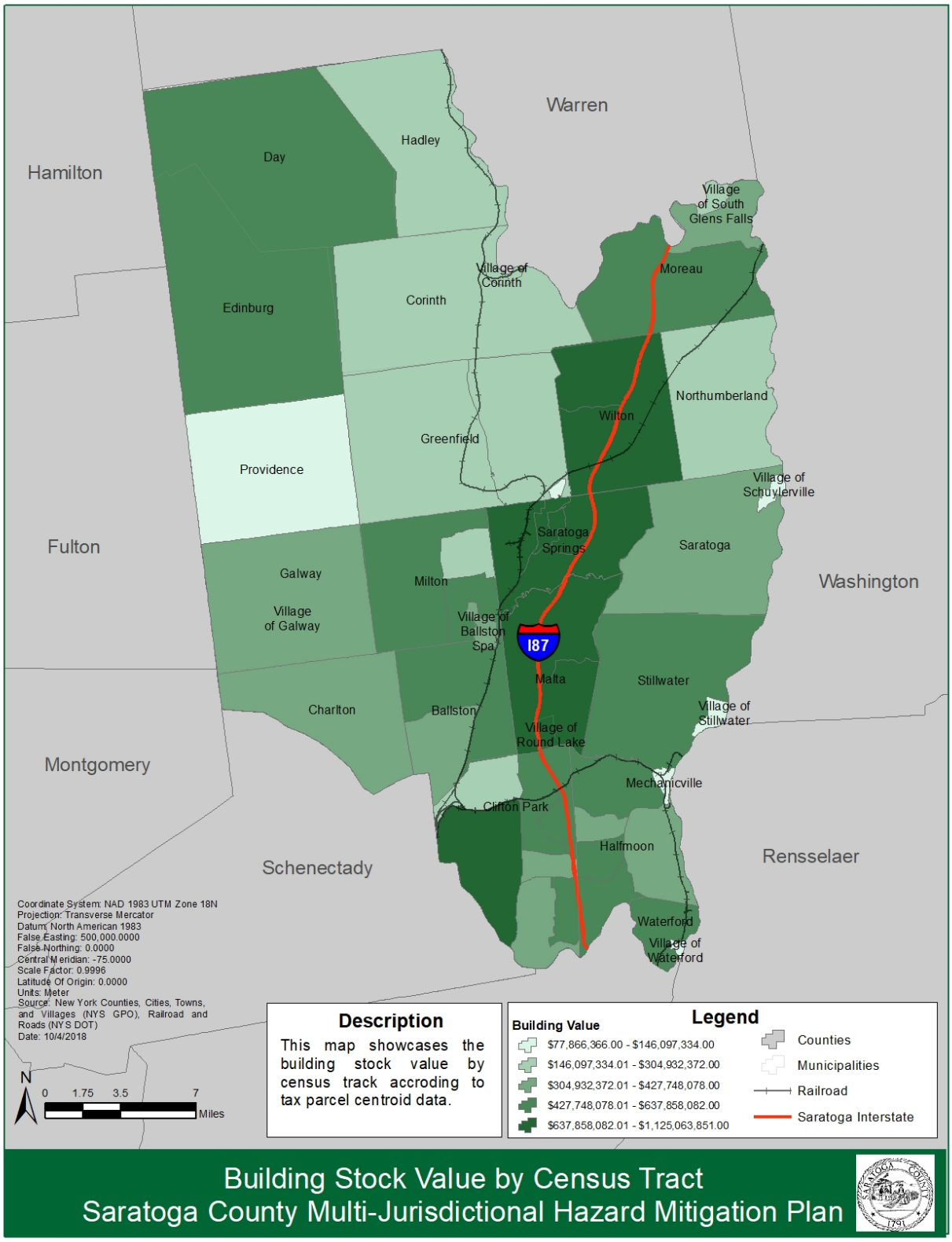
Table 4-5 summarizes the market value of the building stock in Saratoga County, calculated based on the full market value and land value of parcels in Saratoga County, broken out by each municipality. This data was retrieved on New York State's GIS portal from the NYS Tax Parcel Centroid data (dated August 2018). Figure 4-9 showcases the building stock value by census tract. As the map shows, the highest building value per census tract follows the Interstate 84 corridor, particularly in the City of Saratoga Springs, Towns of Malta and Wilton, as well as the Village of Round Lake.

Table 4-5 Building Stock Market Value

Municipality	Full Market Value	Land Value	Building Value
Town of Ballston	$1,145,404,895	$268,898,499	$876,506,396
Village of Ballston Spa	$399,390,411	$65,669,800	$333,720,611
Town of Charlton	$501,093,224	$75,538,528	$425,554,696
Town of Clifton Park	$4,489,563,454	$669,600,286	$3,819,963,168
Town of Corinth	$325,284,069	$104,669,379	$220,614,690
Village of Corinth	$298,523,357	$36,133,650	$262,389,707
Town of Day	$309,794,712	$108,057,512	$201,737,200
Town of Edinburgh	$359,570,706	$65,430,251	$294,140,455
Town of Galway	$460,533,896	$46,830,692	$413,703,204
Village of Galway	$14,432,584	$940,550	$13,492,034
Town of Greenfield	$838,072,416	$282,611,189	$555,461,227
Town of Hadley	$230,527,056	$37,841,960	$192,685,096
Town of Halfmoon	$2,608,662,595	$332,269,204	$2,276,393,391
Town of Malta	$2,489,962,025	$586,913,489	$1,903,048,536
City of Mechanicville	$260,467,464	$40,000,420	$220,467,044
Town of Milton	$1,600,538,531	$186,207,065	$1,414,331,466
Town of Moreau	$1,198,444,619	$285,992,849	$912,451,770
Town of Northumberland	$397,569,951	$118,564,800	$279,005,151
Town of Providence	$178,891,474	$53,017,624	$125,873,850
Village of Round Lake	$81,151,450	$19,551,450	$61,600,000
Town of Saratoga	$477,790,200	$97,008,900	$380,781,300
City of Saratoga Springs	$5,060,142,455	$1,105,712,374	$3,954,430,081
Village of Schuylerville	$101,290,700	$8,858,600	$92,432,100
Village of South Glens Falls	$304,933,381	$51,734,231	$253,199,150
Town of Stillwater	$790,794,510	$170,928,246	$619,866,264
Village of Stillwater	$124,365,683	$15,235,325	$109,130,358
Village of Victory	$28,297,100	$3,165,200	$25,131,900
Town of Waterford	$623,760,860	$28,705,239	$595,055,621
Village of Waterford	$81,145,929	$3,133,910	$78,012,019
Town of Wilton	$2,197,011,865	$535,109,234	$1,661,902,631
Total	$27,977,411,572	$5,404,330,456	$22,573,081,116

Source: NYS GPO, 2018

Figure 4-9 Building Stock Value by Census Tract



4.5 Critical Facilities

A comprehensive inventory of critical facilities in Saratoga County was developed from various sources including the NYS GIS Portal, the Planning Team, and Hazus critical facilities data. This section represents the best effort to collect a comprehensive inventory of facilities, however some data was not readily available at the time of this HMP's publication and may not be included. Saratoga County will continue to make efforts to document and inventory their critical facilities and infrastructure in the future. Due to the sensitive nature of this facility information, facility names and addresses have been redacted from the main body of this plan and may be retrieved through a request to Saratoga County OES.

4.5.1 Essential Facilities

Essential facilities include emergency facilities, hospital and medical facilities, shelters, schools, and senior care and living facilities. For the purposes of this Plan, "emergency facilities" can also include emergency operations centers (EOC), police stations, fire stations and emergency medical services (EMS) centers. A full listing of the American Red Cross shelters in Saratoga County can be found in Appendix F, the Mass Care and Sheltering Annex.

4.5.2 Transportation Systems

Transportation Systems include infrastructure such as roadways and bridges, airports, and railways in Saratoga County. Interstate 87, also known as the Northway, is the major north-south route in Saratoga County. It has 11 interchanges in its 30-mile stretch through the County. Hazus identified 186 highway bridges within Saratoga County. The Saratoga County Airport is located in the Town of Milton and has two runways that accommodate private, prop, and jet aircrafts. There are fourteen other airports throughout the county. Two rail lines service the County, CP Rail and Saratoga and North Creek Railway (NYSDOT, 2016). The Planning Team and Hazus identified fifteen railway bridges and one railway facility in Saratoga County.

4.5.3 Lifeline Utility Systems

Lifeline utility systems include wastewater, energy resource, and communication utilities. National Grid is the primary electric and gas utility company in Saratoga County, serving the majority of the County. New York State Electric and Gas provides service for portions of Halfmoon, Stillwater, Malta, Mechanicville, and Clifton Park (Industrial Development Agency, N.d.). Each of these organizations provided facility information in the redacted appendix.

Additionally, each municipality has either a joint or separate radio station to alert the communities of important announcements during an emergency. The Planning Team and Hazus provided the location of five electric power facilities within the County. The Planning Team and Hazus identified 15 wastewater treatment facilities, 11 potable water facilities, and eight broadcasting facilities in Saratoga County.

4.5.4 High Potential Loss Facilities

High-potential loss facilities include dams, levees, nuclear power plants, military installations, and hazardous materials (HAZMAT) facilities. No levees, nuclear power plants or military installations were identified in the County. According to data received from the National Inventory of Dams (NID), and the New York State Department of Environmental Conservation (NYS DEC), there are 1951 dams in New York State and 138 dams in Saratoga County (USACE NID, n.d.). Of the 138 dams inventoried from the New York State Department of Environmental Conservation, there are 11 dams classified as high hazard, 13 classified as intermediate hazard 79 classified as low, 31 classified as negligible or no hazard, and four with an unknown classification. The Planning Team identified five additional dams in the County. The Flood profile in Section 5 describes the hazard potential classification, as accepted by the NID Interagency Committee on Dam Safety. Additionally, Hazus and the Planning Team identified 15 hazardous material facilities in Saratoga County.

Section 5: Risk Assessment

According to FEMA, a "risk assessment is the process of measuring the potential loss of life, personal injury, economic injury and property damage resulting from natural hazards by assessing the vulnerability of people, buildings and infrastructure to natural hazards." Saratoga County's risk assessment is organized into four sections. Section 5.1 describes the methodology and tools used to support the risk assessment process. Section 5.2 identifies the natural hazards of concern for further profiling and evaluation. In Section 5.3, the identified hazards of concern are ranked for Saratoga County as a whole to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Section 5.4 summarizes the changes to the Risk Assessment since the last plan update, and Sections 5.5 through 5.12 profile and assess vulnerability for each hazard of concern.

5.1 Methodology, Data, and Tools

5.1.1 Methodology

The risk assessment process identifies and profiles hazards that concern the community and then assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard (Section 6 of this plan).

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

The next step of the risk assessment is to prepare a profile for each hazard of concern. Hazard profiles assist communities in evaluating and comparing the hazards that can impact their area. The impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular hazard). The hazard probability of occurrence affects the priority assigned to that hazard. Since each hazard will impact communities based on geography, local development, population distribution, age of buildings, and implemented mitigation measures, each community has a unique risk.

The final step of the risk assessment is to understand the risk posed by each hazard. The county's assets are evaluated for their exposure and vulnerability to the identified hazards. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4, is used to develop risk scenarios and estimate potential damages and losses for each hazard. The results of this analysis help provide a basis for identifying mitigation actions to address the vulnerabilities of the community.

5.1.2 Data and Tools

Storm Events Database

Past occurrence data for several of the hazards profiled in this Risk Assessment was obtained from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database. The database currently contains data from January 1950 to June 2018, as entered by NOAA's National Weather Service (NWS). NOAA's Storm Events Database documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. The database's period of record varies for different hazards:

- Tornado: From 1950 through 1954, only tornado events were recorded.
- Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
- All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605[1].

The NWS Directive 10-1606 defines the hazards that the Storm Events Database contains and outlines the parameters used to categorize and report hazard events.

Disaster Declarations

Disaster declarations provide the basis for discussing the previous hazard occurrences. Since the previous plan update, Saratoga County has had two major disaster declarations; Hurricane Irene (DR-4020) and a severe winter snowstorm (DR-4322). Additionally, the county had an emergency declaration for Hurricane Sandy (DR-3351). Most of the county's previous declarations are from severe winter weather, flooding, or severe summer weather. A summary of all previous disaster declarations can be found on the next page in Table 5-1.

[1] NWS Directive 10-1605 retrieved from: https://www.ncdc.noaa.gov/stormevents/pd01016005curr.pdf

Table 5-1 Disaster Declarations in Saratoga County

Disaster Number	IH	IA	PA	HM	Declaration Date	Disaster Type	Incident Type	Title	Incident Begin Date	Incident End Date	Disaster Close Out Date
4322	No	No	Yes	Yes	7/12/2017	DR	Snow	Severe Winter Storm and Snowstorm	3/14/2017	3/15/2017	
3351	No	No	Yes	No	10/28/2012	EM	Hurricane	Hurricane Sandy	10/27/2012	11/8/2012	2/17/2016
4020	Yes	No	Yes	Yes	8/31/2011	DR	Hurricane	Hurricane Irene	8/26/2011	9/5/2011	
1827	No	No	Yes	Yes	3/4/2009	DR	Severe Storm(s)	Severe Winter Storm	12/11/2008	12/31/2008	3/8/2018
3299	No	No	Yes	No	12/18/2008	EM	Severe Storm(s)	Severe Winter Storm	12/11/2008	12/31/2008	4/1/2014
3262	No	No	Yes	No	9/30/2005	EM	Hurricane	Hurricane Katrina Evacuation	8/29/2005	10/1/2005	7/21/2010
1534	No	No	Yes	Yes	8/3/2004	DR	Severe Storm(s)	Severe Storms and Flooding	5/13/2004	6/17/2004	8/1/2017
3186	No	No	Yes	No	8/23/2003	EM	Other	Power Outage	8/14/2003	8/16/2003	3/3/2011
3173	No	No	Yes	No	2/25/2003	EM	Snow	Snowstorms	12/25/2002	1/4/2003	5/21/2010
1391	No	Yes	Yes	Yes	9/11/2001	DR	Fire	Fires and Explosions	9/11/2001	9/11/2001	
3155	No	No	Yes	No	10/11/2000	EM	Other	West Nile Virus	5/22/2000	11/1/2000	5/25/2004
1222	No	No	Yes	No	6/16/1998	DR	Severe Storm(s)	Severe Storms and Tornadoes	5/31/1998	6/2/1998	5/26/2004
1196	No	Yes	Yes	No	1/6/1998	DR	Snow	Severe Storms and Flooding	1/5/1998	1/17/1998	9/8/2005
1095	No	Yes	Yes	Yes	1/24/1996	DR	Flood	Severe Storms and Flooding	1/19/1996	1/30/1996	10/25/2010
3107	No	No	Yes	Yes	3/17/1993	EM	Snow	Severe Blizzard	3/13/1993	3/17/1993	12/27/2002
801	No	No	Yes	Yes	11/10/1987	DR	Snow	Severe Winter Storm	10/4/1987	10/4/1987	11/30/1993

Source: FEMA, 2018

Geospatial Information Systems Datasets

Data from the New York State Geospatial Information Systems (GIS) Clearinghouse was used for the vulnerability assessment analysis and mapping completed for this plan update. Datasets consulted included:

- NYS Statewide Tax Parcel Centroid Points (Revised August 2018)
- Water Inventory/Priority Waterbodies List
- NYS Roadway Inventory System Geodatabase (Revised 2016)
- NYS Civil Boundaries (includes NYS County Boundaries - Shoreline Version) (Revised April 2018)
- FEMA Q3 digital floodplain data
- Saratoga County does not have digital FIRMs available to use for analysis in ArcGIS software. FEMA Quality 3 (Q3) flood data, a digital representation of certain features of FEMA's FIRMs, is available for Saratoga with the exception of riverine reaches in the northwest portion of the County (Towns of Day, Edinburg, New Providence and Wilton). According to the NFIP, the Town of Day and Town of Wilton are classified as NSFHA or 'no special flood hazard areas' meaning these communities have been surveyed and found to have no flood risk (FEMA, 2009).

Additional datasets retrieved from other sources include:

- Wildland Urban Interface in the United States, 2010, SILVIS Lab
- Digital Compilation of Landslide Overview Map of the Conterminous United States (US Department of the Interior)

Hazus

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. (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, with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. Hazus 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 Hazus provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future

and standardization of data collection and storage. The guidance Using Hazus for Risk Assessment: How-to Guide (FEMA 433) was used to support the application of Hazus for this risk assessment and plan. More information on Hazus is available through FEMA's website.

Hazus 4.2, released on May 25, 2018, was used for this HMP update. Custom methodologies in Hazus were used to assess potential exposure and losses associated with hazards of concern for Saratoga County:

- Inventory: The default demographic data in Hazus, based on the 2010 U.S. Census, was used for analysis. The valuation of general building stock and the loss estimates determined in Saratoga County were based on the default general building stock database provided in Hazus. The general building stock valuations provided in Hazus are Replacement Cost Value from RS Means as of 2014. The default critical facility inventory (essential facilities, utilities, transportation features, high-potential loss facilities and user-defined facilities) was used for all three hazard models (flood, wind, and earthquake). An effort was made to update the default critical facility data using input from Saratoga County and the Planning Team, however due to inconsistencies in the data provided and lack of detailed building specification information, this data was not used to update the default building values in Hazus. In order to run a Level 2 analysis, several different building parameters are required for each facility. In the future, when this information is collected and standardized, a Level 2 analysis can be completed. Section 4 summarizes the facilities that were collected during this effort and a redacted appendix includes details on the facility addresses.
- Wind/Severe Storm: A Level 1 Hazus analysis was performed to analyze the wind hazard losses, associated with hurricanes and other severe storm types, for Saratoga County. The 100- and 500-year mean return periods were examined.
- Earthquake: A Level 1 Hazus analysis was performed to analyze the earthquake hazard losses for Saratoga County. A Level 1 analysis is a basic estimate of earthquake losses based on national databases and using the default data in the model.
- Flood: A modified Level 1 analysis was attempted to analyze the flood losses for Saratoga County. Unfortunately, due to unforeseen circumstances, the flood analysis would not run properly due to processing errors in the Hazus software. These errors were submitted to the FEMA Hazus Helpdesk for reconciliation and were unresolved at the time that this plan was completed. Flood risk was analyzed using an exposure analysis instead.
- Other Hazards: Hazus was used to evaluate other hazards, as feasible. For many of the hazards evaluated in this risk assessment, historic data are not adequate to model future losses at this time. However, Hazus can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data are available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Section 6 and Volume II, Section 9. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

For this risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are

inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their 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; and
- Mitigation measures already employed by Saratoga County and the amount of advance notice residents have to prepare for a specific hazard event.

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Saratoga County will collect additional data to assist in developing refined estimates of vulnerabilities to natural hazards.

5.2 Hazard Identification

To provide a strong foundation for mitigation strategies considered in Sections 6 and 9, Saratoga County considered a full range of natural hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The natural hazard identification process incorporated input from the following sources:

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

- County and participating jurisdictions;
- 2014 New York State Hazard Mitigation Plan (NYS HMP);
- County Emergency Preparedness Assessment (CEPA) and previous hazard identification efforts;
- 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
- Qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them.

Table 5.2-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation.

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

The "Flood" hazard includes riverine, flash, ice jam, man-made dam and beaver dam flooding (overtopping or breaching from natural causes). Other types of flooding such as coastal or urban drainage do not generally occur within the County; therefore, they were not considered for

inclusion within this HMP. 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. In addition, the local phenomenon of sporadic elevated groundwater has been included in this hazard although it is not traditionally addressed in a flood hazard profile. Future investigation of this phenomenon and its historical and future impacts are the subject of proposed mitigation actions in the areas affected by this sporadic hazard.

The "Severe Storm" hazard includes windstorms that often entail a variety of other influencing weather conditions including thunderstorms, hail, lightning and tornados. Since tropical disturbances are identified as a type of severe storm event, this hazard also includes tropical cyclone events (hurricanes, tropical storms and tropical depressions). Tropical cyclones were not grouped as a separate hazard because the County felt that these types of events do not directly impact the County on a frequent basis and that exposure and risk of such events are minimal in comparison to communities along the New York coastline.

The "Severe Winter Storm" hazard includes heavy snowfall, blizzards, freezing rain/sleet, ice storms and extra-tropical cyclones (Nor'easters and severe winter low-pressure systems). Extra-tropical events generally occur during winter weather months; therefore, for the purpose of this HMP, all such events are to be grouped within this hazard. Although not all extra-tropical events, such as nor'easters, occur during the winter, they will remain grouped within this hazard category to avoid duplication of events in hazard profiles. This grouping is consistent with that used in the NYS HMP, as well as the "Severe Winter Storm" hazard used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

In the previous plan, extreme cold temperatures were grouped with Severe Winter Storm. However, for this plan update, the Planning Team agreed to profile Extreme Temperatures separately, including extreme heat. This was partially influenced from CEPA as this assessment categorized extreme temperatures individually.

These groupings do not change the definition of the included specific events/hazards and does not affect the hazard analysis conducted through the use of Hazus, either directly or as a risk assessment support tool.

Please note that technological (for example, hazardous material incidents) and man-made hazards (for example, terrorism) are not being addressed in this planning process, despite being addressed in CEPA. The Disaster Mitigation Act of 2000 (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 the County and planning participants. The County may attempt to expand the scope of this HMP to include other less frequent natural hazards and/or technological (hazardous material incidents) and man-made (terrorism, man-made dam breaches/failures) hazards as resources permit.

Table 5-2 Hazard Identification for Saratoga County, New York

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Avalanche	No	No	• The NYS HMP does not identify avalanche as a hazard of concern for New York State. • The topography and climate of Saratoga County does not readily support the occurrence of an avalanche event. • Lack of previous occurrence data in Saratoga County • The Planning Team did not identify Avalanche as a hazard of concern for Saratoga County.	• 2014 NYS HMP • Planning Team Input
Climate Change	Yes	Yes	• Climate Change has been discussed within the context of its impacts on each hazard profiled in this Risk Assessment.	
Coastal Erosion / Coastal Storm	No	No	• Saratoga County is not bounded by coastal waters; therefore, not directly impacted by coastal storms that result in coastal erosion. • The Planning Team did not identify Coastal Erosion/Coastal Storm as a hazard of concern for Saratoga County.	• 2014 NYS HMP
Drought	Yes	No	• The NYS HMP identifies drought as a hazard of concern for New York State. • Saratoga County is located within the Hudson Valley Climate Division. Between 1908 and 2002, 15 severe and extreme droughts struck this climate division. • Various sources indicated that many drought events or periods impacted large regions of the State, including Saratoga County. • CEPA assessed drought as a risk for Saratoga County.	• 2014 NYS HMP • United States Geological Survey (USGS) • NOAA-NCEI • U.S. Drought Monitor Archive

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Earthquake	Yes	Yes	• The NYS HMP identifies earthquake as a hazard of concern for New York State. Areas within the State with a higher seismic risk include; The North and Northeast third (1/3) of the State (The North Country/Adirondack Region including a portion of the Greater Albany-Saratoga region), the Southeast corner (including the greater New York City area and western Long Island), and the Northwest corner (including the City of Buffalo and vicinity) of the State, in that order from higher to lower. • According to the USGS online seismic hazard maps, the peak ground acceleration with a 10% probability of exceedance over 50 years for Saratoga County is between 3 and 5% g. FEMA guidance recommends earthquakes are evaluated further if an area has a 3% g peak acceleration or more.	• 2014 NYS HMP • NOAA – Review of National Geophysical Data Center (NGDC) Earthquake Database from 1800 to present • USGS – Earthquake Hazards Program, Review of USGS Seismic Maps
Expansive Soils	Yes	Yes	• The NYS HMP identifies expansive soils as a hazard of concern for New York State. • USGS indicated that Saratoga County has little or no clays with swelling potential or have less that 50 percent of soils with abundant clays of slight to moderate swelling potential. • Based on all sources reviewed, no known historical occurrences are reported for Saratoga County.	• 2014 NYS HMP • USGS 1989 Swelling Clays Map of the Conterminous United States.

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Extreme Temperatures	Yes	Yes	• History of previous occurrences • Potential health and safety issues • Link to climate change indicators • Potential impact to critical energy infrastructure • CEPA assessed Extreme Temperatures in Saratoga County and categorized this risk as medium.	• NOAA NCEI • NWS
Flood *(Riverine, Flash, Ice Jam Dam/Beaver Dam Flooding, Elevated Groundwater)*	Yes	Yes	• The NYS HMP identifies flooding as the main hazard of concern for New York State. • Saratoga County is bordered to the south by the Mohawk River and to the north and east by the Hudson River; two major rivers that experience flooding on an annual basis. • Saratoga County has been issued three FEMA Disaster Declarations for flood-related events, each event resulting in extensive damages. • NOAA's NCDC storm events database indicates that Saratoga County was impacted by approximately 111 flood events between 1950 and 2018 (including flash flooding). • The NFIP identifies that Saratoga County has made 578 flood claims between 1978 and 2015, receiving $7.8 M in total payments.	• 2014 NYS HMP • NYS DHSES • FEMA • NOAA-NCEI • National Performance of Dams Program (NPDP) • NYS DEC • NFIP

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Flood *(Riverine, Flash, Ice Jam Dam/Beaver Dam Flooding, Elevated Groundwater)* - **Continued**	Yes	Yes	• Saratoga County's FIS indicates that principle flooding sources in the County are the Hudson and Mohawk Rivers; Kayaderosseras, Mount Anthony, Sturdevant, Slade, Rowland Hollow, Ballston, Fish, Gordon, and Schuyler Creeks; Plum, Geyser and Putnam Brooks; Anthony, Dwaas, Alpaus, Snook and Morning Kills and along the shorelines of Saratoga, Ballston, and Round Lakes; and occasionally, Spring Run • County officials indicated that Beaver Dam problems and associated flooding is a problem throughout the County. A beaver dam in May 2006 caused approximately $200 K in damages in the Town of Greenfield. • Ice Jams are mentioned separately in this table but are grouped with the Flood hazard in this plan (see below). • Elevated groundwater was introduced as an additional flooding hazard towards the end of this planning process. This type of flooding has been occurring in the Towns of Wilton and Moreau. Specific loss information was not available at the time this plan was submitted.	• 2014 NYS HMP • NYS DHSES • FEMA • NOAA-NCEI • National Performance of Dams Program (NPDP) • NYS DEC • NFIP

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Ground Failure *(Landslide, Land Subsidence)*	Yes	Yes	**Landslide** • The NYS HMP identifies landslide as a hazard of concern for New York State, with Saratoga County located in low and high landslide incidence areas. The NYS HMP indicates that Saratoga County has had five landslide occurrences from 1837 to 2014. • The Pleistocene clay deposits of the upper Hudson River Valley that extend north into the Champlain River Valley are highly susceptible to slumps and earth flows. • Saratoga County officials indicated that Landslides are a concern in the County. **Land Subsidence** • The NYS HMP indicates that New York State is vulnerable to land subsidence; however, this hazard is "extremely localized" and poses a "very low risk to population and property." The NYS HMP does not identify Saratoga County as a community that has experienced land subsidence in the past. • According to USGS, Saratoga County is not made up of unconsolidated aquifer systems, hence it is unlikely that there will be permanent subsidence and related ground failures.	• 2014 NYS HMP • USGS • National Atlas.gov (USGS) • USGS Fact Sheet 165-00 (NYS DEC. 2000) • Radbruch-Hall et al. (USGS)
Hurricane *(and other Tropical Cyclones)*	Yes	Yes	Please see Severe Storm	

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Ice Jams *(categorized as a Flood hazard in this HMP)*	Yes	Yes	• The NYS HMP identifies ice jam flooding as a hazard of concern for New York State (grouped as a type of flood). New York State ranks 2nd in the Nation for total number of ice jam events, with over 1,435 incidents documented between February 1, 1867 and March 16, 2007. • The USACE CRREL Ice Jam Database, NYS HMP and various other sources, indicates that 32 reported ice jam events have occurred within Saratoga County between 1900 and 2007.	• 2014 NYS HMP • 2008 NYS HMP • Review of USACE Cole Regions Research and Engineering Library (CRREL) Ice Jam Database
Infestation (Invasive Species)	Yes	Yes	• County officials indicated that invasive species has become a pervasive problem in Saratoga County. • There is a long history of invasive species and subsequent losses in Saratoga County. • Climate change is predicted to exacerbate the presence of invasive species.	• NY iMapInvasives • Cornell Cooperative Extension • New York Invasive Species Information (NYIS.info)
Nor'easters *(and other extra tropical storms)*	Yes	Yes	Please see Severe Winter Storm	

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Severe Storm *(Windstorms, Thunderstorms, Hail, Lightning, Tornados and Hurricanes)*	Yes	Yes	• The NYS HMP identifies all types of severe storms as hazards of concern for New York State. Saratoga County is identified as a high-risk area for tornadoes and has experienced nine tornado events from 1960 to 2018. • The NYS HMP, NYSEMO, FEMA indicate that Saratoga County has been issued five major disaster declarations (DR) or emergency declarations (EM) for severe storm events (some also identified as flooding events), including two since the previous plan update (DR-4020 Hurricane Irene and EM-3351). • NOAA's NCEI storm events database indicates that Saratoga County was impacted by approximately 530 severe storm events between 1950 and 2018.	• 2014 NYS HMP • NYS DHSES • FEMA • NOAA-NCEI Storm Events Database • Hazards & Vulnerability Research Institute (SHELDUS) • Kocin and Uccellini • The Weather Channel • NCEI Snow Climatology • NWS

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Severe Winter Storm *(Heavy Snow, Blizzards, Freezing Rain/Sleet, Ice Storms, Nor'easters and Extreme Cold)*	Yes	Yes	• The NYS HMP identifies all types of severe winter storms as hazards of concern for New York State. According to the NYS HMP, the majority of Saratoga County is located in an area where total average annual snowfall is less than 60 inches, with some northwestern parts of the county averaging between 60 and 95 inches annually. • Saratoga County has had seven major disaster declarations (DR) or emergency declarations (EM) due to severe winter storm events. • NOAA's NCEI storm events database indicates that Saratoga County was impacted by approximately 175 winter storm events and between 1950 and 2018. Most events are of a regional extent rather than localized to just one county or community.	• 2014 NYS HMP • NYS DHSES • FEMA • NOAA-NCEI Storm Events Database
Tsunami	No	No	Tsunami is not identified as a hazard of concern in the NYS HMP	2014 NYS HMP
Volcano	No	No	Volcanoes are not identified as a hazard of concern in the NYS HMP, because there are no known volcanoes located in the state.	2014 NYS HMP

Hazard	Is this a hazard that may occur in Saratoga County?	If yes, does this hazard pose a significant threat to Saratoga County?	Why was this determination made?	Source(s)
Wildfire	Yes	Yes	• The NYS HMP identifies wildfires as hazards of concern for New York State. • The NYS HMP indicates that Saratoga County has experienced wildfires in the past. • Portions of Saratoga County are required to have burn permits. • In the last ten years, Saratoga County has seen increasing populations and changes in land use, including increased subdivision development in areas susceptible to wildfire (wildland urban interface). • CEPA determined Saratoga County had an increased risk of Wildfire (from the years 2015 to 2018).	• 2014 NYS HMP • USGS

The Saratoga County planning team determined that seven natural hazards of concern are identified as significant hazards affecting the County. These hazards will be addressed within this plan:

- Drought
- Earthquake
- Extreme Temperatures
- Flooding (riverine, flash, ice jam, beaver dam and elevated groundwater flooding)
- Ground Failure (landslides)
- Invasive Species
- Severe Storm (windstorms, thunderstorms, hail, tornadoes and hurricanes/tropical storms)
- Severe Winter Storm (heavy snow, blizzards, ice storms, Nor'easters)
- Wildfire

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

5.3 Hazard Ranking

After the hazards of concern were identified for Saratoga County, the hazards were ranked to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Each participating Town, Village or City may have differing degrees of risk exposure and vulnerability compared to the County as a whole; therefore, each Town/Village or City ranked the degree of risk to each hazard as it pertains to their community using the same methodology as applied to the County-wide ranking. This assures consistency in the overall ranking of risk process. The hazard ranking for each participating Town, Village or City can be found in their jurisdictional annex in Volume II of this Plan.

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Saratoga County is described below. Estimates of risk for the County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance and generated by FEMA's Hazus risk assessment tool.

5.3.2 Probability of Occurrences

The probability of occurrence is an estimate of how often a hazard event occurs. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions in Table 5-1.

Table 5-3 Probability of Occurrence Ranking Factors

Probability	Definition	Rating
Rare	Hazard event occurs less than once in 50 years	1
Infrequent	Hazard event occurs once in 8 to 50 years	2
Regular	Hazard event occurs once in 1 to 7 years	3
Frequent	Hazard event occurs annually	4

5.3.3 Impact

The impact of each hazard is considered against each of the three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and a subjective assessment by the Planning Team, an impact rating of high, medium, or low is assigned with a corresponding numeric value, for each hazard of concern. In addition, a weighting factor is assigned to each impact category: three (3) for population, two (2) for property, and one (1) for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard.

Table 5-4 presents the numerical rating, weighted factor and description for each impact category. The impact rating definitions for population and property are consistent with the NYS HMP ranking methodology with minor modifications. Impact to the economy is also being evaluated.

Table 5-4 Definitions of Impacts to Population, Property and Economy

Category	Weight Factor	Low Impact (1)	Medium Impact (2)	High Impact (3)
Population*	3	Serious injury/death unlikely, not large numbers	Serious injury/death likely, large numbers	Serious injury/death likely, extreme numbers
Property*	2	Little or no damage	Moderate damage	Severe Damage
Economy	1	Loss estimate is 9% or less of the total replacement cost for your community	Loss estimate is 10% to 19% of the total replacement cost for your community	Loss estimate is 20% or more of the total replacement cost for your community

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

5.3.4 Risk Ranking Value

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

5.3.5 Hazard Ranking Results

During the Risk Assessment and Capability Review meeting, Saratoga County and jurisdictions participated in a Hazard Ranking exercise. This exercise asked stakeholders to rate the probability of each hazard, as well as rate the impact on population, property, and economy. Population impact was weighted the highest, followed by property, and then economy. The final score was calculated by multiplying the probability by the total impact score. The following table shows the ranking results from Saratoga County. Each jurisdiction's individual hazard ranking results can be found in the annexes in Section 9 of the plan.

Table 5-5 Saratoga County Hazard Ranking

Hazard	Probability of Occurrence (1-4)	Impact Ranking	Risk Ranking Score	Hazard Ranking	Overall Ranking
Flood (riverine, flash, ice jam, beaver dam, and elevated groundwater flooding)	4	14	56	1	High
Severe Storm (windstorm, thunderstorms, hail, tornadoes, and hurricanes/tropical storms)	4	12	48	2	High
Extreme Temperatures	4	12	48	3	High
Ground Failure (Landslides)	3	13	39	4	Medium
Severe Winter Storm (heavy snow, blizzards, ice storms, Nor'easters)	4	9	36	5	Medium
Wildfire	1	8	26	6	Medium
Invasive Species	4	6	24	7	Medium
Earthquake	1	17	17	8	Low
Drought	2	8	16	9	Low

5.3.6 County Emergency Preparedness Assessment Ranking Results

The CEPA provided guidance for hazard identification and ranking for the 2019 Saratoga County Multi-Jurisdictional Hazard Mitigation Plan Update. Table 5-6 shows the Saratoga County natural hazard rankings from CEPA. CEPA assessed the likelihood of the hazard to occur (on a scale from very low to very high) and the consequence of the hazard should it occur (on a scale from very low to very high). The final ranking was determined based on this scoring. More information about CEPA results can be obtained by contacting the Saratoga County OES.

Table 5-6 CEPA Natural Hazard Rankings

Hazard	Likelihood	Consequence	Relative High-Risk Score
Flooding	High	High	16
Ice Storms	High	High	16
Severe Wind/Tornado	High	High	16
Severe Winter Snowstorms	High	Medium	12
Extreme Temperatures	Medium	Medium	9
Earthquake	Low	High	8
Hurricanes/Tropical Storms	Low	High	8
Wildfire	Low	Medium	6
Drought	Low	Low	4
Landslides	Low	Low	4

5.4 Summary of Changes

- Added four new hazard profiles: Drought, Extreme Temperatures, Invasive Species, and Wildfire
- Updated the hazard ranking criteria to align more with the 2014 NYS HMP
- Updated Hazus analysis using 2010 Census data and general building stock based on 2014 RS Means
- NOAA NCEI Storm Events Data updated through 2018
- Disaster declarations updated through 2018
- Updated exposure analysis completed using NYS Statewide Tax Parcel Centroid Points (August 2018)

5.5 Drought

This section describes the nature of Drought hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.5.1 Description

Drought is an extended period of time where there is an absence of water. The Glossary of Meteorology defines drought as “a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area,” (NWS, n.d.). This hazard is unlike other natural hazards in that it is a slowly naturally occurring hazard, that evolves over prolonged periods of time. Moreover, drought is recognized not only due to the lack of precipitation and water availability, but also because of the growing demands of water needs by humans (American Meteorological Society [AMS], n.d.).

There are four ways to classify drought: meteorological drought, hydrological drought, agricultural drought, and socioeconomic drought (NCEI, n.d.).

- **Meteorological drought** is defined as the departure from normal precipitation, when the area is impacted by dry weather. (NCEI, n.d.; NWS, n.d.). This type of drought has a slow onset, requiring at least three months to develop and can last for years (NYS DHSES, 2014).
- **Hydrological drought** occurs when meteorological drought impacts the availability of water at surface and subsurface levels, (NCEI, n.d.; NWS, n.d.). This type of drought is often dependent on the hydrological basin an area is located in, because while a lack of precipitation can affect all areas, depending on the hydrological condition of a basin one region may be more heavily affected than others (NYS DHSES, 2014).
- **Agricultural drought** occurs when crops are impacted by the lack of water availability (NCEI, n.d.; NWS, n.d.). Generally, this occurs when crop water demand is higher than the soil water available.
- **Socioeconomic drought** is identified when people become impacted by drought, particularly through the lack of commodities that are affected by drought (NCEI, n.d.; NWS, n.d.).

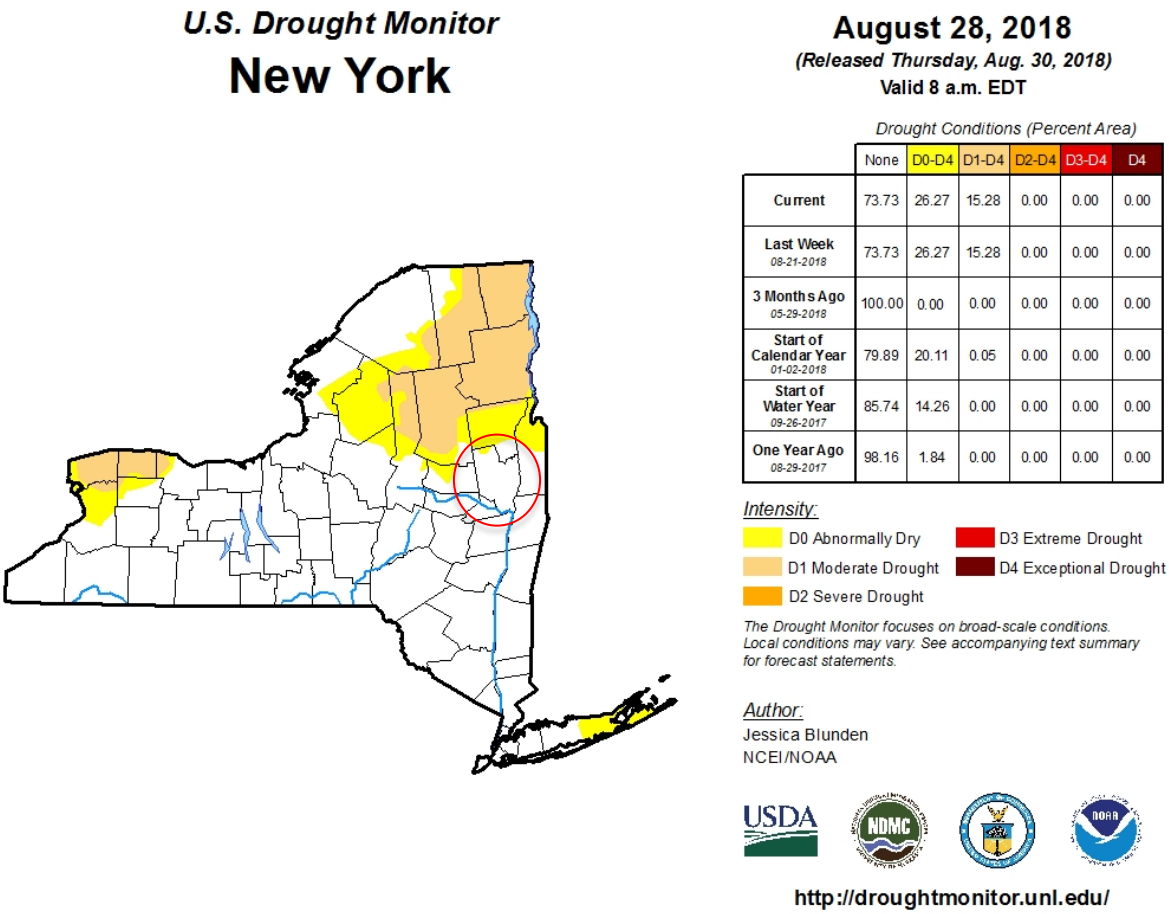
There are several methods and indices to measure drought, including Percent of Normal, Surface Water Supply Index (SWSI), Reclamation Drought Index (RDI), Climate Prediction Center (CPC) Soil Moisture Models, USGS Weekly Streamflow, and Deciles. Three of some of the most commonly used methods include the Streamflow Drought Index (SDI), Palmer Drought Index (PDSI), and Keetch-Byram Drought Index (KBDI) (all defined below). Each of these tools measures different elements that comprise drought conditions to determine the period and severity of a drought (National Drought Mitigation Center, n.d.).

In New York, drought is monitored by DEC. Management of drought is outlined by the Drought Plan, the New York State Comprehensive Emergency Management Plan, the NYS HMP. The DEC has 13 drought management regions which are roughly based on the drainage basins of the state. This helps the DEC monitor precipitation in relation to the lake and reservoir levels, stream flow, and groundwater levels to actively asses the drought.

5.5.2 Location

Drought can impact all jurisdictional areas in Saratoga County, New York in any given year. The U.S. Drought Monitor is a resource that illustrates drought location within the state, updated every Thursday (United States Drought Monitor, 2018). Figure 5-1 shows an example of the drought monitor report, in New York state as of August 28, 2018. A D0 classification, defined as abnormally dry, is impacted the northern area of Saratoga County, New York, on this day. However, drought conditions change so this does not represent an area where drought more frequently occurs.

Figure 5-1 Drought Conditions in New York, August 28, 2018



Source: US Drought Monitor, 2018
Note: Saratoga County is identified with the red circle

5.5.3 Extent

New York State primarily uses the PDSI and the SDI to evaluate drought conditions and define drought severity (NYS HMP, 2014). The SDI was developed by the DEC to more comprehensively determine whether drought indicators reached a critical threshold (New York State Comprehensive Management Plan, 2016). The SDI additionally has specific regional weighting values based on the drought management regions of New York. Table 5-7 outlines the SDI index.

Table 5-7 SDI Index

Drought Stage	Drought Index Range (Sum of the Weighted Indicator Values)
Normal	100 – 150
Watch	75 – 100
Warning	50 – 75
Emergency	0 – 50

The PDSI is one of the most recognized and longest used drought indices. PDSI uses precipitation, temperature, and available water content data to determine drought conditions over an area (National Drought Mitigation Center, n.d.). Table 5-8 shows PDSI and the ranges it uses to categorize drought.

Table 5-8 PDSI Index

Condition	Index Value
Extreme Drought	- 4.0 or less
Severe Drought	- 3.0 to - 3.9
Moderate Drought	- 2.0 to - 2.9
Near Normal	- 1.9 to +1.9
Moderately Moist	+2.0 to +2.9
Very Moist	+3.0 to +3.9
Extremely Moist	+4 and above

Source: NOAA NCEI, n.d

An additional indicator of drought severity in New York State is the drought stage, described further in Table 5-9.

Table 5-9 New York State Drought Stages

Stage	Implication
Drought Watch	The least severe of all the stages, a drought watch is declared when a drought is developing. Public water suppliers begin to conserve water and urge customers to reduce water use.
Drought Warning	Voluntary water conservation is intensified. Public water suppliers and industries update and implement local drought contingency plans. Local agencies make plans in case of emergency declaration.
Drought Emergency	The Governor may declare emergency. The Disaster Preparedness Commission coordinates response. Mandatory local/county water restrictions may be imposed. Communities may need to tap alternative water sources to avoid depleting water supplies, protect public health and provide for essential uses.
Drought Disaster	Disaster plans are implemented. Water use is further restricted. The Governor may declare disaster and request federal disaster assistance. Emergency legislation may be enacted. The state provides equipment and technical assistance to communities.

Source: NYS DEC, 2018.

An additional drought index that is widely used to discuss drought condition includes the KBDI. The KBDI is a drought index used to determine forest fire potential and is based on the balance between precipitation and soil moisture to outline flammable ground material (Texas Weather Connection, 2018). This index is outlined below in Table 5-10. For more information about wildfire in Saratoga County, see Section 5.13.

Table 5-10 KBDI Index

Index Value	Implication
0 - 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation.
200 - 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity.
400 - 600	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively.
600 - 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Source: USFS-Wildland Fire Assessment System (WFAS), n.d.

The US Drought Monitor is an additional tool used by the NDMC, United States Department of Agriculture (USDA), NOAA, and NIDIS to monitor drought. The US Drought Monitor defines its own drought classifications, using several drought measurement indices to synthesize available data into an index for drought. Table 5-11 below shows the US Drought Monitor drought severity.

Table 5-11 US Drought Monitor Drought Severity

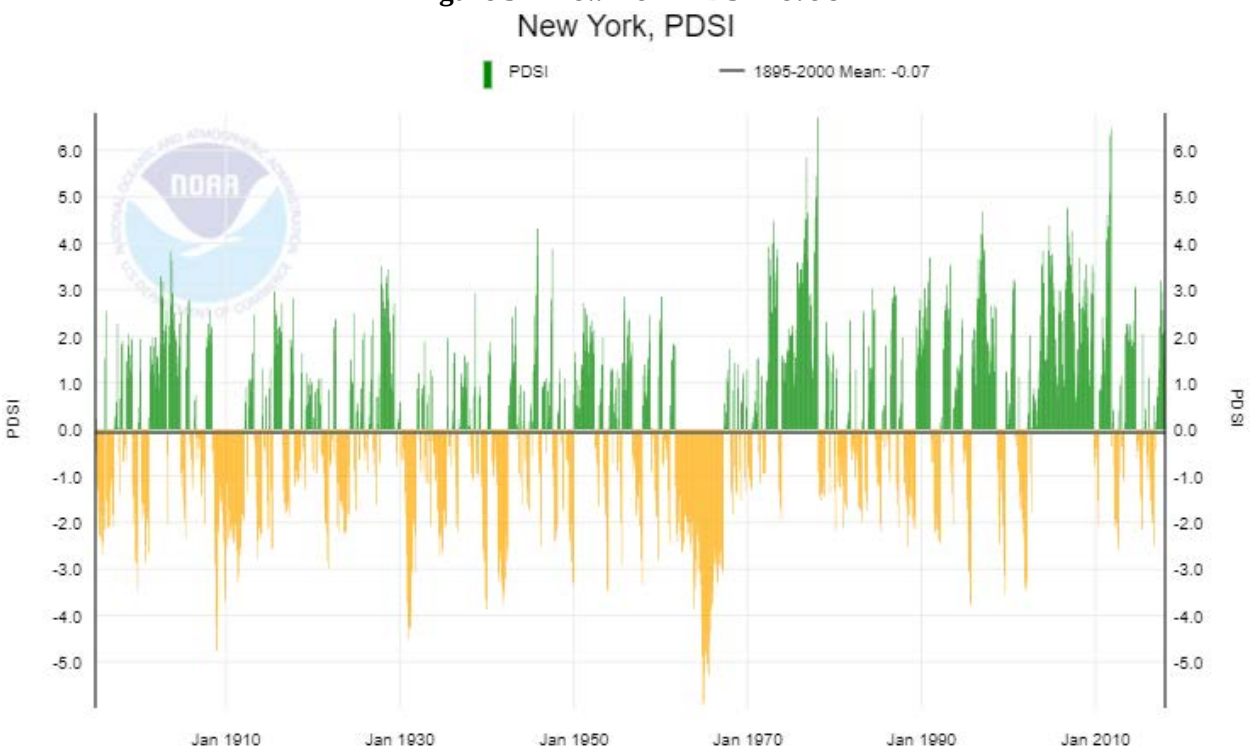
Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures Coming out of drought: some lingering water deficits pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	Crop or pasture losses likely Water shortages common Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	Major crop/pasture losses Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: US Drought Monitor, n.d.

5.5.4 Previous Occurrences and Losses

Annual PDSI numbers have been recorded for the State of New York between 1895 and 2018, detailed in Figure 5-2. Saratoga County would have experienced similar changes in PDSI levels, depending on severity. For the period between 1895 and 2000, the mean of New York State's PDSI was -0.07, which is in the near normal range.

Figure 5-2 New York PDSI Levels



Source: National Centers for Environmental Information, 2018

Saratoga County, New York has experienced more severe droughts in recent years. Table 5-12 details droughts and dry periods for Saratoga County since 2000. The most severe drought in Saratoga County, New York on record since 2000 was in 2016. A State of New York Emergency declaration was declared in 2016 for 51 counties, including Saratoga County due to severe crop damage (New York State, 2016). New York was among many north-eastern states that was impacted by this severe drought in 2016. NYS HMP identified two droughts for Saratoga County between 1960 and 2012 (NYS DHSES, 2014).

Table 5-12 Saratoga County, NY Historical Droughts

Year	Severity
2018	Ranges from abnormally dry to moderate drought
2017	Ranges from abnormally dry to moderate drought
2016	Ranges from abnormally dry to severe drought
2015	Ranges from abnormally dry to moderate drought
2013	Abnormally dry
2012	Abnormally dry
2010	Abnormally dry
2009	Abnormally dry
2007	Abnormally dry
2005	Abnormally dry
2004	Abnormally dry
2002	Ranges from abnormally dry to moderate drought
2001	Ranges from abnormally dry to moderate drought

Source: US Drought Monitor, 2018b

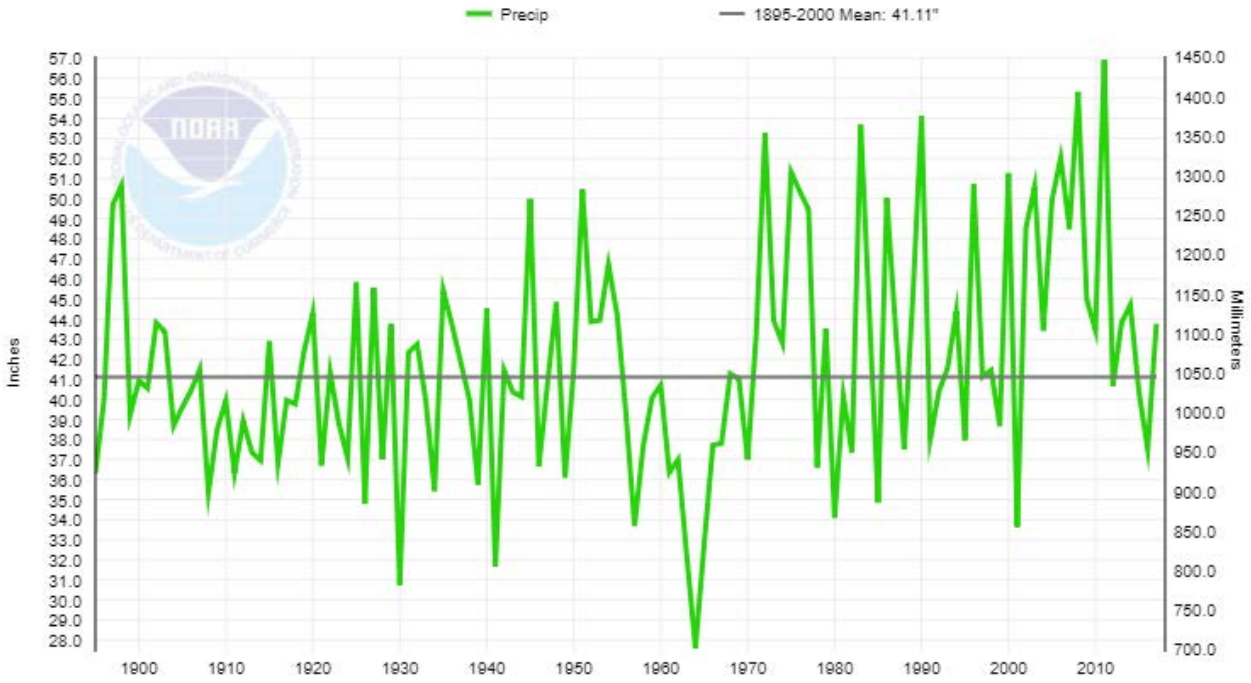
According to the NYS HMP, Saratoga County experienced an estimated total of $16,667 in property damage and $1,851,852 in crop damage between 1960 and 2012 due to droughts, with an average annual loss of $35,933. Droughts are particularly impactful on the agricultural economy in Saratoga County, with farms experiencing significant water loss.

5.5.5 Probability of Future Events

The NYS HMP estimated that Saratoga has a 4% chance of drought, with a hazard event occurring every 26 years (recurrence interval). Therefore, the overall probability of drought occurrence in the future is considered “infrequent”, with one event happening every eight to 50 years. However, the Northeast Climate Adaptation Science Center (NE CASC) estimates that with climate change, droughts will become more frequent throughout the region as temperatures begin to increase (Northeast Climate Adaptation Science Center, 2016). Due to the variability of drought events, it is difficult to estimate the specific locational changes as well as duration changes in future drought events.

Figure 5-3 below indicates the annual precipitation changes for Saratoga County between 1895 and 2018. The chart details that annual precipitation has increased in recent years, with a sharp decrease in the mid-1960s, which as shown in Figure 5-2, was a period of moderate to severe drought (PDSI at or below -1.0). This information is reiterated in the NYS HMP which indicates that the last notable severe drought occurred in the 1960’s.

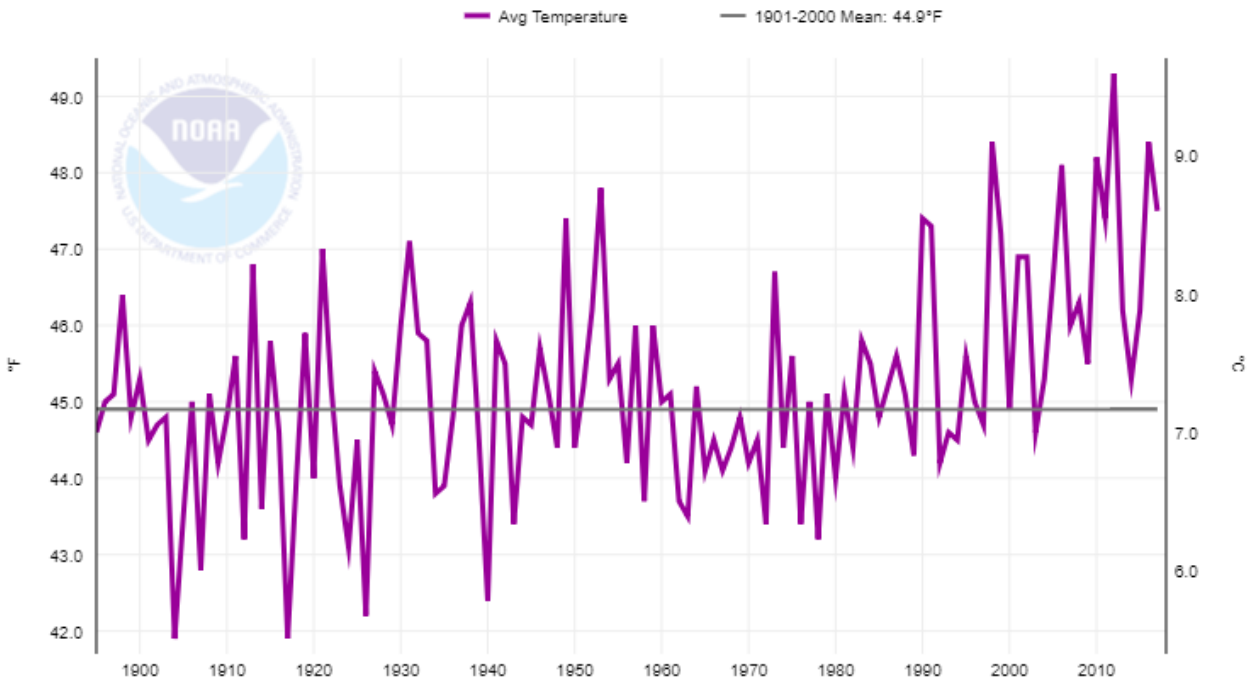
Figure 5-3 Saratoga County Annual Precipitation, 1895 to 2018



Source: National Centers for Environmental Information, 2018b

Figure 5-4 shows the average temperature for Saratoga County, NY. This chart indicates that the average annual temperature for the county has increased over the past 100 years. Given this trend, and future climate projections, temperatures are expected to continue to increase (NYS DEC, n.d.). With increased temperatures, more rain will fall as snow and snow will melt faster increasing hydrological and agricultural drought in the region (Union of Concerned Scientists, n.d.).

Figure 5-4 Saratoga County, NY Average Annual Temperature, 1895-2018



Source: National Centers for Environmental Information, 2018c

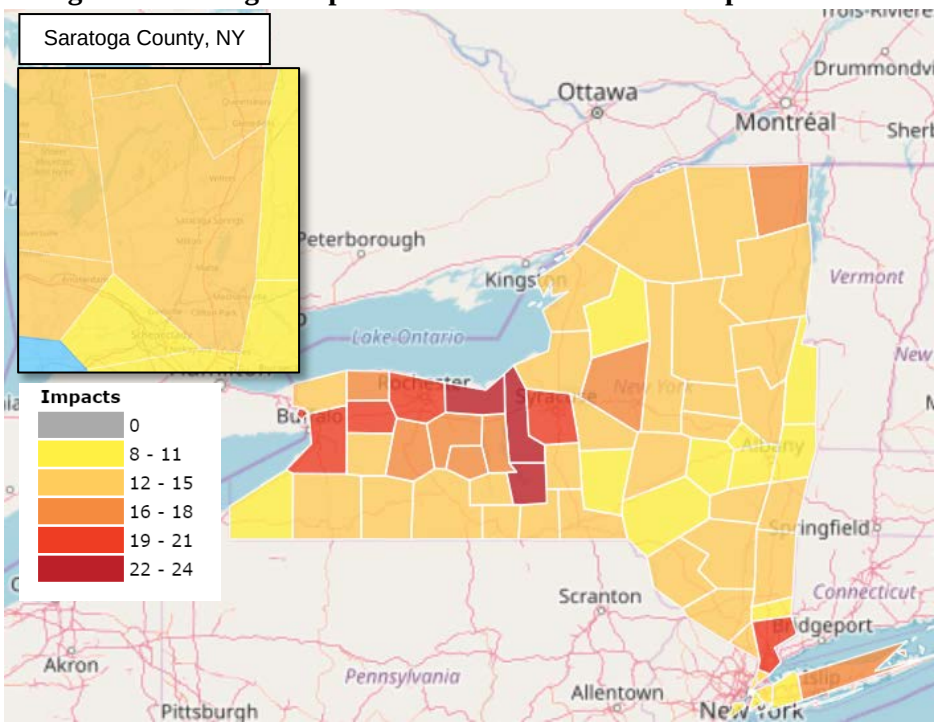
5.5.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of drought in Saratoga County including:

- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time

Figure 5-5 shows the number of drought impacts on New York State counties, including Saratoga County, between 2008 (when the data begins) and September 2018 (National Drought Mitigation Center, 2018c). The NDMC defines impacts as, “An observable loss or change that occurred at a specific place and time because of drought,” (National Drought Mitigation Center N.d.-b). These impacts span various categories, including agriculture, energy, plants and wildlife, society and public health, water supply and quality, business and industry, fire, relief, response, and restrictions, as well as tourism and recreation (National Drought Mitigation Center, 2018c).

Figure 5-5 Drought Impacts Recorded from 2008 to September 2018



Source: National Drought Mitigation Center, 2018c

Data and Methodology

Spatial data was not available for drought risk areas, as drought events vary in frequency, duration, extent, and intensity depending on event. Extensive research was conducted to understand the impact of droughts on various individual community sectors below in Saratoga County, New York.

Impact on Life, Health, and Safety

Drought can impact the health and safety of Saratoga County's entire population. Health issues are the most common impact with this type of event. Health impacts include reductions in nutrition, increased respiratory ailments, and even loss of life due to heat stress, and suicides. Studies show that workers in farming, fishing, and forestry are already 3.4 more likely to commit suicide, which can be exacerbated by drought conditions adding additional stress (Knutson, 2018). Vulnerable populations, such as those under the age of five and over the age of 65, (which comprise over a fifth of Saratoga County's population), are at an increased risk to drought.

Droughts can also impact health and safety by diminishing air quality, drinking water quality and quantity (Centers for Disease Control and Prevention [CDC], n.d.). Individual ground water users may have additional information regarding the vulnerabilities of their specific ground water systems. The levels at which specific areas begin to experience ground water impacts depend on the local ground soil and water conditions and the depth of the well. This can take both a health

and economic toll on individual water users, as drilling a new well can cost between $6,000 and $10,000 (Coin, 2016).

Impact on General Building Stock

There is little to no anticipated impact for infrastructure and facilities. Some may impact may be expected in drought's secondary impacts, such as wildfires, occur which could drastically affect the general building stock and property. Additionally, water shortages may impact the functionality of equipment in buildings and homes.

Impact on Critical Facilities

Drought's impact on critical facilities is due to impacts to surface water supplies, and ground water supplies, diminishing water availability. Lack of water availability could have severe impacts on government services, and critical facilities such as health care centers, and emergency response.

Impact on Economy

Typically, the most profound impact of a drought on a community is to its economy. Important sectors of the Saratoga County economy that can experience economic impacts from drought include agriculture, tourism/recreation, and related sectors (NYS DHSES, 2014). This is due primarily to the direct impact of water loss on agricultural and livestock production, but drought can also impact this sector through the increase in plant and animal disease and pest infestations (NYS DHSES, 2014).

Decreases in agricultural production could lead to income loss for those in the agricultural industry. This would have rippling affects in other sectors of the state economy, including tourism/recreation, food supply, energy supply, and others (NYS DHSES, 2014). New York State Hazard Mitigation Plan estimated that the county experienced approximately $1.8 million in crop losses between 1960-2018 (NYS DHSES, 2014). With Saratoga County having approximately 78,849 acres of farmland that produce an estimated $79.9 million in sales, increased infrequently and severity of drought events would be highly impactful to the county (US Department of Agriculture, 2012).

Impacts on Future Growth and Development

According to future population projections shown in Section 4, the state has experienced population growth since 2010, and expects this growth to continue. The Saratoga County projected population for 2050 is 252,153 people, up 12.1% from 2016 estimates. These population projections could indicate an increase in development to accommodate the growing county population. Increased development could be further impacted by drought events, exposing more people to health and economic risks. Thus, it is important to understand trends for the purposes of hazard mitigation.

As described by the AMS, drought events are due to both precipitation deficits as well increasing human water demands. If population will increase by up to 12% in 2050, there will be an increase in water needs, which could potentially lead to more frequent and impactful drought events.

Increases in critical facilities, infrastructure, general buildings, as well as population, could put added pressure on water availability, increasing the risk of drought events in the future.

Considerations for Future Data Analysis

Future data analysis should consider regularly monitoring agricultural and property losses, public water usage and availability, as well as health impacts due to drought.

5.5.7 Conclusions

Drought's frequency and intensity is increasing, which has already been seen in Saratoga County, particularly with one of the worst droughts in a decade occurring in 2016. Moreover, drought's impacts on human health, agricultural production and water supply could have a devasting impact on the county, particularly due to drought's long duration. Future growth and development could potentially exacerbate drought conditions in the county as well. The overall hazard ranking determined by the Planning Team for Saratoga County for this hazard is "low" with an "infrequent" probability of occurrence (see Table 5-5).

5.6 Earthquake

This section describes the nature of earthquake hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.6.1 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, 2001; Shedlock and Pakiser, 1997). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10% of earthquakes occur within plate interiors. New York is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser, 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser, 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter (FEMA, 2001).

According to the USGS Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches.

5.6.2 Location

The importance of the earthquake hazard in NYS is often underestimated because other natural hazards (for example, hurricanes and floods) occur more frequently and because major floods and hurricanes have occurred more recently than a major earthquake event (NYSDPC, 2008). Typically, areas east of the Rocky Mountains experience fewer and generally smaller earthquakes than the western U.S. However, the potential for earthquakes exists across all of New York State and the entire northeastern U.S.

The NYCEM ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala et al., 2003). The concentration of earthquakes in New York State is located in three general regions. These regions are the north and northeast third of the State, which includes the North County/Adirondack region and a portion of the greater Albany-Saratoga region; the southeast corner, which includes the greater New York City area and western Long Island; and the northwest corner, which includes Buffalo and its surrounding area. Overall, these three regions are the most seismically active areas of the State, with the north-northeast portion having the higher seismic risk and the northwest corner of the State has the lower seismic risk (NYSDPC, 2008):

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

According to a local official in the Town of Charlton, there is a fault located in the western portion of Town, near Route 67, east of Jolly Road. No further information was available or found in the resources consulted during the development of this plan.

5.6.3 Extent

Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a measured value of the earthquake size, or amplitude of the seismic waves, using a seismograph. The Richter magnitude scale (Richter Scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes (USGS, 1989). The Richter Scale is the most widely-known scale that measures the magnitude of earthquakes (Shedlock and Pakiser, 1997; USGS, 2004). It has no upper limit and is not used to express damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude and shock in a remote area that did not cause any damage (USGS, 1989). Table 5-13 presents the Richter Scale magnitudes and corresponding earthquake effects.

Table 5-13 Richter Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Usually felt, but can only be recorded by seismograph
2.5 to 5.4	Often felt, but causes only minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake, serious damage
8.0 or greater	Great earthquake, can totally destroy communities near the epicenter

Source: USGS

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and varies with location. Intensity is expressed by the Modified Mercalli Scale; a subjective measure that describes how strong a shock was felt at a particular location (Shedlock and Pakiser, 1997; USGS, 2004). The Modified Mercalli Scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII. Table 5-14 summarizes earthquake intensity as expressed by the Modified Mercalli Scale.

Table 5-14 Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people; barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like a passing truck.
V	Felt by almost everyone, some people awakened. Small objects move, trees and poles may shake.
VI	Felt by everyone; people may have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.
VIII	Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously cracked. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground move sin waves or ripples. Large rocks may move.

Source: Michigan Tech University, 2007; Nevada Seismological Laboratory, 1996.

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). USGS defines PGA as what is experienced by a particle on the ground, and SA as approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building (USGS, 2009). Both PGA and SA can be measured in g (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). PGA and SA hazard maps provide insight into location specific vulnerabilities (NYSDPC, 2008).

PGA is a common earthquake measurement that shows three things: the geographic area affected, the probability of an earthquake of each given level of severity, and the strength of ground movement (severity) expressed in terms of percent of acceleration force of gravity (%g). In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area (NYSDPC, 2008). The table below details PGA measurements, perceived shaking, and potential damages.

Table 5-15 Modified Mercalli Intensity (MMI) and PGA Equivalent

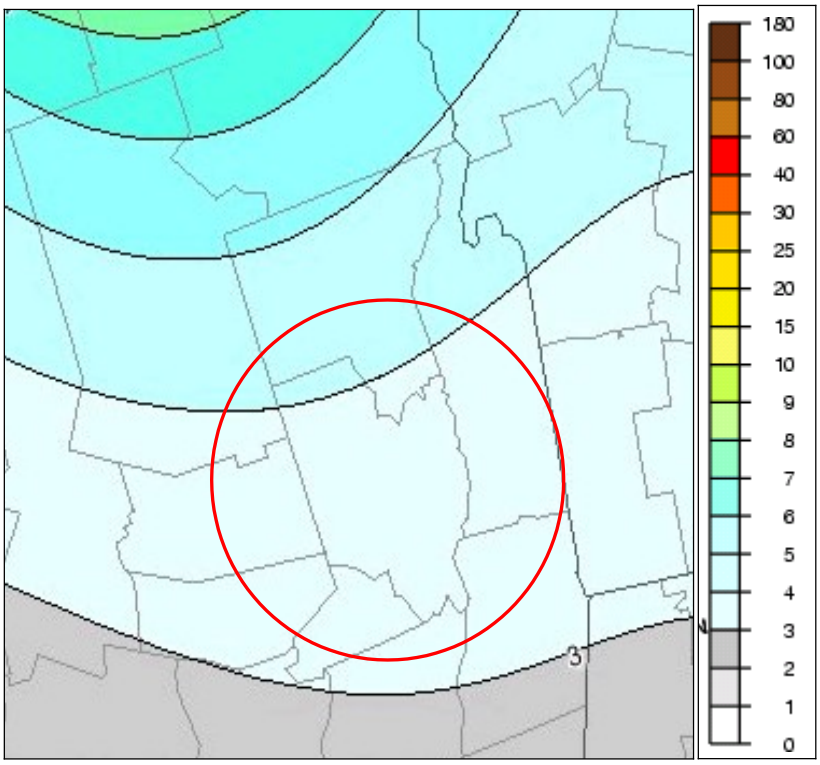
MMI	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	<.17	Not felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy

Source: NYSDPC, 2008

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

The USGS recently updated the National Seismic Hazard Maps in 2008. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps, which supersede the 1996 and 2002 versions. The 2008 map represents the best available data as determined by the USGS (USGS, 2008). Saratoga County has a PGA between 3% and 4% (Figure 5-6). These maps are based on peak ground acceleration (%g) with 10% probability of exceedance in 50 years.

Figure 5-6 Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years



Source: USGS, 2008

A probabilistic assessment was conducted for the 100-, 500- and 2,500-year mean return periods (MRP) through a Level 1 analysis in Hazus to analyze the earthquake hazard for Saratoga County. The Hazus analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 100-year MRP event is an earthquake with a 1% chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 500-year MRP, there is a 0.2% chance the mapped PGA will be exceeded in any given year. For a 2,500-year MRP, there is a 0.04% chance the mapped PGA will be exceeded in any given year. The figures below illustrate the geographic distribution of PGA (*g*) across Saratoga County for the 100-, 500-, and 2500-year MRP events at the census tract level.

Figure 5-7 Peak Ground Acceleration in Saratoga County for a 100-Year MRP Earthquake Event by Census Tract

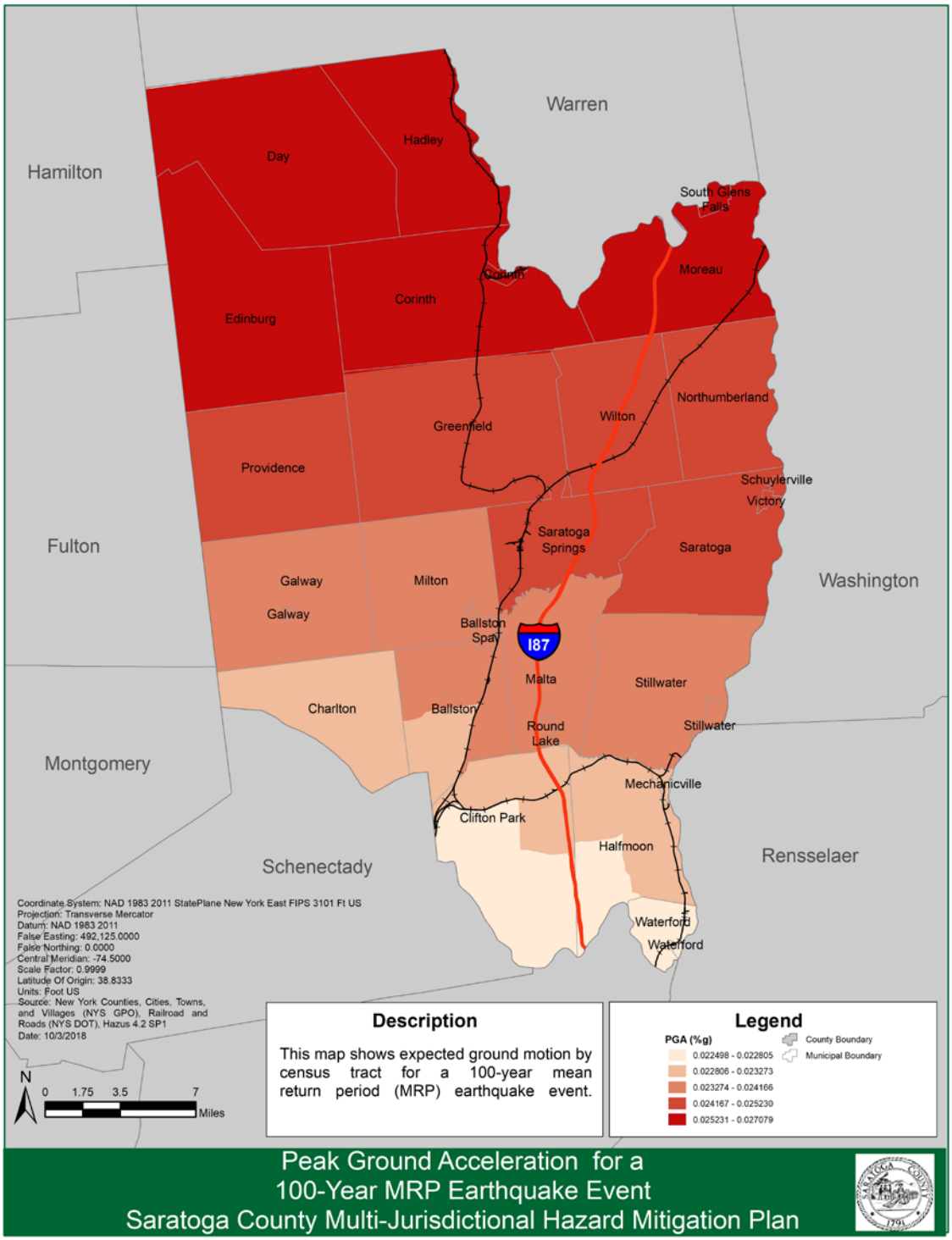


Figure 5-8 Peak Ground Acceleration in Saratoga County for 500-Year MRP Earthquake Event by Census Tract

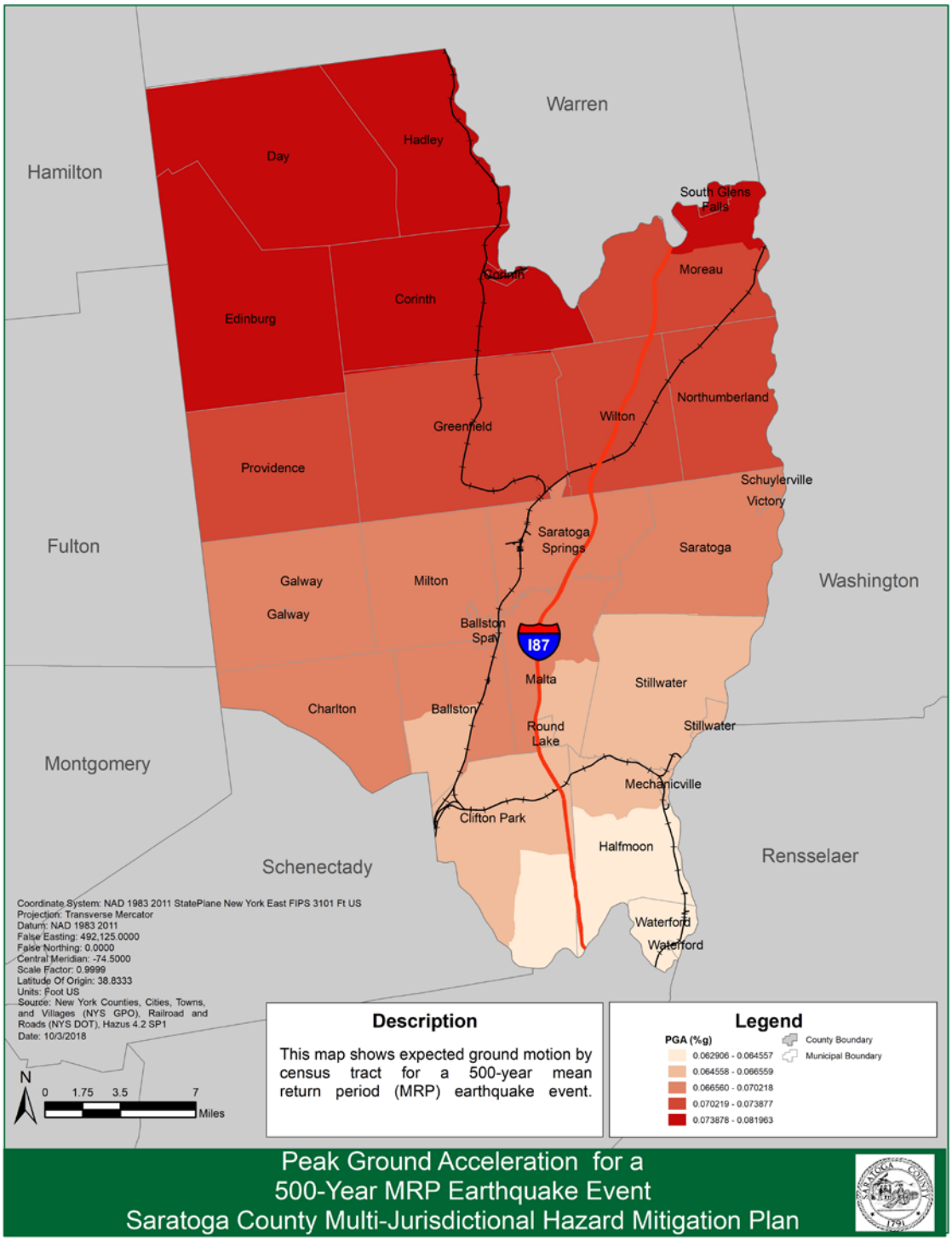
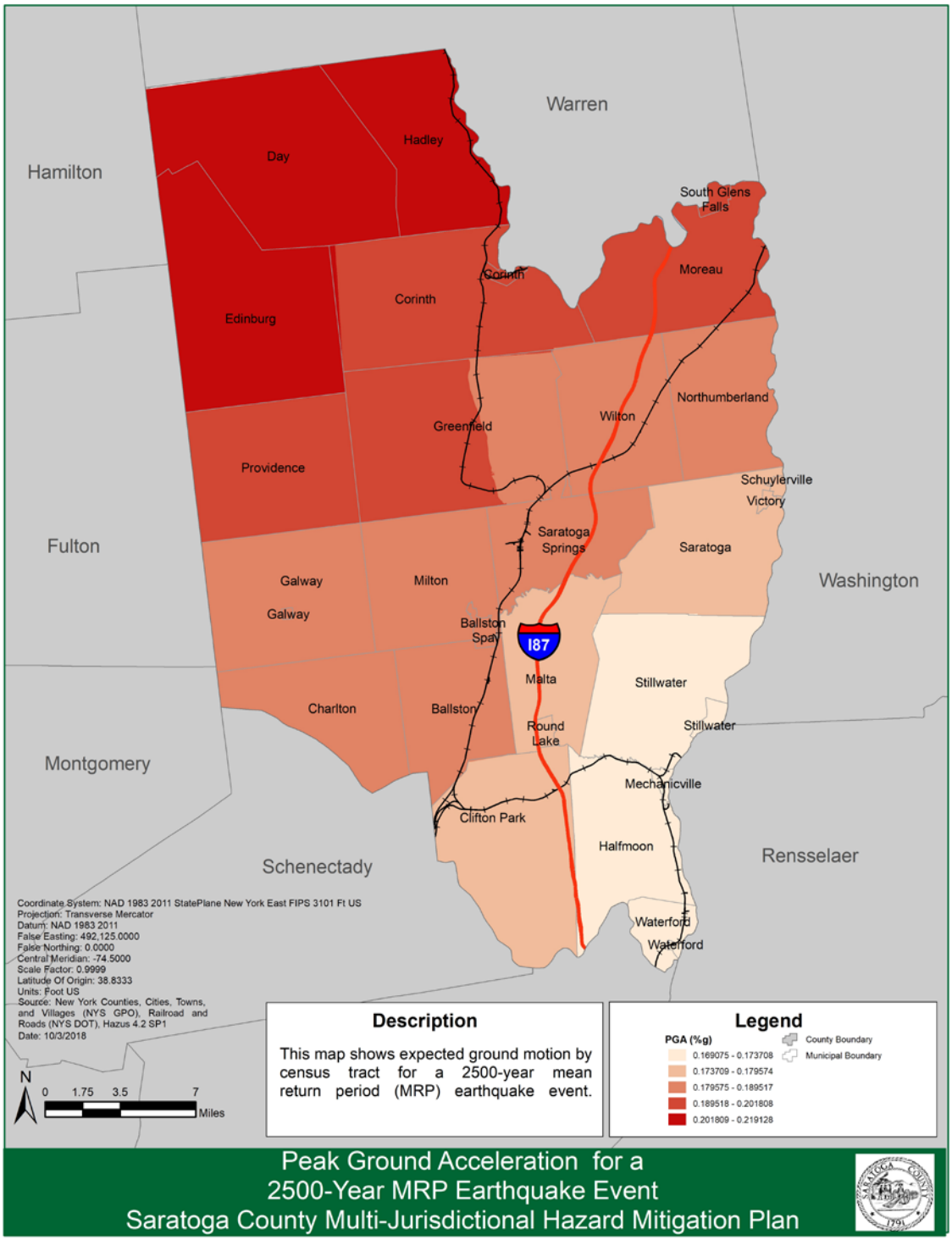


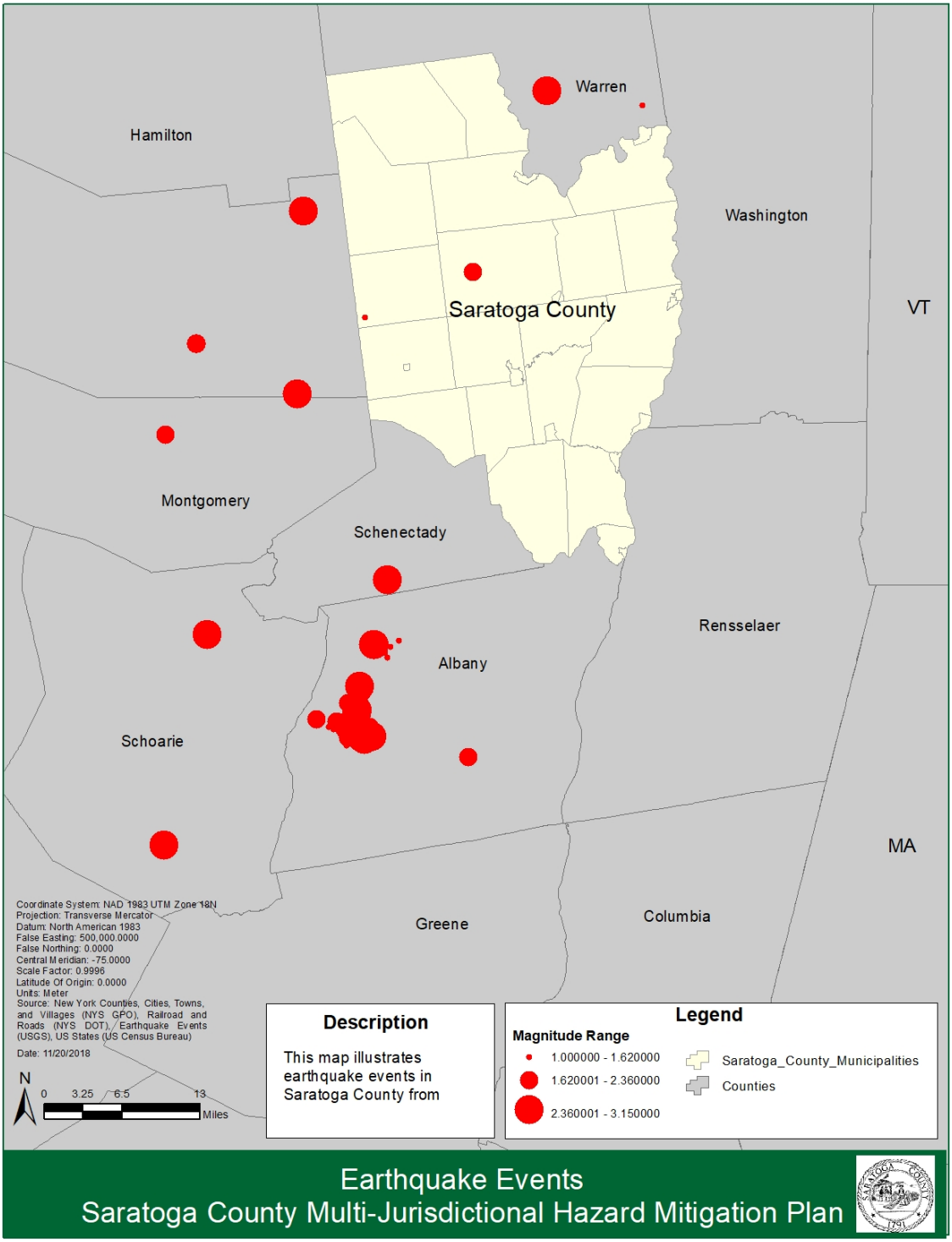
Figure 5-9 Peak Ground Acceleration in Saratoga County for 2500-Year MRP Earthquake Event by Census Tract



5.6.4 Past Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with earthquakes throughout New York and Saratoga County. Therefore, with so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary. Based on seismic records, thousands of earthquakes with magnitudes larger than 2.0, have occurred in New York State over the past few centuries. Between 1730 and 1986, more than 400 earthquakes with a magnitude of greater than 2.0 are on record in New York State, but many more have occurred unrecorded (Tantala et al., 2003). According to the NYSDPC, approximately 48 earthquakes have affected New York State between 1737 and 2009. Additional sources have noted other earthquake events within New York State as well. Figure 5-10 shows earthquake events in Saratoga County and the surrounding region, retrieved from the USGS Earthquake Catalog.

Figure 5-10 Earthquake Events (1700 – October 1, 2018)



Earthquakes in Saratoga County are not common, with documented information on earthquake events and their location being relatively scarce. However, depending on the magnitude, the impacts of earthquake events can be far-reaching; therefore, reported incidences within

surrounding counties or states could have created indirect impacts upon the County. Earthquakes that have had direct effects on the County as documented in historical records or databases are detailed below:

April 20, 1931: During the afternoon of April 20th, the first shock of an earthquake struck Warren County, New York, just north of Saratoga County. It was centered near Warrensburg, New York. In Warren County, shaking was severe; hotels and other buildings swayed, and local stores shook, with their goods falling from shelves. More than 20 chimneys collapsed, and the steeple of a church was twisted in Warrensburg. Damage was widespread throughout Warren County. In Saratoga County, the District Attorney reported that the ceiling of his office collapsed. There were at least three shocks in all, with reports of each shock lasting nearly one minute each time. The shocks from this earthquake were felt as far as Boston, Philadelphia and in the Delaware Gap in Pennsylvania (Warren, 2006).

September 5, 1944: An intensity VII earthquake was felt across more than 172,000 square miles in the U.S., including all of the New England states, Delaware, Maryland, New Jersey, New York, Pennsylvania, and parts of Michigan and Ohio. Parts of Illinois, Indiana, Virginia, West Virginia, and Wisconsin all reported feeling tremors (Stover and Coffman, 1993). The epicenter was located between Massena, New York and Cornwall, Ontario, Canada. It caused an estimated $2 million in damaged between the two cities, and the shock damaged or destroyed about 90% of the chimneys in Massena. The damage effects were similar in Cornwall as well (Lamantagne and Halchuck, 2001). Although Saratoga County was located within the earthquakes range; details regarding the impact of the earthquake in the County were unavailable in the materials reviewed to develop this plan.

April 20, 2002 (FEMA DR-1415): A moderate earthquake occurred about 15 miles southwest of Plattsburgh, New York. The earthquake was felt widely across the northeastern U.S., mid-Atlantic states and southern Canada, including Montreal, Quebec (USGS, 2002). Boston, Massachusetts; Bangor, Maine; Washington, D.C.; Cleveland, Ohio; and Baltimore, Maryland were among the cities that experienced indirect impacts from this event (Cappiello and Tilghman, 2002).

In New York State, this was the largest earthquake in nearly 20 years with an intensity of 5.1 on the Richter Scale and resulted in widespread impacts. Governor George Pataki declared a state of emergency in Clinton and Essex Counties, after feeling the earthquake in Albany (Cappiello and Tilghman, 2002). Overall damage within the State included tipped chimneys and cracked roads; however, no injuries were reported. Road damage and closures were reported at Keeseville and Au Sable Forks (Essex County). Chimney damage was reported in Lake Placid (Essex County). The Township of Jay (Essex County), there was bridge damage and a reported landslide. Slight damage was reported at Blue Mountain Lake, Indian Lake, Minerva, and North River. The earthquake was also felt in Adirondack, Childwold, Moriah Center, Newcomb, North Creek, Old Forge, Olmstedville, Piercefield, Severance, Wanakena, and many other localities of upstate New York, most reporting at an intensity of V (USGS, 2002).

In Saratoga County, reports of having felt the earthquake were noted in Ballston Lake, Ballston Spa, Clifton Park, Corinth, Galway, Greenfield center, Hadley, Mechanicville, Saratoga Springs, Schuylerville, South Glens Falls, and Stillwater (USGS, 2002). Details regarding the impact of the

earthquake in Saratoga County were unavailable in the materials reviewed to develop this plan. Additionally, two aftershocks were felt the morning of the earthquake, which registered 2.2 on the Richter Scale.

This earthquake resulted in a FEMA Disaster declaration (FEMA DR-1415) on May 16, 2002. Through this declaration, the following Counties were declared eligible for federal and State disaster public assistance funds: Clinton, Essex, Franklin, Hamilton, Warren and Washington. Saratoga County was not declared eligible for assistance from this FEMA disaster.

5.6.5 Probability of Future Events

Earlier in this section, the identified hazards of concern for Saratoga County were ranked. NYS DHSES conducts a similar ranking process for hazards that affect the State. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Team, the probability of occurrence for earthquakes in Saratoga County is considered “rare”, with one hazard event occurring less than once every 50 years. It is anticipated that Saratoga County and all of its jurisdictions will continue to experience indirect impacts from earthquakes that may affect the general building stock, local economy and may induce secondary hazards such ignite fires and cause utility failure.

5.6.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of extreme temperatures in Saratoga County, including:

- Data and methodology used for the evaluation;
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development; and
- Further data collections that will assist understanding of this hazard over time.

Data and Methodology

After reviewing the historic data, a probabilistic assessment was conducted for the 100-, 500- and 2,500- year mean return periods through a Level 1 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates for Saratoga County. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

According to NYCEM, probabilistic estimates are best for urban planning, land use, zoning and seismic building code regulations (NYCEM, 2003). The default assumption is a magnitude five earthquake for all return periods. Default demographic, general building stock, and critical facility data in Hazus was used for the earthquake analysis. Please note, according to the Hazus technical manual, there is considerable uncertainty related to the characteristics of ground motion in the eastern U.S. Therefore, loss estimates may be overestimated.

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

Data used to assess this hazard include data available in the Hazus earthquake model, USGS data, professional knowledge, and information provided by the County's Planning Team. The results of this assessment are discussed below.

Impact on Life, Health, and Safety

Overall, the entire population of 229,869 in Saratoga County, based on the 2017 U.S. Census estimates, is exposed to the earthquake hazard event. The impact of earthquakes on life, health and safety is dependent upon the severity of the event. Risk to public safety and loss of life from an earthquake in Saratoga County is minimal with higher risk occurring in buildings as a result of damage to the structure, or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the quake.

Populations considered most vulnerable include the elderly (persons over the age of 65) and individuals living below the Census poverty threshold. Table 5-16 summarizes the County population over the age of 65 and individuals living below the Census poverty threshold.

Table 5-16 Vulnerable Population Exposed to the Earthquake Hazard in Saratoga County

Population Category	Number of Persons	Percent of Total Population
Elderly	40,227	17.5%
Living below the poverty level	14,482	6.3%
Total	54,708	23.8%

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

Table 5-17 summarizes the injuries and casualties estimated for the 2,500-year MRP earthquake event.

Table 5-17 Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00am	2:00pm	5:00pm
Injuries	115	145	113
Hospitalization	20	27	21
Death	3	5	4

Table 5-18 describes the effects of the 500 and 2500-year MRP event on hospital capacity. Less beds will be available after a 2500-year MRP earthquake, but hospitals are expected to have at least 50% of beds available after the first day

Table 5-18 Estimated Hospital Bed Capacity for 500 and 2500-Year MRP Events

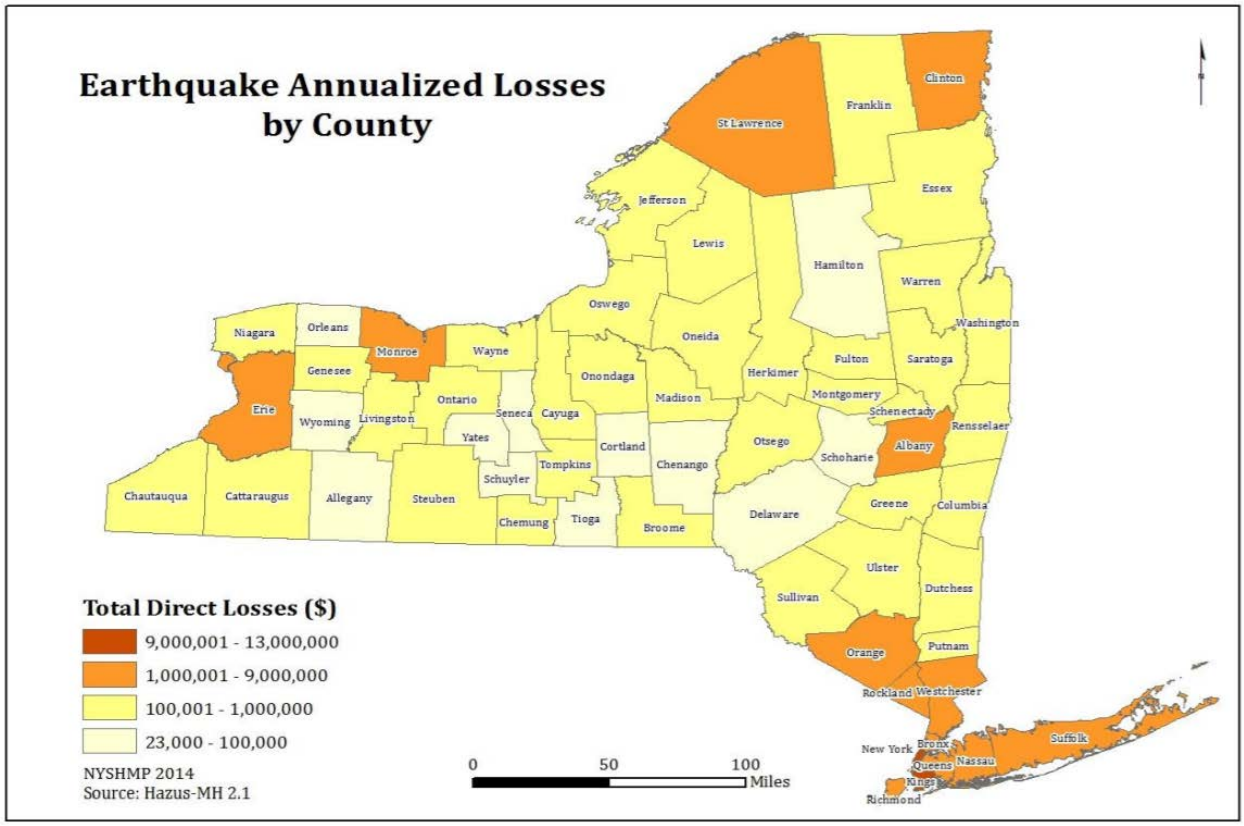
Hospital Capacity	500-Year MRP			2500-Year MRP		
	Day One	After One Week	After One Month	Day One	After One Week	After One Month
Percent of Total Beds Available	%85	%94	%100	%62	%81	%95

Impact on General Building Stock

After considering the population exposed to the earthquake hazard, the value of general building stock exposed to and damaged by 100-, 500- and 2,500-year MRP earthquake events was evaluated. The entire study area's general building stock is considered at risk and exposed to this hazard, at varying degrees. Section 4 summarizes the total replacement value by general occupancy for the general building stock data in Hazus for Saratoga County.

The 2014 NYS HMP conducted a Hazus vulnerability assessment and reported estimates of earthquake losses by County. For Saratoga County, the estimated annualized earthquake loss is $722,000 (Figure 5-11).

Figure 5-11 Annualized Earthquake Losses by County



According to the NYCEM, where earthquake risks and mitigation were evaluated in the New York, New Jersey and Connecticut region, most damage and loss caused by an earthquake is directly or indirectly the result of ground shaking (NYCEM, 2003). There is a strong correlation between PGA and the damage a building might experience. The Hazus model is based on the best available earthquake science and aligns with these statements. Figures earlier in this profile illustrate the geographic distribution of PGA across Saratoga County for 100-, 500- and 2,500-year MRP events at the Census-Tract level, information that was extracted from Hazus.

According to NYCEM, a building's construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that un-reinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that contribute to a building's capability to withstand an earthquake's force include its age, number of stories and quality of construction.

Hazus considers building construction and the age of buildings as part of the analysis. Because the default general building stock was used for this Level 1 Hazus analysis, the default building ages and building types already incorporated into the inventory were used. Potential building damage was evaluated by Hazus across the following damage categories (none, slight, moderate, extensive and complete). Table 5-19 provides definitions of these five categories of damage for

a light wood-framed building; definitions for other building types are included in Hazus technical manual documentation. General building stock damage for these damage categories by occupancy class and building type on a County-wide basis is summarized for the 100-, 500- and 2,500-year events in Table 5-20.

Table 5-19 Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: Hazus Technical Manual

It is estimated that there would be greater than $66 million in building damages during a 500-year earthquake event. This includes structural damage, non-structural damage and loss of contents, representing less than one-percent of the total replacement value for general building stock in Saratoga County. For a 2,500-year MRP earthquake event, the estimated total building damage is greater than $601 million or more than two percent of the total general building stock replacement value. Residential buildings experience the greatest damage from an earthquake event. This is likely because they comprise the majority of the building inventory. Table 5-20 summarizes the number of buildings with each level of damage by occupancy type. Table 5-21 summarizes the estimated damages to buildings by municipality for the 500 and 2500-year MRP event.

Table 5-20 Estimated Number of Buildings Damaged by General Occupancy for 100-year, 500-year and 2,500-year MRP Earthquake Events

Category	Average Damage State														
	100-Year MRP					500-Year MRP					2,500-Year MRP				
	N	S	M	E	C	N	S	M	E	C	N	S	M	E	C
Residential	81,048	454	110	7	1	76,580	2,804	744	30	8	64,317	11,270	5,044	886	102
Commercial	4,240	38	10	1	0	1,855	2	0	0	1	2,910	750	503	114	13
Industrial	1,163	10	2	0	0	300	0	0	0	0	784	201	152	34	4
Education, Government, Religious and Agricultural	930	8	2	0	0	2,434	2	0	0	0	659	158	98	22	3

N=None, S=Slight, M=Moderate, E=Extensive, C=Complete; Source: Hazus MR3, 2007

Table 5-21 Estimated Building Value (Building and Contents) Damaged by Jurisdiction for the 500- and 2,500-Year MRP Earthquake Events

Municipality	Estimated Total Damages		Estimated Residential Damage		Estimated Commercial Damage	
	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year
Ballston	$188,655	$1,669,827	$724,754	$6,057,560	$252,503	$2,183,044
Charlton	$37,896	$338,681	$377,048	$3,234,621	$36,172	$317,864
Clifton Park	$325,333	$2,865,947	$2,976,924	$25,113,549	$1,252,141	$10,896,712
Corinth	$149,406	$1,235,134	$552,192	$4,383,964	$123,955	$1,021,461
Day	$46,627	$398,642	$329,046	$2,686,347	$25,730	$217,456
Edinburg	$44,544	$380,847	$314,118	$2,564,538	$24,540	$207,411
Galway	$46,250	$402,139	$409,670	$3,456,014	$40,336	$349,555
Greenfield	$88,372	$753,788	$631,536	$5,062,867	$118,513	$987,727
Hadley	$16,677	$138,131	$204,954	$1,649,264	$26,578	$220,769
Halfmoon	$157,408	$1,380,455	$1,461,150	$11,934,038	$525,789	$4,518,751
Malta	$147,522	$1,271,704	$1,243,042	$10,027,299	$333,861	$2,807,057
Mechanicville	$35,624	$298,903	$276,380	$2,233,970	$110,631	$931,597
Milton	$287,873	$2,505,354	$1,319,723	$10,750,482	$385,086	$3,260,660
Moreau	$179,888	$1,452,113	$1,185,726	$9,105,665	$448,186	$3,556,279
Northumberland	$34,108	$276,773	$407,828	$3,092,736	$49,826	$396,326

Municipality	Estimated Total Damages		Estimated Residential Damage		Estimated Commercial Damage	
	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year
Providence	$33,996	$295,743	$196,120	$1,612,454	$23,126	$194,984
Saratoga	$106,144	$858,972	$453,154	$3,455,826	$116,117	$924,451
Saratoga Springs	$1,081,945	$9,242,997	$2,787,483	$22,104,227	$1,825,234	$15,139,885
Stillwater	$107,918	$905,629	$576,553	$4,507,040	$103,123	$848,781
Waterford	$186,262	$1,671,248	$551,084	$4,545,021	$116,345	$1,000,154
Wilton	$138,141	$1,137,895	$1,388,617	$10,802,267	$466,810	$3,785,566
Village of Ballston Spa	$97,119	$833,099	$372,439	$3,035,667	$195,497	$1,649,164
Village of Corinth	$117,552	$970,642	$193,951	$1,536,567	$85,518	$706,502
Village of Galway	$266	$2,310	$2,359	$19,901	$232	$2,011
Village of Round Lake	$9,306	$81,371	$59,185	$478,268	$20,600	$174,777
Village of Schuylerville	$20,517	$162,937	$65,023	$491,716	$26,598	$209,159
Village of South Glens Falls	$38,303	$303,565	$285,307	$2,189,333	$123,282	$990,369
Village of Stillwater	$22,139	$180,142	$100,289	$778,586	$21,130	$172,132
Village of Victory	$19,228	$152,693	$60,875	$460,336	$24,939	$196,109
Village of Waterford	$30,470	$263,976	$118,626	$983,345	$34,601	$299,427
Saratoga County	$3,795,490	$32,431,655	$19,625,155	$158,353,470	6,937,000	$58,166,141

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 100-, 500- and 2,500-year MRP earthquake events, critical facilities were evaluated. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities and user-defined facilities) in Saratoga County are considered exposed and vulnerable to an earthquake.

Hazus estimates the probability that critical facilities may sustain damage as a result of 100-, 500- and 2,500-year MRP earthquake events. Additionally, Hazus estimates percent functionality for each facility days after the event. The analysis was run using the default critical facility data in Hazus. For the 100, 500, and 2500-Year MRP event, Hazus estimates that no emergency facilities (police, fire, EMS and medical facilities) will receive major structural damage. For the 100-year MRP earthquake event, all facilities will be nearly 100% functional on day one after the event.

A detailed summary of damage by facility was generated for the 500 and 2500-year MRP earthquake events. The results are summarized in tables found in the Risk Assessment Appendix C. For the 500-year event, all critical facilities will have greater than an 80% chance of sustaining no damage.

Impact on Economy

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. A Level 1 Hazus analysis estimates the total economic loss associated with each earthquake scenario, which includes building- and lifeline-related losses (transportation and utility losses) based on the available inventory (facility [or GIS point] data only). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section above. Lifeline-related losses include the direct repair cost to transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. These losses are discussed below. For the all MRP events, in terms of utilities, Hazus estimates each potable water facility, wastewater facility, electric transfer/substation and communication facility will not receive any structural damage.

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

For all MRP events, Hazus estimates all highway and railway bridges in Saratoga County will be fully functional day one of the event. Hazus does estimate economic loss sustained from some damages to these systems. For the 100-year MRP event, Hazus estimates $0.3 million in economic loss. For the 500-year MRP event, Hazus estimates $0.68 million in loss, and for the 2500-year MRP event Hazus estimates $9.93 million in loss.

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 (Hazus Earthquake User's Manual). For the 100- year MRP event, Hazus estimates 3,000 tons of debris will be generated. For the 500-year MRP event, Hazus estimates more than 28,000 tons of debris will be generated with 74% being brick and wood and the remaining debris as reinforced concrete and steel. For the 2,500-year MRP event, Hazus estimates greater than 157,000 tons of debris will be generated with 60% being brick and wood and the remaining debris as reinforced concrete and steel.

Hazus estimates the total economic loss of an earthquake scenario taking into account building and lifeline related losses. The estimated total economic impact for the 100-year MRP event is $6.58 million, while the estimated loss for the 500-year MRP event is estimated to be $88.26 million. Finally, the estimated economic loss for the 2500-year MRP event is estimated to be $701.43 million.

Impact on Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. For the earthquake hazard, the entire County has been identified as the hazard area. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. 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. Please refer to Section 4 for hazard maps that illustrate where potential new development is located in relation to Saratoga County's hazard areas.

Considerations for Future Data Analysis

A Level 1 Hazus earthquake analysis was conducted for Saratoga County using the default model data. For future plan updates, the national default inventories with more accurate local inventories can replace inventory default data. Additional data that can enhance the County's analysis would include: (1) updated demographic and building stock data to refine/update the default data for all jurisdictions; and (2) soil liquefaction data. In terms of general building stock data, updated building age, construction type and current replacement value would further support the refined analysis.

5.6.7 Conclusions

Earthquakes are rare events in the study area causing impacts and losses mainly to the County's structures and facilities. Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The overall hazard ranking determined by the Planning Team for Saratoga County for this hazard is "low" with a "rare" probability of occurrence (see Table 5-5).

5.7 Extreme Temperatures

This section describes the nature of extreme temperature hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.7.1 Description

Extreme temperatures include both extreme cold and extreme heat. Extreme temperatures pose a hazard to Saratoga County for multiple reasons; almost no facet of the environment or society is protected from the effects of extreme temperatures. Extreme temperatures impact people and animals, public health, critical facilities and infrastructure, utilities, transportation, and the environment.

Extreme Cold

For the purposes of this plan, extreme cold is characterized by temperatures falling to -22°F (or -30°C) or less. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

Extreme Heat

Extreme heat is defined by the New York State Department of Health profile of Saratoga County as temperatures that are substantially hotter and/or more humid than expected or typical for a specific region. In Saratoga County, when the outside temperature exceeds 90 degrees for three or more days, it is a heat wave.

This definition for extreme heat may be refined to read: summertime temperatures that hover ten degrees or more above the historical average high temperature for the region for any amount of time. An extreme heat event (EHE) is an extended period of unusually hot weather conditions that can potentially be harmful to human health.

The Heat Index (HI) or the "apparent temperature" is an accurate measure of how hot it really feels when the relative humidity (RH) is added to the actual air temperature. The HI may be used to help determine when an extreme heat event is occurring. Public alerts for extreme heat, released from the NWS, are based mainly on HI values.

5.7.2 Location

Saratoga County's location places it in the path of global weather patterns that often contribute to extremely hot or cold temperatures. According to the NOAA, nearly all storm and frontal systems (frontal systems being the boundary between two masses of air of different densities) move eastward across the U.S., passing through or in close proximity to New York State and Saratoga County. Storm systems often move north along the Atlantic coast and have an important influence on the weather and climate of the entire state; areas deep in the interior of New York often feel the effects of strong coastal storms. Extreme cold temperatures also prevail over New York State when Arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay.

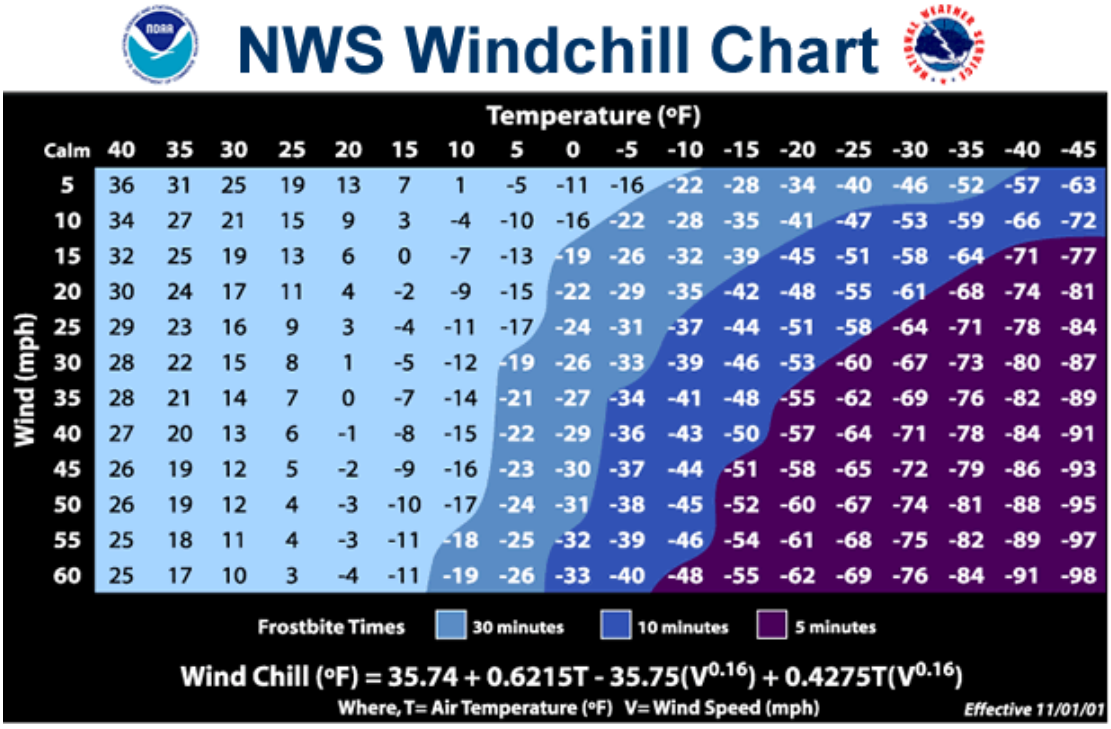
5.7.3 Extent

Extreme Cold

The cold season in Saratoga County lasts for approximately three months with an average daily high temperature below 40 degrees. Extreme cold temperatures can exist throughout most of the winter season and sometimes accompany winter storm events throughout the County. Historically, the coldest day of the year is January 29, with an average high of 30 degrees Fahrenheit and an average low of 13 degrees Fahrenheit (Weather Spark, n.d.). The average annual low temperature in Saratoga Springs, a municipality in the central part of Saratoga County, is 37.3 degrees Fahrenheit.

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature. Wind chill temperature represents how cold people and animals feel, based on the rate of heat loss from exposed skin. The NWS uses a wind chill temperature index to measure the current wind chill in the atmosphere and the speed at which frostbite will set in. A wind chill index of -5°F indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five degrees below zero, even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening. The NWS Wind Chill chart is displayed below.

Figure 5-12 NWS Wind Chill Chart



Many atmospheric and physiographic controls on the climate result in a considerable variation of temperature conditions over New York State. Because of this, the State has been divided into climatically homogenous regions (Energy Information Administration, 2005). Figure 5-13 identifies the 10 climate divisions of the State; Saratoga County falls within the Hudson Valley (Division 5) (NOAA, n.d.; CPC, 2005; Earth System Research Laboratory (ESRL), n.d.).

Figure 5-13 Climate Divisions of New York State

Source: NOAA CPC

Winter temperatures in Division 5 are moderated by the Atlantic Ocean in the southern portion of the Hudson Valley Division. The coldest temperature in most winters will range between 0° and -

10°F (NOAA, n.d.). As provided by The Weather Channel, a range of average high and low temperatures during the winter months in Saratoga County are identified in Table 5-22.

Table 5-22 Average High and Low Temperature Range for Winter Months in Saratoga County

Month	Average High	Average Low	Record Low Events
January	28 – 34	8 – 15	-30 °F (1961) -26 °F (1968) -28 °F (1971) -23 to -35 0 F (1994)
February	32 – 38	9 – 16	-22 °F (1943) -28 °F (1948) -23 °F (1967) -17 to -30 °F (1979) -30 °F (1994)
March	42 – 47	20 – 26	-16 to -21 °F (1948) -24 °F (1950) -13 °F (1967) -13 °F (1982) -13 °F (1984)
November	46 – 51	28 – 33	-11 °F (1938) -1 °F (1951) 2 °F (1962)
December	34 – 39	16 – 21	-23 °F (1950) -23 °F (1955) -22 °F (1969) -15 to -29 °F (1980)

Source: The Weather Channel, 1995-2007

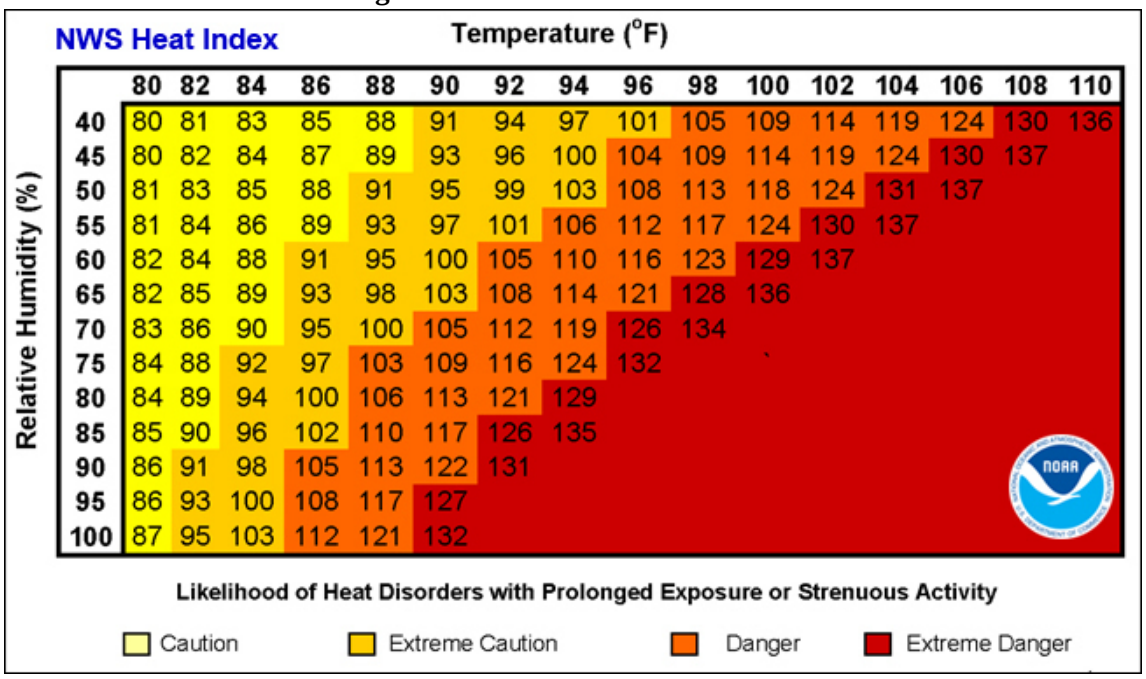
Extreme Heat

The warm season in Saratoga County lasts for approximately three months. Hot temperatures and extreme heat can occur and last for any amount of time, which can vary from one day to several weeks. Extremely hot temperatures are rare in Saratoga County. Historically, three occurrences of extreme heat have been recorded between 1996 and 2013 (NYS DHSES, 2014).

The Heat Index measures how extreme heat feels for people and animals (Figure 5-14). The Heat Index can be used to determine what effects temperature and humidity can have on the population. The table also describes the likelihood of heat disorders with prolonged exposure or strenuous activity. To determine the Heat Index, the temperature and the relative humidity are needed. Once both values are identified, the Heat Index will be the corresponding number of both the values. While our definition is only related to temperature, the true extent of the hazard can be identified through the HI.

It is important to know that Heat Index values are devised for shady, light wind conditions. Exposure to full sunshine can increase Heat Index values by up to 15 degrees. Also, strong winds, particularly with very hot, dry-air can be extremely hazardous to individuals.

Figure 5-14 NWS Heat Index Chart



5.7.4 Past Occurrences and Losses

Saratoga County routinely experiences cold temperatures during the winter months. In early January 2018, Saratoga County, along with much of the surrounding area, experienced extreme cold temperatures with nightly temperature averaging around zero degrees Fahrenheit. There were eight days that month that were 20 degrees Fahrenheit or colder.

Temperatures in New York State have been increasing for the past several Decades and are predicted to continue to increase along with more frequent and intense EHEs over the next century. Similarly, Saratoga County's summers have been getting hotter. In 2018, the region had 42 consecutive days with the temperature reaching above 80 degrees Fahrenheit. Twelve of those 42 days saw temperatures in excess of 90 degrees Fahrenheit. The historical record for consecutive days of heat in excess of 80 degrees Fahrenheit for the region was previously 26, according to the Albany NWS (Wilkin, 2018).

Extreme temperature events can result in injuries and deaths, and communities can suffer economic impacts. Extreme temperatures can cause infrastructure damage and disrupt communications, inhibiting efficient coordination of emergency services and other critical functions. Instances of extreme cold and heat can threaten lives, properties and the environment.

5.7.5 Probability of Future Events

Extremely cold or extremely hot temperatures in New York State are virtually guaranteed yearly. The State is located at relatively high latitudes where resulting winter temperatures range between zero degrees Fahrenheit and 32°F for a good deal of the fall through early spring season.

Within the State, Saratoga County experiences significant and frequent cold weather events and some extreme heat events. Based on historical records and input from the Planning Team, the probability of occurrence for extreme temperatures in Saratoga County is considered “frequent”, with at least one hazard event (both hot and cold) occurring annually. Extremely hot temperatures have been increasing in the County as the effects of climate change contribute to shifting weather patterns across the northeast and entire U.S. In comparison to other extreme weather hazards, EHEs occur less frequently but can have devastating consequences and can be underestimated as a public health hazard.

5.7.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of extreme temperatures in Saratoga County, including:

- Data and methodology used for the evaluation;
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development; and
- Further data collections that will assist understanding of this hazard over time.

Data and Methodology

National weather databases and local resources were used to collect and analyze extreme temperature impacts on the County.

Impact on Life, Health, and Safety

Extreme temperatures can have severe impacts on life, health, and safety, both human and animals. Extreme cold can cause hypothermia and frostbite and disproportionately affects vulnerable populations including the elderly, children, those living in poorly insulated homes or homes without heat, and the homeless. Extreme cold often accompanies other winter weather events like snow and high winds, which can contribute to accidents and other transportation hazards (for more information on winter weather, see Section 5.11. Freezing temperatures can cause transportation issues and dangerous road conditions, contributing to car accidents and traffic jams. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, individuals may also face indoor hazards. Many homes will be too cold—either due to a power failure or because the heating system is not adequate for the weather. The effects of any of these winter emergencies can be compounded, leading to cascading impacts on health and safety.

Similarly, extreme heat often causes severe effects in people and animals, contributing to heat stroke, hyperthermia, and death. According to the NWS, heat caused 4,086 deaths in the United States between 1986 and 2017 (NOAA, 2017). The EPA, contends that, according to death certificates, more than 9,000 Americans have died from heat-related causes since 1979, while the CDC states that from 1999 to 2010, 8,081 heat-related deaths were reported in the U.S. (EPA 2016, CDC, n.d.). These different numbers reflect the difficulty in fully capturing the extent to

which extreme heat affects human populations. Impacts on health and safety can occur because of heat itself or because of extreme heat's impact on critical medical and health equipment, access to emergency medical services, and potential for heat to cause shutdowns in critical utilities like electricity and water systems. Heat can be a direct or contributing factor to illness and deaths, particularly in vulnerable populations like the elderly, but these impacts may not be noted on death certificates.

Impact on General Building Stock

Extremely cold temperatures and heavy icing of surfaces may lead to property damage, as well as power loss, heat loss, and lack of shelter from the elements. Heating systems in homes may not be adequate for the weather and can lead to the use of space heaters and fireplaces, increasing the risk of household fires and carbon monoxide poisoning. Pipes in homes may freeze and burst, causing disruption of water service, as well as flooding. Businesses or households may be faced with an increased financial burden due to unexpected repairs, such as pipes bursting and higher utility bills, and business interruption due to power failure.

In relation to extreme heat, loss of electricity may impact air conditioning and cooling mechanisms, leading to increased indoor temperatures, making some buildings unsafe to use until temperatures are reduced.

Impact on Critical Facilities

Extreme cold can affect critical facilities directly or because of cascading impacts. For example, critical facilities may be shut down or disrupted due to unsafe travel conditions for workers (should extreme cold occur in conjunction with severe winter weather), the risk of serious health problems for employees exposed to the elements, or the failure of processes, materials, or machinery because of the cold. Extreme cold events can lead to power interruption or failure and increased demand for utilities, such as electricity and natural gas. This increased demand may result in shortages and higher costs for energy resources, in addition to overwhelming infrastructure systems that are already aged and in need of repair. According to the New York Independent System Operator (NYISO), the organization that manages New York State's electrical grid, aging electric infrastructure in the state is already inadequate to carry the load of the state's increasingly complex generation resources (Platsky, 2018). The additional stress of extreme temperatures can cause malfunctions and disruptions in this and other critical infrastructure systems.

Delivery of services may be impacted by icy and dangerous transportation conditions, causing food, water, and resource systems to be delayed or halted, as well as personal transportation by the public. Waterways can freeze, stopping barge and ship traffic. Extremely cold temperatures may also damage or destroy goods if exposed for longer periods of time. As mentioned above, energy consumption is extremely high during extremely cold conditions due to heating homes and critical facilities, which creates a strain on energy supply.

In terms of extreme heat, facility integrity is equally at risk with regards to overwhelmed electrical systems and power cables and stations becoming overheated. This overheating could lead to brownouts in urban areas where power lines are damaged by the heat or overtaxed by use. Power

outages may cause air conditioning systems to be inoperable, increasing risk to the public. While unlikely, it is possible that prolonged power outages may result in civil disturbances, as the case was in New York City following the citywide power outage in 1977. Power outages may also impact the availability of water and fresh food if the infrastructure is not restored quickly.

Impact on Economy

Extreme heat and cold have similar impacts on the local economy. Whether it's too hot or too cold, people often (and are advised to) limit time outdoors, and this means people spend more time at home and less time out doing and buying things that contribute to the local economy. The economy can be affected directly or indirectly because of extreme temperatures on local populations including impacts and corresponding costs or revenue loss because of issues related to public health, ability of the population to shop and travel, increased energy consumption, and damages associated with extreme temperature events. Cold snaps and heat waves can also damage or kill plants and crops, leading to economic hardship.

Saratoga County's dairy industry does an estimated $500 million a year in business[2] and is a major economic driver for this region. Projected increases in temperature in New York State are correlated directly to decreased milk production, according to the New York State ClimAID report.[3] Saratoga County will need to increase outreach to dairy producers to educate and familiarize them with these vulnerabilities and connect the producers with farm advisors and extension personnel who can assist with developing heat stress abatement practices and strategies for their specific situations.

Impact on Future Growth and Development

As extreme temperature events affect Saratoga County, water and land use may change. Future growth and development in the County must consider the impacts of extreme temperatures on the population and environment and plan accordingly for growth and development.

Considerations for Future Data Analysis

It is anticipated that Saratoga County will experience with increasing frequency extreme temperature events related to climate change. Sources indicate that future climate change could become a large factor in influencing the frequency of not only extreme temperature events in Saratoga County but also the overall frequency and severity of extreme temperature events throughout the U.S. In the event of climate change, research has indicated that temperatures will become warmer, even during winter weather months, which could influence the quantity of extreme heat events through the U.S.

According to the Intergovernmental Panel on Climate Change (IPCC), all of North America is very likely to warm during this century, and the annual mean warming is likely to exceed the global mean warming in most areas. In northern regions which would include New York State and

[2] Retrieved from: https://dailygazette.com/article/2018/09/19/saratoga-county-farm-impact-put-at-500m
[3] Responding to Climate Change in New York State, November 2011.

Saratoga County, warming is likely to be largest in winter. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America, and the highest summer temperatures are likely to increase more than the average summer temperature in the southwest U.S. (IPCC, 2007). Although many uncertainties exist regarding magnitude, severity or impact of climate change, the U.S. EPA indicated that future temperature changes, including a greater number of heat waves, are anticipated as a result, along with atmospheric, precipitation, storm and sea level changes (EPA, 2007).

Future data analysis should consider climate change data as well as the impacts of extreme heat on public health and the effects of increased energy consumption on the economy and critical infrastructure systems.

5.7.7 Conclusions

Climate change has made extreme temperature events (particularly temperature increases) more common. Rising temperatures have been documented in Saratoga County as well as for much of New York State. As discussed earlier in this profile, Saratoga County will likely continue to see hotter temperatures that last for longer durations of time. The vulnerability of the county is also increasing as water use and land use change. The overall hazard ranking determined by the Planning Team for Saratoga County for this hazard is “low” with a “frequent” probability of occurrence (see Table 5-5).

5.8 Flood

This section describes the nature of flood hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.8.1 Description

Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA, 2013). 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 floodplains of a major water source.

FEMA defines flooding as “a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from the overflow of inland or tidal waters or the rapid accumulation of runoff of surface waters from any source,” (FEMA, N.d.). NYS DHSES and FEMA indicate that flooding could originate from one of the following:

- Riverine flooding, including overflow from river channels, flash floods, alluvial fan floods, ice jam floods and dam-break floods;
- Local drainage or high groundwater levels;
- Fluctuating lake levels;

- Coastal flooding from storm surge or coastal storms;
- Coastal erosion;
- Unusual and rapid accumulation or runoff of surface waters from any source;
- Mudflows (or mudslides);
- Collapse or subsidence of land along the shore of a lake or similar body of water caused by erosion, waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above;
- Sea Level Rise; or
- Climate Change (Global Warming) (NYS DHSES, 2014; FEMA, N.d.-a).

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. Most often floodplains are referred to as 100-year floodplains. A 100-year floodplain is not the flood that will occur once every 100 years, rather it is the flood that has a one-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. With this term being misleading, FEMA has properly defined it as the one percent annual chance flood. This one percent annual chance flood is now the standard used by most Federal and State agencies and by the NFIP (FEMA, N.d.-b).

For the purpose of this HMP and as deemed appropriate by the County: Riverine, Flash, Ice Jam and Dam Failure flooding are main flood types of concern that could impact Saratoga County. An additional cause of occasional flooding in Saratoga County has been attributed to beaver dams. All flood types are further defined as follows:

Riverine/Flash Floods: Riverine floods, the most common flood type in the country, occur along a channel and include overbank and flash flooding. Channels are defined features on the ground that carry water through and out of a watershed. They may be called rivers, creeks, streams or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas. These floods usually occur after heavy rains, heavy thunderstorms, or snowmelt, and can be slow or fast-rising, and generally develop over a period of hours to days, (FEMA, N.d.-a). NWS defines flash flood as, “a flood caused by heavy or excessive rainfall in a short period of time, generally less than six hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets, or mountain canyons sweeping everything before them” (NWS, N.d.).

Ice Jam Floods: As indicated by the Northeast States Emergency Consortium (NESEC), an ice jam is an accumulation of ice in a river that acts as a natural dam and can flood low-lying areas upstream. Downstream areas also can flood if the jam releases suddenly, releasing a wave of ice and water, (NESEC, N.d.). There are two types of ice jams, freeze-up and break-up. NWS explains the difference as,” Freeze-up jams happen when extremely cold air temperatures occur over open water. This results in the rapid production of large amounts of river ice that can jam downstream. Break-up jams account for about 2/3 of local ice jams and occur when rapid thaw and/or runoff entering the river system break the existing ice cover and cause jamming downstream,” (NWS, 2011). As indicated by the USACE November 1994 Engineer Pamphlet

1110-2-11 “Ice Jam Flooding: Causes and Possible Solutions,” the following influence or cause ice jam events:

- River geometries, weather characteristics, and floodplain land-use practices;
- When ice transport capacity or ice conveyance of the river is exceeded by the ice transported to
- that location by the river’s flow;
- Location (the confluence of a tributary stream and a larger river, lake, or reservoir);
- Collection of ice in riverbends limiting movement or flow;
- Obstructions to ice movement, for example closely spaced bridge or dam piers; and/or
- Structural or operational changes in reservoir regulation (USACE, 1994).

Dam Failure Floods: A "dam" is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (different types of dams). Dams are man-made structures built for the purpose of power production, agriculture, water supply, recreation, and flood protection. A levee is a natural or artificial barrier that diverts or restrains the flow of a stream or other body of water for the purpose of protecting an area from inundation by flood waters. According to FEMA, dam failure is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release (FEMA, N.d.-a). According to FEMA, dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;
- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;
- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance and upkeep; (FEMA, N.d.-c)

Beaver Dam Flooding: The habitat modification by beavers, caused primarily by dam building, is often beneficial to fish, furbearers, reptiles, amphibians, waterfowl, and shorebirds. However, when this modification comes in conflict with human objectives, the nuisance, disruption and impact of damage may far outweigh the benefits. According to Animal and Plant Health Inspection Services (APHIS), “flooding by beavers generally occurs where beavers dam streams or plug culverts,” (US APHIS, 2017). Beaver dams can cause a number of problems, including flooding of downstream property, upstream flooding of land that kills trees and/or crops, flooding of homes, flooding of highways and railroads, damage to bridges, contamination of water supplies, impairment of drainage systems, damage to wildlife habitat, or landowner distress (NYS DEC, 2008).

Housing developments, beaver dam flooding has threatened thousands of acres of cropland and young pine plantations. Experts estimated that the U.S. timber industry suffers more than $22 million in damage in a single year due to flooding caused by beaver dams (Silverman, 2008).

Identifying beaver damage generally is not difficult. Signs include dams, dammed-up culverts, bridges, or drain pipes resulting in flooded lands, timber, roads, and crops.

Elevated Groundwater Flooding: Per the FEMA's "Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy (1997), "high groundwater levels may be of concern and can cause problems even when there is no surface flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, while in others high groundwater occurs only after long periods of above-average precipitation."

For the purposes of this planning effort, the elevated groundwater flooding hazard has been defined as the condition of a sufficiently shallow groundwater table (saturated zone) above the level of subsurface structures resulting in negative impacts.

5.8.2 Extent

In the case of riverine flooding, once a river reaches flood stage the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based for associated property damage and public threat.

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS, 2005).

The severity of riverine flooding depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to deal with this water. The amount of water that may accumulate depends on the quantity and rate of precipitation falling and the size of the basin into which the precipitation is falling. Once the precipitation has fallen, the land's ability to absorb the water will impact the severity of the flood. When it rains, soil acts as a sort of sponge. When the land is saturated (soaked up all the water it can), any additional water that falls on the land will flow as runoff. Paved areas are less pervious to water than open land; therefore, development can decrease the soil's ability to act as a sponge and can increase flood severity.

Flood severity from a dam failure can be measured with a low, medium or high severity, which are further defined as follows:

- Low severity occurs when no buildings are washed off their foundations. Use the low severity category if most structures would be exposed to depths of less than 10 ft (3.3 m).
- Medium severity occurs when homes are destroyed but trees or mangled homes remain for people to seek refuge in or on. Use medium flood severity if most structures would be exposed to depths of more than 10 ft (3.3 m).
- High severity occurs when the flood sweeps the area clean and nothing remains. High flood severity should be used only for locations flooded by the near instantaneous failure of a concrete dam, or an earth fill dam that turns into "jello" and washes out in seconds

rather than minutes or hours. In addition, the flooding caused by the dam failure should sweep the area clean and little or no evidence of the prior human habitation remains after the floodwater recedes (Graham, 1999).

5.8.3 Location

Flooding has always been and continues to be a statewide concern for New York. Although some areas are more prone to certain types of flooding than others, there is no area of the State that is exempt from flood hazards altogether, including Saratoga County. In New York State, there are over 52,000 miles of river and streams, and along their banks there are 1,480 communities that are designated as flood prone. It is estimated that 700,000 people live in these flood-prone areas (NYS DHSES, 2014).

Flooding is the primary natural hazard in New York State because the State exhibits a unique blend of climatological and meteorological features that influence the potential for flooding. Factors include temperature, which is affected by latitude, elevation, proximity to water bodies and source of air masses; and precipitation which includes snowfall and rainfall. Precipitation intensities and effects are influenced by temperature, proximity to water bodies, and general frequency of storm systems. The geographic position of the State (Northeast U.S.) can make it more vulnerable to precipitation events. This is because nearly all storms and frontal systems moving eastward across the continent pass through, or in close proximity to, New York State. Additionally, the potential for prolonged periods of heavy precipitation is increased because of the available moisture of the Atlantic Ocean. This heavy rain can quickly saturate the ground leading to increased runoff and flooding. The heavy rainmakers New York State is subject to come in the form of coastal storms (Nor'easters, Tropical Storms, and Hurricanes) as well as thunderstorms. Flood problems in the State are most acute in the Delaware, Susquehanna, Erie-Niagara, Genesee, Chemung, Hudson, Mohawk, Lake Champlain, and Alleghany River Basins. These major waterways, along with their tributary streams in the basins are subject to direct flooding (NYS DHSES, 2014).

As indicated in the County Profile (Section 4), the streams in Saratoga County are tributaries to the Hudson River and Mohawk River Basins of the Hudson River Watershed. In general, streams flowing easterly discharge into the Hudson River; and those flowing southerly discharge into the Mohawk River, which enters the Hudson River at the southeast corner of the County (Natural Resources Conservation Services [NRCS], 2004). Much of the tributaries that fall within Saratoga County experience frequent flooding, including the Hudson, Mohawk and Sacandaga Rivers; Kayaderosseras, Mount Anthony, Sturdevant, Slade, Rowland Hollow, Ballston, Fish, Gordon, and Schuyler Creeks; Plum, Geyser and Putnam Brooks; Anthony, Dwaas, Alpaus, Snook and Morning Kills and along the shorelines of Saratoga, Ballston, Round Lakes and Sacandaga Reservoir (FEMA, 1995).

FEMA Flood Hazard Areas

According to FEMA, flood hazard areas are defined as areas that are shown to be inundated by a flood of a given magnitude on a map. These areas are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the

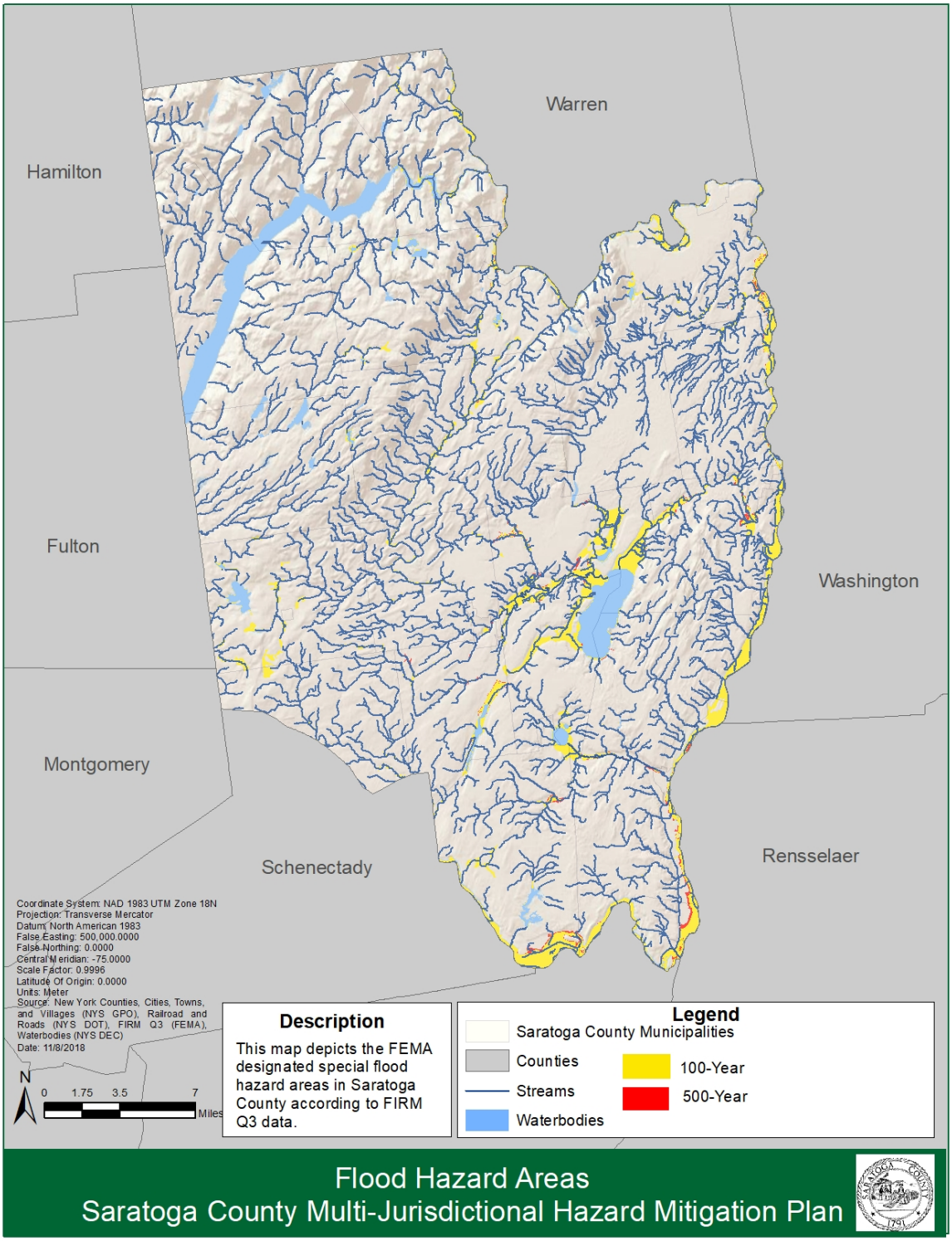
community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FEMA's Flood Insurance Rate Maps (FIRM), which are official maps of a community on which the Federal Insurance and Mitigation Administration has indicated both the Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community. These maps identify the SFHAs; the location of a specific property in relation to the SFHA; the base (100-year) flood elevation (BFE) at a specific site; the magnitude of a flood hazard in a specific area; the undeveloped coastal barriers where flood insurance is not available and locates regulatory floodways and floodplain boundaries (100-year and 500-year floodplain boundaries) (FEMA, 2003; FEMA, 2004; FEMA, 2006; FEMA, 2008).

The land area covered by the floodwaters of the base flood is the SFHA on a Floor Insurance Rate Map (FIRM). It is the area where the NFIP floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V. (FEMA, 2007). This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps showing the extent of the base flood and likely depths that will be experienced. The base flood is often referred to as the "100-year" flood designation. The BFE on a FIRM is the elevation of a base flood event, or a flood which has a one-percent chance of occurring in any given year as defined by the NFIP. The BFE describes the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating the potential damage to occur in a given area. A structure located within a 100-year floodplain has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage. The 100-year flood is a regulatory standard used by Federal agencies and most states, to administer floodplain management programs. The 100-year flood is used by the NFIP as the basis for insurance requirements nationwide. FIRMs also depict 500-year flood designations, which is a boundary of the flood that has a 0.2-percent chance of being equaled or exceeded in any given year (FEMA, 2003; FEMA, 2006). Available FIRMs and Digital FIRMs (DFIRMs) through FEMA for the County are dated August 16, 1995. These maps for the County are outdated; however, they give a general indication of the flood problem areas of the County, which lie primarily along the Hudson, Sacandaga and Mohawk Rivers (FEMA, 2008). Figure 5-15 shows the FEMA special flood hazard areas in Saratoga County based on FIRM Q3 Data.

In addition to FIRM and DFIRMs, FEMA also provides Flood Insurance Studies (FISs) for entire counties and individual jurisdictions. These studies aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. They are narrative reports of countywide flood hazards, including descriptions of the flood areas studied and the engineered methods used, principal flood problems, flood protection measures and graphic profiles of the flood sources (FEMA, N.d.). The countywide flood insurance study (FIS) for Saratoga County was completed in August 16, 1995. Under FEMA's Flood Map Modernization and Risk MAP programs, no updates of the FIS for the County has been completed thus far. Currently, single jurisdictional FISs have not been completed for the County. This FIS does not present principle flood problems for all communities of the County. Also, since completion of this FIS, new flood conditions or major

flood events may have developed, and new flood protection measures may have been considered or implemented.

Figure 5-15 FEMA Flood Hazard Areas



Ice Jam Hazard Areas

Areas of New York State that include characteristics lending to ice jam flooding include the northern counties of the Finger Lakes region and far western New York, the Mohawk Valley of Central and Eastern New York (which includes all of Saratoga County) and the North Country (NYS DHSES, 2014). Mohawk River and the Hudson River, which pass through Saratoga County, have had approximately 52 (Mohawk) and 40 (Hudson) ice jam incidents on record. Other leading rivers within the state include the Cazenovia Creek (74 incidences), Great Chazy River (70 incidences), Genesee River (56 incidences), and the Walkill River (54 incidences). (USACE CRREL, 2018).

Dam Failure Hazard Areas

According to the NYS DEC Division of Water Bureau of Dam Safety, Coastal and Flood Protection, the hazard classification of a dam is assigned according to the potential impacts of a dam failure pursuant to 6 New York Code, Rules and Regulations (NYCRR) Subpart 673.5(b). Dams are classified in terms of potential for downstream damage if the dam were to fail. These hazard classifications are identified and defined below:

- Class "A" or "Low Hazard" dam: A dam failure is unlikely to result in damage to anything more than isolated or unoccupied buildings, undeveloped lands, minor roads such as town or county roads; is unlikely to result in the interruption of important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; and/or is otherwise unlikely to pose the threat of personal injury, substantial economic loss or substantial environmental damage.
- Class "B" or "Intermediate Hazard" dam: A dam failure may result in damage to isolated homes, main highways, and minor railroads; may result in the interruption of important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; and/or is otherwise likely to pose the threat of personal injury and/or substantial economic loss or substantial environmental damage. Loss of human life is not expected.
- Class "C" or "High Hazard" dam: A dam failure may result in widespread or serious damage to home(s); damage to main highways, industrial or commercial buildings, railroads, and/or important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; or substantial environmental damage; such that the loss of human life or widespread substantial economic loss is likely.
- Class "D" or "Negligible or No Hazard" dam: A dam that has been breached or removed, or has failed or otherwise no longer materially impounds waters, or 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, N.d.)

Refer to Section 4 for a map of the location of dams located in Saratoga County.

Beaver Dam Hazard Areas

According to County Officials, beavers are becoming more and more of a problem throughout the County. Incidences of beaver dam disturbances have been reported particularly in the Towns Ballston, Charlton, Corinth, Greenfield and Galway.

Elevated Groundwater Hazard Area

Elevated groundwater in Saratoga County was introduced as an additional flood hazard of concern towards the end of the previous plan's planning process. All information gathered to date has been included in this profile.

According to members of the Planning Team, elevated groundwater occurs in the Towns of Moreau and Wilton. In 2007, Hanson Van Vleet, LLC cited that over 40 residents in the Town of Wilton experienced elevated groundwater and thus wet and flooded basements that spring. According to Hanson Van Vleet LLC the cause is an inter-relationship of the geology, hydrogeology and weather (mainly precipitation; however, the connection to rainfall is debated (Hanson Van Vleet, LLC; 2007). This type of flooding is sporadic and occurs mainly during the spring months, but also occurs other times throughout the year.

5.8.4 Previous Occurrences and Losses

Many sources provide historical information regarding previous occurrences and losses associated with flooding throughout New York State and Saratoga County. Saratoga County has been declared as a disaster area because of three flood events between 1955 and 2018 (FEMA, 2018). Information related to individual event monetary and human losses is available through the NOAA NCEI Storm Events Database and has been summarized below in Table 5-23. Past ice jam events reported from municipalities in Saratoga County through the USACE CRREL database are summarized in Table 5-24 below. This table may not be a full representation of all possible ice jams that have occurred in the county.

NYS DHSES estimates that Saratoga County has experienced approximately $57,687,644 in property damage and $1,032,781 in crop damage due to flood events between 1960 and 2012 (NYS DHSES, 2014).

Table 5-23 Saratoga County Previous Flood Events

Event Type	Total Events	Total Property Damage	Crop Damage	Deaths	Injuries	Annualized Events	Annualized Total Damages
Flood	48	$615,000.00	0	0	0	2.09	$26,739.13
Flash Flood	63	$11,048,000.00	0	0	0	2.74	$480,347.83

Source: NCEI Storm Events Database, January 1996 – September 2018

Table 5-24 Saratoga County Previous Ice Jams

City	River	Gage Number	Jam Date	Jam Type
Ballston Spa	Kayaderosseras Creek	NR	1/13/2014	Break-up
Schuylerville	Hudson River	NR	2/7/2007	Released
Corinth	Hudson River	NR	1/13/2004	Freeze-up
Hadley	Hudson River	1318500	3/26/2003	Break-up
Corinth	Hudson River	NR	2/1/1985	Controlled
Hadley	Hudson River	1318500	3/23/1948	NR
Hadley	Hudson River	1318500	3/19/1927	NR

Source: USACE CRREL, 2018

5.8.5 Probability of Future Events

Given the history of flood events that have impacted Saratoga County, it is apparent that future flooding will occur to varying degrees. The fact that the elements required for flooding exist and that major flooding has occurred throughout the county in the past suggests that many people and properties are at risk from the flood hazard in the future. Based on historical records, FIRMs provided through FEMA, and the perception of the Planning Team, the probability of occurrence for flood events in Saratoga County is considered “frequent”, with more than one event happening on an annual basis.

As defined by FEMA, geographic areas within the 100-year floodplain in Saratoga County are estimated to have a one percent chance of flooding in any given year. A structure located within a 100-year floodplain has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage (FEMA). Geographic areas in Saratoga County located within the 500-year flood boundary are estimated to have a 0.2-percent chance of being flooded in any given year (FEMA, 2002). As noted, Figure 5-15 illustrates the location of the 100-year and 500-year flood zones for Saratoga County.

Historic flood disaster and emergency declaration records indicate Saratoga County has experienced three federally declared flood related disasters since 1954. Therefore, to estimate the probability of future disasters, on average, the County can estimate one flood event meeting disaster criteria approximately every eighteen years. However, the period of record indicates smaller flooding events occur more frequently.

In addition to riverine flooding, ice jams frequently occur in New York State and Saratoga County is no exception. In 2018, New York State experienced the most ice jam of any other state. (CRREL, 2018). New York has been ranked as among the highest, usually second, regularly for the last several years for most ice jam flooding events in the country (NYS DHSES, 2014). The USACE CRREL reported seven in reported history in Saratoga County. Dam breaks and beaver dams also continue to be a hazard of concern for the County.

It is estimated that Saratoga County and all of its jurisdictions, will continue to experience flooding annually that may induce secondary hazards such as ground failure and water quality and supply concerns and experience evacuations, infrastructure deterioration and failure, utility failures, power outages, transportation delays/accidents/inconveniences and public health concerns.

According to the National Climate Assessment in 2014, the Northeast will continue to experience increasing temperatures due to climate change. Though it is uncertain, these increasing temperatures are likely to increase precipitation in the region, which can directly impact the frequency, extent, and duration of flood events in Saratoga County (Federal Advisory Committee, 2014). NYSERDA's ClimAID report projects a regional 4 to 12% increase in precipitation. The state, including Saratoga County, should expect an increase in heavy downpours which can lead to flooding and related impacts on water quality, infrastructure, and agriculture (New York State Energy Research and Development Authority [NYSERDA], 2014).

Additionally, Saratoga County's population continues to increase and is one of the counties with the highest growth in the state. Saratoga County prioritizes the agricultural land and green infrastructure currently in the county and has created plans that strategize clustered growth to protect these areas. However, as seen in Section 4, there has been increases in suburban development and road infrastructure. If development continues to increase and encroach on floodplains and other vulnerable areas, this could exacerbate the extent and impacts of flooding events.

5.8.6 Vulnerability Assessment

Data and Methodology

Areas with a one percent and 0.2% annual chance of flooding (MRP's) were utilized to evaluate Saratoga County's exposure to flood hazards. These MRP's are generally those considered by planners and evaluated under federal programs such as the NFIP. Saratoga County does not have DFIRMs available to use for this analysis. Therefore, FEMA Digital Q3 Flood Data was obtained from the NYS GIS Clearinghouse. This data is derived by scanning FEMA's hardcopy FIRM's and capturing a thematic overlay of flood risks. Digital Q3 Flood Data was available for all of Saratoga County except for riverine reaches in the northwest portion of the County. (Towns of Day, Edinburg and Providence) and the Town of Wilton. According to the NFIP, the Town of Day and Town of Wilton are classified as NSFHA, meaning these communities have been surveyed and found to have no flood risk (FEMA, 2009).

To assess exposure, critical facilities and building stock were intersected with the Q3 food data. To conduct the analysis, a 30-foot buffer was added to all critical facilities and infrastructure points to replicate a standard building footprint. Critical facilities were then spatially joined with the closest municipality to summarize final results by municipality. Building stock data already contained a municipality field. The building stock data was also found to have very limited coverage in the villages. Building value exposed was calculated by joining tax parcel centroid data from Saratoga County to the building points.

Impact of Life, Health, and Safety

Floods can have a severe impact on the health and safety of the public across the county. This hazard causes an increased risk of death or injury to the public. Most flood-related deaths can be attributed to rapidly rising floods. Additionally, flood hazards can cause subsequent health impacts by restricting access to healthcare services when roads and bridges are damaged, as well as

increasing the potential for contaminated water and water-borne disease. Mental health illness is another health risk which can be brought on by the flood event, the restoration process, or from impacts due to major infrastructure damage, such as the displacement of populations.

Of the population exposed, the most vulnerable include the economically disadvantaged (households with an income of less than $20,000) and the population over the age of 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the net economic impact to their family. The population over the age of 65 is also more vulnerable because they are more likely to seek or need medical attention which may not be available to due isolation during a flood event and they may have more difficulty evacuating.

Impact on General Building Stock

As exemplified in the discussion of previous occurrences, flooding can incur high cost for the county in property damage. Additionally, this damage can cause subsequent impacts, such as depleting economic resources as businesses are forced to close and evacuate. Property and buildings located in floodplains are particularly vulnerable to flooding, however all buildings and property have some chance of being flooded, even if the probability is low. Table 5-25 showcases the total building value at risk to the one percent and 0.2% annual chance floods.

Table 5-25 Building Exposure to Flooding

Municipality	1% Annual Chance Flood	0.2% Annual Chance Flood
Town of Ballston	$21,721,462.00	$3,285,048.00
Village of Ballston Spa	$25,206,330.00	$2,511,962.00
Town of Charlton	$4,650,772.00	$0.00
Town of Clifton Park	$9,512,110.00	$28,673,860.00
Town of Corinth	$12,325,200.00	$327,800.00
Village of Corinth	$154,585,300.00	$603,400.00
Town of Day	$0.00	$0.00
Town of Edinburg	$0.00	$0.00
Town of Galway	$10,886,300.00	$0.00
Village of Galway	$0.00	$0.00
Town of Greenfield	$11,099,999.00	$0.00
Town of Hadley	$8,213,883.00	$581,229.00
Town of Halfmoon	$26,263,091.00	$21,817,148.00
Town of Malta	$51,251,100.00	$944,400.00
City of Mechanicville	$21,009,975.00	$10,918,100.00
Town of Milton	$7,138,015.00	$0.00
Town of Moreau	$32,146,320.00	$817,900.00
Town of Northumberland	$10,264,200.00	$187,600.00

Municipality	1% Annual Chance Flood	0.2% Annual Chance Flood
Town of Providence	$2,004,950.00	$0.00
Village of Round Lake	$2,059,200.00	$0.00
Town of Saratoga	$50,243,100.00	$493,200.00
City of Saratoga Springs	$71,132,050.00	$5,923,549.00
Village of Schuylerville	$10,622,100.00	$995,800.00
Village of South Glens Falls	$19,755,800.00	$0.00
Town of Stillwater	$25,987,606.00	$4,808,837.00
Village of Stillwater	$47,796,840.00	$0.00
Village of Victory	$907,600.00	$0.00
Town of Waterford	$80,314,030.00	$13,189,445.00
Village of Waterford	$37,718,334.00	$7,813,090.00
Town of Wilton	$0.00	$0.00

National Flood Insurance Program

According to FEMA's 2002 NFIP: Program Description, the U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. As stated in the NYS HMP, the NFIP collects and stores a vast quantity of information on insured structures, including the number and location of flood insurance policies number of claims per insured property, dollar value of each claim and aggregate value of claims, repetitive flood loss properties, etc. NFIP data presents a strong indication of the location of flood events among other indicators (NYS DHSES, 2014). Table 5-26 below shows the communities in Saratoga County that participate in the program and summarizes the total policies currently in force.

The CRS is program under the NFIP that incentivizes communities to go beyond minimum NFIP requirements to receive discounted insurance premiums. Community actions are required to meet one of the three program goals: 1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management (FEMA, 2017). As of April 2018, there are no communities in Saratoga County that participate in the CRS program.

Table 5-26 NFIP Participation in Saratoga County

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date	Tribal	Policies in Force	Coverage	Losses	Payments
360710#	Village of Ballston Spa	5/31/1974	6/1/1984	8/16/1995	6/1/1984	No	57	$8,732,800.00	13	$68,596.00
360711#	Town of Ballston	8/2/1974	6/1/1984	8/16/1995	6/1/1984	No	19	$4,714,200.00	1	$2,495.00
360712#	Town of Charlton	7/19/1974	7/18/1985	8/16/1995	7/18/1985	No	3	$610,800.00	7	$30,630.00
360713#	Town of Clifton Park	5/31/1974	3/1/1984	8/16/1995	3/1/1984	No	48	$10,897,400.00	23	$310,419.00
360715#	Town of Corinth	8/2/1974	3/1/1984	8/16/1995	3/1/1984	No	12	$2,405,500.00	9	$46,437.00
360714#	Village of Corinth	8/7/1974	3/1/1984	8/16/1995	3/1/1984	No	9	$1,456,100.00	1	$4,294.00
361188#	Town of Day	11/15/1974	8/16/1995	(NSFHA)	6/22/1984	No	4	$1,330,000.00	0	$0.00
N/A	Town of Edinburg[1]	N/A	N/A	N/A	N/A	N/A	0	$0.00	0	$0.00
360716#	Town of Galway	6/14/1974	5/1/1985	8/16/1995	5/1/1985	No	7	$819,800.00	1	$0.00
N/A	Village of Galway[1]	N/A	N/A	N/A	N/A	N/A	0	$0.00	0	$0.00
360717#	Town of Greenfield	6/28/1974	6/5/1985	8/16/1995	6/5/1985	No	23	$4,649,200.00	3	$23,804.00
360718#	Town of Hadley	9/13/1974	9/15/1983	8/16/1995	9/15/1983	No	13	$2,861,000.00	2	$25,465.00
360719#	Town of Halfmoon	6/21/1974	3/1/1984	8/16/1995	3/1/1984	No	46	$11,081,200.00	21	$435,548.00
360720#	Town of Malta	10/18/1974	3/1/1984	8/16/1995	3/1/1984	No	83	$17,907,700.00	19	$148,577.00
360721#	City of Mechanicville	4/5/1974	1/5/1984	8/16/1995	1/5/1984	No	N/A	N/A	N/A	N/A
360722#	Town of Milton	6/14/1974	5/15/1985	8/16/1995	5/15/1985	No	13	$2,101,100.00	1	$361.00
360723#	Town of Moreau	8/9/1974	6/15/1984	8/16/1995	6/15/1984	No	21	$4,821,200.00	7	$108,664.00
360725#	Town of Northumberland	6/21/1974	12/15/1982	8/16/1995	12/15/1982	No	10	$1,834,400.00	3	$15,629.00
361190#	Town of Providence	11/15/1974	8/16/1995	8/16/1995	12/2/1985	No	1	$350,000.00	0	$0.00
360726#	Village of Round Lake	4/12/1974	1/5/1984	8/16/1995	1/5/1984	No	1	$350,000.00	1	$0.00
360728#	City of Saratoga Springs	9/20/1974	6/15/1984	8/16/1995	6/15/1984	No	47	$12,939,500.00	11	$92,669.00

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date	Tribal	Policies in Force	Coverage	Losses	Payments
360727#	Town of Saratoga	9/13/1974	6/15/1984	8/16/1995	6/15/1984	No	83	$18,250,800.00	39	$220,935.00
360729#	Village of Schuylerville	3/29/1974	6/1/1984	8/16/1995	6/1/1984	No	10	$1,762,500.00	8	$47,058.00
360730#	Village of South Glens Falls	4/12/1974	6/5/1985	8/16/1995	6/5/1985	No	0	$0.00	2	$397.00
360731#	Town of Stillwater	6/21/1974	6/1/1984	8/16/1995	6/1/1984	No	47	$8,428,500.00	32	$144,645.00
360732#	Village of Stillwater	4/12/1974	1/5/1984	8/16/1995	1/5/1984	No	39	$6,955,200.00	15	$66,411.00
360733#	Village of Victory	4/5/1974	6/1/1984	8/16/1995	8/12/1985	No	1	$5,000,000.00	0	$0.00
360734#	Town of Waterford	3/29/1974	12/4/1979	8/16/1995	12/4/1979	No	80	$18,274,200.00	143	$2,830,029.00
360735#	Village of Waterford	3/29/1974	5/1/1980	8/16/1995	5/1/1980	No	176	$24,879,700.00	216	$3,190,487.00
360736#	Town of Wilton	6/14/1974	8/16/1995	(NSFHA)	11/20/1985	No	8	$2,460,000.00	0	$0.00

Source: FEMA; Data as of September 30, 2015

1 – The Town of Edinburg and the Village of Galway do not participate in the NFIP.

NSFHA = No Special Flood Hazard Area – all Zone C

N/A = Information not available at this time

The NFIP tracks the total claims and payments made by properties insured in the program. Some properties have experienced multiple claims of a certain amount over a particular period and are categorized to as Repetitive Loss (RL) properties. FEMA defines a RL property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP." (FEMA, N.d.)

FEMA Region II tracks these RL properties and provided a summary of the total payments and losses by municipality (Table 5-27) and a count of the type of RL properties (Table 5-28) for inclusion in this plan. The Town of Waterford has the highest total payments for buildings, and the highest number of losses, followed by the Village of Waterford.

Table 5-27 Repetitive Loss NFIP Payments and Losses

Municipality	Payments				Losses
Municipality	*Total Payment for Building*	*Total Payment for Contents*	*Total Paid*	*Number of Losses*	*Average Payment per Loss*
Village of Ballston Spa	$31,467.48	$2,728.39	$34,195.87	4	$8,548.97
Town of Charlton	$16,924.18	$9,167.59	$26,091.77	2	$13,045.89
Town of Clifton Park	$90,515.24	$19,964.47	$110,479.71	11	$10,043.61
Town of Halfmoon	$22,281.98	$235.00	$22,516.98	5	$4,503.40
City of Mechanicville	$44,404.23	$672.41	$45,076.64	7	$6,439.52
Town of Saratoga	$18,523.91	$239.98	$18,763.89	4	$4,690.97
Town of Stillwater	$78,852.30	$5,538.36	$84,390.66	16	$5,274.42
Town of Waterford	$1,403,480.56	$761,333.42	$2,164,813.98	55	$39,360.25
Village of Waterford	$937,154.76	$95,238.07	$1,032,392.83	54	$19,118.39

Source: FEMA Region II, October 2017

Table 5-28 Repetitive Loss Property Types

Municipality	
Municipality	*Total RL/SRL Properties*
Village of Ballston Spa	2 (RL)
Town of Charlton	1 (RL)
Town of Clifton Park	5 (RL)
Town of Halfmoon	3 (RL)
City of Mechanicville	3 (RL)
Town of Saratoga	3 (RL)

Municipality	
Town of Stillwater	1 (RL)
Town of Waterford	14 (RL)
Village of Waterford	18 (RL), 1 (SRL)

Source: FEMA Region II, June 2019

Impact on Critical Facilities

Flooding can have severe impacts on the use and operation of critical facilities. The contents stored inside of critical facilities is susceptible to damage from flooding events. Flood waters can prohibit travel and services by damaging road and transportation infrastructure, as well as cause damage to other facilities such as culverts and buildings. Additionally, water contamination is also a risk for critical facilities, as the lack of fresh water and use of utilities could cause halts in production. Flooding also has the potential to inundate wastewater treatment plants and other vulnerable development within floodplains. In cases where short-term functionality is impacted by a hazard, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impact to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.

An analysis was run to identify the critical facilities located in the one percent and 0.2% annual chance flood zone in the County. This analysis is based on best available data at the time and does not reflect every critical facility in the County. As additional data is captured about the location of critical facilities, this analysis can be updated. Table 5-29 and Table 5-30 summarize the count of critical facilities in areas with a one percent annual chance of flooding. No critical facilities were identified in the 0.2% annual chance flood zone. The Village of Stillwater and Village of Waterford have the most critical facilities at risk, including two schools, a police department, and a fire department. While the critical facility inventory includes highway bridges, many of these bridges are located in a flood zone since bridges are typically built over waterbodies and therefore are designed to withstand flooding forces. The jurisdictions monitor the age of their bridges and perform maintenance to keep the infrastructure in peak working condition.

Table 5-29 Exposure of Critical Facilities to Flooding, by Facility Type

Facility Type	Count in 1% Annual Chance Flood Zone
Fire	2
Hazardous Material Facility	1
Law Enforcement	2
Schools	3
Wastewater	2

Table 5-30 Exposure of Critical Facilities to Flooding, by Municipality

Municipality	1% Annual Chance Flood
Town of Ballston	1
Village of Ballston Spa	1
Town of Charlton	0
Town of Clifton Park	0
Village of Corinth	0
Town of Corinth	1
Town of Day	0
Town of Edinburg	0
Village of Galway	0
Town of Galway	0
Town of Greenfield	0
Town of Hadley	0
Town of Halfmoon	0
Town of Malta	0
City of Mechanicville	0
Town of Milton	1
Town of Moreau	0
Town of Northumberland	0
Town of Providence	0
Village of Round Lake	0
Town of Saratoga	0
City of Saratoga Springs	0
Village of Schuylerville	1
Village of South Glens Falls	0
Village of Stillwater	2
Town of Stillwater	0
Village of Victory	0
Village of Waterford	2
Town of Waterford	1
Town of Wilton	0
Grand Total	10

Impact on Economy

Agricultural land makes up a significant part of the land use in Saratoga County. In the case of a flood event, waters can inundate agricultural lands, restricting the ability of farmers to produce

crops for profit. Additionally, farm animals could be left without clean water or food and be at risk of drowning. The economy would also be impacted if flood waters cause property damage to businesses, as businesses would close to rebuild or repair.

Flooding can cause extensive damage to public utilities and disruptions to the delivery of services. Loss of power and communications may occur; and drinking water and wastewater treatment facilities may be temporarily out of operation. Flooded streets and road blocks make it difficult for emergency vehicles to respond to calls for service. Floodwaters can washout sections of roadway and bridges (Foster, N.d.).

Impact on Future Growth and Development

As discussed in Section 4 and Section 9 within each jurisdiction's annex, areas targeted for future growth and development have been identified across the County. Any new development within the identified flood hazard areas will be at risk to flooding. Urban areas (due to impermeable surfaces, including roads and buildings), steep slopes, and low-lying areas are particularly vulnerable. Please refer to these sections for maps that illustrate where potential new development is projected.

Considerations for Future Data Analysis

In future revisions of the HMP, up to date FEMA Digital FIRMs (DFIRMs) and replacement values of critical facilities would support a refined analysis.

5.8.7 Conclusions

The flood hazard was ranked overall as a "high" risk by the Planning Team for Saratoga County with a "frequent" probability of occurrence (see Table 5-5 in Section 5.3). This hazard can be managed and planned for through the mitigation strategy and specific activities that build on efforts already undertaken by these communities.

5.9 Ground Failure

This section provides hazard profile information for ground failure including description, extent, location, past occurrences and losses and the probability of future occurrences.

5.9.1 Description

Ground failure includes, but is not limited to, landslides, land subsidence, erosion, debris flows and sinkholes. The historic record indicates Saratoga County has been impacted by ground failure, more specifically landslides, in the past. Few incidences of other types of ground failures were found, therefore this hazard profile will primarily discuss landslides. The definition for a landslide is provided below, as well as condensed definitions for the non-landslide types of ground failure.

Landslide

The movement of rock, soil, artificial fill, or a combination thereof on a slope in a downward or outward direction. The primary causes of landslides are slope saturation by water from intense rainfall, snowmelt, or changes in ground-water levels on primarily steep slopes, earthen dams, and the banks of lakes, reservoirs, canals, and rivers (USGS, n.d.). Other causative factors include steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake, volcanic eruptions, and the loss of vegetation from construction or wildfires. Other factors may indirectly influence the occurrence of a landslide. For example, loss of vegetation can contribute to more frequent landslides, but heavy rains may be the actual trigger. The saturation or destabilization of a slope allows the material to succumb to the forces of gravity or ground movement.

Many different types of landslides exist: slides, falls, topples, flows, and lateral spreads. Complex landslides involve any combination of these types (USGS, n.d.).

- **Rock Falls:** Falls occur when materials, mostly rocks and boulders, fall abruptly from a steep slope or cliff. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water.
- **Rock Topples:** Topples are similar to falls, yet they pivot around a connection point at the base of the material and are most often caused by gravity or fluids in the cracks of the rocks.
- **Slides:** Slides involve the mass movement of material from a distinct zone of weakness separating the slide material from the more stable underlying material. The primary types of slides are rotational slides and translational slides.
- **Flows**: Flows typically have a higher percentage of water material embedded in them and behave more like a liquid than other types of landslides. The five primary categories of flows are debris flows, debris avalanches, earthflows, mudflows and creeps.
    - Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of rapidly-moving landslides. They are flowing rivers of rock, earth, and other water-saturated debris that develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowfall (FEMA, 2006).
- **Lateral spreads:** Usually occur on gentle slope or flat surfaces when liquefaction occurs and leads to fractures on the surface.

Landslides can occur naturally or be triggered by human-related activities. Naturally-occurring landslides can occur on any terrain, given the right condition of soil, moisture, and the slope's angle. Landslides can also be induced, accelerated or retarded by human actions. Human-related causes of landslides can include grading, terrain/slope cutting and filling, quarrying, removal of retaining walls, lowering of reservoirs, vibrations from explosions, machinery, road and air traffic and excessive development. Normally stable slopes can fail if disturbed by development activities. Often, a slope can also become unstable by earthmoving, landscaping, or vegetation clearing activities (International Union of Geological Sciences [IUGS], n.d.). Changing drainage patterns, groundwater level, slope and surface water through agricultural or landscape irrigation, roof downspouts, septic-tank effluent or broken water or sewer lines can also generate landslides (City of Homer, 2004; United States Search and Rescue Task Force [USSARTF], 2007). Due to the

geophysical and human factors that can induce a landslide event, they can occur in developed areas, undeveloped areas, or any areas where the terrain was altered for roads, houses, utilities, buildings, and even for lawns in one's backyard.

Land Subsidence

Land subsidence can be defined as the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion, owing to the subsurface movement of earth materials (NYSDPC, 2008; USGS, 2007). Subsidence often occurs through the loss of subsurface support in Karst terrain (a distinctive topography largely shaped by the dissolving action of water on carbonate bedrock), which may result from a number of natural and human-caused occurrences (New York State Disaster Preparedness Commission [NYSDPC], 2008).

Erosion

Erosion is the gradual breakdown and movement of land, due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural (geologic) erosion has occurred since the Earth's formation and continues each year at a very slow and uniform rate. There are two types of soil erosion: wind erosion and water erosion (Northern Virginia Regional Commission [NVRC], 2006).

Sinkholes

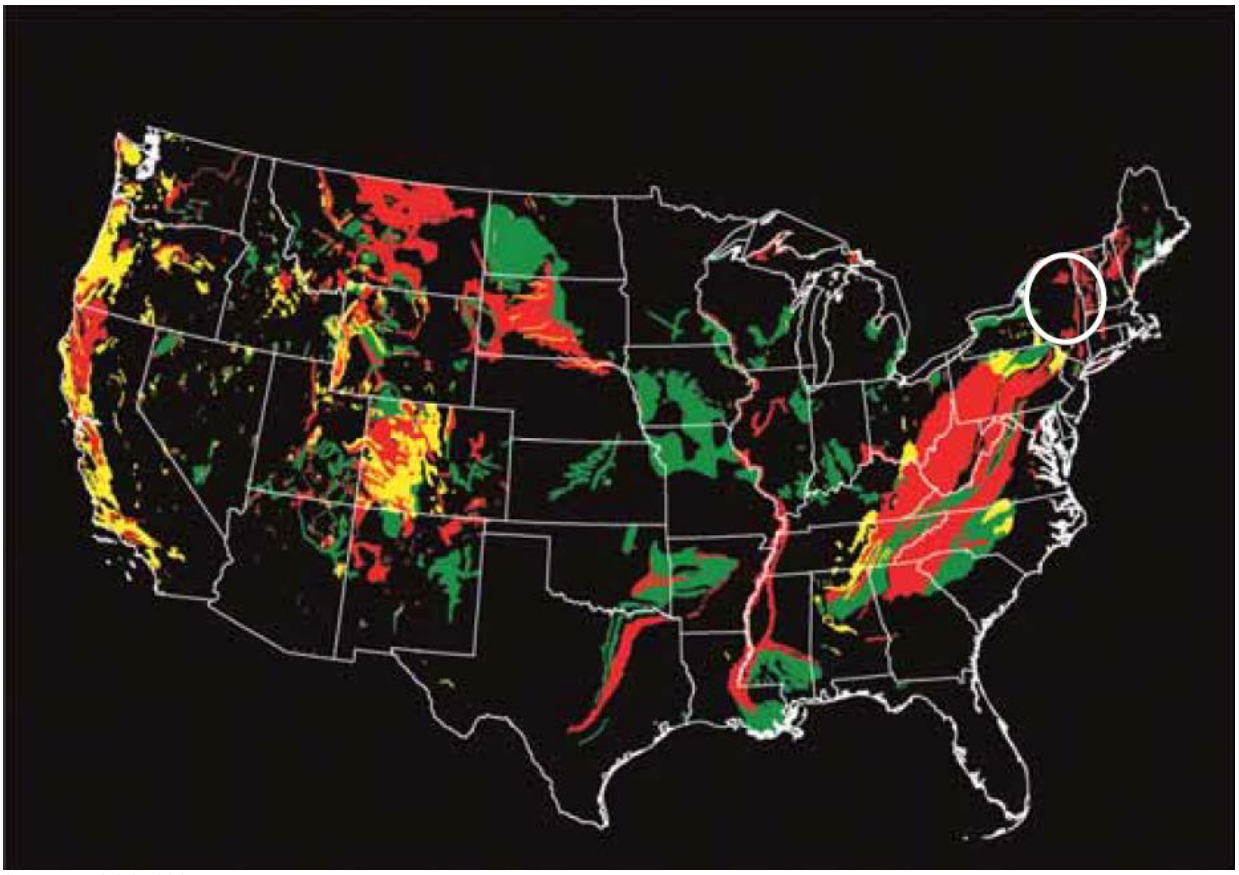
Sinkholes are a natural and common geologic feature in areas with underlying limestone, carbonate rock, salt beds, or other rocks that are soluble in water. As the rock dissolves, spaces and caverns develop underground. The land usually stays intact until the underground cavities become too large. If there is not enough support for the land above these voids, a sudden collapse of overlying sediments can occur, creating a sinkhole (USGS, 2008). There are three general types of sinkholes:

- **Collapse sinkholes**: Most common in areas where the overburden is thick with soils and heavy clay (Cervone, 2003).
- **Solution sinkholes:** These form where no overburden is present, and the limestone is exposed at land surface (NVRC, 2006).
- **Subsidence sinkholes:** Form gradually where overburden is thin. The dissolving limestone is replaced by sand that falls into the depression and fills the holes. As the sediments fill the depression, water flow is restricted through the bottom hole and the hole begins to retain water. As water accumulates, a lake or pond can form (Cervone, 2003).

5.9.2 Location

The entire U.S. experiences landslides and other ground failure hazards, with 36 states having moderate to highly severe landslide hazards. Landslide potential is displayed in Figure 5-16 with red areas indicating very high landslide potential, yellow areas indicating high potential, and green areas indicating moderate potential. Landslides can and do occur in the black areas, but the potential is low.

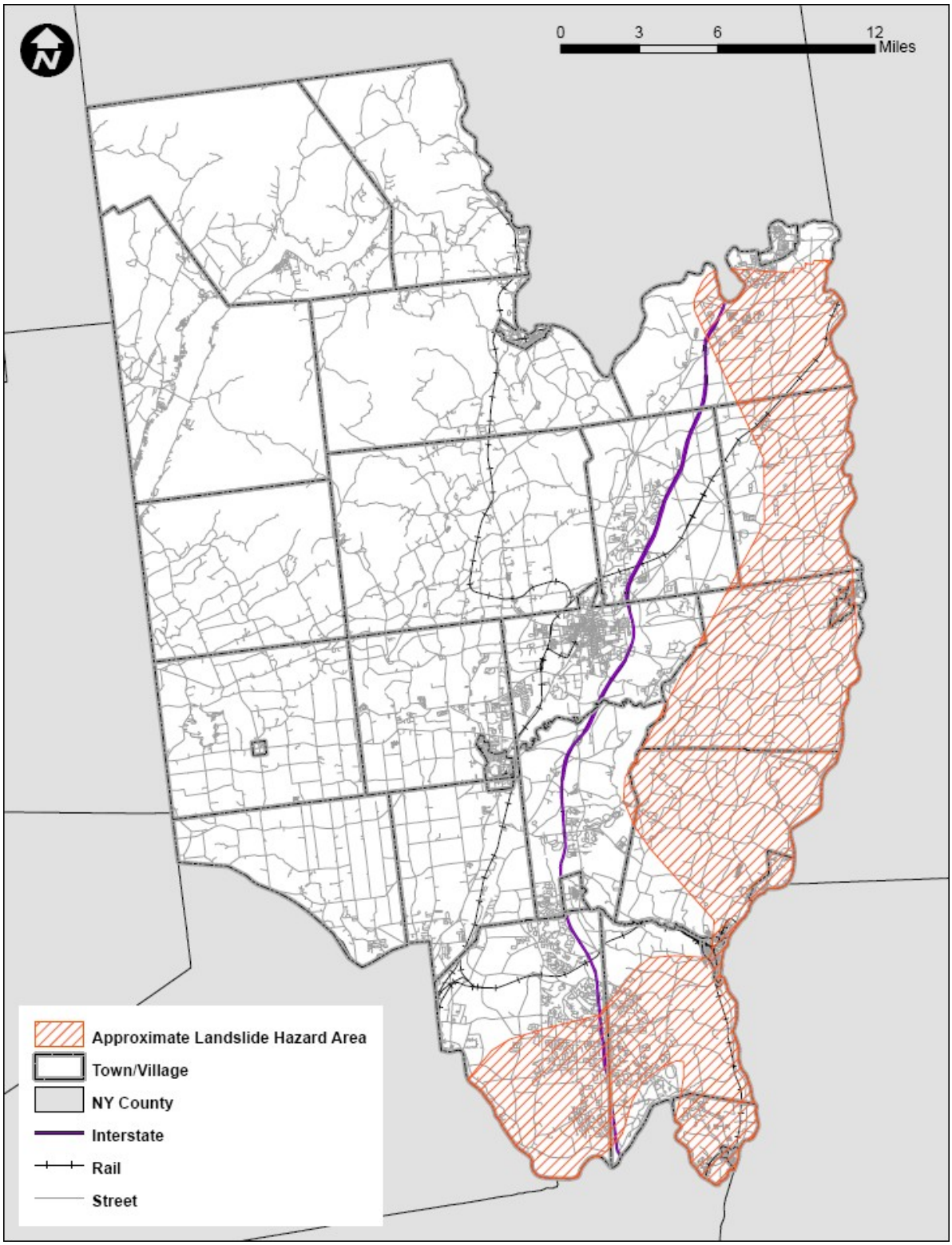
Figure 5-16 Landslide Potential of the Conterminous U.S. United States



Source: USGS, 2007

The potential for landslides exists throughout the entire northeast, including New York State and Saratoga County. Scientific and historical landslide data indicate that some areas of northern and eastern New York State have a substantial landslide risk. However, compared to other states, New York State is not identified as a State with having a serious landslide threat. According to information provided by USGS and New York State Geological Survey (NYSGS), it is estimated that 80% of New York State has a low susceptibility to landslide hazard. In general, the highest potential for landslides can be found along major rivers and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits (glacial lake clays) and usually associated with steeper slopes. A good example of this is the Hudson and Mohawk River valley (NYSDPC, 2008). Most of Saratoga County is categorized as a having a low landslide incidence overall with the eastern section along the Hudson River categorized as having a high landslide incidence. Figure 5-17 on the following page displays the approximate landslide hazard area in Saratoga County.

Figure 5-17 Approximate Landslide Hazard Area in Saratoga County



Source: Approximate ground failure hazard area generated using maps from the New York State HMP (NYSDPC, 2008).

The hazard area refers to where in the County more frequent or severe landslides can be expected to occur, while the figure below displays an overview of landslide incidence and occurrences in Saratoga County. As displayed on the map, the eastern and southern sections of Saratoga County – which encompass portions of the Cities of Mechanicville and Saratoga Springs, the Towns of Clifton Park, Halfmoon, Malta, Moreau, Northumberland, Saratoga, Stillwater, Waterford, Wilton, and the Villages of Schuylerville, Stillwater, Victory, and Waterford – have a high landslide incidence.

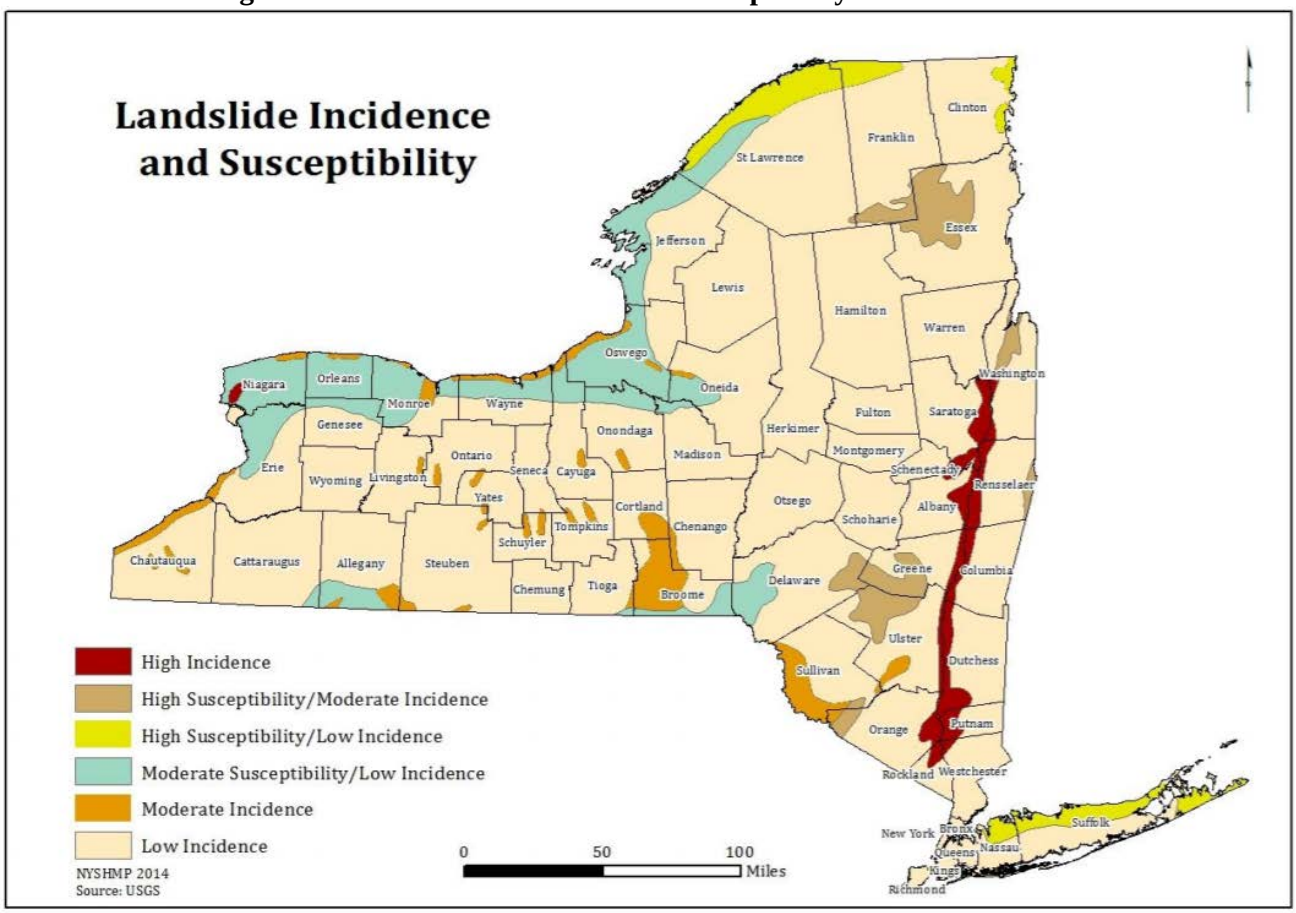
5.9.3 Extent

To determine the extent of a landslide hazard, potentially affected areas need to be identified and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, defined below:

- Landslide Incidence: The number of landslides that have occurred in a given geographic area, based on available data and the historical record. High incidence means greater than 15% of a given area has been involved in land sliding; medium incidence means that 1.5% to 15% of an area has been involved; and low incidence means that less than 1.5% of an area has been involved (Geological Hazards Program, n.d.).
- Landslide Susceptibility: The probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of land sliding (Geological Hazards Program, n.d.; OAS, 1991).

A landslide hazard incidence and susceptibility map was created by NYS DHSES based on a USGS landslide susceptibility map for New York State. Figure 5-18 was created including two primary characteristics that define landslide potential, terrain slopes and soil makeup or type. As displayed on the map, Saratoga County's eastern edge has a high landslide incidence and susceptibility.

Figure 5-18 Landslide Incidence and Susceptibility in New York State

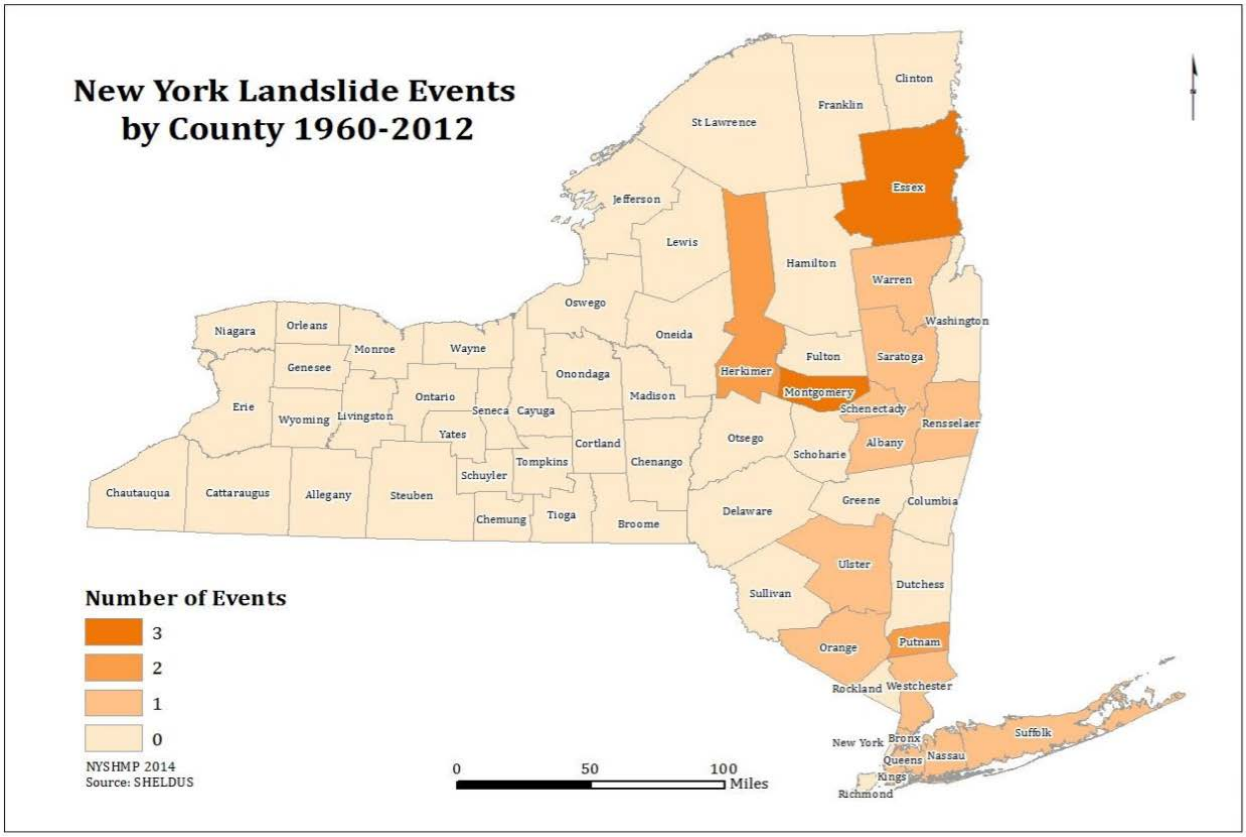


Source: NYSDPC, 2014

5.9.4 Past Occurrences and Losses

Most landslide incidences within New York State have not been well documented. Incidents that have occurred in the State and were documented have been identified on the figure below. This map indicates landslide events by county from 1960 to 2012. Certainly, many more landslides have occurred in the State and Saratoga County that have not been recognized or recorded in public documents (NYS DHSES, 2014).

Figure 5-19 Landslide Events by County 1960-2012



As noted above, most landslide incidents in the State and Saratoga County have not been well documented. This is because they either had no immediate impact or they occurred in isolated locations with few people aware of their existence. Therefore, information on actual landslide locations within the County is limited. Although most landslide events in Saratoga County have gone unnoticed, slides of varying severity have changed land contours, disrupted surface-water flows, and/or altered ground-water levels over time. Overall, the County has experienced five reported landslides and has been ranked as the 17th county in New York State most threatened by landslides and vulnerable to landslide loss (NYSDPC, 2008).

County officials recall two recent landslide incidents within Saratoga County. In April 2007, a 200-foot section of a hillside in the Town of Providence slid, causing substantial damage. In the Spring of 2008, a historic underground viaduct blew out from a heavy rain event in the Village of Schuylerville. No additional information regarding these events was provided. Based on the lack of any additional information available for Saratoga County, further documentation on previous landslide occurrence and losses within the County could not be included in this HMP.

Landslides can have severe impacts to people, property, and the environment. Economic impacts can be caused by public and private property damage and destruction, response and remediation costs, and loss of revenue for businesses affected by the event. The viaduct incident mentioned

above caused a substantial amount of damage to Schuylerville. Public property damages were estimated at $60,000 to $70,000, and private property damage also resulted.

5.9.5 Probability of Future Events

Based on historical records and input from the Planning Team, the probability of occurrence for ground failure in Saratoga County is considered “occasional”, with at least one hazard event occurring every eight to 50 years. As indicated in the NYS HMP, given the history of landslide occurrences in New York State, it is certain that future landslides will occur. However, the severity of landslides cannot be determined. Although historical data indicates a high frequency of landslide occurrence, the frequency of damaging landslides within and adjacent to New York State has been classified as low. The NYSGS estimates that 80% of the State has a low susceptibility to landslides. However, the fact that high landslide susceptibility exists, and landslides have occurred in the past suggests that the State’s infrastructure is at risk of landslide occurrence.

Saratoga County is one of the counties within New York State with a high incidence of landslides, ranking 17th in the state most threatened by landslides and vulnerable to landslide losses (NYSDPC, 2008). Therefore, Saratoga County is at greater risk of future landslide events than other sections of the State. Since landslides can occur as a result of many factors within Saratoga County, including past landslides and their distribution, bedrock type, slope steepness or inclination, hydrologic factors, and human-initiated effects, it is extremely difficult to predict landslide hazards in absolute terms (Organization of American States [OAS], 1991). Also, a sufficient understanding of landslide processes within the County does not exist to be able to make an estimation of landslide hazard potential. The potential risk posed by the landslide hazard in Saratoga County can be curbed through a better understanding and mapping of the hazard and improved capabilities to mitigate and respond to the landslide hazard (Spiker and Gori, 2000).

5.9.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of extreme temperatures in Saratoga County, including:

- Data and methodology used for the evaluation;
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development; and
- Further data collections that will assist understanding of this hazard over time.

Data and Methodology

National databases, the NYSGS Landslide Inventory Study, the NYS HMP, and local resources were used to collect and analyze ground failure impacts on the county. To estimate the general building stock and critical facilities vulnerable to this hazard of concern, a GIS layer called Digital Compilation of Landslide Overview Map of the Conterminous United States, from the U.S. Department of Interior, was used to map the areas of landslide incidence and susceptibility. This

approximate hazard area encompasses historic landslide occurrences, but it should be noted that landslides may also occur outside the 'high landslide incidence' sections of the County. For the purposes of this plan, only the 'high landslide incidence' areas are included in the defined hazard area.

Address point data, retrieved from NYS GIS Clearinghouse, was used for general building stock. Critical facility data from Hazus was also used for this analysis. A 30-foot buffer was added to each critical facility point to replicate the footprint of a structure. Then, the landslide GIS layer was overlaid upon the general building stock and critical facilities to identify buildings exposed to landslide. Available information is discussed and displayed in the sections below.

Impact on Life, Health, and Safety

Entire communities can be altered by a landslide, and the public has a risk of high impact. Life, health and safety can be threatened by the initial landslide itself, while recovery from a landslide can impact populations for years to come. In past years, landslides in the U.S. have caused deaths, injuries, and destruction. In Washington State in 2014, a portion of an unstable hill collapsed, engulfing the nearby community and covering an area of approximately one square mile with mud and debris. Forty-three individuals were killed, and 49 homes destroyed (Snohomish County Medical Examiner's Office, 2014). In 2005 in La Conchita, California, a major landslide killed ten people and destroyed 13 homes (Covarrubias, 2015). Most recently, massive mud and debris flows killed 17 in Montecito, California, burying homes and cars under a torrent of mud and boulders (Queally et al., 2018). In Saratoga County, landslides have the potential to impact life, health, and safety of the population.

Impact on General Building Stock

Properties and structures in Saratoga County are vulnerable to a landslide. Impacts to the general building stock could include severe damage, total destruction of properties, or loss of access to properties and structures for an extended period of time. As discussed above, to estimate the general building stock vulnerable to this hazard, buildings in the approximate landslide hazard areas were identified and the associated building values were summarized. Table 5-31 displays this information:

Table 5-31 General Building Value Exposed and Vulnerable to Landslides in Saratoga County

Municipality	Building Value	Number of Buildings
Town of Ballston	$0.00	0
Village of Ballston Spa	$0.00	0
Town of Charlton	$0.00	0
Town of Clifton Park	$2,109,012,553.00	7,683
Town of Corinth	$0.00	0
Village of Corinth	$0.00	0
Town of Day	$0.00	0
Town of Edinburg	$0.00	0
Town of Galway	$0.00	0

Municipality	Building Value	Number of Buildings
Village of Galway	$0.00	0
Town of Greenfield	$0.00	0
Town of Hadley	$0.00	0
Town of Halfmoon	$1,616,014,387.00	5,921
Town of Malta	$1,817,000.00	7
City of Mechanicville	$67,783,005.00	463
Town of Milton	$0.00	0
Town of Moreau	$363,283,751.00	2,476
Town of Northumberland	$135,467,951.00	1,064
Town of Providence	$0.00	0
Village of Round Lake	$0.00	0
Town of Saratoga	$340,850,700.00	2,011
City of Saratoga Springs	$0.00	0
Village of Schuylerville	$56,748,616.00	331
Village of South Glens Falls	$0.00	0
Town of Stillwater	$486,532,594.00	2,904
Village of Stillwater	$109,130,358.00	713
Village of Victory	$25,131,900.00	282
Town of Waterford	$587,316,696.00	2,286
Village of Waterford	$78,012,019.00	651
Town of Wilton	$0.00	0
Total County	$5,977,101,530.00	26,792

Impact on Critical Facilities

A significant amount of critical infrastructure can be exposed to landslides. Roads and bridges can be damaged, destroyed, or cut off from other transportation corridors. Railroads, pipelines, electric and telecommunication lines, dams, offshore oil and gas production facilities, port facilities, and waste repositories are also affected by land movement and can be severely impacted by a landslide.

Landslide damages to buildings, roads, utilities, and transportation lines can have catastrophic repercussions, such as loss of power to critical facilities (hospitals, schools, fire departments, etc.), impaired disposal of sewage, contamination of water supplies, disruption of transportation infrastructure, or the release of flammable fuels and other potentially hazardous chemicals. The overall impact of such lifeline failures, including secondary failure of systems that depend on those lifelines, can be much greater than the impact of individual facility or systems failures.

Table 5-32 and Table 5-33 list the critical facilities located within the approximate landslide hazard area generated for the purposes of this analysis (described earlier within the ‘Data and Methodology’ subsection).

Table 5-32 Critical Facilities Susceptible to Landslides in Saratoga County, by Sector

Critical Facility Type	Number of Facilities at Risk
Airport	0
Bus Facility	1
Communications	1
Emergency Response	0
Fire	10
Hazardous Material Facilities	20
Highway Bridges	38
Hospital	0
Law Enforcement	2
Power (Electric)	0
Rail Facility	0
Railway Bridges	2
Schools	10
Wastewater Facility	3
Grand Total	87

Table 5-33 Critical Facilities Susceptible to Landslides in Saratoga County, by Municipality

Municipality	Critical Facilities
Town of Ballston	0
Village of Ballston Spa	0
Town of Charlton	0
Town of Clifton Park	7
Village of Corinth	0
Town of Corinth	0
Town of Day	0
Town of Edinburg	0
Village of Galway	0
Town of Galway	0
Town of Greenfield	0
Town of Hadley	0
Town of Halfmoon	6
Town of Malta	0
City of Mechanicville	2
Town of Milton	0
Town of Moreau	9
Town of Northumberland	3
Town of Providence	0
Village of Round Lake	0
Town of Saratoga	6

Municipality	Critical Facilities
City of Saratoga Springs	0
Village of Schuylerville	2
Village of South Glens Falls	0
Village of Stillwater	7
Town of Stillwater	5
Village of Victory	4
Village of Waterford	6
Town of Waterford	30
Town of Wilton	0
Grand Total	87

Impact on Economy

The impact of a landslide on the economy and estimated dollar losses are difficult to measure because landslides impose both direct and indirect costs. Direct costs include the actual damage sustained by buildings and property. Indirect costs are harder to measure and include business disruption, loss of tax revenues, reduced property values, loss of productivity, losses in tourism, and losses from litigation.

Direct building losses are the estimated costs to repair or replace the damage caused to the building. The estimated replacement value of general building stock located in landslide susceptible areas is nearly $5.9 billion. These dollar value losses to the county's total building inventory replacement value would impact Saratoga County's tax base and the local economy.

Impact on Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. It is anticipated that new development within the identified hazard area will be exposed to such risks. Hazard maps that illustrate where potential new development is located in relation to the ground failure hazard area can also be found in Section 4. Additionally, any new development, even that which occurs outside the identified hazard areas, can exacerbate the landslide problem in hilly areas by altering the landscape, slopes, and drainages and by changing runoff directions and causing channeling, thereby increasing the potential for landslides. Landslides also have adverse environmental consequences, such as dramatically increased soil erosion, siltation of streams and reservoirs, blockage of stream drainages, and loss of valuable watershed, grazing, and timber lands (Spiker and Gori, 2000).

Considerations for Future Data Analysis

Obtaining historic damages to buildings and infrastructure incurred due to ground failure will help with loss estimates and future modelling efforts, given a margin of uncertainty.

5.9.7 Conclusions

Ground failure can significantly impact the County's population health and safety, general building stock and economy. The overall hazard ranking determined for this HMP for the ground failure hazard is "medium" with a "regular" probability of occurrence (see Table 5-5).

Human-caused impacts and development will continue to contribute to the probability of landslides and other ground failure incidents in Saratoga County. As noted above, road building and construction often exacerbate landslide incidence in hilly areas by altering the landscape and by changing runoff directions. Careful consideration of the potential for landslide and the effects of development on certain areas of the County and the local environment is crucial to mitigating the damages that can occur because of ground failure events.

5.10 Invasive Species

5.10.1 Description

An invasive species is an organism that is not native to an environment and causes ecological or economic harm to an environment where it is not native (NOAA, n.d.). Due to the lack of natural predators in their new environment and high reproductive ability, invasive species can quickly become widespread and out-compete native species. Invasive species can impact the plants and animals in the ecosystem as well as threaten human use of natural resources. In general, humans have largely been the cause of the spread of invasive species, carrying invasive species on boats, aircraft, and by foot.

The Cornell Cooperative Extension of Saratoga County website identifies the following types of invasive species in the county:

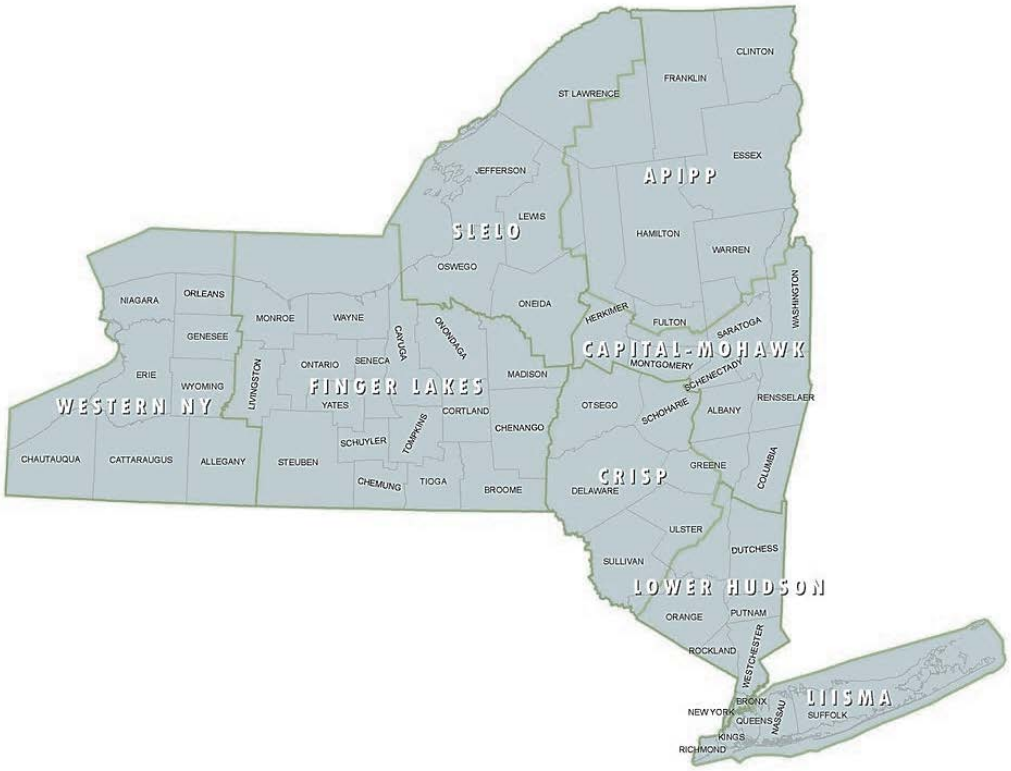
Table 5-34 Invasive Species in Saratoga County

Type	Aquatic	Terrestrial
Animals	Asian Carp Asian Clam Mute Swan Round Goby Spiny Waterflea Zebra Mussels	Feral Swine
Plants	Common Reed Japanese Knotweed Water Chestnut	Buckthorn Garlic Mustard Giant Hogweed Honeysuckle Japanese Knotweed Multiflora Rose Wild Parsnip Mugwort

Type	Aquatic	Terrestrial
Insects		Asian Longhorned Beetle Emerald Ash Borer European Crane Fly Hemlock Woolly Adelgid Sirex Woodwasp Spotted Wing Drosophila Swede Midge

NYIS.info, founded in 2008, is a website currently maintained by New York Sea Grant that includes a wealth of scientific and policy information pertaining to the prevention, eradication, control, and management of invasive specifies in New York. The state is broken into eight PRISMS, or Partnerships for Regional Invasive Species Management (Figure 5-20). The southern portion of Saratoga County is in the Capital/Mohawk PRISM, which is hosted by the Cornell Cooperative Extension of Saratoga County, and the north western part of Saratoga County is in the Adirondacks Park Invasive Plant Program (APIPP).

Figure 5-20 New York State Partnerships for Regional Invasive Species Management



Source: NYS DEC

5.10.2 Extent

The extent, or magnitude, of an invasive species spread can be measured in terms of the density of observations of that organisms. However, the number of organisms is not the only indicator of severity of the invasive species hazard. For example, ecosystems are particularly at risk to being

overtaken by an invasive species when it's in a stressed state, such as during a drought. The native ecosystem can more easily succumb to an invasive species when it is already in this weakened state.

The extent of an invasive species outbreak depends on a number of factors, including:

- Plant or animal species
- Number and type of predators
- Environmental conditions, including temperature
- Availability of mitigation measures
- Awareness of invasive species location

5.10.3 Location

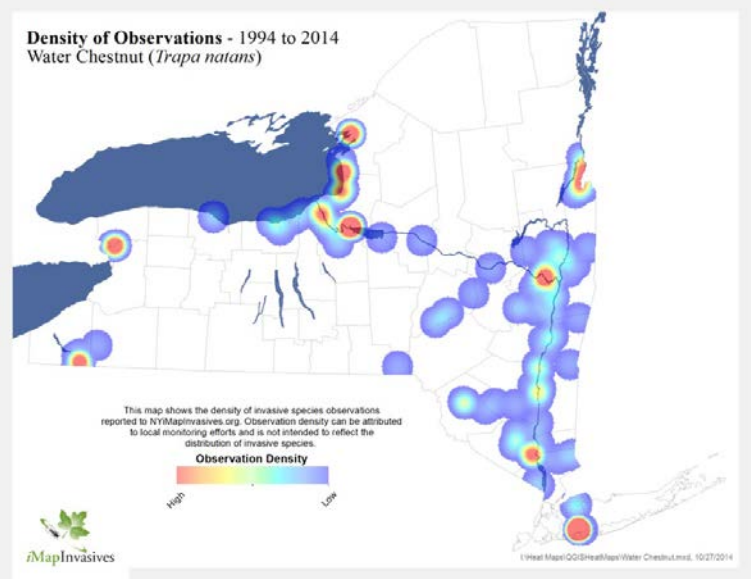
Invasive species can be found throughout Saratoga County. The exact location of invasive species depends on the preferred habitat of the species as well as the species' ease of movement. Modes of introduction of invasive species in Saratoga County include:

- Contamination of internationally traded goods
- Movement of soil, compost, wood, vehicles, or other materials and equipment
- Unregulated sale of organisms

To discuss the location of invasive species in Saratoga County, three invasive species were chosen to discuss in more detail below. Density of observation maps provide an understanding of where the highest concentrations of these invasive species can be found in the county.

The European water chestnut (Trapa natans, or *T. natans*) is an aquatic invasive species that was inadvertently released into the waters of the Northeast in the 1800s. Today, *T. natans* can be found ranging from low to high density almost continuously along the Hudson River from Albany south to New York City, as well as along the Mohawk River (Figure 5-21). Both rivers run through Saratoga County and therefore water chestnuts pose a threat to the local ecosystem.

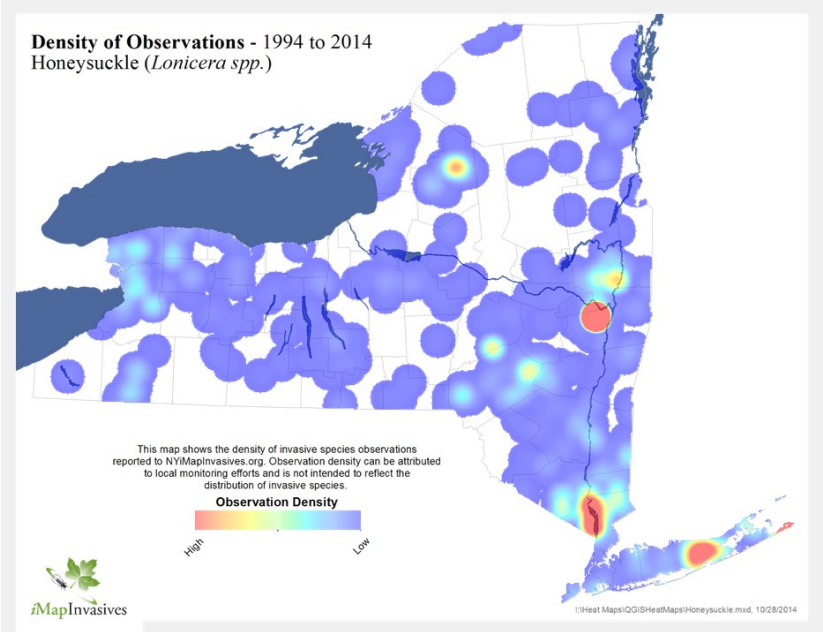
Figure 5-21 Water Chestnut Density of Observations (1994 – 2014)



Retrieved from: http://nyis.info/invasive_species/water-chestnut/

There are also several different species of honeysuckle that have taken root throughout Saratoga County. Figure 5-22 shows the location and density of previous observations of this invasive species. In general, honeysuckle can form very dense populations that eventually outcompete and suppress native plant species. The shade created by this species can shade out the understory growth and prevent native understory plants and tree seedlings from growing.

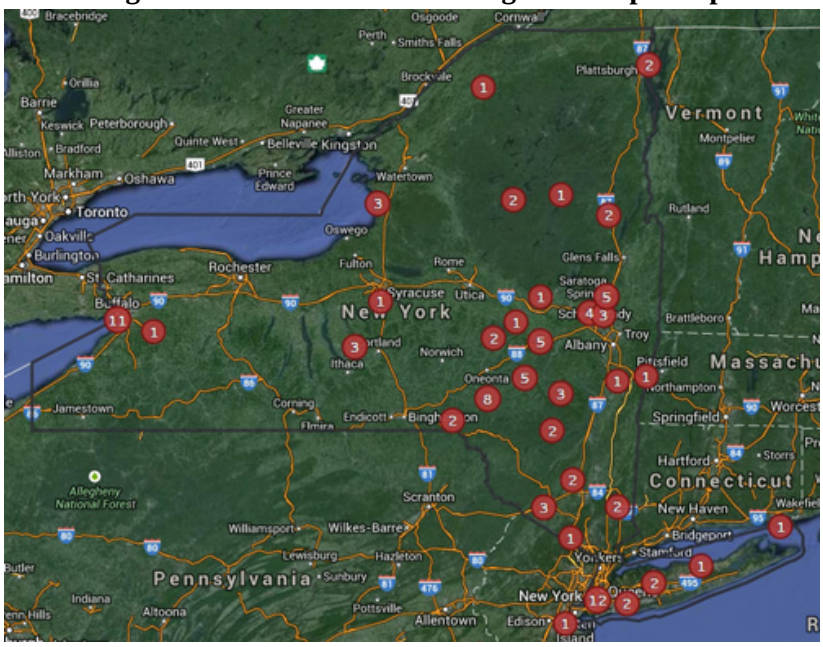
Figure 5-22 Honeysuckle Density of Observations (1994-2014)



Retrieved from: NYIS.info, n.d.-b

Wild parsnip has been reported across New York State, with the heaviest concentration of reports being found in the Lower Hudson Valley, Catskills, and southern Adirondacks. Saratoga County is in this area and there have been multiple reports of wild parsnip in the county, as seen in Figure 5-23.

Figure 5-23 New York State range of wild parsnip



Retrieved from http://nyis.info/invasive_species/wild-parsnip/,
from iMapInvasives database, accessed 16 July 2014

5.10.4 Previous Occurrences and Losses

Invasive species have been entering New York State since the arrival of early European settlers. The NY iMapInvasives website is New York State's online, all-taxa invasive species database and mapping tool. This database documents invasive species observations, as well as survey, assessment, and treatment data. Website users can query the database for invasive species within a particular geographic boundary, or a specific type of animal or plant. Table 5-35 summarizes the results of a query for the most common invasive species in New York State and their frequency of reporting in Saratoga County. Honeysuckle, Common Buckthorn, and Multiflora Rose make up the majority of reported invasive species in Saratoga County.

Table 5-35 Commonly Reported Invasive Species in Saratoga, NY

Species	Reports
Honeysuckle	896
Common Buckthorn	643
Multiflora Rose, Rambler Rose	446
Purple Loosestrife	149
Garlic Mustard	125
Common Reed	105
Japanese Barberry	104
Water Chestnut	88
Japanese Knotweed, Japanese Bamboo	66
Mugwort	8
Morrow Honeysuckle	3

Source: NY iMapInvasives, Retrieved October 2018

One way to discuss losses from invasive species is to consider the amount of money that has been spent on cleaning up and preventing the future spread of invasive species. Removing zebra mussels from the Great Lakes, where they have clogged water intakes at water treatment facilities and power plants, is estimated to cost $500 million annually (Copper Development Association, 2009). Zebra mussels are present in Saratoga County and present a costly challenge to manage, though at a much smaller scale.

5.10.5 Probability of Future Events

Invasive species, including insects, plant, and animal species, impact the ecosystems in Saratoga County on an annual basis and will continue to in the future. Pathways for invasive species can include global trade, genetic engineering, bio-terrorism, internet sales, and climate change (Cornell Cooperative Extension, n.d.). Any increase or growth in these pathways will likely increase the number of invasive species. Changing temperatures will allow certain non-native species to thrive in an otherwise inhospitable climate.

Mitigation efforts against invasive species in Saratoga County have found some success in recently years. On June 17, 2018, at a state boat launch on the Great Sacandaga in Edinburg, a steward making boat inspections found a vessel with live zebra mussels clinging to water plants on it (Nearing, 2017). The lake is not currently known to have zebra mussels and mitigation measures such as this can be credited for preventing the future spread of this invasive species into the county's waterbodies.

5.10.6 Vulnerability Assessment

Data and Methodology

Data analysis was not possible for this hazard because of the lack of spatial data available at the time of this plan. Impacts and vulnerability to invasive species are discussed qualitatively.

Impact on Life, Health, and Safety

Invasive species cause habitat degradation and loss, which leads to loss of native fish, wildlife, and tree species. Some invasive species can result in diseases in humans and livestock.

Secondary impacts on other species could occur, especially those that interact with or depend on the impacted species. The health of water resources can be impacted by the presence of invasive species. For example, the quality of drinking water can be negatively affected, and the safety of swimmable waterbodies can be diminished.

Some invasive plant species can cause harm to humans that come in contact with the plant. For example, Wild parsnip can cause chemical burns on human skin when the oil comes in contact with direct sunlight. Essential oils from this plant can also cause hallucinations if ingested (New York Invasive Species Information (NYIS.Info), n.d.). Giant hogweed's toxic sap can also cause burns to skin (Center for Agriculture and Biosciences International [CABI], n.d.).

Invasive species can also impact human health. Invasive zebra mussels accumulate toxins in their tissues. When other organisms prey on these mussels, the toxins are passed up the food chain and can also enter animals consumed by humans (Aquatic Nuisance Species [ANS] Task Force, n.d.).

Impact on General Building Stock

Invasive species can diminish property values, especially for waterfront property along a waterbody with poor health due to invasive animals and plants.

Impact on Critical Facilities

Invasive species have the potential to significantly impact critical facilities in Saratoga County. Invasive species can damage buildings, drainage systems, railway lines, and other structures. Accounting for and managing these invasive species can add huge costs to development and regeneration schemes. Water treatment plants and water storage facilities can be particularly impacted by aquatic plants and animals. For example, the zebra mussel can grow on a variety of infrastructure systems, including water intake pipes for drinking water, irrigation, and power plants (US Department of the Interior [US DOI], 2016).

Impact on Economy

In the United States, invasive species cost an estimated $120 billion annually in control methods and in loss of environmental resources (Crowl, T.A., et al, 2008). Invasive species cause loss of recreational opportunities and income. Economic impacts result from invasive aquatic plants, such as *T. natan's* impenetrable mats of vegetation, that can impede swimming, boating, commercial navigation, fishing, and waterfowl hunting. Invasive species can also interfere with the growth of crops, causing losses in agriculture-based economies.

Impacts on Future Growth and Development

Invasive species can impact the desirability of future land development because of the cost to remove that species from the site. If an invasive species renders a waterbody toxic to human use, the value of homes surrounding this lake can be diminished, impacting future development. Drinking water availability may also be impacted in the area, making future development less attractive in that area.

Considerations for Future Data Analysis

Additional mapping of invasive species will increase awareness of their location and prevalence in Saratoga County. Collecting information related to the losses from invasive species will help target future mitigation measures.

5.10.7 Conclusions

Invasive species will continue to impact Saratoga County on an annual basis. This hazard was ranked overall as a “medium” risk by the Planning Team for Saratoga County with a “frequent” probability of occurrence (see Table 5-5). Local, regional, and statewide efforts will need to continue in the future to identify and mitigate against invasive species.

5.11 Severe Storm

This section describes the nature of severe storm hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.11.1 Description

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

Hailstorm: The National Weather Service defines hail as, “Showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud,” (NWS, 2009). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight; they fall as precipitation, in the form of balls or irregularly shaped masses of ice. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth’s surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

Windstorm: According to FEMA, wind is air moving from high to low pressure. It is rough horizontal movement of air (as opposed to an air current) caused by uneven heating of the Earth's surface. It occurs at all scales, from local breezes generated by heating of land surfaces and lasting tens of minutes to global winds resulting from solar heating of the Earth (FEMA, 1997). A type of windstorm that is experienced often during rapidly moving thunderstorms is a derecho. A derecho is a widespread and long-lived windstorm associated with thunderstorms. (Johns and Evans, Data Unknown). The two major influences on the atmospheric circulation are the differential heating

between the equator and the poles, and the rotation of the planet. Windstorm events are associated with cyclonic storms (for example, hurricanes), thunderstorms and tornadoes (FEMA, 1997).

Lightning: According to the NWS, lightning is a visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground (NWS, 2009b). The discharge of electrical energy resulting from the build-up of positive and negative charges within a thunderstorm creates a "bolt" when the build-up of charges becomes strong enough. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit (°F). Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder.

Thunderstorm: According to the NWS, a thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS, 2009c). 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. Severe thunderstorms can cause downbursts, or "a strong downdraft current of air from a cumulonimbus cloud," as defined by NWS (NWS, 2009). Downbursts can produce significantly high wind speeds (up to 168 MPH) and cause extensive damage (NWS, n.d.-f). There are two types of downbursts: microbursts and macrobursts. Microbursts typically cause wind speeds as higher than 160 MPH, last approximately five to fifteen minutes, and span less than 2.5 in diameter (NWS, n.d.-f). Conversely, macrobursts, have wind speeds higher than 130 MPH, last approximately five to 30 minutes, and span more than 2.5 miles in diameter (NWS, n.d.-f).

Tornado: The National Weather Service defines tornado as, "A violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomena" (NWS, 2009d). Tornadoes can occur at any time, but typically occur between 3 and 9 PM with average speeds around 35 mph (NWS, n.d.-a).

Tropical Cyclone: Tropical cyclone is a term that encompasses all storm systems that are "non-frontal synoptic scale low-pressure system[s] over tropical or sub-tropical waters with organized convection (i.e. thunderstorm activity) and definite cyclonic surface wind circulation," (Landsea, 2011).

Tropical Depressions: Tropical depressions are known as tropical cyclones that form when a "low pressure area is accompanied by thunderstorms that produce a circular wind flow with maximum sustained winds below 39 mph," (NASA, n.d.).

Tropical Storms: Tropical storms are formed when the cyclonic circulation of a tropical depression becomes more organized, and reaches wind gusts between 39 and 73 mph (NASA, n.d.)

Hurricanes: Hurricanes are formed once tropical storms reach wind speeds of over 74 mph. It is a category of tropical cyclone characterized by thunderstorms and defined surface wind circulation. They are caused by the atmospheric instability created by the collision of warm air with cooler air. They form in the warm waters of tropical and sub-tropical oceans, seas, or Gulf of Mexico (NOAA, n.d.).

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

- *Storm Surge* is simply water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more. Storm surge is responsible for nearly 90-percent of all hurricane-related deaths and injuries.
- *Wind Damage* is the force of wind that can quickly decimate the tree population, down power lines and utility poles, knock over signs, and damage/destroy homes and buildings. Flying debris can also cause damage to both structures and the general population. When hurricanes first make landfall, it is common for tornadoes to form which can cause severe localized wind damage.
- *Rainfall / Flooding* is the torrential rains that normally accompany a hurricane can cause serious flooding.

5.11.2 Extent

Thunderstorm

Thunderstorms are classified as severe if it has one of the following: 1) hail that is one (1) inch in diameter or large, or 2) winds of 58 miles per hour (mph) or greater, (NWS, n.d.).A severe thunderstorm warning is issued when thunderstorms are “occurring or imminent in the warning area,” whereas a severe thunderstorm watch is issued when a thunderstorm is possible in the warning area (NWS, n.d.-e).The Beauford Wind Scale is used to measure wind speed and damage, and which can be used to determine a thunderstorm’s severity. The table below explains the different levels of the Beauford Wind Scale.

Table 5-36 Beauford Wind Scale

#	MPH	Knots	Description	Specifications
0	< 1	< 1	Calm	Smoke rises vertically.
1	1-3	1-3	Light Air	Direction of wind shown by smoke drift but not by wind vanes.
2	4-7	4-6	Light Breeze	Wind felt on face; Leaves rustle; Wind vanes moved by wind
3	8-12	7-10	Gentle Breeze	Leaves and small twigs in constant motion; Wind extends light flag.
4	13-18	11-16	Moderate	Raises dust, loose paper; Small branches moved.
5	19-24	17-21	Fresh	Small trees begin to sway; Crested wavelets form on inland waters.
6	25-31	22-27	Strong	Large branches in motion; Whistling heard in telephone wires; Umbrellas used with difficulty.
7	32-38	28-33	Near Gale	Whole trees in motion; Inconvenience felt walking against the wind.
8	39-46	34-40	Gale	Twigs break off trees; Wind generally impedes progress; Mobile homes may shake.

#	MPH	Knots	Description	Specifications
9	47-54	41-47	Strong Gale	Slight structural damage occurs; Mobile homes, sheds, roofs, lanais, and RV's suffer minor damage.
10	55-63	48-55	Storm	Small trees uprooted; Moderate damage occurs to mobile homes and RV's; Brick and wood frame houses receive minor structural and roof damage; Some signs blown down.
11	64-73	56-63	Violent Storm	Moderate sized trees uprooted; Large branches snapped off trees; Chimneys and road signs toppled; Significant mobile home damage; Power lines downed.

Source: NWS, N.d.-g

Tornado

The magnitude or severity of a tornado was originally categorized using the Fujita Scale (F-Scale) or Pearson Fujita Scale introduced in 1971, based on a relationship between the Beaufort Wind Scales (measure of wind intensity) and the Mach number scale (measure of relative speed). The Enhanced Fujita Scale (EF Scale) replaced the F-Scale on February 1, 2007. The EF Scale measures wind speed and damage to give a tornado a rating, and it improved on the F-Scale by aligning wind speeds better with damage. (NWS, n.d.-b). Table 5-37 shows the comparison between the Fujita Scale and the Enhanced Fujita Scale.

Table 5-37 Comparison between Fujita Scale and Enhanced Fujita Scale Wind Speeds

Fujita Scale		Enhanced Fujita Scale		
F Number	**Wind Speed (mph)**	**EF Number**	**Wind Speed (mph)**	**Damages**
0	40-72	0	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
1	73-112	1	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	113-157	2	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
3	158-207	3	136-165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	208-260	4	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled, cars thrown, and small missiles generated.
5	261-318	5	Over 200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NWS, n.d.-b; NWS, n.d.-c; NWS, 2015

In the Fujita Scale, there was a lack of clearly defined and easily identifiable damage indicators. The EF Scale considers more variables than the original F-Scale did when assigning a wind speed rating to a tornado. The EF Scale incorporates 28 damage indicators (DIs), such as building type, structures, and trees. For each damage indicator, there are eight degrees of damage (DOD), ranging from the beginning of visible damage to complete destruction of the damage indicator. Table 5-38 lists the 28 DI's. Each one of these indicators has a description of the typical construction for that category of indicator. Each DOD in every category is given an expected estimate of wind speed, a lower bound of wind speed, and an upper bound of wind speed.

Table 5-38 Enhanced Fujita Scale Damage Indicators

Number	Damage Indicator	Abbreviation
1	Small barns, farm outbuildings	SBO
2	One- or two-family residences	FR12
3	Single-wide mobile home	MHSW
4	Double-wide mobile home	MHDW
5	Apt, condo, townhouse (3 stories or less)	ACT
6	Motel	M
7	Masonry apt. or motel	MAM
8	Small retail bldg. (fast food)	SRB
9	Small professional (doctor office, branch bank)	SPB
10	Strip mall	SM
11	Large shopping mall	LSM
12	Large, isolated ("big box") retail bldg.	LIRB
13	Automobile showroom	ASR
14	Automotive service building	ASB
15	School - 1-story elementary (interior or exterior halls)	ES
16	School - junior and senior high school	JHSH
17	Low-rise (1-4 story) bldg.	LRB
18	Mid-rise (5-20 story) bldg.	MRB
19	High-rise (over 20 stories)	HRB
20	Institutional bldg. (hospital, govt. or university)	IB
21	Metal building system	MBS
22	Service station canopy	SSC
23	Warehouse (tilt-up walls or heavy timber)	WHB
24	Transmission line tower	TLT
25	Free-standing tower	FST
26	Free standing pole (light, flag, luminary)	FSP
27	Tree - hardwood	TH
28	Tree - softwood	TS

Source: NWS, n.d.-b

Hurricane

The extent of a hurricane is categorized by the Saffir-Simpson Hurricane Wind Scale (Table 5-39). This scale rates hurricanes on a scale from one (Minimal) to five (Catastrophic) based on their intensity. This scale is used to estimate the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline, in the landfall region (NWS, n.d.-d).

Table 5-39 Saffir-Simpson Hurricane Wind Scale

Categories	Sustained Winds	Expected Damage
1	74-95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (Major)	111-129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (Major)	130-156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (Major)	157 mph or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center (NHC), n.d.

In evaluating the potential for hazard events of a given magnitude, an 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, in years, between occurrences of a particular hazard event (equal to the inverse of the annual frequency of exceedance) (Dinicola, 2005).

Figures 1.1.2-2 and 1.1.2-3 show the estimated peak gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP Hazus model runs. The maximum peak gust wind speeds for the County range from 44 to 57 mph for the 100-year MRP event. The maximum peak gust wind speeds for the County range from 59 to 69 mph for the 500-year MRP event. For both events, the highest wind speeds are expected to affect the southern region of the

County. The associated impacts and losses from these 100-year and 500-year MRP hurricane event model runs are reported in the Vulnerability Assessment later in this section.

Figure 5-24 Peak Wind Speeds for the 100-Year MRP Wind Event in Saratoga County

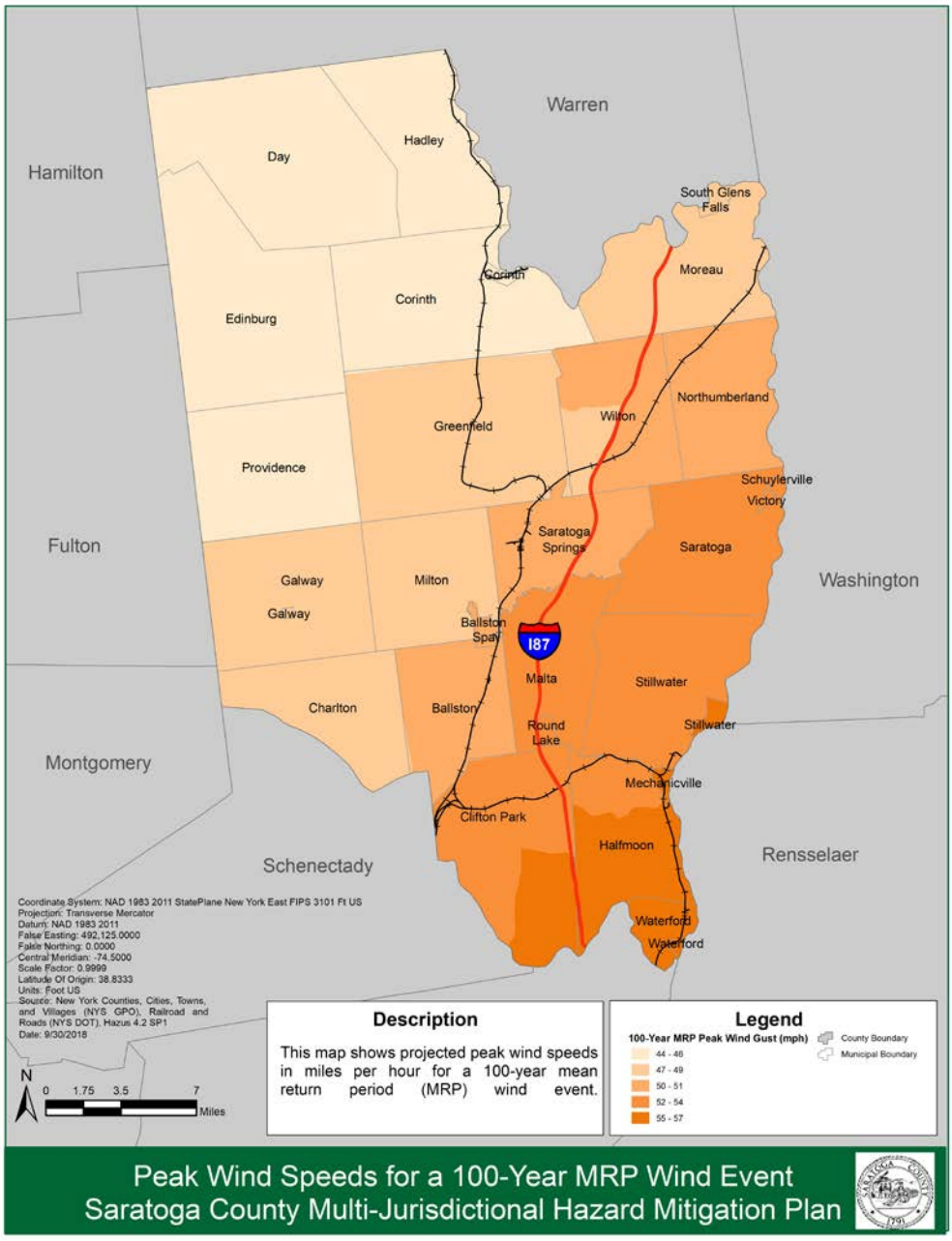
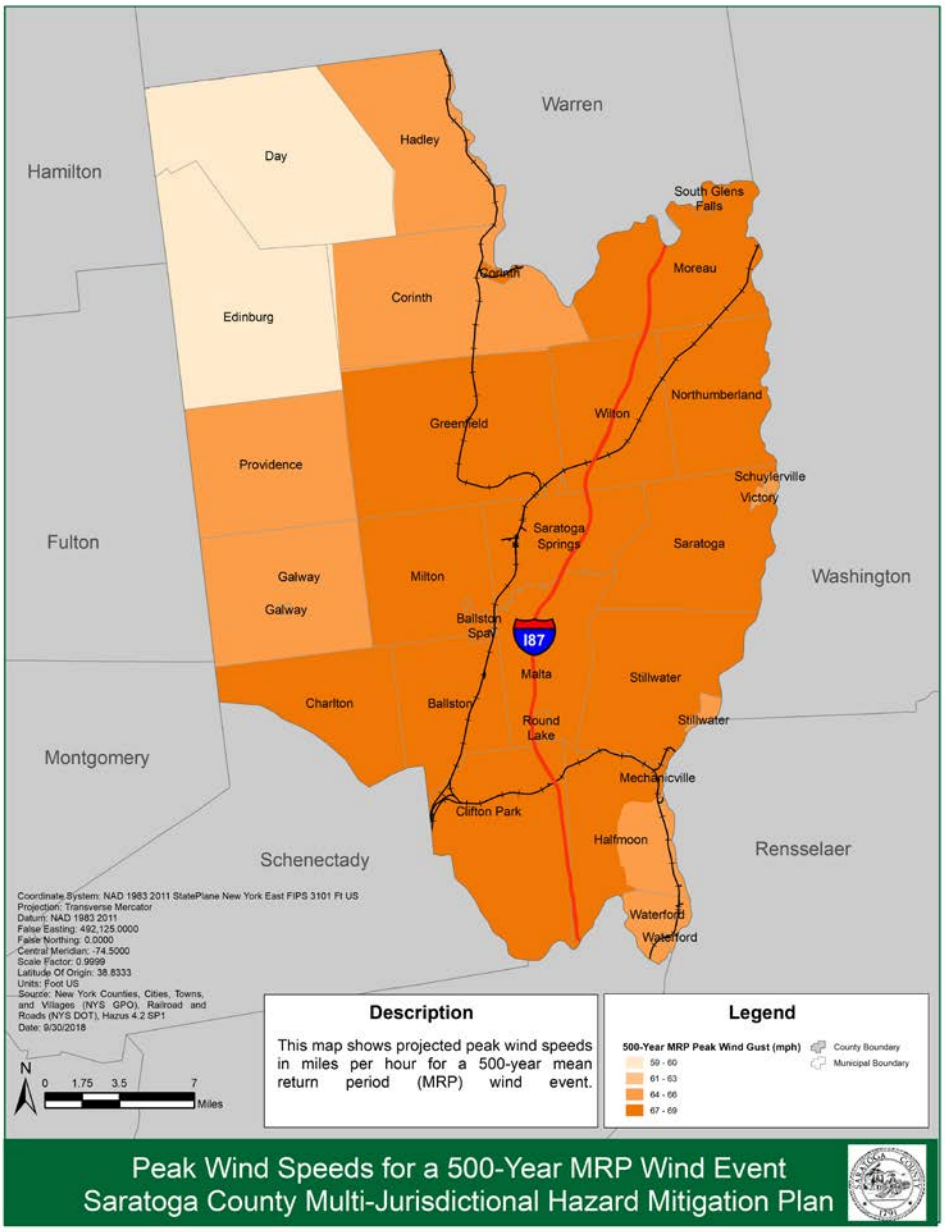


Figure 5-25 Peak Wind Speeds for the 500-Year MRP Wind Event in Saratoga County



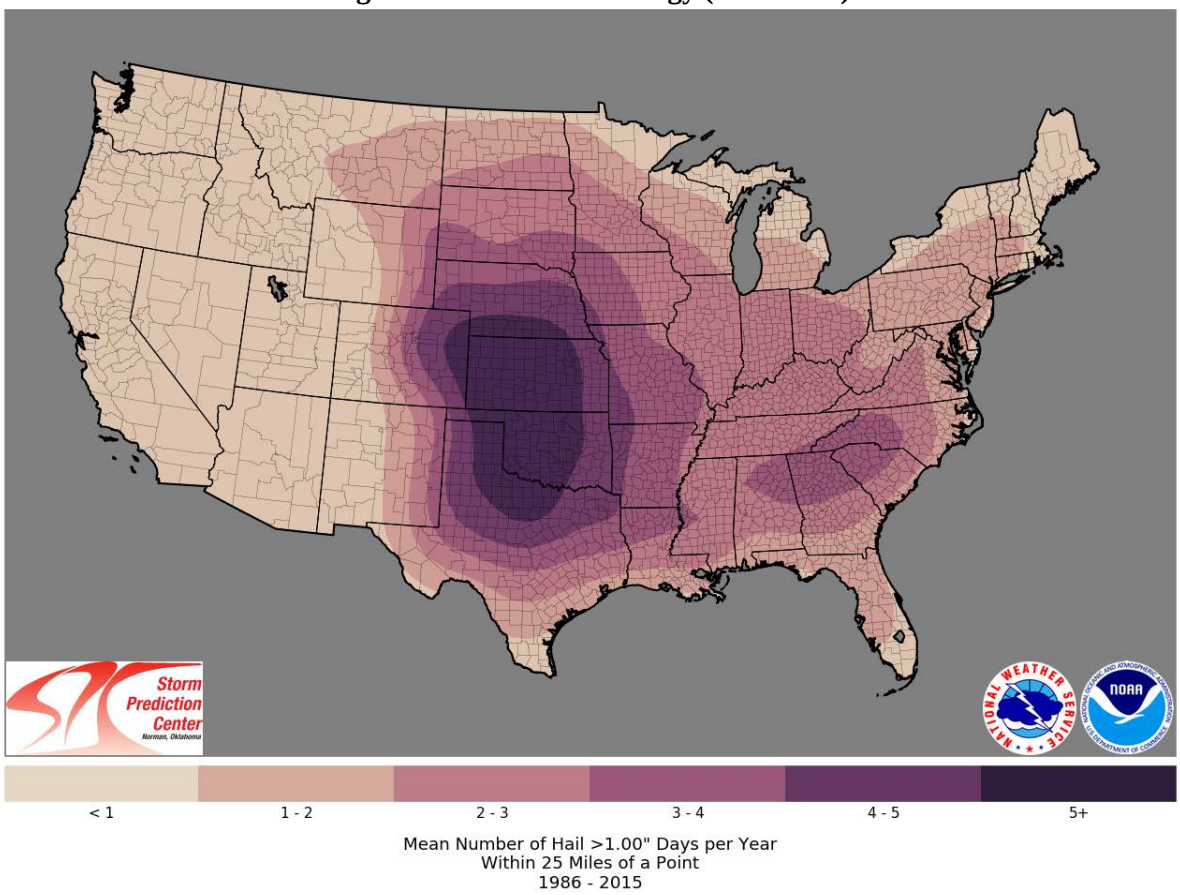
5.11.3 Location

Severe storms are a common natural hazard in Saratoga County because the County exhibits a unique blend of weather (geographically and meteorological) features that influence the potential for severe storms. Factors include temperature, which is affected by latitude, elevation, proximity to water bodies and source of air masses; and precipitation which includes snowfall and rainfall. Precipitation intensities and effects are influenced by temperature, proximity to water bodies, and general frequency of storm systems. Though some areas may be more susceptible to storms than others, the entire county is at risk and vulnerable to severe storms.

Hailstorms

Figure 5-26 shows the mean number of days with severe hail (>1.00") reported between 1986 and 2015. As the figure shows, the central states are most impacted by hail. Saratoga County experienced anywhere from 1-2 severe hail days per year. The New York State Hazard Mitigation Plan shows that Saratoga County has one of the highest rates of hail event occurrences in the state, with approximately 51-60 events having occurred between 1960 and 2012 (NYS DHSES, 2014).

Figure 5-26 Hail Climatology (1986-2015)

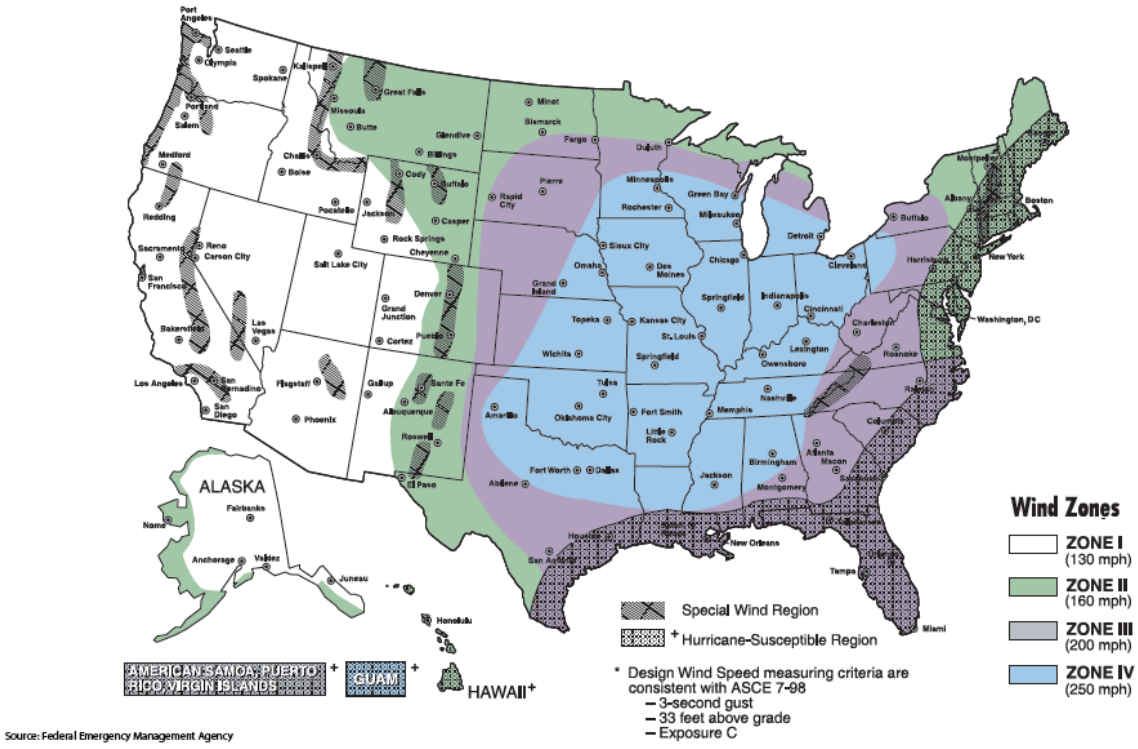


Source: Storm Prediction Center (SPC), 2016

Windstorms

Figure 5-27 indicates how the frequency and strength of windstorms impacts the U.S. and the general location of the most wind activity. This is based on 40 years of tornado history and 100 years of hurricane history, collected by FEMA. Saratoga County is in Wind Zone II with speeds up to 160 miles per hour. The County is also located within the Hurricane Susceptibility Region, which extends along the north-eastern coastline of the U.S. (FEMA, 2006). The New York State Hazard Mitigation Plan has also identified the entire county of Saratoga has having one of the counties with the highest wind occurrences with approximately 221-328 events occurring between 1960 and 2012 (NYS DHSES, 2014).

Figure 5-27 Wind Zones in the United States



Source: FEMA, 2006

Thunderstorms

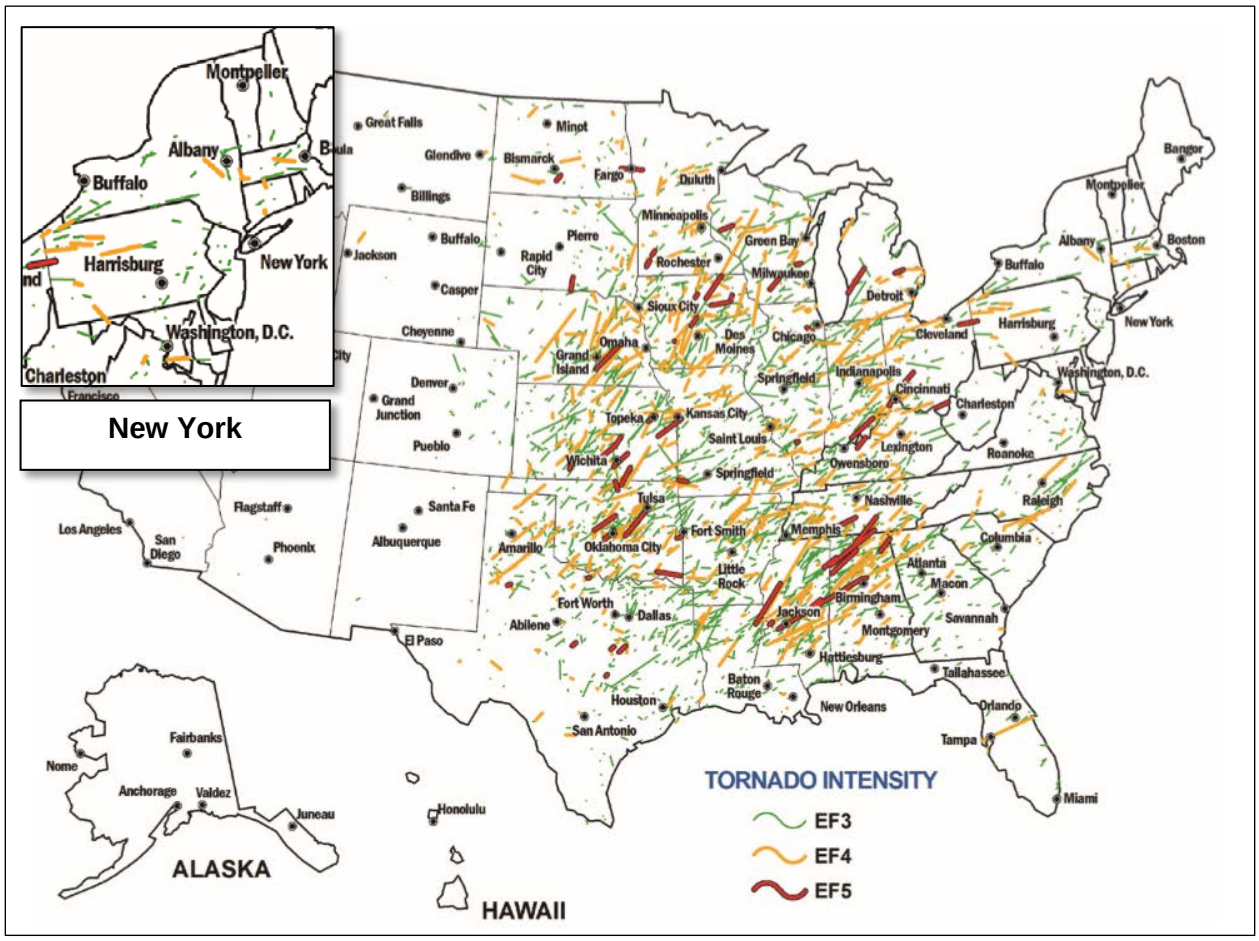
Thunderstorms affect relatively small localized areas, rather than large regions much like winter storms, and hurricane events. Thunderstorms can strike in all regions of the U.S.; however, they are most common in the central and southern states. More than 100,000 thunderstorms occur each year in the U.S., however, only about 10-percent are classified as “severe” (NWS, N.d.-h).

Tornadoes

Figure 5-28 below shows the number of tornado incidents from 1950 and 2013 with a magnitude of EF3 or greater. Saratoga County and the surrounding region has had limited experience with

severe tornadoes, with only a small amount of EF3 and EF4 tornadoes occurring in the area between 1950 and 2013. The southern portion of Saratoga County has statistically had higher risk based on previous occurrences.

Figure 5-28 EF3, EF4, and EF5 Tornadoes (1950-2013)



Source: FEMA, 2014

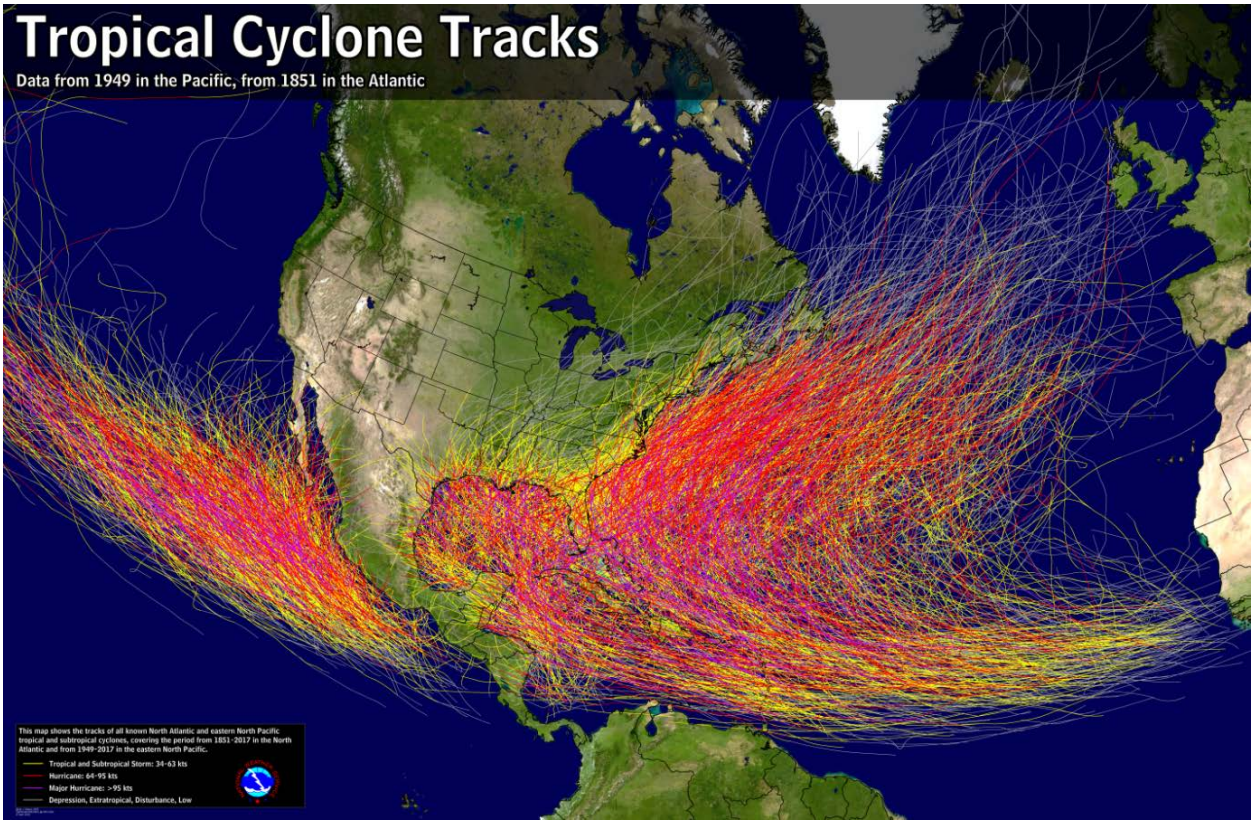
Hurricanes/Tropical Storms

Due to Saratoga County's inland location, hurricanes do not often make direct landfall on the mitigation study area. However, the County has more frequently been known to experience tropical storms and their indirect landward effects, including high winds, heavy rains, and major flooding associated with hurricane and/or tropical storm events. Hurricanes and tropical storms can impact New York State from June to November, the official eastern U.S. hurricane season.

Figure 5-29 below shows tropical storm, tropical depression, and hurricane tracks from 1851 to 2017. While Saratoga County is not at high risk of taking a direct impact from a severe hurricane, the county is in an area that can experience tropical storms and remnants of hurricanes. The winds and heavy precipitation associated with these storms is the biggest concern in Saratoga

County. Due to the inland nature of the County, storm surge is not a hazard that will impact the area.

Figure 5-29 Tropical Cyclone Tracks (1851-2017)



Source: NHC, n.d.

5.11.4 Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe storms throughout New York State and Saratoga County. For the purposes of this HMP update, the NOAA NCEI Storm Events Database was used to collect information on previous severe storm events and losses. Table 5-40 details the severe storm events from January 1960 to September 2018. Of those events, FEMA indicates that Saratoga County has been declared as a disaster area because of severe storm events approximately four times, in addition to three hurricane declarations, between 1987 and 2018 (FEMA, 2018).

Table 5-40 Saratoga Severe Storm Events

Type	Total Events	Total Property Damage	Total Crop Damage	Total Deaths	Total Injuries	Annualized Events	Annualized Damages
Thunderstorm Wind	328	$9,441,000	$130,000	0	8	5.56	$162,220
Hail	104	$233,000	$200,000	0	1	1.76	$7,339
Tornado	9	$60,325,000	$0	0	69	0.15	$1,022,458
High Wind	42	$531,500	$0	0	1	0.71	$9,008
Lightning	21	$352,000	$0	1	4	0.36	$5,966
Heavy Rain	7	$30,000	$0	0	0	0.12	$508
Strong Wind	18	$90,000	$3,000	0	2	0.31	$1,576
Tropical Storm	1	$0	$0	0	0	0.02	$0

Source: NCEI Storm Events Database, January 1960 to September 2018

Additional information regarding losses can be found in the New York State Hazard Mitigation Plan. Saratoga County has experienced losses amounting to $388,133 due to hail and $69,449,234 due to wind between 1960 and 2012 (NYS DHSES, 2014). Estimated annualized losses from Hurricanes in Saratoga County is approximately $448 (NYS DHSES, 2014).

5.11.5 Probability of Future Events

Based on historical records and input from the County Planning Team, the probability of occurrence for severe storms in Saratoga County is considered “frequent”, with at least one event occurring annually. It is estimated that Saratoga County will continue to experience direct and indirect impacts of severe storms annually that may induce secondary hazards such as flooding, infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences.

Recent research suggests that changes in global climate will likely increase the frequency of severe convective storms and will also increase their duration due to abundant moisture in the air (Federal Advisory Committee, 2014). Models also predict that hurricanes will become more frequent and increase in magnitude due in part to increasing sea temperatures (Federal Advisory Committee, 2014). However, trends in tornadoes, hail, and thunderstorm winds are still being researched, and it is uncertain whether climate change will impact the probability of their future occurrence in Saratoga County (Federal Advisory Committee, 2014). It is also uncertain how future development will impact the probability of severe storms.

5.11.6 Vulnerability Assessment

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

- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of County residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Data and Methodology

Extensive research was conducted to understand the impact of severe storms on various individual community sectors below in Saratoga County, New York. Spatial analysis was not conducted for severe storms such as thunderstorms, as these events vary in type, frequency, duration, extent, and intensity depending on event. However, Hazus, a hazard loss estimation program administered by FEMA, was used to predict losses for the winds associated with a hurricane. Hurricane and inventory data available in Hazus were used to evaluate potential losses from the 100- and 500-year MRP events (severe wind impacts). For both MRP's, damages were estimated to the general building stock and critical facilities. The results of this analysis are summarized in the sections below.

Impact on Life, Health, and Safety

The impact of severe storms on life, health and safety is dependent upon the severity of the storm event. 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, particularly from auto accidents. This weather can also cause delay in response times from emergency services. It is assumed that the entire County population is exposed to the severe storm hazard.

Some individuals with disabilities may also be disproportionally affected if they are unable to access evacuation routes, have difficulty in understanding or receiving warnings of impending danger, or have limited ability to communicate their needs. Socially vulnerable populations are most susceptible, based on several factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Section 4 shows the number of people under the age of five and over the age of 65 that might be particularly vulnerable to a severe storm event.

Severe storm events can also cause risk to health. Severe precipitation events increase risk of waterborne illness with microorganisms and toxins that can cause illnesses such as cholera, schistosomiasis and other gastrointestinal problems (National Institute of Environmental Health Sciences, n.d.).

Impact on General Building Stock

Buildings are at risk of severe structural damage from hailstorms, windstorms, downbursts, tornadoes, lightning, and thunderstorms. Severe storms can break windows, tear off roofs, and destroy buildings and homes. After a storm, excess moisture and standing water contribute to the growth of mold in homes and other buildings.

The value of general building stock exposed to and damaged by 100- and 500-year MRP events was evaluated. Potential damage is the modeled loss that could occur to the exposed inventory. Hazus estimates there is a total building replacement value (structure only) of greater than $17 billion in Saratoga County, as summarized by occupancy category in Table 5-41.

According to Hazus MR3 estimates, no buildings will be completely destroyed as a result of the 100- and 500-year events and less than one-percent will be severely damaged. Residential buildings comprise most of the building inventory and are estimated to experience the majority of building damage (no damage to moderate damage). Wind speeds associated with a 100-year event, as described earlier in this profile, equate to a tropical storm; wind speeds associated with a 500-year event equate to a Category 1 hurricane. Table 5-42 and Table 5-43 summarize the estimated damage to the building stock, by general occupancy class and by municipality, for the 100 and 500-year MRP wind events.

Figure 5-30 and Figure 5-31 present the estimated loss to the residential building stock by census block group for the 100 and 500-year MRP wind event. For the 100-year wind event, most of the loss to the residential building stock is centered around the southern region of the County. For the 500-year wind event, the loss to the residential building stock is much more widespread across the county with only the north-eastern region having few damaged areas. Estimated losses could be as high as $50,000 in a one Census block group from a 500-year wind event.

Table 5-41 Building Stock Replacement Value (Structure Only), by Occupancy Class

Occupancy Class	Replacement Value
Residential	$11,164,214,000
Commercial	$3,679,035,000
Industrial	$855,155,000
Agricultural, Religious, Government, Education	$1,334,784,000
Total County Replacement Value	$17,063,188,000

Source: Hazus 4.2 SP1 2018

Notes:

(1) Replacement value (RV) reflects the building structure and does not include building contents. The valuation of general building stock and the loss estimates determined in Saratoga County were based on the default general building stock database provided in Hazus MR3. The general building stock valuations provided in Hazus MR3 are Replacement Cost Value from RS Means as of 2006.

Table 5-42 Estimated Saratoga County Building Replacement Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Winds

Occupancy Category	Building Value Damage (Structure Only)	
	100-Year	500-Year
Residential	$1,176,159	$21,241,113
Commercial	$0	$376,202
Industrial	$0	$70,026
Agricultural, Religious, Government, Education	$0	$30,814,782

Source: Hazus 4.2 SP1 2018

Table 5-43 Estimated Building Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Winds

Jurisdiction	Total (All Occupancy Classes)		Residential Buildings		Commercial Buildings		Industrial Buildings	
	100 Yr.	500 Yr.	100 Yr.	500 Yr.	100 Yr.	500 Yr.	100 Yr.	500 Yr.
Ballston	$79,456	$2,601,184	$79,456	$1,077,803	$0	$14,423	$0	$4,205
Charlton	$9	$833,088	$9	$541,394	$0	$2,096	$0	$684
Clifton Park	$373,135	$9,315,555	$373,135	$4,346,536	$0	$75,816	$0	$8,442
Corinth	$190	$1,561,309	$190	$440,768	$0	$5,570	$0	$2,232
Day	$0	$87,024	$0	$86,177	$0	$3	$0	$1
Edinburg	$0	$82,166	$0	$82,123	$0	0	$0	$0
Galway	$0	$947,769	$0	$449,129	$0	$2,147	$0	$618
Greenfield	$45	$1,262,661	$45	$679,242	$0	$5,787	$0	$1,757
Hadley	$0	$450,777	$0	$117,530	$0	$1,016	$0	$225
Halfmoon	$132,752	$2,891,929	$132,752	$1,692,659	$0	$31,894	$0	$5,550
Malta	$129,638	$2,541,969	$129,638	$1,624,214	$0	$19,244	$0	$4,739
Mechanicville	$117	$948,091	$117	$154,399	$0	$6,724	$0	$659
Milton	$18,938	$3,926,403	$18,938	$1,550,149	$0	$21,527	$0	$6,234
Moreau	$184	$2,584,490	$184	$1,109,555	$0	$20,372	$0	$2,835
Northumberland	$44,556	$550,928	$44,556	$405,090	$0	$2,633	$0	$768
Providence	$0	$574,691	$0	$166,357	$0	$1,091	$0	$490
Saratoga	$38,890	$1,022,288	$38,890	$497,114	$0	$6,243	$0	$1,684
Saratoga Springs	$169,630	$8,380,292	$169,630	$2,436,606	$0	$95,603	$0	$10,975
Stillwater	$55,470	$1,542,821	$55,470	$731,551	$0	$6,098	$0	$3,081
Waterford	$25,492	$2,039,535	$25,492	$386,478	$0	$7,631	$0	$7,991
Wilton	$53,499	$2,789,825	$53,499	$1,543,880	$0	$22,383	$0	$2,157
Village of Ballston Spa	$22,141	$1,596,540	$22,141	$337,819	$0	$10,956	$0	$1,677
Village of Corinth	$0	$842,521	$0	$153,138	$0	$3,920	$0	$1,554
Village of Galway	$0	$5,458	$0	$2,586	$0	$12	$0	$4
Village of Round Lake	$6,818	$124,148	$6,818	$70,130	$0	$1,193	$0	$342
Village of Schuylerville	$198	$249,604	$198	$54,599	$0	$1,385	$0	$171
Village of South Glens Falls	$0	$987,756	$0	$223,153	$0	$5,658	$0	$270
Village of Stillwater	$460	$568,295	$460	$110,910	$0	$1,156	$0	$321
Village of Victory	$165	$234,076	$165	$51,053	$0	$1,298	$0	$160
Village of Waterford	$24,376	$958,929	$24,376	$118,971	$0	$2,323	$0	$201
Saratoga County	$1,176,159	$52,502,123	$1,176,159	$21,241,113	$0	$376,202	$0	$70,026

Source: Hazus 4.2 SP1 2018

Figure 5-30 Estimated Residential Building Loss for a 100-Year MRP Wind Event by Census Block

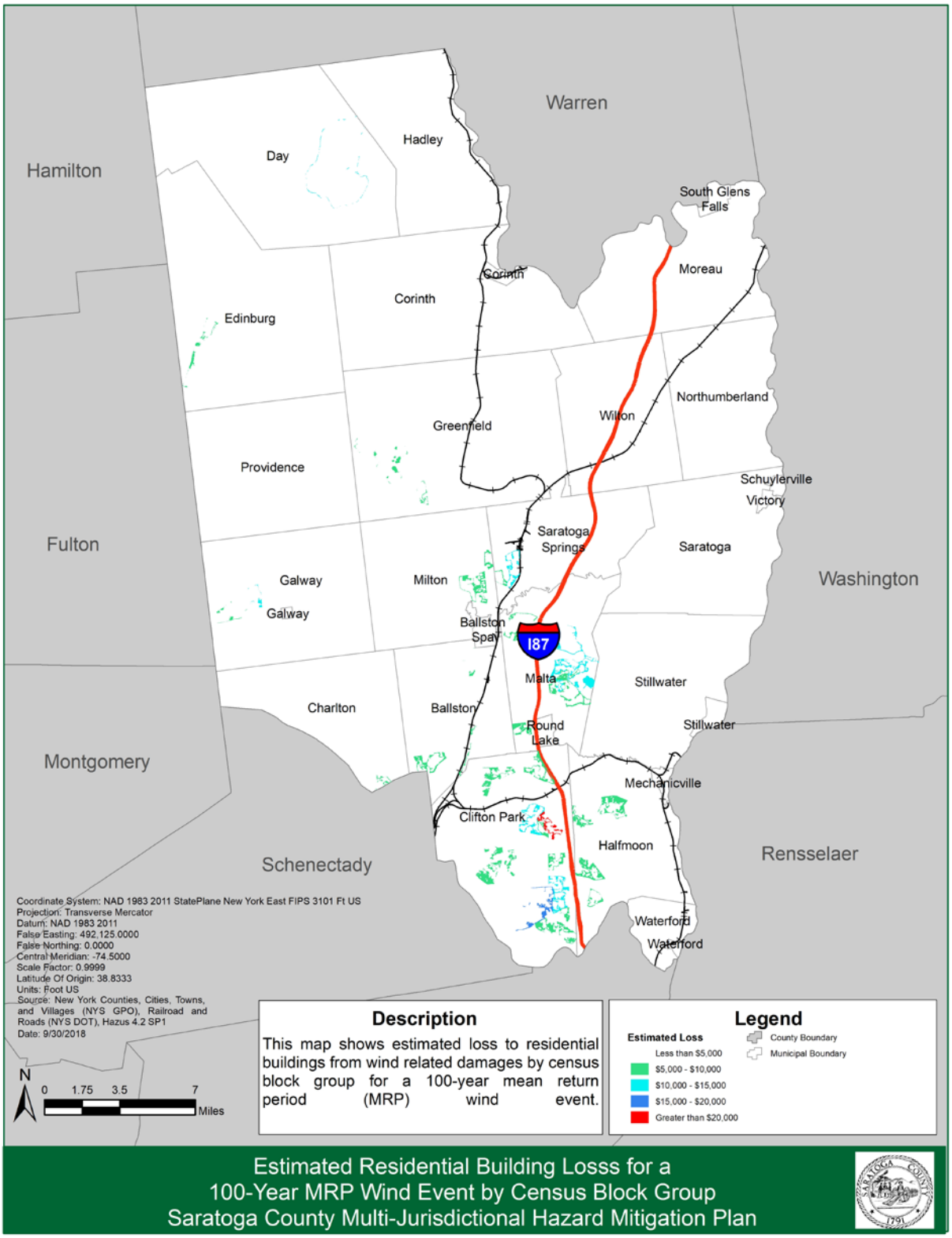
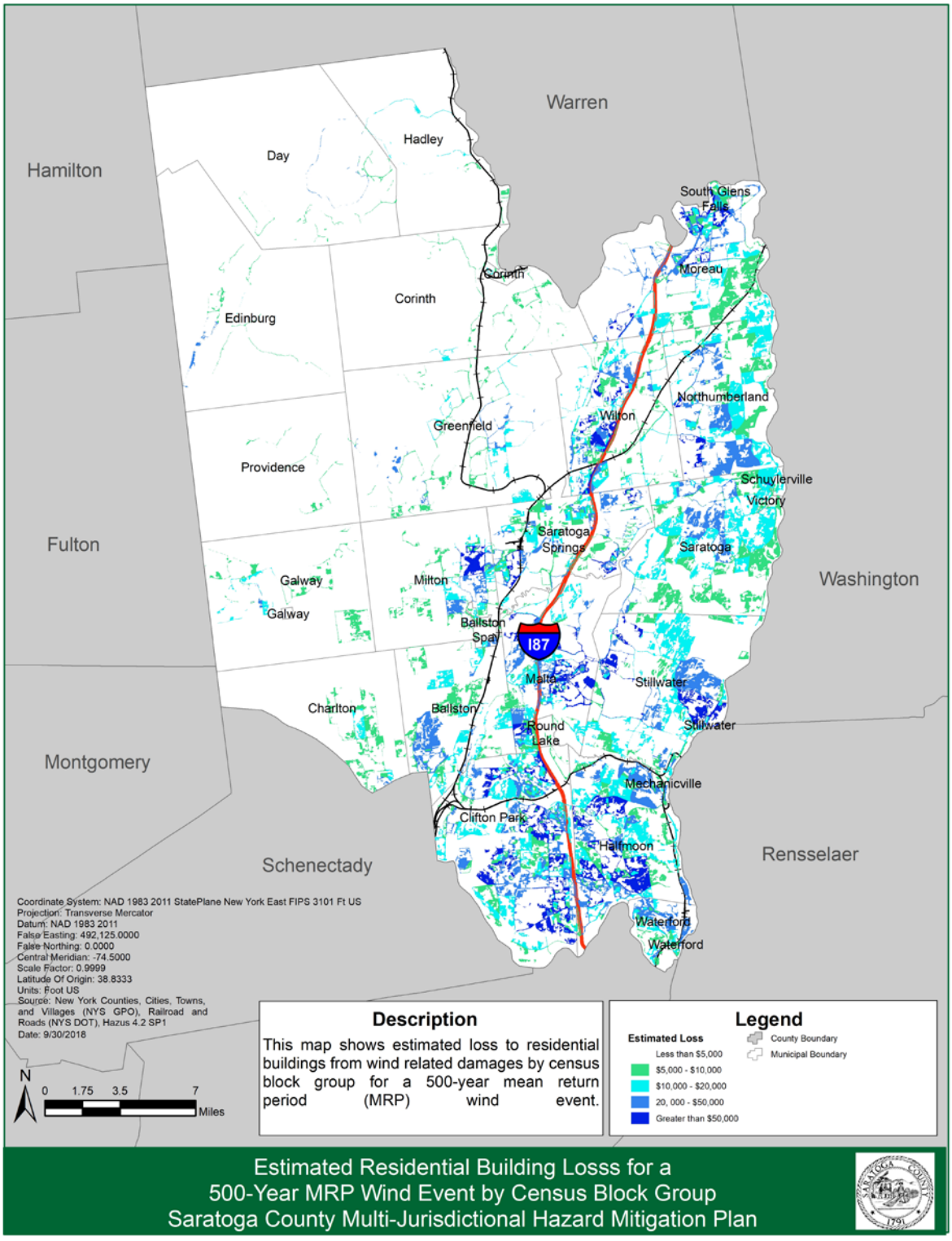


Figure 5-31 Estimated Residential Building Loss for a 500-Year MRP Wind Event by Census Block



Impact on Critical Facilities

Severe storms can detrimentally impact critical facilities. Lightning, or hail, can strike power lines and cause outages, which will have subsequent impacts on delivery of services and continuity of operations. Lack of city power during these events causes production loss at critical facilities, such as at the Ball Metal Beverage Container Corporation, due to inability to discharge water. There is also a risk of downed trees/limbs and broken poles. Other aspects of severe storms, such as downbursts, tornadoes, hailstorm, windstorm, and thunderstorms can cause extensive structural damage to critical facilities and infrastructure, including roads, equipment, bridges, and culverts.

Hazus estimates the police departments, fire stations, hospitals and schools would not suffer damages during a 100 and 500-year event. All facilities are expected to be fully functional after the first day of the event.

Impact on Economy

Severe storms 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. Direct building losses are the estimated costs to repair or replace the damage caused to the building. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the storm. Additionally, road closures caused by severe storms can prohibit access to businesses.

Transportation lifelines are not considered particularly vulnerable to a severe storm wind hazard. However, utility structures could suffer damage associated with falling tree limbs or other debris. Such impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts).

Hazus estimates that the total economic loss for the 100-year MRP wind event to be $1.8 million and the total economic loss for the 500-year MRP wind event to be $30.4 million.

Impacts on Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the severe storm hazard because the entire planning area is exposed and vulnerable. Please refer to Section 4 and each jurisdictions' annex (Section 9) for maps that illustrate where potential new development is in relation to Saratoga County's hazard areas.

Considerations for Future Data Analysis

Over time, Saratoga County will obtain additional data to support the analysis of this hazard. Data that will support the analysis would include additional detail on past hazard events and impacts, additional information on estimated frequency of these events, and future data regarding events and damages as they occur. In addition, information on buildings or infrastructure and their value

will support updates regarding the particular assets in the County that are most vulnerable to severe storm (wind related) events. Additional utility data would support an improved assessment of potential damage for this infrastructure category.

For the severe storm events that cannot currently be directly modelled in Hazus (tornado, thunderstorm, etc.), additional detailed loss data from past and future events will assist in assessing potential future losses. Based on these values and a sufficient number of data points, future losses could be modeled.

5.11.7 Conclusions

The Severe Storms, especially high wind events, are a frequent hazard in Saratoga County that continues to cause damages to buildings and down trees and powerlines. This hazard was ranked overall as a “high” risk by the Planning Team for Saratoga County with a “frequent” probability of occurrence (see Table 5-5). This hazard can be managed and planned for through the mitigation strategy and specific activities that build on efforts already undertaken by these communities.

5.12 Severe Winter Storm

This section describes the nature of severe winter storm hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.12.1 Description

For this HMP and as deemed appropriated by Saratoga County, most severe winter storm hazards include heavy snow, blizzards, sleet, freezing rain, ice storms and can be accompanied by extreme cold. Since most extra-tropical cyclones, particularly northeasters (or Nor’easters) generally take place during the winter weather months (with some exceptions), Nor’easters have also been grouped as a type of severe winter weather storm in this section. These types of winter events or conditions are listed in alphabetical order and further defined below:

Blizzard: A blizzard is characterized by the following conditions prevailing or expected to prevail for a period of three hours or longer: Sustained wind or frequent gusts to 35 miles an hour or greater, and considerable falling and/or blowing snow (i.e., reducing visibility frequently to less than ¼ mile) (NOAA, 2018).

Extra-Tropical Cyclone: A cyclone or group of cyclones in the middle and high latitudes of the Earth, often defined as synoptic scale, low-pressure weather systems. Cyclones usually contain a cold front that extends toward the equator for hundreds of kilometers. These storms have neither tropical nor polar characteristics and relate to fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones". Extra-tropical cyclones are everyday weather phenomena which, along with anticyclones, drive the weather over much of the Earth. These cyclones produce impacts ranging from cloudiness and mild showers to heavy gales and thunderstorms. (Canadian Hurricane Centre [CHC], 2003; NOAA, 2018).

Extreme Cold: Extreme cold events are when temperatures drop well below normal in an area. Extremely cold temperatures often accompany a winter storm. More information on extreme cold events can be found in the Extreme Temperatures hazard profile.

Heavy Snow: According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to four inches or more in depth in 12 hours or less; or snowfall accumulating to six inches or more in depth in 24 hours or less. A snow squall is an intense, but short period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers) (NOAA, 2018).

Snowstorms are complex phenomena involving heavy snow and winds, whose impact can be affected by a great many factors, including a region's climatologically susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and occurrence during the day, weekday versus weekend, and time of season (Kocin and Uccellini, 2004).

Ice Storm: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous and can create extreme hazards to motorists and pedestrians (NOAA, 2018).

Nor'easter: A strong low-pressure system that affects the Mid-Atlantic and New England States. It can form over land or over the coastal waters. These winter weather events are notorious for producing heavy snow, rain, and tremendous waves that crash onto Atlantic beaches, often causing beach erosion and structural damage. Wind gusts associated with these storms can exceed hurricane force in intensity. A Nor'easter gets its name from the continuously strong northeasterly winds blowing in from the ocean ahead of the storm and over the coastal areas.

Unlike tropical cyclones that form in the tropics and have warm cores (including tropical depressions, tropical storms and hurricanes), Nor'easters contain a cold core of low barometric pressure that forms in the mid-latitudes. Their strongest winds are close to the earth's surface and they often measure several hundred miles across. Nor'easters may occur at any time of the year but are most common during the fall and winter months (September through April).

Nor'easters can cause heavy snow, rain, gale force winds, and oversized waves (storm surge) potentially leading to beach erosion, coastal flooding, structural damage, power outages and unsafe human conditions. If a Nor'easter cyclone stays just offshore, the results are much more devastating than if the cyclone meanders up the coast on an inland track. Nor'easters that stay inland are generally weaker and only cause strong wind and rain. Those that stay offshore can bring heavy snow, blizzards, ice, strong winds, high waves, and severe beach erosion. In these storms, the warmer air is aloft. Precipitation falling from this warm air moves into the colder air at the surface, causing crippling sleet or freezing rain.

If a significant pressure drop occurs within a Nor'easter, this change can turn a simple extra-tropical storm into what is known as a "bomb." "Bombs" are characterized by a pressure drop of at least 24 millibars within 24 hours (similar to a rapidly-intensifying hurricane). Even though

“bombs” occasionally share some characteristics with hurricanes, the two storms have several differences. “Bombs” (being a type of Nor’easter) are extra-tropical, and therefore, are associated with fronts, higher latitudes, and cold cores (Loff, 2018).

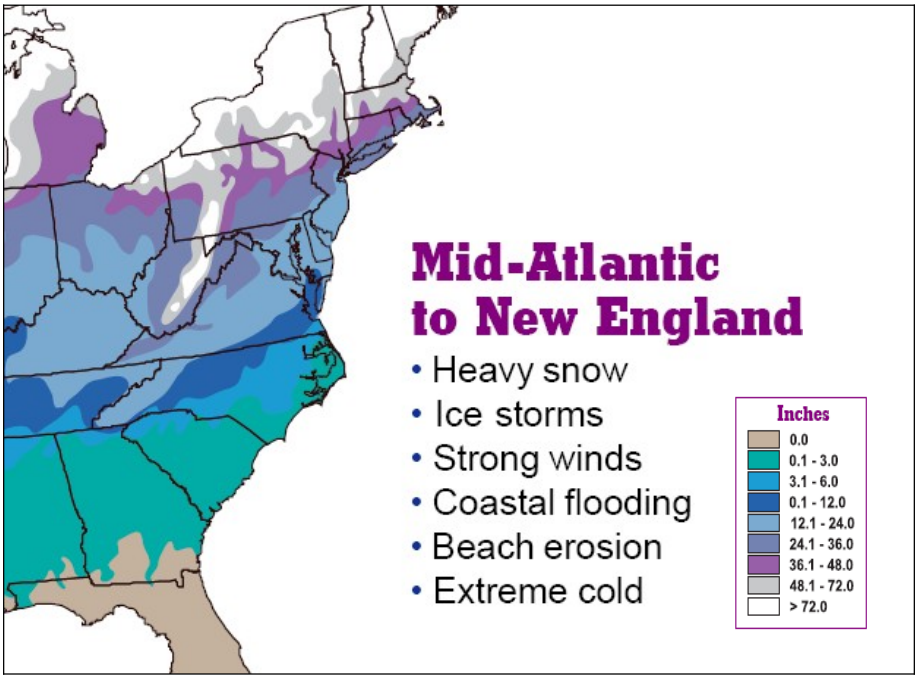
Sleet or Freezing Rain: Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NOAA, 2018).

Snowmelt: Sudden thaw of a heavy snow pack often leads to flooding (National Severe Storms Laboratory [NSSL], 2006).

5.12.2 Location

Winter weather, particularly snowstorm events, has historically affected many U.S. states, mainly in the Northeast and Midwest. Abundant snowfall marks the climate of New York State. Winter weather can reach New York State as early as October and is usually in full force by late November with average winter temperatures between 20 and 40°F. As indicated in the New York State HMP, communities in New York State receive more snow than most other communities in the nation. Although the entire State of New York is subject to winter storms, the eastern and west-central portions of the State are more likely to suffer under winter storm occurrences than any other location (New York State Disaster Preparedness Commission [NYSDPC], 2008). The average annual snowfall is greater than 70 inches over 60% of New York State's area. Saratoga County receives between 48 and 72 inches of snow annually (Figure 5-32).

Figure 5-32 Annual Mean Snowfall within the Eastern U.S.



Source: NWS, 2001

Topography, elevation and proximity to large bodies of water result in a great variation of snowfall in the State's interior, even within relatively short distances. Maximum seasonal snowfall, averaging more than 175 inches, occurs on the western and southwestern slopes of the Adirondacks and Tug Hill. A secondary maximum of 150 to 180 inches prevails in the southwestern highlands, some 10 to 30-miles inland from Lake Erie.

The NYSDPC and NYS DHSES listed Saratoga County as the 20th County in the State most threatened by and vulnerable to snow and snow loss, with an annual average snowfall of 68.7 inches. Saratoga County is also listed as the 40th County in New York State most threatened by and vulnerable to ice storms and ice storm loss (NYSDPC, 2008). Although Saratoga County is not ranked as a highly susceptible county to snow and ice hazards, they do constitute a hazard of local concern because of their frequency, drain on local resources and potential for economic hardships, property damage and transportation disruption.

5.12.3 Extent

The extent 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, time of occurrence during the day (e.g., weekday versus weekend), and time of season. The extent of a severe winter storm can be classified by meteorological measurements such as those detailed in the definitions above, as well as by evaluating its societal impacts. The Northeast Snow Impact Scale (NESIS) categorizes snowstorms, including Nor'easter events, in this manner.

Unlike the Fujita and Saffir-Simpson Scales that characterize tornados and hurricanes, respectively, there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS to characterize and rank high-impact, northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. These numbers are calculated into a raw data number ranking from "1" for an insignificant fall to over "10" for a massive snowstorm. Based on these raw numbers, the storm is placed into its appropriate category. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers (Enloe, 2007). This scale is detailed in the table below:

Table 5-44 NESIS Ranking Categories 1 – 5

Category	Description	NESIS Range	Definition
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4-in. (10-cm) accumulations and small areas of 10-in. (25-cm) snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10-in. (25- cm) snows while some include small areas of 20-in. (50-cm) snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations [greater than 30 in. (75 cm)].
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10-in. snows (generally between 50 and 150 × 103 mi2 — roughly 1–3 times the size of New York State with significant areas of 20- in. (50-cm) accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10-in. (25-cm) snowfalls, and each case is marked by large areas of 20-in. (50-cm) and greater snowfall accumulations.
5	Extreme	10+	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 in. (25, 50, and 75 cm). These are the only storms in which the 10-in. (25-cm) accumulations exceed 200 × 103 mi2 and affect more than 60 million people.

Source: Kocin and Uccellini, 2004 Notes: cm = centimeters. in = inches. mi2 = square miles.

In comparison to winter storms, predicting the extent and impact of a Nor'easter can be more complex. The Dolan-Davis Nor'easter Intensity Scale can categorize the extent of a Nor'easter. In 1993, researchers Robert Davis and Robert Dolan created this scale that considers storm magnitude in terms of beach and coastal deterioration. The scale, presented in Table 5-45, categorizes or rates the intensity of Nor'easters from 1 (weak) to 5 (extreme) based on their storm class. This is used to give an estimate of the potential beach erosion, dune erosion, overwash and property damages expected from a Nor'easter (Multi-County Environmental Storm Observatory [MESO], 2002). The magnitude of a Nor'easter that impacts an area without a coastline, such as Saratoga County, is typically considered in terms of the strength of the wind and the quantity of snowfall that accompanies the storm.

Table 5-45 The Dolan-Davis Nor'easter Intensity Scale

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across the beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community level
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional scale; millions of dollars

Source: MESO, 2002

5.12.4 Past Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with flooding throughout New York State and Saratoga County. With so many sources reviewed for this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP. According to the NCEI Storm Events Database, 175 winter storm events (blizzards and heavy snow) were reported in Saratoga County from January 1996 to September 2018; 136 of these reported events occurred between 2000 and 2018 (NOAA, 2018). The number and types of events as well as the losses associated with these events are listed in the table below.

Table 5-46 Saratoga County Past Occurrences: Severe Winter Storms, 1996 - 2018

Type of Event	Total Events	Total Property Damage	Total Crop Damage	Total Deaths	Total Injuries	Annual. Events	Annual. Damages
Blizzard	77	$11,000	$0	0	7	25.67	$3,667
Heavy Snow	67	$777,300	$0	0	0	22.33	$259,100
Winter Storm	2	$0	$0	0	0	0.67	$0
Winter Weather	29	$50,000	$0	0	0	9.67	$16,667

Source: NCEI Storm Events Database, January 1996 - September 2018

Saratoga County has had four major disaster declarations related to severe winter storms. One of these disaster declarations was made since the previous plan update, when a crippling blizzard swept through the northeastern U.S. from March 14th to 15th, 2017. A full summary of all emergency declarations and major disaster declarations can be found at the beginning of Section 5.

Severe winter storms can result in injuries and deaths, and communities can suffer economic impacts. Winter storms can cause infrastructure damage and disrupt communications, inhibiting

efficient coordination of emergency services and other critical functions. Winter storms can threaten lives, properties and the environment. The resources and agencies that manage a large winter storm operation are complex and require aid from many different agencies and jurisdictions.

Descriptions of particularly severe winter storms that have impacted Saratoga County in the past are provided below. These descriptions are provided to give the reader a context of the winter storm events that have affected the County and to assist local officials in locating event-specific data for their municipalities.

Monetary figures within the event descriptions were USD figures calculated during or within the approximate time of the event (unless present day recalculations were made by the sources reviewed). If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

March 11-14, 1888 ("Blizzard of '88" or "Great White Hurricane"): The "Blizzard of '88," remains perhaps the most infamous and unpredictable of all Northeast snowstorms. This event paralyzed the east coast of the U.S. and Atlantic Canada from the Chesapeake Bay to Maine and beyond, also affecting the Maritime Provinces of Eastern Canada. Communication infrastructure was disabled, isolating New York City, Boston, Philadelphia, Baltimore, and Washington, D.C. for days. Two hundred ships were grounded and at least one hundred seamen died. Fire stations were immobilized; property losses from fire alone were estimated at $25 million. Saratoga County received between 30 and 50 inches of snow during this storm (Kocin and Uccellini, 2004). Saratoga Springs received the highest amount of snow in New York State, averaging 58 inches (Lott, 1993).

March 12-15, 1993 ("Superstorm of 1993," "Storm of the Century" or "Great Storm of 1993") (FEMA EM-3107): This storm was identified as both a Nor'easter and a blizzard by many sources. It was a massive storm complex, affecting at least 26 states and much of eastern Canada. The March 1993 storm is listed among the NOAA Top Billion Dollar Weather Disasters (Miller, 1995-2007), reportedly causing a total of $6.6 billion in damages along the eastern coast of the U.S. and resulting in over 270 fatalities (23 fatalities in New York State) (Lott, 1993). According to NYS HMP and NYS DHSES, this blizzard resulted in total eligible damages of approximately $8.5 million through New York State (NYSDPC, 2008; NYS DHSES, 2006).

Achieving a NESIS rating of 12.52, the "Storm of the Century" ranks as an 'Extreme' snow event. With a final total of five to 50 inches of snowfall from Maine to Florida and hurricane force winds, the storm ground most of the Eastern seaboard to a halt for days. Total snowfall accumulations for Saratoga County were between 20 and 30 inches (Kocin and Uccellini, 2004).

The storm resulted in a statewide FEMA Emergency Declaration (FEMA EM-3107) on March 17, 1993. Through this declaration, all counties were declared eligible for federal and State disaster public assistance funds (NYS DHSES, 2006; FEMA, 2008).

March 4-7, 2001: A major snowstorm caused snow to fall at a rate of one inch per hour throughout the northeastern U.S. over a two-day period. Snowfall amounts ranged from 10 to 30 inches. High winds caused snowdrifts and whiteout conditions in many parts of southern and central New York

State (NCEI, 2007). Achieving a NESIS rating of 3.53, this event places itself in the 'Significant' category (Kocin and Uccellini, 2004).

The heaviest snowfall from this event fell across Pennsylvania, New York State, and New England. Snowfall totals for Saratoga County ranged from 10 inches to 30 inches (Kocin and Uccellini, 2004). Specific snowfall totals within the County include:

- Jonesville (32 inches)
- Saratoga Springs (31.5 inches)
- Ballston Lake (30.5 inches)
- Porter Corners (30 inches)
- Mechanicville (30 inches)
- Malta (29 inches)
- Ballston Spa (27 inches)
- Charlton (26 inches)
- Milton (25.5 inches)
- Greenfield Center (25 inches)
- Burnt Hills (24.5 inches)
- Clifton Park (24 inches)
- Corinth (24 inches)
- Northumberland (24 inches)
- South Glens Falls (23.5 inches)
- Middle Grove (21 – 23 inches)
- Edinburg (21 inches)
- Rexford (20.5 inches) (Freedom Communications, 2008).

December 24-26, 2002 and January 2-4, 2003 (FEMA EM-3173): Two major storm systems extending through the northeastern U.S. on December 25-26, 2002 and January 3-4, 2003. Achieving a NESIS rating of 4.42, the December event placed itself in the 'Major' category (Figure 5.4.2-8) (Kocin and Uccellini, 2004).

Snowfall totals in Saratoga County ranged between 10 to 30 inches during the December event. A transformer malfunction left 2,600 customers in the dark in the Ballston Spa area with spotty power outages noted elsewhere. Specific snowfall totals within the County include:

- Town of Galway (22.6 inches)
- Harmony Corners (21.5 inches)
- Village of Ballston Spa (22.0 inches)
- Town of Clifton Park (18.2 inches) (NWS, 2003)

The second storm on January 3-4, 2003 brought heavy snow to New York State, resulting in approximately $434,000 in property damages in the counties affected. Achieving a NESIS rating of 2.65, this event placed itself in the 'Significant' category (Kocin and Uccellini, 2004). Snowfall totals in Saratoga County ranged between 14 and 22 inches during this January event and resulted in nearly $29,000 in property damages. Specific snowfall totals within the County include:

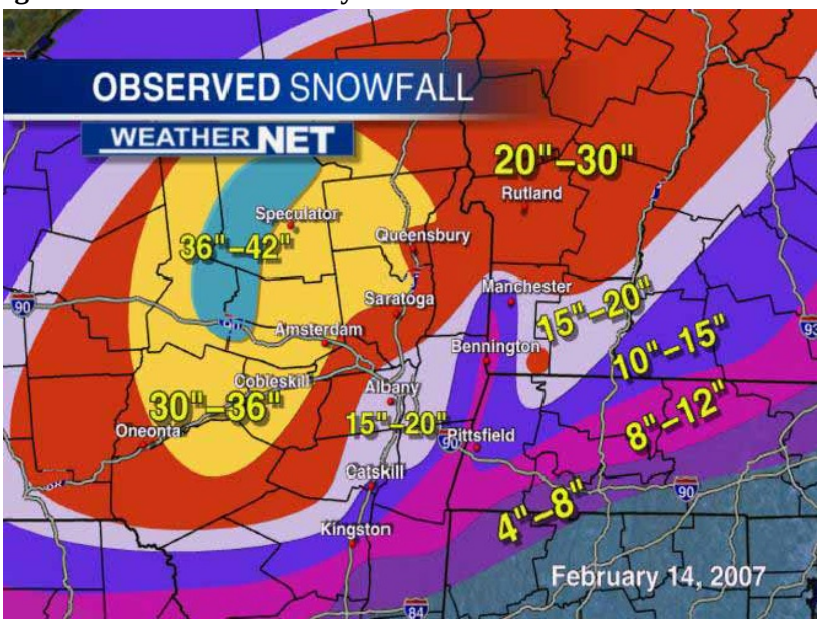
- Malta (22.0 inches)
- Clifton Park (19.0 inches)
- Providence (18.0 inches)
- Charlton (18.0 inches)
- Saratoga Springs (14.0 to 19.0 inches)
- Jonesville (17.5 inches)
- Gansevoort (16.0 inches)
- Greenfield Center (16.0 inches)
- Galway (16.0 inches)
- Milton (15.1 inches)
- Hadley (15.0 inches)
- Edinburg (14.0 inches)
- Corinth (14.0 inches) (Freedom Communications, 2008)

These storms resulted in a FEMA Emergency Declaration (FEMA EM-3173) on February 25, 2003. Through this declaration, the following Counties were declared eligible for federal and State disaster funds: Albany, Broome, Chenango, Columbia, Delaware, Fulton, Greene, Herkimer, Madison, Montgomery, Oneida, Orange, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Sullivan, Tioga and Ulster (NYS DHSES, 2006; FEMA, 2008). As of April 29, 2003, FEMA indicated that $11.3 million in disaster aid was approved for the Counties affected by these storms. Saratoga County received $559,025 in disaster aid from this event (FEMA, 2003).

February 12-15, 2007 ("Valentine's Day Storm"): The "Valentine's Day Storm" was the largest storm to affect central New York State and north-northeast Pennsylvania during the 2006-2007 winter season. In much of the area, the storm was the biggest blizzard in several years with snow accumulations of over two to three feet in some locations (Evans, 2007). This storm achieved a NESIS rating of 5.63, placing the storm in the 'Major' category (Kocin and Uccellini, 2004). The following snowfall totals were provided by NWS for Saratoga County communities:

- Porter Corners (30.5 inches)
- Greenfield Center (30.0 inches)
- Gansevoort (27.0 inches)
- South Glens Falls (24.0 inches)
- Waterford (23.5 inches)
- Saratoga Springs (22.0 inches)
- Jonesville (22.0 inches)
- Wilton (22.0 inches)
- Middle Grove (21.8 inches)
- Ballston Lake (21.0 inches)
- Burnt Hills (20.5 inches)
- Clifton Park (20.1 inches)
- Round Lake (20.0 inches)
- Vischer Ferry (19.0 inches)
- Malta (18.0 inches)
- Mechanicville (18.0 inches) (NWS, 2007)

Figure 5-33 "Valentine's Day Storm" 2007 Snowfall Accumulations



Source: CBS, 2007

5.12.5 Probability of Future Events

Winter storm hazards in New York State are virtually guaranteed yearly since the State is located at relatively high latitudes where resulting winter temperatures range between zero degrees Fahrenheit and 32°F for a good deal of the fall through early spring season (late October until Mid-April). In addition, the State is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that several significant winter storms will occur during the Winter and Fall season, what is not easily determined is how many such storms will occur during that time frame (NYSDPC, 2008). Similar to winter storms, the frequency of occurrence for ice storms cannot be predicted.

Based on historical records and input from the County Planning Team, the probability of occurrence for severe winter storms in Saratoga County is considered "frequent", with at least one event occurring annually. Based on historical snow related disaster declaration occurrences, New York State can expect a snow storm of disaster declaration proportions, on average, once every 3-5 years. Similarly, for ice storms, based on historical disaster declarations, it is expected that on average, ice storms of disaster proportions will occur once every 7-10 years within the State (NYSDPC, 2008). Based on historical winter storm event data summarized in Table 5-46, Saratoga County could experience as many as five winter storm or winter weather related incidents in any given year. Heavy snow events and blizzards are less frequent but still likely to occur once a year or once every couple of years.

5.12.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of extreme temperatures in Saratoga County, including:

- Data and methodology used for the evaluation;
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development; and
- Further data collections that will assist understanding of this hazard over time.

Data and Methodology

National weather databases and local resources were used to collect and analyze severe winter storm and extreme cold temperature impacts on the County.

Impact on Life, Health, and Safety

According to the NOAA's NSSL, winter storms indirectly and deceptively kill hundreds of people in the U.S. every year, 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 snow and ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Snow and ice 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 severe winter storms each year is extensive, with costs for snow removal, damage and loss of business in the millions (NSSL, 2006).

Winter storm events can adversely affect all people, but infants, persons 65 years or older, and the homeless population are especially vulnerable. Human vulnerability is impacted by the availability, reception, understanding of advanced warnings of impending significant winter weather events (e.g., Winter Storm Watches and Warnings issued by the NWS), and heeding the advice of local officials. In some cases, despite having access to technology (e.g., computers, radio, television) and resources that enable the reception of a watch or warning, language barriers may prevent individuals from understanding and responding appropriately. Socially vulnerable populations and rural communities are especially at-risk during winter storms. Outdoor animals are also susceptible to exposure to winter storms, which may lead to illness or death.

For the purposes of this HMP, the entire population in Saratoga County (229,869 people) is exposed to severe winter storm (U.S. Census Bureau, 2017). Snow accumulation and frozen road surfaces increase the frequency and impact of traffic accidents for the general population, resulting in personal injuries. As mentioned above, the elderly, children and the homeless or those living in poverty are particularly vulnerable to the effects of severe winter storms. Table 5-47 summarizes these vulnerable populations in Saratoga County:

Table 5-47 Vulnerable Population Exposed to Severe Winter Storm Events in Saratoga County, 2017 (U.S. Census Bureau, 2017)

Population	Number of Persons Exposed	Percent of Total 2017 Saratoga County Population
Elderly (Over 65 years of age)	40,227	17.5%
Children (Under five years of age)	11,953	5.2%
All Populations Living in Poverty	14,481	6.3%

*The U.S. Census Bureau poverty threshold for an individual aged 65 years or older in 2017 is $11,756. For individuals under age 65, the 2017 threshold is $12,752.

Impact on General Building Stock

The entire general building stock inventory in Saratoga County is exposed and vulnerable to the severe winter storms. In general, structural impacts include damage to roofs and building frames. Historic information indicates Saratoga County has experienced losses up to $833,000 in damages due to a single severe winter storm event. In that case, the losses were experienced due to a freezing rain event in December 1991; however, specific losses to structures are unknown. Additionally, Saratoga County has received greater than $500,000 in disaster aid for the severe winter storm events from December 2002 to January 2003 (FEMA EM-3173).

Severe winter storms can cause several secondary impacts to structures and buildings. Downed powerlines due to heavy snow and ice can lead to a loss of electricity and heat in homes and

businesses. Extended power outages would require residents to identify supplemental heat sources and increase the risk for injury or death caused by house fires or carbon monoxide poisoning. Additionally, many Saratoga County residents and businesses rely on electricity or utility gas to heat their homes and properties. While gas may still be available during a power outage, equipment required to convert the gas to heat (i.e., furnaces) may not function if they have electric components. Attempts to re-ignite furnaces without adequate knowledge, proper ventilation, or failure to notice the smell of gas may cause injury to the individual by igniting gas and causing burns or fires.

Historic data and current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. Table 5-48 summarizes the exposure of the County's building stock to the severe winter storm hazard by estimating the losses from 1, 5, and 10-percent damage of this inventory.

Table 5-48 Building Stock Estimated Losses from Severe Winter Storm Events in Saratoga County

Municipality	Building Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Town of Ballston	$876,506,396.00	$8,765,063.96	$43,825,319.80	$87,650,639.60
Village of Ballston Spa	$333,720,611.00	$3,337,206.11	$16,686,030.55	$33,372,061.10
Town of Charlton	$425,554,696.00	$4,255,546.96	$21,277,734.80	$42,555,469.60
Town of Clifton Park	$3,819,963,168.00	$38,199,631.68	$190,998,158.40	$381,996,316.80
Town of Corinth	$220,614,690.00	$2,206,146.90	$11,030,734.50	$22,061,469.00
Village of Corinth	$262,389,707.00	$2,623,897.07	$13,119,485.35	$26,238,970.70
Town of Day	$201,737,200.00	$2,017,372.00	$10,086,860.00	$20,173,720.00
Town of Edinburgh	$294,140,455.00	$2,941,404.55	$14,707,022.75	$29,414,045.50
Town of Galway	$413,703,204.00	$4,137,032.04	$20,685,160.20	$41,370,320.40
Village of Galway	$13,492,034.00	$134,920.34	$674,601.70	$1,349,203.40
Town of Greenfield	$555,461,227.00	$5,554,612.27	$27,773,061.35	$55,546,122.70
Town of Hadley	$192,685,096.00	$1,926,850.96	$9,634,254.80	$19,268,509.60
Town of Halfmoon	$2,276,393,391.00	$22,763,933.91	$113,819,669.55	$227,639,339.10
Town of Malta	$1,903,048,536.00	$19,030,485.36	$95,152,426.80	$190,304,853.60
City of Mechanicville	$220,467,044.00	$2,204,670.44	$11,023,352.20	$22,046,704.40
Town of Milton	$1,414,331,466.00	$14,143,314.66	$70,716,573.30	$141,433,146.60
Town of Moreau	$912,451,770.00	$9,124,517.70	$45,622,588.50	$91,245,177.00
Town of Northumberland	$279,005,151.00	$2,790,051.51	$13,950,257.55	$27,900,515.10
Town of Providence	$125,873,850.00	$1,258,738.50	$6,293,692.50	$12,587,385.00
Village of Round Lake	$61,600,000.00	$616,000.00	$3,080,000.00	$6,160,000.00
Town of Saratoga	$380,781,300.00	$3,807,813.00	$19,039,065.00	$38,078,130.00
City of Saratoga Springs	$3,954,430,081.00	$39,544,300.81	$197,721,504.05	$395,443,008.10

Municipality	Building Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Village of Schuylerville	$92,432,100.00	$924,321.00	$4,621,605.00	$9,243,210.00
Village of South Glens Falls	$253,199,150.00	$2,531,991.50	$12,659,957.50	$25,319,915.00
Town of Stillwater	$619,866,264.00	$6,198,662.64	$30,993,313.20	$61,986,626.40
Village of Stillwater	$109,130,358.00	$1,091,303.58	$5,456,517.90	$10,913,035.80
Village of Victory	$25,131,900.00	$251,319.00	$1,256,595.00	$2,513,190.00
Town of Waterford	$595,055,621.00	$5,950,556.21	$29,752,781.05	$59,505,562.10
Village of Waterford	$78,012,019.00	$780,120.19	$3,900,600.95	$7,801,201.90
Town of Wilton	$1,661,902,631.00	$16,619,026.31	$83,095,131.55	$166,190,263.10
Total:	$22,573,081,116.00	$225,730,811.16	$1,128,654,055.80	$2,257,308,111.60

Source: NYS Statewide Tax Parcel Centroid Points, August 2018

Impact on Critical Facilities

Heavy snow and other winter storm effects can cause power outages, potentially affecting critical facilities and infrastructure including utilities, transportation networks, emergency medical services, and communications. While the impact of a severe winter storm on physical structures is likely to be minor, frozen and burst water pipes can lead to flooding. Damages may cause disruptions in service for critical facilities.

Transportation infrastructure may be heavily impacted by severe winter weather, causing detours, delays, and accidents. Roads and bridges can be completely obstructed by downed trees, powerlines, and snow accumulation. Snow and ice can impact access to homes and critical facilities such as hospitals, schools, and supermarkets. Power loss can lead to disruption of critical infrastructure and technology.

Reduced functionality or loss of critical infrastructure may have devastating impacts on the economy. Without power, communications, or transportation, commerce will slow or completely halt until the infrastructure is restored. Employees will be unable to commute to work, unable to conduct operations without power, or unable to purchase goods or services with bank cards or credit cards. The cost of snow removal, repairing damage, and the loss of business caused by power outages can have severe economic impacts.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. 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 from traveling to work within and outside of the County.

Impact on Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. For the severe winter storm hazard, the entire County has been identified as the hazard area.

Considerations for Future Data Analysis

It is anticipated that the County will continue to experience severe winter storm events during the winter weather months. Many sources indicate that climate change is contributing to shifts in the severity and frequency of weather events, including severe winter storms, across the nation. Research has indicated that temperatures will become warmer, even during winter weather months, which could influence the quantity of winter storm events through the U.S. in general and Saratoga County in particular.

All of North America is very likely to warm during this century, according to the Fourth Assessment Report of the IPCC, and the annual mean warming is likely to exceed the global mean warming in most areas. In northern regions which would include New York State, warming is likely to be greatest in winter. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America, and the highest summer temperatures are likely to increase more than the average summer temperature in the southwest U.S (IPCC, 2007). If temperatures become warmer, as predicted, the occurrence of winter storms is anticipated to decrease or have less of an impact; therefore, making it difficult to predict the probability of winter-related events. Although many uncertainties exist regarding magnitude, severity or impact of climate change, the U.S. Environmental Protection Agency indicated that future temperature changes, including a greater number of heat waves, are anticipated as a result, along with atmospheric, precipitation, storm and sea level changes (US Environmental Protection Agency [US EPA], 2007).

If scientific predictions are accurate and based on regional studies that have been done for New York State and its neighbors, it is anticipated that Saratoga County will be no exception and will also experience a change in temperatures in the future, which will determine the overall severity of winter conditions within the County. Although warming temperatures year-round may reduce the length of the winter season and increase temperatures overall, warming temperatures can also contribute to an increase in the amount of snow due to something called “the Goldilocks effect”. This effect refers to the fact that for snow to fall, temperatures must not be too warm or too cold. Temperatures in the “Goldilocks” range, between about 28°F and 32°F, accompanied by moisture, mean more snow. The amount of snowfall at 32°F would be at least double that at 14°F (The Conversation, 2015).

5.12.7 Conclusions

Severe winter storms are common in Saratoga County, often causing impacts and losses to the local population and economy as well as infrastructure including roads, structures, facilities and utilities. The overall hazard ranking determined for this HMP for the severe winter storm/extreme

cold hazard is “medium” with a “frequent” probability of occurrence (see Table 5-5). Existing and future mitigation efforts should continue to be developed and employed that will enable the County to be prepared for these events when they occur.

5.13 Wildfire

This section describes the nature of wildfire hazards in Saratoga County and assesses the vulnerability of people, property, and economy to this hazard.

5.13.1 Description

Wildfires, often called forest fires, damage thousands of acres of natural resources every year in New York. A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson. Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds.

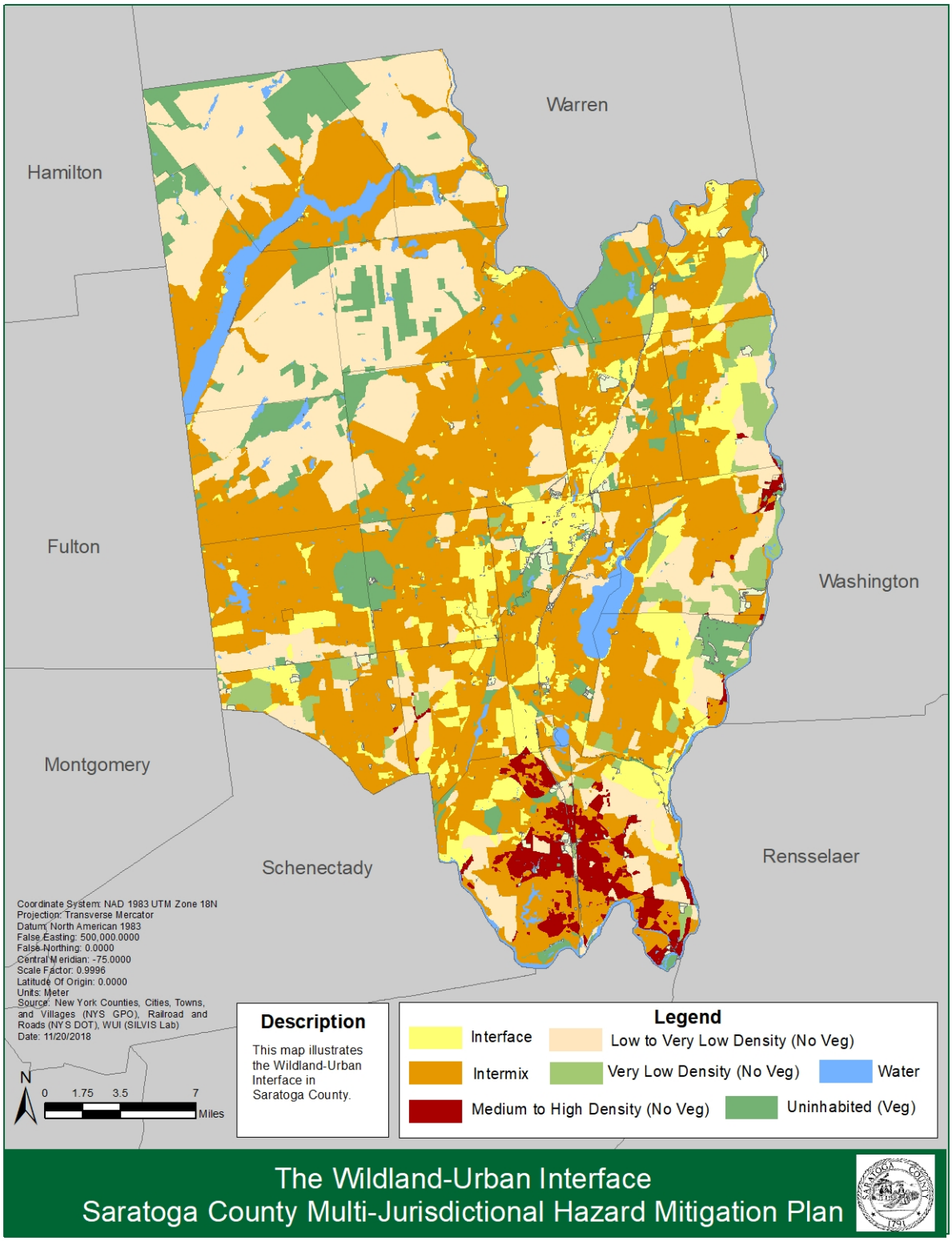
The potential for significant damage to life and property exists in areas designated as “wildland-urban interface areas,” where development is adjacent to densely vegetated areas. Devastating urban-wildland interface fires have resulted in establishment of more fire stations and facilities in hillside areas of Saratoga County, and in more stringent requirements for fire hydrant installation, hillside brush clearance, fire access road systems, home sprinklers, fire resistant construction and landscaping materials, and development of improved firefighting strategies and equipment.

5.13.2 Location

New York State is 30.9 million acres in size with 18.9 million acres of non-federal forested lands. These forests support destructive and deadly wildfires when weather conditions are favorable for fire to spread. In addition, there is an undetermined amount of open-space non-forested lands with significant wildfire potential. The wetlands of western New York State and New York City frequently burn as weather conditions allow. These fires often threaten nearby homes and businesses, thereby becoming a wildland-urban interface fire.

Wildfires can occur in any location in Saratoga County, although some areas are more susceptible than others. Northern parts of the County are fire towns where burning permits are required. These towns are more susceptible to wildfire because of the higher percentage of wild, forested, and conservation lands. Section 4 discusses land use in more detail and includes a figure that shows the land use in Saratoga County in 2016. In the wider New York region, the most wildfires have occurred in Niagara and Erie counties along the western edge of New York State, Monroe County along Lake Erie, Orange, Duchess, Rockland, Putnum, and Westchester Counties to the south as well as the counties in eastern New York City and along Long Island, and Saratoga, Schenectady, Albany, and Rensselaer Counties in the eastern part of the state. Figure 5-34 shows the wildfire risk in Saratoga County.

Figure 5-34 The Wildland-Urban Interface in Saratoga County



5.13.3 Extent

Wildfire extent is typically described by the level of severity and organized into color coded "flags" for public safety and awareness. Flag levels are based on a combination of current meteorological conditions (winds, relative humidity), longer term dryness (rainfall amounts, Keetch-Byram Drought Index) and the vegetation status. When drought or near-drought conditions warrant, the potential for wildfires spreading is real. KBDI is an index used to determine forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches) and is expressed in hundredths of an inch of soil moisture depletion. The drought profile discusses this index in more detail.

Fires may also be measured in terms of acres burned. Acreage measurements may be estimations in the early stages of response, but are also more accurately measured through infrared scanning, aerial Global Position System (GPS) readings, and on-the-ground measurements of the fire perimeter to determine the size and speed of spread of a fire.

The accurate prediction of the potential risk of a fire and the forewarning of dangerous wildfire conditions can help reduce the incidence and seriousness of wildland fires. It can also provide firefighters the critical time needed for important preparation and readiness for wildfire suppression, as well as assist decision makers in the appropriate uses and activities for the public at large during times of extreme fire danger to aid in the prevention efforts.

The following table presents the color-coded wildfire flag system and factors influencing severity levels:

Table 5-49 Wildfire Color-Coded Flag System

Rating Class and Color Code	Description
Red Flag	A short-term, temporary warning, indicating the presence of a dangerous combination of temperature, wind, relative humidity, fuel or drought conditions which 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.

Rating Class and Color Code	Description
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.

NYS Department of Environmental Conservation. 2018. Fire Danger Map. Retrieved at http://www.dec.ny.gov/lands/68329.html

5.13.4 Past Occurrences and Losses

According to NYS DEC, New York State forest rangers and fire departments have reported a total of 80,822 wildfire incidents from 2003-2017, with the top five causes during that time period in the area encompassing Saratoga County being debris burning, campfires, lightening, arson, and miscellaneous (e.g., electrical wiring on a meter or explosives and munitions without arson intent). Most recently, in April 2018, a series of small wildfires broke out in Saratoga, Sullivan, Warren, and Suffolk County due to dry conditions and high temperatures. The table below details historic occurrences of wildfire in New York State by year, number of incidents, total acres burned, and average acres burned per fire:

Table 5-50 Historic Occurrences of Wildfire in New York State

Year	Number of Wildfire Incidents	Acres Burned	Average Acres Burned Per Fire
2000	134	451	3.4
2001	460	4,545	9.9
2002	324	2,062	6.4
2003	106	594	5.6
2004	73	431	5.9
2005	208	669	3.2
2006	231	2,323	10.1
2007	211	855	4.1
2008	157	3,634	23.1
2009	150	1,313	8.8
2010	155	1,413	9.1
2011	47	232	4.9
2012	177	146	12.1
2013	133	1,059	8.0
2014	131	836	6.4
2015	175	3,924	22.4
2016	185	4,191	22.7
2017	55	191	3.5
Totals	3,112	28,869	9.4

NYS Department of Environmental Conservation. 2017. Wildfire Map. Retrieved at https://www.dec.ny.gov/lands/68333.html

Wildfires can result in severe injuries and deaths, and communities can suffer extreme financial loss. Wildfire can cause infrastructure damage and disrupt communications that inhibit efficient coordination of fire operations support during the immediate response and post-emergency period. Even small wildfires can threaten lives, and if not properly controlled can cause significant destruction of property and the environment. The resources and agencies that manage a large firefighting operation are complex and require aid from many different agencies and jurisdictions. All wildfires have the potential of becoming large and/or catastrophic and cause significant losses.

5.13.5 Probability of Future Events

Multiple wildland fires occur on an annual basis in New York State and in Saratoga County. Most fire seasons present the chance for a few significant wildland fires. Based on historical records and input from the County Planning Team, the probability of occurrence for wildfires in Saratoga County is considered "frequent", with at least one event occurring annually. Wildland fire occurrence is weather dependent and highly variable from year to year. As history shows, larger fires can burn tens of thousands of acres, and wildland fires in the hundreds of thousands of acres are possible, although no previous occurrences of wildfires of this magnitude have been recorded in Saratoga County.

5.13.6 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of wildfires in Saratoga County, including:

- Data and methodology used for the evaluation;
- Impact, including: (1) impact on life, safety and health, (2) general building stock, (3) critical facilities and infrastructure, (4) economy and (5) future growth and development; and
- Further data collections that will assist understanding of this hazard over time.

Data and Methodology

National wildfire databases and local resources were used to collect and analyze wildfire impacts on the County. An exposure analysis was also conducted using SILVIS Lab Wildland-Urban Interface (WUI) data to understand the critical facilities, infrastructure, and building stock that are at wildfire risk. This analysis was conducted by intersecting WUI data with critical facilities and building stock to find infrastructure at risk. Prior to the analysis, a 30-foot buffer was created for critical facilities to better replicate building footprints. Critical facilities were then spatially joined with municipality data based on the closest proximity. Building stock data contained municipality locations in Saratoga, however, there was limited building stock data for villages in the county.

Impact on Life, Health, and Safety

Wildfires can have severe impacts on life, health, and safety and can contribute to injuries and death. According to the NIFC, 14 deaths were attributed to wildfire nationwide in 2017, with a total of 1,128 wildfire deaths from 1910 to 2017 (National Interagency Fire Center [NIFC], 2017).

Wildfires can be categorized by type of wildland-urban interface. These interfaces are (1) intermix, areas where housing (more than one per 40 acres) intermingles with wildland (nonagricultural) vegetation and (2) interface, areas with housing and low-density vegetation within fire's reach (1.5 miles) of a large, contiguous block of wildland vegetation (Radeloff et al. 2004). Wildfires in either area pose risks to life, health, and safety. Additionally, wildfires can release toxic components that can cause adverse health effects in people as well as animals. The respiratory and cardiovascular systems are most affected by fire and smoke inhalation, and psychological and psychiatric problems may arise as well due to exposure to the traumatic event. Young children and the elderly are especially vulnerable to health and medical issues stemming from fire and smoke exposure.

In addition to injuries and death, people located in the immediate area of a wildfire face the risk of relocation for unknown periods of time due to damage or destruction of homes and properties, exacerbating health and safety issues either pre-existing or those that are direct effects of the wildfire itself. Generally, the population at risk can evacuate before a wildfire moves into their area. Occasionally when strong winds are in place, wildfires can move very rapidly and catch people by surprise, or people may just refuse to evacuate. In these types of situations, firefighters can also be at risk from rapidly moving wildfires. Many times, wildfire fatalities of the evacuating population occur when frantic drivers or poor visibility due to smoke cause a traffic accident.

Impact on General Building Stock

Wildfire impacts on general building stock and properties can be severe and can significantly alter entire communities. Buildings, structures, farmland, equipment, and other assets may be damaged or destroyed by wildfire. The general building stock in Saratoga County, especially single-family residential homes, is particularly at risk. The County provides a perfect example of the intermix zone. Land that used to be heavily agricultural has been transitioning over the past few Decades to suburban home developments. Agricultural production has gone down significantly as a result, changing building stock and population characteristics as well as the impact of wildfire.

Table 5-51 details the building value at wildfire risk (both interface and intermix) in each municipality. There is over $15.5 billion at risk county-wide, with the City of Saratoga Springs having the most building value at risk with approximately $3.5 billion in intermix and interface zones.

Table 5-51 Building Value at Risk in Wildland-Urban Interface

Municipality	Intermix	Interface	Total
Town of Ballston	$457,404,546.00	$343,996,294.00	$801,400,840.00
Village of Ballston Spa	$10,194,465.00	$319,543,069.00	$329,737,534.00
Town of Charlton	$290,155,584.00	$82,328,626.00	$372,484,210.00
Town of Clifton Park	$1,278,736,524.00	$281,956,801.00	$1,560,693,325.00
Town of Corinth	$197,921,030.00	$11,260,980.00	$209,182,010.00
Village of Corinth	$4,341,900.00	$257,586,507.00	$261,928,407.00
Town of Day	$170,906,362.00	$6,499,492.00	$177,405,854.00
Town of Edinburg	$211,273,270.00	$28,279,309.00	$239,552,579.00
Town of Galway	$347,302,674.00	$37,140,475.00	$384,443,149.00
Village of Galway	$13,492,034.00	$0.00	$13,492,034.00

Municipality	Intermix	Interface	Total
Town of Greenfield	$438,288,131.00	$71,249,999.00	$509,538,130.00
Town of Hadley	$58,809,109.00	$30,555,400.00	$89,364,509.00
Town of Halfmoon	$483,691,254.00	$178,036,396.00	$661,727,650.00
Town of Malta	$1,164,356,820.00	$583,019,716.00	$1,747,376,536.00
City of Mechanicville	$601,900.00	$214,755,344.00	$215,357,244.00
Town of Milton	$404,484,812.00	$561,669,863.00	$966,154,675.00
Town of Moreau	$348,231,307.00	$319,531,817.00	$667,763,124.00
Town of Northumberland	$128,912,700.00	$97,420,900.00	$226,333,600.00
Town of Providence	$96,444,800.00	$8,551,600.00	$104,996,400.00
Village of Round Lake	$21,648,900.00	$38,792,100.00	$60,441,000.00
Town of Saratoga	$208,655,800.00	$70,391,000.00	$279,046,800.00
City of Saratoga Springs	$774,511,555.00	$2,778,143,988.00	$3,552,655,543.00
Village of Schuylerville	$0.00	$0.00	$0.00
Village of South Glens Falls	$29,157,500.00	$220,260,750.00	$249,418,250.00
Town of Stillwater	$292,928,137.00	$242,936,167.00	$535,864,304.00
Village of Stillwater	$54,487,938.00	$37,754,366.00	$92,242,304.00
Village of Victory	$2,009,000.00	$0.00	$2,009,000.00
Town of Waterford	$101,632,813.00	$0.00	$101,632,813.00
Village of Waterford	$0.00	$0.00	$0.00
Town of Wilton	$686,859,393.00	$785,835,764.00	$1,472,695,157.00
Grand Total	$8,277,440,258.00	$7,607,496,723.00	$15,884,936,981.00

Impact on Critical Facilities

Wildfire can damage or destroy property and critical facilities, as well as lead to interruption of power, communications, water, and transportation systems. Electrical power infrastructure may be destroyed, causing long-term power outages. Without electricity to fuel pumps, water supply may also be disrupted. Wildfires may cause trees to collapse and down power lines, causing a disruption even if the powerlines are not directly damaged by the fire. Similarly, wildfires may cause damage to communications infrastructure and cause outages until damaged components can be repaired or restored.

Wildfires can also have serious and lasting negative consequences for a water systems' ability to provide clean drinking water to its customers. Ash carrying toxins may contaminate water treatment facilities, in addition to nearby streams and rivers. Additionally, if there are limited quantities available, these systems may need to be preserved to support fire suppression efforts.

Large wildfires may also interrupt transportation systems such as trains, buses, subways, and cars and bus lines, creating a challenge for public transit, especially during evacuation. Wildfires may cause damage to roadways, bridges, or other means of transportation. While transportation infrastructure may appear to be intact after a wildfire, access will still need to be restricted until structural integrity is assessed and confirmed. Forest damage from fires may block interior access roads and fire breaks.

In Saratoga County, a total of 208 critical facilities and infrastructure exist in areas at risk to wildfire (both intermix and interface). Table 5-52 and Table 5-53 show the critical facilities at risk by sector as well as by municipality. The Town of Milton and the City of Saratoga Springs have the most

critical facilities located in both the interface and intermix zones. Highway bridges and schools face the highest risk of all facility types assessed.

Table 5-52 Critical Facilities at Risk, by Sector

Facility Type	Interface	Intermix	Total
Airport	1	0	1
Bus Facility	1	0	1
Communications	2	4	6
Emergency Response	2	0	2
Fire	9	17	26
Hazardous Material Facilities	5	0	5
Highway Bridges	34	65	99
Hospital	1	0	1
Law Enforcement	6	2	8
Power (Electric)	1	0	1
Rail Facility	0	1	1
Railway Bridges	3	4	7
Schools	26	20	46
Wastewater Facility	3	1	4
Grand Total	94	114	208

Table 5-53 Critical Facilities at Risk, by Municipality

Municipality	Intermix	Interface	Total
Town of Ballston	7	8	15
Village of Ballston Spa	1	10	11
Town of Charlton	5	1	6
Town of Clifton Park	10	2	12
Village of Corinth	1	7	8
Town of Corinth	2	0	2
Town of Day	6	0	6
Town of Edinburg	3	0	3
Village of Galway	1	0	1
Town of Galway	4	0	4
Town of Greenfield	13	2	15
Town of Hadley	2	0	2
Town of Halfmoon	1	5	6
Town of Malta	4	7	11
City of Mechanicville	0	11	11
Town of Milton	12	5	17
Town of Moreau	5	3	8
Town of Northumberland	1	1	2

Municipality	Intermix	Interface	Total
Town of Providence	7	0	7
Village of Round Lake	2	0	2
Town of Saratoga	3	1	4
City of Saratoga Springs	9	12	21
Village of South Glens Falls	3	4	7
Village of Stillwater	2	5	7
Town of Stillwater	3	4	7
Town of Waterford	3	0	3
Town of Wilton	4	6	10
Grand Total	114	94	208

Impact on Economy

The economic impact of wildfire can extend beyond the initial impact caused by fire damage. Wildfires can affect any type of asset and may threaten major population centers when they break on the rural-urban fringe. Wildfires drain state and local resources. There is a fiscal impact on the local government even if costs can be recouped by federal grants.

Saratoga County's agriculture and tourism industries are a major component of the local, county, and state economy. Major wildfires can cause significant impact to those sectors, further draining local and county resources. Wildfire-related costs may be attributed to loss of state parks or forests, damage to businesses or agricultural crops, loss or damage to rented homes or apartments, costs associated with fire suppression, and restoration of sensitive habitats and environments.

Impact on Future Growth and Development

Damage from wildfires can be severe and can significantly alter entire communities. Impacts to local ecology and vegetation may cause long-lasting effects to the environment, while damage to properties and facilities may allow dangerous chemicals and agents to leak into natural environments and water reservoirs, causing contamination or additional damage. Agricultural resources and assets may become contaminated by hazardous materials in the event of damage to nearby facilities or equipment.

In addition to lasting impacts on the environment, planning for development and future growth may be affected by consideration of wildfire probability and extent in the County. Any area of growth could potentially be impacted by wildfire events because the entire planning area is exposed and vulnerable, but some locations are more likely to experience wildfire than others. The growth and development of these locations must be carefully considered to reduce vulnerability to wildfires; please refer to Section 4 for hazard maps that identify areas of new development. In relation to wildfire risk, areas of new development indicate areas of concern because of the increase in population in a newly developed area. These areas inherently increase the public's exposure to wildfire.

Considerations for Future Data Analysis

It is anticipated that Saratoga County will continue to experience wildfire events. Many sources indicate that future climate change could become a large factor in influencing the frequency of wildfires not only in Saratoga County but also the overall frequency and severity of wildfire events throughout the U.S. In the event of climate change, research has indicated that temperatures will become warmer and that these warmer temperatures will persist for longer durations of time, increasing the potential for dry conditions that fuel wildfires.

According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), North America is very likely to warm during this century, and the annual mean warming is likely to exceed the global mean warming in most areas. In northern regions which would include New York State, warming is likely to be largest in winter. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America, and the highest summer temperatures are likely to increase more than the average summer temperature in the southwest U.S (IPCC, 2007). If temperatures become warmer, as predicted, the occurrence of wildfires is anticipated to increase. Although many uncertainties exist regarding magnitude, severity or impact of climate change, the U.S. Environmental Protection Agency indicated that future temperature changes, including a greater number of heat waves, are anticipated as a result, along with atmospheric, precipitation, storm and sea level changes (USEPA, 2007).

If scientific predictions are accurate and based on regional studies that have been done for New York State and its neighbors, it is anticipated that Saratoga County will be no exception and will also experience a change in temperatures in the future. Future data analysis should consider the impact of climate change on wildfire hazards in Saratoga County.

5.13.7 Conclusions

Wildfires have occurred in Saratoga County, often causing impacts and losses to the local population and economy as well as infrastructure including roads, structures, facilities and utilities. The overall hazard ranking determined for this HMP for the wildfire hazard is “medium” with a “rare” probability of occurrence (see Table 5-5).

In general, wildfire risks are increasing nationwide. Wildfire experts say there are four reasons for this:

- The way forests were handled in the past allowed fuel in the form of fallen leaves, branches and plant growth, to accumulate. Now this fuel is lying around the forest with potential to “feed” a wildfire.
- Increasingly hot, dry weather in the U.S.
- Changing weather patterns across the country.
- More homes built in WUI areas, meaning homes are built closer to areas where wildfires can occur.

All of these factors contribute to wildfire risk in Saratoga County, and all can be mitigated to some extent by human actions. Saratoga County may not be able to fully mitigate the effects of global

climate change, but it can recognize the threat and plan accordingly. Encouragement of sustainable forestry practices and development along with public education is critical to reducing the ability of wildfires to cause devastating consequences. Future mitigation efforts should continue to be developed and employed that will enable the County to be prepared for these events when they occur.

Section 6: Mitigation Strategies

This section presents a strategy that Saratoga County plans to implement through a series of mitigation actions to reduce exposure and losses to the natural hazard risks reviewed in the previous section. The Planning Team reviewed the Risk Assessment section to identify and develop these mitigation actions, which are presented herein. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment. Actions can include activities such as revisions to land use planning, training and education, and structural and nonstructural safety measures.

This section includes:

1. Background and past mitigation accomplishments
2. General mitigation planning approach (including plan mitigation goals and objectives)
3. Capability assessment
4. Identification, analysis, and implementation of potential mitigation actions

6.1 Background and Past Accomplishments

The NYS DHSES Planning Standards F5 requirement and the FEMA Element D2 in 44 Code of Federal Regulations (CFR) 201.6(d)(3) require an overview of past mitigation efforts. The F5 requirement states that jurisdictions are required to identify mitigation projects completed since the approval of the previous mitigation plan (or within the last five years) (NYS DHSES, 2017). Similarly, Element D2 requires that the Mitigation Strategy is updated to reflect progress in local mitigation efforts (FEMA, 2011).

Evaluating past mitigation efforts provides context for jurisdictions' projects, acts as a source of ideas for mitigation projects, evaluates the accuracy of solutions to inform future projects, and supports future mitigation project planning and coordination within the jurisdiction (NYS DHSES, 2017). The 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. A full review of all previous mitigation actions, including the identification of completed actions, can be found in Appendix D.

These past and ongoing activities have contributed to the County's understanding of its hazard preparedness and future mitigation activity needs, costs, and benefits. These efforts provide a foundation for the Planning Team to use in developing this hazard mitigation plan (HMP).

6.2 General Mitigation Planning Approach

The general mitigation planning approach used to develop this plan is based on the FEMA's Local Mitigation Planning Handbook and Guide and the NYS DHSES New York State Hazard Mitigation

Planning Guide. The FEMA document and NYS DHSES guidance include four steps, which were used to support this HMP update:

- **Develop mitigation goals and objectives:** FEMA defines **goals** as general guidelines that explain what should be achieved, and **objectives** as strategies or implementation steps to attain mitigation goals. Mitigation goals were developed using the hazard characteristics, inventory, and findings of the Risk Assessment, and through the results of the public outreach program. By reviewing these outputs and other municipal policy documents, objectives tying to these overarching goals were identified and characterized into similar themes.
- **Identify and prioritize mitigation actions:** FEMA defines **mitigation actions** as specific actions that help to achieve the mitigation goals and objectives. Based on the risk assessment outputs, the mitigation goals and objectives, existing literature and resources, and input from the participating entities, alternative mitigation actions were identified. The potential mitigation actions were qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria and then were prioritized into three categories: high, medium, and low.
- **Prepare an implementation strategy:** High priority mitigation actions are recommended for first consideration for implementation. However, based on community-specific needs and goals and available funding and costs, some low or medium priority mitigation actions may also be addressed or could be addressed before some of the high priority actions.
- **Document the mitigation planning process**: The mitigation planning process is documented throughout this Plan.

6.2.1 Guiding Principle, Mitigation Goals and Objectives

This section presents the guiding mitigation principles for this Plan, including the mitigation goals and objectives identified to reduce or avoid long-term vulnerabilities to the identified hazards.

Mission Statement

Per FEMA guidance, a mission statement or guiding principle describes the overall duty and purpose of the planning process and serves to identify the principle message of the Plan. It focuses or constrains the range of goals and objectives identified. This is not a goal because it does not describe outcomes. Saratoga County's mission statement is broad in scope and provides a direction for the Plan.

The mission statement for the Saratoga County HMP is as follows:

Through partnerships and careful planning, identify and reduce the vulnerability to natural hazards in order to protect the general health, safety, welfare, quality of life, environment and economy of the residents and communities within Saratoga County.

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

Planning Team developed mitigation goals and objectives based on the risk assessment results, discussions, research, and input from the committee itself, existing authorities, polices, programs, resources, stakeholders and the public.

For the purposes of this HMP, 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 HMP is trying to achieve. The success of the Plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

The Planning Team identified five goals that are compatible with the needs and goals expressed in other available community planning documents as well as the NYS HMP. Each goal has a number of corresponding objectives that further define the specific actions or implementation steps. Achievement of these goals will define the effectiveness of a mitigation strategy. The goals also are used to help establish priorities.

Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Objectives were then developed and/or updated by the Planning Team through its knowledge of the local area, review of past efforts, findings of the risk assessment, qualitative evaluations, and identification of mitigation options. The objectives are used to 1) measure the success of the HMP once implemented, and 2) to help prioritize identified mitigation actions.

The Planning Team selected objectives that would meet multiple goals, as listed below. The objectives serve as a stand-alone measurement of a mitigation action, rather than as a subset of a goal. Achievement of the objectives will be a measure of the effectiveness of a mitigation strategy. The objectives also are used to help establish priorities.

The following are the mitigation goals and objectives for the Saratoga County Plan:

Goal 1. Protect life and property

- ***Objective 1-1:*** Protect critical facilities and infrastructure.
- ***Objective 1-2:*** Decrease the number of repetitive and severe repetitive loss properties.
- ***Objective 1-3:*** Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions and/or projects designed to benefit essential facilities, services, and infrastructure.
- ***Objective 1-4:*** Implement mitigation actions that enhance the capabilities of the County to better profile and assess exposure of hazards.
- ***Objective 1-5:*** Better characterize current and future flood/stormwater hazard events by conducting additional hazard studies, including climate modeling, and identify inadequate stormwater facilities and poorly drained areas.
- ***Objective 1-6:*** Develop, maintain, strengthen and promote enforcement of ordinances, regulations, plans and other mechanisms that facilitate hazard mitigation.
- ***Objective 1-7:*** Integrate the recommendations of this plan into existing local programs.

- ***Objective 1-8:*** Ensure that development is done according to modern and appropriate standards, including the consideration of natural hazard risk.
- ***Objective 1-9*****:** Identify and pursue funding opportunities to develop and implement local and county mitigation activities.

Goal 2. Increase public awareness and preparedness of natural hazards and their risks

- ***Objective 2-1:*** Develop and implement program(s) to better understand and enhance the public's level of individual and household preparedness.
- ***Objective 2-2:*** Develop and implement additional education and outreach programs to better understand and increase public awareness of hazard areas and the risks associated with hazards, and to educate the public on specific, individual and household preparedness activities.
- ***Objective 2-3:*** Promote awareness among homeowners, renters, and businesses about obtaining insurance coverage available for natural hazards (e.g., flooding).
- ***Objective 2-4:*** Encourage property owners to take preventive and mitigative actions in areas that are especially vulnerable to hazards.
- ***Objective 2-5:*** Provide information on tools, partnership opportunities, funding resources, and current government initiatives to assist in implementing mitigation activities.

Goal 3. Promote a sustainable economy

- ***Objective 3-1:*** Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions and/or projects designed to benefit essential facilities, services, and infrastructure.
- ***Objective 3-2:*** Where appropriate, coordinate and integrate hazard mitigation actions with existing local emergency operations plans and business continuity plans.
- ***Objective 3-3:*** Identify the need for, and acquire, any special emergency services, training, equipment, facilities, and infrastructure to enhance response capabilities for specific hazards.
- ***Objective 3-4:*** Ensure continuity of governmental operations, emergency services, and essential facilities at the local level during and immediately after disaster and hazard events.
- ***Objective 3-5:*** Develop and maintain adequate services and utilities to serve the County's population and businesses.

Goal 4. Protect open space, the environment and natural resources

- ***Objective 4-1*****:** Protect and preserve environmentally sensitive and critical areas.
- ***Objective 4-2:*** Identify, protect and restore natural land and features that serve to mitigate losses from natural hazards (including wetlands, floodplains, stream corridors, hillsides and ridge lines).
- ***Objective 4-3*****:** Incorporate current and future hazard considerations into land-use planning and natural resource management.
- ***Objective 4-4*****:** Promote sustainable land development practices.

Goal 5. Promote cooperation and county-wide partnerships

- ***Objective 5-1:*** Maintain and expand shared services in acquiring, maintaining, and providing emergency services and equipment.
- ***Objective 5-2*****:** Strengthen inter-jurisdiction and inter-agency communication, coordination, and partnerships to foster hazard mitigation actions and/or projects.
- ***Objective 5-3*****:** Identify and implement ways to engage public agencies with individual citizens, non- profit organizations, business, and industry to promote hazard mitigation planning and implement mitigation actions more effectively.

6.3 Capability Assessment

According to FEMA, 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 mitigation planning process. It identifies, reviews and analyses local and state programs, polices, regulations, funding and practices currently in place that may either facilitate or hinder mitigation.

A capability assessment was prepared by Saratoga County and each participating jurisdiction and the results are presented in Section 9 of this plan. By completing this assessment, Saratoga County and each jurisdiction evaluated their capability to implement mitigation actions by determining the following:

- Types of mitigation actions that may be prohibited by law;
- 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 (funding);
- The jurisdiction is not vulnerable to the hazard; and
- Action is already being implemented.

6.4 Identification, Prioritization, Analysis, and Implementation of Mitigation Actions

This section discusses the identification, prioritization, analysis and implementation of mitigation actions for Saratoga County and its jurisdictions.

6.4.1 Mitigation Strategy Review and Development

Prior to and during the Mitigation Strategies Meeting, the Planning Team reviewed the previous plan's mitigation actions to ensure the actions were comprehensive and relevant and identify the need for revised and/or new mitigation actions (Refer to Appendix D for the previous mitigation action plan). As part of this effort, each municipality reviewed their mitigation actions from the previous HMP and reflected on the following:

- Project status (completed, in progress, not started, or canceled);
- Description of the project's implementation
- Inclusion of project/initiative in the 2019 Mitigation Strategy; and
- Recommended revisions to project/initiative in 2019 Mitigation Strategy (if applicable).

Each municipality utilized this information to determine whether the action is still relevant, viable, aligns with best mitigative practices, and should remain in the 2019 Mitigation Strategy. Additionally, Hagerty worked with Saratoga County and each jurisdiction to develop new mitigation actions to address gaps in previous initiatives, accommodate updates to municipal policies, plans, and resources, and mitigate newly identified hazards.

This process also included an additional step to comply with New York State Planning Standards. Each municipality is required to complete two NYS DHSES action worksheets for two high-priority projects. These action worksheets provide an opportunity for a jurisdiction to think through a project implementation plan in a little more detail and can serve as a starting point should funding and resources become available in the future. During the Mitigation Strategies Meeting, representatives from NYS DHSES and Hagerty assisted the Planning Team in completing an action worksheet for one project. Each jurisdiction identified an additional high-priority project and completed a second action worksheet independently.

6.4.2 2019 Mitigation Action Plan

The mitigation actions are the key element of the natural hazard mitigation plan. Mitigation actions are activities designed to reduce or eliminate losses resulting from natural hazards. It is through the implementation of these actions that Saratoga County and the participating jurisdictions can strive to become disaster-resistant through sustainable hazard mitigation.

Although one of the driving influences for preparing this HMP was grant funding eligibility, its purpose is more than just access to federal funding. It was important to the Planning Team to look at mitigation actions that will work through all phases of emergency management. Some of the actions outlined in this HMP may not be grant eligible—grant eligibility was not the focus of the selection. Rather, the focus was the actions' effectiveness in achieving the goals of the HMP and whether they are within the County or each jurisdiction's capabilities.

A series of mitigation actions were identified by Saratoga County and each participating jurisdiction. The 2019 Mitigation Action Plan was developed based on the Planning Team's review of past mitigation actions, and the creation of new mitigation actions. For each action, the following information is identified:

- Hazards mitigated;
- Goals and objectives met;
- Lead and support agencies;
- Estimated cost;
- Potential funding sources; and
- Proposed timeline.

The proposed timeline for a mitigation action was categorized in general terms as follows:

- Short Term = To be completed in one to five years
- Long Term = To be completed in greater than five years
- Ongoing = Currently being funded and implemented under existing programs

Each jurisdiction and the county maintain their own mitigation action plan, found in the Jurisdictional Annexes in Section 9 of this plan. These annexes were updated from the previous plan to capture information provided by the jurisdictions, including updates to local government capabilities, hazard history, and mitigation actions. Where no updates were provided, these annexes maintain all information from the previous plan with limited updates.

All proposed mitigation actions were aligned to the goals and objectives presented above. The mitigation actions cover a range of project types, falling generally into six categories:

1. **Prevention:** Government, administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.
2. **Property Protection:** Actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
4. **Natural Resource Protection:** Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
5. **Emergency Services:** Actions that protect people and property, during and immediately following, a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities.
6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.

Each jurisdiction's annex includes an implementation plan for the identified mitigation actions, which includes the following information:

- Mitigation actions for individual and multiple hazards;
- Mitigation objectives supported by each action (Goals are not listed because all objectives meet multiple goals);
- Implementation priority;

- Potential funding sources for the mitigation action (grant programs, current operating budgets or funding, or the agency or jurisdiction that will supply the funding; additional potential funding resources are identified);
- Estimated budget for the mitigation action (financial requirements for new funding or indication that the action is addressed under current operating budgets);
- Time estimated to implement and complete the mitigation action; and
- Existing policies, programs, and resources to support implementation of the mitigation action (additional policies, programs, and resources identified).

Specific mitigation actions were identified to prevent future losses; however, current funding is not identified for all of these actions at present. Saratoga County has limited resources to take on new responsibilities or projects. The implementation of these mitigation actions is dependent on the approval of the local elected governing body and the ability of the community to obtain funding from local or outside sources. Where such actions are high priorities, the community will work together with NYS DHSES, FEMA and other Federal, State and County agencies to secure funds.

6.4.3 Prioritization

Section 201.c.3.iii of 44 CFR requires that a mitigation action plan describe how the actions identified will be prioritized. The Saratoga County Planning Team, along with their contract consultant, developed a prioritization methodology for the HMP that meets the needs of the County and participating jurisdictions while at the same time meeting the requirements of Section 201.6 of 44 CFR. The mitigation actions identified were prioritized according to the criteria defined below.

- **High Priority**: A project that meets multiple plan goals and objectives, benefits exceed cost, has funding secured under existing programs or authorizations, or is grant-eligible, and can be completed in one to five 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 one to five 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 (five to 10 years).

The priority of a mitigation action can change with time, as circumstances related to that project change. For example, a project might be assigned a medium priority because of the uncertainty of a funding source. This priority could change to high once a funding source is identified and awarded. The MPC will review and update this prioritization schedule as needed, or otherwise annually. Section 7 further describes this plan maintenance strategy.

6.4.4 Benefit and Cost Review

Section 201.6.c.3iii of 44 CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and

their associated costs. The County and participating jurisdictions weighed the estimated benefits of each mitigation project versus the estimated costs to establish a parameter that helped prioritize the project.

This benefit/cost review was qualitative; that is, it did not include the level of detail required by FEMA for project grant eligibility under the HMGP and PDM grant program. This qualitative approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time. Each project was assessed by assigning subjective ratings (high, medium, and low) to its costs and benefits, described in Table 6-1.

Table 6-1 Cost and Benefit Definitions

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 (for example, bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the County initiatives identified, Saratoga County may seek financial assistance under FEMA's HMGP or PDM programs. Both 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 model process. The Planning Team 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 Team reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

The annexes in Section 9 present the results of applying the prioritization methodology to the set of mitigation actions identified by Saratoga County and each participating jurisdiction, and includes the following prioritization parameters:

- Number of objectives met by the initiative
- Benefits of the project (high, medium, or low)
- Cost of the project (high, medium, or low)

- Do the benefits equal or exceed the costs?
- Is the project grant-eligible?
- Can the project be funded under existing programs and budgets?
- Priority (high, medium, or low)

In general, mitigation actions ranked as high priorities will be addressed first. However, medium or even low priority mitigation actions will be considered for concurrent implementation. Therefore, the ranking levels should be considered as a first-cut, preliminary ranking and will evolve based on input from Saratoga County departments and representatives, the public, NYS DHSES, and FEMA as the HMP is implemented.

Section 7: Plan Maintenance

This section describes the system that Saratoga County and all participating jurisdictions have established to monitor, evaluate, and update the mitigation plan, implement the mitigation plan through existing programs, and solicit continued public involvement for plan maintenance.

7.1 Monitoring, Evaluating, and Updating the Plan

The Saratoga County MPC will be responsible for monitoring, evaluating, and updating this Plan. The Saratoga County HMP Coordinator, Mr. Michael Stanley (Saratoga County OES), will oversee and facilitate the MPC. Each jurisdiction participating in this plan is expected to maintain representation on the MPC. Therefore, the MPC does not include representation from jurisdictions that did not participate and adopt this plan. Many of the individuals who served on the Planning Team are also members of the MPC, though some municipalities identified alternative points of contact to serve on the committee. Table 7-1 identifies the representation of the MPC, as of the date of this Plan, and will be updated on an as needed basis.

Table 7-1 Mitigation Planning Committee

Jurisdiction	Primary Point of Contact	Secondary Point of Contact
Saratoga County	Carl Zeilman, Director of Saratoga County Office of Emergency Services (OES)	Mike Stanley, Emergency Services Specialist, Saratoga County OES
Town of Ballston	Joseph Whalen, Highway and Water Superintendent Deputy Supervisor	Tim Szczepaniak, Town Supervisor
Village of Ballston Spa	John P. Romano, Mayor	Randy Lloyd, Building Inspector
Town of Charlton	Alan Grattidge, Supervisor	Dave Robbins, Town Councilman
Town of Clifton Park	Phil Barrett, Supervisor	Lou Pasquarell, Safety Officer
Town of Corinth	Brian & Tammy Martineau, Emergency Management Coordinators	Richard Lucia, Town Supervisor
Town of Day	Preston Allen – Supervisor	Ken Metzler – Code Enforcement
Town of Greenfield	Daniel Pemrick – Supervisor	Walter Barss – Highway Superintendent
Town of Hadley	Arthur Wright, Town Supervisor	Andrew Gilbert, Highway Supervisor
Town of Halfmoon	John Cooper Jr., Fire/Code Enforcement Officer – Emergency Services Coordinator	Kevin J. Tollisen, Town Supervisor
Town of Malta	Kevin T. King/Comptroller	Wayne Hoffman /Code Enforcement Officer
Town of Milton	Scott Ostrander, Supervisor	Bill Lewis, Deputy Building Inspector
Town of Moreau	Matthew Dreimiller, Building Inspector/Code Enforcement Officer	Theodore Kusnierz, Supervisor

Jurisdiction	Primary Point of Contact	Secondary Point of Contact
Town of Northumberland	Richard E. Colozza, Building Code Administrator	Highway Superintendent
Town of Providence	Sandra Winney, Supervisor	Sue Wemple, Town Clerk
City of Saratoga Springs	Marilyn Rivers, Director of Risk and Safety and City Safety and Compliance Officer	Tina Carton, Administrator of Parks, Open Lands, Historic Preservation, and Sustainability
Village of Schuylerville	Daniel Carpenter – Mayor	Sherry Doubleday
Village of South Glens Falls	Joe Patricke, Building Inspector	Harry Gutheil, Mayor
Town of Wilton	Arthur Johnson, Town Supervisor	Mark Mykins, Assistance Disaster Preparedness Officer

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. The MPC shall be informed at the time of each change in representation on the committee and will vote on the committee membership at semi-annual progress meetings to be coordinated by the HMP Coordinator. The HMP Coordinator shall maintain the current membership of the MPC on the Saratoga County Hazard Mitigation Plan website.

7.1.2 Monitoring

The MPC shall be responsible for monitoring progress on, and evaluating the effectiveness of, the Plan, and documenting this progress in an annual progress report to be prepared initially one year after approval (thus starting the “Five Year Update Clock”) for annual plan review and reporting requirements. At least once a year and prior to the annual meeting of the MPC (detailed below), county and local MPC representatives will collect and process the annual reports from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes, Section 9 of this Plan. Collection of this information will be conducted through phone calls and meetings with persons responsible for initiating and/or overseeing the mitigation projects to obtain this progress information. Copies of any grant applications filed on behalf of any of the participating jurisdictions shall be provided to the MPC. Further, the representatives shall obtain from their municipal supervisor/mayor or clerk any public comments made on the plan and provide to the MPC for inclusion in the annual report.

The MPC representatives shall be expected to document, as needed and appropriate:

- Hazard events and losses occurring in their jurisdiction including their nature and extent and the effects that hazard mitigation actions have had on impacts and losses;
- Progress on the implementation of mitigation actions, including efforts to obtain outside funding for mitigation actions;
- Any obstacles or impediments to the implementation of actions;
- Additional mitigation actions believed to be appropriate and feasible; and
- Public and stakeholder input and comment on the Plan.

Local MPC representatives may use the progress reporting forms, Worksheet 7.1 in the FEMA Local Mitigation Planning Handbook, to facilitate collection of progress data and information on specific mitigation actions. Local progress reports shall be provided to the County HMP Coordinator at least two weeks prior to the annual MPC plan review meeting to be held in the month of September.

7.1.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the Plan goals are being reached, and whether changes are needed. The Plan will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that may affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the MPC, to be held in the month of September. In June, at least one month before the annual plan review meeting, the Saratoga County HMP Coordinator will advise MPC members of the meeting date, agenda and expectations of the members.

The Saratoga County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and assessing 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 exist
- Outcomes have occurred as expected
- Changes in county or municipal resources impacted plan implementation (for example, funding, personnel, and equipment)
- New agencies/departments/staff should be included, including other local governments as defined under 44 Code of Federal Regulations (CFR) 201.6
- Documentation for hazards that occurred during the last year

Specifically, the MPC will review the mitigation goals, objectives, and activities/projects using performance-based indicators, including:

- New agencies/departments created that have authority to implement mitigation actions or are required to meet goals, objectives, and actions
- Project evaluation based on current needs of the mitigation plan
- Project completion regarding progress of proposed or ongoing actions
- Under/over spending regarding proposed mitigation action budgets
- Achievement of the goals and objectives
- Resource allocation to note if resources are required to implement mitigation activities

- Timeframes comment on whether proposed schedules are sufficient to address actions
- Budgets note if budget basis should be changed or is sufficient
- Lead/support agency commitment note if there is a lack of commitment on the part of lead or support agencies
- Resources regarding whether resources are available to implement actions
- Feasibility comment regarding whether certain goals, objectives, or actions prove to be unfeasible

As part of the Mitigation Strategy evaluation, the MPC should use the NYS DHSES Mitigation Action Worksheets to update the progress report section of each jurisdictions' selected projects. Finally, the MPC 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 (see the "Implementation of Mitigation Plan through Existing Programs" subsection later in this Section). Other programs and policies can include those that address:

- Economic Development
- Environmental Preservation & Permitting
- Historic Preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public Education and Outreach
- Transportation

The MPC may refer to the evaluation form, Worksheet 7.2 in FEMA Local Mitigation Planning Handbook guidance document, to assist in the evaluation process.

The MPC Coordinator shall be responsible for preparing an Annual HMP Progress Report, based on the provided local annual progress reports from each jurisdiction, information presented at the annual MPC meeting, and other information as appropriate and relevant. These annual reports will provide data for the 5-year update of this HMP and will assist in pinpointing implementation challenges. By monitoring the implementation of the Plan on an annual basis, the MPC will be able to assess which projects are completed, which are no longer feasible, and what projects may require additional funding.

This annual progress report shall apply to all planning partners, and as such, shall be developed according to an agreed format and with adequate allowance for input and comment of each planning partner prior to completion and submission to the State Hazard Mitigation Officer. Each planning partner will be responsible for providing this report to its governing body for their review. During the annual MPC meeting, the planning partners shall establish a schedule for the draft development, review, comment, amendment and submission of the Annual HMP Progress Report to NYS DHSES.

The Annual HMP Progress Report shall be posted on the Saratoga County Hazard Mitigation Plan website to keep the public apprised of the Plan's implementation. This report will also be

provided to each community participating in the CRS to meet CRS Activity 510 and annual CRS recertification requirements. To meet this recertification timeline, the MPC will strive to complete the review process and prepare an Annual HMP Progress Report by the end of September.

The Plan 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 of this Plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.1.4 Updating

The 44 CFR 201.6.d.3 requirement states 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 Saratoga County MPC to update this Plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the Saratoga County HMP Coordinator, with support of the MPC, shall use the third annual MPC meeting (September of 2022, assuming this Plan is approved in 2019) to develop and commence the implementation of a detailed Plan update program. The Saratoga 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 MPC shall determine what resources will be needed to complete the update. The Saratoga 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 MPC members, special purpose district participants and the New York State Hazard Mitigation Officer.

Further, it is recognized that additional jurisdictions within Saratoga County may elect to join this Plan. Any such new Plan participants shall be formally included and documented in the five-year formal Plan update. Procedures for the addition of new Plan participants shall be reviewed with NYS DHSES and FEMA prior to their formal inclusion in this Plan.

7.2 Implementation of Mitigation Plan Through Existing Programs

Participating jurisdictions have provided a detailed listing of related programs, through which mitigation planning may be implemented, in the local capability assessments provided in each jurisdictional annex (Section 9).

It is the intention of the MPC and participating jurisdictions to incorporate mitigation planning as an integral component of daily government operations. MPC members 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 (Appendix A) 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 MPC anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
2. The Hazard Mitigation Plan and Comprehensive and Emergency Management Plans for both Saratoga County and its municipalities will become mutually supportive documents that work in concert to meet the goals and needs of County residents; and
3. Duplication of effort can be minimized.

The information on hazard, risk, vulnerability and mitigation contained in this Plan is based on the best science and technology available at the time of the Plan's preparation. It is recognized by all participating jurisdictions that this information can be invaluable in making decisions under other planning programs, such as comprehensive, capital improvement, and emergency management plans. Table 7-2 below includes existing processes and programs through which the mitigation plan should be implemented.

During the annual plan evaluation process, the MPC will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

Table 7-2 Existing Processes and Programs for Mitigation Plan Implementation

Process	Action	Implementation of Plan
Administrative	Departmental or organizational work plans, policies, and procedural changes	▪ County Public Works Department ▪ County Emergency Services ▪ County Emergency Medical Services ▪ County Highway Department ▪ County Information Services ▪ County Public Health ▪ County Planning Department ▪ County Soil and Water Conservation Department

Process	Action	Implementation of Plan
Administrative	Other organizations' plans	▪ Include reference to this plan in: o Saratoga County Comprehensive Emergency Management Plan o Jurisdiction-specific Emergency Management Plans o Other county and local plans as appropriate
Budgetary	Capital and operational budgets	▪ Review of county and local budgets to include line item mitigation actions
Regulatory	Executive Orders, ordinances and other directives	▪ Comprehensive Planning - Institutionalize hazard mitigation for new construction and land use. ▪ Zoning and Ordinances ▪ Building Codes ▪ Capital Improvements Plan - Ensure that the person responsible for projects under this plan evaluates if the new construction is in a high hazard area, floodplain, etc. so the construction is designed to mitigate the risk. Revise requirements for this plan to include hazard mitigation in the design of new construction. ▪ National Flood Insurance Program – Continue participation in this program. ▪ Continue to implement storm water management plans. ▪ Prior to formal changes (amendments) to comprehensive plans, zoning, ordinances, capital improvement plans, or other mechanisms that control development must be reviewed to ensure they are consistent with the hazard mitigation plan
Funding	Secure traditional sources of financing	▪ Apply for grants from federal or state government, nonprofit organizations, foundations, and private sources including Pre-Disaster Mitigation Program (PDM), Flood Mitigation Assistance Program (FMA), and the Hazard Mitigation Grant Program (HMGP-Stafford Act, Section 404). ▪ Research grant opportunities through U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG) ▪ Other potential federal funding sources include: o Stafford Act, Section 406 – Public Assistance Program Mitigation Grants o Federal Highway Administration o Catalog of Federal Domestic Assistance o United States Fire Administration – Assistance to Firefighter Grants o United States Small Business Administration Pre and Post Disaster Mitigation Loans o United States Department of Economic Development Administration Grants o United States Army Corps of Engineers o United States Department of Interior, Bureau of Land Management o Other sources as yet to be defined ▪ See Appendix E for additional funding sources

Process	Action	Implementation of Plan
Partnerships	Develop creative partnerships, funding and incentives	▪ Public-Private Partnerships ▪ State Cooperation ▪ In-kind resources
Partnership	Existing Committees and Councils	▪ Local Government Committees: o Planning Boards o Zoning Board of Appeals ▪ Chambers of Commerce ▪ Property Owners Associations
Partnership	Working with other federal, state, and local agencies	▪ Army Corps of Engineers (USACE) ▪ American Red Cross of NE New York ▪ Cornell Cooperative Extension Agroforestry Resource Center ▪ Department of Homeland Security (DHS) ▪ Federal Emergency Management Agency (FEMA) ▪ Saratoga County Soil & Water Conservation District ▪ National Oceanic and Atmosphere Agency (NOAA) ▪ National Weather Service (NWS) ▪ New York State Department of Environmental Conservation (NYDEC) ▪ New York State Department of Transportation (NYSDOT) ▪ New York State Division of Homeland Security and Emergency Services (NYS DHSES) ▪ United States Department of Agriculture (USDA) ▪ United States Department of Transportation (USDOT) ▪ United States Geological Service (USGS)

7.2.2 Continued Public Involvement

Saratoga County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. Therefore, copies of the Plan will be made available for review during normal business hours at the Saratoga County Department of Emergency Services.

Municipal supervisors/mayors or clerks and the Saratoga County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. Contact information for the County is included in the Point of Contact information in the County annex of this document.

The public will have an opportunity to comment on the Plan at the annual review meeting for the HMP and during the 5-year plan update. The annual progress reports will be posted on the Saratoga County mitigation website in addition to the Hazard Mitigation Plan. Saratoga County will maintain this website, posting the annual progress reports and maintaining an active link to collect public comments.

The Saratoga 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 5-year plan update as appropriate. Additional meetings may also be held as deemed necessary by the planning group. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan. Annual progress reports will also be posted to the project web site.

The Jurisdictional MPC representatives shall be responsible to ensure that:

- Public comment and input on the Plan, and hazard mitigation in general, are recorded and addressed, as appropriate. Opportunity to comment on the plan will be provided directly on the project web site. Provisions for public comment in writing will also be made. All written public comments shall be addressed to:

  Saratoga County Office of Emergency Services
  c/o Natural Hazards Pre-disaster Mitigation Plan Steering Committee
  25 West High Street
  Ballston Spa, NY 12020

- Copies of the latest approved Plan (or draft in the case that the five-year update effort is underway) are available for review at the municipal buildings, at the County Office of Emergency Services, and on the project website, along with instructions to facilitate public input and comment on the Plan.
- Appropriate links to the Saratoga County Hazard Mitigation Plan website are maintained. The web site will be maintained throughout the course of the project.
- Public notices are made as appropriate to inform the public of the availability of the Plan, particularly during Plan update cycles.

The Saratoga County HMP Coordinator shall be responsible to ensure that:

- Public comment and input on the Plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- The Saratoga County HMP website is maintained and updated as appropriate.
- All public and stakeholder comments received are document and maintained.
- Copies of the latest approved Plan (or draft in the case that the five-year update effort is underway) are available for review at the County Office of Emergency Services, 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.

7.3 Increasing Partnership Through Linkage

Any eligible jurisdiction wishing to link to the Plan must complete all the steps outlined in Appendix G of this plan. These steps will include contacting the Saratoga County Hazard Mitigation Planning Coordinator to request a “linkage package” that includes the required paperwork and forms, as well as developing and carrying out a public engagement strategy to involve the public in the plan development process. The result of this process will be an updated jurisdictional annex that meets all plan requirements. This annex will be submitted to the Mitigation Planning Committee, NYS DHSES, and FEMA Region II for review and approval. Following approval, the jurisdiction will be permitted to adopt the plan and then participate in on-going plan implementation and maintenance.

Section 8: Planning Partnership

8.1 Background

Section 201.6.a(4) 44 CFR states: “Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.” FEMA and NYS DHSES both encourage multi- jurisdictional planning. Therefore, in the preparation of the Saratoga County HMP, a Planning Partnership was formed to pursue grant funding for the plan and to meet requirements of the DMA for as many eligible local governments in Saratoga County as possible.

The DMA defines a local government as follows: “Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.”

8.2 The Planning Partnership

8.2.1 Invitation to Participate

Saratoga County solicited the participation of all local governments in the County at the commencement of this project. All local governments received invitations through email to participate in the plan update process and be a member of the Planning Team. The County distributed invitations to each meeting to all local governments and followed up with jurisdictions by phone and email to continue to solicit participation throughout the planning process. For those jurisdictions that did participate, they agreed to the following expectations:

- Establish Plan development goals;
- Establish a timeline for completion of the Plan;
- Ensure that the Plan meets the requirements of DMA 2000, FEMA, and NYS DHSES guidance;
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and citizens in the Plan development process;
- Assist in gathering information for inclusion in the Plan, including the use of previously developed reports and data;
- Organize and oversee the public involvement process;
- Develop, revise, adopt, and maintain the main body of the Plan in its entirety, as well as the local jurisdictional annex, including developing at least two mitigation action worksheets.

8.2.2 Jurisdiction Annex Updates

For the 2019 HMP Update, jurisdictions were asked to update the previously developed annexes with any new information. The designated point-of-contact for each participating jurisdiction, as well as the County, was asked to fill out the Jurisdiction Annex Update Form using the instructions provided and technical assistance provided during the Risk Assessment and Capability Review Meeting held on October 11, 2018. All updates included on the Jurisdiction Annex Update Forms were incorporated into the jurisdiction annexes. An example of this form can be found in Appendix B Planning Process.

At the Risk Assessment and Capability Review meeting, an overview was provided for each section in the annex. The meeting was designed to be instructional, but also allow for open discussion and questions. In addition, personalized technical assistance was available and provided to each jurisdiction, if needed. The Planning Team also was led through an exercise to review and rank risk for the County as a whole. This was a collaborative effort by all meeting attendees. Concurrently, each committee member was asked to rank each risk specifically for its jurisdiction, based on probability of occurrence and impacts to people and property.

8.2.3 Benefit/Cost Review

Each jurisdiction's annex includes an action plan of prioritized initiatives to mitigate natural hazards. 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. As part of jurisdiction annex updates, the Planning Team was asked to weigh the estimated benefits of a project versus the estimated costs to establish a parameter to be used in the prioritization of a project. This benefit/cost review was qualitative; that is, it did not include the level of detail required by FEMA for project grant eligibility under the HMGP and PDM grant programs. This qualitative approach was used because projects may not be implemented for up to 10 years, and the associated costs and benefits could change dramatically in that time. Each project was assessed by assigning subjective ratings (high, medium, and low) to its costs and benefits, as described in Table 6-1 in Section 6.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the initiatives identified in the action plans, participating jurisdictions may seek financial assistance under FEMA's HMGP or PDM programs. Both of these programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA model process. Moving forward, the participating jurisdictions that make up the MPC are 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 MPC reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this plan.

The Jurisdictional Annexes also contain the completed mitigation action worksheets submitted by the participating jurisdictions. These worksheets satisfy a NYS DHSES planning requirement and

also help jurisdictions think through some of their mitigation projects in more detail to preposition them for applying for funding in the future.

8.2.4 Completion of the Planning Process

All participating cities, towns, and villages in the County completed the planning and annex-preparation process. Completed jurisdictional annexes are presented in Section 9. Any non-participating local government within the Saratoga County planning area can "link" to this plan in the future by following the procedures outlined in Appendix G. This linking process will include completing any additional outreach to the public and submitted the two required NYS DHSES mitigation action worksheets.

Acronym List

Acronym	Definition
ACS	American Community Survey
ACT	Apt, Condo, Townhouse (3 stories or less)
AMS	American Meteorological Survey
ANS	Aquatic Nuisance Species
APA	Approved Pending Adoption
APHIS	Animal and Plant Health Inspection Services
APIPP	Adirondacks Park Invasive Plant Program
ASB	Automotive Service Building
ASR	Automobile Showroom
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
CABI	Centre for Agriculture and Biosciences International
CDBG	Community Development Block Grant
CDC	Centers for Disease Control and Prevention
CEPA	County Emergency Preparedness Assessment
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
CHA	Village Designated Engineer
CHC	Canadian Hurricane Centre
CIP	Capital Improvement Plan
CPC	Climate Prediction Center
CRREL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System
DFIRMs	Digital Flood Insurance Rate Maps
DHS	United States Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000
DOD	Degrees of Damage
DOF	Dependent on Funding
DPW	Department of Public Works
EDP	Environmental Design Partner
EF	Enhanced Fujita Scale
EHE	Extreme Heat Event
EMS	Emergency Medical Services
EOC	Emergency Operation Centers
ES	School - 1-story Elementary (Interior or Exterior Halls)
ESRL	Earth System Research Laboratory
F-Scale	Fujita Scale

Acronym	Definition
FCAAP	Flood Control Assistance Account Program
FEMA	Federal Emergency Management Agency
FIA	Flood Insurance Administration
FIRMs	Flood Insurance Rate Maps
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance Grants
FR12	One- or two-family residences
FSP	Free Standing Pole (light, flag, luminary)
FST	Free-Standing Tower
GIS	Geographical Information Systems
GPS	Global Positioning System
HAZMAT	Hazardous Material
Hazus	Hazards US
HAZUS-MH	Hazards US - Multi-Hazard
HI	Heat Index
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HRB	High-rise (over 20 stories)
IB	Institutional Building (Hospital, Govt. or University)
IT	Information Technology
IUGS	International Union of Geological Sciences
JHSH	School - Jr. or Sr. High School
KBDI	Keetch-Byram Drought Index
LIRB	Large, Isolated ("Big Box") Retail Building
LLC	Limited Liability Company
LRB	Low-rise (1-4 story) building
LSM	Large Shopping Mall
M	Motel
MAM	Masonry Apt. or Motel
MBS	Metal Building System
MESO	Multi-County Environmental Storm Observatory
MHDW	Double-Wide Mobile Home
MHSW	Single-Wide Mobile Home
MPH	Miles per Hour
MRB	Mid-rise (5-20 story) building
MRP	Mean Return Period
MS4	Municipal Separate Storm Sewer System
NCEI	National Centers for Environmental Information
NCRS	Natural Resources Conservation Service
NDMC	National Drought Mitigation Center
NE CASC	Northeast Climate Adaptation Science Center

Acronym	Definition
NESEC	Northeast States Emergency Consortium
NESIS	Northeast Snow Impact Scale
NFIP	National Flood Insurance Program
NGDC	National Geophysical Data Center
NHC	National Hurricane Center
NID	National Inventory of Dams
NIDIS	National Integrated Drought Information System
NIFC	National Interagency Fire Center
NOAA	National Oceanic and Atmospheric Association
NPDP	National Performance of Dams Program
NRCS	National Resources Conservation Service
NSFHA	No Special Flood Hazard Areas
NSFHA	Non-Special Flood Hazard Area
NSSL	National Severe Storms Laboratory
NVRC	Northern Virginia Regional Commission
NWS	National Weather Service
NYCDEP	New York State Department of Environmental Protection
NYCEM	New York City Emergency Management Agency
NYCRR	New York Code, Rules, and Regulations
NYIS.info	New York Invasive Species Information
NYISO	New York Independent System Operator, Inc.
NYS	New York State
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
NYSDOT	New York State Department of Transportation
NYSDPC	New York State Disaster Preparedness Commission
NYSERDA	New York State Energy Research and Development Authority
NYSGS	New York State Geological Survey
OAS	Organization of American States
OES	Saratoga County Office of Emergency Services
OG	Ongoing Program
PD	Police Department
PDM	Pre-Disaster Mitigation Grant
PDSI	Palmer Drought Index
PGA	Peak Ground Acceleration
PRISMs	Partnerships for Regional Invasive Species Management
Q3	Quality 3
RDI	Reclamation Drought Index
RH	Relative Humidity
RL	Repetitive Loss

Acronym	Definition
RV	Replacement Value
SA	Spectral Acceleration
Saratoga PLAN	Saratoga Preserving Land and Nature
SBO	Small Barns, Farm Outbuildings
SFHA	Special Flood Hazard Areas
SHELDUS	Hazards & Vulnerability Research Institute
SM	Strip Mall
SO	Sheriff's Office
SPB	Small Professional (doctor office, branch bank)
SPC	Storm Prediction Center
SRB	Small retail Building (fast food)
SSC	Service Station Canopy
SWSI	Surface Water Supply Index
TH	Tree- Hardwood
TLT	Transmission Line Tower
TS	Tree- Softwood
US DOI	United States Department of Interior
US EPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
USD	United States Dollar
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USGS	United States Geological Survey
USGS	United States Geological Survey
USSARTF	United States Search and Rescue Task Force
WFAS	Wildland Fire Assessment System
WHB	Warehouse (Tilt-up Walls or Heavy Timber)
WUI	Wildland Urban Interface

Glossary

This resource defines terms used throughout this hazard mitigation plan. These definitions were based on terms defined in documents included in the reference section, with modifications as appropriate to address the Saratoga County specific definitions and requirements.

100-year flood – A flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management to determine the need for flood insurance.

500-year flood – A flood that has a 0.2-percent chance of being equaled or exceeded in any one year.

Aggregate Data – Data gathered together across an area or region (for example, census tract or census block data).

Annualized Loss – The estimated long-term value of losses from potential future hazard occurrences of a particular type in any given single year in a specified geographic area. In other words, the average annual loss that is likely to be incurred each year based on frequency of occurrence and loss estimates. Note that the loss in any given year can be substantially higher or lower than the estimated annualized loss.

Annualized Loss Ratio – Represents the annualized loss estimate as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula: Annualized Loss Ratio = Annualized Losses / Exposure at Risk. The annualized loss ratio gauges the relationship between average annualized loss and building value at risk. This ratio can be used as a measure of relative risk between hazards as well as across different geographic units

Asset – Any man-made or natural feature that has value, including but not limited to people, buildings, infrastructure (such as bridges, roads, and sewer and water systems), and lifelines (such as electricity and communication resources or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks).

At-Risk – Exposure values that include the entire building inventory value in census blocks that lie within or border the inundation areas, or any area potentially exposed to a hazard based on location.

Base Flood – Flood that has a 1-percent probability of being equaled or exceeded in any given year. It is also known as the 100-year flood.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as the standard for the National Flood Insurance Program.

Benefit – Net project outcomes, usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of conducting a benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including a reduction in expected property losses (building, content, and function) and protection of human life.

Benefit-cost analysis (BCA) – Benefit-cost analysis is a systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Blizzard – Characterized by low temperatures, wind gusts of 35 mph or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours).

Building – A structure that is walled and roofed, principally aboveground and permanently fixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Codes – Regulations that set forth standards and requirements for construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural disasters.

Buildup Index – Cumulative numerical index derived from daily weather data, presumably indicates the moisture content in medium-driving forest fuels.

Capability Assessment – An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Climate – The meteorological elements, including temperature, precipitation, and wind, that characterizes the general conditions of the atmosphere over a period of time (typically 30-years) for a particular region.

Community Rating System (CRS) – CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specific activities, the insurance premiums of these policyholders in communities are reduced.

Comprehensive Plan – A document, also known as a "general plan", covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and

transportation. In most states, the comprehensive plan has no authority in and of itself but serves as a guide for community decision-making.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following a hazard. Critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities. As defined for the Saratoga County risk assessment, this category includes police stations, fire and/or EMS stations, major medical care facilities and emergency communications.

Dam Failure – A partial or complete breach in a dam, which impacts its integrity. Dam failures occur for a number of reasons such as flash flooding, inadequate size of spillways, mechanical failure of valves and other equipment, rodent activities in earthen dams, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris – The scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digital Elevation Model (DEM) – U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data files that are digital representations of cartographic information in a raster form. DEMs include a sampled array of elevations for a number of ground positions at regularly spaced intervals. These digital cartographic/geographic data files are produced by USGS as part of the National Mapping Program.

Digital Flood Insurance Rate Maps (DFIRMs) – These maps are used to calculate the cost insurance premiums, establish flood risk zones and base flood elevations to mitigate against potential future flood damages to properties.

Displacement Time – After a hazard occurs, the average time (in days) that a building's occupants must operate from a temporary location while repairs are made to the original building due to damages resulting from the hazard.

Disaster Mitigation Act of 2000 (DMA 2000) – Law that requires and rewards local and state pre- disaster planning, promotes sustainability as a strategy for disaster resistance, and is intended to integrate state and local planning with the aim of strengthening state-wide mitigation planning.

Duration – The length of time a hazard occurs.

Earthquake – A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Essential Facility – A facility that is important to ensure a full recovery of a community or state following the occurrence of a hazard. These facilities can include government facilities, major employers, banks, schools, and certain commercial establishments (such as grocery stores, hardware stores, and gas stations). For the Saratoga County risk assessment, this category was defined to include schools, colleges, shelters, adult living and adult care facilities, medical facilities and health clinics, hospitals.

Exposure – The number and dollar value of assets that are considered to be at risk during the occurrence of a specific hazard.

Extent – The size of an area affected by a hazard or the occurrence of a hazard.

Extra-Tropical Cyclone – A group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes of the Earth. These storms have neither tropical nor polar characteristics and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as “baroclinic zones”. These cyclones produce impacts ranging from cloudiness and mild showers to heavy gales and thunderstorms.

Federal Emergency Management Agency (FEMA) – Independent agency (now part of the Department of Homeland Security) created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Flash Flood – A flood occurring with little or no warning where water levels rise at an extremely fast rate.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas resulting from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth – Height of the flood water surface above the ground surface.

Flood Elevation – Height of the water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or mean sea level).

Flood Hazard Area – Area shown to be inundated by a flood of a given magnitude on a map.

Flood Information Tool (FIT) – Hazard U.S. Multi-Hazard (HAZUS-MH)- related tool designed to process and convert locally available flood information to data that can be used by the HAZUS-MH Flood Module. The FIT is a system of instructions, tutorials and geographic information system (GIS) analysis scripts. When provided with user-supplied inputs (such as ground elevations, flood elevations, and floodplain boundary information), the FIT calculates flood depth and elevation for river and coastal flood hazards.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Flood Mitigation Assistance (FMA) Program – A program created as a part of the National Flood Insurance Report Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings,

manufactured homes, and other NFIP insurance structures, with a focus on repetitive loss properties.

Floodplain – Any land area, including a watercourse, susceptible to partial or complete inundation by water from any source.

Flood Polygon – A geographic information system vector file outlining the area exposed to the flood hazard. HAZUS-MH generates this polygon at the end of the flood computations in order to analyze the inventory at risk.

Freezing Rain – Rain that falls as a liquid but freezes into glaze upon contact with the ground.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average and would have a 1-percent chance of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity – Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 (wind speed less than 73 mph) indicates minimal damage such as broken tree limbs or signs, while an F5 (wind speeds of 261 to 318 mpg) indicated severe damage sustained.

Geology – The scientific study of the earth, including its composition, structure, physical properties, and history.

Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Geographic Information Systems (GIS) – A computer software application that relates data regarding physical and other features on the earth to a database to be used for mapping and analysis.

GIS Shape Files – A type of GIS vector file developed by ESRI for their ArcView software. This type of file contains a table and a graphic. The records in the table are linked to corresponding objects in the graphic.

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.

Hailstorm – Storm associated with spherical balls of ice. Hail is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the higher reaches of a well-developed thunderstorm. When hailstones become too heavy to be caught in an updraft back into the clouds of the thunderstorm (hailstones can be caught in numerous updrafts adding a coating of ice to the original frozen droplet of rain each time), they fall as hail and a hailstorm ensues.

Hazard – A source of potential danger or an adverse condition that can cause harm to people or cause property damage. For this risk assessment, priority hazards were identified and selected

for the pilot project effort. A natural hazard is a hazard that occurs naturally (such as flood, wind, and earthquake). A man-made hazard is one that is caused by humans (for example, a terrorist act or a hazardous material spill). Hazards are of concern if they have the potential to harm people or property.

Hazards of Interest – A comprehensive listing of hazards that may affect an area.

Hazards of Concern – Those hazards that have been analytically determined to pose significant risk in an area, and thus the focus of the particular mitigation plan for that area (a subset of the Hazards of Interest).

Hazard Identification – The process of identifying hazards that threaten an area.

Hazardous Material Facilities – Facilities housing industrial and hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins.

Hazard Mitigation – Sustained actions taken to reduce or eliminate the long-term risk and effects that can result from the occurrence of a specific hazard. For example, building a retaining wall can protect an area from flooding.

Hazard Mitigation Grant Program (HMGP) – Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard Mitigation Plan – A collaborative document in which hazards affecting the community are identified, vulnerability to hazards assessed, and consensus reached on how to minimize or eliminate the effects of these hazards.

Hazard Profile – A description of the physical characteristics of a hazard, including a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard Risk Gauge – The graphic icon used during the initial planning process to convey the relative risk of a given hazard in the study area. The scale ranges from green indicating relatively low or no risk to red indicating severe risk.

Hazard Analysis New York (HAZNY) - Developed by the American Red Cross and the New York State Department of Homeland Security and Emergency Services (formerly the New York State Emergency Management Office) on October 2, 2003. It is an automated interactive spreadsheet that asks specific questions on potential hazards in a community and records and evaluates the responses to these questions.

Hazards U.S. (HAZUS) – A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA. HAZUS was replaced by HAZUS-MH (see below) in 2003.

Hazards U.S. – Multi-Hazard (HAZUS-MH) – A GIS-based nationally standardized earthquake, flood, and wind loss estimation tool developed by FEMA. The purpose of this pilot project is to demonstrate and implement the use of HAZUS-MH to support risk assessments

HAZUS-MH Risk Assessment Methodology – This analysis uses the HAZUS-MH modules (earthquake, wind--hurricane and flood) to analyze potential damages and losses. For this pilot project risk assessment, the flood and hurricane hazards were evaluated using this methodology.

HAZUS-MH-Driven Risk Assessment Methodology – This analysis involves using inventory data in HAZUS-MH combined with knowledge such as (1) information about potentially exposed areas, (2) expected impacts, and (3) data regarding likelihood of occurrence for hazards. For this risk assessment, a HAZUS-Driven Risk Assessment Methodology could not be used to estimate losses associated with any hazards because of a lack of adequate data. However, the methodology was used, based on more limited data to estimate exposure for the dam failure, urban fire, fuel pipeline breach, and HazMat release hazards.

Heavy Snow – Snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.

High Potential Loss Facilities – Facilities that would have a high loss associated with them, such as nuclear power plants, dams, and military installations.

Hurricane – An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean (east of 160°E longitude). Hurricane circulation is counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Hydraulics – That branch of science, or of engineering, which addresses fluids (especially, water) in motion, its action in rivers and canals, the works and machinery for conducting or raising it, its use as a prime mover, and other fluid-related areas.

Hydrology – The science of dealing with the waters of the earth (for example, a flood discharge estimate is developed through conduct of a hydrologic study).

Infrastructure – The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, transportation system (such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams).

Ice Jam – An accumulation of ice in a river that acts as a natural dam and can flood low-lying areas upstream. They occur when warm temperatures and heavy rains cause rapid snow melt.

Ice Storm – Term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication.

Intensity – A measure of the effects of a hazard occurring at a particular place.

Inventory – The assets identified in a study region. It includes assets that can be lost when a disaster occurs, and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide – Downward movement of a slope and materials under the force of gravity.

Level 1 Analysis – A HAZUS-MH analysis that yields a rough estimate or preliminary analysis based on the nationwide default database included in HAZUS-MH. A Level 1 analysis is a great way to begin the risk assessment process and prioritize high-risk communities without collecting or using local data.

Level 2 Analysis – A HAZUS-MH analysis that requires the input of additional or refined data and hazard maps that will produce more accurate risk and loss estimates. Assistance from local emergency management personnel, city planners, GIS professionals, and others may be necessary for this level of analysis.

Level 3 Analysis – A HAZUS-MH analysis that yields the most accurate estimate of loss and typically requires the involvement of technical experts such as structural and geotechnical engineers who can modify loss parameters based on the specific conditions of a community. This level analysis will allow users to supply their own techniques to study special conditions such as dam breaks and tsunamis. Engineering and other expertise is needed at this level.

Lifelines – Critical facilities that include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways).

Lightning – A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground.

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.

Loss Estimation – The process of assigning hazard-related damage and loss estimates to inventory, infrastructure, lifelines, and population data. HAZUS-MH can estimate the economic and social loss for specific hazard occurrences. Loss estimation is essential to decision making at all levels of government and provides a basis for developing mitigation plans and policies. It also supports planning for emergency preparedness, response, and recovery.

Lowest Floor – Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure. For the HAZUS-MH flood model, this information can be used to assist in assessing the damage to buildings.

Magnitude – A measure of the strength of a hazard occurrence. The magnitude (also referred to as severity) of a given hazard occurrence is usually determined using technical measures specific to the hazard. For example, ranges of wind speeds are used to categorize tornados.

Major Disaster Declarations – Post-disaster status requested by a state's governor when local and state resources are not sufficient to meet disaster needs. It is based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery. The event must be clearly more than the state or local government can handle alone.

Mean Return Period (MRP) – The average period of time, in years, between occurrences of a particular hazard (equal to the inverse of the annual frequency of exceedance).

Mitigation Actions – Specific actions that help you achieve your goals and objectives.

Mitigation Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term, and represent global visions.

Mitigation Objectives – Strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Mitigation Plan – A plan that documents the process used for a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a state or community. The plan includes a description of actions to minimize future vulnerability to hazards. This plan should be developed with local experts and significant community involvement.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 Code of Federal Regulations (CFR) §60.3.

Nor'easter – Named for the strong northeasterly winds blowing in ahead of the storm, are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms). A Nor'easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the Northeastern U.S. and Atlantic Canada.

National Weather Service (NWS) – Organization that prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.

Objectives – Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Occupancy Classes – Categories of buildings used by HAZUS-MH (for example, commercial, residential, industrial, government, and "other").

Ordinance – A term for a law or regulation adopted by local government.

Outflow – Associated with coastal hazards and follows water inundation creating strong currents that rip at structures and pound them with debris and erode beaches and coastal structures.

Parametric Model – A model relating to or including the evaluation of parameters. For example, HAZUS-MH uses parametric models that address different parameters for hazards such as earthquake, flood and wind (hurricane). For example, parameters considered for the earthquake hazard include soil type, peak ground acceleration, building construction type and other parameters.

Planimetric – Maps that indicate only man-made features like buildings.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Post-disaster mitigation – Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Presidential Disaster Declaration – A post-disaster status that puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities in the areas of human services, public assistance (infrastructure support), and hazard mitigation. If declared, funding comes from the President's Disaster Relief Fund and disaster aid programs of other participating federal agencies.

Preparedness – Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Priority Hazards – Hazards considered most likely to impact a community based on frequency, severity, or other factors such as public perception. These are identified using available data and local knowledge.

Provided Data – The databases included in the HAZUS-MH software that allow users to run a preliminary analysis without collecting or using local data.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Public Education and Outreach Programs – Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Q3 Flood Zone Data – FEMA flood data that delineate the 100- and 500-year flood boundaries. The Q3 Flood Data are digital representations of certain features of FEMA's Flood Insurance Rate Map (FIRM) product, intended for use with desktop mapping and GIS technology.

Recovery – The actions taken by an individual or community after a catastrophic event to restore order and lifelines in the community.

Regulation – Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Recurrence Interval – The average time between the occurrences of hazardous events of similar size in a given location. This interval is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This cost is usually expressed in terms of cost per square foot and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Resolutions – Expressions of a governing body's opinion, will, or intention that can be executive or administrative in nature. Most planning documents must undergo a council resolution, which must be supported in an official vote by a majority of representatives to be adopted. Other methods of making a statement or announcement about a particular issue or topic include proclamations or declarations.

Resources – Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment – A methodology used to assess potential exposure and estimated losses associated with priority hazards. The risk assessment process includes four steps: (1) identifying hazards, (2) profiling hazards, (3) conducting an inventory of assets, and (4) estimating losses. This pilot project report documents this process for selected hazards addressed as part of the pilot project.

Risk Factors – Characteristics of a hazard that contribute to the severity of potential losses in the study area.

Riverine – Of or produced by a river (for example, a riverine flood is one that is caused by a river overflowing its banks).

Saffir-Simpson Scale – This scale categorizes or rates hurricanes from 1 (Minimal) to 5 (Catastrophic) based on their intensity. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the shape of the coastline, in the landfill region.

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scour – Removal of soil or fill material by the flow of floodwaters. This term is frequently used to describe storm-induced, localized, conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Seiche - The sloshing of a closed body of water from earthquake shaking (USGS, 2008).

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1-percent or greater chance of flood occurrence in any given year (that is, the 100-year or base flood zone);

represented on FIRMS as darkly shaded areas with zone designations that include the letter “A” or “V.”

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law (PL) 100-107 was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder – Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

State Hazard Mitigation Officer (SHMO) – The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structure – Something constructed (for example, a residential or commercial building).

Study Area – The geographic unit for which data are collected and analyzed. A study area can be any combination of states, counties, cities, census tracts, or census blocks. The study area definition depends on the purpose of the loss study and in many cases will follow political boundaries or jurisdictions such as city limits.

Substantial Damage – Damage of any origin sustained by a structure in a SFHA, for which the cost of restoring the structure to its pre-hazard event condition would equal or exceed 50 percent of its pre-hazard event market value.

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.

Tectonic Deformation - A change in the original shape of a material due to stress and strain.

Thunderstorm – A local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder. It forms from a combination of moisture, rapidly rising warm air and a force capable of lifting air such a warm and cold front, a sea breeze, or a mountain.

Topographic – Map that shows natural features and indicate the physical shape of the land using contour lines based on land elevation. These maps also can include man-made features (such as buildings and roads).

Tornado – A violently rotating column of air extending from a thunderstorm to the ground.

Transportation Systems – One of the lifeline system categories. This category includes airways (airports, heliports, highways), bridges, tunnels, roadbeds, overpasses, transfer centers; railways (tracks, tunnels, bridges, rail yards, depots), and waterways (canals, locks, seaports, ferries, harbors, dry docks, piers).

Tropical Cyclone – A generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters containing a warm core of low barometric pressure which typically produces heavy rainfall, powerful winds and storm surge.

Tropical Depression – An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of less than 38 mph. It has no “eye” (the calm area in the center of the storm) and does not typically have the organization or the spiral shape of more powerful storms.

Tropical Storm – An organized system of strong thunderstorms with a defined surface circulation and maximum sustained wind between 39 to 73 mph.

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.

Utility Systems – One of the lifeline systems categories. This category includes potable water, wastewater, oil, natural gas, electric power facilities and communication systems.

Vulnerability – Description of how exposed or susceptible an asset is to damage. This value depends on an asset’s construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. If an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct affects.

Vulnerability Assessment – Evaluation of the extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard occurrences on the existing and future built environment.

Watershed – Area of land that drains down gradient (from areas of higher land to areas of lower land) to the lowest point; a common drainage basin. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves downstream, eventually reaching an estuary, lake, or ocean.

Wildfire - Unplanned or unwanted fires burning vegetation in areas where development is minimal or non-existent. They may also be referred to as forest fires, brush fires, grass fires, range fires, ground fires or crown fires. (NYS DEC, 2018)

Wildfire Mitigation - Activity designed to reduce or eliminate risks of wildfire to people or property by reducing the actual or potential effects, or consequences of a wildfire. (NYS DEC, 2018)

Wildland Fire - Wildfires and those fires intentionally set or allowed to burn according to a recognized land management plan and are commonly referred to as prescribed fires or controlled burns. (NYS DEC, 2018)

Wildland Fire Management - Activity related to wildfire mitigation and the use of prescribed fire to accomplish ecological goals. (NYS DEC, 2018)

Wildland/Urban Interface Fire - Wildfires that burn or threaten to burn buildings and other structures. (NYS DEC, 2018)

Windstorm – A storm characterized by high wind velocities.

Wind Chill Index (WCI) – The temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold.

Zone – A geographical area shown on a National FIRM that reflects the severity or type of flooding in the area.

Zoning Ordinance – Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

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Sections 6 through 9

No external resources used.