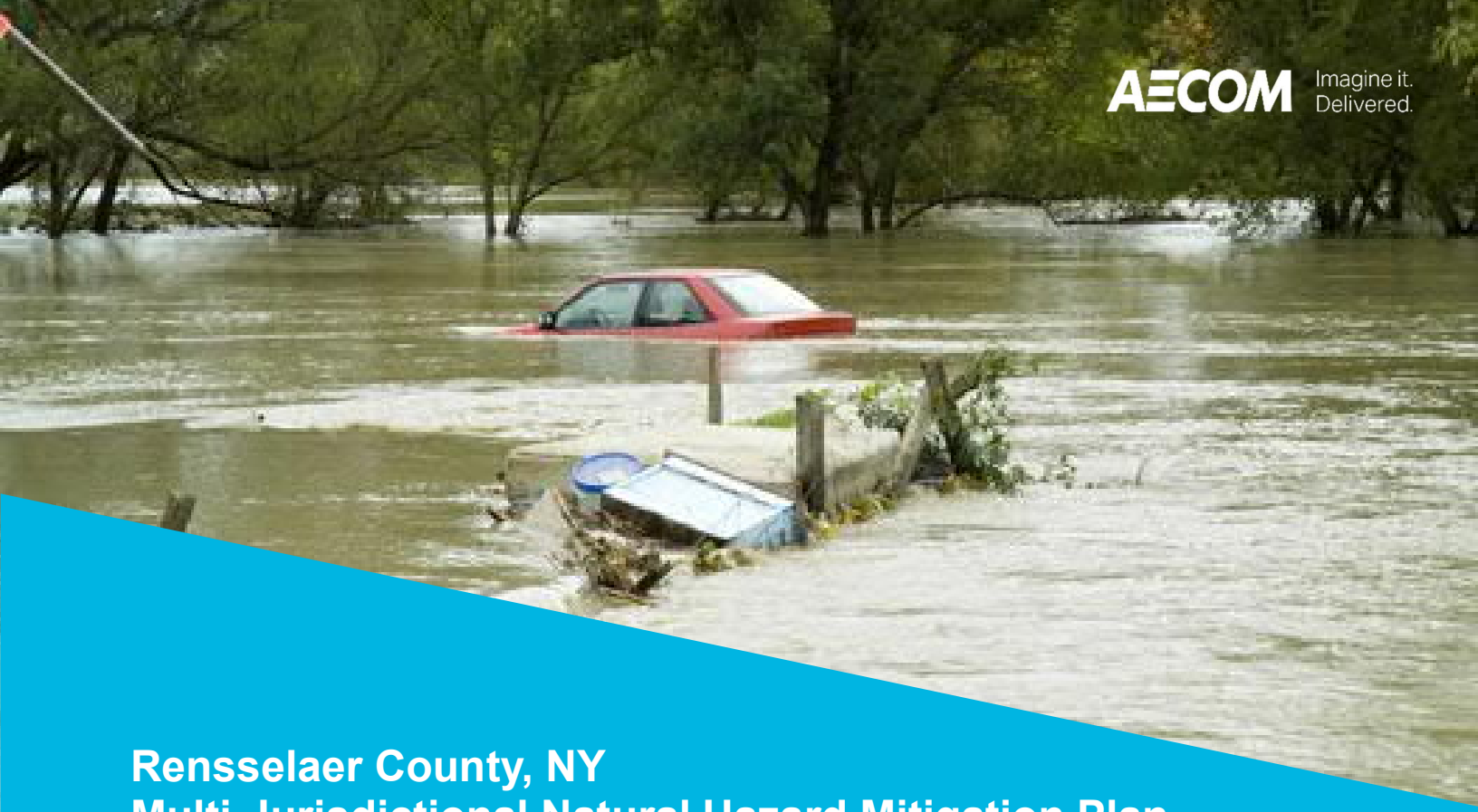

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Rensselaer County, NY
Multi-Jurisdictional Natural Hazard Mitigation Plan

JULY 2020

Multi-Jurisdictional Natural Hazard Mitigation Plan Rensselaer County, New York

Prepared for

Rensselaer County
Bureau of Public Safety
Public Safety Building
4000 Main Street
Troy, New York 12180

AECOM
1255 Broad Street, Suite 201
Clifton, New Jersey 07013

Final Plan Update – July 2020

PLAN ADOPTION RESOLUTIONS

In accordance with Part 201.6 of the Disaster Mitigation Act of 2000 (DMA 2000), Rensselaer County, New York, has developed this Multi-Jurisdictional Hazard Mitigation Plan to identify hazards that threaten the County and ways to reduce future damages associated with these hazards.

Following this page are the signed adoption resolutions of the County and all participating jurisdictions that have adopted this plan, authorizing municipal government staff to carry out the actions detailed herein.

INSERT ADOPTION RESOLUTIONS HERE

Signed resolutions of adoption by all participating jurisdictions shall be inserted here after FEMA has reviewed and determined that the Draft plan is approvable.

The adoption resolution should be signed by the jurisdiction's chief elected official or be accompanied by a signed statement from the clerk's office attesting to the passage of the resolution.

Failure of any participating jurisdiction to ultimately adopt the plan and provide their adoption resolution to FEMA will result in a determination from FEMA that such jurisdiction has not successfully met the requirements of DMA 2000 and that the community does not have a plan "in place".

EXECUTIVE SUMMARY

Across the United States and around the world, natural disasters occur each day, as they have for thousands of years. As the world's population and development have increased, so have the effects of these natural disasters. The time and money required to recover from these events often strain or exhaust local resources. The purpose of hazard mitigation planning is to identify policies, actions, and tools for implementation that will, over time, work to reduce risk and the potential for future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together an in effort to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damages.

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act ("the Stafford Act"), enacted by Section 104 of the Disaster Mitigation Act of 2000 ("DMA 2000"), provides new and revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance and establishes a new requirement for local mitigation plans. In order to apply for Federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with DMA 2000 and its implementing regulations (44 CFR Part 201.6).

While Rensselaer County has always sought ways to reduce their vulnerability to hazards, the passage of DMA 2000 helped County officials recognize the benefits of pursuing a long-term, coordinated approach to hazard mitigation through hazard mitigation planning. The County has received grant funds from the Federal Emergency Management Agency (FEMA) for the purpose of developing this very hazard mitigation plan. Funding was received under the Hazard Mitigation Grant Program for development of a multi-jurisdictional hazard mitigation plan for the County and as many of its 22 municipalities that chose to participate. This Rensselaer County Multi-Jurisdictional Natural Hazard Mitigation Plan represents the collective efforts of the county and seven fully participating jurisdictions, the general public, and other stakeholders. Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementations of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

The Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan has been developed by the Rensselaer County Hazard Mitigation Planning Team (the "Planning Team"), with support from outside consultants. The efforts of the Planning Committee were headed by Jay Wilson, Director of the Rensselaer County Bureau of Public Safety (RCBPS) and supported by Eric Gaunay, Emergency Preparedness Coordinator; in coordination with the County Planning, Engineering, Health, and Highway Departments. The overall Planning Committee was divided into a Core Planning Group (CPG) and Jurisdictional Assessment Teams (JATs), with one JAT for each of the County's participating jurisdictions. The JATs consisted of a wide range of position titles for each community, from key individuals involved in emergency management to specialists in, planning, engineering, floodplain management, and local administrators.

Rensselaer County's first hazard mitigation plan was approved by FEMA in November 2011. Thereafter, it was adopted by resolutions passed by the County and each participating jurisdiction. FEMA requires hazard mitigation plans to be monitored and evaluated regularly and updated at least once every five years. This document represents the first update of the Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan.

The Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan has been developed with a wide range of County, municipal, and stakeholder involvement. The County, participating jurisdictions, and key stakeholders met regularly throughout the plan update timeline to share information and ideas about natural hazards, areas in need of mitigation, and potential mitigation measures to reduce risks. RCBPS officiated the following key plan update meetings:

- November 5, 2018 — Project Initiation Meeting (RCBPS and Consultant)
- December 10, 2018 — Kickoff Meeting of the CPG and Key Stakeholders
- January 16, 2018 — One on One Municipal Assistance Sessions
- January 17, 2018 — One on One Municipal Assistance Sessions
- March 25, 2019 — Morning - Key Stakeholders Meeting
Afternoon - Progress Meeting of the CPG
- March 26, 2019 — One on One Municipal Assistance Sessions
- June 5, 2019 — Morning – County JAT Working Session
Afternoon - CPG Mitigation Strategy Working Session
- July 29-August 1, 2019 — One on One Municipal Assistance Sessions

In addition, JATs in each municipality met individually throughout the plan update process as they deemed necessary and conducted further outreach and coordination activities to provide residents and key local stakeholders various opportunities to learn about the plan update and to become involved, and to provide comments and feedback.

Community support is vital to the success of any hazard mitigation plan. The County and each participating community were responsible for conducting outreach within their respective jurisdictions. Since the first plan update process began in the fall of 2018, more than 100 outreach activities have been undertaken by the planning team members. These efforts provided the general public and other stakeholders with opportunities to take part in the decisions that will affect their future. Each jurisdiction's outreach activities are summarized in detail in their respective jurisdictional annexes.

County-Led Outreach Activities. The County-led outreach actions during the plan update were similar to those undertaken during the development of the initial plan. The County performed ongoing maintenance of its online hazard mitigation planning web presence at http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/ with information on the planning process and where to go for additional information or to provide

feedback. The County Freeholders discussed the hazard mitigation plan and passed a resolution to participate in the multi-jurisdictional hazard mitigation plan update on July 10, 2018 at an open public meeting. Project Update Fact Sheets were widely distributed by the County JAT members at various meetings throughout the process such as meetings with local emergency management officials and public safety representatives (EMS coordinators, Fire Coordinators, hazardous materials coordinators, Fire and EMS Chiefs from local municipalities). Particular outreach was also undertaken by RCBPS to area nursing home administrators. They were also made available at the County Office Building and various libraries and at the RCBPS Booth at the Schaghticoke Fair in both 2018 and 2019. Additionally, the Plan Update Fact Sheet was posted electronically on the RCBPS webpage and in hard copy on the RCBPS office notice board. The plan update was also discussed at the regular monthly Community Emergency Response Team (CERT) meetings beginning in November 2018.

The County's JAT met throughout the plan update process to discuss progress and work on development of the County's mitigation strategy. The County JAT included direct membership and participation from the following groups or individuals who attended various meetings throughout the process and provided input on action items being considered for the County's mitigation strategy:

Steve McLaughlin - County Executive
Michael Stammel - Chairman of the Legislature
Jim Breig - Deputy Director of Budget
Jay Wilson - Director of Public Safety
Eric Gaunay - Emergency Preparedness Coordinator
Mark Lacivita – Public Safety
Paul Glasser – Public Safety
Linda von der Heide - Principal Planner
Joe Teliska - Rensselaer County Department of Engineering and Highways
Michael Czornyj - Rensselaer County Buildings and Codes
Len Claus - Rensselaer County Health Department
Jolene Weidlich – Rensselaer County Bureau of Research and Information Services
Mark Castiglione - Capital District Regional Planning Commission
Fred Aliberti - Hudson Valley Community College
Brian Boudreau - St. Peter's Health Partners
Aran Mull - University at Albany
Vadim Thomas - Rensselaer Polytechnic Institute
Michael Temblay - Russell Sage College
Brian Wood - Albany County
Allison Strohl - Bennington County
Henry Swartz - Columbia County
Mike Stanley - Saratoga County
Bonney Hartley - Mohican Tribal Historic Preservation Office

Other stakeholders who did not wish to be represented on the County JAT were still offered opportunities to contribute to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, and reviewing draft updates of the document. Input, questions, and feedback were welcomed at any time. In addition to the above stakeholder entities represented on the County JAT, the below stakeholder agencies participated by attending one or more planning team meetings:

American Red Cross
Cornell Cooperative Extension
National Grid
Natural Resources Conservation Service
New York State Department of Transportation
New York State Department of Homeland Security and Emergency Services
New York State Electric and Gas
Questar III Board of Cooperative Educational Services (BOCES)

Municipal JAT Outreach Activities. Participating communities supplemented the above range of County-led efforts with outreach targeted toward members of the general public and other stakeholders within their respective municipalities to get the word out even further and to supplement the County's larger outreach activities. JATs employed a wide range of techniques for providing opportunities for feedback and participation from the public and other stakeholders. Many distributed copies of the project fact sheet, posted information on their web sites, discussed the plan update at open public meetings in their communities, reached out to key stakeholder groups, and collectively undertook more than 100 activities throughout the plan update process to ensure that the public and other stakeholders were made aware of the process and their opportunity to participate and provide feedback and input.

The initial hazard mitigation planning process consisted of the following key steps:

- Researching a full range of natural hazards to identify which hazards could affect the County;
- Identifying the location and extent of hazard areas;
- Identifying assets located within these hazard areas;
- Characterizing existing and potential future assets at risk;
- Assessing vulnerabilities to the most prevalent hazards; and
- Formulation and prioritization of goals, objectives, and mitigation actions to reduce or avoid long-term vulnerabilities to the identified hazards.

For this Plan Update, the CPG:

- Assessed current development patterns and development pressures
- Evaluated new hazard or risk information
- Described progress in local plan maintenance and plan integration efforts
- Assessed previous goals and actions
- Summarized progress in implementing actions
- Adjusted actions to address current realities
- Explained changes in priorities
- Addressed changes in Federal/State requirements
- Reviewed the 2011 Natural Hazard Mitigation Plan to determine the changes that occurred since the Plan was prepared.

Significant natural hazards in Rensselaer County that are included in the Plan are:

Atmospheric Hazards	Hydrologic Hazards	Geologic Hazards	Other Hazards
• Extreme Temperatures (Coldwaves and Heat Waves) • Hurricane/Tropical Storm • Lightning • Tornado • Wind • Winter Storm (Ice Storm and Snow Storm)	• Drought • Flooding (includes Flooding, Dam Failure, and Ice Jams)	• Earthquake • Landslide	• Wildfire

After evaluating these hazards and assets within the County to which they are vulnerable, each participating jurisdiction developed an updated hazard mitigation strategy to increase the disaster resilience of the County, along with procedures for monitoring, evaluating and updating the Plan to ensure that it remains a "living document." A total of 348 mitigation actions are included in this plan update to reduce the impacts of natural hazards throughout the County, including 63 initiatives submitted by the County alone. Most jurisdictions intend to apply for various types of grant funding for at least some portion of their activities to offset the local cost burden. The robust mitigation strategies developed by each participating jurisdiction as part of this plan update are a significant expansion of many of the strategies that were proposed in the 2011 plan and represent a substantial improvement in addressing each jurisdiction's highest hazards and key risks.

This Draft Update of the Multi-Jurisdictional Natural Hazard Mitigation Plan for Rensselaer County is presently open for review by the public and other stakeholders. If you have any questions or comments, please contact:

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Troy, New York 12180
Phone: (518) 266-7676
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Rensselaer County Bureau of Public Safety
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Phone: (518) 266-7671
E-Mail: egaunay@rensco.com

For specific information regarding a particular community, please contact the Jurisdictional Representative and/or Alternate as identified in that community's Jurisdictional Annex.

Plan information is continuously maintained on the Rensselaer County web site at:
http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/

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ACKNOWLEDGEMENTS

Rensselaer County would like to thank the following County employees for their dedication to natural hazard mitigation and their tremendous contributions to the plan update process and this updated Multi-Jurisdictional Hazard Mitigation Plan. Particular thanks are extended to Jay Wilson and Eric Gaunay of RCBPS, who spearheaded the project and worked tirelessly to engage our communities, the public, and other stakeholders at every stage of the process.

Steve McLaughlin - County Executive
Michael Stammel - Chairman of the Legislature
Jim Breig - Deputy Director of Budget
Jay Wilson - Director of Public Safety
Eric Gaunay - Emergency Preparedness Coordinator
Linda von der Heide - Principal Planner
Joseph Teliska - Rensselaer County Department of Engineering and Highways
Michael Czornyj - Rensselaer County Buildings and Codes
Len Claus - Rensselaer County Health Department
Jolene Weidlich – Rensselaer County Bureau of Research and Information Services

Rensselaer County would also like to thank each of its 22 municipal entities for their commitment to the process, dedication of resources, and full engagement and participation in the development of this updated plan:

Berlin, Town of
Brunswick, Town of
Castleton-on-Hudson, Village of
East Greenbush, Town of
East Nassau, Village of
Grafton, Town of
Hoosick, Town of
Hoosick Falls, Village of
Nassau, Town of
Nassau, Village of
North Greenbush, Town of
Petersburgh, Town of
Pittstown, Town of
Poestenkill, Town of
Rensselaer, City of
Sand Lake, Town of
Schaghticoke, Town of
Schaghticoke, Village
Schodack, Town of
Stephentown, Town of
Troy, City of
Valley Falls, Village of

Rensselaer County and its communities are grateful for the contributions of the following stakeholder entities who agreed to participate directly on the Rensselaer County JAT and contributed to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, reviewing draft updates of the document, and attending one or more planning team meetings :

Capital District Regional Planning Commission
Hudson Valley Community College
St. Peter's Health Partners
University at Albany
Rensselaer Polytechnic Institute
Russell Sage College
Albany County
Bennington County
Columbia County
Saratoga County
Mohican Tribal Historic Preservation Office

Thanks are also extended to the following stakeholder entities who offered their valuable feedback throughout the process on topics ranging from sheltering locations to power needs and mitigation planning requirements:

American Red Cross
Cornell Cooperative Extension
National Grid
Natural Resources Conservation Service
New York State Department of Transportation
New York State Department of Homeland Security and Emergency Services
New York State Electric and Gas
Questar III Board of Cooperative Educational Services (BOCES)

Lastly, AECOM (Clifton, NJ) acted as the plan development consultant providing hazard mitigation planning services and authored the document.

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SECTION 1 - INTRODUCTION

Purpose

Rensselaer County is susceptible to a number of different natural hazards. These natural hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. While an important aspect of emergency management deals with disaster recovery – those actions that a community must take to repair damages and make itself whole in the wake of a natural disaster – an equally important aspect of emergency management involves hazard mitigation. Hazard mitigation measures are efforts taken before a disaster happens to lessen the impact that future disasters of that type will have on people and property in the community. They are things you do today to be more protected in the future.

Recognizing the risks that natural hazards pose to Rensselaer County, the Rensselaer County Bureau of Public Safety (RCBPS) submitted an application, and was approved for, grant monies from the Federal Emergency Management Agency (FEMA) under the Hazard Mitigation Grant Program (HMGP) in 2006 to develop the County's first hazard mitigation plan, which was approved by FEMA in November 2011. Grant monies were approved by FEMA under the Pre-Disaster Mitigation (PDM) Program in 2017 to develop this first hazard mitigation plan update.

This Rensselaer County Multi-Jurisdictional Natural Hazard Mitigation Plan (the "Plan") has been developed by the Rensselaer County Hazard Mitigation Planning Committee (the "Planning Committee"), with support from outside consultants at AECOM (the contractor responsible for providing the Planning Committee with hazard mitigation planning support services). The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

Through the development of this Plan, the Planning Committee has identified the natural hazards that could affect the County and has evaluated the risks associated with these hazards. The successful implementation of this Plan will make Rensselaer County more disaster-resilient because the County has taken the initiative to recognize the benefits that can be gained by planning ahead and taking measures to reduce damages before the next disaster strikes. The Plan will also allow Rensselaer County and participating jurisdictions to comply with the Disaster Mitigation Act of 2000 (DMA 2000) and its implementing regulations (44 CFR Part 201.6), thus resulting in eligibility to apply for Federal aid for technical assistance and post-disaster hazard mitigation project funding.

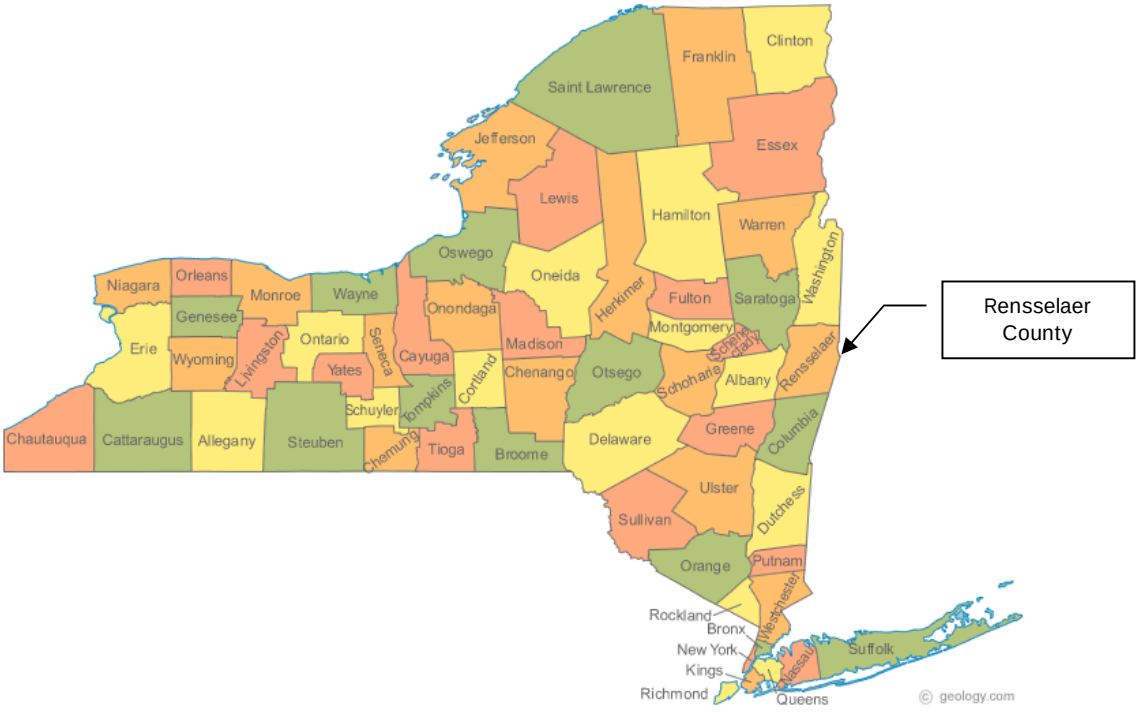
Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementation of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

About the County

Overview

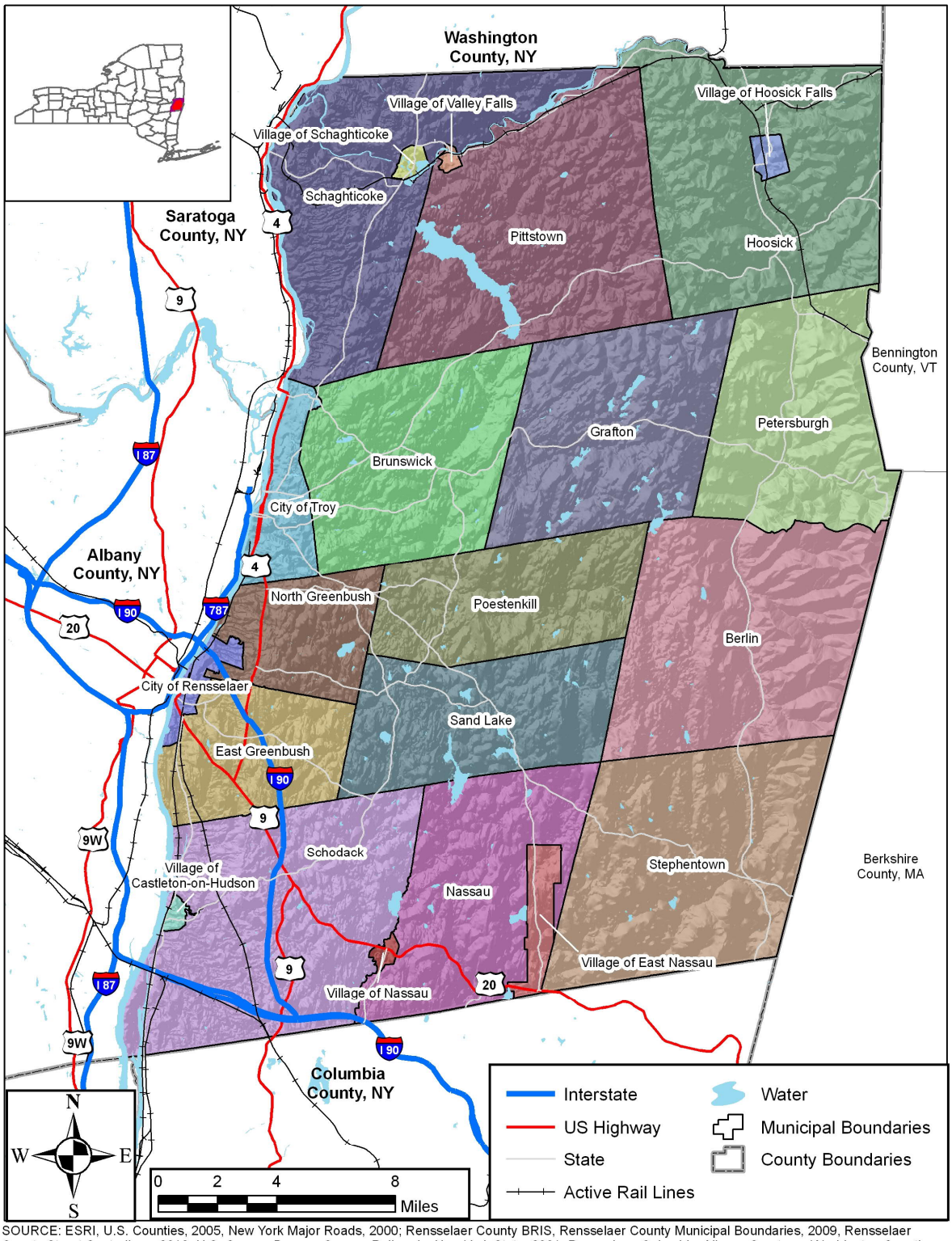
Rensselaer County is located in the eastern part of New York State. It is bounded to the west by Saratoga and Albany Counties and to the east by the States of Vermont and Massachusetts. Washington Counties lies to the north, and Columbia County is to the south. The county seat is the City of Troy. Rensselaer County is located in New York State's Capital District Region, the four counties of Albany, Rensselaer, Schenectady, and Saratoga surrounding the state's capital city of Albany. According to the U.S. Census Bureau 2010, Rensselaer County has a total area of 665 square miles, of which 652 square miles is land and 13 square miles is water. Figure 1.1 depicts the location of Rensselaer County in relation to the rest of New York State.

Figure 1.1 - Location of Rensselaer County in New York State



Rensselaer County is home to 22 municipalities (two cities, 14 towns, and six villages). They are the Cities of Rensselaer and Troy; the Towns of Berlin, Brunswick, East Greenbush, Grafton, Hoosick, Nassau, North Greenbush, Petersburgh, Pittstown, Poestenkill, Sand Lake, Schaghticoke, Schodack, and Stephentown; and the Villages of Castleton-on-Hudson, East Nassau, Hoosick Falls, Nassau, Schaghticoke, and Valley Falls. The location and extent of all these municipalities, as well as significant highways are shown on the base map of the County in Figure 1.2.

Figure 1.2 – Base Map of Rensselaer County



SOURCE: ESRI, U.S. Counties, 2005, New York Major Roads, 2000; Rensselaer County BRIS, Rensselaer County Municipal Boundaries, 2009, Rensselaer County Street Centerlines, 2010; U.S. Census Bureau, Census Railroads, New York State, 2001, Rensselaer, Columbia, Albany, Saratoga, Washington Counties, Area Hyrdography, 2007; USGS, 1-Arc Second National Elevation Dataset, 2009

Population

Rensselaer County's population has increased only slightly over the last several decades; from 154,429 in 1990 to 152,538 in 2000; 159,429 in 2010; and an estimated 159,442 in 2018. The Cornell Program on Applied Demographics projects the County's population to increase steadily to 2027, where it is projected to peak at 162,070 before declining steadily thereafter to approximately 160,846 by 2040. Table 1.1 shows key County population changes (county-wide and for each municipality) as reported by the US Census Bureau.

Table 1.1 - Rensselaer County Population , 1990 to 2018

Municipality	Census Population 1990	Census Population 2000	Census Population 2010	Census ACS Population Estimate, 2018
Berlin, Town of	1,929	1,901	1,880	Not available
Brunswick, Town of	11,093	11,664	11,941	Not available
Castleton-on-Hudson, Village of	1,491	1,619	1,473	1,473
East Greenbush, Town of	14,076	15,560	16,473	Not available
East Nassau, Village of	Not available **	571	587	571
Grafton, Town of	1,917	1,987	2,130	Not available
Hoosick Falls, Village of	3,490	3,436	3,501	3,373
Hoosick, Town of *	6,696	6,759	6,924	Not available
Nassau, Town of *	4,989	4,818	4,789	Not available
Nassau, Village of	1,254	1,161	1,133	1,105
North Greenbush, Town of	10,891	10,805	12,075	Not available
Petersburgh, Town of	1,461	1,563	1,525	Not available
Pittstown, Town of *	5,468	5,644	5,735	Not available
Poestenkill, Town of	3,809	4,054	4,530	Not available
Rensselaer, City of	8,255	7,761	9,392	9,212
Sand Lake, Town of	7,642	7,987	8,530	Not available
Schaghticoke, Town of *	7,574	7,465	7,679	Not available
Schaghticoke, Village of	794	676	592	582
Schodack, Town of *	11,839	12,536	12,794	Not available
Stephentown, Town of	2,521	2,873	2,903	Not available
Troy, City of	54,269	49,170	50,129	49,374
Valley Falls, Village of	527	491	466	427
Rensselaer, County of	154,429	152,538	159,429	159,442

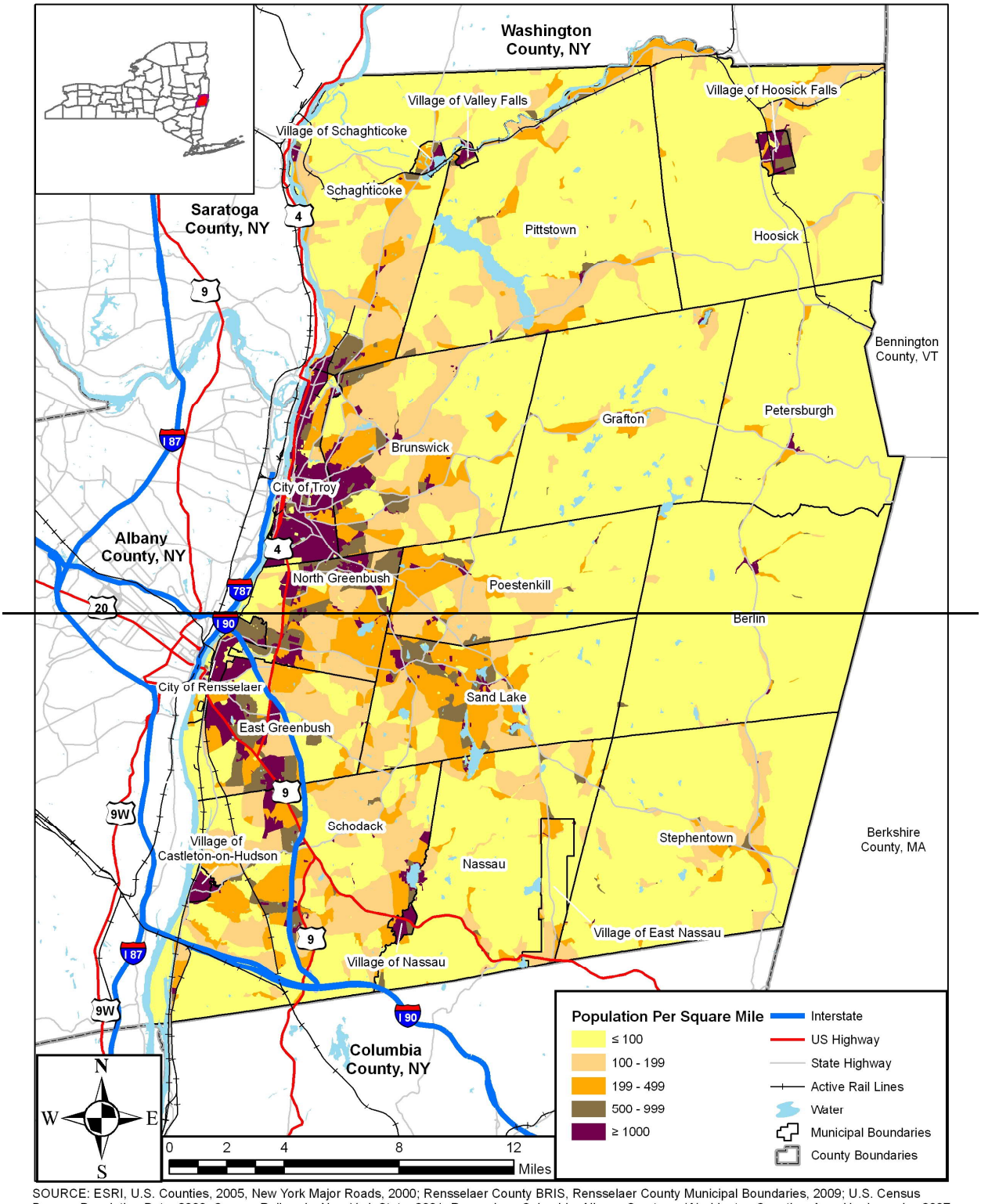
(Source: US Census Bureau)

* Town of Hoosick includes Village of Hoosick Falls; Town of Nassau includes Village of East Nassau and part of Village of Nassau; Town of Pittstown includes part of Village of Valley Falls; Town of Schaghticoke includes Village of Schaghticoke and part of Village of Valley Falls; Town of Schodack includes Village of Castleton-on-Hudson and part of Village of Nassau

** Population of East Nassau 1990 is not available because the Village did not incorporate until 1998

The 2010 U.S. Census population density per square mile of land in Rensselaer County was 244 persons per square mile; whereas, in the 2000 Census there were 233 persons per square mile, and 236 persons per square mile in 1990. Most of the county's residents live in the County's more developed communities along the Hudson River. Looking east, communities are much more rural and tend to be sparsely populated, with development generally clustered along major east-west transportation routes.

Figure 1.3 – Rensselaer County Population Density



SOURCE: ESRI, U.S. Counties, 2005, New York Major Roads, 2000; Rensselaer County BRIS, Rensselaer County Municipal Boundaries, 2009; U.S. Census Bureau, Population Data, 2000, Census Railroads, New York State, 2001, Rensselaer, Columbia, Albany, Saratoga, Washington Counties, Area Hyrdography, 2007

The overall median age in 2010 has been estimated by the U.S. Census Bureau to be 39.2, up from 36.7 in 2000 and 32.8 in 1990. The percentage of the County population over 65 years of age according to the US Census Bureau was 13.6% in 2010 with the Census Bureau estimating no significant change between 2000 and 2010 though the Cornell Program on Applied Demographics estimates that the proportion of elderly residents in Rensselaer County will increase sharply in the future (16.7% estimated by 2020; 19.7% estimated by 2030, and 19.4% estimated by 2040). The portion of the County population under 5 years of has decreased slightly since 2000 (6.1% in 2000, and 5.5% in 2010).

Since the year 2000, median household and median family incomes in Rensselaer County have been higher than national averages. However, the percentage of families and individuals living below the poverty level has also increased, according to the U.S. Census Bureau, as shown in Table 1.2.

Table 1.2 - Income and Employment in Rensselaer County
Source: U.S. Census Bureau

Economic Characteristic	Census 2000		Census 2010		2017 American Community Survey	
	Rensselaer County	USA	Rensselaer County	USA	Rensselaer County	USA
Median Household Income	$42,905	$41,994	$54,152	$51,914	$63,166	$57,652
Median Family Income	$52,864	$50,046	$68,390	$62,982	$81,817	$70,850
Families Below Poverty Level	6.7%	9.2%	8.5%	10.1%	8.5%	10.5%
Individuals Below Poverty Level	9.5%	12.4%	11.7%	13.8%	12.6%	14.6%
Unemployed*	4.1%	5.8%	7.3%	5.1%	3.8%	4.1%

*As a percentage of the population aged 16 years or more, civilian labor force

Transportation Links

Rensselaer County is linked to the surrounding area by road, with Interstate 90 traversing the southwestern region of the County; Routes 7, 2, and 66/43 providing east/west access; and Route 22 running the length of the eastern side of the County from north to south. Interstate 87 provides major north/south access just across the county's western border in neighboring Albany and Saratoga Counties. Passenger rail service is provided by Amtrak out of the station in the City of Rensselaer (rated among the Top 10 busiest in the nation, servicing the entire northeast). Commercial rail services include CSX Transportation, Canadian Pacific Railway, and Guilford Rail System. Though no passenger air services are provided directly in Rensselaer County, such services are immediately accessible to local residents via the nearby Albany International Airport.

FEMA Disaster Declarations

Disaster declarations, for the county or counties affected by a disaster, are declared by the President of the United States under the authority of the Robert T. Stafford Disaster Relief and

Emergency Assistance Act (the "Stafford Act"). FEMA then manages the entire process, including making federally-funded assistance available in declared areas; coordinates emergency rescue and response efforts; provides emergency resources; and provides other related activities/funding in the process of aiding citizens and local governments in a nationally-declared disaster. Since 1954, Rensselaer County has been designated as eligible for at least one form of FEMA assistance in 16 Federally declared major disasters and eight Federally-declared emergencies. Tables 1.3 and 1.4 provide a summary of disaster and emergency declarations for the State of New York (based on review of the FEMA and DHSES web sites and the New York State Hazard Mitigation Plan), with an indication as to whether Rensselaer County was part of the declared area, and the type of assistance the County was eligible for: PA – Public Assistance, IA – Individual Assistance.

Table 1.3 - New York State Major Disaster Declarations, 1954 to July 2019

Year	Declaration Date	Disaster Type	Disaster Number	Was Rensselaer County Designated?
2018	1-Oct	Severe Storms and Flooding	DR-4397	
2017	14-Nov	Flooding	DR-4348	
2017	12-Jul	Severe Winter Storm and Snowstorm	DR-4322	Yes; PA only
2014	22-Dec	Severe Winter Storm, Snowstorm, and Flooding	DR-4204	
2014	8-Jul	Severe Storms and Flooding	DR-4180	
2013	12-Jul	Severe Storms and Flooding	DR-4129	
2013	23-Apr	Severe Winter Storm and Snowstorm	DR-4111	
2012	30-Oct	Hurricane Sandy	DR-4085	
2011	13-Sep	Remnants of Tropical Storm Lee	DR-4031	
2011	31-Aug	Hurricane Irene	DR-4020	Yes; PA and IA
2011	10-Jun	Severe Storms, Flooding, Tornadoes, and Straight-Line Winds	DR-1993	
2011	18-Feb	Severe Winter Storm and Snowstorm	DR-1957	Yes; PA Cat. B
2010	14-Oct	Severe Storms, Tornadoes, and Straight-line Winds	DR-1943	
2010	16-Apr	Severe Storms and Flooding	DR-1899	
2009	31-Dec	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'easter	DR-1869	
2009	1-Sep	Severe Storms and Flooding	DR-1857	
2009	4-Mar	Severe Winter Storm	DR-1827	Yes; PA only
2007	31-Aug	Severe Storms, Flooding, and Tornado	DR-1724	
2007	2-Jul	Severe Storms and Flooding	DR-1710	
2007	24-Apr	Severe Storms and Inland and Coastal Flooding	DR-1692	
2006	12-Dec	Severe Storms and Flooding	DR-1670	
2006	24-Oct	Severe Storms and Flooding	DR-1665	
2006	1-Jul	Severe Storms and Flooding	DR-1650	Yes; PA only
2005	19-Apr	Severe Storms and Flooding	DR-1589	Yes; PA and IA
2004	1-Oct	Tropical Depression Ivan	DR-1565	
2004	1-Oct	Severe Storms and Flooding	DR-1564	
2004	3-Aug	Severe Storms and Flooding	DR-1534	
2003	29-Aug	Severe Storms, Tornadoes and Flooding	DR-1486	Yes; IA only
2003	12-May	Ice Storm	DR-1467	
2002	16-May	Earthquake	DR-1415	
2002	1-Mar	Snowstorm	DR-1404	

Table 1.3 - New York State Major Disaster Declarations, 1954 to July 2019

Year	Declaration Date	Disaster Type	Disaster Number	Was Rensselaer County Designated?
2001	11-Sep	World Trade Center Terrorist Attack	DR-1391	Yes; PA only
2000	21-Jul	Severe Storms	DR-1335	Yes; PA only
1999	19-Sep	Hurricane Floyd	DR-1296	Yes; IA only
1998	11-Sep	Severe Storms	DR-1244	
1998	7-Jul	Severe Storms and Flooding	DR-1233	
1998	16-Jun	New York Severe Thunderstorms and Tornadoes	DR-1222	Yes; PA only
1998	10-Jan	Ice Storm	DR-1196	
1996	9-Dec	Severe Storms/Flooding	DR-1148	
1996	19-Nov	Severe Storms/Flooding	DR-1146	
1996	24-Jan	Severe Storms/Flooding	DR-1095	Yes; PA and IA
1996	12-Jan	Blizzard	DR-1083	Yes; PA only
1993	2-Apr	World Trade Center Explosion	DR-984	
1992	21-Dec	Coastal Storm, High Tides, Heavy Rain, Flooding	DR-974	
1991	16-Sep	Hurricane Bob	DR-918	
1991	21-Mar	Severe Storm, Winter Storm	DR-898	
1987	10-Nov	Severe Winter Storms	DR-801	Yes; PA only
1987	15-May	Flooding	DR-792	
1985	18-Oct	Hurricane Gloria	DR-750	
1985	22-Mar	Snow Melt, Ice Jams	DR-734	
1985	20-Mar	Flooding	DR-733	
1984	25-Sep	Severe Storms/Flooding	DR-725	
1984	17-Apr	Coastal Storms/Flooding	DR-702	
1977	5-Feb	Snowstorms	DR-527	
1976	3-Sep	Hurricane Belle	DR-520	Yes; PA and IA
1976	21-Jul	Severe Storms/Flooding	DR-515	
1976	29-Jun	Flash Flooding	DR-512	
1976	19-Mar	Ice Storm, Severe Storms, Flooding	DR-494	
1975	2-Oct	Hurricane Eloise	DR-487	
1974	23-Jul	Severe Storms/Flooding	DR-447	
1973	20-Jul	Severe Storms/Flooding	DR-401	Yes; PA and IA
1973	21-Mar	High Winds, Wave Action and Flooding	DR-367	
1972	23-Jun	Tropical Storm Agnes	DR-338	
1971	13-Sep	Severe Storms/Flooding	DR-311	
1970	22-Jul	Heavy Rains, Flooding	DR-290	
1969	26-Aug	Heavy Rains, Flooding	DR-275	
1967	30-Oct	Severe Storms/Flooding	DR-233	
1965	18-Aug	Water Shortage	DR-204	
1963	23-Aug	Heavy Rains, Flooding	DR-158	
1962	16-Mar	Severe Storm, High Tides, Flooding	DR-129	
1956	29-Mar	Flood	DR-52	Not Recorded
1955	22-Aug	Hurricanes Connie and Diane	DR-45	Not Recorded
1954	7-Oct	Hurricanes Carol and Hazel	DR-26	Not Recorded

Source: FEMA, online at https://www.fema.gov/disasters, queried on July 11, 2019

Table 1.4 - New York State Emergency Declarations, 1954 to July 2019				
Year	Date	Emergency Type	Declaration Number	Was Rensselaer County Designated?
2012	28-Oct	Hurricane Sandy	EM-3351	
2011	13-Sep	Remnants of Tropical Storm Lee	EM-3341	
2011	26-Aug	Hurricane Irene	EM-3328	
2008	18-Dec	Severe Winter Storm	EM-3299	Yes; PA only
2007	23-Feb	Snow	EM-3273	
2006	15-Oct	Snowstorm	EM-3268	
2005	30-Sep	Hurricane Katrina Evacuation	EM-3262	Yes; PA only
2004	3-Mar	Snow	EM-3195	
2003	23-Aug	Power Outage	EM-3186	Yes; PA only
2003	27-Mar	Snowstorm	EM-3184	
2003	26-Feb	Snowstorm	EM-3173	Yes; PA only
2002	1-Jan	Snowstorm	EM-3170	
2000	4-Dec	Snowstorm	EM-3157	
2000	11-Oct	Virus Threat	EM-3155	Yes; PA only
1999	18-Sep	Hurricane Floyd	EM-3149	
1999	10-Mar	Winter Storm	EM-3138	
1999	15-Jan	Snow Emergency	EM-3136	
1993	17-Mar	Severe Blizzard	EM-3107	
1980	21-May	Chemical Waste, Love Canal	EM-3080	
1978	7-Aug	Chemical Waste, Love Canal	EM-3066	
1977	29-Jan	Snowstorms	EM-3027	
1974	2-Nov	Flooding (NYS Barge Canal)	EM-3004	

Source: FEMA, online at https://www.fema.gov/disasters
NYSEMO, online at http://www.semo.state.ny.us/programs/recovery/History.cfm

Plan Development Process

Multi-Jurisdictional Approach

Rensselaer County took a multi-jurisdictional approach to preparing its hazard mitigation plan. The County had resources (i.e., funding, data, GIS, etc.) which local jurisdictions lacked. However, the County could not develop the plan on its own. To undertake such a regional planning effort, the County needed to involve its member municipalities since only they have the legal authority to enforce compliance with land use planning and development issues. Throughout the plan development process, the Rensselaer County Bureau of Public Safety (RCBPS) worked tirelessly to involve each of its 22 municipalities. These local jurisdictions were not only invited to participate but were truly guided through the process by RCBPS at every stage.

The following municipal entities (Rensselaer County and each of its 22 constituent municipalities) participated successfully in the development of this plan by attending meetings and submitting the key deliverables:

Rensselaer, County of

Berlin, Town of	Hoosick Falls, Village of	Rensselaer, City of
Brunswick, Town of	Nassau, Town of	Sand Lake, Town of
Castleton-on-Hudson, Village of	Nassau, Village of	Schaghticoke, Town of
East Greenbush, Town of	North Greenbush, Town of	Schaghticoke, Village
East Nassau, Village of	Petersburgh, Town of	Schodack, Town of
Grafton, Town of	Pittstown, Town of	Stephentown, Town of
Hoosick, Town of	Poestenkill, Town of	Troy, City of
		Valley Falls, Village of

A detailed summary of the participation demonstrated by each municipality in the County, including attendance at meetings and submission of requested deliverables, is presented in Table 1.5. Names of municipal representatives are included in each jurisdictional annex.

The following stakeholder entities agreed to participate directly on the Rensselaer County JAT and contributed to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, reviewing draft updates of the document, and/or attending one or more planning team meetings:

Capital District Regional Planning Commission
Hudson Valley Community College
St. Peter's Health Partners
University at Albany
Rensselaer Polytechnic Institute
Russell Sage College
Albany County
Bennington County
Columbia County
Saratoga County
Mohican Tribal Historic Preservation Office

The following stakeholder entities offered their valuable feedback throughout the process on topics ranging from sheltering locations to power needs and mitigation planning requirements:

American Red Cross
Cornell Cooperative Extension
National Grid
Natural Resources Conservation Service
New York State Department of Transportation
New York State Department of Homeland Security and Emergency Services
New York State Electric and Gas
Questar III Board of Cooperative Educational Services (BOCES)

AECOM (Clifton, NJ) acted as the plan development consultant. AECOM provided hazard mitigation planning services and authored the updated document.

Table 1.5 - Rensselaer County Jurisdictions Plan Participation

Jurisdiction	Passed Resolution to Participate	Meetings Attended										Key Deliverables Submitted[1]								
		Project Initiation Meeting (County and Consultant only) 11/5/18	Kickoff Meeting 12/10/18	Municipal Assistance Sessions 1/16/19, 1/17/19	Key Stakeholder Meeting 3/25/19	CPG Progress Meeting 3/25/19	Municipal Assistance Sessions 3/26/19	County JAT Working Session 6/5/19	CPG Mitigation Strategy Working Session 6/5/19	Municipal Assistance Sessions 7/29/19-8/1/19		WS1 JAT Members	WS2 Local Administration of the NFIP	WS3 Development Trends	WS4 Capabilities	WS5 Plan Integration	WS6 Status of Past Projects	WS7 Mitigation Actions	Outreach Log	Comments Log
Rensselaer County	■	■	■	■	■	■	■	■[2]	■	■		■	n/a[3]	■	■	■	■	■	■	■
Berlin, Town of	■	n/a			n/a	■		n/a		■		■	■	■	■	■	■	■	■	■
Brunswick, Town of	■	n/a	■	■	n/a	■	■	n/a				■	■	■	■	■	■	■	■	■
Castleton-on-Hudson, Village of	■	n/a			n/a			n/a		■		■	■	■	■	■	■	■	■	■
East Greenbush, Town of	■	n/a	■	■	n/a	■		n/a				■	■	■	■	■	■	■	■	■
East Nassau, Village of	■	n/a		■	n/a	■		n/a				■	■	■	■	■	■	■	■	■
Grafton, Town of	■	n/a			n/a			n/a	■	■		■	■	■	■	■	■	■	■	■
Hoosick Falls, Village of	■	n/a	■	■	n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Hoosick, Town of	■	n/a	■	■	n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Nassau, Town of	■	n/a	■		n/a	■		n/a				■	■	■	■	■	■	■	■	■
Nassau, Village of	■	n/a			n/a			n/a				■	■	■	■	■	■	■	■	■
North Greenbush, Town of	■	n/a	■	■	n/a	■		n/a				■	■	■	■	■	■	■	■	■
Petersburgh, Town of	■	n/a			n/a	■		n/a		■		■	■	■	■	■	■	■	■	■
Pittstown, Town of	■	n/a	■		n/a	■		n/a				■	■	■	■	■	■	■	■	■
Poestenkill, Town of	■	n/a	■	■	n/a		■	n/a	■			■	■	■	■	■	■	■	■	■
Rensselaer, City of	■	n/a	■		n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Sand Lake, Town of	■	n/a	■		n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Schaghticoke, Town of	■	n/a	■	■	n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Schaghticoke, Village of	■	n/a		■	n/a	■		n/a	■			■	■	■	■	■	■	■	■	■
Schodack, Town of	■	n/a	■		n/a	■		n/a				■	■	■	■	■	■	■	■	■
Stephentown, Town of	■	n/a	■		n/a	■	■	n/a		■		■	■	■	■	■	■	■	■	■
Troy, City of	■	n/a	■		n/a			n/a		■		■	■	■	■	■	■	■	■	■
Valley Falls, Village of	■	n/a			n/a			n/a		■		■	■	■	■	■	■	■	■	■
NYS Electric and Gas (NYSEG)		n/a	■	n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
SUNY Albany		n/a	■	n/a		n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rensselaer County Soil and Water		n/a	■	n/a		n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Capital District Regional Planning Commission		n/a	■	n/a		n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NYS Department of Transportation (NYSDOT)		n/a	■	n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rensselaer Polytechnic Institute		n/a	■	n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NYSDHSES		n/a	■	n/a		n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hudson Valley Community College		n/a	■	n/a		n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[1] WS = Worksheet
[2] The County JAT Working Session on June 5, 2019 was attended by representatives of: RCBPS, County Economic Development and Planning, County Buildings and Codes, County Department of Health, and FEMA.
[3] NY Counties do not participate in the NFIP

Table 1.5 - Rensselaer County Jurisdictions Plan Participation

Jurisdiction	Passed Resolution to Participate	Meetings Attended										Key Deliverables Submitted[1]								
		Project Initiation Meeting (County and Consultant only) 11/5/18	Kickoff Meeting 12/10/18	Municipal Assistance Sessions 1/16/19, 1/17/19	Key Stakeholder Meeting 3/25/19	CPG Progress Meeting 3/25/19	Municipal Assistance Sessions 3/26/19	County JAT Working Session 6/5/19	CPG Mitigation Strategy Working Session 6/5/19	Municipal Assistance Sessions 7/29/19-8/1/19		WS1 JAT Members	WS2 Local Administration of the NFIP	WS3 Development Trends	WS4 Capabilities	WS5 Plan Integration	WS6 Status of Past Projects	WS7 Mitigation Actions	Outreach Log	Comments Log
St. Peter's Health Partners		n/a		n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Questar III BOCES		n/a		n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Columbia County OEM		n/a		n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
National Grid		n/a		n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cornell Cooperative Extension		n/a		n/a	■	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

While Rensselaer County retained the services of a consultant to author the initial plan and this first update, each participating jurisdiction was required to engage fully in each step of the mitigation planning process. The consultant's role was to guide participants through each step, and then collate local feedback into an updated document. Participating jurisdictions attended meetings, provided feedback, conducted local outreach, and contributed key local information throughout the plan update timeline, as follows:

Resolution to Participate	The County and all 22 local municipalities each passed a formal Resolution to Participate in the process at the start of the plan update timeline and identified a lead individual and alternate to represent their community on the CPG. Resolutions were generally passed in the window between December 2018 and January 2019.
Establish Jurisdictional Teams	The Consultant provided "Guidance Memorandum 1 – Building the Jurisdictional Assessment Team" at the project outset (December 2018). This memorandum was later distributed to all CPG members at the Kickoff Meeting and at various points thereafter (via email and/or subsequent meeting handouts). It provided Rensselaer County and its participating jurisdictions with suggestions for assessing community support and building their local planning teams. CPG members used Guidance Memorandum 1 as a tool as they were developing their respective local JATs. Each participating jurisdiction dedicated staff to participate in the overall county-wide CPG. Under the leadership of each community's CPG member, local JATs were formed and documented on Worksheet 1 – the Jurisdictional Assessment Team. JAT members were responsible for reviewing information, data and documents, submitting feedback to the Consultant via the CPG leads, completing worksheets, reaching out to the public and other stakeholders in their respective jurisdictions, developing a unique updated mitigation strategy for their municipality, and reviewing and commenting on draft documents. The County and all 22 local municipalities submitted Worksheet 1. Names and contact information for CPG and JAT members are documented in each Jurisdictional Annex. More information on the planning team structure and roles/responsibilities is presented later in this section.
Outreach to the Public and Other Stakeholders	The Consultant provided "Guidance Memorandum 2- Outreach to the Public and Other Stakeholders" at the project outset (December 2018). This memorandum was later distributed to all CPG members at the Kickoff Meeting and at various points thereafter (via email and/or subsequent meeting handouts). This memorandum was prepared to provide Rensselaer County and its participating jurisdictions with suggestions for engaging the public and other stakeholders throughout the plan development process and prior to plan approval. The JAT for each municipality used this memorandum as a guide for outreach, documented their completed activities in the memorandum's "Outreach Log". The County and all 22 jurisdictions provided a summary of their outreach activities to the Consultant for incorporation into the plan. Each JAT was asked to keep track of comments received from the public or other local stakeholders on a "Comments Log". The County and all 22 jurisdictions provided completed Comments Logs for inclusion in the plan. Most municipalities received no comments as of October 2019. Comments that were received by October 2019 were incorporated by the jurisdictions, as outlined in the annexes. As this plan is a living document, future comments will be reviewed by the RCBPS together with relevant municipalities and integrated into the plan as applicable during future maintenance cycles and plan updates. Other outreach activities and meetings are presented in each jurisdictional annex.

Feedback on Hazards	The consultant obtained hazard information obtained through research of past disaster declarations in the County, review of the New York State Hazard Mitigation Plan (2019), and review of readily available online information from reputable sources (such as federal and state agencies). At meetings of the CPG, the Consultant presented information about the various hazards to which the County is vulnerable and asked attendees to provide feedback as to whether they concurred with the consultant's findings. No jurisdictions expressed a desire for revised findings.
Updated Information on Local Administration of FEMA's National Flood Insurance Program	All of Rensselaer County's communities participate in FEMA's NFIP, apart from the Village of Valley Falls which has been suspended. All 22 jurisdictions provided "Worksheet 2 – NFIP", providing information about their respective floodplain managers/administrators, NFIP administration services, barriers experienced, compliance issues, community assistance and monitoring activities, etc.
Growth/Development Trends Update	Participating jurisdictions provided feedback during the evaluation of Growth/Development Trends step of the process (Section 3.d of the plan) through their completion and submittal of "Worksheet 3 – Growth/Development Trends" to the Consultant. Jurisdictions provided updated information regarding: (1) development trends occurring within their jurisdiction, such as the predominant types of development occurring, location, expected intensity, and pace by land use; and (2) any regulations/ordinances/codes their jurisdiction enforces to protect new development from the effects of natural hazards. The County and 22 jurisdictions returned this worksheet.
Capability Assessment Update	The County and 22 participating jurisdictions completed "Worksheet 4 – Capability Assessment Update" updating their assessment of local capabilities and how these capabilities can be expanded and/or improved to reduce risk.
Plan Integration Update	The County and 22 participating jurisdictions submitted "Worksheet 5 – Plan Integration" to document their past progress on plan integration activities that were set forth in the 2011 plan, and to document to FEMA the manner in which each community plans to integrate the hazard mitigation plan into local government operations over the next plan maintenance cycle (2019 to 2024).
Document Past Mitigation Accomplishments	The County and 22 participating jurisdictions submitted "Worksheet 6 – Status of Past Projects" to document the status of their respective hazard mitigation initiatives from the 2011 plan and assess whether incomplete projects were deemed to be still relevant for carrying forward to updated mitigation strategies. Jurisdictions also provided information regarding how local priorities had changed since the 2011 plan was prepared and provided a summary of any hazard mitigation projects they had undertaken that were not listed in the 2011 plan.
Problem Areas in Need of Mitigation and Development of Mitigation Actions	Participating jurisdictions provided feedback regarding problem areas in need of mitigation and possible mitigation alternatives. Some municipalities provided this type of information to the consultant separately, either via email or separate written correspondence. Their feedback was incorporated into the plan. At a working session of the Core Planning Group on June 5, 2019, participating jurisdictions were asked to consider a range of various types of hazard mitigation actions and identify an updated mitigation strategy for their municipality. Rensselaer County and all of its participating jurisdictions have developed a unique mitigation strategy. The County and 22 jurisdictions returned "Worksheet 7 – Mitigation Actions" to document their community's updated hazard mitigation strategy for the 2019 plan. This include
Critical Facilities Assessment	Critical Facilities must remain accessible and functional before, during and after disasters to meet the jurisdiction's Continuity of Government (COG) and Continuity of Operations (COOP) standards, and to support emergency government and sheltering functions. The consultant prepared a summary of critical facilities in hazard areas as part of the Risk Assessment Interim Deliverable (Section 3b of the plan). At the June 5, 2019 Mitigation Strategy Working Session, communities considered this information as they were developing local mitigation strategies and proposed mitigation measures to reduce key risks and provide protection to the 500-year level.

Plan for Displaced Residents	Intermediate needs for disaster temporary housing and more long-term needs for permanent housing were considered. The consultant identified candidate sites for the placement of temporary housing units to house residents displaced by disaster and conducted a preliminary assessment of suitable sites for floodplain structures to be relocated to and/or rebuilt upon.
Plan for Evacuation Needs and Sheltering	Rensselaer County's Comprehensive Emergency Management Plan documents the County's plans to protect residents and mitigate risk, stress and personal hardships during hazard events. The 2012 CEMP is maintained at RCBPS and is being updated at the present time. The County will post the updated CEMP on its web site when it is finalized. Shelters have been included the risk assessment of this plan as one type of critical facility (see Appendix B Addendum).

Rensselaer County Hazard Mitigation Planning Committee

This Plan has been developed by the Rensselaer County Hazard Mitigation Planning Committee (the "Planning Committee"), with support from an outside consulting firm (AECOM). The efforts of the Planning Committee were headed by Jay Wilson, Director of the RCBPS with assistance from Eric Gaunay, the RCBPS Emergency Preparedness Coordinator. The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

The overall Planning Committee consisted of members of Rensselaer County, each participating jurisdiction, and the public and other stakeholders. The overall Planning Committee did not meet together in one place during the planning process. Instead, a team concept was used to more evenly distribute responsibilities and to make best of use of every participant's unique capabilities.

As shown in Figure 1.4, the overall Planning Committee was divided into a Core Planning Group (CPG) and a series of Jurisdictional Assessment Teams (JATs), with one JAT for each of the County's participating jurisdictions. Each jurisdiction was required to form a JAT by bringing together personnel from their local government organization, ideally utilizing people with knowledge and experience of local administration, planning, hazards, and infrastructure. CPG and JAT members are listed in each Jurisdictional Annex.

The Role of the County in the Plan Development Process

The role of the County in the plan development process was to act as lead agency and facilitator on behalf of the participating jurisdictions. The County was originally responsible for securing the grant funding for the plan and for originally soliciting the participation of all jurisdictions. The County was responsible for selecting the consultant, administering the contract, and ensuring payment to the consultant.

As well as acting as a jurisdiction in its own right, the County took on the responsibility of managing all communications between the consultant and the CPG (principally through the use of a master email mailing list), distributing all drafts to jurisdictions and reviewing agencies, distributing deliverables and outreach materials, and facilitating meetings. For each meeting the County was responsible for procuring a venue and presentation equipment,

distributing invitations, and disseminating any subsequent relevant information. The County also hosted the central hazard mitigation planning website. The RCBPS was the County agency tasked with meeting the County's responsibilities, and the plan coordinator and main point of contact was Jay Wilson, Director of the RCBPS.

RCBPS Efforts to Involve All of the County's Municipalities in the Plan Update

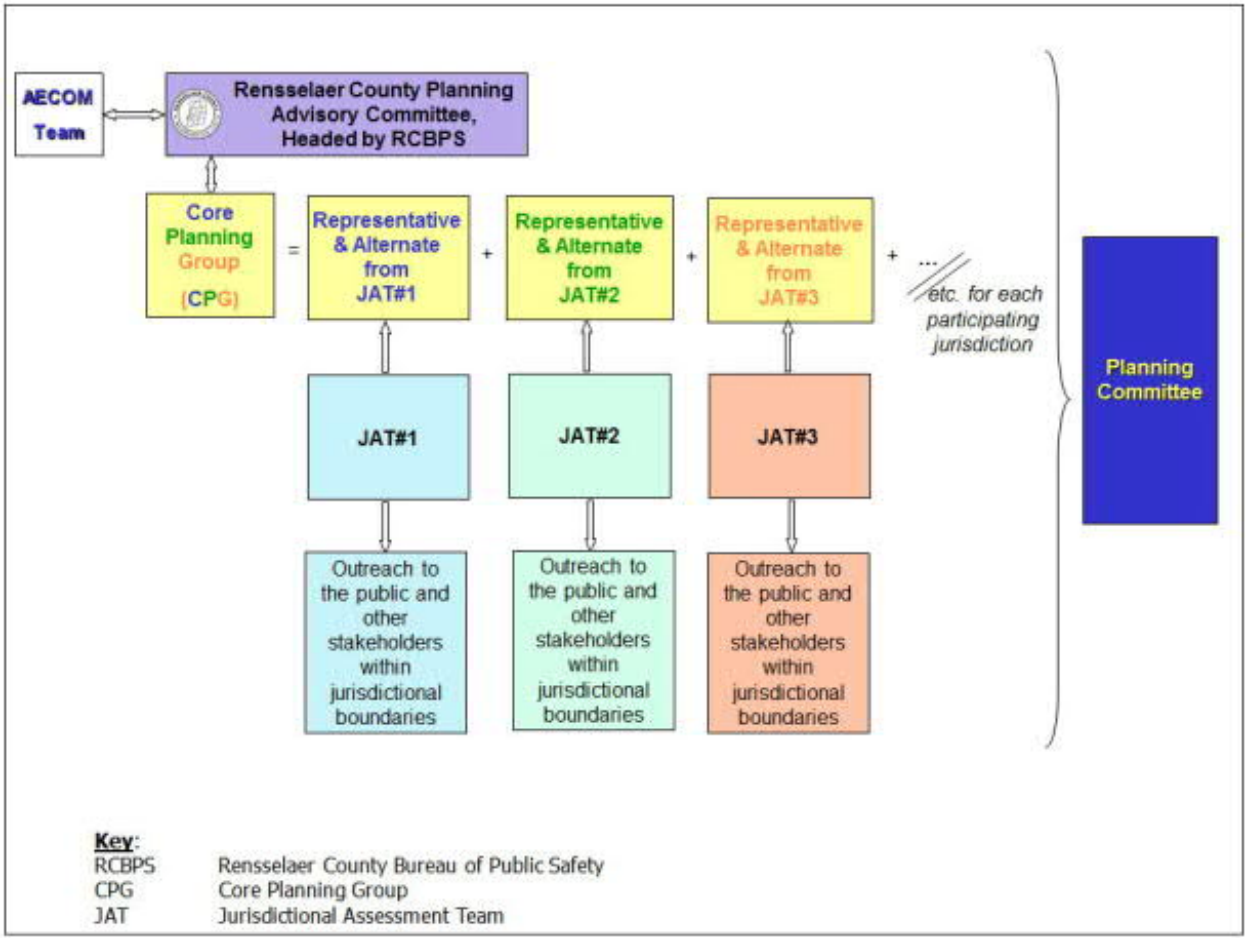
On November 15, 2018, RCBPS sent formal correspondence to each of the 22 municipalities in the county inviting them to participate in the multi-jurisdictional hazard mitigation planning process. The letter explained the process, invited local participation in the multi-jurisdictional plan, and outlined some advantages to having a plan in place and participating in a larger multi-jurisdictional plan. Each municipality was asked to sign and return one of two formal responses – a local municipal resolution documenting the community's desire to participate, or a record of decision to decline. Municipalities were advised that if opting to participate, they should identify two representatives who are authorized to represent their jurisdiction on the Core Planning Group, actively participate as requested throughout the process, and lead a municipal Jurisdictional Assessment Team tasked with carrying out local participation requirements. In this same letter, municipalities were also invited to attend one of two project Kickoff Meetings scheduled for December 10, 2018 (at their choice of 3pm or 6pm) at the Rensselaer County Department of Social Services, Administration Building, Second Floor, 127 Bloomingrove Drive, Troy.

Subsequent to the November 2018 invitation letter and the December 10, 2018 Kickoff Meeting, municipalities passed formal resolutions to participate. Engagement time was slower than the County had hoped given its initially targeted plan update timeline. Recognizing the importance of expanding and enhancing local jurisdiction participation with an aim toward participation by all of the county's municipalities, schedules were extended to allow time for RCBPS and the consultant contacted each municipality via phone and email, again inviting participation and providing a copy of all presentation materials and handouts from the Kickoff Meeting. In addition, a CD of information was hand-delivered by RCBPS to any municipality not represented at the Kickoff Meeting.

Outreach to the municipalities was conducted on an ongoing basis thereafter. Regular telephone calls were made between the County and/or consultant and CPG members to offer assistance, support, reminders regarding meetings and upcoming deliverables, etc. RCBPS also sent out periodic email messages to every jurisdiction in the county (regardless of stated desire to participate) regarding the project overview, status, current level of municipal participation and ongoing invitation to join in the process, upcoming meetings, current deliverables due for completion by CPG members and subsequent delivery to consultant, and next steps in going forward.

As a result of all of these efforts of the RCBPS, each of the County's 22 municipalities ultimately participated successfully in the plan update through attending meetings, providing feedback, and updating a mitigation action plan to address highest hazards and key risks.

Figure 1.4 – Planning Committee Organizational Structure



All members of the CPG and the JATs were also members of the overall Planning Committee. The CPG included head members of each JAT (the County and each of the municipalities who elected to participate in the process). The Rensselaer County Planning Committee was responsible for managing overall plan formulation activities. The CPG was responsible for attending CPG meetings and providing information and feedback and coordinating an outreach program within their municipality's JAT and beyond to the public and other stakeholders. Each JAT was responsible for coordinating and facilitating local efforts, sending CPG representatives to meetings, providing information and feedback, involving the public and local community stakeholders in the planning process, assessing mitigation alternatives, selecting a course of action to be followed for their community, adopting the plan, and participating in plan monitoring and implementation.

With regard to meetings, RCPBS was responsible for setting meeting dates and times, securing a meeting facility, and notifying all team members of upcoming meetings. They also played a very large role in reminding CPG members of certain project deadlines. The Consultant prepared meeting agendas, handouts, PowerPoint presentations, and minutes for

the project initiation meeting. RCBPS maintained the County's web site posting various informational materials and plan documents.

The plan update process was initiated in earnest in the fall of 2018 with the Rensselaer County Hazard Mitigation Plan Project Initiation Meeting held on November 5, 2018. At this meeting, the consultant met with the RCBPS to refine the project work plan, discuss the schedule and the anticipated level of County labor support. At this meeting, expectations and timing of the CPG Project Kickoff Meeting were discussed, along with expectations for jurisdictional resolutions to participate.

While Jurisdictional Assessment Teams met individually throughout the plan development process as they deemed necessary, the following is an overview of CPG meetings held during the plan development process.

- December 10, 2018 – CPG Kickoff Meeting. This was the first meeting of the CPG. Participants were provided with an overview of: the importance of hazard mitigation, the requirements for mitigation planning and plan updates, the current plan's content, the importance of municipal involvement in mitigation plans and plan updates, participation requirements, and the targeted plan update project timeline. Worksheets for municipal feedback were distributed on CD to all municipalities, who were instructed to begin Worksheets 1 through 5 (JAT membership, local administration of the NFIP, capability assessment update, update of growth and development trends, and plan integration) and to initiate their outreach activities.
- January 16 and January 17, 2019 – CPG Municipal Assistance Sessions. RCBPS and AECOM met with municipalities who were in need of assistance providing the requested feedback for the plan update. These meetings were held at the RCBPS.
- March 25, 2019 – Core Planning Group Progress Meeting. This meeting was conducted to provide an overview of plan update progress and continued work to be completed. RCBPS also reiterated the benefits of municipal participation and the requirements that must be met for a municipality to be considered fully participating. Attendees were reminded of outstanding Batch 1 worksheets from about one third of municipalities (despite an extension), and the outreach requirements. Batch 2 Worksheets 6 and 7 were rolled out (status of past projects and developing a mitigation strategy for this plan update). Attendees also brainstormed ideas for County-led mitigation actions for the County's updated mitigation strategy.
- March 26, 2019 – CPG Municipal Assistance Sessions. RCBPS and AECOM met with municipalities who were in need of assistance providing the requested feedback for the plan update. These meetings were held at the RCBPS.
- June 5, 2019 – CPG Mitigation Strategy Working Session. The purpose of the meeting was to: (1) present an overview of the risk assessment and the Risk Assessment Interim Deliverable (a document comprised of the following working chapters of the draft report: Hazard Identification, Hazard Profiles, Asset Identification, Vulnerability Assessment, Mitigation Goals, Range of Mitigation Actions to be Considered, Plan Maintenance, and For More Information); and (2) provide guidance to, and conduct working sessions with, municipalities in their development of updated mitigation

strategies, including reports on the status of past projects from the 2011 plan, as well as developing a suite of updated mitigation initiatives for the 2019 plan update. Representatives from FEMA and DHSES were available to provide support to breakout groups as well at this working session.

- July 29 through August 1, 2019 – Municipal Assistance Sessions. RCBPS and AECOM met with municipalities who were in need of assistance providing the requested feedback for the plan update. For these sessions, RCBPS and AECOM traveled to each municipality to meet in their local offices.

See Appendix D for meeting agendas, attendance sheets, and copies of presentations made at the CPG meetings listed above.

The Role of the Contractors in the Plan Development Process

This Hazard Mitigation Plan is the County's plan; as such, its success rests on the decisions and directions set by the Planning Committee members throughout the plan development process. AECOM was contracted by Rensselaer County to work with the RCBPS and the Planning Committee to assist them in developing a plan update that would meet the requirements of DMA 2000. AECOM served as the direct County point of contact, assisted in the hazard identification and risk assessment, lead the hazard mitigation planning efforts, authored the final document, and provided overall contract administration.

AECOM assisted the Planning Committee by conducting the analyses necessary to provide the team members with the information they needed to make sound decisions and helped guide them through the necessary steps of the plan development process. The Planning Committee, in turn, took the lead by including the local community, assessing the alternatives, and ultimately selecting the course of action to be followed. At the end of the planning process, AECOM prepared this Plan text (with feedback from the Planning Committee) to document the group's efforts, along with hazard information and findings, in a manner consistent with applicable regulations (DMA 2000), criteria (44 CFR Part 201.6), and guidance as well as NYSDHSES Hazard Mitigation Planning Standards.

Two guidance memorandums were provided to the CPG to provide a summary of key topic areas relevant to plan updates. Each memo provides suggestions to municipalities in a certain topic area, and requests feedback from each municipality at the end of the process regarding their decisions. A summary of the Guidance Memos is presented below.

Guidance Memorandum #1 – Building the Jurisdictional Assessment Team, dated December 2018. The purpose of Guidance Memo 1 was to provide each jurisdiction with suggestions for assessing community support, building their local JAT, and documenting JAT members on Worksheet 1.

Guidance Memorandum #2 – Outreach to the Public and Other Stakeholders, dated November 2018. The purpose of Guidance Memo 2 was to provide the Core Planning Group (CPG) - Rensselaer County and its participating municipalities - with suggestions for engaging the public and other stakeholders in the plan update in a manner that will meet FEMA's minimum requirements for plan approval. This memo included an Outreach Log for jurisdictions to document their outreach activities, as well as a Comments Log to document comments received from the public or stakeholder groups.

The memos provided valuable tools to guide the municipal team members through each step toward the establishment of the hazard mitigation plan and the planning process that leads to the formal adoption of the plan.

In addition, AECOM also: (1) Distributed worksheets for CPG member completion, as described previously beginning on Page 1-13 through 1-15. They were: Worksheet 1 JAT, Worksheet 2 Local Administration of the NFIP, Worksheet 3 Growth and Development Trends, Worksheet 4 Capability Assessment, Worksheet 5 Plan Integration, Worksheet 6 Status of Past Projects, Worksheet 7 Mitigation Actions; (2) Assisted the CPG through preparation of a plan update Fact Sheet (discussed on Page 1-22) and development support for an updated County web page on the project. (discussed beginning on Page 1-21); and (3) presented at each CPG meeting to guide participating jurisdictions through the process, and advise CPG members regarding each step of the process such as hazards identified and profiled, risks and vulnerabilities identified, possible types of mitigation solutions, etc.

Opportunities for Public Involvement in the Plan Development Process

The role of public involvement in the plan development process is to provide the general public with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. CPG members undertook a range of activities to: (a) alert the public to the fact that the Planning Committee was working to develop this Hazard Mitigation Plan, and (b) provide the public an opportunity to participate with a forum to ask questions and submit comments and/or suggestions on the process.

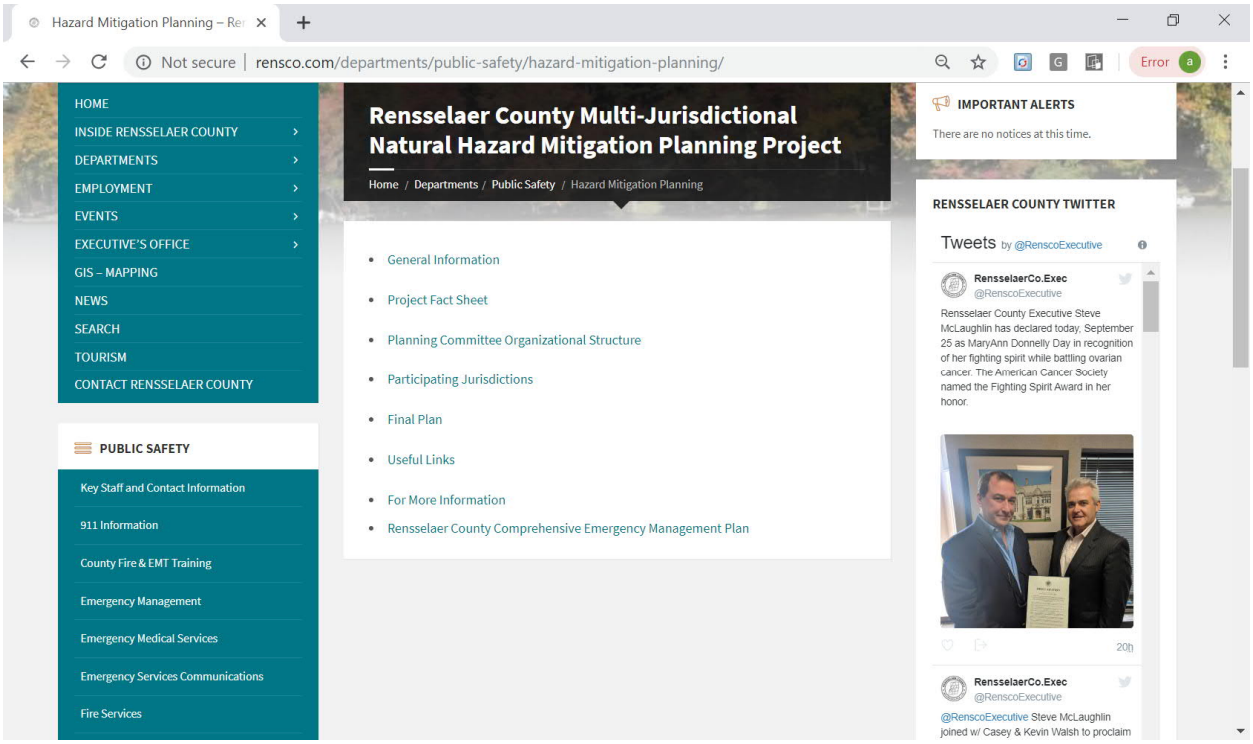
The Planning Committee pursued a variety of different ways to provide the public with an opportunity to become involved and engaged during the planning process, in addition to ensuring that the participating jurisdictions were also fully aware of the process and were able to contribute and voice their concerns as well as the general public. As such, the following key activities were employed:

- Rensselaer County Multi-jurisdictional Mitigation Planning web site
- Plan Facts project fact sheet
- Open Public Meetings
- Press
- Other Outreach Activities by RCBPS and CPG Members

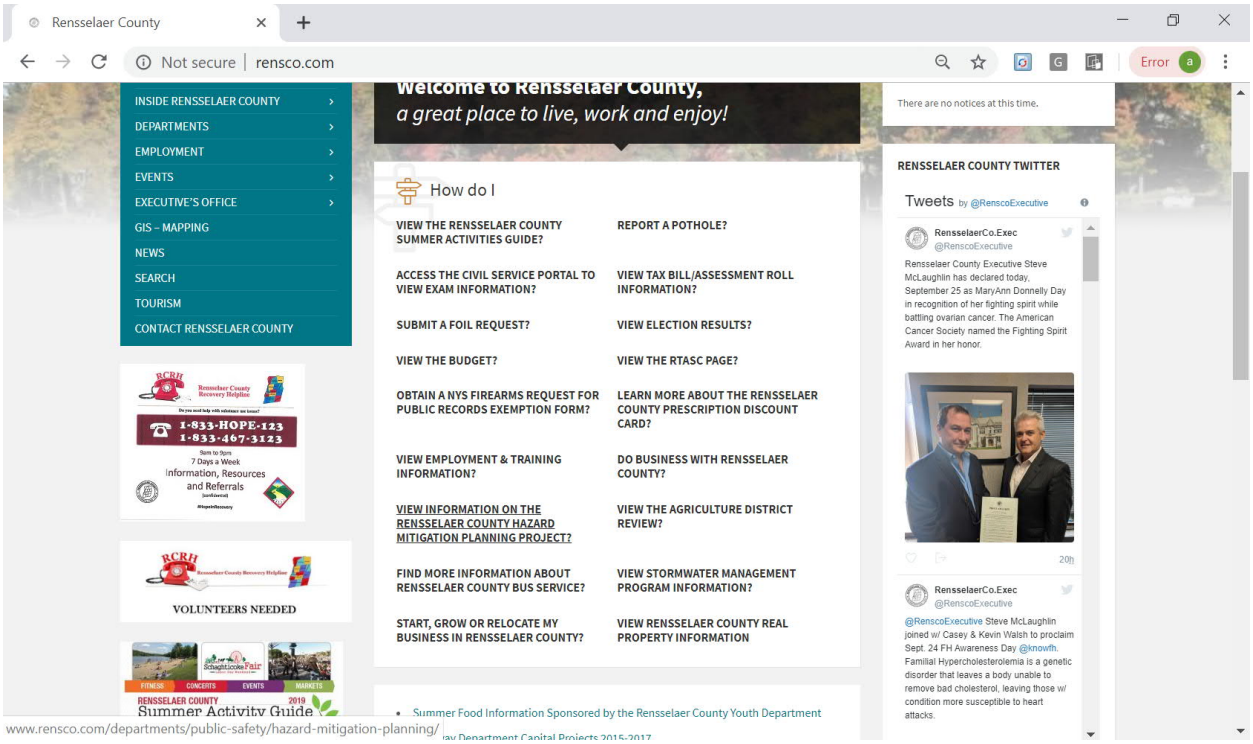
Rensselaer County Multi-Jurisdictional Hazard Mitigation Planning Web Site

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a mitigation planning web site. Rensselaer County has maintained mitigation plan information on its web site at http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/.

The web site was initiated in October 2010 and has been maintained and updated by RCBPS on a regular basis. The purpose of the site is to inform the public and other stakeholders about the importance of hazard mitigation planning and their opportunity to participate and provide feedback during the process. The site provides general information about the process, the project fact sheet, the organizational structure of the planning team, participating jurisdictions, the current plan, other reference materials, and useful links. Contact information for the RCBPS Coordinator and Deputy are also provided and individuals are invited to reach out to this person for information on how to become involved or to provide comments. The image below is a screen-capture of the main mitigation planning web page on the County's site. Many municipal jurisdictions also included links on their web sites to this overall project page.



A link to this page appears on the County home page as well (see below).



PlanFacts

The Planning Committee increased public awareness of the hazard mitigation plan update process by providing a one-page fact sheet summation on hazard mitigation and the mitigation planning update process to the public, community leaders, business owners, local residents and other stakeholders in the plan. The flyer provides a brief overview of hazard mitigation and mitigation planning, explains the purpose and need for the mitigation plan in Rensselaer County, and provides contact information for questions or other feedback or to become involved in the process.

PlanFacts was distributed to the CPG at the Kickoff Meeting on December 10, 2018 in paper and electronic format. It was also posted by many Core Planning Group Members on local notice boards and web sites throughout the county and distributed by CPG members during their outreach meetings. The Fact Sheet can be found electronically (PDF format) at the Rensselaer County Office of Emergency Management web site address given above.

PlanFacts was also distributed in hard copy format widely throughout the County by CPG members. Locations where it has been posted/distributed include local libraries, fire departments, and city/town halls. Copies were also made available at the RCBPS booth at the Schaghticoke Fair in both 2018 and 2019. A copy of the full fact sheet is presented here:

Rensselaer County
Multi-Jurisdictional Hazard Mitigation Plan Update

Natural hazards are a part of life throughout Rensselaer County. All of these hazard events have the potential to cause property loss, economic hardship, environmental degradation, and threats to public health and safety including loss of life. An important part of emergency management involves **hazard mitigation planning** aimed at minimizing these impacts and improving resiliency. The Plan describes the hazard risks that can occur, identifies vulnerable community assets, and presents mitigation strategies comprised of actions and projects that will be implemented to reduce key hazard risks.

Purpose and Need for the Plan

The **Multi-Jurisdictional Natural Hazard Mitigation Plan for Rensselaer County** was adopted in 2011 to meet the requirements of the Disaster Mitigation Act of 2000 (or "DMA 2000"). The Plan allows for potential future Federal Emergency Management Agency (FEMA) funding opportunities for participating jurisdictions to implement hazard mitigation projects. Its development was led by the County, and planning costs were offset by a FEMA planning grant. The County opted to use what FEMA calls a "multi-jurisdictional" approach as a form of municipal shared service, meaning that instead of just being a plan for the County government, every municipality participated as an equal partner. As such, the plan includes information for each municipality that has been adopted at the local level. The Plan also includes a capability assessment, risk assessment, mitigation strategies, and utilization and maintenance guide. To remain in compliance with DMA 2000, and maintain eligibility to apply for FEMA mitigation project funding, the plan must be updated regularly. The County has once again obtained FEMA grant funding for this first plan update. Representatives from each municipality and various stakeholder groups within the County, as well as the public, will have opportunities to attend meetings and provide feedback throughout the plan update process.

For More Information

For questions or other feedback, or to find out how you can become involved, please contact Jay Wilson, Director, and Rensselaer County Bureau of Public Safety at 518-266-7676 or at Jwilson@rensco.com.

Information is also available on our web site at: http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/

Planning Timeline

- The initial hazard mitigation plan was adopted in 2011
- Regular updates are required by FEMA
- The first plan update process began in October 2018 and is targeted for completion in 2019

Natural hazard events cannot be prevented from occurring. However, by implementing the hazard mitigation projects identified in the Plan, we can reduce vulnerabilities, risks, and future damage. Over time, our hazards will result in fewer disasters.

Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan Update • "*PlanFacts* "• October 2018 •

Open Public Meetings

Each participating jurisdiction about the mitigation plan update process at regularly scheduled meetings in their respective municipalities (i.e., board meetings), granting the public and other stakeholders an opportunity to participate in the process. At a minimum, this included each jurisdiction's governing body discussing the plan and the plan update at an open public meeting prior to passing their formal resolution to participate. In addition, there will be open meetings of local governing bodies before resolutions are passed to formally adopt the plan (see individual resolutions for more information). Other outreach activities and meetings are presented in each jurisdictional annex. The draft plan was made available to the public in October 2019; a public forum will be held to present the final plan to Rensselaer County Legislators before it is adopted.

Other Outreach Activities by RCBPS and CPG Members

In addition to the web site, fact sheet, and open public meetings held, the Core Planning Group (through their respective JATs) undertook the actions summarized in in their respective jurisdictional annexes to raise awareness of the plan development process among those not directly tasked with involvement in the plan process, and provide the public and other stakeholders with a forum for participating in - and providing feedback throughout - the plan development process. While participating jurisdictions have provided comments, to date, limited documented feedback from the public or other stakeholders was received. Comments that were received by October 2019 were incorporated by the jurisdictions, as outlined in the annexes. As this plan is a living document, future comments will be reviewed by the RCBPS together with relevant municipalities and integrated into the plan as applicable during future maintenance cycles and plan updates. Other outreach activities and meetings are presented in each jurisdictional annex.

Outreach activities undertaken by Rensselaer County included:

Table 1.6
Rensselaer County Outreach Log

Date of Activity	Type of Activity	Activity Details	Lead Department and/or Staff Title Who Undertook Activity
July 10, 2018	Regular meeting of the County Legislature, open to the public	Discussed the mitigation plan update and passed a resolution to participate in the multi-jurisdictional hazard mitigation plan update	Jay Wilson, RCBPS
August 29, 2018 through September 3, 2018	Fact Sheet at fair booth	Hard copies of the project fact sheet were made available at the RCBPS booth at the annual Schaghticoke Fair and BPS staff was available to talk to residents about the plan update if they had questions.	Jay Wilson, RCBPS
November 2018	Meeting	The plan update was discussed at the regular monthly Community Emergency Response Team (CERT) meeting	Eric Gaunay, RCBPS

Table 1.6 Rensselaer County Outreach Log			
Date of Activity	Type of Activity	Activity Details	Lead Department and/or Staff Title Who Undertook Activity
December 2018	Meeting	The plan update was discussed at the regular monthly Community Emergency Response Team (CERT) meeting	Eric Gaunay, RCBPS
January 30, 2019	Meeting	County public safety representatives (EMS coordinators, Fire Coordinators, hazardous materials coordinators) overview of county activities, of which included discussion of the mitigation plan update	Eric Gaunay, RCBPS
January 20, 2019	Meeting	Quarterly meeting with Fire and EMS Chiefs from local municipalities, where County discussed activities of each part of public safety. This included discussion of the mitigation plan update.	Eric Gaunay, RCBPS
February 2019	Posted Fact Sheet on notice board	Fact Sheet hard copy posted on notice board at BPS	Eric Gaunay, RCBPS
February 2019	Web site update	Web site maintained 2011 to present; and updated with new information on the plan update	Mark Lacivita, RCBPS
February 2019	Outreach to nursing homes	Large meeting of administration reps from various nursing homes throughout Rensselaer County, main topic was centers for Medicaid services, but the hazard mitigation plan update was discussed as well.	Eric Gaunay, RCBPS
March 18, 2019	Mobile App and press release	Release of the new “Prepare Rensselaer” mobile app. Press release was issued to advertise the app. The app was developed to aid in emergency alerting and preparedness. It allows for emergency alerts, and also to see and share the latest RCBPS news from Facebook and Twitter.	Eric Gaunay, RCBPS
March 2019	Meeting	The plan update was discussed at the regular monthly Community Emergency Response Team (CERT) meeting	Eric Gaunay, RCBPS
August 28, 2019 through September 2, 2019	Fact Sheet at fair booth	Hard copies of the project fact sheet were made available at the RCBPS booth at the annual Schaghticoke Fair and BPS staff was available to talk to residents about the plan update if they had questions.	Jay Wilson and Eric Gaunay, RCBPS

Opportunities for Involvement of Other Stakeholders in the Plan Development Process

In order to meet Federal requirements, the plan development process must be open to stakeholders beyond planning group members and the general public. That is, opportunities must be available for other stakeholders (such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties) to become involved in the planning process.

As with the general public, other stakeholders must be provided with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. With support and guidance from AECOM, each JAT took the lead in pursuing a range of activities to: (a) alert other stakeholders to the fact that the planning was working to develop this Hazard Mitigation Plan, and (b) provide other stakeholders with a forum to ask questions, and to submit comments and/or suggestions on the process or directly participate.

The Core Planning Group determined that outreach activities to the general public as summarized in the previous section would also reach and provide the same opportunities for other stakeholders such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties. Note, however, that many actions undertaken by the CPG Member as summarized in Table 1.6 also incorporate direct outreach to key local municipal stakeholder entities. To supplement these efforts, RCBPS undertook a separate outreach program to key stakeholders at the county level. Activities included: coordination with other stakeholders to invite them to participate in the plan update, attend the December 10, 2018, Kickoff Meeting; and distribution of a letter of invitation to the Stakeholders Information Session of March 25, 2019. In addition, the RCBPS Program Coordinator and/or his assistant spoke with key stakeholder groups at various times during the plan development stage to alert them to the fact that the plan was under development and open the door for their participation and feedback. The County JAT included direct membership and participation from the following groups or individuals who attended various meetings throughout the process and provided input on action items being considered for the County's mitigation strategy:

Steve McLaughlin - County Executive
Michael Stammel - Chairman of the Legislature
Jim Breig - Deputy Director of Budget
Jay Wilson - Director of Public Safety
Eric Gaunay - Emergency Preparedness Coordinator
Mark Lacivita – Public Safety
Paul Glasser – Public Safety
Linda von der Heide - Principal Planner
Joe Teliska - Rensselaer County Department of Engineering and Highways
Michael Czornyj - Rensselaer County Buildings and Codes
Len Claus - Rensselaer County Health Department
Jolene Weidlich – Rensselaer County Bureau of Research and Information Services
Mark Castiglione - Capital District Regional Planning Commission
Fred Aliberti - Hudson Valley Community College

Brian Boudreau - St. Peter's Health Partners
Aran Mull - University at Albany
Vadim Thomas - Rensselaer Polytechnic Institute
Michael Temblay - Russell Sage College
Brian Wood - Albany County
Allison Strohl - Bennington County
Henry Swartz - Columbia County
Mike Stanley - Saratoga County
Bonney Hartley - Mohican Tribal Historic Preservation Office

Other stakeholders who did not wish to be represented on the County JAT were still offered opportunities to contribute to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, and reviewing draft updates of the document. Input, questions, and feedback were welcomed at any time. In addition to the above stakeholder entities represented on the County JAT, the below stakeholder agencies participated by attending one or more planning team meetings:

American Red Cross
Cornell Cooperative Extension
National Grid
Natural Resources Conservation Service
New York State Department of Transportation
New York State Department of Homeland Security and Emergency Services
New York State Electric and Gas
Questar III Board of Cooperative Educational Services (BOCES)

Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

In the process of preparing this hazard mitigation plan, many other existing plans, studies, reports, and technical information were evaluated. These sources are noted throughout this report as various topics are discussed. In summary, the development of this hazard mitigation plan included the review and incorporation as applicable of data from the following sources:

- Readily available on-line information from federal and state agency web sites including: FEMA, NYSEMO, NY State Department of Environmental Conservation, US Forest Service National Avalanche Center, US Geological Survey, National Oceanic and Atmospheric Administration (including National Weather Service and National Climatic Data Center, and the National Severe Storms Laboratory),U.S. Department of Agriculture Natural Resources Conservation Service, U.S. Army Cold Regions Research and Engineering Laboratory USGS National Geomagnetism Program, National Drought Mitigation Center Drought Impact Reporter, USGS National Earthquake Information Center, NASA Space Environment Center, and the US Department of Transportation Federal Highway Authority.
- New York State Hazard Mitigation Plan (2019)
- FEMA Flood Data and municipal Flood Insurance Studies (The flooding portion of this hazard mitigation plan has been revised as part of this 2019 plan update to reflect changes between the old Q3 mapping used previously and the new 2016 Digital Flood

Insurance Rate Maps (DFIRMs) for the six municipalities where new maps were released in January 2016 (Town of Hoosick, Village of Hoosick Falls, Town of Pittstown, Town of Schaghticoke, Village of Schaghticoke, and the Village of Valley Falls); and FEMA Q3 Flood Data (1996) for the balance of communities for which the Q3 still represents best readily available data.

- NYSDEC Coastal Erosion Hazard Area Mapping (evaluated, though none in Rensselaer County)
- Rensselaer County GIS data
- Town of Berlin Comprehensive Plan
- Town of Berlin Emergency Plan
- Town of Berlin Site Plan Review Act
- Town of Berlin Zoning Ordinance
- Town of Berlin Land Subdivision Regulations
- Village of Castleton-on-Hudson Comprehensive Plan
- Village of Castleton-on-Hudson Stormwater Management Plan
- Town of East Greenbush Land Use Plan
- Town of East Greenbush Comprehensive Zoning Law
- Town of East Greenbush Emergency Operations Plan
- Town of East Greenbush Community Amenities Enhancement Strategy
- Town of East Greenbush Stormwater Management Program Services
- Final Design Report for Intersection Improvements at Route 4 and 151
- Route 4 Corridor Study
- Town of East Greenbush Master Plan
- Final Report for Route 9 and 20 Corridor
- Village of East Nassau Comprehensive Plan
- Town of Grafton Subdivision Regulations
- Tow of Grafton Road Specifications
- Town of Grafton Master Plan
- Town of Grafton Emergency Plan
- Town of Nassau Comprehensive Plan
- Town of Nassau Zoning Ordinance
- Town of North Greenbush Comprehensive Plan
- Town of North Greenbush Recreation Master Plan
- Town of Pittstown Land Use Regulations
- Town of Pittstown Comprehensive Plan
- Quackenderry Creek Dam Emergency Action Plan
- City of Rensselaer Stormwater Management Plan
- City of Rensselaer Flood Damage Prevention Ordinance
- City of Rensselaer Comprehensive Plan
- City of Rensselaer Transportation Study
- Town of Schaghticoke Stormwater Management Plan
- Town of Schaghticoke Comprehensive Plan
- Town of Schaghticoke Zoning Ordinance
- Village of Schaghticoke Emergency Response Plan

- Engineering Report, Slope Movement Evaluation Behind the A.E. Diver Memorial Library (Clough Harbour, May 2006)
- Town of Schodack Flood Damage Prevention Ordinance
- Town of Schodack Emergency Plan
- Town of Schodack Erosion and Sediment Control Code
- Town of Stephentown Land Use Regulations
- Town of Stephentown subdivision Regulations
- Village of Valley Falls Floodplain Regulations
- USGS Earthquake History of New York State
- NY State Geological Survey NEHRP Soil Class Mapping
- NY State Landslide Inventory Mapping
- USGS National Landslides Program Landslide Mapping
- USGS Fact Sheet 165-00, Land Subsidence in the United States
- National Agricultural Statistics Service, Rensselaer County Profile
- New York agricultural Statistics Service, Rensselaer County Profile
- HAZUS-MH database for emergency facilities and utilities
- NYSDEC Inventory of Dams
- Stanford University National Performance of Dams Program web site
- U.S. Army Corps of Engineers National Inventory of Dams
- New York State Historic Preservation Office GIS shape files for state and federally listed historic and cultural resources
- The NYS Park System: An Economic Asset to the Empire State – Parks and Trails New York/ The Political and Economic Research Institute of the University of Massachusetts
- The American Society of Civil Engineers Standard 7-02, Minimum Design Loads for Buildings and Other Structures and "Wind Zones in the United States" map
- New York City Area Consortium for Earthquake Loss Mitigation website
- FEMA Publication 320: Taking Shelter from the Storm
- FEMA NFIP Community Status Book
- FEMA data for NFIP Repetitive Loss Properties and Community Rating System communities
- FEMA's "NFIP Floodplain Management Requirements: a Study Guide and Desk Reference for Local Officials (FEMA-480)"
- USGS Landslide Overview Map of the Conterminous United States, prepared in hard copy format in 1982 by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes (Geologic Survey Professional Paper 1183), compiled digitally by Jonathan W. Godt (USGS Open File Report 97-289), as viewed on NationalAtlas.gov
- American Society of Civil Engineers (ASCE) Standard 7-98: Minimum Design Loads for Buildings and Other Structures
- FEMA's "Multi-Hazard Identification and Risk Assessment" (1997)
- American Meteorological Society "Glossary of Meteorology"
- Relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, comprehensive plans, capital

improvements plans, economic development plans, emergency response plans, post-disaster recovery plans, post-disaster recovery ordinances, and real estate disclosure ordinances were considered by local jurisdictions in the process of conducting their Capability Assessments. For additional information, please see the "Capabilities and Resources" section of this plan.

Document Organization

This Multi-Jurisdictional Hazard Mitigation Plan for Rensselaer County is organized into the following major sections.

Section 1 - Introduction. Plan purpose, overview of Rensselaer County, summary of plan development process, document organization, and key terms.

Section 2 - Identification of Significant Hazards. Documentation of the Planning Committee's evaluation of a full range of natural hazards, and indication of which hazards were identified for inclusion in this plan (and why) versus those that were not identified (and why not).

Section 3 - Risk Assessment. Hazard profiles, identification and characterization of assets in hazard areas, damage estimates, and summary of growth and development trends in hazard areas.

Section 4 - Capabilities and Resources. Overview of local, state, and federal resources for hazard mitigation.

Section 5 - Mitigation Strategy. Summary of the guiding principles for this Plan, and the mitigation initiatives that have been identified to reduce or avoid long-term vulnerabilities to the County's most significant hazards.

Section 6 – Plan Maintenance and Integration. Procedures selected for monitoring, evaluating, and updating this mitigation plan; including participation of the public and other stakeholders in plan maintenance, and plan integration.

Section 7 – For More Information. Contact information for questions or comments.

Regulatory Compliance

This 2019 mitigation plan update was prepared in a manner consistent with applicable regulations, criteria, and guidance. The Plan's components address the local hazard mitigation planning requirements of the DMA 2000. The planning team used FEMA's Local Mitigation Planning Handbook (March 2013) and its "Regulation Checklist" as a guide. In addition, the 2017 NYS Hazard Mitigation Planning Standards (2017) are addressed under Element F of the Regulation Checklist. Each element of the Regulation Checklist must be addressed

satisfactorily for a plan to be approved. Table 1.7 summarizes the requirements, and where the regulation is addressed in this plan.

Table 1.7
FEMA Plan Review Criteria

Regulation	Location in Plan[4]
Element A - Planning Process	
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction (Requirement 201.6(c)(1))	Section 1 and each Jurisdictional Annex
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interest to be involved in the planning process? (Requirement 201.6(b)(2))	Section 1 and each Jurisdictional Annex
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement 201.6(b)(1))	Section 1 and each Jurisdictional Annex
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement 201.6(b)(3)	Section 1
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (requirement 2016(c)(4)(iii))	Section 6 and each Jurisdictional Annex
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement 201.6(c)(4)(i))	Section 6 and each Jurisdictional Annex
Element B – Hazard Identification and Risk Assessment	
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? (Requirement 201.6 (c)(2)(i))	Sections 2 and 3a and each Jurisdictional Annex
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement 201.6(c)(2)(i))	Section 3a and each Jurisdictional Annex
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement 2016(c)(2)(ii))	Sections 3b,3c, 3d and each Jurisdictional Annex
B4. Does the Plan address NFIP insured structure within the jurisdiction that have been repetitively damaged by floods? (Requirement 201.6(c)(2)(ii)	Section 3a, 3c, and each Jurisdictional Annex
Element C – Mitigation Strategy	
C1. Does the plan document each jurisdiction's existing authorities, policies, programs, and resources and its ability to expand on and improve these existing policies and programs? (Requirement 201.6(c)(3))	Section 4 and each Jurisdictional Annex
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement 201.6(c)(3)(ii))	Section 3a and each Jurisdictional Annex
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement 201.6(c)(3)(i))	Section 5
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement 201.6(c)(3)(ii))	Section 5 and each Jurisdictional Annex
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement 201.6(c)(3)(iii))	Section 5 and each Jurisdictional Annex
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement 201.6(c)(4)(ii))	Section 6 and each Jurisdictional Annex

[4] "Location in the Plan" is referring to the primary plan Section where the requirement is met, and any appendices referenced in that section.

Element D – Plan Review, Evaluation, and Implementation (applicable to plan updates only)	
D1. Was the plan revised to reflect changes in development? (Requirement 201.6(d)(3))	Section 3d and each Jurisdictional Annex
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement 201.6(d)(3))	Section 5 and each Jurisdictional Annex
D3. Was the plan revised to reflect changes in priorities? (Requirement 201.6(d)(3))	Section 5 and each Jurisdictional Annex
Element E – Plan Adoption	
E1. Does the Plan include documentation that the Plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement 201.6(c)(5))	Page i[5]
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement 201.6(c)(5))	Page i[20]
Element F – Additional State Requirements	
F1. Does the plan document how stakeholders were invited to participate at each phase of the planning process and provide a summary of feedback?	Section 1 and each Jurisdictional Annex
F2. Do jurisdictions identify critical facilities, assess vulnerabilities and ensure protection to a 500-year flood event or worst case scenario?	Appendix B and Jurisdictional Annexes
F3. Do jurisdictions containing an SFHA identify: potential sites for the placement of temporary housing units for residents displaced by disaster; and potential sites within the jurisdiction suitable for relocating houses out of the floodplain, or building new houses once properties in the floodplain are razed?	Appendix C
F4. Do jurisdictions identify: routes and procedures to evacuate citizens prior to and during an event; and shelters for evacuated citizens, to include provisions for a range of medical needs, accommodation for pets, and compliance with the Americans with Disabilities Act (www.ada.gov)?	See each jurisdictional annex section 10.x.12. and Appendix B2
F5. Do jurisdictions identify mitigation projects completed since the approval of the previous mitigation plan (or within the last five years)?	Jurisdictional Annexes
F6. Does the plan include an annex for every jurisdiction within the County's boundaries?	Yes; see each Jurisdictional Annex
F7. Within each jurisdictional annex, are: projects developed in accordance with the NYS DHSES Proposed Projects Table; and two (2) NYS DHSES Action Worksheets provided?	Yes; see each Jurisdictional Annex
F8. Does the plan include a list of potential funding sources?	General information in Section 4; with project-specific identification in each Jurisdictional Annex
F9. Does the plan assess how climate change may affect vulnerability to hazards, propose actions to address this, and discuss sea level rise (if applicable)?	End of Sections 3b and 3c
F10. Was the draft plan posted for public comment?	Yes; see http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/

[5] Participating jurisdictions will each be responsible for passing their resolutions after agency reviews are completed and FEMA indicates that the plan is "Approvable Pending Adoption". Each jurisdiction is responsible for providing a copy of their adoption resolution to RCBPS. RCBPS is responsible for providing a copy of all resolutions to FEMA, and inserting hard copies into the bound document following Page i.

Key Terms

For the purpose of clarity throughout this document, the following definitions are briefly outlined:

- Hazard mitigation is the method by which measures are taken to reduce, eliminate, avoid or redirect natural hazards in order to diminish or eradicate the long-term risks to human life and property.

- A natural hazard is any hazard that occurs or results from acts of nature such as floods, earthquakes, hurricanes, tornadoes and coastal storms, to name a few.

- A hazard mitigation plan is a well-organized and well-documented evaluation of the natural hazards and the extent that the events will occur. In addition, the plan identifies the vulnerability to the effects of the natural hazards typically present in a certain area, as well as the goals, objectives and actions required for minimizing future loss of life and property damage as a result of natural hazards.

- Hazard mitigation planning is the process of managing actions taken by individual citizens and professional organizations involved in mitigation activities. The process involves carrying out plans to reduce loss of life, injuries and damage to property, as well as reducing the costs associated with losses from natural hazards. It is a long-term process with benefits best realized over time.

- A disaster is any catastrophic event that causes loss of life, injuries and widespread destruction to property. For the purpose of this document, a disaster is the result of a natural hazard, whether anticipated (such as flash flood warnings) or fortuitous (such as earthquakes).

- The term human-caused hazards refers to technological hazards and terrorism, where “technological hazards” are incidents that arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials, where the incidents are accidental and their consequences unintended; and “terrorism” is the intentional, criminal, and/or malicious acts resulting from the use of Weapons of Mass Destruction (WMD), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive and armed attacks; industrial sabotage and intentional hazardous materials releases; and cyberterrorism.

SECTION 2 - IDENTIFICATION OF SIGNIFICANT HAZARDS

Rensselaer County is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. FEMA's current regulations and interim guidance require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of "human-caused" hazards (i.e., technological hazards and/or terrorism) is not required for plan approval under DMA 2000. Rensselaer County has chosen to focus solely on natural hazards at this time. Human-caused hazards can be evaluated in future versions of the plan, as it is a "living document" which will be monitored, evaluated and updated regularly.

As part of this 2019 Plan Update, the hazards of the initial 2011 Plan were reviewed, and the need for adding or removing hazards was considered. All earlier assessments were determined to still be applicable for the plan update. Rensselaer County has identified several significant hazards of concern that are addressed in this Hazard Mitigation Plan. The identification of significant hazards of concern involved the following:

- Input from the County
- Input from the jurisdictions participating in the plan
- Review of the 2019 New York State Hazard Mitigation Plan (2019 SHMP) and 2011 Rensselaer County HMP hazard identification efforts
- Review of local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have affected the region
- Qualitative or anecdotal information on natural hazards and the perceived vulnerability of the County's assets to them

Using this approach, the following hazards were identified as significant hazards in Rensselaer County warranting further evaluation and assessment of risk:

Atmospheric Hazards	Hydrologic Hazards	Geologic Hazards	Other Hazards
• Extreme Temperatures (Coldwaves and Heat Waves) • Hurricane/Tropical Storm • Lightning • Tornado • Wind • Winter Storm (Ice Storm and Snow Storm)	• Drought • Flooding (includes Flooding, Dam Failure, and Ice Jams)	• Earthquake • Landslide	• Wildfire

For the purposes of this plan, no additional discussion will be included on those hazards not considered to be a significant threat to Rensselaer County. The hazard will be considered in future updates of the plan to determine if a greater threat is occurring.

On the following pages: Table 2.1 presents the full range of natural hazards considered and provides a brief description of each hazard; Table 2.2 summarizes the process that was used to identify the natural hazards of concern for further evaluation; Table 2.3 provides a summary of the results of the 2017 Rensselaer CEPA for reference and comparison.

Table 2.1- Hazards Evaluated	
Hazard	Description
ATMOSPHERIC HAZARDS	
Avalanche	A rapid downhill flow of a large mass of snow or ice dislodged from a mountainside.
Extreme Temperatures	Coldwave: Temperatures at or below zero degrees Fahrenheit for an extended period of time. Heatwave: Temperatures that are 10 degrees above average, usually combined with an elevated level of humidity, for a prolonged period of time.
Hail	Hail is a type of precipitation that is formed when drops of water freeze together in the cold upper regions of thunderstorm clouds, also referred to as hailstones. Most hailstones measure between 5 millimeters and 15 centimeters in diameter and can be round or jagged.
Hurricane/ Tropical Storm	Hurricanes are large swirling storms that produce winds of 74 mph or higher. They are a type of storm called a tropical cyclone, which forms over tropical or subtropical waters. Tropical storms are tropical cyclones that produce sustained winds of between 39 and 73 mph.
Lightning	A brief electrical discharge between a cloud and the ground or from cloud to cloud.
Nor'easter	A storm along the East Coast with winds over the coastal area typically from the northeast. Nor'easters typically occur in the fall and winter months and are characterized by heavy rain and/or snow, gale force winds, rough seas, and occasional coastal flooding.
Tornado	A violently rotating column of air extending from the base of a thunderstorm cloud to the ground.
Wind	High winds (Straight Line) are not associated with rotation, like tornado winds. Damaging winds are often called "straight-line" winds to differentiate the damage they cause from tornado damage.
Winter Storm	Ice Storm: Occasions when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are usually accumulations of 0.25-inch or greater. Snow Storm: Snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 degrees Fahrenheit), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage.
HYDROLOGIC HAZARDS	
Coastal Erosion	The process by which large storms, flooding, strong wave action, sea level rise, and human activities wear away beaches and bluffs along coastlines.
Dam Failure	The collapse, breach, or other failure of a dam structure resulting in downstream flooding.
Drought	A shortage of water from lack of rain over an extended period of time.
Flooding	A temporary condition of partial or complete inundation of water on land that is normally dry.
Ice Jams	A stationary accumulation of ice that restricts or blocks streamflow.
Storm Surge	An abnormal rise in sea level accompanying a hurricane or other intense storm, whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic tide from the observed storm tide.
Wave Action	The characteristics and effects of waves that move inland from a large body of water.
GEOLOGIC HAZARDS	
Earthquake	A sudden, rapid shaking of the ground caused by the breaking and shifting of rock beneath the Earth's surface.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions and will expand/contract accordingly as moisture content increases/decreases.
Landslide	The movement of a mass of rock, debris, or earth down a slope by the force of gravity.
Land Subsidence	The gradual settling or sudden sinking of the Earth's surface to do the subsurface movement of earth materials.

Table 2.1- Hazards Evaluated	
Hazard	Description
Tsunami/ Seiche	Tsunami: A series of great waves caused by disturbances such as earthquakes, volcanic eruptions, landslides, undersea slumps, or meteor impacts. Seiche: A standing wave that oscillates back and forth like a pendulum in an enclosed or partially enclosed body of water.
Volcano	An eruption of the earth's crust.
OTHER HAZARDS	
Wildfire	A fire that is not planned, controlled, or supervised in a natural area such as a forest, grassland, or prairie.

Source: 2019 New York State Hazard Mitigation Plan, https://mitigateny.availabs.org/, accessed January 2019 and the NOAA National Weather Service Glossary at https://w1.weather.gov/glossary/)

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
ATMOSPHERIC HAZARDS					
Avalanche		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• US Forest Service National Avalanche Center website • 2019 SHMP • FEMA's Multi-Hazard Identification and Risk Assessment (MHIRA) • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP indicates that rare and localized avalanches have occurred in the Adirondacks Mountains and that the one event recorded in NY by the NCEI occurred in Essex County. • Avalanches are not discussed for NY on the US Forest Service Avalanche Center website. • The topography and climate in Rensselaer County do not support conditions required for the occurrence of significant avalanches. • Avalanches were not included in the Rensselaer County 2017 CEPA.
Extreme Temperatures (Coldwave and Heatwave)		Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update; however, Coldwave and Heatwave are being evaluated separately under Extreme Temperatures as part of this	• 2019 SHMP • NOAA NCEI Storm Events Database • FEMA's MHIRA • Rensselaer County 2017 CEPA • Rensselaer County Heat-Health Profile Report. Developed by New York State Department of Health, Center for Environmental Health. 2018 • Core Planning Group feedback	<u>Coldwave</u>: • Coldwave is mentioned in the 2019 SHMP as a discrete hazard, which is an update from the 2014 SHMP which grouped extreme heat and cold together. Coldwave includes Cold/Wind Chill, Extreme Cold/Wind Chill and Frost/Freeze events as described in the NCEI Storm Events database. • The 2019 SHMP describes 58 Coldwave events for Rensselaer County in the period of 1996-2017, with no damages. Rensselaer County is not included on the list of high risk counties. • The NCEI reports 38 Cold/Wind Chill, nine Extreme Cold/Wind Chill, and 42 Frost/Freeze events in the Rensselaer County zones since 1996. None of these events resulted in any deaths or injuries. No Cold/Wind Chill or Extreme Cold/Wind Chill events resulted in property or crop damages; while only one Frost/Freeze event (May 1, 2008) resulted in crop damages of $30,800. • Coldwave was not included in the Rensselaer County

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
			plan update to better align with the 2019 SHMP.		2017 CEPA. Sustained power outages, however, were included and would represent a condition that could exacerbate the effects of a Coldwave. The 2017 CEPA assesses sustained power outage as a high relative risk with very high likelihood and potentially high consequence. • The 2019 SHMP states that the entire state is exposed to the hazard of extreme temperatures. Coldwaves can cause pipes to freeze and burst. They can also result in injuries and fatalities from exposure to these extreme low temperatures. Extreme cold can disproportionately affect vulnerable populations. <u>Heatwave:</u> • Heatwave is mentioned in the 2019 SHMP as a discrete hazard, which is an update from the 2014 SHMP which grouped extreme heat and cold together. Heatwave includes Heat and Excessive Heat events as described in the NCEI Storm Events database. • The 2019 SHMP describes seven heatwave events affecting Rensselaer County since 1996 and does not include Rensselaer County on the list of high risk counties. • The NCEI reports 28 heat events and five excessive heat events from 1996 through 2018, with no damages, injuries, or deaths. • Heatwave was not included in the Rensselaer County 2017 CEPA. Sustained power outages, however, were included and would represent a condition that could exacerbate the effects of a heatwave. The 2017 CEPA assesses sustained power outage as a high relative risk with very high likelihood and potentially high

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					consequence. • The 2019 SHMP states that the entire state is exposed to the hazard of extreme temperatures. Coldwaves can cause pipes to freeze and burst. They can also result in injuries and fatalities from exposure to these extreme low temperatures. Extreme heat can disproportionately affect vulnerable populations. • The 2018 Rensselaer County Heat-Health Profile Report states that extreme heat conditions can potentially be harmful to human health. The report notes areas within Rensselaer County that are highly vulnerable to the effects of extreme heat.
Hail	⊘	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• 2019 SHMP • FEMA's MHIRA • NOAA NCEI Storm Events Database • NOAA National Severe Storms Laboratory (NSSL) website • USDA's 2012 Census of Agriculture • National Agricultural Statistics Service website • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP describes 103 hail events in Rensselaer County with $80K in damages, ranking the County 37th out of the 62 counties in NY. The top 20 counties all had more than $500K in damages, while the top 12 counties all had more than $1M in damages. Rensselaer County is not included on the list of high risk counties. • NCEI reports 95 significant hail event records (3/4 inch diameter hail or greater) for Rensselaer County from 52 hail days between 1996 and 2018, with 1 injury, $40K in property damages, and $31K in crop damages. Damages are about $3,300 per year county-wide. • According to NSSL mapping, Rensselaer County is in a region with the lowest annual number of days with hailstorms (less than 2), and where the annual average number of damaging hail events is essentially zero. • Hail is not included in the Rensselaer County CEPA 2017. • There are minimal hazard mitigation techniques available to reduce hail impacts to property, outside of the emergency preparedness procedures and severe weather warning systems already in place (i.e., mass

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					public notifications that recommend immediate protective actions such as moving automobiles into protected spaces). • Agriculture is an integral part of the economy of Rensselaer County. According to the USDA's 2012 Census of Agriculture, 21% of the County is devoted to agricultural uses, and 12% of the County land area is devoted to cultivated cropland. The National Agricultural Statistics Service ranked Rensselaer County 37th out of 62 counties in the state for value of crops sold. Agricultural losses during a significant hail event have the potential to be significant; however, there are no known hail mitigation measures for crops, which would be exposed to the greatest hail damages.
Hurricane and Tropical Storm	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• 2019 SHMP • NOAA historical tropical cyclone tracks • NOAA National Hurricane Center (NHC) website • NOAA NCEI Storm Events Database • FEMA's Disaster Declarations Database • FEMA's MHIRA • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Hurricane is discussed in detail in the 2019 SHMP and identified as the top hazard impacting NY. Although hurricanes can impact the entire state, Rensselaer County is ranked #49 out of the 62 counties in NY. The 2019 SHMP describes 17 hurricane events that have impacted the county, but with no damages. • Hurricane includes hurricane, hurricane (typhoon), marine hurricane/typhoon, marine tropical storm, tropical storm, tropical depression, and hurricane flood events as described in the NCEI Storm events database. • FEMA's records show that Rensselaer County has been included in the area covered by three Presidential disaster declarations and three emergency declarations due to hurricanes and tropical storms since 1973: o Hurricane Belle, 1976 o Hurricane Floyd, 1999 o Hurricane Katrina, 2005 o Hurricane Irene, 2011

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					o Tropical Storm Lee, 2011 o Hurricane Sandy, 2012 • NOAA historical records indicate three hurricane tracks, eight tropical storm tracks, and five extratropical systems passing within 65 miles of Rensselaer County between 1863 and 2018. • The most recent of these tracked events was Tropical Storm Irene in 2011, causing heavy rainfall and flash flooding across New York State. The most proximate hurricane to Rensselaer County during the last 100 years was the famously destructive New England Hurricane of 1938, which was still considered a Category 2 hurricane when it passed approximately 10 to12 miles to the east of Rensselaer County. • The NCEI database reports two tropical storm events affecting Rensselaer County in 2011, with no recorded damages. No hurricane events, tropical depression, or other hurricane-related events (as described in the second bullet) have been recorded. • The Rensselaer County 2017 CEPA assesses the hurricane/tropical storm hazard as relatively moderate risk with low likelihood and very high potential consequences.
Lightning	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan	• 2019 SHMP • NOAA NCEI Storm Events Database, NOAA lightning statistics, and NSSL website • Review of FEMA's MHIRA • Rensselaer County	• Lightning considered as a discrete hazard in the 2019 SHMP, which is a change from the 2014 SHMP. Lightning was not considered as a discrete hazard in the Rensselaer County 2017 CEPA. The lightning hazard includes lightning, thunderstorm winds, and marine lightning events from the NCEI Storm Events database. • The 2019 SHMP reports 11 lightning events with total damages of $366K. Rensselaer County is ranked #10 out of the 62 NY counties for this hazard but is not

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
			update.	2017 CEPA • Core Planning Group feedback	included in the list of high risk counties. • While NOAA records that New York State has experienced the fourth most deaths and third most damages from lightning in the United States from 1959 to 1994, FEMA and NOAA data also shows that Rensselaer County is located in an area of the country that experiences an average of 20 to 30 thunder days annually, and two to four lightning flashes per square kilometer per year. For comparison, large areas of the country experience more than 40 thunder days per year and twice as many flashes per square kilometer. • NCEI reports 10 lightning events for Rensselaer County since1996 resulting in 11 injuries and a total of $236K in property damages. NCEI also reports 286 Thunderstorm Wind events in the County since 1996 resulting in one death, 15 injuries, and $2.27M in property damage. • A direct strike to the RCBPS building in July 2010 damaged equipment and required temporary operations out of the BPS trailer for several days.
Nor'easter		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The NCDC and SHELDUS databases do not specifically list nor'easters as individual hazard events. • The Rensselaer County 2017 CEPA did not consider nor'easters as a discrete hazard for individual assessment. • Nor'easters are discussed in the state plan as a common cause of flooding and severe snowstorms in the southern and eastern portion of the state. Typically, nor'easters affect the New York City and Long Island region. On occasion, the storms are large enough to encompass most of the state. • Rensselaer County is only directly affected by individual nor'easter events on an occasional basis, and the

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					principal potential impacts of such storms (high winds, flooding, and heavy snow) are considered as individual hazards of concern to be addressed separately in this plan.
Tornado	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of NOAA NCEI Storm Events Database • Review of NSSL website • Review of FEMA's MHIRA • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP reports that tornadoes impact NY significantly, causing millions of dollars in damages. NY experiences an average of approximately six tornadoes per year since 1952. • The 2019 SHMP reports that three tornado events have occurred since 1996, with $225K in damages, and ranks Rensselaer County 29th out of 62 counties in NY for this hazard. The county is not included on the list of high risk counties. • FEMA's records show that Rensselaer County has been included in the area covered by one Presidential disaster declaration due to tornadoes since 1973 for the event that occurred on May 31, 1998. • NCEI reports nine damage-causing tornado events in Rensselaer County since August 1973. Of the nine recorded events, three were of magnitude F2 on the Fujita Scale (severe damage), five were of magnitude F1 (moderate damage), and the remaining one was F0 (light damage). A tornado of magnitude F2 in May 1998 is recorded as causing $10 million in property damages and $200K in crop damages in Rensselaer County. • NSSL tornado probability data indicate that while Rensselaer County is in an area that experiences only 0.2 to 0.4 tornado events per year, such events are likely to be life-threatening and cause significant damages when they occur. • The Rensselaer County 2017 CEPA ranked severe wind/tornados as a high hazard with high likelihood and

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					medium potential consequences.
Wind	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• 2019 SHMP • FEMA's MHIRA • NOAA NCEI Storm Events Database • American Society of Civil Engineers (ASCE) Standard 7-02, Minimum Design Loads for Buildings and Other Structures • Wind Zones in the United States provided in FEMA Publication 320 – Taking Shelter From the Storm • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP considers Wind as a discrete hazard, separate from hurricane and tornado, which is an update from the 2014 SHMP, when extreme wind events were included in the context of hurricane and tornado events. • The Wind hazard includes high wind, strong wind, marine high wind, marine strong wind, marine thunderstorm, thunderstorm wind, thunderstorm winds heavy rain, heavy wind, thunderstorm winds/flash flood, thunderstorm winds/heavy rain, thunderstorm winds/funnel cloud, and thunderstorm winds/flooding data events as described in the NCEI Storm Events Database. • The 2019 SHMP reports 299 Wind events in Rensselaer County since 1996, with $2.18M in damages, and ranks Rensselaer County as 30th out of 62 counties in NY for this hazard. • Rensselaer County is located in a climate region that is highly susceptible to numerous types of Wind events including straight line winds, severe thunderstorms, etc. • According to FEMA-320 Figure I-4, Rensselaer County is located in a wind zone where extreme wind speeds of 160 mph are possible. • The NCEI database records the following hazard events for Rensselaer County in the period from 1996 through 2018: o 68 high wind events resulting in 11 injuries, no deaths, and $636K in property damages o 21 strong wind events resulting in no injuries or deaths,

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					and $58K in property damage. o No other wind-related events. • Per ASCE 7-02, the three second wind gust for Rensselaer County for building design purposes is 90 mph. The standard also shows that the southeastern part of Rensselaer County is located in a Special Wind Region, i.e. an area where wind anomalies are known to occur and in which wind speeds may be substantially higher than specified. • The Rensselaer County 2017 CEPA ranked severe storms as a Moderately High Hazard and the 2nd most significant natural hazard in the County out of 12 included in the assessment.
Winter Storm (Ice Storm and Snow Storm)	 Snow Storms and Ice Storms will be evaluated separately	Winter Storms (Snow Storms and Ice Storms combined) were identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update; however, Snow Storms are being evaluated separately from Ice Storms as part of this plan update	• Review of 2019 SHMP • Review of FEMA's MHIRA • Review of NOAA NCEI Storm Events Database • Review of FEMA's Disaster Declarations Database • New York State Climate Office website • Rensselaer County 2017 CEPA Core Planning Group feedback	<u>Ice Storm</u>: • The 2019 SHMP discusses Ice Storm as a discrete hazard, separate from Snow Storm, which is an update from the 2014 SHMP. Ice Storm includes ice storm and sleet events as described in the NCEI Storm Events Database. • The 2019 SHMP indicates that NY is exceptionally prone to serious ice storms, but Rensselaer County is not included in the list of high risk counties and is ranked #50 out of the 62 counties based on recorded losses for Ice Storm. Only three ice storm events are described in the 2019 SHMP, with no damages recorded. • The NCEI database records five ice storm events for Rensselaer County since 1996, all of which occurred in 2007 and 2008 with no damages. No sleet events have been recorded. • The Rensselaer County 2017 CEPA assesses ice storm hazard as high risk with high likelihood and high potential consequences. Ice storms and flooding were determined

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
			to better align with the 2019 SHMP.		to be the two hazards posting the most risk to the County. <u>Snow Storm</u>: • The 2019 SHMP discusses Snow Storm as a discrete hazard, separate from Ice Storm, which is an update from the 2014 SHMP. Snow Storm includes winter weather, winter storm, heavy snow, blizzard, high snow, and lake effect snow events as described in the NCEI Storm Events Database. • The 2019 SHMP reports 85 snow storm events but no damages and ranks Rensselaer County 58th out of 62 counties in NY for this hazard. • Average annual snowfall in Rensselaer County is almost 63 inches, slightly less than the statewide average of 65 inches. • NCEI reports that Rensselaer County has been affected by the follow hazard events in the period from 1996 through 2018: • Two Blizzard events, with no injuries, deaths, or damages • 44 Heavy Snow events, with no injuries or deaths, and $5K in total property damages • 105 Winter Storm events, with no injuries or deaths, and $735.1K in total property damages • 109 Winter Weather events, with no injuries, deaths, or damages • No lake effect snow events. • According to NOAA, Rensselaer County is located in an area where snow depths of 75-100 inches have a 5% chance of being equaled or exceeded in any given year. • Rensselaer County has been included in six winter-related Presidential disaster declarations and two

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					emergency declarations. The Rensselaer County 2017 CEPA study ranked severe winter snow storms as a high hazard, with high likelihood and medium potential consequences.
HYDROLOGIC HAZARDS					
Coastal Erosion		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 NY SHMP • Review of FEMA's MHIRA • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP has grouped the NCEI hazards storm surge, wave action, coastal erosion, coastal flooding, and sea-level rise together for consideration as coastal hazards. • The 2019 SHMP defines coastal erosion as "the process by which ocean waves wash sand and other parts of a beach away from shore, causing the beach itself to shrink." • The 2019 SHMP does not identify Rensselaer County as historically subject to coastal hazard impacts; though it does state that the County's Hudson River Shoreline south of the Federal dam at Troy can experience erosion. NYSDEC has not, however, mapped coastal erosion hazard areas in Rensselaer County and Rensselaer County is located more than 100 miles inland from Atlantic Ocean Coastline. • NCEI reports that Rensselaer County has been affected by zero coastal flood events in the period from 1956 through 2018: • The Rensselaer County 2017 CEPA did not include storm surge, wave action, or coastal erosion as hazards for consideration.

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
Dam Failure	✓ (under "Flood")	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update. However, for the plan update, to better align with the 2019 SHMP, dam failure will be discussed under the "Flood" hazard.	• Review of 2019 NY SHMP • Review of New York State Department of Environmental Conservation (NYSDEC) Bureau of Flood Protection and Dam Safety web site Inventory of Dams 2018 • Review of Stanford University's National Performance of Dams Program (NPDP) database • Review of FEMA's MHIRA • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Dam Failure is briefly discussed in the 2019 SHMP as a potential cause of flooding. It is identified in the plan methodology section as a man-made hazard, while the resulting flood event would be considered a natural hazard. For the purposes of this plan update, Rensselaer County will maintain its consideration of dam failure as a separate discussion from flooding. • The NYSDEC database lists 97 dams in Rensselaer County, of which 10 are classified as having "High" hazard potential, 13 are classified as having "Moderate" hazard potential. The remaining 64 are classified as having "Low" or "Negligible" hazard potential (63) or "unassigned" (1). • According to US Geological Survey (USGS) criteria, there are four "Major" dams in the County, by virtue of having a dam height of 50 feet or more, or a normal storage volume of at least 5,000 acre-feet. All four "Major" dams are classified by NYSDEC as of high hazard potential. • One of the above "Major" dams (the Tomhannock Reservoir) meets both the dam height and normal storage criteria. • Emergency Action Plans are in place for all 10 of the dams with "High" hazard potential; 7 of the 13 with "Moderate" hazard potential; and 2 of the 64 with "Low", "Negligible", or "Unassigned" hazard potential. • The Stanford NPDP database records four minor dam incidents at three dams in the county since detailed records began in 1868. One involved a high hazard dam (2015); two involved a single moderate hazard dam (1995 and 1998); and one involved a low hazard dam (1997). None resulted in dam failure, breach, or recorded damages to property other than repairs to the structure of the dam itself.

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					• Despite the lack of recorded dam failure incidents, dam failure is still considered a concern due to the number of high and moderate hazard dams in the county, and the absence of full coverage of these dams by current Emergency Action plans, Annual Certifications, and Engineering Assessments. • The Rensselaer County 2017 CEPA did not consider dam failure as a discrete hazard for individual assessment.
Drought	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of FEMA's MHIRA • Review of NOAA NCEI • Review of National Drought Mitigation Center /NOAA websites • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Drought is discussed in the 2019 SHMP; no drought events are identified for Rensselaer County since 1996. • According to the Historic Palmer Drought Severity Index (PDSI) Map for the USA, Rensselaer County is located in an area that experienced severe or extreme drought conditions (PDSI≤-3) for between five and ten percent of the period 1895 to 1995, which represents the most recent historic map compilation. • NCEI reports that Rensselaer County has been affected by four droughts since 1996, all occurring in 1999, with no damages. The NCEI indicates that the 1999 droughts can be considered components of a single event. • For the purposes of mitigation plans of this nature the primary impacts of drought are assumed to fall on agriculture. Agriculture is an integral part of the economy of Rensselaer County. According to the USDA's 2012 Census of Agriculture, 21% of the County is devoted to agricultural uses, and 12% of the County land area is devoted to cultivated cropland. The National Agricultural Statistics Service ranked Rensselaer County 37th out of 62 counties in the state for value of crops sold. • The Rensselaer County 2017 CEPA ranked drought as a moderate hazard with low likelihood and high potential consequences.

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
Flooding	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of NOAA NCEI Storm Events Database • Review of FEMA's Disaster Declarations Database • Review of FEMA's MHIRA • Review of FEMA's National Flood Insurance Program (NFIP) Community Status Book and Community Rating System (CRS) status data • Review of FEMA Flood Maps • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Flooding is described in the 2019 SHMP as the primary natural hazard in NY and in Rensselaer County and is discussed in comprehensive detail in the State plan. The flooding hazard includes flood, flash flood, coastal flood, and lakeshore flood events as described in the NCEI Storm Events database. • The NCEI Database includes 54 flooding episodes in Rensselaer County between 1996 and 2018 with 2 injuries, $13M in property damage, and $40,000 in crop damage. • One-third of all the Federal disaster declarations that affected Rensselaer County have involved flooding not associated with hurricanes (for the period 1953 to 2018). • Rensselaer County has been affected by seven flood-related Presidential disaster declarations since 1953, with the most recent due to severe storms and flooding in July 2006. • 21 of the 22 municipal jurisdictions in Rensselaer County participate in the NFIP, with one community currently suspended from the program. None participate in the CRS. • NFIP records indicate a total of 944 policies in force for a total of $171M in insurance in force in Rensselaer County. The 2019 SHMP reports that Rensselaer County ranks 21st in the state for the number of flood losses. The 535 reported losses total $8M in payments, with 157 claims closed without payment. • The 2019 SHMP also reports that Rensselaer County ranks 31st in the state for the number of repetitive loss properties, with 24 properties experiencing 67 losses with a total of $1.49M paid out. • The Rensselaer County 2017 CEPA ranked flooding as

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					high risk with high likelihood and high potential consequences. Ice storms and flooding were determined to be the two hazards posting the most risk to the County.
Ice Jams	 **Under "Flood"**	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update. However, for the plan update, to better align with the 2019 SHMP, ice jams will be discussed under the "Flood" hazard.	• Review of 2019 SHMP • Review of FEMA's MHIRA • USACE Cold Regions Research & Engineering Laboratory (CRREL) Ice Jams Database • Rensselaer County 2017 CEPA • Core Planning Group Feedback	• Ice Jams are mentioned in the 2019 SHMP as part of the Flood hazard. • Ice Jams are not included in the Rensselaer County 2017 CEPA. • The CRREL Ice Jams Database includes a total of 41 ice jams records for Rensselaer County locations. Three of these are new since the preparation of the initial plan: Hoosic River ice jam on 1/13/18 at Buskirk with no reported damages; Hoosic River ice jam on 1/24/19 at Eagle Bridge with no reported damages; and a Hudson River ice jam in Albany on 1/25/19 that caused Ice jams on the Hudson River caused eight boats to become dislodged from their moorings on the Hudson River in Rensselaer County as early as 1am on 1/25/19. One unoccupied vessel, the Captain JP III, became lodged underneath the Amtrak train crossing Livingston Avenue Railroad Bridge (connecting Albany with the City of Rensselaer). A small fleet of tugboats worked to dislodge/dock all vessels. No damages were reported to area bridges, though several bridges were forced to close during morning commuting hours because of the loose vessels.
Storm Surge		Not identified as a significant hazard to be addressed in	Considered again and the earlier assessment was	• Review of 2019 SHMP • Review of FEMA's MHIRA • NYSDOS Coastal Risk Assessment Study	• The Hudson River is tidal up to the Federal dam at Troy. The 2019 SHMP does include a NOAA National Hurricane Center's Sea, Lake, and Overland Surges from Hurricane (SLOSH) map which shows shoreline inundation as a result of a worst-case scenario Category 5 Hurricane (a

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
		the plan at that time.	determined to still be applicable for the plan update. However, given the storm surge flooding observed during Superstorm Sandy, for the plan update, storm surge will be discussed under the "Flood" hazard as a condition that can exacerbate flooding during severe storm events.	2016 • Hudson River Flood Impact Decision Support System 2019 • Rensselaer County 2017 CEPA • NOAA's National Hurricane Center Tropical Cyclone Report for Hurricane Sandy (2013) • Core Planning Group Feedback	hurricane is moving in a northwest direction with landfall just to the south of New York City along the coast of New Jersey, putting New York City in the right-front quadrant of the storm similar to the track of Superstorm Sandy) on the Hudson River only as far north as portions of Columbia and Greene Counties (south of Rensselaer County). • NOAA's National Hurricane Center Tropical Cyclone Report for Hurricane Sandy (2013) indicates that significant flooding due to storm surge (with some contribution from rainfall) occurred in parts of the Hudson River Valley as far north as Albany. Inundation as high as 4 to 5 feet above ground level occurred in many places along the banks of the river in Rockland, Orange, Ulster, Dutchess, Columbia, and Greene Counties, topped by a 5.1 feet high-water mark in Poughkeepsie and 4.9 feet in Kingston. Inundation levels of 2 to 4 feet occurred as far north as Columbia and Greene Counties, over 100 nautical miles upriver from New York Harbor. No reference was made to impacts in Rensselaer County from storm surge during this event. • The NYS DOS Coastal Risk Assessment Study 2016 (http://opdgig.dos.ny.gov/#/storyTemplate/10/1/1) did not include Hudson River inland counties north of Rockland and Westchester Counties and considered these inland communities to be lake and riverine areas. The DOS site notes that riverine areas are presently being studied. • The NCEI database reports no coastal flooding, high surf, rip current, sneakerwave, or other marine related hazard events for Rensselaer County. The NCEI database reports a single storm surge/tide event in the Western

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					Rensselaer Zone since 1950 (October 30, 2012); this event record did not include any reported deaths, injuries, or property damages in Rensselaer County. However, Brickyard Road in Castleton-on-Hudson was reported to be underwater due to tidal flooding during this event.
Wave Action		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of FEMA's MHIRA • Review of NOAA NCEI Storm Events Database • Review of FEMA Flood Maps • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Wave action is a coastal phenomenon and Rensselaer County, being located more than 100 miles inland, has no open coastline or large lakes. • Areas that are subject to significant wave action (wave heights of three feet or more) are designated as Velocity Zones (V-Zones) on FEMA's Flood Maps. FEMA Flood Maps show no mapped V-Zones in Rensselaer County. • The Rensselaer County CEPA does not include wave action as a hazard. • The NCEI Storm Events Database includes no records for wave event occurrences in Rensselaer County.
GEOLOGIC HAZARDS					
Earthquake		Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of USGS Earthquake Hazards Program website • Review of FEMA's MHIRA • Rensselaer County 2017 CEPA • Core Planning Group feedback	• Earthquakes are discussed in the 2019 SHMP, since earthquakes have occurred in and around the State of New York in the past, including a major Presidential Disaster Declaration (DR-1415) for the magnitude 5.0 earthquake that occurred in northern NY on April 20, 2002. • The 2019 SHMP reports no earthquake events in Rensselaer County. The 2019 SHMP reports that Rensselaer County is not among NY counties that would experience ground motion amplification during seismic activity, according to the National Earthquake Hazard Reduction Program's soil classification maps, although neighboring counties to the north would.

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					• According to USGS' 2014 seismic hazard map for NY, the peak ground acceleration (PGA) with a 2% probability of exceedance in 50 years for Rensselaer County is 6-10% of gravity for the majority of the county and 10-14% for the western side. FEMA requires that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3% of gravity or more for a 10% probability event. • USGS records do not show the occurrence of any earthquakes of magnitude 3.0 or greater centered in Rensselaer County between 1973 and 2018. In the area within 50 miles north and west of Rensselaer County, 45 earthquakes of magnitude 3.0-3.9 and five of magnitude 4.0- 5.3 were recorded in the same period. Earthquakes of magnitude less than 3.0 are considered too small to be felt or to be the cause of damage. • The Rensselaer County 2017 CEPA ranked earthquakes a moderate hazard in the county with low likelihood and high potential consequences.
Expansive Soils		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of FEMA's MHIRA • US Department of Transport Federal Highway Administration (USDOT FHA) Geological Data • NRCS Web Soil Survey for Rensselaer County • 2015 International Building Code • Rensselaer County	• Expansive soils are not identified as a hazard in the 2019 SHMP. • According to USDOT FHA Report No. FHAWA-RD-76-82, Rensselaer County lies in an area mapped as non-expansive – the occurrence of expansive materials is extremely limited (see also "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster, published in 1989) • Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is used to determine the shrink-swell potential (expansivity) of soil. The NRCS Web Soil Survey for Rensselaer County shows that 90% of the

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
				2017 CEPA • Core Planning Group feedback	county's land area is mapped with Low Linear Extensibility Rating (below 3%); 6% as Moderate (3-6%); and 4% unspecified. In Rensselaer County, Linear Extensibility Ratings range from a low of 0% to a maximum of 4.5%. None of Rensselaer County is mapped as having High (6-9%) or Very High (above 9%) linear extensibility. • NRCS states that where the linear extensibility is more than 3%, shrinking and swelling can cause damage to structures as soils shift. Damages can range from relatively minor sidewalk uplift, sticking windows/doors, cracks in walls/roofs/foundations; to major structural deficiencies requiring repairs to ensure structural integrity and safe occupancy. New York State building codes are based on the 2015 International Building Code (3rd Printing October 2015), in which Chapter 18 includes provisions for building on expansive soils (through design, removal or stabilization) so that new construction will be protected. • The Rensselaer County 2017 CEPA did not evaluate expansive soils as a hazard for consideration.
Landslide	✓	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of New York State Geological Survey landslide inventory mapping and database • Review of FEMA's	• The 2019 SHMP indicates that landslides have the potential to occur across all of NY. The Landslide hazard includes landslide and debris flow hazards from the NCEI Storm Events Database. • The 2019 SHMP reports no landslide events in Rensselaer County since 1996 and does not include the County on the list of high risk counties. The County is ranked #41 out of 62 counties for this hazard. • Review of NOAA NCEI Storm Events Database includes "debris flow" events such as landslides; however, no historic occurrences are in the database for Rensselaer

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
				MHIRA • Review of NOAA NCEI Storm Events Database • Rensselaer County 2017 CEPA • Core Planning Group feedback	County (1950-2018). • The "Landslide Inventory Map of New York" produced by the New York State Geological Survey (NYSGS) in cooperation with the United States Geological Survey, plots the location of 30 landslide events in Rensselaer County between 1837 and 1989, as well as several areas (mostly along the Hudson River) where individual slides are too numerous to map. • Data sheets obtained from the NYSGS for most of the mapped landslide events also record the dollar damages caused by many of these events, with average losses of approximately $25,000 per event (1980s dollars). • USGS landslide hazard maps indicate "High landslide incidence" (more than 15% of the area is involved in land sliding) for a 2-5 mile wide strip of Rensselaer County along the length of the county's Hudson River shoreline. As well as an area of "high susceptibility / moderate incidence" up to four miles wide in the east of the county along the border with Massachusetts. The remainder of the county is identified as "low incidence". • The Rensselaer County 2017 CEPA ranked landslides as a moderate hazard in the county with very high likelihood and low potential consequences
Land Subsidence		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan	• Review of 2019 SHMP • Review of FEMA's MHIRA • Review of USGS Fact Sheet 165-00 Land Subsidence in the U.S. • Review of NYSDEC Division of Mineral Resources Database	• The 2019 SHMP does not include discussion of land subsidence. The 2014 SHMP, however, delineated certain areas that are susceptible to land subsidence hazards in New York. Mapping in the2014 SHMP and from USGS indicates that a few areas in the north east and south east of Rensselaer County are underlain by carbonate karst rock such as limestone (in which there can be the potential for subsidence caused by sinkholes).

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
			update.	of Mines in Rensselaer County • Rensselaer County 2017 CEPA • Core Planning Group feedback	• USGS Fact Sheet 165-00 indicates that Rensselaer County is located in an area where subsidence caused by compaction of aquifers or drainage of organic soils is not likely. • As a general rule, land subsidence occurrence can be expected where it has occurred in the past. The state plan notes that new sinkhole formation in the karst areas is rare, while in contrast, subsidence occurring in areas that are already subsiding (expanding existing sink holes) are relatively common, occurring every few years. • While land subsidence is common in areas which feature significant underground mining (as opposed to open quarrying). • The NYS DEC Division of Mineral Resources Database of Mines in Rensselaer County includes 137 mines (3620 acres in all) 52 mines are permitted, 25 are not permitted, and 60 are reclaimed. All 137 mines are listed as having no underground acreage. • No significant historical occurrences of land subsidence were found in Rensselaer County during general internet-based research. • The Rensselaer County 2017 CEPA did not include land subsidence as a hazard for consideration.
Tsunami/ Seiche	⊘	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan	• Review of 2019 SHMP • Review of FEMA's MHIRA • Review of NOAA NCEI Storm Events Database • Rensselaer County 2017 CEPA • Core Planning Group	• The 2019 SHMP has added Tsunami/Seiche as a hazard to be considered in NY due to the high potential impact to the highly populated, low-lying coastline of the state. There is no recent history of tsunami in NY. • The 2019 SHMP reports no tsunami or seiche events in Rensselaer County and ranks the county 41st out of 62 counties for this hazard. The County is not included on the list of high risk counties. • The NCEI database indicates that no tsunami or seiche

Table 2.2 - Hazard Identification Process

Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
			update.	feedback	events have occurred in Rensselaer County for the period from 1950 through 2018. • The southernmost border of Rensselaer County is more than 100 miles from the coastline, well beyond the expected range of a tsunami along the Atlantic coast. • The Rensselaer County 2017 CEPA did not include tsunami/seiche as a hazard for consideration.
Volcano		Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of USGS Volcano Hazards Program website • Review of NOAA NCEI Storm Events Database • Rensselaer County 2017 CEPA • Core Planning Group feedback	• The 2019 SHMP lists Volcano as a hazard to be considered; however, the state has no record of volcanic activity and volcanos presently do not pose a threat. • The NCEI records indicate there are no volcanic ash events that affected Rensselaer County. • The Rensselaer County 2017 CEPA did not volcano as a hazard for consideration. • No volcanoes are located within approximately 2,000 miles of Rensselaer County.
OTHER					
Wildfire		Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of 2019 SHMP • Review of NOAA NCEI Storm Events Database • Review of NYSEMO and NYSDEC websites • Review of FEMA's MHIRA • Rensselaer County 2005 HAZNY • Core Planning Group feedback	• Wildfires are discussed in the 2019 SHMP as a hazard of concern. The 2019 SHMP describes one wildfire event that impacted the County, causing $2K in damages and ranks Rensselaer County #3 out of 62 counties for this hazard, as well as including the county on the list of high risk counties. • A significant proportion of the eastern half of Rensselaer County's land area is forested. • NCEI records three wildfire events in Rensselaer County in 2001 and 2002 for which property damages were recorded causing approximately $2K in damages. • General internet research suggests that parts of

Table 2.2 - Hazard Identification Process					
Hazard	Significant Hazard Warranting Risk Assessment?	2011 Plan Assessment	2019 Plan Assessment	Source of Hazard Information	Determination
					Rensselaer County experience minor forest/brush fires somewhat frequently; however, major blazes that damage or threaten developed property are relatively rare. • The Rensselaer County 2005 HAZNY study ranked wildfires as the 7th most significant natural hazard in the County.

Table 2.3 - Rensselaer 2017 CEPA Results			
Hazard	Likelihood	Potential Consequences	Risk
Flooding	High	High	High
Ice Storms (at least ½" or more)	High	High	High
Severe Wind/Tornado	High	Medium	High
Severe Winter Storms	High	Medium	High
Hurricanes/Tropical Storms	Medium	High	Moderate
Drought	Low	High	Moderate
Earthquakes	Low	High	Moderate
Landslides	Very High	Low	Moderate
Wildfire	Low	Low	Low

SECTION 3a- RISK ASSESSMENT: HAZARD PROFILES

This section contains the profiles of Rensselaer County's significant hazards. The profiles consist of information on location, extent (magnitude or severity), previous occurrences, probability of future events, and the role of global climate change in estimating probability. The profiles also include specific information noted by members of the planning committee and other stakeholders, including unique observations or relevant anecdotal information regarding individual historical hazard occurrences and individual jurisdictions. **Table 3a. 1** lists each significant hazard for Rensselaer County and identifies whether or not it has been determined to be a specific hazard of concern for each of the County's municipal jurisdictions based on best available data and local information provided by the Planning Committee (■ = hazard of concern).

Table 3a. 1 - Profiled Hazards by Municipality

Jurisdiction	Atmospheric Hazards						Hydrologic Hazards				Geologic Hazards		Other Hazards
								Flood					
	Extreme Temperatures (Coldwave /Heat Wave)	Hurricane / Tropical Storm	Lightning	Tornado	Wind	Winter Storm	Drought	Flooding[2]	Dam Failure[1]	Ice Jam[3]	Earthquake	Landslide[4]	Wildfire[5]
Rensselaer, County of	■	■	■	■	■	■	■	■	■	■	■	■	■
Berlin, Town of	■	■	■	■	■	■	■	■	■		■	■	■
Brunswick, Town of	■	■	■	■	■	■	■	■	■		■	■	■
Castleton-on-Hudson, Village	■	■	■	■	■	■	■	■		■	■	■	■
East Greenbush, Town of	■	■	■	■	■	■	■	■			■	■	■
East Nassau, Village of	■	■	■	■	■	■	■	■			■		■
Grafton, Town of	■	■	■	■	■	■	■	■	■		■		■
Hoosick, Town of	■	■	■	■	■	■	■	■		■	■	■	■
Hoosick Falls, Village of	■	■	■	■	■	■	■	■			■	■	■
Nassau, Town of	■	■	■	■	■	■	■	■		■	■		■
Nassau, Village of	■	■	■	■	■	■	■	■	■		■		■
North Greenbush, Town of	■	■	■	■	■	■	■	■			■	■	■
Petersburgh, Town of	■	■	■	■	■	■	■	■		■	■	■	■
Pittstown, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■
Poestenkill, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■
Rensselaer, City of	■	■	■	■	■	■	■	■	■	■	■	■	■
Sand Lake, Town of	■	■	■	■	■	■	■	■			■		■
Schaghticoke, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■
Schaghticoke, Village of	■	■	■	■	■	■	■	■			■	■	■
Schodack, Town of	■	■	■	■	■	■	■	■			■	■	■
Stephentown, Town of	■	■	■	■	■	■	■	■	■		■	■	■
Troy, City of	■	■	■	■	■	■	■	■	■	■	■	■	■
Valley Falls, Village of	■	■	■	■	■	■	■	■	■		■		■

Notes to accompany Table 3a.1: (1) Based on presence of a High hazard dam (NYSDEC classification) either in the municipality or close upstream on a watercourse flowing through that municipality and feedback from the County Planning Department. (2) Based on identification of improved property in mapped FEMA flood hazard zones. (3) Based on historical records, Flood Insurance Studies, and local information as well as feedback from the County Planning Department. (4) Based on identification of improved property in mapped high incidence or high susceptibility landslide risk zones, plus those municipalities in which details of individual landslide events are available. (5) Based on identification of improved property in mapped wildfire hazard zones.

ATMOSPHERIC HAZARDS

Extreme Temperatures

Countywide Statistics:

Coldwave	
Total Losses Reported (1996-2018)	$30,800
Total Number of Episodes (1996-2018)	61
Annualized Losses Reported (1996-2018)	$1,400
Annualized Number of Episodes (1996-2018)	2.8
Daily Probability	0.76%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0
Heat Wave	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	22
Annualized Loss (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	1
Daily Probability	0.27%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Extreme Temperatures

Extreme temperatures principally affect the health and safety of the human population, although they can also impact livestock, agricultural crops, and may also cause damage to infrastructure and property. Extreme heat and extreme cold can disproportionately affect vulnerable populations. This section provides detailed profiles of both extreme low temperatures and extreme high temperatures. Coldwaves and heat waves are defined in the 2019 SHMP as follows:

- A **coldwave** occurs when temperatures hover at or below zero degrees Fahrenheit for an extended period of time.
- A **heat wave** occurs when temperatures reach 10 degrees above average for a prolonged period of time, usually combined with an elevated level of humidity.

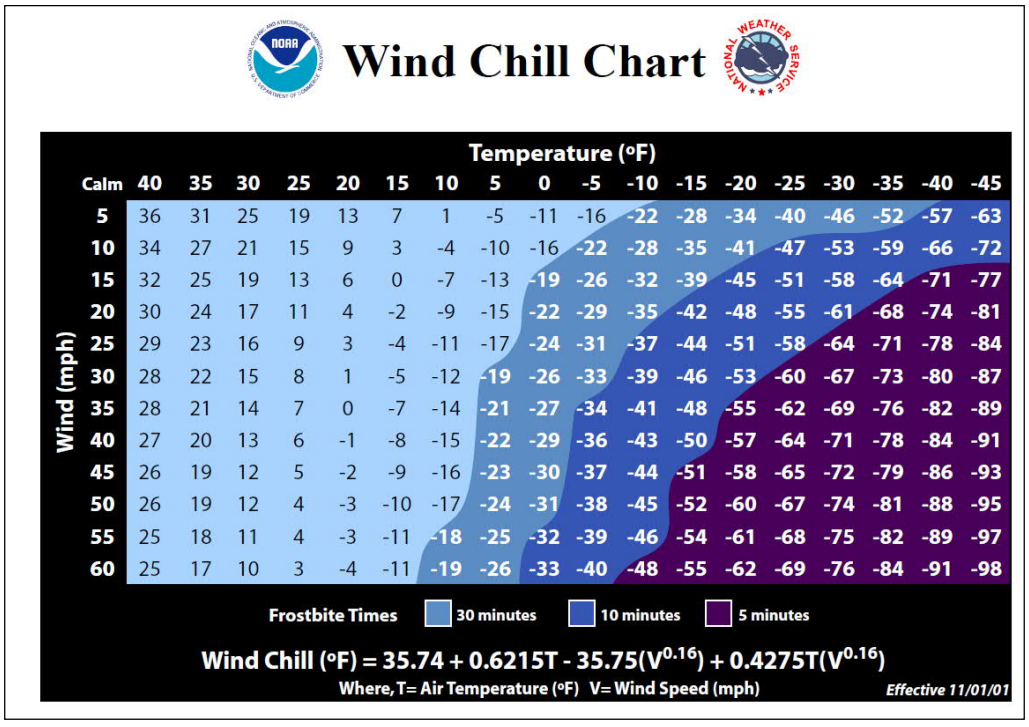
Location– Extreme Temperatures

Rensselaer County is located in a region of the country that is susceptible to both coldwaves and heat waves. Coldwaves and heat waves can occur anywhere in Rensselaer County, and often occur over the entire planning area. The unique characteristics of particular locations can sometimes result in slightly higher or cooler temperatures than observed area wide averages. For example, lower temperatures in heavily wooded areas offering shade versus higher temperatures in urban areas with less tree cover and more of the built environment absorbing heat.

Extent – Extreme Temperatures

The speed of onset of extreme temperature events typically offers 24 hours or more of warning time. The duration of historic events in Rensselaer County is typically less than one week. The extent of extremely cold temperatures (coldwaves) is typically measured through the Wind Chill Temperature (WCT) Index. The WCT Index provides a formula for calculating the dangers from winter winds and freezing temperatures. It is, essentially, a calculation of the temperature that is felt when the effects of wind speed are added to the base air temperature. Figure 3a. 1 shows the NOAA NWS Wind Chill Chart.

Figure 3a. 1 - NWS Wind Chill Index



The extent of the extremely hot temperatures (heat waves) is typically measured through the Heat Index, which calculates the dangers from high relative humidity and extremely hot temperatures. It is, essentially, a calculation of the temperature that is felt when the effects of relative humidity are added to the base air temperature. Figure 3a. 2 shows the NOAA NWS Heat Index.

Figure 3a. 2 - NWS Heat Index

NOAA national weather service: heat index

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

Caution
Extreme Caution
Danger
Extreme Danger

Previous Occurrences – Extreme Temperatures

Coldwave Occurrences

New York State has received no Federal Disaster or Emergency Declarations due solely to coldwaves. According to NOAA's NCEI Storm Events Database, 61 coldwave event days have occurred in Rensselaer County between 1996 and 2018 - or an average of about 2.8 coldwave event days per year. All but two of these events occurred between the months of October and May, the time of year when extreme cold events are most common in the area. No event records included reports of deaths, injuries, or property damage; while only one Frost/Freeze event (May 1, 2008) included reported crop damages ($30,800). Notable events include:

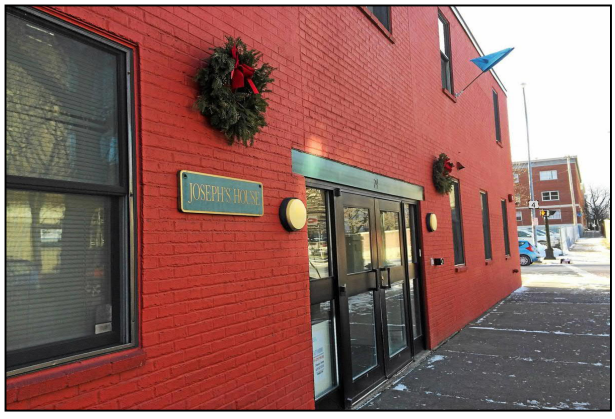


Photo 3a. 1 - A Code Blue Flag flies in front of Joseph's House and Shelter in Troy, December 2017

Winter 2014-2015

Rensselaer County Planning recalls that water transmission lines that had been built to code (four feet below grade) froze in the winter of 2014-2015 due to extreme cold temperatures over

a long duration that put the frost line below four feet. As a result, some people lost public water because the water pipes were frozen. Areas particularly impacted were the City of Troy (Lansingburgh) and some places in the Town of Brunswick.

December 2017

Extreme cold in the month of December 2017 resulted in the declaration of a Code Blue.

Twenty-four coldwave days have occurred since the last version of the plan was finalized in 2011, as shown in Table 3a. 2.

Table 3a. 2 - Coldwaves, 2011-2018

Affected Location (Zone)	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Western Rensselaer	4/27/2012	Frost/Freeze	0	0	$0	$0
Eastern Rensselaer	4/27/2012	Frost/Freeze	0	0	$0	$0
Eastern Rensselaer	4/28/2012	Frost/Freeze	0	0	$0	$0
Western Rensselaer	4/28/2012	Frost/Freeze	0	0	$0	$0
Eastern Rensselaer	4/29/2012	Frost/Freeze	0	0	$0	$0
Western Rensselaer	4/29/2012	Frost/Freeze	0	0	$0	$0
Eastern Rensselaer	1/24/2013	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/2/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/2/2014	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/7/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/7/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/21/2014	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/21/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/23/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/26/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/28/2014	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/7/2015	Extreme Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/7/2015	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/30/2015	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/30/2015	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/5/2015	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	2/13/2015	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/13/2015	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	2/15/2015	Extreme Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/15/2015	Extreme Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/19/2015	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	2/19/2015	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/23/2015	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	2/13/2016	Extreme Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	2/13/2016	Extreme Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	12/15/2016	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	12/27/2017	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	12/27/2017	Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	12/31/2017	Cold/Wind Chill	0	0	$0	$0

Table 3a. 2 - Coldwaves, 2011-2018						
Affected Location (Zone)	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Eastern Rensselaer	12/31/2017	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/1/2018	Extreme Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/1/2018	Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/5/2018	Extreme Cold/Wind Chill	0	0	$0	$0
Western Rensselaer	1/5/2018	Extreme Cold/Wind Chill	0	0	$0	$0
Eastern Rensselaer	1/13/2018	Cold/Wind Chill	0	0	$0	$0
Total:			0	0	$0	$0

Heat Wave Occurrences

New York State has received no Federal Disaster or Emergency Declarations due solely to heat waves. According to NOAA's NCEI Storm Events Database, 22 heat wave event days have occurred in Rensselaer County between 1996 and 2018 - or an average of about 1 heat wave event day per year. No event records included reports of deaths, injuries, property damage, or crop damage. Notable events include:

Date Unspecified

The Core Planning Group noted that Rensselaer County had a case of extreme temperature fluctuation in the 1980's which caused a train derailment outside of North Petersburgh when the steel of the rails responded to a temperature fluctuation of 50 degrees in one hour at the time of a passing train.

Dates Unspecified

The Core Planning Group noted that extreme heat events in the past have caused pavement buckling, mainly on the interstates but also on other roadways, causing damage to passing vehicles.

July 2018

In early July 2018, for a period of six days beginning June 29th, maximum temperatures of over 90 degrees Fahrenheit and heat indices over 100 degrees Fahrenheit were felt in many areas. The Capital Region was under a heat advisory from the morning of Saturday June 30th to the evening of Thursday July 5th. Then on Sunday July 1st and Monday July 2nd, an excessive heat warning was issued for the Capital Region.

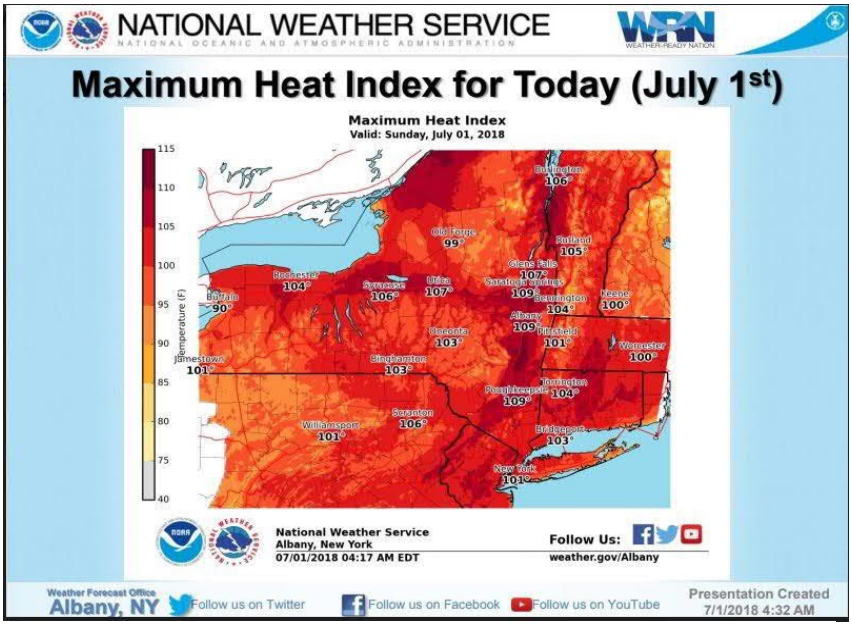


Photo 3a. 2 - NWS Maximum Heat Index for July 1, 2018

Fourteen heat wave days have occurred since the last version of the plan was finalized in 2011, as shown in Table 3a. 3.

Table 3a. 3 – Heat Waves, 2011-2018

Affected Location (Zone)	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Western Rensselaer	7/21/2011	Excessive Heat	0	0	$0	$0
Eastern Rensselaer	7/21/2011	Heat	0	0	$0	$0
Western Rensselaer	7/23/2011	Heat	0	0	$0	$0
Western Rensselaer	7/18/2013	Heat	0	0	$0	$0
Eastern Rensselaer	7/19/2013	Heat	0	0	$0	$0
Western Rensselaer	7/19/2013	Heat	0	0	$0	$0
Western Rensselaer	9/11/2013	Heat	0	0	$0	$0
Western Rensselaer	8/12/2016	Heat	0	0	$0	$0
Western Rensselaer	8/13/2016	Heat	0	0	$0	$0
Western Rensselaer	6/18/2018	Heat	0	0	$0	$0
Eastern Rensselaer	6/18/2018	Heat	0	0	$0	$0
Western Rensselaer	6/30/2018	Heat	0	0	$0	$0
Western Rensselaer	7/1/2018	Excessive Heat	0	0	$0	$0
Eastern Rensselaer	7/1/2018	Excessive Heat	0	0	$0	$0
Western Rensselaer	7/16/2018	Heat	0	0	$0	$0
Eastern Rensselaer	8/28/2018	Heat	0	0	$0	$0
Western Rensselaer	8/28/2018	Heat	0	0	$0	$0
Eastern Rensselaer	8/29/2018	Heat	0	0	$0	$0
Western Rensselaer	8/29/2018	Heat	0	0	$0	$0
Western Rensselaer	9/3/2018	Heat	0	0	$0	$0
Total:			0	0	$0	$0

Probability and Climate Change – Extreme Temperatures

Coldwave

Coldwaves have a history of frequent occurrence in Rensselaer County. Based on historical records in NOAA's NCEI Storm Events Database, since 1996, Rensselaer County has experienced an average of about 2.8 coldwave event days per year.

With regard to climate change impacts on probability of coldwaves, the 2019 SHMP concludes that:

- Current research suggests that there is a significant degree of uncertainty in terms of how climate change will impact the probability of coldwaves.
- Overall, widespread, extreme cold is still expected to be very possible amid a changing climate. However, coldwaves and overall winter temperatures may experience changes in both strength and seasonality because of a changing climate.
- Research suggests that cold air events in North America may not decrease linearly with a warming climate but may shift towards the latter half of winter or increase for periods of time.

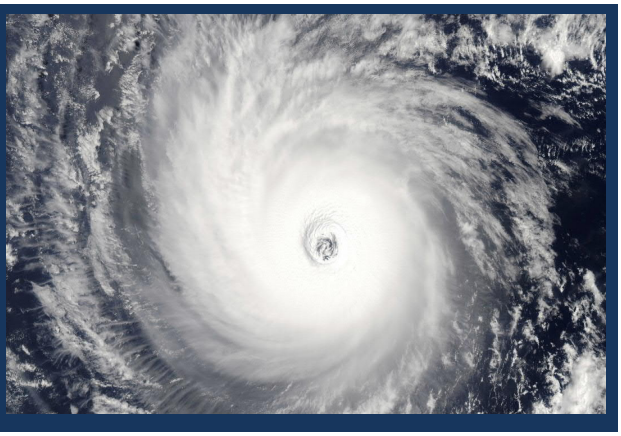
Heat Wave

Heat waves have a history of frequent occurrence in Rensselaer County, and the probability of future occurrences is certain. Based on historical records in NOAA's NCEI Storm Events Database, since 1996, Rensselaer County has experienced an average of about 1 heat wave event day per year.

With regard to climate change impacts on probability of heat waves, the 2019 SHMP concludes that:

- Climate change is expected to increase the frequency of extreme temperature events.
- Summer temperatures have been increasing across New York State and are expected to continue rising.
- New York is currently the 8th-fastest warming state in the country, in terms of annual average temperature.
- By 2050, New York is projected to see a five-fold increase in heat wave days.
- In the past decade average summer temperatures have risen by 1-2 degrees in most areas in the state.
- The number of days with maximum temperatures above 95ºF in New York State has been increasing, putting New Yorkers at higher risk of heat-related illness.

Hurricane/Tropical Storm



Countywide Statistics:

Total Losses Reported (1996-2018)	$1,900,000
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$86,364
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Hurricane/Tropical Storm

A **hurricane** is a severe tropical cyclone with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the system can extend outward from the eye by up to 400 miles. In the Northern Hemisphere, circulation is in a counterclockwise motion around the eye. These storms are usually short in duration but are extremely powerful and cause the greater amount of damage due to significant storm surges and high winds. If these systems have wind speeds of between 39 and 73 miles per hour, they are classified as a **tropical storm**. In the Atlantic basin, hurricanes and tropical storms are most likely to occur between June 1st and November 30th, with the peak number of events typically occurring between mid-August and late October.

Hurricanes and tropical storms are particular types of events. The hazards associated with a hurricane or tropical storm event are: high winds, flooding (including storm surge), coastal erosion, and wave action. Each of the unique hazards associated with hurricane and tropical storm events are specifically discussed elsewhere in the plan, as applicable to Rensselaer County.

Location – Hurricane/Tropical Storm

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States, and while coastal areas are most directly exposed to the brunt of landfalling storms their impact is often felt hundreds of miles inland. No one jurisdiction within Rensselaer County is any more likely to have the path of such a system traverse within its borders than any other location, although due to the distance of Rensselaer County from the coastline, most hurricanes that reach the New York State area are likely to become downgraded to tropical storms, tropical depressions, or extratropical systems as they move any distance inland. Because of the size of hurricane and tropical storm systems, areas within Rensselaer County can still be affected even when the eye makes landfall outside of Rensselaer County. The hazards associated with hurricane and tropical storm events have distinct hazard area locations, discussed in other sections of this report. For Rensselaer County, these include wind and flood hazards.

Extent – Hurricane/Tropical Storm

The magnitude or severity of hurricanes is categorized by the Saffir-Simpson scale. The Saffir-Simpson Scale is a five-category wind speed / storm surge classification scale used to classify Atlantic hurricane intensities. The scale is used to give an estimate of the potential property damage and flooding that can be expected. The Saffir-Simpson values range from Category 1 to Category 5, as shown in **Table 3a. 4**. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region.

Table 3a. 4 - The Saffir-Simpson Hurricane Scale
* Source: FEMA's How-To #2, page 2-23

Category	Wind Speed (miles per hour)	Storm Surge (feet above normal sea level)	Expected Damage	Photo Example
1	74-96 mph	4-5 feet	Minimal: Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, no real damage is done to structures	
2	96-110 mph	6-8 feet	Moderate: Some trees are toppled, some roof coverings are damaged, and major damage is done to mobile homes.	
3	111-130 mph	9-12 feet	Extensive: Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.	
4	131-155 mph	13-18 feet	Extreme: Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.	
5	Greater than 155 mph	Greater than 18 feet	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.	

For tropical storms (which not represented on the Saffir-Simpson Hurricane scale), winds are between 39 and 73 miles per hour and typical effects include breakage of twigs and branches off tress, toppling of shallow-rooted trees, and some damage to signboards and windows.

The magnitude or severity of hurricane and tropical storm events will increase under the following conditions:

- as the storm category increases;
- as the diameter of the storm system increases;
- as the system's forward speed decreases;
- as rainfall amounts increase;
- as the quantity of people, structures and infrastructure in the affected areas increases.

For the sake of clarity, it should also be noted that, for communities with mapped erosion, surge, or wave action zones, the magnitude or severity will also increase with increasing degree of coastal erosion, surge and/or wave action. However, there are no mapped coastal erosion hazard areas or significant wave action hazard areas in Rensselaer County. The Hudson River is tidal up to the Federal dam at Troy. The 2019 SHMP does include a NOAA National Hurricane Center's Sea, Lake, and Overland Surges from Hurricane (SLOSH) map which shows shoreline inundation as a result of a worst-case scenario Category 5 Hurricane (a hurricane is moving in a northwest direction with landfall just to the south of New York City along the coast of New Jersey, putting New York City in the right-front quadrant of the storm similar to the track of Superstorm Sandy) on the Hudson River only as far north as portions of Columbia and Greene Counties (south of Rensselaer County).

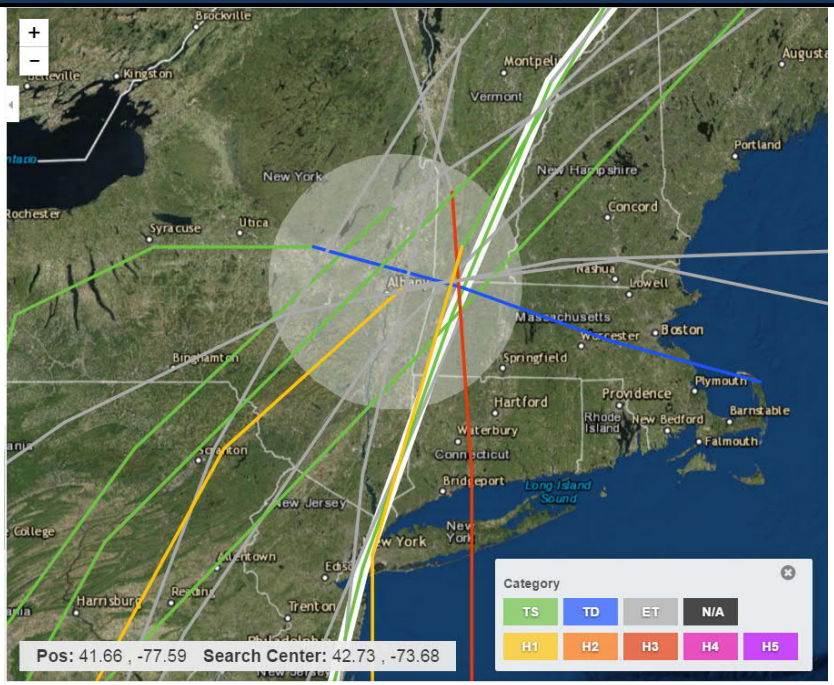
Previous Occurrences – Hurricane/Tropical Storm

Hurricanes and tropical storms have impacted Rensselaer County and its participating jurisdictions in the past and will continue to do so in the future. The County has an active history of hurricane and tropical storm events. Storms have been characterized by flooding and/or wind impacts, with occasional landslides due to excessive rainfall. According to NOAA's improved Historical Hurricane Tracks Tool v4.0, the tracks of three hurricanes (one Category 3 hurricane and two Category 1 hurricanes), eight tropical storms and five extratropical systems have passed within 65 miles of the Rensselaer County seat at Troy since 1863. The most proximate events to Rensselaer County during the last 100 years were an unnamed tropical storm which passed a few miles northwest of the county's northwestern corner in 1949, and the famously destructive New England Hurricane of 1938, which was still considered a Category 3 hurricane when it passed approximately 10 to 12 miles to the east of Rensselaer County. In addition, the extratropical remains of Hurricane Gracie passed directly over central Rensselaer County in 1959. **Figure 3a. 3** shows the track of each recorded historical storm in relation to the Rensselaer County search area. As can be seen in the figure, almost all hurricane and tropical storm tracks traverse in a northeasterly direction through the area.

Table 3a. 5 provides the date of occurrence, storm name (if applicable), maximum wind speed and category of the storm based on the Saffir-Simpson Scale (as recorded within 65 miles of the

Rensselaer County seat in the City of Troy). *Note: Hurricane Floyd and Superstorm Sandy do not appear in Figure 3a. 3 or Table 3a. 5 because their respective storm tracks passed further than 65 miles from Rensselaer County.

Figure 3a. 3 – Hurricane/Tropical Storm Tracks within 65 Miles of Rensselaer County, 1863-2018*



** NOAA 2018 (http://coast.noaa.gov/hurricanes/). Note that Irene's track is highlighted in white.*

Table 3a. 5- Hurricane/Tropical Storm Tracks within 65 Miles of Rensselaer County, 1863-2018

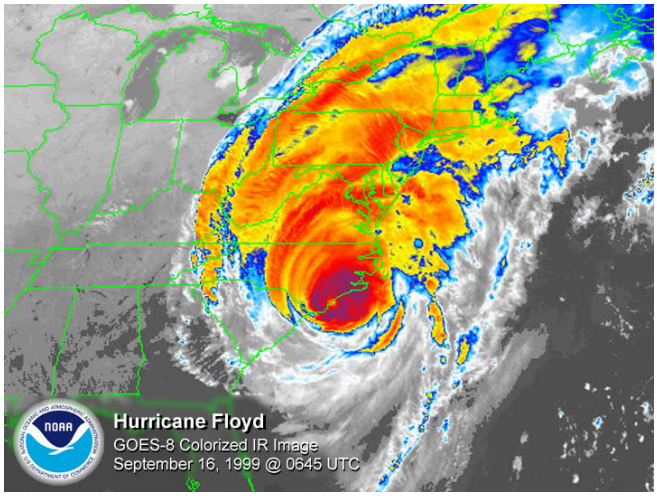
Date of Occurrence	Storm Name	Storm Category
Sep 16, 1863 to Sep 19, 1863	Unnamed 1863	Tropical Storm
Oct 29, 1866 to Oct 30, 1866	Unnamed 1866	Extratropical Storm
Sep 12, 1876 to Sep 19, 1876	Unnamed 1876	Tropical Storm
Oct 18, 1878 to Oct 25, 1878	Unnamed 1878	Category 1 Hurricane
Aug 15, 1893 to Sep 02, 1893	Unnamed 1893	Tropical Storm
Aug 15, 1893 to Aug 26, 1893	Unnamed 1893	Category 1 Hurricane
Oct 26, 1899 to Nov 04, 1899	Unnamed 1899	Extratropical Storm
Sep 27, 1924 to Oct 01, 1924	Unnamed 1924	Extratropical Storm
Sep 19, 1929 to Oct 05, 1929	Unnamed 1929	Extratropical Storm
Sep 09, 1938 to Sep 23, 1938	Unnamed 1938	Category 3 Hurricane
Aug 23, 1949 to Sep 01, 1949	Unnamed 1949	Tropical Storm
Aug 18, 1952 to Sep 03, 1952	Able 1952	Tropical Storm
Sep 20, 1959 to Oct 02, 1959	Gracie 1959	Extratropical Storm
Aug 20, 1971 to Aug 29, 1971	Doria 1971	Tropical Storm
Aug 25, 1979 to Sep 08, 1979	David 1979	Tropical Storm
Aug 21, 2011 to Aug 30, 2011	Irene 2011	Tropical Storm

Rensselaer County has also been significantly impacted by hurricanes and tropical storms whose tracks passed at great distances from the County borders. For example, the County received a FEMA Emergency Declaration after Hurricane Katrina in 2005 resulting from the influx of evacuees from states impacted by the storm, as opposed to direct storm impacts or

damages from the hurricane itself in Rensselaer County. Similarly, Rensselaer County received an Emergency Declaration from FEMA after Hurricane Sandy in 2012, largely due to the tremendous need for support from responders outside of impacted areas to travel to hard-hit areas further south in the path of the storm and assist their colleagues during immediate post-disaster response.

Notable recent events impacting Rensselaer County include:

September 16-17, 1999 - Floyd



The remnants of Hurricane Floyd moved up the eastern seaboard on September 16 and during the early hours on September 17. The storm brought both high winds and exceptionally heavy rainfall to eastern New York, which included a large swath of 3 to 6 inch amounts. Locally higher amounts of rainfall, exceeding a foot, fell in some areas. Specific rainfall amounts included 6.12 inches at Albany International Airport, the highest ever officially recorded from any given storm. Even higher amounts of rainfall included 8.15 inches in Delmar and 9 inches at Knox, both located in Albany County. 12.21 inches of rainfall was recorded in Cairo, Greene County, the most associated with the storm. The rain produced widespread flooding across the region, which proved very destructive and in one case, deadly. The rains, combined with left-over rain from Tropical Storm Dennis, a week earlier, alleviated the fourteen-month drought across most of the region. Winds from the passage of Floyd gusted to 49 mph at Albany International Airport during the evening of September 16. Higher gusts estimated over 60 mph were common across the hill towns. The combination of the wind and very saturated ground produced widespread downing of trees and power lines across much of eastern New York. The rain and wind produced massive power outages across the region. As many as 80,000 people lost power in the Mid-Hudson Valley region; 54,000 in the Greater Capital District; and another 25,000 in the Lake George Saratoga region. Some individuals had to wait over a week for power to be restored. The storm resulted in lost wages, closed schools throughout the region, and cancelled flights at Albany International Airport. Floyd resulted in the counties of Albany, Dutchess, Greene and Rensselaer being declared "major disaster areas" by Governor Pataki.

August 28, 2011 - Irene

The remnants of Hurricane Irene brought heavy to extreme rainfall to the region, which resulted in catastrophic and flash flooding in some areas. In Rensselaer County, numerous road closures were also reported, with one bridge damaged, and 60

evacuations reported. In addition, major flooding occurred on the Hoosic River at Eagle Bridge and on the Hudson River at Troy. Numerous trees and power lines were reported down due to strong winds across Rensselaer County resulting in power outages and road closures including but not limited to the following: in Castleton-On-Hudson, Route 150 at Route 9J. In East Greenbush, a National Weather Service Cooperative Observer reported a measured wind gust of 41 mph. In the Town of Hoosick, a National Weather Service Cooperative Observer reported a measured wind gust of 39 mph in Buskirk. In the Town of Sand Lake, portions of Route 43 in West Sand Lake were reported closed due to flooding, including between Geiser Road and Mammouth Spring Road, and between Route 150 and Route 351. In the Village of Castleton-on-Hudson, Route 9J was closed due to flooding between Knickerbocker Road and Brickyard Road. In the Town of Grafton, Route 2 was closed across Rensselaer County due to numerous reports of flooding and some wash outs. The Poesten Kill and Quacken Kill run along and cross Route 2. In Troy, A mudslide occurred on Route 2 (Brunswick Road) at Route 66 (Pawling Avenue) causing a house to collapse, two other houses were knocked from their foundations by about 8 feet and a large tree fell and destroyed an automobile shop. A home was destroyed in Poestenkill on Franklin Street by flood waters from the Poesten Kill. Route 7 across Rensselaer County was closed due to numerous reports of flooding. Major flooding occurred on the Hoosic River. The Eagle Bridge river gage located on the right bank 0.5 miles upstream from Case Brook, 1.2 miles downstream from Walloomsac River, and 1.2 miles southeast of Eagle Bridge exceeded its 11 foot flood stage at 1:31 pm EST August 28th, its 13 foot moderate flood stage at 3:43 pm, its 16 foot major flood stage at 6:31 pm, it crested at 19.24 feet at 12:30 am August 29th, and dropped below flood stage at 2:29 pm August 29th. Route 103 in Buskirk was reported flooded approximately one mile south of Route 67. Route 136, Whiteview Road, in Wynantskill was closed at Brookside Avenue due to flooding. Route 22 in Petersburgh was closed due to flooding and a washout between Smith Road and Church Hollow Road. Portions of Route 20 were reported closed due to flooding, including at Route 9 in the Town of Schodack, and between Lords Hill Road and Coldwater Tavern Road in Nassau. Wynantskill Creek was reported flowing out of its banks with water on Thais Road at the intersection of Springer Road. Water from the Poesten Kill destroyed a home on Franklin Street in Poestenkill. Route 66 in Wynantskill was reported closed due to flooding. The Troy river gage located about 1 mile north of Route 7 exceeded its 21.5 foot flood stage 5:21 pm EST August 28th, its 24 foot moderate flood stage at 2:06 am August 29th, its 27 foot major flood stage at 2:30 pm, it crested at 27.05 feet at 3:15 pm, and dropped below its flood stage 12:37 pm August 30th.The Albany river gage located on right bank 0.1 miles upstream from bridge on U.S. Highways 9 and 20 in Albany exceeded its 11 foot flood stage at 11:12 pm EST August 28th, its 13 foot moderate flood stage at 6:50 am August 29th, its 15 foot major flood stage 3:26 pm, it crested at 15.40 feet at 6:15 pm August 29th, and dropped below flood stage at 6:44 am August 30th. The Rensselaer County Emergency Management Office requested voluntary evacuations for parts of the City of Troy due to flooding from the Hudson River for the neighborhoods between Ferry Street (Route 2) and the Menands Bridge (Route 378) from the Hudson River east to Fourth Street (Route 4) in South Troy and the area between 112th Street and 126th Street from the Hudson River to 5th Avenue in Lansingburgh (North Troy). Numerous homes and businesses were flooded in downtown Troy including Dinosaur Bar-B-Que.

The Dunn Memorial Bridge eastbound ramp to Routes 9 and 20 was closed due to flooding from 10:45 am August 29th to midday on August 30th.

October 29-30, 2012 – Sandy

Rainfall in Rensselaer County was not excessively heavy and did not cause any flooding, thanks to dry antecedent conditions. Wind gusts of 40 to 60 mph were common from the afternoon of the 29th until the early morning hours of the 30th. Wind gusts of 50 mph were recorded at the National Weather Service Forecast Office in nearby Albany. Trees and wires were reported down due to high winds in Berlin. In addition, the powerful storm caused a storm surge of water that moved up the Hudson River from the New York City area. In Rensselaer County, flooding occurred along the Hudson River causing damage to homes and businesses located near the river. Brickyard Road in Castleton-on-Hudson was reported to be under water due to tidal flooding along the Hudson River.

NOAA's NCEI Storm Events Database only lists one hurricane/tropical storm event day in Rensselaer County between 1996 and 2018 (Hurricane Irene in 2011). No event records included reports of deaths, injuries, property damage, or crop damage. This single event occurred just after the last version of the plan was finalized in 2011 (see Table 3a. 6).

Table 3a. 6 – Hurricane/Tropical Storm Events, 1996-2018

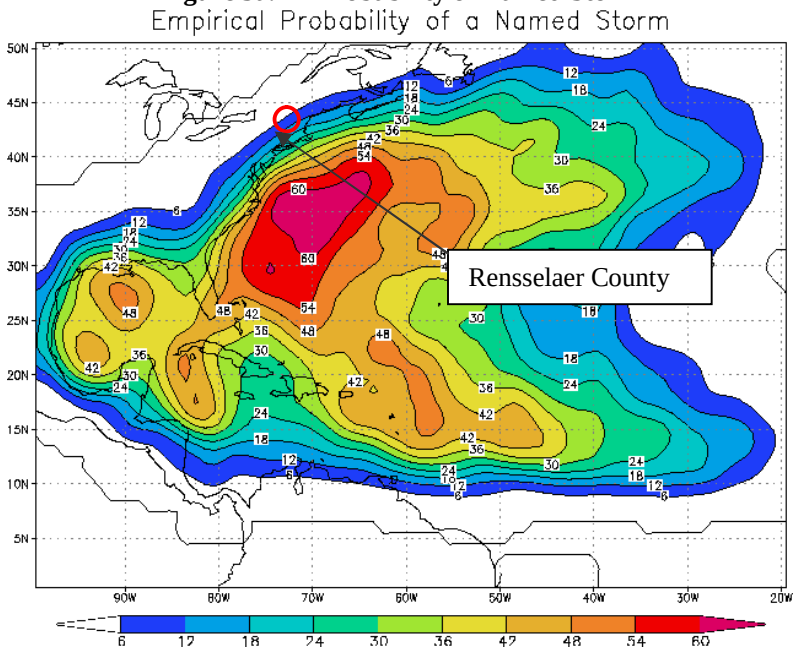
Affected Location	Date(s)	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage*	Reported Crop Damage
Rensselaer County	09/16/1999	Remnants of Hurricane Floyd)	0	0	$1,900,000	$0
Rensselaer County	08/28/2011	Tropical Storm Irene	0	0	$0	$0
Rensselaer County	10/29/12-10/30/12	Remnants of Superstorm Sandy	0	0	$0	$0
Total			0	0	$1,900,000	$0

* Note: Extensive damages discussed qualitatively in NOAA's event records as a result of Irene are not reported quantitatively by NOAA in their Storm Events Database under Reported Property Damage. Also: Floyd and Sandy were included in the NCEI database for their wind, flood, and surge damages.

Probability and Climate Change – Hurricane/Tropical Storm

The probability of future hurricane and tropical storm events for Rensselaer County is high. According to NOAA statistical data, Rensselaer County is located in an area with an annual probability of a named storm between 6 and 12 percent (Figure 3a. 4). This empirical probability is fairly consistent with other scientific studies and observed historical data made available through various federal, state and local sources. Occurrences are most likely during the official Atlantic hurricane season (the months of June through November). The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is six. The probability of storm occurrences will vary significantly based on the return interval for different categories of magnitude. The probability of less intense storms (lower return periods) is higher than more intense storms (higher return periods).

Figure 3a. 4 - Probability of Named Storm



The 2019 SHMP states that global warming will cause sea level rise and the intensifying of storms. The frequency and intensity of coastal storms and severe weather events is expected to increase in the future due to climate change. In the years to come, it is anticipated that Rensselaer County will observe fairly drastic changes in storm character, intensity, frequency, and storm tracking. Hurricanes are likely to become more intense with rising sea water temperatures. Storm effects are expected to be more extensive in the future. The following types of impacts could be anticipated in Rensselaer County's future as a result of climate change: inundation of low-lying areas; increased frequency and extent of storm-related flooding; impacts to human populations (property losses, more frequent flood damage, more frequent flooding of roadways and urban centers, risks to people as the population of flood-prone areas increases); more buildings and infrastructure exposed; currently exposed buildings and infrastructure could be subject to potentially greater losses as water levels increase; impacts on gravity flow stormwater systems; impacts on non-coastal areas. Impacts of climate change can affect all parts of a community, including: transportation infrastructure (ports, marinas, airports, roads, bridges, railways); public infrastructure (stormwater and wastewater management systems, drinking water supply and distribution systems, power utility systems, communications systems); public facilities (i.e., police, fire, ambulance, hospitals, schools, daycare centers, adult living facilities, historic landmarks, government buildings, libraries, parks, etc.); economic viability of a community – particularly for communities where tourism tends to drive local economies, as is the case in some of Rensselaer County's communities. Climate change also could lead to a potential loss of assets that support tourism.

Lightning

Countywide Statistics:

Total Losses Reported (1996-2018)	$236,000
Total Number of Episodes (1996-2018)	10
Annualized Losses Reported (1996-2018)	$10,727
Annualized Number of Episodes (1996-2018)	0.5
Daily Probability	0.12%
Total Injuries (1996-2018)	11
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Lightning

Lightning is brief electrical discharge between a cloud and the ground or from cloud to cloud. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. 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. The 2019 SHMP states that, on average, 55 fatalities and hundreds of injuries occur each year as a result of lightning strikes in the United States.

Location - Lightning

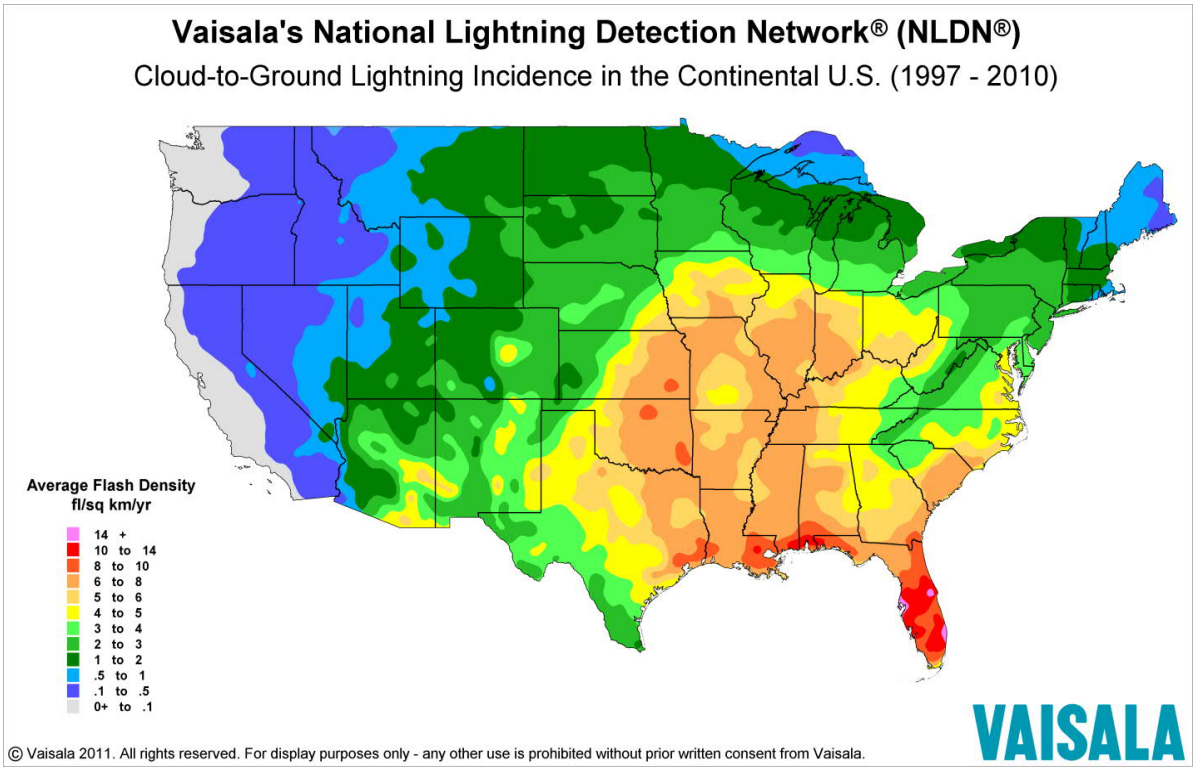
Rensselaer County is located in a region of the country that is susceptible to lightning strikes, though not as susceptible as southeastern states. Figure 3a. 5 shows Cloud-to-Ground Lightning Incidence in the Continental United States for the years 1997 to 2010 based upon data provided by Vaisala's National Lightning Detection Network® (NLDN®)[1]. This shows that two

[1] Source: http://www.vaisala.com/Vaisala%20Documents/Scientific%20papers/2014%20ILDC%20ILMC/ILMC-Thursday/Roeder%20et%20al-Mapping%20Lightning%20Fatality%20Risk-2014-ILDC-ILMC.pdf

to three cloud-to-ground lightning incidences are generally observed per square kilometer[2] per year in Rensselaer County.

All areas of Rensselaer County are equally susceptible to lightning strike. While lightning occurs randomly anywhere and anytime, the most common location for lightning fatalities and injuries to people is in open areas such as parks, beaches, golf courses and other recreational areas. Rensselaer County remains susceptible to lightning deaths and injuries due to the large number of people who engage in outdoor activities.

Figure 3a. 5 – Cloud to Ground Lightning Incidence the Continental US



Extent – Lightning

The 2019 SHMP presents NOAA's Lightning Activity Level (LAL) as a parameter measuring the magnitude or severity of the lightning hazard at any given time. The LAL is an assigned numeric value ranging from 1 to 6 indicating the relative amount of lightning activity based on cloud and storm development and number of lightning strikes per 15 minute interval (see **Figure 3a. 6**).

[2] One square kilometer equals about 0.386 square miles or just over 247 acres.

Figure 3a. 6- NOAA Lightning Activity Levels

LAL	Cloud & Storm Development	Lightning Strikes/15 min
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

*Source: www.prh.noaa.gov

Previous Occurrences – Lightning

NOAA's NCEI Storm Events Database records 10 lightning events in Rensselaer County between 1996 and 2018, causing $236,000 in property damages and 11 injuries. Only one of these event dates occurred after the last version of the plan was prepared in 2011. Details of damages given for these events are as follows (Table 3a. 7):

Table 3a. 7 - Lightning Events, 1996-2018

Affected Area	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Pittstown	8/16/1996	Lightning	0	0	$25,000	$0
Rensselaer	7/6/1999	Lightning	0	0	$10,000	$0
Hoosick	5/13/2000	Lightning	0	0	$70,000	$0
Schaghticoke	7/4/2001	Lightning	0	1	$25,000	$0
Brunswick	6/5/2002	Lightning	0	0	$50,000	$0
Castleton-on-Hudson	8/2/2002	Lightning	0	1	$0	$0
Brunswick	7/1/2004	Lightning	0	2	$1,000	$0
Wynantskill	7/8/2004	Lightning	0	7	$0	$0
Schaghticoke	8/18/2009	Lightning	0	0	$5,000	$0
Troy	5/30/2016	Lightning	0	0	$50,000	$0
Total:			0	11	$236,000	$0

Notable occurrence details are provided below:

August 16, 1996

Lightning burned a single-story barn to the ground in Pittstown. Tools and recreational vehicles were lost in the fire. Damages were estimated at $25,000.

July 6, 1999

Lightning struck several buildings in the City of Rensselaer, causing damage estimated at $10,000 in total.

July 6, 1999
Lightning struck a home in Hoosick, which resulted in much of the house being gutted by fire. Damages were estimated at $70,000.

July 4, 2001
Lightning struck a house in Schaghticoke producing minor damage (estimated at $25,000) and at least one injury.

June 5, 2002
Lightning struck a barn in Brunswick, causing significant damage (estimated at $50,000) to that structure.

July 1, 2004
Lightning struck a place of business in Brunswick. Two minor injuries occurred; one due to smoke inhalation, and another due to a firefighter falling off a ladder. Damages were estimated at $1,000.

July 8, 2004
Seven people sent to hospital with injuries when lightning struck a softball field in Wynantskill in the Town of North Greenbush.

July 8, 2004
A house was struck by lightning in the town of Schaghticoke. Damages were estimated at $5,000.

July 2010
A direct strike to the Rensselaer County Bureau of Public Safety building damaged in July 2010 damaged equipment and required temporary operations out of the BPS trailer for several days.

Date Unspecified
Core Planning Group members also reported at the time of the initial plan's development that the Town Hall telephone system in the Town of Grafton had recently been destroyed by a lightning strike.

May 30, 2016
Lightning struck a home on Lindsey Drive in Brunswick. The lightning struck the chimney and traveled down through the walls to the basement, where it started a fire. The home was reported to have significant damage (approximately $50,000 in damage was reported in the NCEI database).

Probability and Climate Change - Lightning

Lightning occurs regularly in New York State. The probability of occurrence for future lightning events in the planning are is certain. According to NOAA, Rensselaer County is located in an area of the country that experiences an average of one to two lightning flashes per square kilometer (three to five lightning flashes per square mile per year - in the order of 2,000 to 3,300 strikes per year over the 22 jurisdictions in the planning area). Over the last 22 years, damaging events have been recorded about once every two years. Given this frequency of occurrence, it can be expected that future lightning events will continue to threaten life and cause damage to property and communications equipment throughout the County.

Climate change is expected to increase the frequency and intensity of thunderstorms, which can present an associated increase in the probability of lightning occurring.

Tornado

Countywide Statistics:

Total Losses Reported (1996-2018)	$10,425,000
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$473,864
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

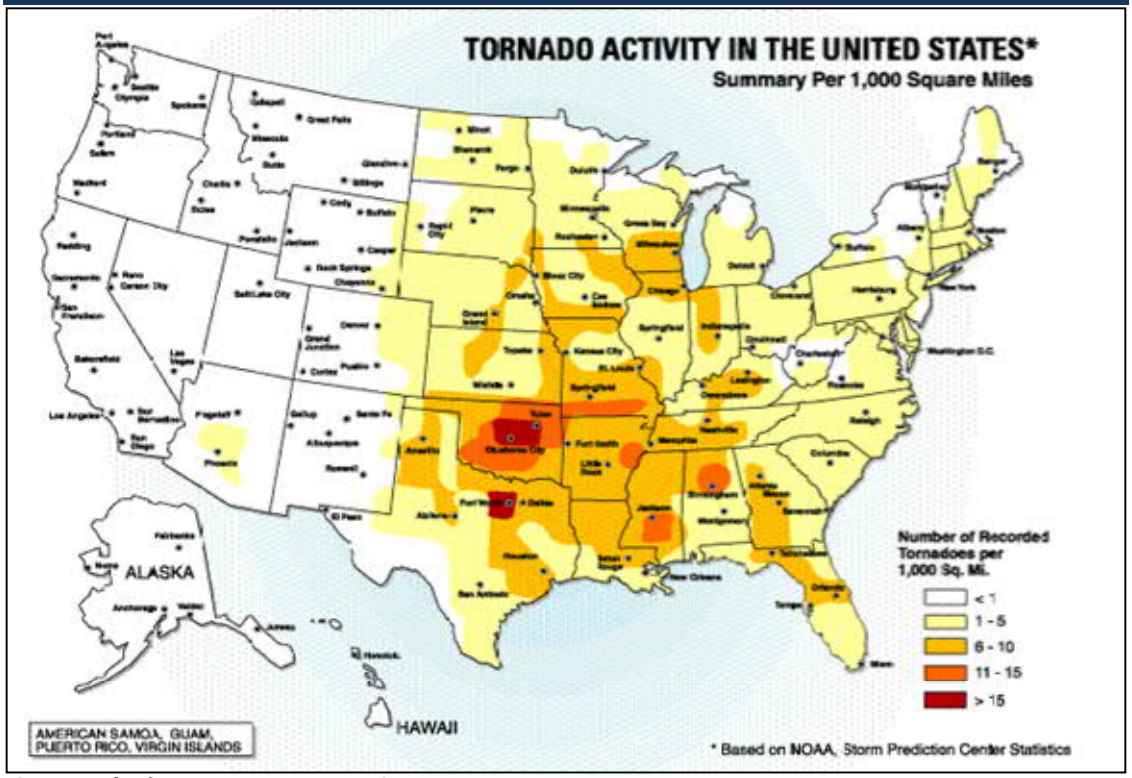
Description – Tornado

The 2019 NYSHMP defines tornados as violently rotating columns of air extending from the base of a thunderstorm cloud to the ground. Tornado wind speeds can range from as low as 40 mph to as high as 318 mph. Tornadoes often accompany thunderstorms and hurricanes. They can occur at any time of the year but are more prevalent during the spring and summer months.

Location – Tornado

Rensselaer County is located in an area that is susceptible to tornados, though their occurrence is not nearly as frequent or intense as it is in other regions of the country. Of the roughly four tornadoes that touch down in New York State each year, approximately 80 percent tend to be of low magnitude (from EF0 to EF2) and typically impact only relatively small areas. Figure 3a. 7 shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles. Tornadoes are completely random, and it is not possible to predict specific tornado hazard areas. Tornadoes can occur anywhere, and no one location is more susceptible than another. All of Rensselaer County is uniformly exposed.

Figure 3a. 7 - Tornado Activity in the United States



Source: Federal Emergency Management Agency

Extent – Tornado

The magnitude or severity of a tornado is dependent upon wind speed and is categorized by the Enhanced Fujita Scale, presented in Table 3a.6. Tornadoes are typically considered to be "significant" for EF2 or EF3 on the Fujita Scale and "violent" for EF4 and EF5. **Table 3a.7** shows the Enhanced Fujita Scale for Tornadoes which was developed to measure tornado strength and associated damages. The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Table 3a. 8 - Enhanced Fujita Scale for Tornadoes				
Storm Category	**Damage Level**	**3 Second Gust (mph)**	**Description of Damages**	**Photo Example**
EF0	Light	65–85	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.	
EF1	Moderate	86–110	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.	
EF2	Significant	111–135	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; high-rise windows broken and blown in; light-object missiles generated.	
EF3	Severe	136–165	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.	
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.	
EF5	Incredible	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; steel reinforced concrete structures badly damaged.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Previous Occurrences – Tornado

NOAA's NCEI Storm Events Database records three tornados in Rensselaer County between 1996 and 2018, causing $10,225,000 in property damages. Details of damages given for these events are as follows (Table 3a. 9). No events have occurred since the last version of this plan was finalized in 2011.

Table 3a. 9 - Tornado Events, 1996-2018						
Affected Location	**Date**	**Event Type**	**Reported Deaths**	**Reported Injuries**	**Reported Property Damage**	**Reported Crop Damage**
Town of Schaghticoke, Village of Schaghticoke, Village of Valley Falls, Town of Pittstown	5/31/1998	F2 Tornado	0	0	$10,000,000	$200,000
Town of Schodack	5/31/1998	F2 Tornado	0	0	$175,000	$0
Nassau	7/21/2003	F1 Tornado	0	0	$50,000	$0
Total:			0	0	$10,225,000	$200,000

Notable occurrence details are provided below:

May 31, 1998

During the morning hours of May 31, several lines of severe thunderstorms formed ahead of an approaching cold front. This resulted in two tornados that caused damage in Rensselaer County.

Photo 3a. 3 - Tornado Damage at Wiley Brothers Lumber and Hardware Store, Route 40, Schaghticoke, 1998

The first tornado touched down west of Mechanicville in Saratoga County and intensified to F3 before crossing the Hudson River into the Town of Schaghticoke in Rensselaer County and decreasing to an F2. The tornado tracked across the Town of Schaghticoke and just brushed the Village of Schaghticoke to the north. Czub Grain Farm on Verbeck Avenue was heavily damaged. It then followed the Hoosic River as it crossed the Village of Valley Falls. Soon thereafter, the track became discontinuous and the intensity decreased to an F1. In the Town of Hoosick, the path became continuous again and increased to an F2. Several farms suffered extensive damage including Lukeland Dairy Farm where a 60-ton silo and barn were leveled. The tornado then tracked from extreme northeast Rensselaer County to Bennington County in southern Vermont where it quickly decreased to an F1 after crossing the border.

A second tornado generated by the weather system mentioned above tracked across southern Rensselaer County. This tornado first touched down on Palmer Road about two miles east of Interstate 90 in the Town of Schodack. The tornado moved due east and passed just south of North Schodack then tracked east northeast to Millers Corners on the south shore of Burden Lake. The damage path continued in this direction to Pike Pond before it dissipated at Alps Mountain. This tornado destroyed three barns, damaged several homes and produced extensive tree damage along its path.

Overall, approximately 50 to 60 homes and businesses were damaged or destroyed, and substantial damages to treed/forested areas were incurred. Power was not restored to parts of this region for three to four days. Approximately 70 injuries occurred with this tornado, but no one was killed. This event resulted in the declaration of disaster DR-1222, under which Rensselaer and neighboring counties were eligible for funding under the FEMA Public Assistance Grant Program.

July 21, 2003

A combination an unstable air mass and strong wind shear aloft the largest tornado outbreak since May 31, 1998. This storm spawned a long-lived significant tornado which initially touched down in southeastern Greene County, and produced a discontinuous path of 17 miles in Greene County, 12.2 miles in northwestern Columbia County and 4.8

miles in southern Rensselaer County. The tornado left a swathe of destruction including hundreds, if not thousands of trees uprooted and snapped away, along with lots of power and telephone wires. Many roads in each of these counties were impassable due to debris. In Rensselaer County, the tornado touched down as an F1 near the Village of Nassau near Route 20. The average width of the twister was between 75 and 100 yards and a discontinuous path length of more than four miles. Homes and a garage were severely damaged, but no injuries were reported. The roof on the Agway was blown off and a gazebo landed across the state highway in a pile of splintered wood. The NWS Survey team noted that the twister had multiple vortices in this area and additional straight line damage was also noted in the same town. The last touchdowns were in the Town of Schaghticoke with an F1 rating.

Date Unknown

Core Planning Group members also recalled (at the time of this plan's initial preparation in 2011) a tornado of unknown magnitude at an unknown date which affected the Park Avenue/McClellan Drive area of the Village of Nassau.

Probability and Climate Change - Tornado

It is likely that Rensselaer County will continue to experience weak to moderate tornadoes, though their frequency of occurrence will be fairly low. Historical storm data made available through NOAA's NCEI indicate that Rensselaer County is in an area that tends to experience less than one tornado event per year (three events in 22 years, resulting in an estimated annual number of 0.1 events per year). In New York, tornadoes are more likely to occur during the months of March through August and tend to form in the late afternoon and early evening.

With regard to climate change impacts on probability of tornadoes, the 2019 SHMP concludes that:

- Current research is undecided about the potential influence of climate change on the frequency and/or severity of tornadoes within New York State.
- This is because the current record of tornadoes in the United States has notable discontinuities and because tornadoes occur at highly localized spatial scales, making modelling the effects of climate change problematic.
- While some research has suggested that climate change may result in more strong tornado days (defined as days with EF3 or greater intensity tornadoes) for New York State by the 2090s, additional studies are required.

Wind

Countywide Statistics:

Total Losses Reported (1996-2018)	$2,640,500
Total Number of Events (1996-2018)	176
Annualized Losses Reported (1996-2018)	$120,023
Annualized Number of Episodes (1996-2018)	8.0
Daily Probability	2.19%
Total Injuries (1996-2018)	23
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

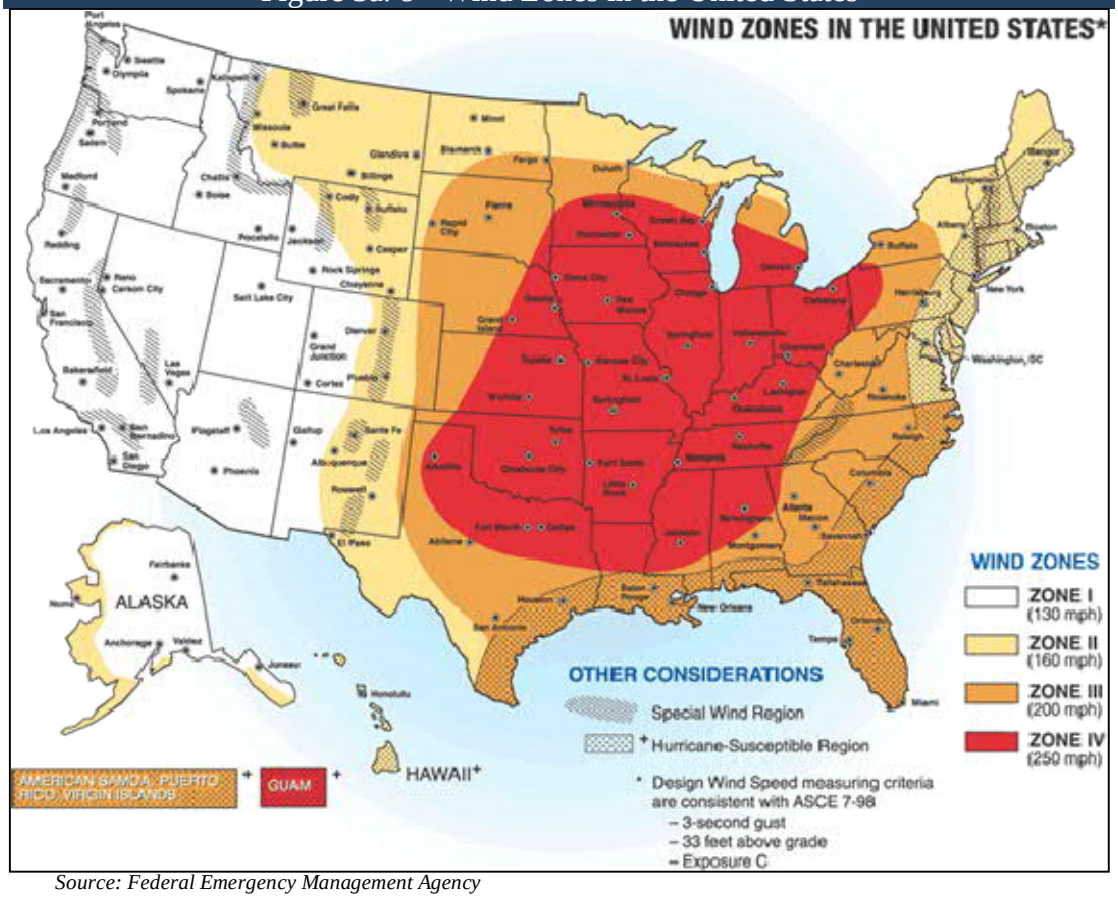
Description – Wind

Wind, as defined by the American Meteorological Society, is air that is in constant motion relative to the surface of the earth. Extreme winds are most commonly the result of tornadoes, hurricanes, tropical cyclones, extratropical cyclones (northeasters), destructive wind, and thunderstorms, but can also occur in their absence as mere "windstorms". High winds (straight line winds) are not associated with rotation, like tornado winds. Damaging winds are often called "straight-line" winds to differentiate the damage they cause from tornado damage. The 2019 SHMP indicates that when straight-line winds meet or exceed 58 miles per hour they are classified as severe by the National Weather Service. Extreme wind events might occur over large, widespread areas or in a very limited, localized area. They can occur suddenly without warning. They can occur at any time of the day or night, at any location within Rensselaer County. Extreme winds pose a significant threat to lives, property, and vital utilities due to flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type that can be picked up by the wind and hurled with great force. Extreme winds also down trees and power lines, often resulting in power outages across an affected area.

Location – Wind

Extreme wind events are experienced in every region of the United States. A useful tool for determining the location of the extreme wind hazard area in a jurisdiction is depicted in Figure 3a. 8. This map of design wind speeds was developed by the American Society of Civil Engineers. It divides the United States into four wind zones, geographically representing frequency and magnitude of potential extreme wind events. The figure shows that Rensselaer County and its jurisdictions are within Zone II, with a design wind speed for shelters of 160 miles per hour, and that the region in which the County is located is also considered to be susceptible to hurricanes, which are the subject of a detailed profile later in this section.

Figure 3a. 8 - Wind Zones in the United States



Source: Federal Emergency Management Agency

Extent –Wind

Extreme wind can occur alone, such as during straight-line wind events and derechos, or it can accompany other natural hazards, including hurricanes and severe thunderstorms. Severe wind poses a threat to lives, property, and vital utilities primarily due to the effects of flying debris or downed trees and power lines. Severe wind will typically cause the greatest damage to structures of light construction, particularly manufactured homes. The 2019 SHMP presents the Beaufort Scale as one measure of the magnitude or severity of the wind hazard (Table 3a. 10).

Table 3a. 10 – Beaufort Scale			
Beaufort Number	Wind Speed (miles per hour)	Description	Wind Effects on Land
0	<1	Calm	Calm, smoke rises vertically.
1	1-3	Light Air	Wind motion visible in smoke.
2	4-7	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate Breeze	Dust and loose paper are raised. Small branches begin to move.
5	19-24	Fresh Breeze	Small trees begin to sway.
6	25-31	Strong Breeze	Large branches are in motion. Whistling is heard in overhead wires. Umbrella use is difficult.
7	32-38	Near Gale	Whole trees in motion. Some difficulty experienced walking into the wind.
8	39-46	Gale	Twigs and small branches break from trees. Cars veer on road.
9	47-54	Strong Gale	Larger branches break from trees. Light structural damage.
10	55-63	Storm	Trees broken and uprooted. Considerable structural damage.
11	64-72	Violent Storm	Widespread damage to structures and vegetation.
12	>73	Hurricane	Considerable and widespread damage to structures and vegetation. Violence.

Previous Occurrences – Wind

Rensselaer County has experienced numerous types of damaging wind events in the past. According to NOAA's NCEI Storm Events Database, 176 wind days and 381 discrete wind events and occurred in Rensselaer County between 1996 and 2018 (including high wind, strong wind, and thunderstorm wind event types; but excluding wind from tornados, which are addressed separately within this section). These incidents resulted in a reported total of 23 injuries, $4,000 in crop damage, and more than $2.6 million in property damages. Details of damages for these events are summarized by event type in Table 3a. 11.

Table 3a. 11 - Wind Event Summary, 2011-2018					
Event Type	Number of Events	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Strong Wind	30	0	0	$67,000	$4,000
Thunderstorm Wind	286	0	12	$1,933,500	$0
High Wind	65	0	11	$636,000	$0
Total:	381	0	23	$2,636,500	$4,000

Seventy wind days and 180 discrete wind events have been recorded since the last version of this plan was approved in 2011, for which seven injuries, $4,000 in crop damage, and $48,000 in property damage were recorded.

A sampling of more notable, damage-causing events (since 1996) includes the following:

July 6, 1999

Powerful thunderstorms brought down trees and power lines in many localities. A microburst was recorded in Rensselaer, bringing a large number of trees down. In addition, roofs were peeled off homes. An even more destructive microburst with estimated winds of 100 mph brought thousands of trees down between Raymertown and Pittstown and tore roofs off storage buildings. $559,500 in property damage was reported.

September 16, 1999

Rensselaer County was included in the area covered by the disaster declaration following Tropical Storm Floyd. $400,000 in damage was reported.

June 25, 2000

Thunderstorm winds blew down trees in Brunswick, Berlin, Tomhannock and Grafton Lake. In Tomhannock, trees were uprooted near the reservoir with two falling on houses. Wind gusts were estimated to be in the 60 to 100 mph range at Grafton State Park, which not only resulted uprooted many trees but damaged camps and year-round houses. Power lines were also downed. Damages of $179,000 were reported.

September 11, 2002

A large concentration of wind damage was recorded in southeastern Rensselaer County where Route 20 near Nassau was closed by many trees toppling onto power lines. Damages of $30,000 were reported.

November 13, 2003

A portion of the roof of a convenience store was blown off in Melrose. Damages were estimated at $30,000.

May 4, 2010

Trees and wires were reported down in Snyder's Corner due to strong thunderstorm winds. Several trees were reported down on some roads in the Luther section of East Greenbush due to strong thunderstorm winds. Several trees were reported down on some roads in the Luther section of East Greenbush due to strong thunderstorm winds. Shingles were reported sheared off the roof of a four-story building at the corner of River Street and First Street in Troy due to strong thunderstorm winds. Wires were reported down in Schodack Center due to strong thunderstorm winds. Damages of $55,000 were reported.

July 23, 2014

Trees and wires were reported down throughout the area due to thunderstorm winds.

June 30, 2017

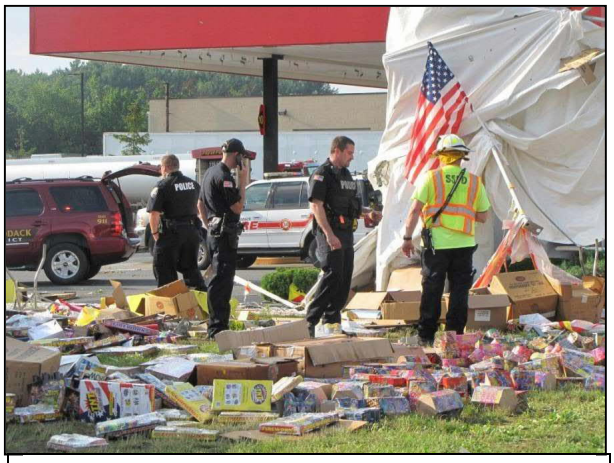


Photo 3a. 4 - Personnel respond in Schodack after a tent collapse due to a storm on June 30, 2017 (Martin Miller / Special to the Times Union)

Numerous strong to severe thunderstorms, especially across the Mohawk Valley, Saratoga Region and Capital Region. The severe storms produced two EF-1 tornadoes in Fulton and Herkimer counties, as well as knocked down numerous trees and power lines across the region. There was also one report of large hail in Saratoga County. One of the storms also caused four injuries in Schodack, where a firework display tent collapsed due to thunderstorm winds. At least 1,500 people lost power as a result of the thunderstorms. In Schodack, four people suffered minor injuries after a firework display tent collapsed at the Pilot truck stop on Route 9 in Schodack due to severe thunderstorm winds. In the Town of Nassau Route 20 was closed between Bliss School House Road and Route 66 due to downed trees and wires as a result of thunderstorm winds. A tree and power lines were downed as a result of thunderstorm winds in the town of Stephentown.

February 26, 2019

Gusts in excess of 50 mph were common across the area, with several sites recording gusts in excess of 60 mph. Gusts were measured as high as 69 mph near Adams, MA, and East Springfield, NY. The 61-mph gust recorded at Albany International Airport was the strongest gust observed during meteorological winter since 1987. The strongest gusts occurred during the afternoon of the 25th. Numerous power outages and downed trees occurred as a result of the winds, and some structural damage to barns and houses was reported as well. In the City of Rensselaer, part of a concession stand roof blew off at the Rensselaer Little League Field, and bricks were also reportedly blown off the side of an auto parts store.

Photo 3a. 6 – Bricks were blown off of the side of an auto parts store in the City of Rensselaer, February 25, 2019 (CBS6 News photo)

Photo 3a. 5 – The roof of the Rensselaer Little League concession stand was blown off in the City of Rensselaer, February 25, 2019 (CBS6 News photo)

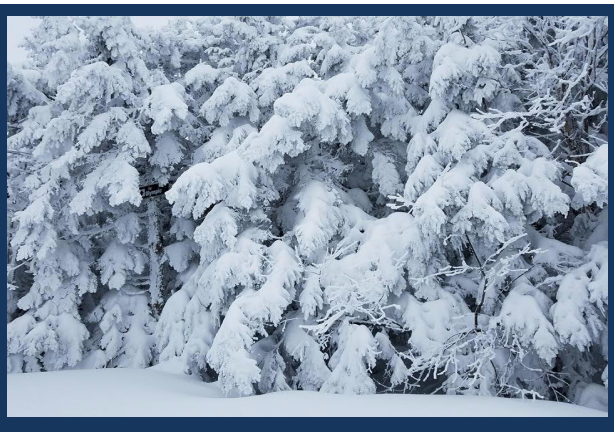
Probability and Climate Change - Wind

Extreme wind events have a history of frequent occurrence in Rensselaer County, and the probability of future occurrences in the County is certain. The entire planning area is susceptible to a wide variety of recurring severe storms that cause extreme wind conditions. Based on NOAA NCEI Storm events database historic occurrence data, Rensselaer County can expect about eight significant wind event days per year.

With regard to climate change impacts on probability of wind events, the 2019 SHMP concludes that:

- Climate change is a major factor when it comes to forecasting potential natural disasters.
- As New York State continues to become more vulnerable to severe thunderstorms and tornadoes it will continue to be impacted by high wind events.
- "Interest in non-convective high winds is growing due to their societal impact, gaps in the scientific understanding of the triggering mechanisms for these events, and possible future changes in their frequency and intensity caused by climate change."

Winter Storm



Countywide Statistics:

Ice Storm	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0
Snow Storm	
Total Losses Reported (1996-2018)	$740,100
Total Number of Episodes (1996-2018)	147
Annualized Loss (1996-2018)	$33,641
Annualized Number of Episodes (1996-2018)	6.7
Daily Probability	1.83%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Winter Storm

Winter storms are a combination of cold temperatures and heavy snow or ice. Because winter storms are regular occurrences during the winter months in Rensselaer County, they are considered hazards only when they result in damage to specific structures and/or overwhelm local capabilities to handle disruptions to traffic, communications, and electric power. Winter storms typically occur in New York State from late October until mid-April. Peak months for

these events for Rensselaer County and its jurisdictions are December through March. This section provides detailed profiles of both ice storms and snow storms.

Ice storms and snow storms are defined in the 2019 SHMP as follows:

- An **ice storm** is an occasion when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are usually accumulations of 0.25-inch or greater.

- **A snow storm** occurs when precipitation falls as snow. Snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 degrees Fahrenheit), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage.

Location – Winter Storm

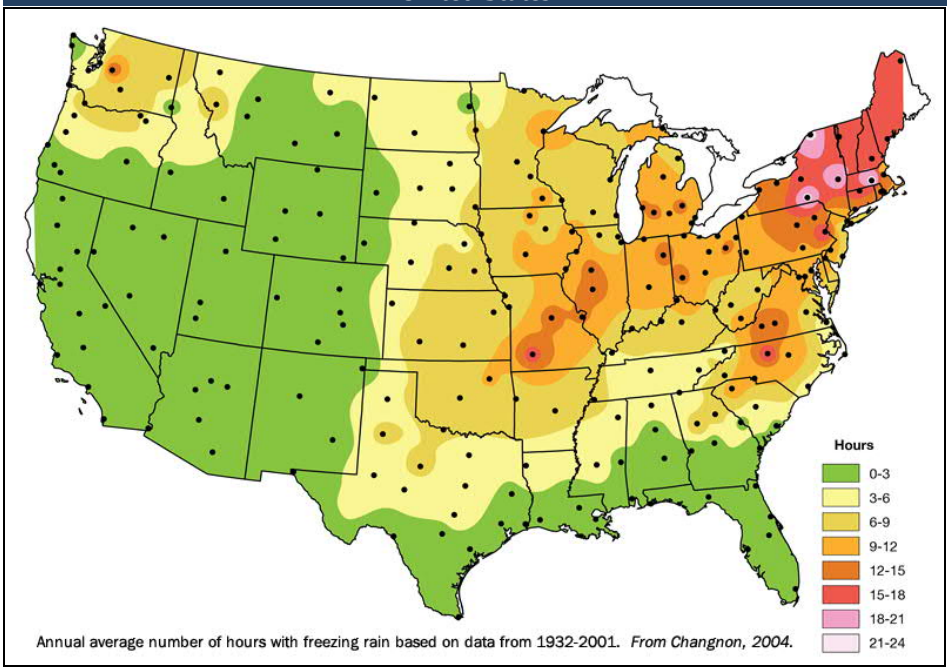
Ice Storm

All of Rensselaer County is susceptible to and can be affected by ice storms; the location of the ice storm hazard area is county-wide. Figure 3a. 9 (on the following page) illustrates the average number of hours per year with freezing rain in the U.S. According to the figure, Rensselaer County experiences between about 18 and 21 hours per year, based on data from 1932 to 2001 (MRCC, 2017). Rensselaer County has one of the highest annual average number of hours of freezing rain nationwide.

Snow Storm

All of Rensselaer County is susceptible to and can be affected by snow storms; the location of the snow storm hazard area is county-wide. For the years 1981 to 2010, Rensselaer County's average annual snowfall ranges from between about 50 and 75 inches per year in northeastern areas, to between 25 and 50 inches per year in southwestern areas (see Figure 3a. 10 on the following page). Rensselaer County is accustomed to severe winter weather conditions and is prepared for the potential disruptions they might cause, though intense ice storms and snow storms can still overwhelm local capabilities from time to time. The 2014 SHMP reports that, on average, New York State receives more snowfall than other states in the US, with average annual snowfall of about 65 inches.

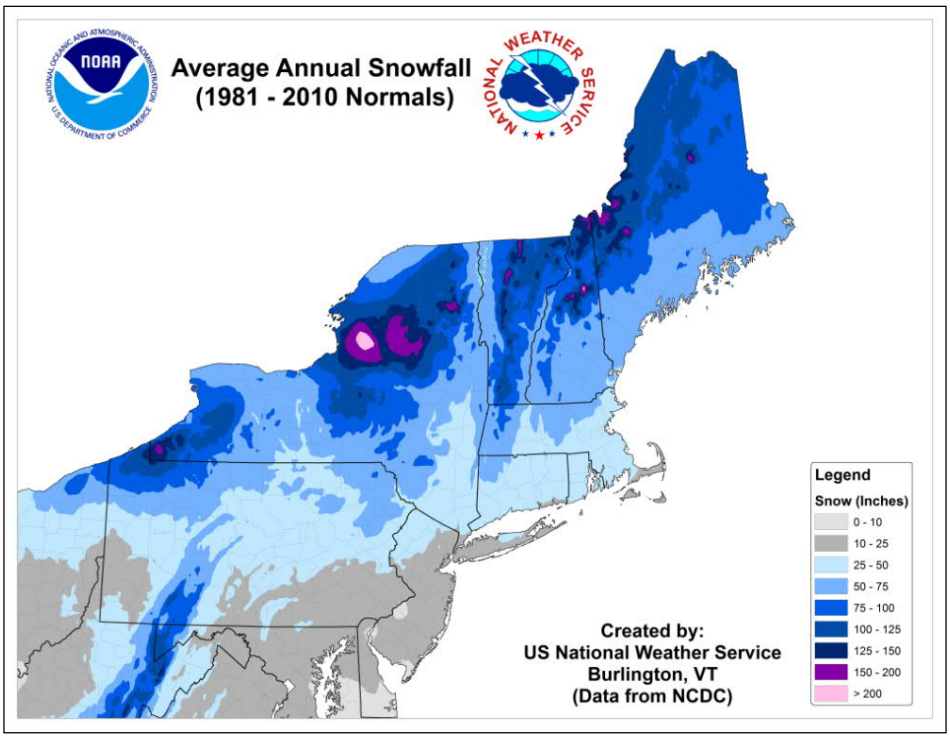
Figure 3a. 9- Average Number of Hours per Year with Freezing Rain in the United States



Source: MRCC, 2017

Note: Rensselaer County is located in an area with an average number of 18 to 21 hours of freezing rain each year.

Figure 3a. 10 - Average Annual Snowfall (1981-2010)



Extent – Winter Storm

Ice Storm

The severity of the effects of ice storms increases as the amount and rate of precipitation increase. In addition, storms with a low forward velocity are in an area for a longer duration and become more severe in their affects. Storms that are in full force during the morning or evening rush hours tend to have their affects magnified because more people are out on the roadways and directly exposed.

The 2019 SHMP indicates that the Sperry-Piltz Ice Accumulation Index (SPIA) as a measure of the magnitude of ice storms. The SPIA uses a scale between 0 and 5 to range storms by damage and impact (see Table 3a. 12).

Table 3a. 12 – Sperry-Piltz Ice Accumulation Index (SPIA)

Scale	Damage and Impact Descriptions
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulations.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting one to five days.
4	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting five to ten days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

Snow Storm

Like ice storms, the severity of the effects of snow storms increases as the amount and rate of precipitation increase. In addition, storms with a low forward velocity are in an area for a longer duration and become more severe in their affects. Storms that are in full force during the morning or evening rush hours tend to have their affects magnified because more people are out on the roadways and directly exposed.

The magnitude of a severe winter storm NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from one to five. It is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms that have occurred since 1900 (NOAA-NCDC 2011). Table 3a. 13 presents the five RSI ranking categories.

Table 3a. 13 - NOAA Regional Snowfall Index		
Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18.0+

Previous Occurrences – Winter Storm

Ice Storm

NOAA's NCEI Storm Events Database records three ice storms in Rensselaer County between 1996 and 2018. No deaths, injuries, property damages, or crop damages were identified in the database. Details are included in Table 3a. 14. No events have occurred since the last version of this plan was finalized in 2011.

Table 3a. 14 – Ice Storm Events, 1996-2018						
Affected Location	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Countywide	1/15/2007	Ice Storm	0	0	$0	$0
Western Zone	2/13/2008	Ice Storm	0	0	$0	$0
Countywide	12/11/2008	Ice Storm	0	0	$0	$0
Total:			0	0	$0	$0

In Rensselaer County, ice storms are considered normal and expected during the winter months. New York State has received two disaster declarations for severe ice storms; however, Rensselaer County was not part of the declared area during either event. The December 2008 event, described below, is categorized as a FEMA Severe Winter Storm disaster declaration; however, we are discussing it here for its significant ice storm characteristics and impacts in Rensselaer County.

December 11-12, 2008

A significant wintry mix of snow, sleet and freezing rain fell, beginning Thursday afternoon, and ending midday Friday. Snow and sleet accumulations of 3 to 6 inches fell. In addition, freezing rain, with estimated accretions in excess of one half of an inch, led to numerous downed tree limbs, trees and power lines. Total ice accretion from freezing rain ranged from around one half of an inch, up to one inch across portions of the Capital District and the Berkshires. The ice storm resulted in widespread damage to trees and resultant power outages across eastern New York, where an estimated 220,000 utility customers lost power. Many schools and businesses were shut down for several days due to the loss of power, and impassable roads from extensive fallen debris, resulting in significant economic and societal impacts. States of emergency were declared across large portions of eastern New York. The hardest hit areas were within the immediate Capital

District, across Albany and extreme southern Saratoga Counties, as well as across the central and southern Taconics, from central Rensselaer County into Columbia County and northern Dutchess County. Bitterly cold temperatures followed in the wake of the storm Saturday and Sunday, compounding the power outages across the region. Numerous warming shelters were setup to assist those who were without power and heat. The storm resulted in the declaration of disaster DR-1827, under which Rensselaer County received more than $600,000 in funding from the FEMA Public Assistance Grant Program.

Photo 3a. 12 - Ice Storm, Troy, December 2008

Photo 3a. 13 - Ice Storm, Troy, December 2008

Photo 3a. 7 - Route 117, December 2008.

Snow Storm

Rensselaer County has experienced numerous types of snow storms in the past. According to NOAA's NCEI Storm Events Database, 147 snow storm days and 265 discrete snow storm events and occurred in Rensselaer County between 1996 and 2018 (including blizzard, heavy snow, winter storm, and winter weather) and more than $740,000 in property damages. Details of damages for these events are summarized by event type in Table 3a.15. Forty-eight storms occurred after the 2011 plan was prepared; no losses were reported for these recent events.

Table 3a. 15 – Snow Storm Event Summary, 1996-2018

Event Type	Number of Events	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Blizzard	1	0	0	$0	$0
Heavy Snow	27	0	0	$227	$0
Lake Effect Snow	0	0	0	$0	$0
Winter Storm	59	0	0	$33,414	$0
Winter Weather	69	0	0	$0	$0
Total:		0	0	0	$0

Like ice storms, severe winter snow storms are considered normal and expected in Rensselaer County during the winter months. The FEMA web site (www.fema.gov/disasters) documents that New York State has been declared following 20 snow storms since 1953. Rensselaer County has been declared during three snow disasters and two snow emergencies, as detailed in Table 3a. 16. No disasters or emergencies have been declared by FEMA since the initial plan was prepared in 2011.

Table 3a. 16 - FEMA Snow Declarations Affecting Rensselaer County

Disaster/ Emergency #	Declaration Type	Event	Incident Period	Eligible Assistance for Rensselaer County
DR-801	Major Disaster Declaration	Severe Winter Storm	October 4, 1987	Public Assistance
DR-1083	Major Disaster Declaration	Blizzard	January 6-12, 1996	Public Assistance
EM-3173	Emergency Declaration	Snow Storm	December 25, 2002 to January 4, 2003	Public Assistance
DR-1827	Major Disaster Declaration	Severe Winter Storm	December 11-31, 2008	Public Assistance
EM-3299	Emergency Declaration	Severe Winter Storm	December 11-31, 2008	Public Assistance

A sampling of more notable, damage-causing events includes the following:

October 4, 1987

What was at the time the earliest winter storm formally recorded for Albany, this unusual snowstorm covered the Capital Region with 6 to 12 inches of very heavy, wet snow. Though not unusual in terms of its snow depth, this storm caused tremendous damage as the weight of its heavy, wet snow fell on trees in full leaf, downing limbs and power lines and leaving many areas without power for several days. The storm resulted in the declaration of disaster DR-801.

March 12-13, 1993

What has sometimes been termed the "Storm of the Century" or the "Great Blizzard of 1993" was a massive storm which, at its peak, stretched from Canada to Central America. Its impacts were felt up and down the US east coast, where hurricane force winds and upwards of a foot of snow combined with storm surge and scattered tornados. Total US damages from this storm were estimated at $6.6 billion. In nearby Albany, 27 inches of snow were reported. Impacts in Rensselaer County noted by Core Planning Group members included heavy snow accumulations, high winds, tree damage, power outages, limited road passage, and various parking restraints. The storm resulted in Federal emergency declaration EM-3107 (though Rensselaer County was not declared).

December 31, 1994

A mixture of snow and freezing rain occurred across much of eastern New York creating treacherous traveling conditions on New Year's Eve. In the Capital District area alone hundreds of accidents occurred as roadways became ice covered. The icy conditions forced the closure of several major highways and several of the accidents had fatalities.

January 12, 1996

Heavy snow fell across much of eastern New York except for the central Mohawk Valley Region. Specific snowfall totals included 12 inches in Troy in Rensselaer County. The storm resulted in the declaration of disaster DR-1083 under which Rensselaer County became eligible for funding under the FEMA Public Assistance Grant Program.

March 31, 1997

Heavy snow fell over eastern New York from the Mohawk Valley southward. Snowfall amounts were highly elevation dependent. Snowfall exceeded 2 feet in many mountain locations. Specific snowfall totals included 15 inches at the Albany Airport and 11 inches at Poestenkill in Rensselaer County. The wet snow brought down many trees and power lines causing widespread power outages and many road closures, and many areas remained without power for several days. In the Capital District, 50,000 customers lost power. Damages of $500,000 were reported in Rensselaer County.

December 6-8, 2003

A band of heavy snow, with rates up to 3 inches per hour, settled over the Taconics for a while on Saturday afternoon into the evening hours. The storm lasted about 30 hours. By the time the low pressure had moved to the east, a general swath of one to two feet of snow had fallen across the region. Unusually high amounts fell east of Albany in Rensselaer County with 32 inches noted at Averill Park and up to 39 inches at West Sand Lake. The storm caused numerous flight cancellations at Albany International Airport. Many localities declared snow emergencies. There were quite a few vehicular accidents, but most were minor.

December 25, 2003 and January 4, 2004

Back-to-back severe snowstorms blanketed much of New York State. This resulted in a FEMA emergency declaration EM-3173. The declaration allowed state and local governments, and certain private non-profit organizations in the counties to apply for federal assistance to fund 75 percent of the total eligible costs of equipment, contracts, and personnel overtime related to emergency services in dealing with the snow. The State of New York was responsible for 12.5 percent of the eligible costs and applicants funded the remaining 12.5 percent. Federal assistance provided to Rensselaer County and its municipalities as a result of this declaration totaled nearly $800,000. CPG members recalled heavy snow accumulations, high winds, tree damage, power outages, limited road passage, and various parking restraints as a result of these events.

January 1-3, 2010

A powerful storm brought widespread snowfall to east central New York along with blustery conditions, resulting in blowing and drifting of the snow. Snowfall totals were generally 6 to 16 inches, with up to 2 feet across portions of Washington and eastern Rensselaer counties.

December 26-27, 2012

Snow, heavy at times, fell across much of eastern New York. This was combined with a mix of sleet and freezing rain across the mid-Hudson Valley and Taconic Region. Most areas in the immediate Capital District reported between 6 and 11 inches of snow. This storm resulted in very slow travel during the holiday season, especially on the evening of the 26th and morning on the 27th.

March 2 and 7, 2018

On March 2nd, heavy wet snow blanketed higher elevations. Winds gusted 35 to 50 mph in some areas. On March 7th, 8 to 12 inches of snow accumulated across much of the Capital District, eastern Catskills, and Lake George-Saratoga Region. The heavy snowfall resulted in the closure of Interstates 84 and 88 and the New York State Thruway to high-profile vehicles. This event was the second major winter storm in less than a week.

January 19-20, 2019

One of the worst storms of the 2018-2019 winter season occurred, when, between January 19th and January 20th, Rensselaer County communities received between 8

and 18 inches of snow (8 inches in the Town of Berlin; 18 inches in Speigletown). County snowfall totals were generally higher in western areas.

Photo 3a. 8 - Valley Falls, January 20, 2019.
Photo courtesy of Spectrum Local News (Korrine Jasmine)

Probability and Climate Change - Winter Storm

Ice Storm

Ice storms have occurred regularly in Rensselaer County. Based on occurrences reported in NOAA's NCEI Storm Events Database (1996-2018), Rensselaer County has about a 0.04% daily probability of an ice storm episode, or about 0.1 ice storms per year. New York State's relatively high latitude supports freezing temperatures from late-October or mid-November through mid-April.

The 2019 SHMP concludes that data is not sufficient at this time to estimate the impact of climate change on ice storms in New York State. Future updates of this plan should incorporate better data on this topic when it becomes available.

Snow Storm

Snow storms have a history of very frequent occurrence in Rensselaer County. Based on occurrences reported in NOAA's NCEI Storm Events Database (1996-2018), Rensselaer County has about a 1.83% daily probability of a snow storm episode, or about 6.7 winter storms per year. New York State's relatively high latitude supports freezing temperatures from late-October or mid-November through mid-April.

The 2019 SHMP concludes that data is not sufficient at this time to estimate the impact of climate change on snow storms in New York State. Future updates of this plan should incorporate better data on this topic when it becomes available.

HYDROLOGIC HAZARDS

Drought

Countywide Statistics:

Drought

Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	2
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.02%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Drought

The 2019 SHMP defines drought as the shortage of water that results from a lack of rain over an extended period of time.

According to the National Oceanic and Atmospheric Administration's (NOAA's) Drought Information Center, there are four types of drought:

- Meteorological Drought – A measure of precipitation departure from normal.
- Agricultural Drought – When the amount of moisture in soil does not meet the needs of a particular crop.
- Hydrological Drought – When both surface and subsurface water supplies are below normal.
- Socioeconomic Drought - When a water shortage begins to affect people.

Meteorological droughts are typically defined by the level of "dryness" when compared to an average, or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts (when the

amount of moisture in soil does not meet the needs of a particular crop). Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that affect people and limit the ability to supply water-dependent products in the marketplace.

Location – Drought

Droughts occur in all parts of the country and at any time of year, depending on temperature and precipitation over time. Similarly, droughts can occur in all parts of Rensselaer County at any time of year, depending on temperature and precipitation over time. While arid regions of the United States are more susceptible to long-term or extreme drought conditions, other areas such as Rensselaer County tend to be more susceptible to short-term, less severe droughts. It is impossible to delineate a drought hazard area for the County, per se, but it is generally assumed that drought is a county-wide hazard, with drought conditions being possible in all geographic areas.

Extent – Drought

The 2019 SHMP highlights the Palmer Drought Severity Index (PDSI) as the most common indicator of the magnitude or severity of a drought based on soil moisture conditions. The PDSI ranges from -4.0 to +4.0. Positive values indicate wet soil conditions and negative values indicate dry soil conditions. Palmer classifications are shown in Table 3a. 17.

Table 3a. 17 – Palmer Drought Severity Index

Palmer Classification	Description
4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme Drought

Previous Occurrences – Drought

NOAA's NCEI Storm Events Database records two episodes of drought in Rensselaer County between 1996 and 2018. No deaths, injuries, property damages, or crop damages were identified in the database. Details are included in Table 3a. 14. No episodes are reported in the NCEI database since the last version of this plan was finalized in 2011.

Table 3a. 18 – Drought Episodes, 1996-2018

Affected Location	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Countywide	4/1/1999	Drought	0	0	$0	$0
Countywide	8/1/1999	Drought	0	0	$0	$0
Total:			0	0	$0	$0

The FEMA web site (www.fema.gov/disasters) documents that New York State has received one major disaster declaration due to drought, as detailed in **Table 3a. 19**. No disasters or emergencies have been declared by FEMA since the initial plan was prepared in 2011.

Table 3a. 19 - FEMA Drought Declarations, 1953-2019

Disaster/ Emergency #	Declaration Type	Event	Incident Period	Eligible Assistance for Rensselaer County
DR-204	Major Disaster Declaration	New York Water Shortage	August 18, 1965	Affected counties are not available on the FEMA web site or in the 2019 SHMP. The 2014 SHMP does list affected counties; however, Rensselaer County is not included in the list.

Drought episodes are also recorded by the United States Department of Agriculture (USDA), whereby the USDA Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Data is available for the years 2012 through 2019. USDA records indicate three drought declarations for Rensselaer County (two where Rensselaer was the primary declared county and one where Rensselaer was contiguous to a declared county (**Table 3a. 20**).

Table 3a. 20 - USDA Drought Declarations, Rensselaer County, 2012-2019

Rensselaer County as Primary or Contiguous County Declared	Drought Begin Date	Declaration Approval Date	Description of Disaster	Crop Disaster Year
Primary	6/2/2012	10/24/12	Drought, excessive heat	2012
Primary	6/1/2015	9/9/2015	Drought	2015
Contiguous	4/26/2016	9/21/2016	Drought	2016

A brief summary of some of the more notable drought episodes follows:

1960's

In the 1960s, New York State was impacted by two major drought occurrences. During the 1960s, an extended period of drought affected the entire state. The drought of the 1960s ended in 1967. The worst stint lasted from 1964 to 1965 placing a severe impact on agriculture, water quality, and forest and human health. As a result, there were widespread impacts, including forest fires, crop failure, fish kills, water shortages, harmful algal blooms, and heat related deaths. A Federal disaster declaration was issued on August 18, 1965 (DR-204). Neither the 2019 SHMP nor the FEMA web site lists declared Counties for this declaration; however, the superseded 2014 SHMP does list declared counties and Rensselaer County was not listed. Because of the widespread nature of this event, we present its summary here to provide an overview of the types of affects that were observed during a widespread event such as this one.

August to December 1993

A prolonged period of drought starting in the summer of 1993 decimated much of the agriculture in southern and eastern New York State. Counties hit hard by drought included Albany, Rensselaer, Columbia and Greene. Estimates of feed grain losses in affected counties were well over 40 percent and in some cases nearly 100 percent. Hay and corn crops were especially hard hit, as well as fruits and vegetables. Total crop damages were estimated at $50 million across the affected area. The SHELDUS database lists crop damages of more than $800,000 specific to Rensselaer County for this event.

April 1999

April 1999 was officially the second driest April on record in Albany and the driest of this century. Only 0.60 inches of rain fell at the Albany International Airport and only 0.56 inches at the N.W.S. office located on the University at Albany (SUNY) Campus. Rainfall amounts were a little bit higher to the south of Albany, but still fell well short of normal. The combination of low rainfall, along with frequent gusty winds, turned the underbrush into very dry tinder. This scenario led to numerous brush fires during the month across the Berkshires.

August 1999

August 1999 was the peak of the long term drought across Eastern New York that began in July of 1998. The fourteen-month stretch, ending in August, saw rainfall and melted snowfall throughout the region only tallying up to about 80 percent of normal. At the Albany International Airport 35.41 inches of water equivalent was recorded from July 1998 through August 1999, compared to the thirty year normal of 42.82 inches. The long term drought combined with the heat of the summer, resulted in a drought warning across much of the region as well as a declaration of agricultural disaster. The Mohawk Valley and Western Adirondacks were especially hard hit. The drought resulted in record low levels of the Mohawk River, numerous forest fires across the Adirondacks, and many wells going completely dry. Most communities implemented voluntary or mandatory water restrictions.

2016

The 2019 SHMP reports that the 2016 drought in New York State resulted from "an unusually low winter snow pack, followed by lower than average rainfall and higher than average temperatures during the 2016 growing season". This event had a major impact on farmers in Western and Central New York and the USDA-Farm Service Agency (FSA) declared "most counties" in Western New York to be "natural disaster areas". According to the Cornell Institute for Climate Smart Solutions (CICSS): (a) crop loss estimates from a late summer survey of over 200 farmers suggest that more than 70% of rain fed field crop and pasture acreage had losses greater than 30%, with some reporting over 90% crop failure; and (b) most fruit and vegetable growers who irrigate lacked the irrigation capacity and water supplies to keep up with the drought, and estimated crop losses of up to 35% were reported.

Probability and Climate Change – Drought

It is estimated that Rensselaer County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities.

Periods of drought have occurred regularly in Rensselaer County. Based on occurrences reported in NOAA's NCEI Storm Events Database (1996-2018), Rensselaer County has about a 0.02% daily probability of a drought episode, or about 0.1 droughts per year. New York State's normal variations in temperature and precipitation patterns can lead to drought episodes despite the state's overall moderately humid climate.

The 2019 SHMP concludes the following with respect to the effect of climate change on drought probability:

- Climate change increases the potential for drought and can make drought more severe and long-lasting.
- While it is unclear how climate change will impact regional water supply, any added stress from climate change increases the competition for water resources.
- In New York, there is an expectation that droughts – specifically seasonal summer ones - could become more common as a result of climate change and by the end of the century, it is more likely than not that late-summer short-duration droughts will increase in the New York metropolitan region.
- It is less clear what impacts climate change will have on longer term "multi-year" droughts in the New York region, but it is clear that climate change is likely to make at least some droughts more common.

Flooding

Countywide Statistics:

Flooding	
Total Losses Reported (1996-2018)	$13,103,000
Total Number of Episodes (1996-2018)	54
Annualized Losses Reported (1996-2018)	$595,591
Annualized Number of Episodes (1996-2018)	2.5
Daily Probability	0.67%
Total Injuries (1996-2018)	2
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Flooding

The 2019 SHMP defines flooding as a temporary condition of partial or complete inundation of water on land that is normally dry. According to FEMA's NFIP Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials (FEMA-480), most floods fall into the following three categories:

- **Riverine Flooding – Flooding that occurs along a channel** (where a "channel" is defined as a feature on the ground that carries water through and out of a watershed, whether natural channels such as rivers and streams, or man-made channels such as drainage ditches). Riverine flooding occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity. It can also be caused by heavy snow melt and ice jams. Ice jams are very common in the north east United States, and according to data from the USACE Cold Region Research and Engineering Laboratory (USACE CRREL), 1,442 ice jam events have been recorded in New York State between 1867 and 2008, a number exceeded only by the State of Montana.

  - Overbank flooding occurs along a channel as excess flows overflow channel banks. Overbank flooding occurs when downstream channels receive more rain or snowmelt from their watershed than normal, or a channel is blocked by an ice jam or debris.
  - Flash floods are a type of riverine flooding typically caused when a significant amount of rainfall occurs in a very short duration. Flash flooding is characterized by a rapid rise in water level and high velocity flows. Flash floods can also be caused by ice jams (ice jam flooding, which can be upstream of an intact jam or downstream of a jam that has broken downstream) or dam breaks.
- Coastal Flooding – Flooding that occurs along the coasts of oceans, the Gulf of Mexico, and large lakes (i.e., the Great Lakes). Hurricanes and severe storms cause most coastal flooding, including "Nor'easters" which are severe storms that occur in the Atlantic basin that are extratropical in nature with winds out of the northeast.
  - Storm surge is one characteristic of coastal flooding caused as persistent high winds and changes in air pressure work to push water on shore, often on the order of several feet. Storm surge can travel upriver many miles from ocean coastlines.
- Shallow Flooding – Flooding that occurs in flat areas where a lack of channels means water cannot drain away easily.
  - Sheet flow occurs when there are inadequate or no defined channels, and floodwaters spread out over a large area at a somewhat uniform depth. Sheet flow occurs after intense or prolonged rainfalls during which rain cannot soak into the ground.
  - Ponding occurs when runoff collects in a depression and cannot drain out. Ponding floodwaters do not move or flow away; they will remain until the water infiltrates into the soil, evaporates, or is pumped away.
  - Urban drainage flooding occurs when the capacity of an urban drainage system is exceeded. An urban drainage system comprises the ditches, storm sewers, retention ponds and other facilities constructed to store runoff or carry it to a receiving stream, lake or the ocean. Urban drainage flooding can also occur in areas protected by levees, as water collects on the protected side of the levee when pump capacities are exceeded during severe storms.

Floods are considered hazards when people and property are affected. Historically, development in floodplains was often a necessity, as water bodies provided a means of transportation, power, water supply, and often supported the livelihood of local residents (i.e., fishing, farming, etc.). Today, development in floodplains is more often spurred by the aesthetic and recreational value of the floodplain. Flooding is widely regarded as the most common major natural hazard in New York State. It is also the most significant of all natural hazards in Rensselaer County.

The National Flood Insurance Program (NFIP) was established by Congress with the passage of the National Flood Insurance Reform Act of 1968. Through this program, Federally-backed flood insurance is made available to homeowners, renters, and businesses in a community if that

community adopts and enforces a floodplain management ordinance to reduce future flood damages within its floodplains. This includes not only preventative measures for new development, but also corrective measures for existing development. FEMA also administers the Community Rating System (CRS), a program under which communities choosing to implement floodplain management actions that go beyond the minimum requirements of the NFIP become eligible for discounts on flood insurance premiums for properties within that community. As of the time of this 2019 plan update, every individual municipality in Rensselaer County is an active member of the NFIP with the exception of the Village of Valley Falls[3]. No Rensselaer County communities are presently participating in the CRS program (as per April 2019 NFIP Flood Insurance Manual).

In addition to providing flood insurance, the NFIP also studies and maps the nation's floodplains, preparing its findings in Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs). FEMA also prepares digital maps of flood hazard areas. The flooding portion of this hazard mitigation plan has been revised as part of this 2019 plan update to reflect changes between the old Q3 mapping used previously and the new 2016 Digital Flood Insurance Rate Maps (DFIRMs) for the six municipalities where new maps were released.

Location – Flooding

Flooding is the primary natural hazard in Rensselaer County. While Rensselaer County and its jurisdictions experience several types of flooding, the vast majority of flooding in the County is riverine flooding and shallow flooding resulting from urban drainage issues. Ice jam flooding occurs occasionally and, because the Hudson River is tidal up to the Federal dam at Troy, significant hurricanes can exacerbate riverine flooding on the Hudson River and its tributaries as a result of storm surge being pushed upstream[4]. It is estimated that approximately six percent of lands within Rensselaer County are located in the FEMA 100-year floodplain.

Figure 3a. 11 illustrates the location of currently mapped special flood hazard areas for Rensselaer County. This figure is reflective of 2016 DFIRMs for six Rensselaer County communities (Town of Hoosick, Village of Hoosick Falls, Town of Pittstown, Town of Schaghticoke, Village of Schaghticoke, and the Village of Valley Falls) that were released in January 2016; and FEMA Q3 Flood Data (1996) for the balance of communities for which the Q3 still represents best readily available data. This includes Zones A/AE/AO (100-year floodplain), Zone X500 (500-year floodplain), and Zone X (areas higher than the elevation of the 500-year flood). There are no mapped areas of Zone V (100-year floodplain with wave action). Community land area in the 100-year floodplain is presented in **Table 3a.21**. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas – particularly in areas that were not included in detailed study areas or where significant development has occurred in the watershed since the last detailed studies were undertaken.

[3] Suspended, 01/07/16

[4] Some flooding was observed in Rensselaer County due to storm surge traveling up the Hudson River during Superstorm Sandy in 2012. Many areas of Rensselaer County are also susceptible to urban (stormwater) flooding.

Figure 3a. 11 - Rensselaer County Flood Hazard Areas

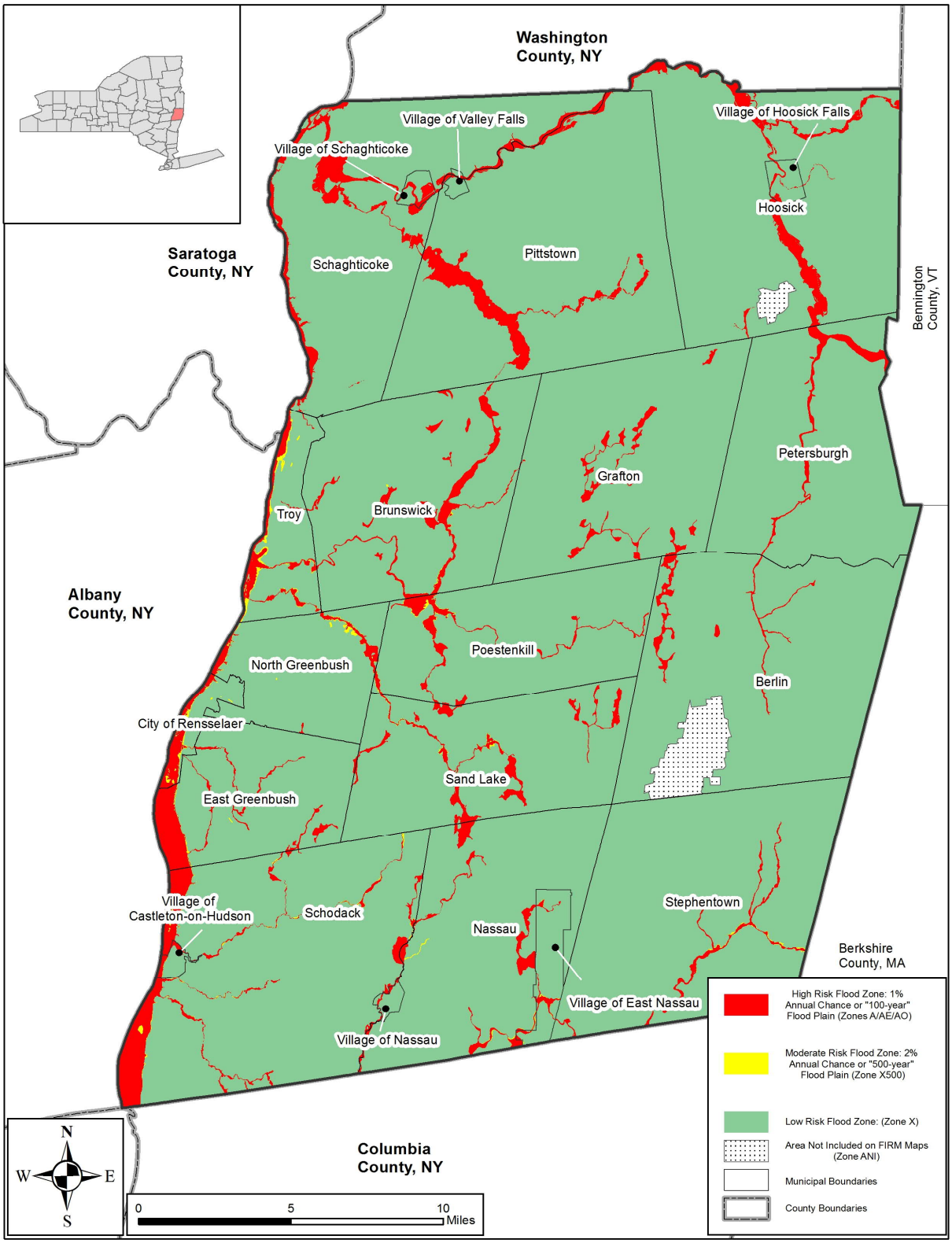


Table 3a. 21 – Land in the 100-year Floodplain			
Municipality	Land Area of Municipality[5] (Acres)	Land in the 100-year Floodplain (Acres)	Percent of Land in the 100-Year Floodplain (%)
Berlin, Town of	38,227	745	2%
Brunswick, Town of	28,284	1,765	6%
Castleton-on-Hudson, Village of	531	139	26%
East Greenbush, Town of	15,672	1,746	11%
East Nassau, Village of	3,029	178	6%
Grafton, Town of	29,711	967	3%
Hoosick Falls, Village of	950	113	12%
Hoosick, Town of	39,361	2,317	6%
Nassau, Town of	25,558	1,066	4%
Nassau, Village of	442	49	11%
North Greenbush, Town of	12,079	479	4%
Petersburgh, Town of	26,683	945	4%
Pittstown, Town of	41,256	2,516	6%
Poestenkill, Town of	20,727	991	5%
Rensselaer, City of	2,191	741	34%
Sand Lake, Town of	23,088	1,305	6%
Schaghticoke, Town of	32,545	3,031	9%
Schaghticoke, Village of	640	210	33%
Schodack, Town of	40,217	3,433	9%
Stephentown, Town of	37,263	671	2%
Troy, City of	7,066	1,054	15%
Valley Falls, Village of	308	29	9%
Total:	425,825	24,491	6%

Ice jam hazard area mapping does not exist at this time to incorporate into this plan. Ice jams have a history of occurrence on the following watercourses in Rensselaer County: (listed in order of the number of past events): Hoosic River, Poesten Kill, Moordener Kill, Little Hoosick River, and the Hudson River).

Rensselaer County is also potentially subject to flooding in the event of dam failure. Dam failure is the breakdown, collapse or other failure of a dam structure characterized by the uncontrolled release of impounded water that results in downstream flooding. There are varying degrees of failure, and an unexpected or unplanned dam breach (an opening through a dam which drains the water impounded behind it) is considered one type of failure. Dam failure can result from natural events, human-induced events or a combination of the two. The most common cause of

[5] Land

dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. Human-induced actions may include the deterioration of the foundation or the materials used in dam construction. In recent years, dams have also received considerably more attention in the emergency management community as potential targets for terrorist acts.

The New York State Department of Environmental Conservation (NYSDEC), the body responsible for dam safety and regulation in the State of New York, classifies the hazard potential of dams using four categories, as shown in Table 3a.22. An overview of Rensselaer County dams by hazard ranking is provided in Table 3a.23.

Table 3a. 22- NYSDEC Downstream Hazard Classification System for Dams

NYSDEC Classification	Description
Class C	**High Hazard Potential**. 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 B	**Intermediate Hazard Potential**. 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 A	**Low Hazard Potential**. 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 D	**Negligible or No Hazard**. 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.

Table 3a. 23 – NYSDEC Inventory of Dams in Rensselaer County

NYSDEC Classification	Hazard Ranking	Number of Dams	Number with EAP Required	Number with EAP On File	Number with GIS Inundation Mapping Required	Number with GIS Inundation Mapping*
C	High	10	10	10	10	0
B	Intermediate	13	13	7	0	0
A	Low	49	0	2	0	0
D	Negligible or No Hazard	24	0	0	0	0
Unassigned	Unassigned	1	0	0	0	0
Total		97	23	19	10	0

* See Footnote 7

In addition to the above, there are also four locks on the Hudson River which are classified as dams and span the width of the river between Saratoga County to the west, and Rensselaer County to the east. The locks are reflected in the NYSDEC Saratoga County inventory. Although these structures are recorded by NYSDEC as located in Saratoga County, since they span the river between Rensselaer and Saratoga Counties it has been assumed for the purposes of this plan that breach or failure of the structures could have impacts on both sides of the river and hence all have been identified here. They include: Lock 3 in Mechanicville (C- high hazard); Lock 2 in Mechanicville (A-low hazard); Lock 1 in Waterford (A-low hazard); and the Federal Lock in Troy (B-moderate hazard). Additionally, Lock 4 (A- low hazard) lies just upstream of the County's northern boundary in Stillwater. Locks 1 through 4 are owned and operated by the NYS Canal Corporation, and the Federal Lock is owned and operated by the US Army Corps of Engineers.

Table 3a.24 presents details for all dams affecting Rensselaer County classified as of high or moderate hazard by the NYSDEC. The location of all high and moderate hazard dams recorded in the NYSDEC inventory of dams is presented in Figure 3a.12.

The Rensselaer County Planning Department also highlighted: the Village of Castleton on Hudson (Dunham Reservoir), Village of Nassau (Nassau Lake), Town of Poestenkill (Dyken Pond), and Village of Valley Falls (Johnsonville Dam) as downstream communities potentially impacted.

Table 3a. 24 –High and Intermediate Hazard Dams in Rensselaer County

Dam Name	River/Stream	Owner Type	Purpose	Location	Nearest Downstream Municipality	Year Built	EAP Status	Max Storage	Last Condition Rating[6]
High Hazard Dams – Class C									
Black River Pond Dam	Black River	State	Recreation	Town of Berlin	Town of Stephentown	1935	On File	1,710	Unsound - Fair
Bradley Lake Dam	Piscawan Kill	Local Government	Recreation	City of Troy	City of Troy	1859	On File	215	Unsound - Fair
Johnsonville Dam	Hoosic River	Private	Hydroelectric	Town of Pittstown	Town of Pittstown, Town of Schaghticoke	1910	On File	6,430	Not Rated
Long Pond Dam	Tributary – Quacken Kill	State	Recreation	Town of Grafton	Town of Grafton	1918	On File	1,702	Not Rated
Martin Dunham Reservoir Dam	Quacken Kill	State	Recreation	Town of Grafton	Town of Grafton	1913	On File	4,500	Not Rated
Mill Pond Dam	Tributary – Quacken Kill	State	Recreation	Town of Grafton	Town of Grafton	1918	On File	173	Not Rated
Quackenderry Creek Dam	Quackenderry Creek	Local Government	Flood Control and Storm Water Management	City of Rensselaer	City of Rensselaer	2002	On File	61.5	No Deficiencies Noted
Second Pond Dam	Tributary – Quacken Kill	State	Recreation	Town of Grafton	Town of Grafton	1975	On File	415	Not Rated
Tomhannock Reservoir Dam	Tomhannock Creek	Local Government	Water Supply - Primary	Town of Schaghticoke, Town of Pittstown	Town of Schaghticoke; Town of Pittstown	1905	On File	56,600	No Deficiencies Noted
Wright Lake Dam	Piscawan Kill	Local Government	Recreation	City of Troy	City of Troy	1861	On File	129	Unsound - Fair
NYS Canal Lock C-3	Hudson River	NYS Canal Corporation	Hydroelectric, Navigation	City of Mechanicville	City of Mechanicville, Town of Halfmoon, Town of Schaghticoke	1965	On File	8,785	Not Rated

[6] Value of most recent Condition Rating assigned to the dam by the DEC Dam Safety program.

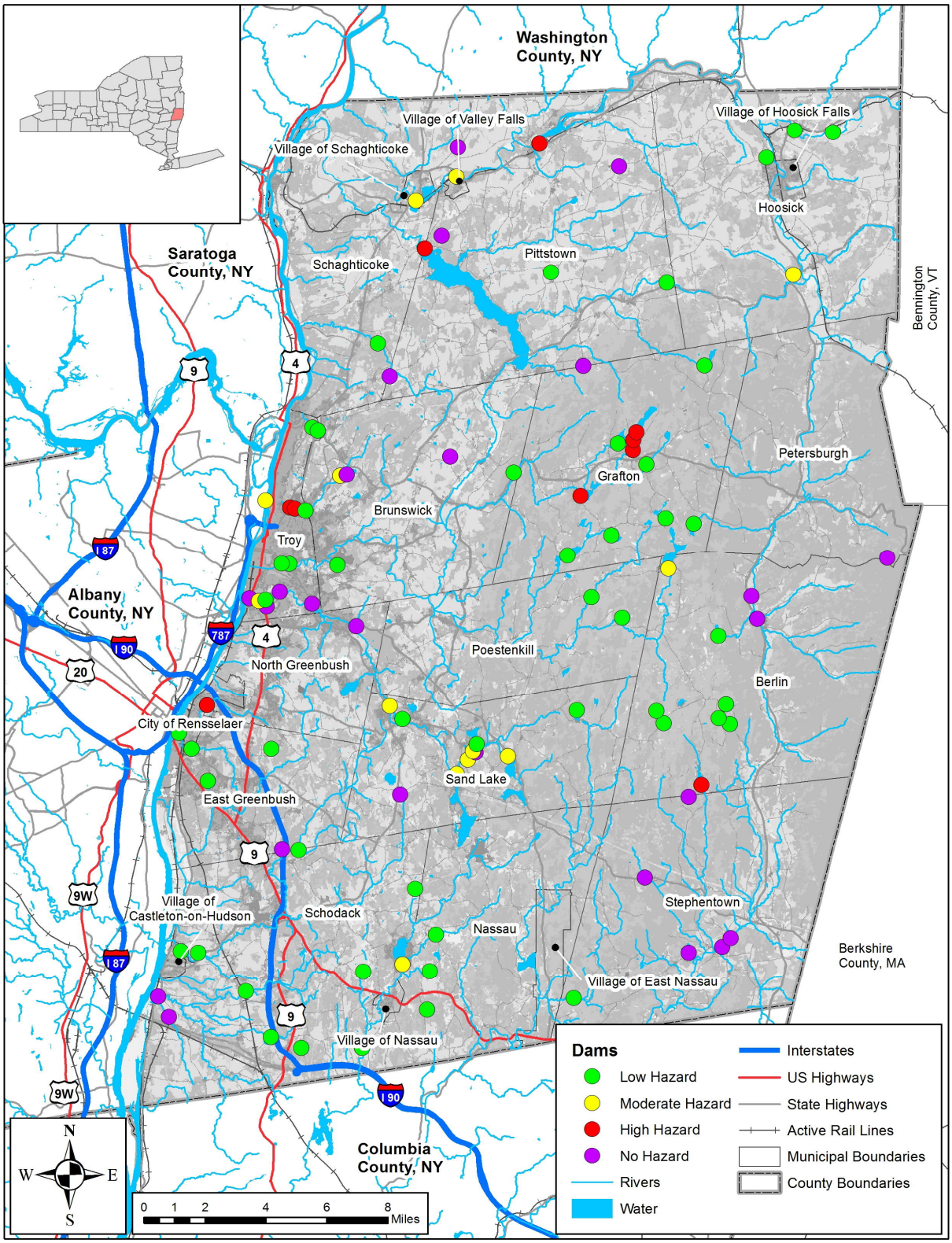
Table 3a. 24 –High and Intermediate Hazard Dams in Rensselaer County

Dam Name	River/Stream	Owner Type	Purpose	Location	Nearest Downstream Municipality	Year Built	EAP Status	Max Storage	Last Condition Rating[6]
Intermediate Hazard Dams – Class B									
Burden Lake Dam	Tributary – Wynantskill	Private	Recreation	Town of Sand Lake	Town of Sand Lake	1916	None	7,600	Unsound - More Analysis Needed
Dyken Pond Dam	Poesten Kill	Local Government	Recreation	Town of Berlin	Town of Berlin	1914	None	3,273	Unsound - More Analysis Needed
Faith Mills Lower Dam	Wynants Kill	Private	Hydroelectric, Irrigation	Town of Sand Lake	Town of Sand Lake	1930	None	26	Not Rated
Glass Lake Dam	Wynants Kill	Private	Recreation	Town of Sand Lake	Town of Sand Lake	1916	On File	3,630	Not Rated
Hastings Power Dam	Wynants Kill	Private	Hydroelectric, Irrigation	Town of Sand Lake	North Greenbush	1920	None	22	Not Rated
Hoosic School Dam	Pine Valley Brook	Private	Recreation	Town of Hoosick	Village of Hoosick Falls	1950	On File	103	Not Rated
James Thompson Dam (Hoosic River Dam)	Hoosic River	Private	Hydroelectric	Town of Schaghticoke, Village of Valley Falls	Village of Valley Falls	1927	On File	320	Not Rated
Kane Dam	Wynants Kill	Private	Recreation	Town of Sand Lake	Town of Sand Lake	1923	None	50	Not Rated
Nassau Lake Dam	Valatie Kill	Private	Recreation	Towns of Schodack and Nassau	Village of Nassau	1792	On File	550	Not Rated
Rail Joint Mill Dam (Portec Dam)	Wynants Kill	Local Government	Irrigation	City of Troy	City of Troy	1903	None	10	Unsound - More Analysis Needed
Schaghticoke Dam	Hoosic River	Private	Hydroelectric	Town of Schaghticoke	Town of Schaghticoke	1909	On File	1,150	Not Rated

Table 3a. 24 –High and Intermediate Hazard Dams in Rensselaer County

Dam Name	River/Stream	Owner Type	Purpose	Location	Nearest Downstream Municipality	Year Built	EAP Status	Max Storage	Last Condition Rating[6]
Troy Lock & Dam #1	Hudson River	Public Utility	Hydroelectric, Navigation	City of Troy	City of Troy	1914	On File	8,200	Not Rated
Van Derheyden Reservoir Dam (Troy Reservoir Dam)	Piscawan Kill	Local Government	Recreation, Water Supply - Secondary	Town of Brunswick	City of Troy	1868	On File	79	Unsound – Deficiency Recognized

Figure 3a. 12 - Rensselaer County Dam Locations



Dam failure inundation mapping would provide the best geographical representation of the potential dam failure hazard area. Inundation mapping included in the 2011 plan for Class C dams was sourced from each dam's EAP, current as of 2010. Class C dam EAPs have since been updated. Additionally, NYSDEC EAP Instructions issued in December 2012, owners of Class C dams are now required to submit shapefiles of inundation areas. NYSDEC was contacted on April 29, 2019 to request updated inundation mapping shapefiles for Rensselaer County dams. A response was received on Mary 30, 2019; NYSDEC indicated that such files were not available[7].

Extent – Flooding

The National Weather Service (NWS) categorizes the extent (magnitude or severity) of riverine and flash flooding in which a river has reached the flood stage as minor, moderate, and major. The categories are based on property damage and public threat and are as follows:

- **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.
- **Major flooding** – Extensive inundation of structures and roads; significant evacuations of people and/or transfer of property to higher elevations.

The severity of a flood depends not only on the amount of water that accumulates within a certain period but also on the management of the water. The size of rivers and streams is important, and the capacity of land to absorb water is equally as important. Soil acts as a sponge when it rains. When the land is saturated or frozen, infiltration into the ground slows, and water that does not infiltrate flows as runoff.

The magnitude or severity of riverine ice jam flooding can be affected by the amount of snowpack in the watershed, rate of snowmelt, water level at freeze-up, characteristics of both the ice itself as well as the channel, and local weather conditions.

Two factors that influence the potential severity of a full or partial dam failure are the amount of water that is impounded and the density, type, and value of downstream development and infrastructure. Flood severity from a dam failure is measured as low, medium, or high as follows:

- **Low severity** – No buildings are washed off their foundations; structures are exposed to depths of less than 10 feet.
- **Medium severity** – Homes are destroyed but trees or mangled homes remain for people to seek refuge in or on; structures are exposed to depths of more than 10 feet.
- **High severity** – Floodwaters sweep the area clean and nothing remains. Locations are flooded by the near instantaneous failure of a concrete dam, or an earthfill dam washes out in seconds rather than minutes or hours. In addition, the flooding caused by the dam

[7] Email from Donna Bekkering, Environmental Program Specialist, Division of Water, NYSDEC, to Anna Foley, AECOM, dated 5/30/2019.

failure sweeps the area clean and little or no evidence of the prior human habitation remains after the floodwater recedes.

Previous Occurrences – Flooding

NOAA's NCEI Storm Events Database records 54 flooding[8] episodes in Rensselaer County between 1996 and 2018 causing over $13 million in property damage, $40,000 in crop damage, and two injuries. Details of damages for these events are summarized by event type in Table 3a.25. Twelve of these episodes occurred after the 2011 plan was prepared; losses reported for these recent events included $330,000 in property damage.

Table 3a. 25 – Flooding Episodes Summary, 1996-2018

Event Type	Number of Episodes[9]	Reported Fatalities	Reported Injuries	Reported Property Damage	Reported Crop Damage
Flood	25	0	2	$6,216,000	$0
Flash Flood	35	0	0	$6,857,000	$40,000
Total:		0	2	$13,073,000	$40,000

The National Performance of Dams Program (NPDP) at Stanford University maintains a performance and event history for each dam in the County that includes descriptions of any safety-related incidents that have occurred since 1978, along with the incident's causes and impacts. This dataset was accessed in 2018 as part of the plan update. Despite having a total of 97 dams, the NPDP database for Rensselaer County includes only four recordable incidents, **none of which involved uncontrolled release of the reservoir.** Incident dates range from 1995 to 2015. One incident has occurred since the initial plan was adopted in 2011. Table 3a.25 provides a summary.

[8] Database query included the following event types: flood, flash flood, coastal flood, and lakeshore flood. The output included only records of flood and flash flood. **This section does not tally episodes from flooding during hurricane/tropical storm events. Please refer to the Hurricane/Tropical Storm section for discrete information regarding that hazard.**

[9] Note: Six episode dates had both flood and flash flood event types.

Table 3a. 26 – Dam Incident Summary, 1978-2018					
Dam Name	**Event Date**	**Event Type**	**Incident Type**	**Uncontrolled Release? (Yes/No)**	**Description**
Schaghticoke Dam	1/12/1995	Dam Incident	Partial penstock collapse during scheduled dewatering	No	200 feet of the middle penstock collapsed from surge tank to powerhouse during scheduled dewatering.
Ida Lake Dam	6/18/1997	Dam Incident	Concrete Deterioration	No	The DIN indicates that the incident occurred during 6/18-19/97. This incident involved the failure of a drain, which was caused by age and a deteriorated condition. The size of the breach was 4 feet wide by 6 feet high. Damage included the silting of Poestenkill. Belden Pond elevation dropped about 4 feet. Dam backwatered into pond. Loss of wetland.
Schaghticoke Dam	4/17/1998	Dam Incident	Penstock Failure	No	Failure of the penstock. Four linear feet of the five foot diameter penstock was completely torn away (structural failure). Damage included erosion of side hill and embankment adjacent to the powerhouse, spill of lubricating oil, tipped over transformers, local power outage, flooding of the powerhouse about three to four feet with mud, and extensive damage to one of four generators.

Johnsonville Dam	10/19/2015	Dam Incident	Equipment Failure Initiating Event of Unspecified Type in the Incident Report	No	On October 29, 2015, Mr. Ian Borlang, a Compliance Manager with Brookfield Renewable Energy Group, telephoned D2SI-NYRO to report a partially inoperable low-level sluice gate at Johnsonville Dam, located on the Hoosic River, New York. Mr. Borlang stated that on October 20, 2015, personnel with Erie Boulevard Hydropower (Brookfield) notice that the low-level gate, which is designed to open 9 feet, could only open approximately 2 feet during a routine operation. The gate actuator reached the torque limit, and rather than continuing to open the gate further and risk damaging the equipment, the gate operation was stopped, the gate was lowered into the closed position, and a contractor was brought on-site on October 26, 2015, to evaluate the conditions. The contractor and the Operations Supervisor investigated the hoisting equipment and determined that the issue was below the water surface and would require dive support and additional equipment, including the fabrication of a bulkhead. Failure of this gate to operate could affect spillway capacity during a large flood event. When zero-freeboard capacity is reached, the Licensee is required to install stoplogs in a floodwall (road closure) structure, located adjacent to the left spillway abutment. The floodwall ensures that the left embankment does not overtop and thereby flood the houses located immediately downstream of the embankment. No injuries and no damage to any project works or private property were reported due to the incident. The diving crew and a crane are scheduled to be on-site beginning December 7, 2015, to evaluate the condition of the gate and, if possible at the time, remediate the gate opening issue or otherwise develop a plan for effecting repairs.

CPG members reported two additional incidents in which flooding and damage was attributed to dam failure: failure of a dam on Woods Brook caused damage and flooding in the Village of Hoosick Falls in the 1920s (this event may have contributed to a project to remove a dam and construct floodwalls in the Village completed by the US Army Corps of Engineers in 1952); and failure of another dam on the Quackenkill which caused damage in Brunswick in the 1930s.

The USACE CRREL database indicates that 41 ice jam incidents on seven different watercourses in Rensselaer County since 1925 (16 on the Hoosic River, ten on the Poesten Kill, seven on the Moordener Kill, five on the Little Hoosick River, two on the Hudson River, and one on the Sunkauissa Creek). Nine incidents have been recorded in Rensselaer County between 1996 and 2019, as detailed in Table 3a.27.

Table 3a. 27 – Ice Jam Incident Summary, 1996-2019

Date	Watercourse	Location	Description
2/22/1996	Poesten Kill	Poestenkill	Flooding and road closures
1/19/1999	Hoosic River	Buskirk	Water overflowed onto Route 103 and River Road near the Buskirk covered bridge. Ice extended from Buskirk most of the way to Eagle Bridge and was clogging parts of the river. The flood waters affected some low lying homes in the area and there was minor flooding along River Road and Route 103 near Buskirk.
3/16/2007	Hudson River	Troy	Description not in CRREL database
2/13/2008	Hoosic River	Buskirk	Description not in CRREL database
2/13/2009	Hoosic River	Eagle Bridge	Description not in CRREL database
1/13/2018	Hoosic River	Buskirk	Description not in CRREL database
1/23/2018	Sunkauissa Creek	Pittstown	Description not in CRREL database.
1/24/2019	Hoosic River	Eagle Bridge	Description not in CRREL database
1/25/2019	Hudson River	Albany	Ice jams on the Hudson River caused eight boats to become dislodged from their moorings on the Hudson River in Rensselaer County as early as 1am on 1/25/19. One unoccupied vessel, the Captain JP III, became lodged underneath the Amtrak train crossing Livingston Avenue Bridge in Rensselaer (**Photo 3a.14**). A small fleet of tugboats worked to dislodge/dock all vessels. No damages were reported to area bridges, though several bridges were forced to close during morning commuting hours because of the loose vessels.

Photo 3a. 9 – A train passes over the Captain JP III cruise ship while it is stuck under a bridge spanning the Hudson River in Albany, NY (Hans Pennink/AP)

CPG members have also reported floods due to ice jams causing damage to residential properties on the Tackawasick and South Kinderhook Creeks in the Town of Nassau. In addition, the Rensselaer County Planning Department highlighted: the City of Rensselaer (Hudson River) and Town of Schaghticoke (Johnsonville area).

The FEMA web site (www.fema.gov/disasters) documents Rensselaer County has received eight Major Disaster Declarations and one Emergency Declarations due to flooding disasters between the years of 1996 and 2018, as detailed in Table 3a.28. None of these are related to dam failure or ice jams. Almost half (4 out of 9, or roughly 44%) of the declarations are related to impacts from tropical systems (hurricanes and tropical storms). Two Major Disaster Declarations and one Emergency Declaration have been declared by FEMA since the initial hazard mitigation plan was completed in 2011.

Table 3a. 28 - FEMA Flood Disasters for Rensselaer County, 1996-2018

Disaster/ Emergency Number	Declaration Type	Event	Incident Period	Eligible Assistance for Rensselaer County[10]
DR-1095	Major Disaster Declaration	Flooding	1/19/1996 to 1/30/1996	IA and PA
DR-1296	Major Disaster Declaration	Tropical Storm Floyd	9/15/1999 to 9/18/1999	IA
DR-1335	Major Disaster Declaration	Severe Storms/Flooding	5/3/2000 to 9/14/2000)	PA
DR-1486	Major Disaster Declaration	Summer Storms	7/21/2003 to 8/11/2003	IA
DR-1589	Major Disaster Declaration	Severe Rains/Floods	4/2/2005 to 4/4/2005	IA and PA
DR-1650	Major Disaster Declaration	Severe Storms/Flooding	1/19/2006 to 1/30/2006	IA and PA
DR-4020	Major Disaster Declaration	Hurricane Irene	8/26/2011 to 9/5/2011	IA
EM-3341	Emergency Declaration	Tropical Storm Lee	9/7/2011 to 9/11/2011	PA (Category B- Emergency Protective Measures)
DR-4322	Major Disaster Declaration	Hurricane Sandy	10/27/2012 – 11/8/2012	PA (Category B- Emergency Protective Measures)

Details from a sampling of some more notable flood events in Rensselaer County since 1996 are provided below:

January 19, 1996

An intense area of low pressure which was located over the Mid-Atlantic region on Friday morning January 19th produced unseasonably warm temperatures, high dew points and

[10] Through the Public Assistance (PA) Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, Emergency Declaration protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The Individual Assistance Program (IA) provides money or direct assistance to individuals, families and businesses in an area whose property has been damaged or destroyed and whose losses are not covered by insurance. It is meant to assist with critical expenses that cannot be covered in other ways, rather than to restore damaged property to its condition before the disaster.

strong winds. This resulted in rapid melting of one to three feet of snow. In addition to the rapid snowmelt one to three inches of rain fell as the system moved northeast along the coast. This resulted in widespread flooding across Rensselaer County. Small streams flooded across the entire county which resulted in several road washouts. Extensive flooding also occurred along the Hudson and Hoosic Rivers. The hardest hit areas within the county were East Greenbush and the Cities of Troy and Rensselaer. In the City of Troy extensive damage occurred along the Hudson River where fifteen businesses were flooded. Some of the businesses included Troy Brew Pub, Castaway Grille, City Hall, Taylor Apartments and a submerged mobile home park in Lansingburgh. Severe damage also occurred to the city marina and Riverfront Park. At Leonard Hospital located in Lansingburgh, 50 patients were evacuated due to basement flooding. In Castleton several residents were evacuated and route 9J near Castleton was closed due to flooding. This event resulted in Federal Disaster Declaration DR-1095. The NCEI Database records $6 million in damages in Rensselaer County as a result of this event.

Photo 3a. 10 – Flooding in Troy, January 1996 (RCBPS)

Photo 3a. 11 – Flooding in Lansingburgh, January 1996 (RCBPS)

February 22, 1996 – Ice Jam Flooding

The NWS reported an ice jam on the Poesten Kill in Poestenkill, New York flooded Plank Road on 2/22/96. Two more ice jams were reported on the creek between Fifty Six Road and Cropsey Road in Poestenkill. Plank Road (Route 40) was closed from Barbersville to the hamlet of East Poestenkill due to several washed out sections. Twenty-five families were also evacuated along Plank Road as several homes were flooded. By February 24, the jams were decreasing in size and water receded to within its banks.

June 8, 1996

A stationary front which extended across eastern New York on June 9 produced isolated severe thunderstorms and flooding. In northern Rensselaer County training showers and thunderstorms resulted in flash flooding when approximately 6 inches of rain fell during the late afternoon. Dirt roads were washed out in Pittstown, Raymertown and Boyntonville. Homes were evacuated and flooded in Pittstown and Boyntonville. Around 20 families were evacuated at Pittstown in the County Acres Trailer Park. Three hundred thousand dollars in damages is recorded for this event in the NCEI database.

Photo 3a. 12 – East Road in Stephentown; July 29, 2009. (RCBPS)

January 8, 1998

From January 8 to January 12, the Hudson River flooded from its headwaters to where it crosses into Greene and Columbia Counties, due to a combination of significant rain and snowmelt. In Rensselaer County, flooding occurred along Riverfront Park behind City Hall and in low lying areas especially in Lansingburgh. Approximately 34 homes in the City of Troy sustained flood damage. Several roads were flooded elsewhere in the county. The Hoosic River in northern Rensselaer also flooded, due to a combination of significant rain and snowmelt. The river crested approximately one foot over flood stage at Eagle Bridge during the morning of January 9. Flooding occurred along State Highways 7 and 22 in Rensselaer County. County Highway 103 was also flooded from Route 67 to the covered bridge. The Hoosic River spilled into the Buskirk Fire House and Circuit Materials Plant. A total of $815,000 in damages is included in the NCEI record for this event.

January 19, 1999 – Ice Jam Flooding

An ice jam occurred on the Hoosic River at Buskirk. As a result of this ice jam, and also rain and snowmelt, water overflowed onto Route 103 and River Road near the Buskirk covered bridge. Ice extended from Buskirk most of the way to Eagle Bridge and was clogging parts of the river. The flood waters affected some low lying homes in the area and there was minor flooding along River Road and Route 103 near Buskirk.

Photo 3a. 13 – Ice jam at the Buskirk Covered Bridge; date unknown. (Richard Clayton Photography)

September 16, 1999

Tropical Storm Floyd: Declared Disaster DR-1296. The storm brought both high winds and exceptionally heavy rainfall to eastern New York, which included 6.12 inches at nearby Albany Airport. Widespread flooding was reported across the region. Total damages for this event as recorded in the NCEI storm events database are $1,500,000.

July 15-16, 2000

This event occurred during a pattern of severe weather in the summer of 2000, resulting in Federal disaster declaration DR-1335. Severe storms caused flooding throughout the county. A state of Emergency was declared in the City of Rensselaer. The worst hit area in the city was The Hollow where many places were flooded. A man had to be evacuated by boat from his house. The City's pumping equipment was damaged. Rapid movement of water uprooted trees and severe flood damage resulted in the loss of power, natural gas, and water to many streets in Rensselaer. Roads also flooded in Schodack and were closed in Nassau. Six roads were impassable in East Greenbush and several homes were endangered by rising water. The Village of Castleton noted street and sidewalk washouts throughout the Village, mostly in hilly areas. Damages of $235,000 are recorded in the NCEI database for this event in Rensselaer County.

February 13, 2003 – Ice Jam Flooding

An ice jam obstructed the flow of water in the Hoosic River, causing the water to back up behind the jam and overflow the banks of the river near the Buskirk Bridge. The water flowed through a cornfield and affected several buildings. Heavy rain exacerbated this situation. The ice jam resulted in flooding on County Route 103.

October 9, 2005

Moderate flooding occurred along the Hoosic River at Eagle Bridge. Roads were reported to be flooded at Buskirk, and several evacuations were made. There were two fatalities at Hoosick Falls. A 6-year-old boy accidently fell into the river and drowned. A 39-year-old man drowned while trying to save him.

Photo 3a. 14 – Hoosic River flooding in Buskirk, 2005 (Richard Clayton Photography).

Photo 3a. 15 – Hoosic River flooding in Buskirk, 2005 (Richard Clayton Photography).

August 11, 2008

Very heavy rainfall from strong thunderstorms led to significant urban and small stream flash flooding in and near the City of Rensselaer. This was due to a microburst, and

approximately three inches of rain fell in a relatively short period of time in Rensselaer County. A State of Emergency was declared in the City of Rensselaer as numerous roads were closed, with six or more feet of standing water reported on city streets. Evacuations of 50 to 75 homes occurred due to the flooding. Flooding was mainly concentrated along and near the banks of Quackenderry Creek, as well as near Mill Creek. The Amtrak Station in Rensselaer was also closed due to the flooding. Flash flooding also closed Routes 9 and 20, a portion of Route 151, and Luther Road, in East Greenbush. The NCEI database records $4M in damages in Rensselaer County from this event.

July 29, 2009

Significant flash flooding occurred in central and southern Rensselaer County Wednesday afternoon and evening, as a result of training thunderstorms which produced excessive rainfall and caused Kinderhook Creek to overflow its banks. Numerous roadways and bridges were closed, some of which were washed out. The hardest hit areas included, but were not limited to, Nassau, Stephentown, Schodack, and Sand Lake. In Nassau, a state of emergency was declared, and State Route 43 between Pikes Pond Road and Reno Road was closed due to flooding. In Stephentown, the bridge at State Route 22 and Provost Road was deemed unsafe, resulting in the closure of a portion of Route 22. In addition, flooding closed a portion of South Stephentown Road between Garfield Road and Andrews Lane. In Sand Lake, Bauer Road was closed due to a bridge washout. In Schodack, Clove Road off State Route 43 was closed to due flooding. Roads were flooded on Route 22 in Stephentown.

Photo 3a. 16 – Stephentown Firehouse, July 29, 2009 (David Flint).

Photo 3a. 17 – Flooding on Route 22 in Stephentown, July 2009 (alloveralbany.com).

August 11, 2011

Tropical Storm Irene brought heavy to extreme rainfall and widespread flash flooding and river flooding across eastern New York. Portions of Route 43 in West Sand Lake were reported closed due to flooding, including between Geiser Road and Mammouth Spring Road, and between Route 150 and Route 351. Route 9J in Castleton-on-Hudson was closed due to flooding between Knickerbocker Road and Brickyard Road. Route 2 was closed across Rensselaer County due to numerous reports of flooding and some wash outs. The Poesten Kill and Quacken Kill run along and cross Route 2. In Troy, a mudslide occurred on Route 2 (Brunswick Road) at Route 66 (Pawling Avenue) causing a house to collapse, two other houses to be knocked from their foundations by about 8 feet, and the destruction of an automobile shop. A home was destroyed in Poestenkill on Franklin Street by flood waters from the Poesten Kill. Route 7 across Rensselaer County was closed due to numerous reports of flooding. Major flooding occurred on the Hoosic River. Route 103 in Buskirk was reported flooded approximately one mile south of Route 67. Route 136, Whiteview Road, in Wynantskill was closed at Brookside Avenue due to flooding. Route 22 in Petersburgh was closed due to flooding and a washout between Smith Road and Church Hollow Road. Portions of Route 20 were reported closed due to flooding, including at Route 9 in the Town of Schodack, and between Lords Hill Road and Coldwater Tavern Road in Nassau. Wynantskill Creek was reported flowing out of its banks with water on Thais Road at the intersection of Springer Road. Route 66 in Wynantskill was reported closed due to flooding.

Photo 3a. 18 – Flooding in Troy after Hurricane Irene, August 2011 (alloveralbany.com).

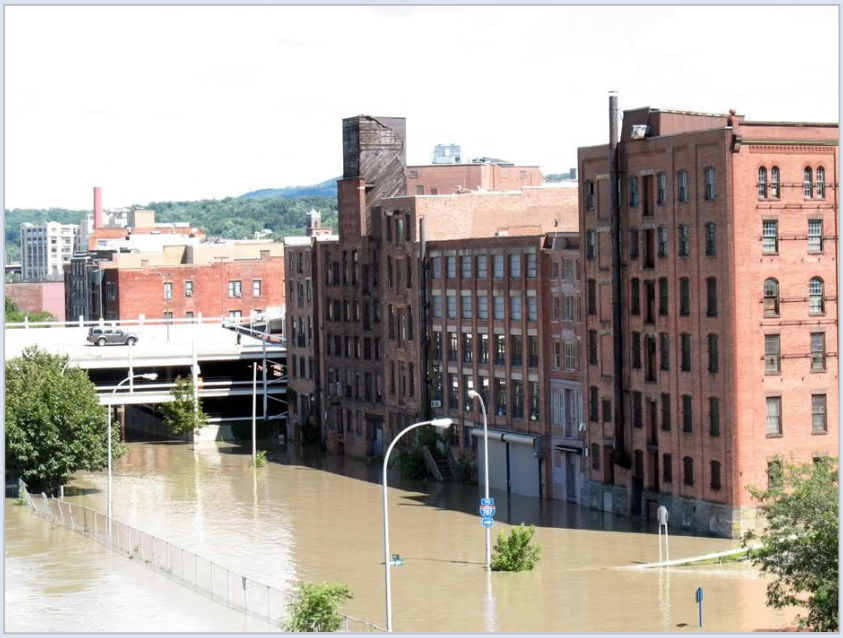


Photo 3a. 19 – Flooding in Troy after Hurricane Irene, August 2011 (alloveralbany.com).

June 25, 2014

Heavy rain led to flash flooding on North Street in Valley Falls. Rapid runoff led to the erosion of the ground beneath a 100 year old, two-apartment house. The home's owner estimated that about 300 cubic yards of land was lost beneath the home in about a five minute period. Although the home's foundation remained intact, a small porch lost all the ground underneath it. Ten thousand dollars in damages are identified in the NCEI event record.

Photo 3a. 20 – Flood damage on River Road in Melrose, June 2014 (timesunion.com)

Photo 3a. 21 – Flood damaged home on North Street in Valley Falls, June 2014 (timesunion.com)

July 1, 2017

A creek flooded over Cooksboro Road in Raymertown. One lane of Route 7 was washed out in two places between the Hoosic River and Potter Hill. The shoulder was washed out in places as well. This resulted in a 20-mile road closure from Brunswick to the Vermont state line. Portions of County Routes 95 and 103 were also closed in the Town of Hoosick. Tamarac Road was closed with water running over the road. Severe flooding occurred in the Village of Hoosick Falls as heavy rain resulted in a partial collapse of the culvert (Woods Brook flood protection system). A nearby rain gauge reported 1.63 inches of rain in an hour, and an additional 1.23 inches in the next two hours. The brook spilled out of its banks and coursed through the village, causing water and debris to rush into yards and residences. Numerous houses reported basement flooding, with a few reporting flooding on the first floor, leading to evacuations. Three sinkholes developed, one the size of two tractor trailers. Several roads remained closed well into the following day, and flood waters washed out a portion of the train tracks that pass through the village. A local state of emergency was declared. The Village of Hoosick Falls was hit particularly hard by flash flooding, with many residences experiencing basement and first-floor flooding and several roads washed out as Woods Brook overwhelmed its flood protection system and coursed through the town. A state of emergency was declared for the village, where an estimated $300,000 in damage occurred.

Photo 3a. 22 - Flooding on Hall Street, Hoosick Falls - July 2017

Historical Summary of Insured Flood Losses

Floods have occurred in Rensselaer County's communities in the past and will continue to do so in the future. Rensselaer County and its component municipalities have generally been impacted by riverine flooding and shallow flooding. A picture of the flooding history of Rensselaer County in terms of damage to private property over the last several decades or so can be derived from the recorded flood losses and payments data under FEMA's National Flood Insurance Program (NFIP).

All communities in Rensselaer County are susceptible to flooding and have FEMA mapped floodplains. According to the latest FEMA flood insurance records[11], there are 944 active flood insurance policies in Rensselaer County. Insurance In Force is more than $171 million and Premiums In Force are approximately $1.6 million. There have been 535 flood losses reported through the NFIP since 1972, totaling $7,998,879 in claims payments, or more than $173,889 per year. Of the County's 22 municipalities, 21 participate in the NFIP and are in good standing in the program[12]. The position title of the Floodplain Administrator (the person responsible for ensuring that development activities comply with floodplain management ordinances and NFIP regulations) for each jurisdiction is included in each Jurisdictional Annex.

Under the NFIP's Community Rating System (CRS), communities that implement floodplain management actions that go beyond the minimum requirements of the NFIP are eligible to apply for discounts on flood insurance premiums for their policyholders. No Rensselaer County communities are presently participating in the CRS[13].

This data is presented in **Table 3a.29** along with the total number of current policies, the total coverage values, and key dates associated with the municipalities' participation in the NFIP. All data in **Table 3a.29** is current as of September 30, 2018 as accessed on February 21, 2019. Actual flood losses are likely to be higher than insured flood losses shown in the table, since this value only includes NFIP payouts and does not include losses incurred by non-policy holders, losses for which a claim was not submitted, losses for which payment on a claim was denied, or other uncovered losses.

The average NFIP payment for the County overall was $14,951 per individual loss – ranging from a minimum of $324 in the Village of Valley Falls to a maximum of $33,419 per loss in the Village of Nassau. Six communities contribute 90 percent of all NFIP payments in the County (Town of Nassau- $3,000,835; City of Troy- $2,219,294; Village of Nassau $802,056; Village of Hoosick Falls $488,318; City of Rensselaer-$382,194; and the Town of Poestenkill-$320,694). Approximately 65 percent of all NFIP payments in Rensselaer County have occurred in just two

[11] Source: FEMA Policy and Claims Data accessed 02/21/19, current as of 09/30/18.

[12] As per FEMA's Community Status Book of participating communities accessed 02/21/19. The Village of Valley Falls is presently suspended.

[13] As per the FEMA's list of Community Rating System Eligible Communities accessed 02/21/19.

communities (the Town of Nassau and the City of Troy).

Table 3a. 29 – FEMA NFIP Policy and Claim Information for Rensselaer County

Community Name	Community Number	Date Entered NFIP	Current Effective FIRM Date*	Policies In Force	Insurance in Force ($)	Total Number of Losses	Total Claims Paid ($)
Berlin, Town of	360672#	08/17/1979	08/17/1979	8	$2,394,000	1	$0
Brunswick, Town of	361130#	06/04/1980	12/06/2000	25	$4,135,500	9	$112,703
Castleton-on-Hudson, Village of	360673#	11/15/1984	11/15/1984	16	$2,299,100	18	$45,111
East Greenbush, Town of	361133#	03/18/1980	03/18/1980	21	$5,904,900	5	$5,455
East Nassau, Village of	360257#	10/05/2007	09/05/1984	0	$0	0	$0
Grafton, Town of	361150#	10/13/1978	10/13/1978	4	$664,000	0	$0
Hoosick Falls, Village of	360674#	05/16/1980	01/06/2016	8	$2,105,400	21	$488,318
Hoosick, Town of	361154	08/01/1987	01/06/2016	7	$2,694,000	7	$34,366
Nassau, Town of	361155#	09/05/1984	09/05/1984	29	$6,188,300	97	$3,000,835
Nassau, Village of	360675	08/11/1978	05/18/1979	3	$630,600	24	$802,056
North Greenbush, Town of	361164#	06/18/1980	06/18/1980	45	$9,295,600	16	$112,566
Petersburgh, Town of	361165#	09/01/1978	09/01/1978	5	$860,700	6	$17,093
Pittstown, Town of	361166#	02/01/1988	01/06/2016	10	$1,175,000	5	$58,262
Poestenkill, Town of	360676#	09/02/1981	09/02/1981	20	$3,624,800	14	$320,694
Rensselaer, City of	361032#	03/18/1980	03/18/1980	113	$16,591,400	64	$382,194
Sand Lake, Town of	361167#	05/15/1980	05/15/1980	31	$7,737,000	11	$63,141
Schaghticoke, Town of	361168#	07/16/1984	01/06/2016	36	$5,714,600	33	$270,668
Schaghticoke, Village of	361058#	06/11/1982	01/06/2016	0	$0	0	$0
Schodack, Town of	361169#	08/15/1984	08/15/1984	29	$6,314,800	8	$65,478
Stephentown, Town of	361170#	08/03/1981	08/03/1981	12	$2,855,500	1	$0
Troy, City of	360677#	03/18/1980	03/18/1980	522	$90,129,000	193	$2,219,294
Valley Falls, Village of	361469#	01/17/2016(S)	01/06/2016	0	$0	2	$647
Total:				944	$171,314,200	535	$7,998,879

Repetitive Flood Losses

The NFIP tracks Repetitive Loss (RL) properties, which are NFIP-insured properties that, since 1978 and regardless of any changes in ownership during that period, have experienced any of the following:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property

FEMA Region 2 RL data for Rensselaer County was provided by NYSDHSES on 05/21/2019, Rensselaer County has 23 RL properties located in eight municipalities. Roughly half are located

in the City of Rensselaer and City of Troy. Of the 23 properties, 17 are single-family residential homes, two are other residences (2- to 4-family residences and condominiums), and four are non-residential. These properties are associated with a total of 68 losses and $1,536,791 in claims paid. Table 3a.30 provides a summary of RL properties in Rensselaer County.

Table 3a. 30 – Repetitive Losses in Rensselaer County

Type of Property	Number of Repetitive Loss Properties
Residential	17
Other Residential *	2
Non-residential	4
Total Properties:	23
Number of RL Losses:	68
Amount of RL Claims Paid:	$1,536,791

Source: FEMA Region 2 via NYSDHSES, as received on 05/21/2019
* 2- to 4-family residences and condominiums

Table 3a.31 presents information about each property on the RL list. The average repetitive loss property in Rensselaer County has experienced 2.96 loss events, with an average paid claim of approximately $22,600 for each event. **The RL data suggests that 19% of all the NFIP payments in Rensselaer County may be attributable to just 2% of insured properties in the County** (depending on how many of these properties remain insured by the NFIP).

Table 3a. 31 – NFIP Repetitive Loss Properties in Rensselaer County					
Municipality	**Property Type**	**Flood Hazard Zone**	**Number of Losses**	**Total Claims Paid**	**Average Claims Paid**
Brunswick, Town of 1 RLP	Single Family	C	2	$24,379	$12,189
	Subtotal, Town of Brunswick:		2	$24,379	$12,189
Hoosick Falls, Village of 3 RLPs	Single Family	AE	5	$119,429	$23,886
	Single Family	X	4	$88,080	$22,020
	Single Family	X	3	$84,884	$28,295
	Subtotal, Village of Hoosick Falls:		12	$292,393	$74,201
Hoosick, Town of 1 RLP	Single Family	A	5	$93,481	$18,696
	Subtotal, Town of Hoosick:		5	$93,481	$18,696
Poestenkill, Town of 1 RLP	Single Family	A	2	$86,034	$43,017
	Subtotal, Town of Poestenkill:		2	$86,034	$43,017
Rensselaer, City of 6 RLPs	Single Family	A12	2	$9,784	$4,892
	Single Family	A11	3	$8,138	$2,713
	Single Family	AE	3	$21,858	$7,286
	Single Family	A05	3	$18,793	$6,264
	Single Family	C	2	$73,830	$36,915
	Single Family	A05	4	$29,599	$7,400
	Subtotal, City of Rensselaer:		17	$162,002	$65,470
Sand Lake, Town of 2 RLPs	2-4 Family	A12	2	$9,420	$4,710
	Nonresidential	A04	2	$10,123	$5,061
	Subtotal, Town of Sand Lake:		4	$19,543	$9,771
Schaghticoke, Town of 4 RLPs	Single Family	X	2	$10,058	$5,029
	Single Family	A	8	$61,669	$7,709
	Single Family	A10	2	$58,296	$29,148
	Single Family	A	2	$30,016	$15,008
	Subtotal, Town of Schaghticoke:		14	$160,039	$56,894
Troy, City of 5 RLPs	2-4 Family	A11	2	$19,101	$9,551
	Nonresidential	A12	3	$428,819	$142,940
	Other Residential	A11	2	$20,351	$10,176
	Nonresidential	B	3	$206,759	$68,920
	Nonresidential	A11	2	$23,892	$11,946
	Subtotal, City of Troy:		12	$698,922	$243,533
Total, Rensselaer County: 23 RLPs			**68**	**$1,536,791**	**$22,600**
Rensselaer County, All NFIP Policyholders 944 Policies			535	$7,998,879	$14,951

The approximate location of RL property areas throughout Rensselaer County is presented in Figures 3a.13 through Figure 3a.18. These figures are intended to illustrate the general extent of areas in which RL properties are particularly concentrated, to act as pointers to areas where flooding of structures may be the most severe. It is possible that in these areas there also exist other properties that suffer significantly from flooding but, for a variety of possible reasons do not meet RL criteria or have not participated in the NFIP, and which may also benefit from mitigation actions. More specific data regarding the exact locations of these structures is subject to the 1974 Privacy Act. This legislation prohibits the public release of any information regarding individual NFIP claims or information which may lead to the identification of associated individual addresses and property owners. However, while this information is not available to the general public, municipal authorities have access to comprehensive RL property data directly from FEMA Region 2 for the purposes of targeted mitigation of RL areas or individual RL structures, on the condition that all such data is treated as strictly confidential and the required privacy procedures are strictly followed.

Figure 3a. 13 – Repetitive Loss Claims Paid by Municipality

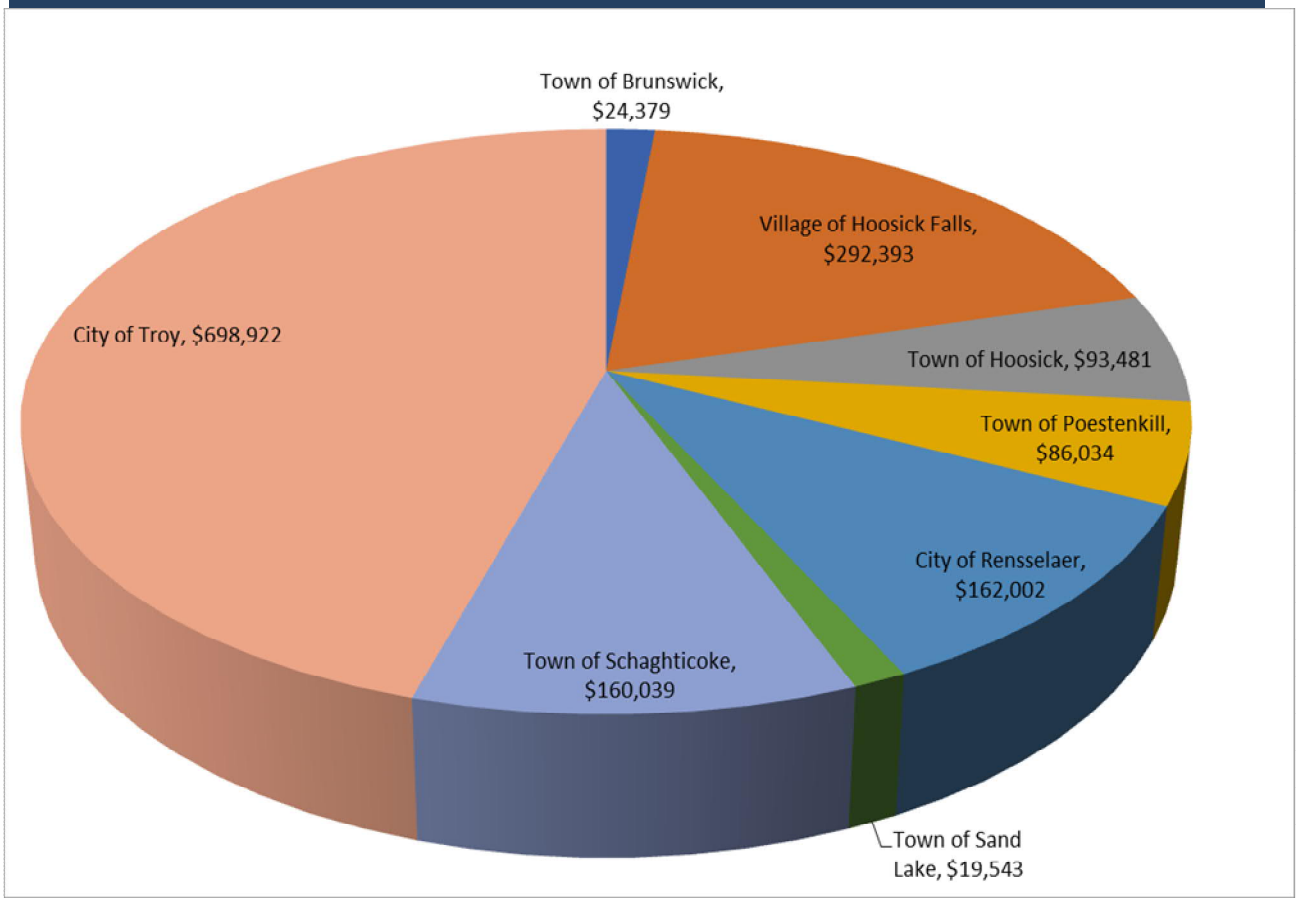
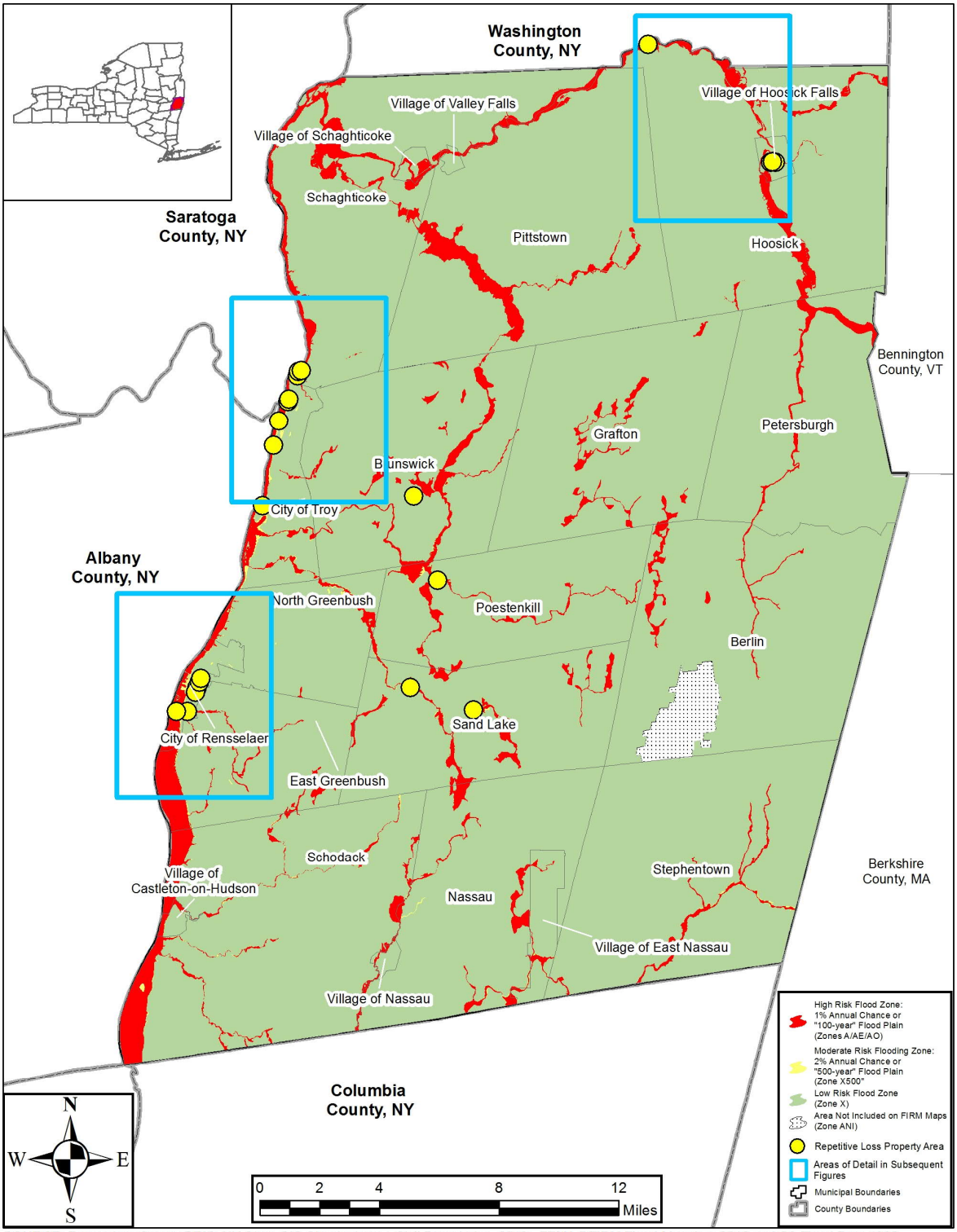
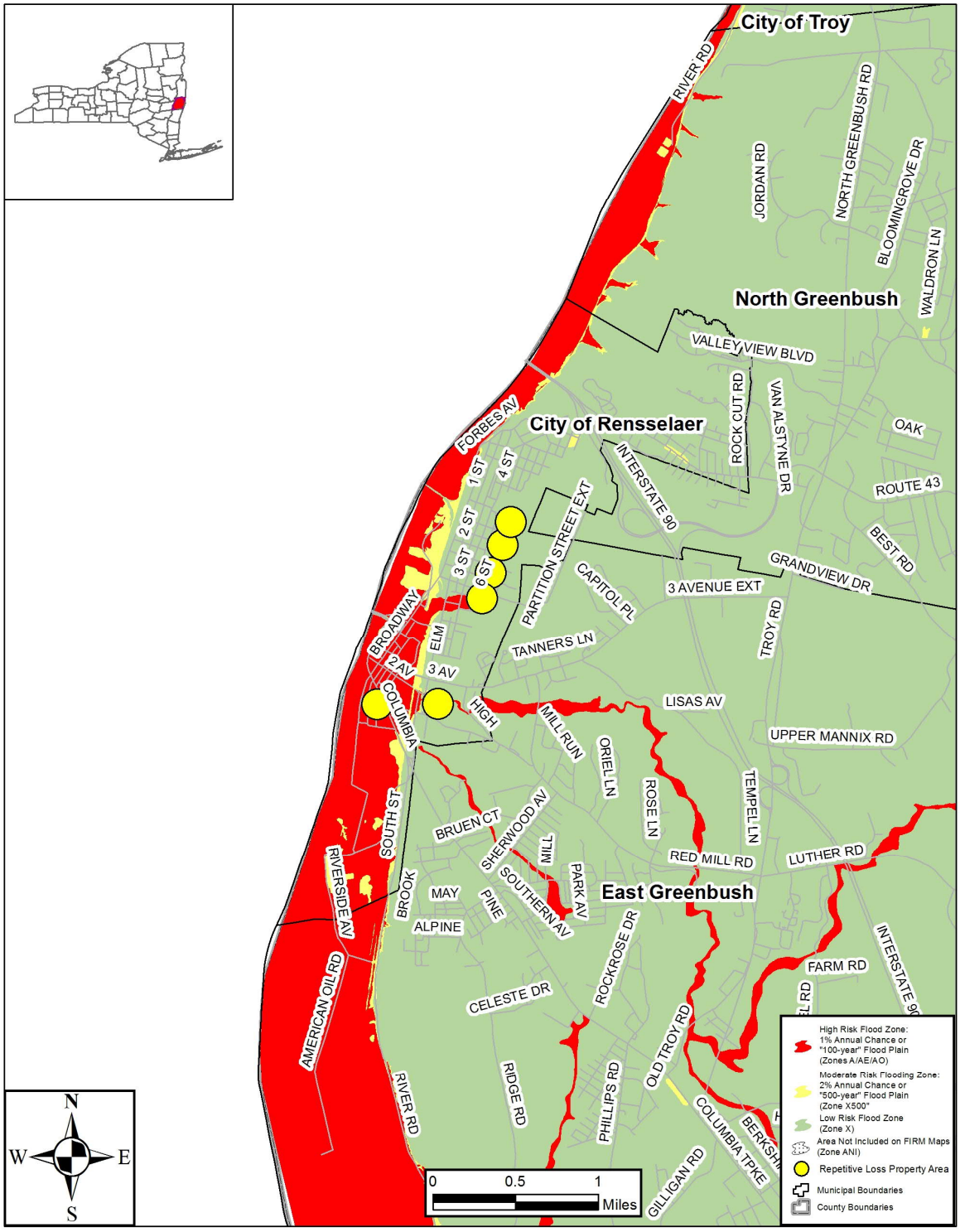


Figure 3a. 14 - NFIP Repetitive Loss Areas, Rensselaer County



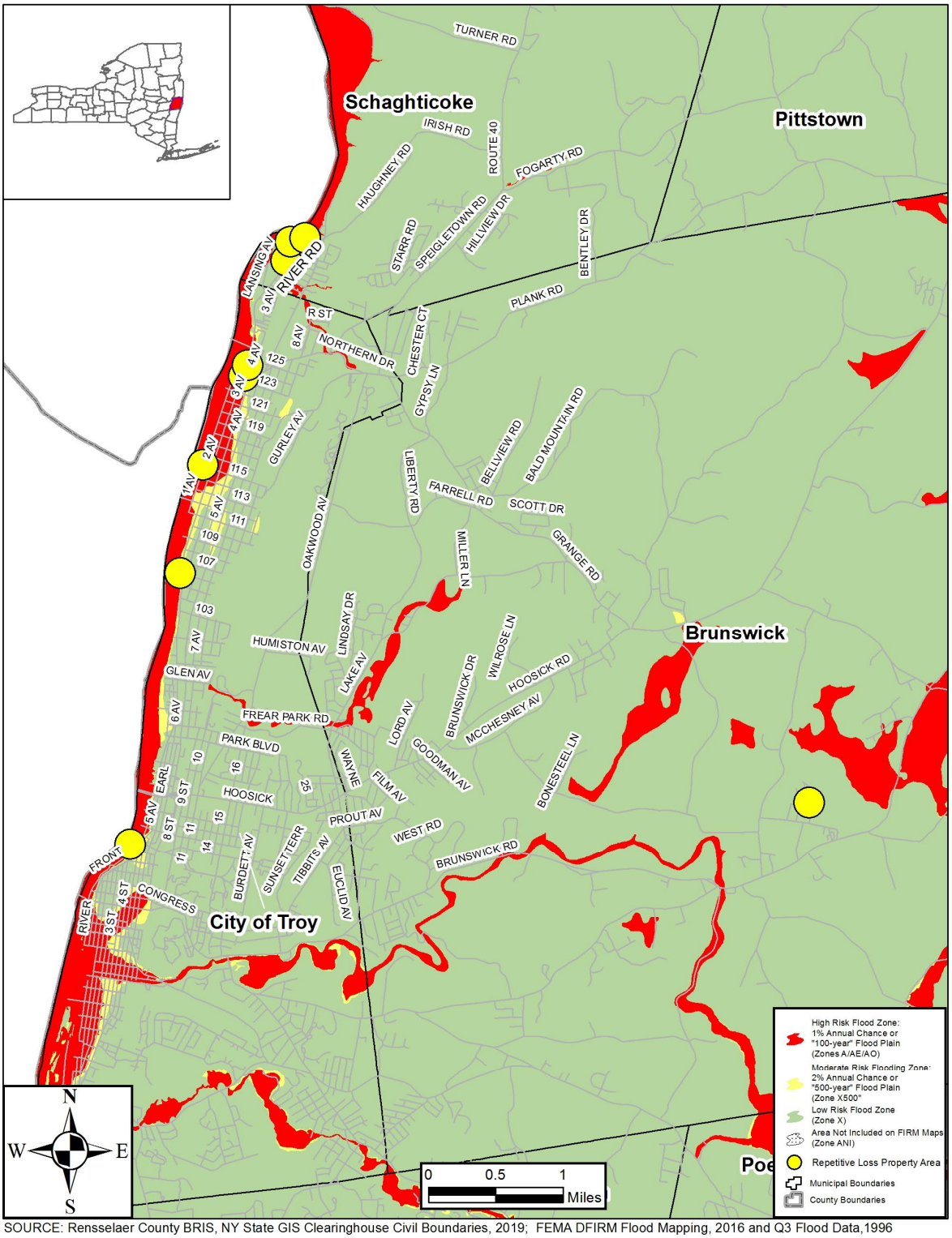
SOURCE: Rensselaer County BRIS, NY State GIS Clearinghouse Civil Boundaries, 2019; FEMA DFIRM Flood Mapping, 2016 and Q3 Flood Data,1996

Figure 3a. 15 - NFIP Repetitive Loss Areas, City of Rensselaer



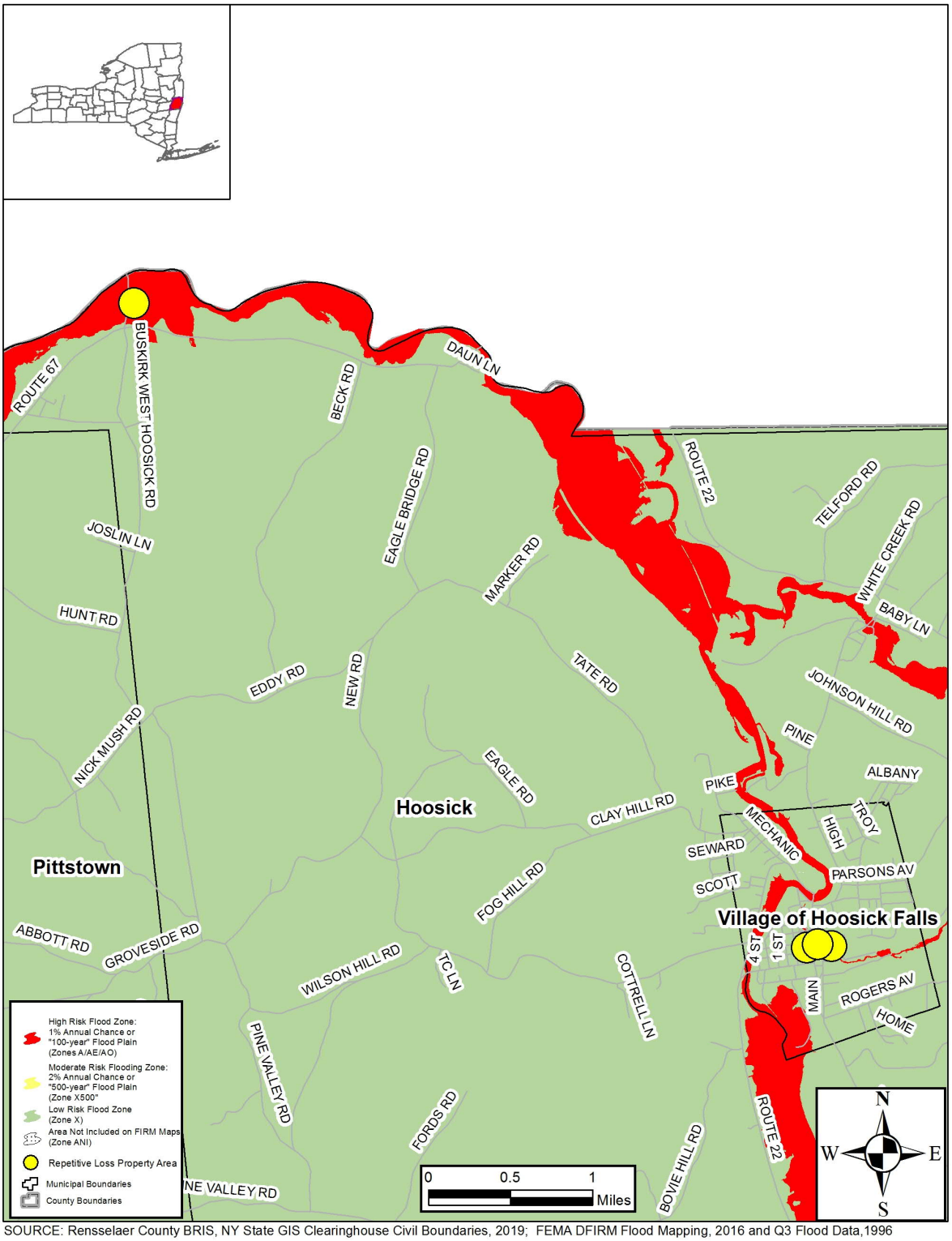
SOURCE: Rensselaer County BRIS, NY State GIS Clearinghouse Civil Boundaries, 2019; FEMA DFIRM Flood Mapping, 2016 and Q3 Flood Data,1996

Figure 3a. 16 - NFIP Repetitive Loss Areas (Brunswick, Troy, Town of Schaghticoke)



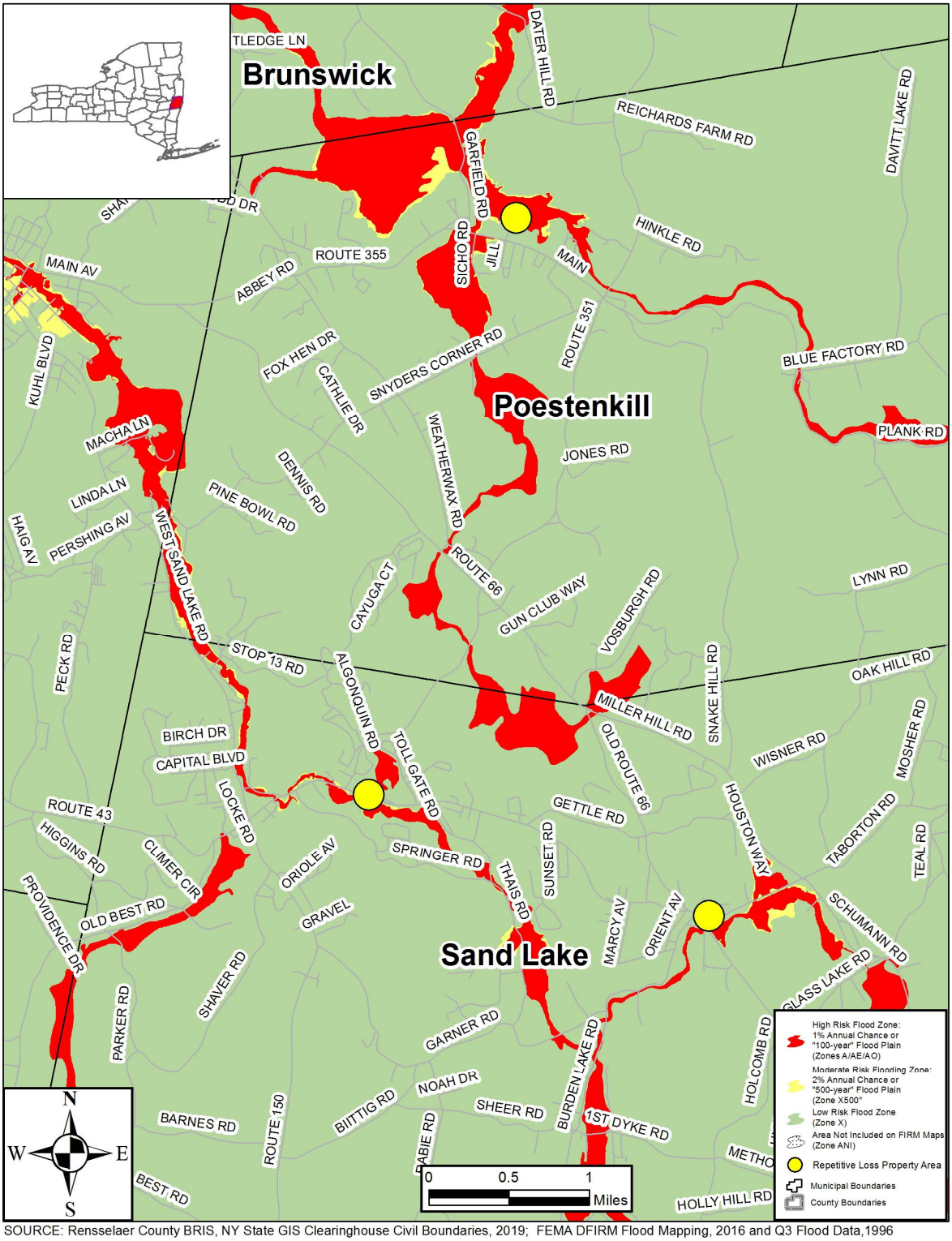
SOURCE: Rensselaer County BRIS, NY State GIS Clearinghouse Civil Boundaries, 2019; FEMA DFIRM Flood Mapping, 2016 and Q3 Flood Data,1996

Figure 3a. 17 - NFIP Repetitive Loss Areas, Village of Hoosick Falls and Town of Hoosick



SOURCE: Rensselaer County BRIS, NY State GIS Clearinghouse Civil Boundaries, 2019; FEMA DFIRM Flood Mapping, 2016 and Q3 Flood Data,1996

Figure 3a. 18 - NFIP Repetitive Loss Areas, Poestenkill and Sand Lake



SOURCE: Rensselaer County BRIS, NY State GIS Clearinghouse Civil Boundaries, 2019; FEMA DFIRM Flood Mapping, 2016 and Q3 Flood Data,1996

Severe Repetitive Flood Losses

The NFIP also tracks Severe Repetitive Loss (SRL) properties, which are NFIP-insured properties that, since 1978 and regardless of any changes in ownership during that period, have experienced any of the following:

- 4 or more separate claim payments have been made under a Standard Flood Insurance Policy issued pursuant to this title, with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or
- At least 2 separate claims payments have been made under a Standard Flood Insurance Policy, with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss.

FEMA Region 2 SRL data for Rensselaer County was provided by NYSDHSES on 05/21/2019. Rensselaer County has 1 SRL property, located in the Village of Hoosick Falls. This property is a single-family home. Flash flooding from Woods Brook has been a problem in the Village. Table 3a.32 provides a summary of RL properties in Rensselaer County.

Table 3a. 32 – NFIP Severe Repetitive Loss Properties in Rensselaer County

Type of Property	Number of Severe Repetitive Loss Properties
Residential	1
Other Residential *	0
Non-residential	0
Total Properties:	1
Total Claims Payouts:	$119,429

Source: FEMA Region 2 via NYSDHSES, as received on 05/21/2019
* 2- to 4-family residences and condominiums

Neighboring properties to this SRL are on the RL list. This area would be a particularly favorable candidate for a hazard mitigation project (i.e., acquisition, elevation) depending on the level of homeowner interest.

Probability and Climate Change – Flooding

Flooding has a long and well-documented history of frequent occurrence throughout Rensselaer County and the probability of future flood events in Rensselaer County is certain. It is estimated that Rensselaer County will continue to experience direct and indirect impacts of flooding annually. With 54 floods in the last 22 years (1996 to 2018), the probability of future events is 2.5 events per year or greater than a 100 percent chance of flooding in any given year.

Due to the nature of the terrain and the climate in Rensselaer County, ice jams are essentially certain to occur in the future, although whether or not such events will cause significant damage is less easy to predict, since detailed records of actual damage caused by ice jams are scarce. The probability of ice jam flooding is lower than the probability of flooding overall; with eight recorded ice jam flood events in the last 22 years (0.36 events per year) and, based on historic occurrences, may be more likely to occur along the Hoosic River, Poesten Kill, Moordener Kill, Little Hoosick River, and the Hudson River.

The probability of a dam failure occurrence in Rensselaer County is relatively low due to routine inspection, repair and maintenance programs carried out by the NYSDEC, which serves to ensure the safety and integrity of dams in New York and, thereby, protect people and property from the consequences of dam failures. However, the possibility of a future failure event is likely increasing due to aging dam structures that may be in need of repair or reconstruction, and occasional problems related to private dam owners' degree of cooperation with State regulatory agencies.

The 2019 SHMP concludes that given the history of occurrences, climate change, and sea level rise, it is probable that flood hazard events will become more frequent throughout New York State.

Know Your Risk

The probability of occurrence of a flood at a given location is expressed in percentages as the chance of a flood of a specific magnitude occurring in any given year. The "100-year flood" has a one percent chance of occurring in any given year. The 100-year flood is often also referred to as the "base flood". One hundred year floods do not reoccur only once every 100 years; in reality, a 100-year flood can happen multiple times in a single year, or not at all for more than 100 years. Smaller floods, with magnitudes of 10-years or 50-years for example, are also possible within the 100-year floodplain. These are not as deep or as widespread as a 100-year flood would be, however, they are much more likely to occur. In any given year, a property in the 100-year floodplain has a 10 percent chance of being flooded by a 10-year flood, and a one percent chance of being flooded by a 100-year flood. This may not sound particularly risky at first glance. However, over a 30–year period, that same location has a 96 percent chance of being flooded by a 10-year flood and a 26 percent chance of being flooded by a 100-year flood.

WHAT ARE THE ODDS OF BEING FLOODED?

The term "100-year flood" has caused much confusion for people not familiar with statistics. Another way to look at flood risk is to think of the odds that a 100-year flood will happen sometime during the life of a 30-year mortgage—a 26% chance for a structure located in the SFHA.

Chance of Flooding over a Period of Years

Time Period	Flood Size 10-year	25-year	50-year	100-year
1 year	10%	4%	2%	1%
10 years	65%	34%	18%	10%
20 years	88%	56%	33%	18%
30 years	96%	71%	45%	26%
50 years	99%	87%	64%	39%

Even these numbers do not convey the true flood risk because they focus on the larger, less frequent, floods. If a house is low enough, it may be subject to the 10- or 25-year flood. During a 30-year mortgage, it may have a 26% chance of being hit by the 100-year flood, but the odds are 96% (nearly guaranteed) that it will be hit by a 10-year flood. Compare those odds to the only 1-2% chance that the house will catch fire during the same 30-year mortgage.

GEOLOGIC HAZARDS

Earthquake

Countywide Statistics:

Earthquake	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	0
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.0
Daily Probability	0.00%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NYSHMP 2019

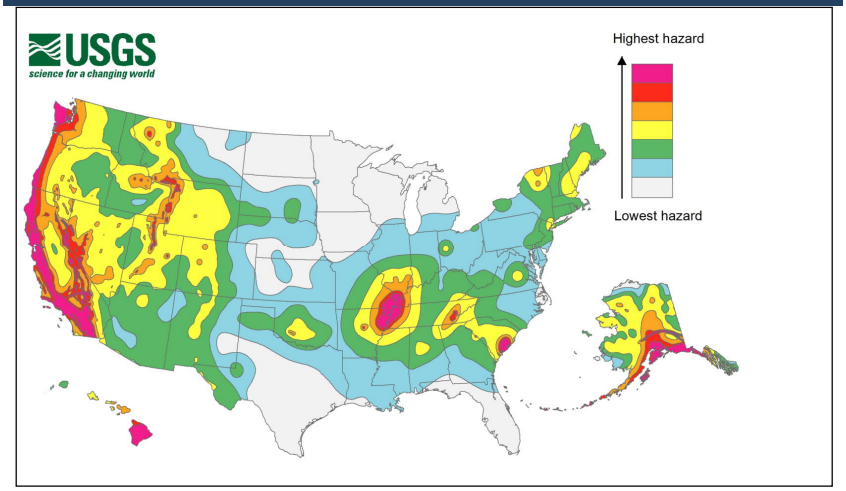
Description – Earthquake

The 2019 SHMP defines the term “earthquake” as a sudden, rapid shaking of the ground caused by the breaking and shifting of rock beneath the Earth's surface. According to the USGS Earthquake Hazards Program, most earthquakes (approximately 90%) occur at the boundaries where the plates meet, although it is possible for earthquakes to occur entirely within plates. New York State is not on a seismically active fault line, and Rensselaer County is significantly distant from any plate boundaries. Regardless of where they are centered, earthquakes can impact locations at – and well beyond – their point of origin. They are often accompanied by “aftershocks” – secondary quakes in the earthquake sequence. Aftershocks are typically smaller than the main shock, and can continue over a period of weeks, months, or years from the main shock. In addition to the effects of ground shaking, earthquakes can also cause landslides and liquefaction under certain conditions. Liquefaction occurs when unconsolidated, saturated soils exhibit fluid-like properties due to intense shaking and vibrations experienced during an earthquake. Together, ground shaking, landslides, and liquefaction can damage or destroy buildings, disrupt utilities (i.e., gas, electric, phone, water), and sometimes trigger fires.

Location – Earthquake

The 2019 SHMP states that the potential for earthquakes exists entire northeastern side of the United States including New York State. Rensselaer County is mapped in a region of low earthquake hazard and earthquakes could potentially affect any of Rensselaer County's communities. Figure 3a.19 shows relative seismic risk for the United States.

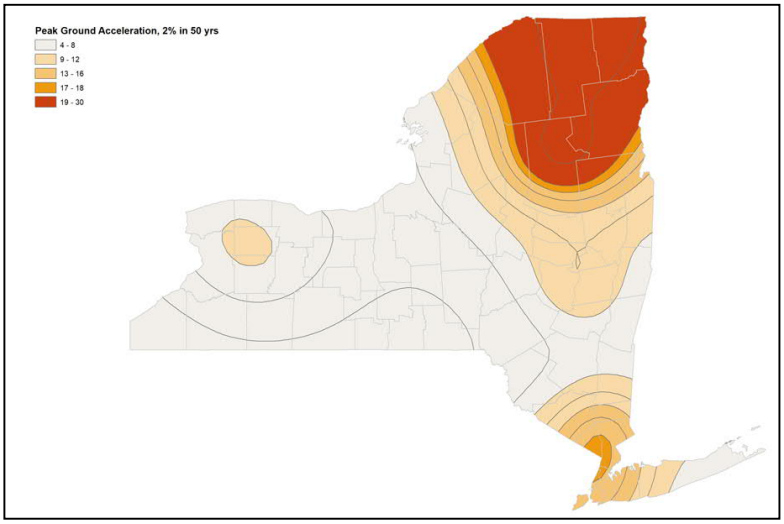
Figure 3a. 19 - United States Earthquake Hazard Map



Source: USGS, 2014
https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_lg.jpg

The USGS 2014 seismic hazard map of New York State shows the Peak Ground Acceleration (PGA) with a 2% probability of exceedance in 50 years for Rensselaer County as 4-8% of gravity for the majority of the county, and 9-12% for the western side (see Figure 3a.20).

Figure 3a. 20 - Earthquake Hazard Map of New York State



Source: 2019 SHMP

Extent – Earthquake

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is a quantification of the energy release of an earthquake at its source, as determined by seismographs. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. A detailed description of the MMI Scale of earthquake intensity and its corresponding magnitude is given in Table 3a.33.

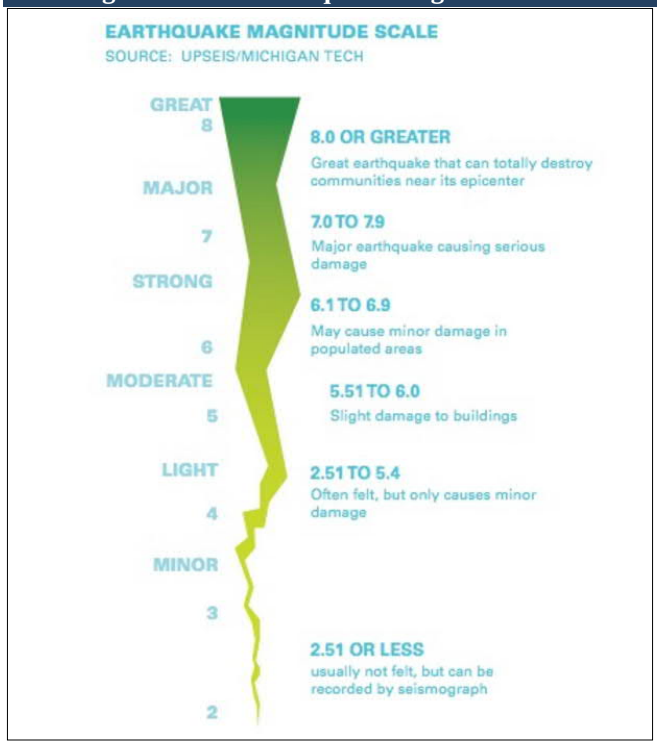
Table 3a. 33 – Magnitude/Intensity Comparison for Earthquakes

Magnitude	Typical Maximum MMI	Abbreviated Modified Mercalli Intensity Scale
1.0 - 3.0	I	I. Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II - III	II. Felt only by a few persons at rest, especially on upper floors of buildings.
		III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	IV - V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
		V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	VI - VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
		VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 - 6.9	VII - IX	VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
		VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	VIII or higher	VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
		X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
		XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
		XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: US Geological Survey (http://earthquake.usgs.gov/learn/topics/mag_vs_int.php, page last modified September 29, 2014)

The 2019 SHMP also presents the Earthquake Magnitude Scale prepared by UPSEIS/Michigan Tech as a means of quantifying the magnitude or severity of an earthquake (Figure 3a.21).

Figure 3a. 21 - Earthquake Magnitude Scale



Source: 2019 SHMP

As noted in the 2019 SHMP, soil type can have an impact on the severity of an earthquake at a given location and soft soils (i.e., including fill, loose sand, waterfront, lake bed clays) are more likely to amplify ground motion during an earthquake. Liquefaction is also more likely to occur in areas of soft soils. Table 3a.34 shows soil types in five basic categories with varying degrees in likelihood of amplifying the effects of an earthquake, with Category A being far less likely to amplify the effects of seismic motion than Category E.

Table 3a. 34 – Geological Soil Classifications

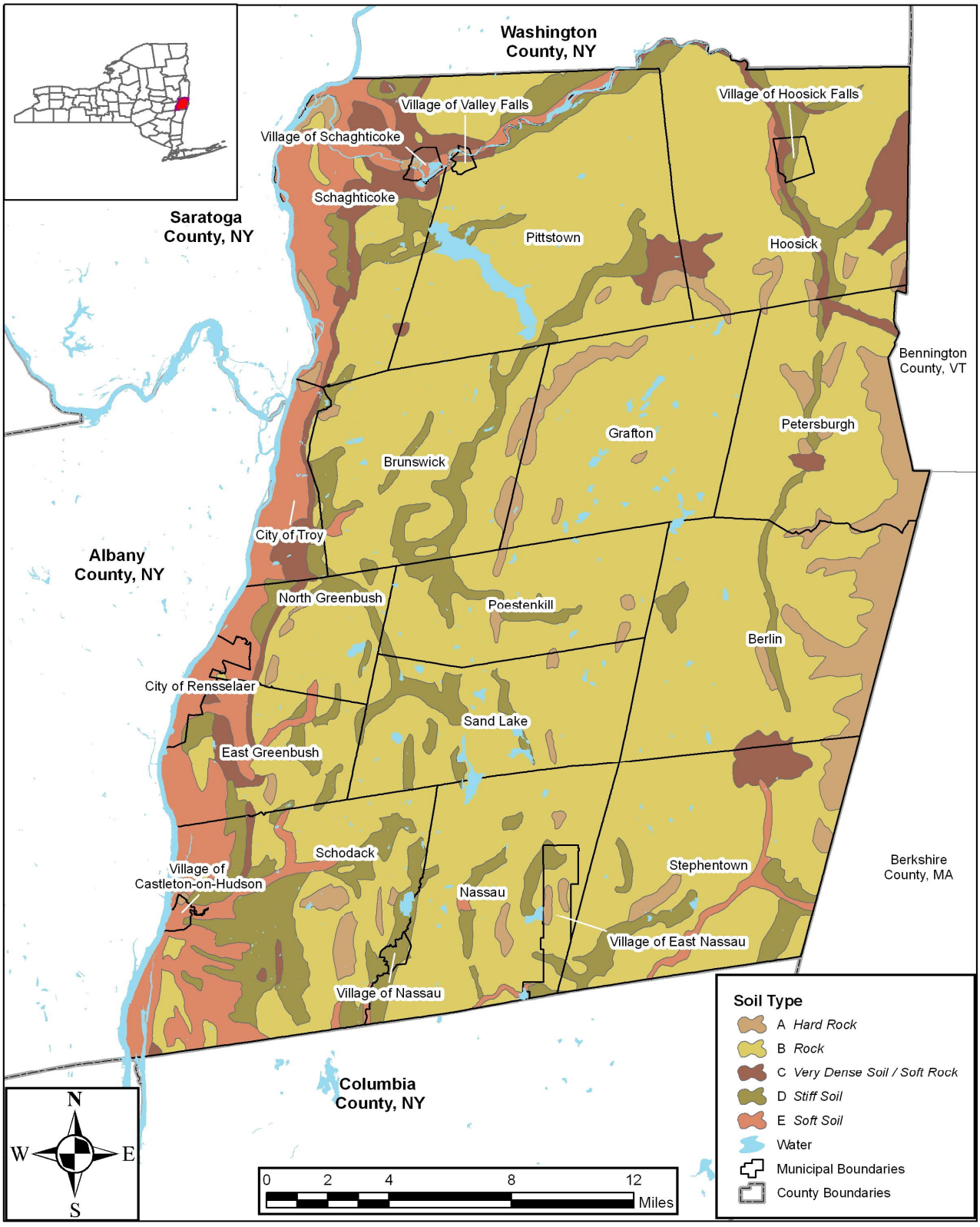
Category	Soil Type
A	Hard Rock
B	Rock
C	Very Dense Soil / Soft Rock
D	Stiff Soil
E	Soft Soil

Table 3a.35 tabulates the area of soft soils (Category E) for each municipality in Rensselaer County. Soil types are mapped in Figure 3a.22.

Table 3a. 35 – Soils that could Amplify the Effects of an Earthquake

Municipality	Total Acres	Category E (Soft Soils)	
		Acres	%
Berlin, Town of	38,227	1,583	4%
Brunswick, Town of	28,284	5,576	20%
Castleton-on-Hudson, Village of	531	490	92%
East Greenbush, Town of	15,672	7,274	46%
East Nassau, Village of	3,029	671	22%
Grafton, Town of	29,711	5	<1%
Hoosick, Town of	950	345	36%
Hoosick Falls, Village of	39,361	3,781	10%
Nassau, Town of	25,558	3,177	12%
Nassau, Village of	442	410	93%
North Greenbush, Town of	12,079	3,764	31%
Petersburgh, Town of	26,683	1,004	4%
Pittstown, Town of	41,256	4,518	11%
Poestenkill, Town of	20,727	2,407	12%
Rensselaer, City of	2,191	2,191	100%
Sand Lake, Town of	23,088	3,126	14%
Schaghticoke, Town of	32,545	14,280	44%
Schaghticoke, Village of	640	299	47%
Schodack, Town of	40,217	22,700	56%
Stephentown, Town of	37,263	5,467	15%
Troy, City of	7,066	5,000	71%
Valley Falls, Village of	308	4	1%
Rensselaer County Total:	425,825	88,078	21%

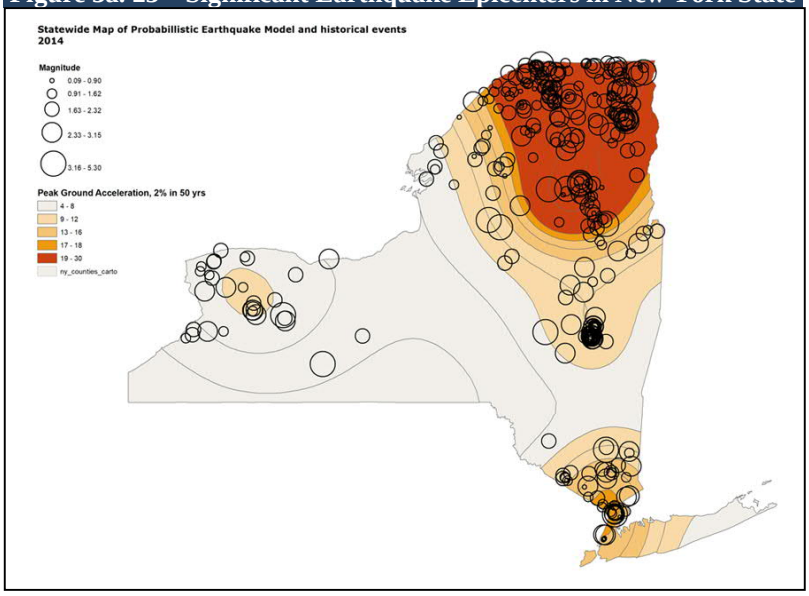
Figure 3a. 22 – Rensselaer County Geological Soil Classification Map



Previous Occurrences – Earthquake

As noted in the 2019 SHMP, although the probability of damaging earthquakes in New York State is low, earthquakes do have a history of occurring on a regular basis. Figure 3a.23 illustrates the location of historic earthquake epicenters in New York, as obtained from the 2019 SHMP.

Figure 3a. 23 – Significant Earthquake Epicenters in New York State



Source: 2019 SHMP

Table 3a.36 on the following page summarizes the history of earthquakes in New York State. No significant earthquakes have occurred in, or caused damage in, Rensselaer County.

Strong earthquakes centered outside of New York State can also be felt – sometimes strongly – within the State. One of the strongest recent events of this type on August 23, 2011, when the magnitude 5.9 earthquake centered at Mineral, VA was felt strongly up and down the east coast including in New York State but caused no reported damage.

There has been one Federally-declared disaster in New York State due to an earthquake (DR-1415), following an event of Magnitude 3.1 that occurred in the far north eastern part of the state in April 2002 (with aftershocks in May 2002). Rensselaer County was not affected by this event.

Table 3a. 36 – New York State Earthquakes, 1996-2018				
Type	**Magnitude**	**Impacts**	**Number of Earthquakes, 1996-2018**	**Comments**
Minor	≤2.51	usually not felt, but can be recorded by seismograph	457	
Light	2.51-5.4	often felt, but only causes minor damage	61	Of the 61 light earthquakes, only 18 were greater than magnitude 3, and only 1 was greater than magnitude 5 (a magnitude 5.3 event on April 20, 2002; Rensselaer County was not affected by this event)
Moderate	5.5-6.0	slight damage to buildings	0	
Strong	6.1-6.9	may cause minor damage in populated areas	0	
Major	7.0-7.9	major earthquake causing serious damage	0	
Great	≥8.0	great earthquake that can totally destroy communities near its epicenter	0	
Total, New York State:			518	
Total, Rensselaer County:			0	

Probability and Climate Change – Earthquake

Earthquakes occur frequently in New York State. However, the frequency of damaging earthquakes in the state has been relatively low.

Based on the recorded history of earthquakes in New York State from 1996 through 2018, the State experienced 23 earthquakes per year (of any magnitude); however, there were only 0.045 damaging earthquakes per year. Of the 518 earthquakes that have occurred in New York State from 1996 to 2018, 88% were minor – that is, usually not felt and not damaging. The remaining 12% were light (often felt, but only causing minor damage. None could be classified as moderate, strong, major, or great. The probability of significant, damaging earthquake events in or affecting Rensselaer County is very low. From 1996 through 2018, the annual number of events was 0.

The 2019 SHMP indicates that an earthquake of magnitude 5.0 (moderately destructive) or higher on the Richter Scale has a 2% probability of occurrence within the next 50 years in the New York area. More destructive earthquakes are very rare, low probability events for Rensselaer County with highly infrequent recurrence periods.

Climate change has no known impact on earthquake probability.

Landslide

Countywide Statistics:

Landslide

Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	0
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.0
Daily Probability	0.00%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description - Landslide

The 2019 SHMP defines the term "landslide" as the movement of a mass of rock, debris, or earth down a slope. Slope failure occurs when the force of gravity pulling the slope downward exceeds the strength of the earth materials that comprise the slope to hold it in place. In addition to the force of gravity, other contributing factors to landslides can include rainfall and/or rapid snowmelt, earthquakes, volcanic activity, changes in groundwater, and human-induced modifications to existing slopes.

The potential for a landslide to occur exists in every state in the country wherever very weak or fractured materials are resting on a moderate to steep slope (typically, a slope steep enough to make walking difficult).

The 2019 SHMP cites the following key factors affecting the risk of landslide occurrence:

- Slope. Slopes are more likely to fail when they are greater than or equal to 10 degrees, as are slopes where the height from the top of the slope to its toe is treater than 40 feet. Minor landslides called “slumps” can occur with very minor slopes.
- Vegetative Cover. Slopes with little or no vegetative cover are more prone to landslides than other more vegetated slopes.
- Soil Water Content. Slopes are more likely to fail when soil water content is high.

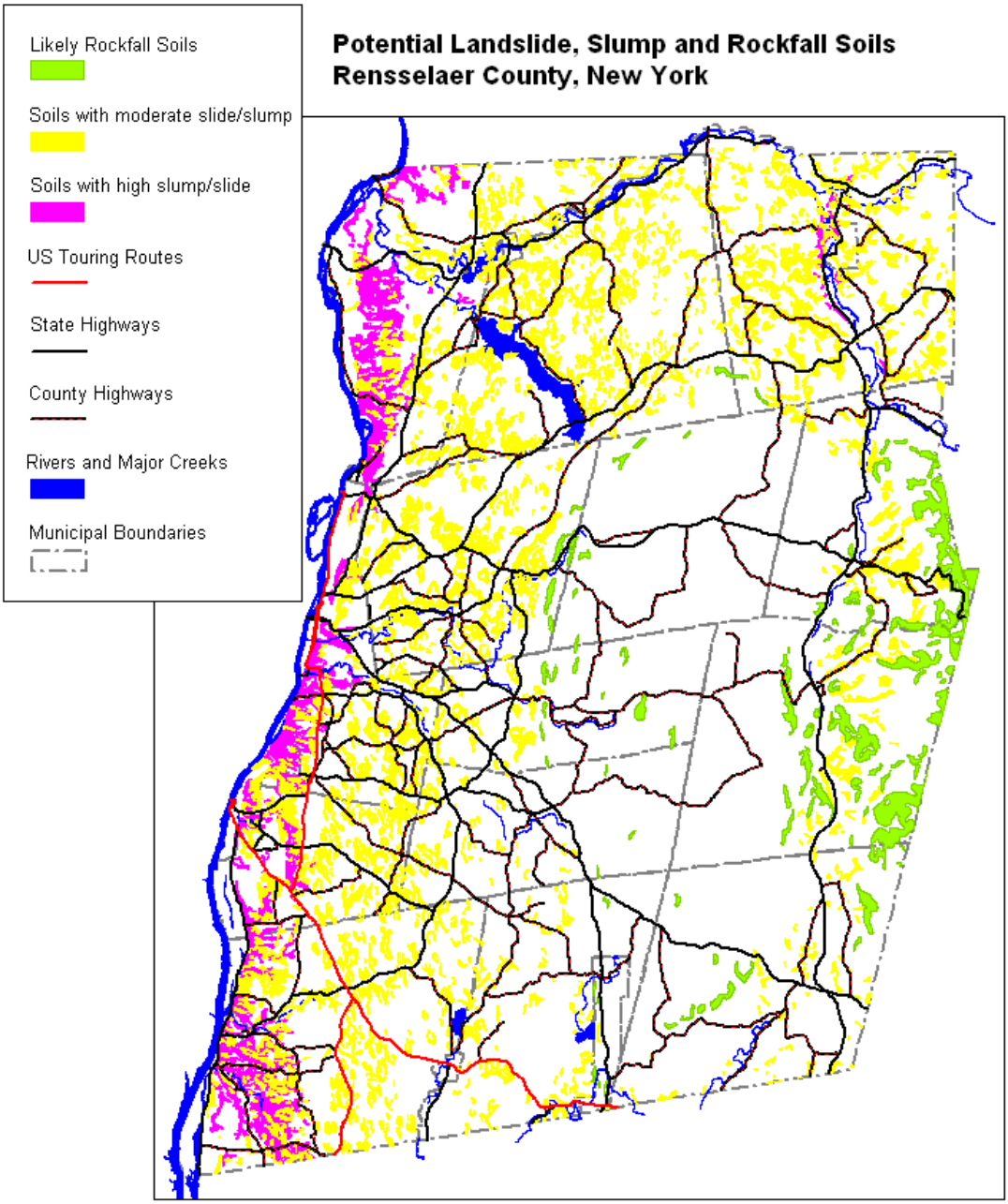
Landslides can be triggered by natural events or by humans. Natural events include erosion, decreases in vegetative cover due to natural causes and/or seasonal changes, and ground shaking from earthquakes. Human caused triggers include altering the slope gradient, increasing the soil water content, and removal of vegetative cover.

Location - Landslide

The 2019 SHMP indicates that New York State’s soil generally stands up well to landslide tendency. Areas that are commonly considered to be safe from landslides include areas that have not experienced landslides in the past, areas of minimal slope, and areas set back from the tops of slopes. Conversely, areas that are commonly considered to be more prone to landslides tend to be areas where a landslide has occurred in the past, bases of steep slopes or drainage channels, and developed hillsides where leach field septic systems are used. In general, the highest potential for landslides can be found along major river and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits (glacial lake clays) and usually associated with steeper slopes.

Figure 3a.24, prepared by the Rensselaer County Department of Economic Development and Planning on December 30, 2010 and, which shows the US Department of Agriculture Natural Resource Conservation Service Soils Map for Rensselaer County, and highlights soil types with likely, moderate, and high slump/slide potential.

Figure 3a. 24 – Potential Landslide, Slump and Rockfall Soils in Rensselaer County



Source: U.S. Department of Agriculture Natural Resource Conservation Service
Soils Map, Rensselaer County, New York

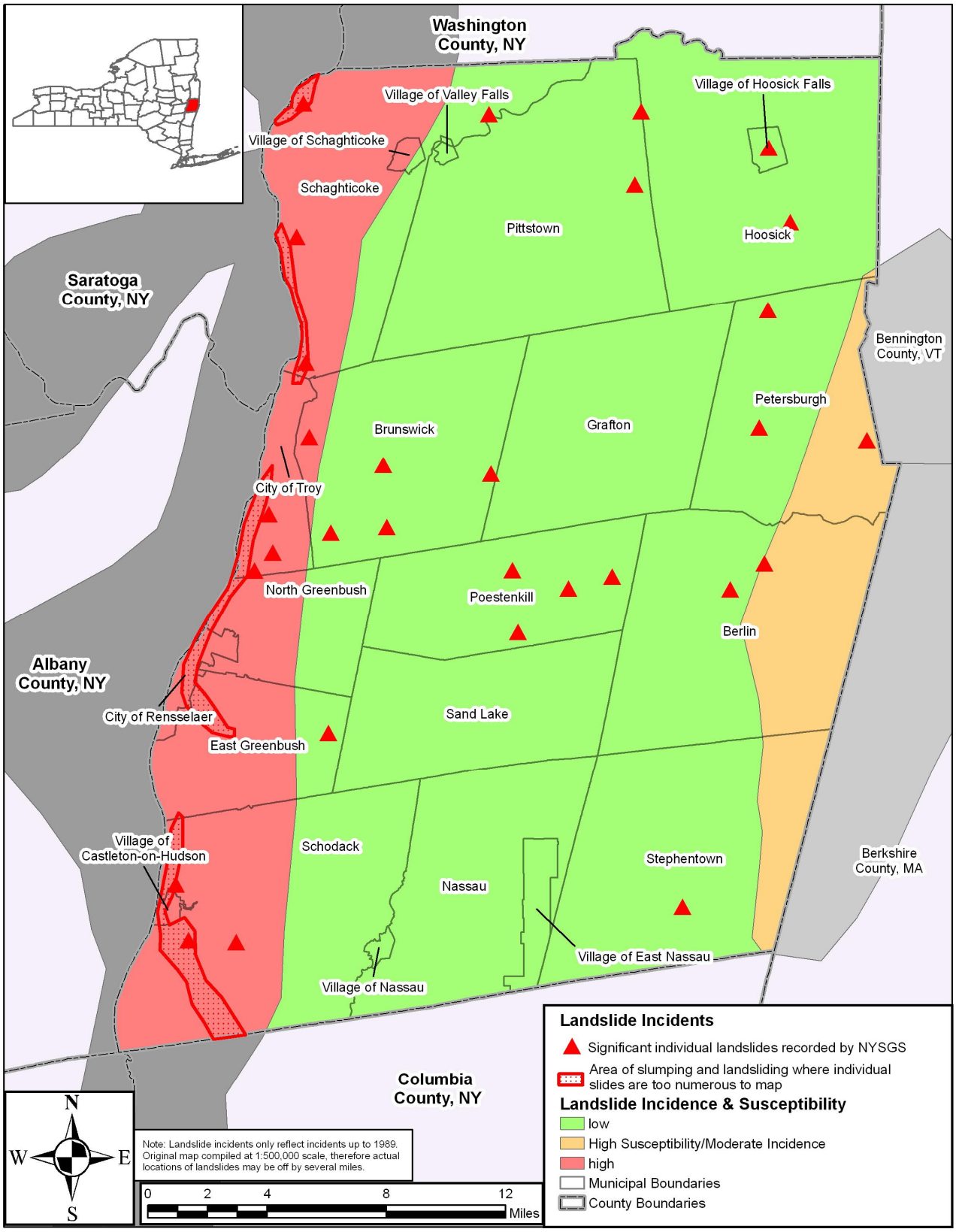
USGS landslide susceptibility mapping uses three basic classifications to communicate the risk, in conjunction with three further classifications to communicate the combinations of susceptibility and incidence:

- High incidence (Greater than 15 % of the area involved)
- Moderate incidence (1.5% - 15% of the area involved)
- Low incidence (Less than 1.5% of the area involved)
- High susceptibility/moderate incidence
- High susceptibility/low incidence
- Moderate susceptibility/low incidence

USGS landslide susceptibility mapping for Rensselaer County is presented in Figure 3a.25. The figure shows that the area with the highest identified risk of landslides is the western side of the County in an area mapped as "High Incidence" generally within 2 to 5 miles of the Hudson River. Another portion of the County along its eastern boundary is identified as "High Susceptibility/Moderate Incidence". The remainder of the County is mapped as "Low Incidence", although the majority of individual landslide incidents in the County for which records are available have been recorded in this zone. Of the six categories of incidence and susceptibility listed above, only these three have been identified in Rensselaer County. It should be noted that this mapping represents the overall risk of landslides, and occasional areas more vulnerable to landslides may exist within low risk or incidence areas due to local topographical conditions.

The municipalities most likely to experience landslide events are those immediately adjacent to the Hudson River: the Cities of Troy and Rensselaer; the Towns of Schaghticoke, North Greenbush, East Greenbush and Schodack; and the Villages of Schaghticoke and Castleton-on-Hudson.

Figure 3a. 25 – Landslide Incidence and Susceptibility in Rensselaer County



Extent – Landslide

The 2019 SHMP states that there is no universal scale to measure the magnitude of a landslide. It advises that movement can be measured by using extensometer, inclinometer, or GPS.

The severity of a landslide depends in large part on the degree of development in the area in which it occurs and the geographic area of slide itself. Generally speaking, landslides can result in devastating consequences, but only in very localized areas. A landslide occurring in an undeveloped area would be less severe because lives and property would not be affected; the only impacts would be to land, vegetation, and possibly some wildlife. On the contrary, a landslide occurring in a developed area could have devastating effects, ranging from structure and infrastructure damage to injury and/or loss of life. Structures or infrastructure built on susceptible land would likely collapse as their footings slide downhill, while those below the land failure would likely be crushed. Landslides in the area of roadways could have the potential to fall and damage or destroy vehicles and force other drivers to have accidents.

Table 3a.37 tabulates the area of land in each incidence/susceptibility category for each municipality in Rensselaer County, as presented graphically in the previous Figure 3a.25.

Table 3a. 37 – Land in Areas Susceptible to Landslides in Rensselaer County

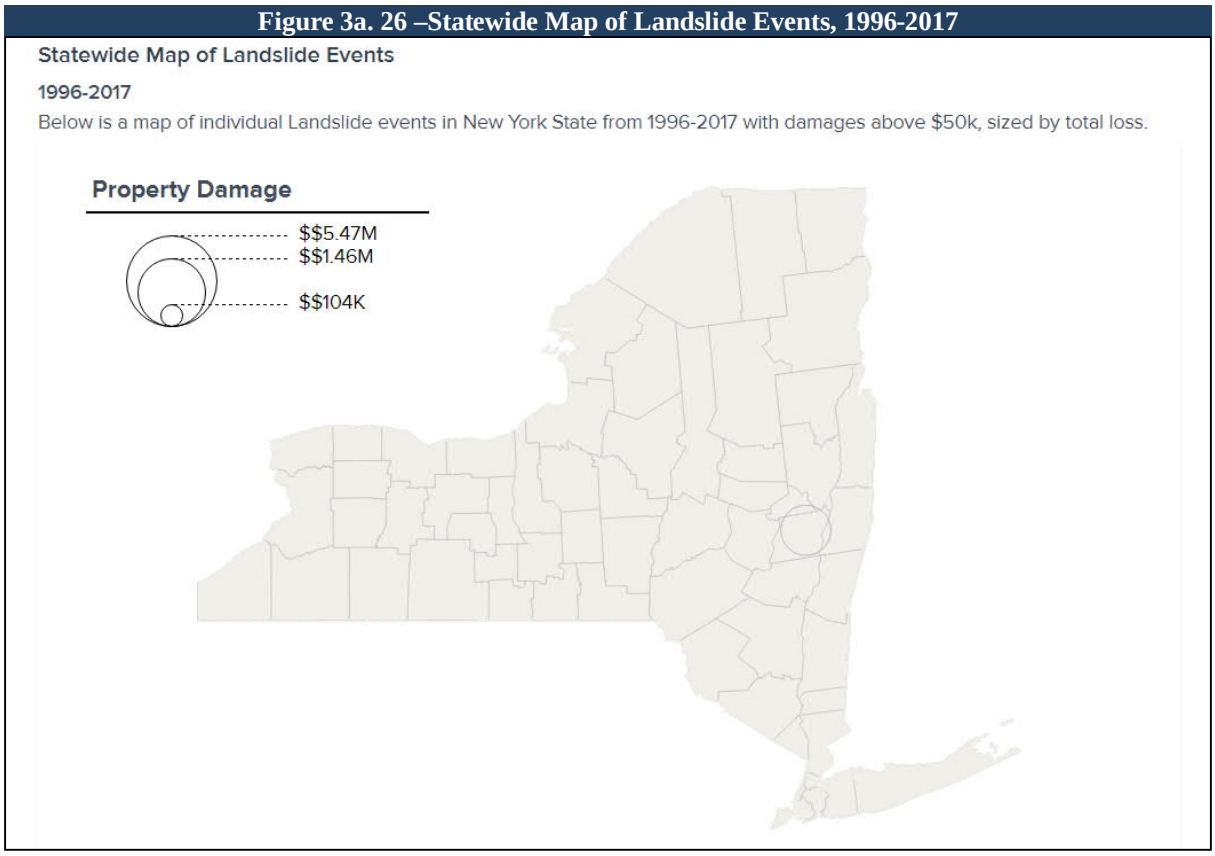
Municipality	Total Acres	High Incidence		High Susceptibility/ Moderate Incidence	
		Area (Acres)	%	Area (Acres)	%
Berlin, Town of	38,227	0	0%	15,774	41%
Brunswick, Town of	28,284	2,189	8%	0	0%
Castleton-on-Hudson, Village of	531	531	100%	0	0%
East Greenbush, Town of	15,672	12,208	78%	0	0%
East Nassau, Village of	3,029	0	0%	0	0%
Grafton, Town of	29,711	0	0%	0	0%
Hoosick Falls, Village of	950	0	0%	64	7%
Hoosick, Town of	39,361	0	0%	0	0%
Nassau, Town of	25,558	0	0%	0	0%
Nassau, Village of	442	0	0%	0	0%
North Greenbush, Town of	12,079	6,026	50%	0	0%
Petersburgh, Town of	26,683	0	0%	8,916	33%
Pittstown, Town of	41,256	0	0%	0	0%
Poestenkill, Town of	20,727	0	0%	0	0%
Rensselaer, City of	2,191	2,191	100%	0	0%
Sand Lake, Town of	23,088	0	0%	0	0%
Schaghticoke, Town of	32,545	22,281	68%	0	0%
Schaghticoke, Village of	640	474	74%	0	0%
Schodack, Town of	40,217	23,084	57%	0	0%
Stephentown, Town of	37,263	0	0%	6,931	19%
Troy, City of	7,066	6,972	99%	0	0%
Valley Falls, Village of	308	0	0%	0	0%

Table 3a. 37 – Land in Areas Susceptible to Landslides in Rensselaer County					
Municipality	Total Acres	High Incidence		High Susceptibility/ Moderate Incidence	
		Area (Acres)	%	Area (Acres)	%
Rensselaer County Total:	425,825	75,970	18%	31,685	7%

Previous Occurrences – Landslide

The 2019 SHMP provides a Statewide map of landslide events from 1996 through 2017 for which damages exceeded $50,000 (Figure 3a.26). The map shows only the Albany County landslide of May 2000 ($500k). A landslide which partially buried a resident in the City of Schenectady in 2018 is not shown.

Figure 3a. 26 –Statewide Map of Landslide Events, 1996-2017



The "Landslide Inventory Map of New York" produced by the New York State Geological Survey (NYSGS) in cooperation with the United States Geological Survey, plots the location of 30 landslide events in Rensselaer County between 1837 and 1989, as well as several areas in the "High Incidence" risk zone near the Hudson River where individual slides are too numerous to map. Data sheets obtained from the NYSGS for most of the individual mapped landslide events also record the dollar damages caused by many of these events, with average losses of approximately $25,000 per event (1980s dollars). The details available for landslides in Rensselaer County recorded by NYSGS are presented in Table 3a.38.

Table 3a. 38 – Landslide Events Recorded by NYSGS in Rensselaer County 1837 – 1989

Date	Municipality Affected	Description	Damage Estimate
1837	City of Troy	Corner of Washington/Fourth Streets: Large landslide destroyed three houses and two stables, five people killed.	not recorded
1843	City of Troy	Nine residential structures and several other buildings destroyed by large landslide, 17 people killed.	not recorded
1854	City of Troy	Construction site of St Peter's College destroyed by landslide	not recorded
1930s	City of Troy	Landslide destroyed three buildings on RPI campus	not recorded
1950s	City of Troy	Proudfit Laboratory building south of Sage Avenue damaged by landslide, subsequently removed	not recorded
1951	City of Troy	Main approach road to RPI damaged by landslide	not recorded
1970	City of Troy	Thompson Street, Troy: Housing development on top of slope, slide destroyed one housing unit and damaged city road	not recorded
1981	City of Troy	Stanton Street: Major slide in sand/clay destroyed foundations of several housing units under construction	not recorded
1983	City of Troy	Major debris flow on steep slope (100 feet high) into Poesten Kill. Top of Congress Street behind old Wooltex factory. Significant part of construction site lost, creek blocked.	not recorded
pre-1985	Town of Stephentown	Soil slump caused by undercutting stream, affects highway (County Route 26)	$35,000
pre-1985	Town of Schodack	Soil slump, portion of highway undercut by stream (County Route 4 at South Schodack)	$20,000
pre-1985	Town of Schodack	Soil slump caused by undercutting stream, affects highway (County Route 4 near Castleton-on-Hudson)	$25,000
pre-1985	Town of Schodack	Soil slump caused by undercutting stream, affects highway (County Route 8 at Stony Point)	$20,000
pre-1985	Town of East Greenbush	Soil slump caused by undercutting stream, affects highway (County Route 53 at Best)	$25,000
pre-1985	Town of Poestenkill	Failure of Cut slope near County Route 40, East Poestenkill	$5,000
pre-1985	Town of Poestenkill	Soil slump caused by undercutting stream, affects highway (County Route 79)	$20,000
pre-1985	Town of Brunswick	Failure of Cut slope on County Route 139 at Eagle Mills	$10,000
pre-1985	Town of Brunswick	Soil slump caused by undercutting stream, affects highway (County Route 79 at Cropseyville)	$30,000
pre-1985	Town of Brunswick	Soil slump caused by undercutting stream, encroaching on highway (County Route 134 at Eagle Mills)	$120,000
pre-1985	City of Troy	Oakwood Avenue: housing development "lost"	not recorded
pre-1985	Town of Schaghticoke	Soil slump caused by undercutting stream, affects highway (County Route 121 at Speigletown)	$20,000
pre-1985	Town of Schaghticoke	Soil slump caused by undercutting stream, affects highway (County Route 121 west of Melrose)	$15,000
pre-1985	Town of Schaghticoke	Soil slump caused by undercutting stream, affects highway (County Route 125)	$15,000
pre-1985	Town of Schaghticoke	Soil slump caused by undercutting stream, affects highway (County Route 114)	$20,000
pre-1985	Town of Hoosick	Failure of cut slope on County Route 103, southwest of Eagle Bridge	$10,000

Table 3a. 38 – Landslide Events Recorded by NYSGS in Rensselaer County 1837 – 1989			
Date	**Municipality Affected**	**Description**	**Damage Estimate**
pre-1985	Town of Pittstown	Failure of cut slope on County Route 109, west of West Hoosick	$10,000
pre-1985	Town of Hoosick	Soil slump in clay undercut by stream affecting State Route 7[14]	not recorded
pre-1985	Town of Petersburgh	Soil slump caused by undercutting stream, affects highway (County Route 98 at North Petersburgh)	$20,000
pre-1985	Town of Petersburgh	Soil slump caused by undercutting stream, affects highway (County Route 94)	$30,000
pre-1985	Town of Berlin	Soil slump caused by undercutting stream, affects highway (County Route 38)	$20,000
pre-1985	City of Troy	South end of Troy in the vicinity of Menands Bridge: 12 homes reported lost in two separate slides	not recorded
1986	City of Troy	Many slides in Lake Albany clays in Prospect Park/RPI area	$1,000,000
1986	City of Troy	South end of Troy in the vicinity of Menands Bridge: group of slides in Lake Albany clays	not recorded
1987	City of Troy	Southwest corner of RPI campus, slumping of corner of new parking lot	$10,000
1987	City of Troy	Between Lexington Avenue and Spring Avenue: one home destroyed by slide, portions of Lexington Avenue closed	$50,000
1987	City of Troy	Hawthorne Street overlooking Spring Avenue: slide on steep slope did not impact buildings but one house later condemned as a result	$115,000

New York State has not received any Major Disaster or Emergency Declarations for landslides.

In addition to events recorded by NYSGS up to 1989, general research has uncovered several additional landslide incidents;

Date Unspecified

A Core Planning Group Member reported that in the early 1970s NYS Route 2 in the Town of Brunswick slumped in the Poestenkill requiring the road to be closed and major work to be done which is still visible to this day.

May 6, 1998

Following torrential rain, four sections of State Highway 9 from Castleton-on-the-Hudson to the Columbia County line, were blocked by mud slides.

Photo 3a. 23 - Landslide, Troy, March 2008. (Photo courtesy of RCBPS).

[14] Mitigated during the summer of 2019.

March 2008

A landslide occurred in Troy south of Thomson Street near Delaware Avenue. No details of the impacts were available. A photo of the slide indicates some damage did result.

February 25-26, 2010

The NYSHMP 2019 indicates that a mudslide was reported off Main Street in Castleton-on-the-Hudson on February 25, 2010, affecting access to a home. The mudslide was the result of heavy rainfall and snowmelt. On February 26, 2010, a landslide occurred behind the Castleton Volunteer Fire Department forcing the evacuation of the firehouse and its equipment and burying a basketball court located behind the firehouse on Green Street. Heavy rains weakened the hillside and for a time it was feared that there were signs that a more severe landslide was on its way. The firehouse and its equipment were evacuated. At a subsequent meeting between the Village and the Rensselaer County Soil and Water Conservation Service (RCSWCS) the Village indicates that they were advised by RCSWCS that the best approach for moving forward would be to allow the material to remain intact at the base of the slope, and fence in the area. Local regulations exist in the Village to protect against slumping, sliding, and erosion regarding activities that can be taken on slopes of greater than 25% where HUE (250e) soils are present. More formal mitigation activities for this particular site were not recommended.

August 28, 2011

A mudslide occurred on Route 2 (Brunswick Road) at Route 66 (Pawling Avenue) causing a house to collapse. Two other houses were knocked from their foundations by about 8 feet, and an automobile shop was destroyed and displaced by about 75 feet. Newspaper articles from that day report minor injuries (cuts and scrapes) for impacted residents, and precautionary evacuations of dozens of residents along Brunswick Road and Highland Street.

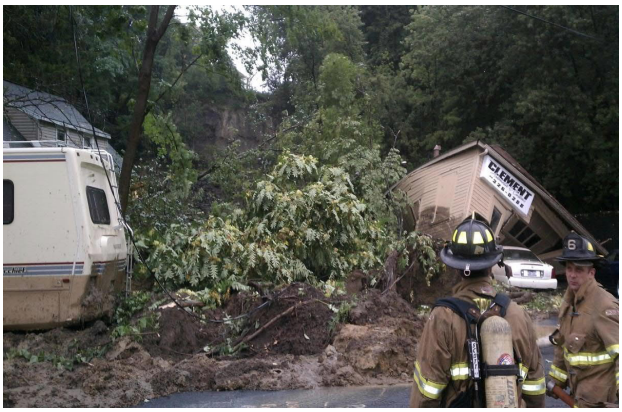


Photo 3a. 24 – Garage destroyed on Brunswick Road in Troy after landslide, August 28, 2011 (Photo courtesy of The Troy Record).

Date Unspecified – late April 2019

A Core Planning Group Member from the Town of Brunswick identified the residence located at 528 McChesney Avenue Extension as at risk from landslide. The Town communicated the problem to the Rensselaer County Bureau of Public Safety. The property is located on a cliff high above a bend in the Poesten Kill and over time, the water has eroded the base of the slope causing the land to slide toward the

Photo 3a. 25 – 528 McChesney Avenue Extension, April 2019. (Photo courtesy of Google Earth).

creek. In April 2019, another large portion of the ground eroded away and fell, leaving only feet before the property. Slope failure behind the residence due to erosion at the base of the slope from the Poesten Kill also poses a potential future risk to McChesney Avenue Extension, a County road. RCBPS coordinated with NRCS.

Probability and Climate Change – Landslide

While it is certainly possible for landslides to occur within Rensselaer County, the current readily available data regarding historic occurrences does not permit a reliable estimation of the frequency of future occurrences. While the overall probability of future occurrence is assumed to be low for much of the central portion of the County, there are significant areas (basically comprising the municipalities adjacent to the Hudson River) where landslides have historically been comparatively frequent: the available records suggest that landslides have been occurring at a rate of at least one every five years or so in the County overall, with an assumed higher rate in the areas identified as of "high incidence" and "Areas of slumping and landsliding where individual slides are too numerous to map" by USGS and NYSGS.

The 2019 SHMP concludes that, with regard to climate change:

- A rise in unpredictable weather patterns could increase landslide occurrence in New York State.
- An increase in frequency of extreme rainfall events can be directly correlated to an increase in the number of landslides.
- An increase in the number of hazard events such as hurricanes, tornadoes, and extreme heat and cold can also initiate landslides.
- One of the major causes of landslides - changing forest and vegetative cover – is, according to the US Forest Service, going to be affected by climate change in parts of New York State. The forest service extensively modeled climate change effects in numerous regions across New England. Model projections suggest that many northern and boreal species, including balsam fir, red spruce, and black spruce, may fare worse under future conditions, but other species may benefit from projected changes in climate.

OTHER HAZARDS

Wildfire

Countywide Statistics:

Wildfire	
Total Losses Reported (1996-2018)	$2,000
Total Number of Episodes (1996-2018)	1
Annualized Losses Reported (1996-2018)	$91
Annualized Number of Episodes (1996-2018)	0.046
Daily Probability	0.01%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Description – Wildfire

A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Wildfires can occur in areas essentially void of development, or in areas where development intermingles with these natural areas (known as the "urban-wildland interface"). Many wildfires occur in locations that abound in dense forests, grasslands and shrubs. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk.

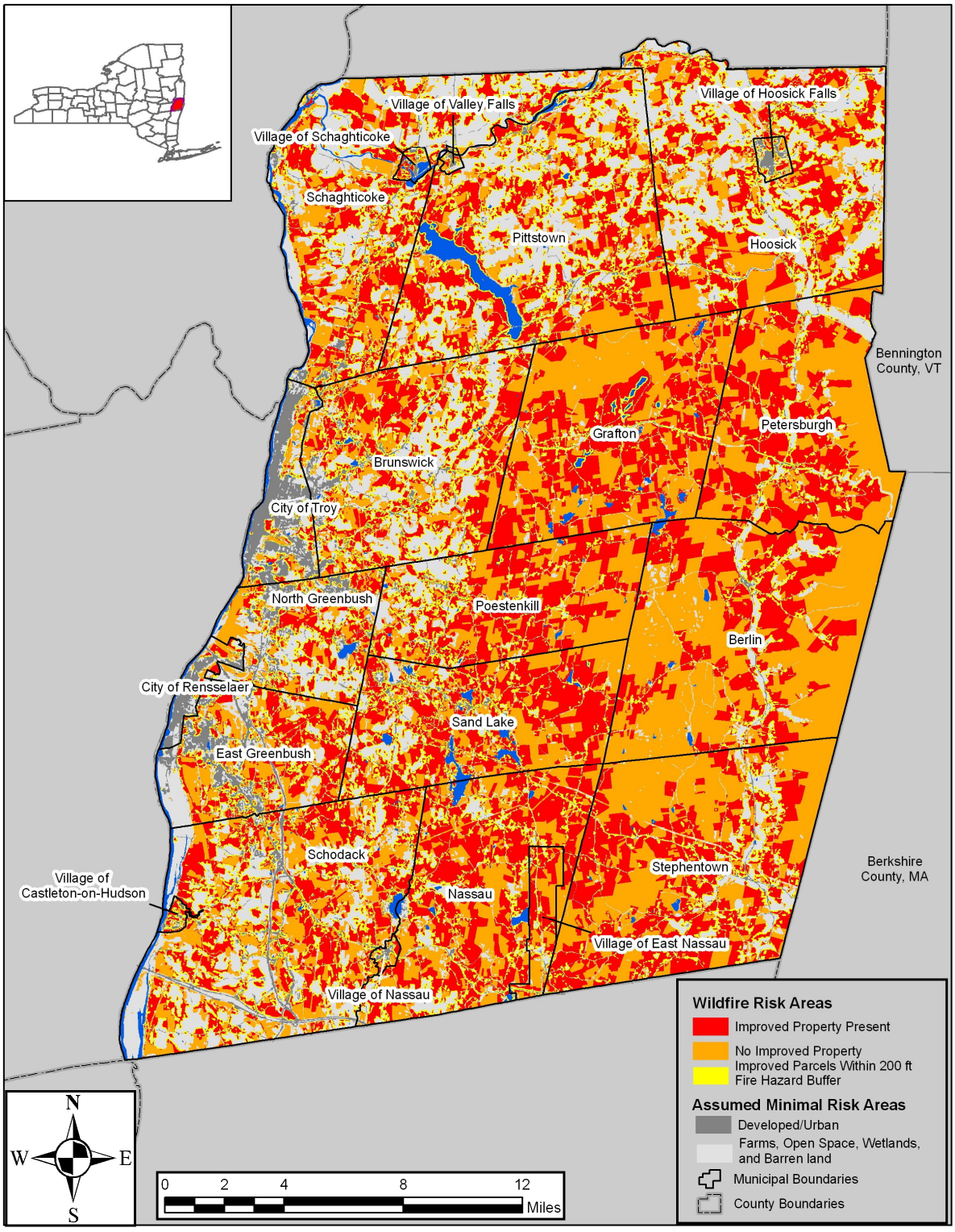
Wildfires can occur at any time of the year but will usually occur during warmer and dryer months. Wildfires are most commonly caused by people (i.e., arson, debris burns, and carelessness). Lightning is the next most common cause of wildfires. As reported by the Wildland Fire Assessment System (WFAS) wildfires resulting from a lightning strike largely depend on the duration of the current and the kind of fuel the lightning hits. Spread of the wildfire after ignition usually depends primarily on fuel moisture.

Location – Wildfire

Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity, at steeper slopes – particularly those that are far away from firefighting apparatus that would suppress the spread of wildfires once reported. **Figure 3a.25** shows the areas of Rensselaer County that are considered to be susceptible to wildfires (including the following land cover types: deciduous, evergreen, and mixed forest, shrub land, and grassland). In the figure, at-risk parcels with improved property present upon them are colored red; at-risk parcels with no improved property present are colored orange; cultivated agricultural land and pastureland areas that are not generally considered to be at significant risk from wildfire are colored light gray; and urban/developed parcels are colored dark gray. This allows a general determination to be made regarding those areas at risk from wildfire in which there is a higher likelihood that such fires could also pose a threat to lives and structures, in addition to susceptible areas where improved property is present (colored red) which have a direct interface with the wildfire hazard.

Wildfires are a significant hazard in Rensselaer County, particularly in the forested areas of the county. Many of the areas at risk from wildfires are also popular with hikers and campers. Several locally important transportation routes such as State Routes 2, 7 and 43 pass through potentially vulnerable areas, leaving them vulnerable to closure during forest fire due to smoke conditions. Areas in Rensselaer County where the magnitude and severity of the hazard are the greatest tend to exhibit the lowest population densities in the County; as a result, exposure of people living and working in the highest hazard areas is often relatively low.

Figure 3a. 27 – Wildfire Risk Areas in Rensselaer County



The wildfire risk for the individual municipalities within Rensselaer County has been quantified by measuring the length of the urban-wildland interface and the total value of improved property located in the areas considered to be vulnerable to wildfires, and these estimations are presented in Table 3a.26. The urban-wildland interface measurements were estimated incorporating a 200 ft buffer extending from the wildfire risk areas into the developed areas, to account for the likelihood that structures in the developed area are at risk of combustion even if they are not immediately adjacent to sources of fuel for wildfires.

Including the buffer applied to wildfire risk areas, 81 percent of the County's land area is in some way vulnerable to wildfire, with more than 50 percent of the land area vulnerable in all municipalities except for the Cities of Troy and Rensselaer.

In terms of the urban-wildland interface, the Town of Schodack exhibits the biggest vulnerability to wildfires, with an interface more than 70 miles in length. The Towns of Brunswick and Sand Lake each have interfaces of more than 40 miles. Several municipalities in the more forested parts of the County have interfaces of less than 10 miles. While this may appear low, it is explained by assuming that in such areas developed land/improved property tends to lie within the expansive areas vulnerable to wildfire rather than adjacent to them.

Table 3a.39 tabulates the area of land in each incidence/susceptibility category for each municipality in Rensselaer County, as presented graphically in the previous Figure 3a.25.

Table 3a. 39 – Land in Wildfire Risk Zones

Municipality	Urban-Wildland Interface (Miles)	Wildfire Risk Zones with No Improved Property (Acres)	Wildfire Risk Zones with Improved Property (Acres)	Total Municipal Area (Acres)
Berlin, Town of	6.1	24,319	12,255	38,227
Brunswick, Town of	43.8	7,330	13,914	28,284
Castleton-on-Hudson, Village of	4.6	43	312	531
East Greenbush, Town of	38.8	4,507	6,344	15,672
East Nassau, Village of	2.5	1,261	1,563	3,029
Grafton, Town of	4.2	15,041	13,560	29,711
Hoosick Falls, Village of	8.4	152	378	950
Hoosick, Town of	19.1	9,557	18,845	39,361
Nassau, Town of	11.0	8,388	14,611	25,558
Nassau, Village of	3.6	103	219	442
North Greenbush, Town of	33.1	3,401	4,494	12,079
Petersburgh, Town of	6.1	12,553	12,424	26,683
Pittstown, Town of	24.7	9,310	20,537	41,256
Poestenkill, Town of	26.5	7,978	10,700	20,727
Rensselaer, City of	2.7	368	320	2,191
Sand Lake, Town of	41.3	7,261	13,223	23,088
Schaghticoke, Town of	37.3	7,440	14,461	32,545
Schaghticoke, Village of	4.1	110	256	640

Table 3a. 39 – Land in Wildfire Risk Zones				
Municipality	Urban-Wildland Interface (Miles)	Wildfire Risk Zones with No Improved Property (Acres)	Wildfire Risk Zones with Improved Property (Acres)	Total Municipal Area (Acres)
Schodack, Town of	71.0	11,926	17,207	40,217
Stephentown, Town of	10.6	17,248	17,377	37,263
Troy, City of	14.8	1,048	1,228	7,066
Valley Falls, Village of	1.6	100	98	308
County Totals:	415.8	149,447	194,326	425,825

Previous Occurrences – Wildfire

NOAA's NCEI Storm Events Database records two wildfire episodes in Rensselaer County between 1996 and 2018 causing approximately $2,000 in property damages. One of the events was a wildfire located in Rensselaer County; the other episode involved smoke from a wildfire burning in Quebec. No episodes have been reported since the last version of the plan was adopted in 2011. Details of damages for these events are summarized by event type in Table 3a.40.

Table 3a. 40 - Wildfire Events, 1996-2018						
Affected Area	Date	Event Type	Reported Deaths	Reported Injuries	Reported Property Damage	Reported Crop Damage
Town of Schaghticoke	04/19/2001	Wildfire	0	0	$2,000	$0
Countywide	07/05/2002	Smoke from a wildfire burning in Quebec	0	0	$0	$0
Total:			0	11	$2,000	$0

April 1962

A larger brush fire burned in an unspecified location, causing damages estimated to be approximately $8,000. No other information is available. (Source: SHELDUS).

April 19, 2001

Very dry and breezy conditions allowed a small fire to erupt briefly out of control on the afternoon of April 19 in the Town of Schaghticoke. The fire scorched a 3-acre section of the Swallow Farm cornfield, located on Route 67. The blaze was extinguished in about an hour and luckily, resulted in neither injuries nor building damage. (Source: NOAA NCEI)

July 5, 2002

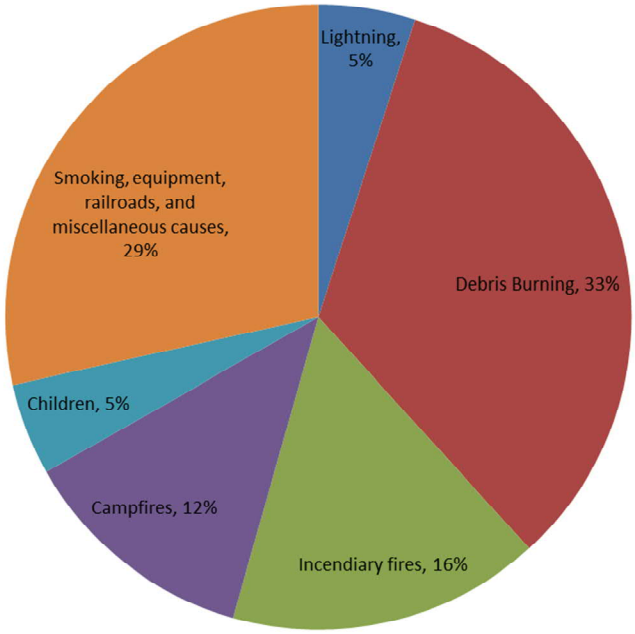
Smoke from a wildfire burning in northern Quebec was transported south across eastern New York. Advisories were issued warning people with respiratory problems to remain indoors and all individuals to curb outside activity. (Source: NOAA NCEI)

Date Unknown, 2007

A large brush fire occurred in the Town of Berlin. No additional information is available. (Source: Rensselaer County Department of Economic Development and Planning, 2010)

Probability and Climate Change - Wildfire

The 2019 SHMP concludes that New York State will always be susceptible to wildfires. It indicates that, for the period 1996 through 2017, New York State has experienced 16 wildfires (approximately 0.76 events per year) causing $106,636 in damages (approximately $5,078 per year statewide). The State plan also indicates that 95 percent of all wildfires in the state are attributable to human causes; only 5 percent are caused by lightning.



Based on that same window of time and data source (NOAA NCEI), Rensselaer County experienced only 1 wildfire causing $2,000 in damages (approximately 0.046 events per year, and $91 per year).

Wildfire probability depends on local weather conditions; outdoor activities such as camping, debris burning, and construction; and the degree of public cooperation with fire prevention measures. Wildfire events are expected to remain at least an occasional occurrence in Rensselaer County, and although there is insufficient readily available data that could be used to calculate actual probabilities, future occurrences of wildfires in the County are considered to be certain. The likelihood of increased future development (particularly residential) could result in an increase in the length of the urban-wildland interface, an increase in the improved value of property within wildfire hazard zones, and a greater risk of property damage and danger to the public in future years. However, most wildfires in the County are typically contained and extinguished rather quickly and those events causing major property damage or life/safety threats are much less likely to occur.

Open Burning in New York. NYSDEC's web site indicates that open burning is the greatest cause of wildfires in New York State. Open burning is prohibited in New York State. There are several exceptions. For example, small campfires, small cooking fires, and ceremonial/celebratory bonfires are allowed, though they cannot be left unattended and must be fully extinguished. Tree limbs with attached leaves can be burned in towns with a total population less than 20,000 and for brush less than 6 inches in diameter and 8 feet in length. burning large piles of brush collected from local residents at town or county transfer sites is prohibited. Burning leaves is banned. Open burning to control invasive plant or insect species is allowed on a case-by-case

basis. Fires on agricultural lands must be located on contiguous agricultural land larger than 5 acres and the materials must be capable of being fully burned within 24 hours. The State's burn ban is in effect from March 16 through May 14. When followed, the burn ban and open burn restrictions work to reduce the likelihood of wildfires. More information can be found on the NYSDEC web site at https://www.dec.ny.gov/chemical/58519.html .

With regard to climate change, the 2019 SHMP concludes:

- Climate change make forests more susceptible to severe fires due to changing precipitation patterns.
- Climate change vulnerability is strongly influence by regional differences in climate impacts and the adaptive capacity of particular forest types and vegetation.
- The probability of very large fires tends to increase when long-term drought, depleted fuel moisture, and elevated fire weather align; these conditions are expected with climate change.

SECTION 3b - RISK ASSESSMENT: IDENTIFICATION AND CHARACTERIZATION OF ASSETS IN HAZARD AREAS

Asset Categories

An inventory of geo-referenced assets in Rensselaer County has been created in order to identify and characterize property and persons potentially exposed to the identified hazards. Understanding the type and number of hazards that exist in relation to known hazard areas is an important step in the process of formulating the risk assessment and quantifying the vulnerability of the municipalities that make up Rensselaer County. For this plan, seven key categories of assets have assessed:

1. Acres of land: This category includes municipal land area (in acres) as per NY State GIS Clearinghouse Civil Boundaries (2019).
2. Improved property: This category includes all developed properties in Rensselaer County.[1]
3. Emergency facilities: This category covers all facilities dedicated to the management and response of emergency or disaster situations and includes fire stations, police stations, ambulance stations, shelters, and hospitals.[2]
4. Critical infrastructure and utilities: This category covers facilities and structures vital to the maintenance of basic living conditions in the county, and includes power generating stations, potable water treatment plants, wastewater treatment plants, significant public works buildings, airports, and major hazardous materials facilities (suppliers, producers, and users).[3]
5. Other key facilities: This category covers facilities which may be capable of providing refuge and limited medical care and hence may be utilized as emergency shelters, and those which routinely house more vulnerable sectors of the county population, making them potentially especially vulnerable to identified hazards. Included in this category are schools and senior care facilities.[4]
6. Historic and cultural resources: This category includes those historic structures, landmarks and sites that are included in the New York State or National Register of Historic Places. Impacts to these assets are presented by tabulating the number of each type of facility present in areas exposed to each identified hazard. Any other structure, landmark or asset identified during the course of general research for this

[1] Source: HAZUS-MH version 4.0

[2] Source: Fire stations, police stations, and hospitals extracted from HAZUS-MH version 4.0. Ambulance stations downloaded from the NYGIS Clearinghouse as prepared by Rensselaer County BRIS (2000). Shelter locations were provided by the American Red Cross (Josh Moskowitz, Disaster Program Manager NENY, American Red Cross, Eastern New York Region, January 9, 2019). Rensselaer County Planning corrected inconsistencies in November 2019.

[3] Source: Wastewater facilities, water treatment facilities, electric power facilities, communications facilities, oil facilities, natural gas facilities, and major hazardous materials facilities were extracted from HAZUS-MH version 4.0. Rail freight stations and passenger stations were downloaded from the NYSGIS Clearinghouse (Rail stations and passenger stations last revised May 2013). Rensselaer County Planning corrected inconsistencies in November 2019.

[4] Schools were extracted from HAZUS-MH version 4.0. Senior care facilities were downloaded from the NYSGIS Clearinghouse (RCBRIS, date not specified; metadata July 2003). Rensselaer County Planning corrected inconsistencies in November 2019.

section that has been judged to be potentially of local historical or cultural significance has also been included in this category.

7. Population: This category covers the number of people residing in Rensselaer County as measured by the 2010 U.S. Census. Municipal populations are broken down by age categories to identify communities in which more vulnerable sectors of the population are concentrated.

Asset Exposure

Exposure of assets to each identified hazard is assessed by identifying and characterizing which assets fall within the various hazard areas.

The following hazards in Table 3b.1 were identified as significant hazards in Rensselaer County warranting further evaluation and assessment of risk.

Table 3b. 1 – Identified Hazards in Rensselaer County

Atmospheric Hazards	Hydrologic Hazards	Geologic Hazards	Other Hazards
• Extreme Temperatures (Coldwaves and Heat Waves) • Hurricane/Tropical Storm • Lightning • Tornado • Wind • Winter Storm (Ice Storm and Snow Storm)	• Drought • Flooding (includes Flooding, Dam Failure, and Ice Jams)	• Earthquake • Landslide	• Wildfire

Land Area

Table 3b.2 on Page 3b-3 presents the land area of each municipality and the percent of land exposed to each hazard.

Improved Property

Improved property covers all development in the form of structures for residential, commercial, industrial, municipal, recreational, and utility uses. The total Replacement Cost Value (RCV) of improved property (structure and contents) in the 22 Rensselaer County jurisdictions is estimated to be more than $33 billion.[5] Table 3b.3 on Page 3b-4 summarizes the value of improved property in each jurisdiction and the exposure in hazard areas.

[5] Source: HAZUS-MH 4.0 Replacement Cost Values

Table 3b. 2 – Land Area Exposed to Hazards

Municipality	Land Area (acres)	Acres of Land Area Exposed to Each Hazard							
		Atmospheric Hazards	Hydrologic Hazards			Geologic Hazards			Other Hazards
		Coldwave, Heatwave, Hurricane/ Tropical Storm, Lightning, Tornado, Wind, Ice Storm, Snow Storm	Drought (all land)	Drought (acres of pasture and cultivated crops)	Flood (100-year)	Earthquake (all soil types)	Earthquake (Soft Soils that could exacerbate impacts)	Landslide (High and Moderate Incidence)	Wildfire
Berlin, Town of	38,227	38,227	38,227	2,823	745	38,227	1,584	15,774	36,574
Brunswick, Town of	28,284	28,284	28,284	8,952	1,765	28,284	5,576	2,189	21,244
Castleton-on-Hudson, Village of	531	531	531	13	139	531	488	531	355
East Greenbush, Town of	15,672	15,672	15,672	2,936	1,746	15,672	7,255	12,208	10,851
East Nassau, Village of	3,029	3,029	3,029	260	178	3,029	671	0	2,824
Grafton, Town of	29,711	29,711	29,711	837	967	29,711	5	0	28,601
Hoosick Falls, Village of	950	950	950	59	113	950	91	64	530
Hoosick, Town of	39,361	39,361	39,361	16,326	2,317	39,361	14,294	0	28,402
Nassau, Town of	25,558	25,558	25,558	3,424	1,066	25,558	3,172	0	22,999
Nassau, Village of	442	442	442	13	49	442	410	0	322
North Greenbush, Town of	12,079	12,079	12,079	3,370	479	12,079	3,757	6,026	7,895
Petersburgh, Town of	26,683	26,683	26,683	2,378	945	26,683	1,004	8,916	24,977
Pittstown, Town of	41,256	41,256	41,256	15,385	2,516	41,256	4,518	0	29,847
Poestenkill, Town of	20,727	20,727	20,727	2,959	991	20,727	2,406	0	18,678
Rensselaer, City of	2,191	2,191	2,191	86	741	2,191	2,185	2,191	688
Sand Lake, Town of	23,088	23,088	23,088	3,115	1,305	23,088	3,126	0	20,484
Schaghticoke, Town of	32,545	32,545	32,545	12,291	3,031	32,545	14,297	22,281	21,901
Schaghticoke, Village of	640	640	640	52	210	640	299	474	366
Schodack, Town of	40,217	40,217	40,217	11,469	3,433	40,217	22,685	23,084	29,133
Stephentown, Town of	37,263	37,263	37,263	4,655	671	37,263	5,464	6,931	34,625
Troy, City of	7,066	7,066	7,066	342	1,054	7,066	5,007	6,972	2,276
Valley Falls, Village of	308	308	308	64	29	308	4	0	198
Rensselaer County Total	425,825	425,825	425,825	91,802	24,491	425,825	88,059	107,655	343,773

Table 3b. 3 – Improved Property Exposed to Hazards

Municipality	Replacement Cost Value ($)	Improved Property Exposed to Each Hazard							
		Atmospheric Hazards	Hydrologic Hazards			Geologic Hazards			Other Hazards
		Coldwave, Heatwave, Hurricane/ Tropical Storm, Lightning, Tornado, Wind, Ice Storm, Snow Storm	Drought (all land)	Drought (acres of pasture and cultivated crops)	Flood (100-year)	Earthquake (all)	Earthquake (Soft Soils that could exacerbate impacts)	Landslide (High and Moderate Incidence)	Wildfire
Berlin, Town of	$446,676,000	$446,676,000	$446,676,000	$0	$20,363,981	$446,676,000	$67,594,440	$173,607,696	$243,652,932
Brunswick, Town of	$2,342,127,000	$2,342,127,000	$2,342,127,000	$0	$103,311,319	$2,342,127,000	$793,904,020	$556,538,649	$588,609,008
Castleton-on-Hudson, Village of	$271,600,000	$271,600,000	$271,600,000	$0	$66,023,202	$271,600,000	$261,967,982	$271,600,000	$63,812,075
East Greenbush, Town of	$3,659,758,000	$3,659,758,000	$3,659,758,000	$0	$100,211,645	$3,659,758,000	$1,515,882,418	$3,521,010,299	$732,801,341
East Nassau, Village of	$94,148,000	$94,148,000	$94,148,000	$0	$9,186,976	$94,148,000	$50,393,227	$0	$47,235,329
Grafton, Town of	$458,781,000	$458,781,000	$458,781,000	$0	$13,484,223	$458,781,000	$243,110	$0	$340,045,542
Hoosick Falls, Village of	$583,380,000	$583,380,000	$583,380,000	$0	$13,644,246	$583,380,000	$176,684,408	$0	$205,873,106
Hoosick, Town of	$745,594,000	$745,594,000	$745,594,000	$0	$35,729,151	$745,594,000	$407,869,692	$0	$68,258,380
Nassau, Town of	$571,880,000	$571,880,000	$571,880,000	$0	$17,671,547	$571,880,000	$134,466,488	$0	$302,106,699
Nassau, Village of	$173,160,000	$173,160,000	$173,160,000	$0	$11,701,596	$173,160,000	$172,200,419	$0	$26,065,615
North Greenbush, Town of	$2,801,151,000	$2,801,151,000	$2,801,151,000	$0	$134,711,130	$2,801,151,000	$1,397,151,238	$1,909,744,723	$599,492,739
Petersburgh, Town of	$333,098,000	$333,098,000	$333,098,000	$0	$22,930,876	$333,098,000	$33,551,508	$56,214,114	$194,865,456
Pittstown, Town of	$737,726,000	$737,726,000	$737,726,000	$0	$24,859,645	$737,726,000	$142,899,966	$0	$276,729,925
Poestenkill, Town of	$945,815,000	$945,815,000	$945,815,000	$0	$51,390,025	$945,815,000	$224,547,540	$0	$464,367,208
Rensselaer, City of	$1,588,138,000	$1,588,138,000	$1,588,138,000	$0	$372,823,892	$1,588,138,000	$1,573,400,570	$1,588,137,979	$258,237,821
Sand Lake, Town of	$1,782,955,000	$1,782,955,000	$1,782,955,000	$0	$97,593,476	$1,782,955,000	$509,225,270	$0	$846,946,748
Schaghticoke, Town of	$1,379,356,000	$1,379,356,000	$1,379,356,000	$0	$59,405,704	$1,379,356,000	$445,482,610	$1,063,032,627	$454,247,033
Schaghticoke, Village of	$129,380,000	$129,380,000	$129,380,000	$0	$2,653,655	$129,380,000	$50,201,413	$118,979,267	$37,264,933
Schodack, Town of	$2,486,786,000	$2,486,786,000	$2,486,786,000	$0	$54,039,912	$2,486,786,000	$1,312,953,983	$1,521,934,522	$865,773,330
Stephentown, Town of	$509,235,000	$509,235,000	$509,235,000	$0	$14,734,176	$509,235,000	$134,661,613	$75,229,297	$283,287,545
Troy, City of	$11,211,809,000	$11,211,809,000	$11,211,809,000	$0	$885,055,654	$11,211,809,000	$9,639,810,284	$11,184,251,316	$403,148,667
Valley Falls, Village of	$81,394,000	$81,394,000	$81,394,000	$0	$1,772,249	$81,394,000	$13,706	$0	$14,635,887
Rensselaer County Total	$33,333,947,000	$33,333,947,000	$33,333,947,000	$0	$2,107,001,207	$33,333,947,000	$19,101,971,745	$21,907,736,183	$7,187,150,179

Emergency Facilities

Emergency facilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of key facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Emergency facilities by jurisdiction are presented in Table 3b.4. There are a total of 104 emergency facilities in the County.

Table 3b. 4 – Emergency Facilities

Municipality	Fire Stations	Police Stations	EMS / Ambulance Stations	Hospitals	Shelters[6]
Berlin, Town of	1	0	1	0	2
Brunswick, Town of	4	1*	1 **	0	1
Castleton-on-Hudson, Village of	1	0	0	0	1
East Greenbush, Town of	6	1	1	0	0
East Nassau, Village of	1	0	1	0	1
Grafton, Town of	1	0	1	0	0
Hoosick Falls, Village of	1	1	1	0	2
Hoosick, Town of	4	0	0	0	4
Nassau, Town of	0	0	0	0	0
Nassau, Village of	1	1	1	0	0
North Greenbush, Town of	2	1	1	0	2
Petersburgh, Town of	1	0	1	0	0
Pittstown, Town of	2	0	2	0	2
Poestenkill, Town of	1	0	1	0	2
Rensselaer, City of	1	1	1	0	1
Sand Lake, Town of	3	0	1	0	4
Schaghticoke, Town of	6	0	1	0	0
Schaghticoke, Village of	1	0	0	0	2
Schodack, Town of	4	2*	1	0	3
Stephentown, Town of	1	0	1	0	0
Troy, City of	1	3	3	2	6
Valley Falls, Village of	1	0	0	0	0
County Total	44	11	19	2	33

* State Troopers
** The Mohawk Ambulance Station in Brunswick is operated privately and is under contract as backup to many of the surrounding communities.

Critical Infrastructure and Utilities

Critical infrastructure and utilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of key facilities

[6] Specific shelter data is protected information and is not released to the public unless and until necessary during a disaster.

located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Critical infrastructure and utilities by jurisdiction are presented in Table 3b.5. There are a total of 112 critical infrastructure and utility facilities in the County.

Airports has been taken to mean substantial airfields with paved runways operating scheduled services or suitable for the operation of fixed-wing aircraft for the transporting of emergency response personnel and equipment.

Communications facilities are transmitting stations for emergency services or for radio and/or television stations licensed by the Federal Communications Commission.

Table 3b.5 - Critical Infrastructure and Utilities by Jurisdiction

Municipality	Wastewater Facilities	Water Treatment	Airports	Railroads (Passenger/ Freight Station)	Electric Power Facilities	Communications Facilities	Oil Facilities	Hazardous Materials Sites	Natural Gas Facilities	Ports
Berlin, Town of	0	1	0	0	0	0	0	0	0	0
Brunswick, Town of	0	0	0	0	0	1	0	0	0	0
Castleton-on-Hudson, Village of	1	0	0	1	0	0	0	0	0	0
East Greenbush, Town of	1	0	0	0	0	1	2	0	0	2
East Nassau, Village of	0	0	0	0	0	0	0	0	0	0
Grafton, Town of	0	0	0	0	0	0	0	0	0	0
Hoosick Falls, Village of	0	1	0	1	0	0	0	11	0	0
Hoosick, Town of	1	0	0	5	0	0	0	0	0	0
Nassau, Town of	0	0	0	0	0	0	0	1	0	0
Nassau, Village of	0	0	0	0	0	0	0	0	0	0
North Greenbush, Town of	1	0	0	0	0	2	0	3	0	0
Petersburgh, Town of	0	0	0	0	0	0	0	2	0	0
Pittstown, Town of	0	0	0	0	0	0	0	0	0	0
Poestenkill, Town of	0	0	0	0	0	2	0	0	0	0
Rensselaer, City of	1	0	0	3	2	0	2	42	0	2
Sand Lake, Town of	0	0	0	0	0	0	0	0	0	0
Schaghticoke, Town of	0	0	0	0	1	0	0	0	0	0
Schaghticoke, Village of	0	0	0	1	1	0	0	0	0	0
Schodack, Town of	2	1	0	0	0	0	0	0	1	0
Stephentown, Town of	0	0	0	0	0	0	0	0	0	0
Troy, City of	2	1	0	2	1	0	0	1	0	4
Valley Falls, Village of	1	0	0	0	1	0	0	0	0	0
County Total	10	4	0	13	6	6	4	60	1	8

Other Key Facilities

Other key facilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of such facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Schools and senior care facilities by jurisdiction are presented in Table 3b.6. There are a total of 58 such key facilities in the planning area.

Table 3b.6 - Other Key Facilities by Jurisdiction

Municipality	Schools	Senior Care Facilities *
Berlin, Town of	2	0
Brunswick, Town of	4	0
Castleton-on-Hudson, Village of	1	0
East Greenbush, Town of	5	0
East Nassau, Village of	0	0
Grafton, Town of	0	0
Hoosick Falls, Village of	0	0
Hoosick, Town of	3	0
Nassau, Town of	0	0
Nassau, Village of	1	0
North Greenbush, Town of	7	0
Petersburgh, Town of	0	0
Pittstown, Town of	0	0
Poestenkill, Town of	2	0
Rensselaer, City of	3	0
Sand Lake, Town of	3	0
Schaghticoke, Town of	0	0
Schaghticoke, Village of	2	0
Schodack, Town of	3	1
Stephentown, Town of	0	0
Troy, City of	19	2
Valley Falls, Village of	0	0
County Total	55	3

* As per the County Department of Economic Development and Planning, these figures only encompass the senior centers which are not residential facilities.

The exposure of identified emergency services, critical facilities, and infrastructure assets to hazards with discrete delineable impact areas is presented in Appendix B.

Historical and Cultural Resources

Historical and cultural resources were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of culturally or historically valuable assets located in hazard areas, which may influence the focus of individual mitigation

activities in the mitigation goals and strategy stage of the plan. At the State and Federal levels, official listings of historic resources are established and maintained to foster the preservation of particular cultural resources. The State and National Registers of Historic Places are the official listings of buildings, structures, districts, objects, and sites significant in the history, architecture, archaeology, engineering, and culture of the State and the nation. Cultural and historic resources are defined as follows:

Cultural Resources: As defined by the National Park Service in its "Cultural Resources Management Guidelines," cultural resources are: “Those tangible and intangible aspects of cultural systems, both living and dead, that are valued by or representative of a given culture or that contain information about a culture . . . and [they] include but are not limited to sites, structures, districts, objects and artifacts, and historic documents associated with or representative of peoples, cultures, and human activities and events, either in the present or in the past. Cultural resources also can include the primary written and verbal data for interpreting and understanding those tangible resources.”

Historic Resources: Historic resources are any cultural resource dating from the period between the onset of written records (which in northern New York State is typically placed around the time of first European contact in the sixteenth century) and 50 years ago.

In the State of New York, the State Historic Preservation Office (SHPO) – within the New York State Office of Parks, Recreation and Historic Preservation (NYS OPRHP) – helps communities identify, evaluate, preserve, and revitalize their historic and cultural resources. New York SHPO maintains GIS databases of all historic and cultural assets listed on the State and National Registers. To identify the resources of this nature located in Rensselaer County, GIS files were obtained through a request to the NYS OPRHP. This data includes only those cultural and historic properties and sites that are included in the New York State or National Registers of Historic Places, or that have been determined Eligible for inclusion through federal or state processes as administered by the New York SHPO. Inclusion in this data set does not preclude the existence of other historic properties or sites not within this category or as yet unidentified.

Historical and cultural assets located in Rensselaer County are presented in Table 3b.7. According to New York SHPO and National Register of Historic Places data there are 84 such assets georeferenced and registered in the planning area. According to the available records, State and Federally listed historical assets are located in 15 of the 22 municipalities covered by this hazard mitigation plan. The exposure of identified historical and cultural resources to hazards with discrete delineable impact areas is presented in Appendix C.

Table 3b.7 - Historic and Cultural Resources in Rensselaer County		
Municipality	Historic Structure / Landmark Name	Location / Address
Berlin, Town of	None	
Brunswick, Town of	District No. 6 Schoolhouse	Brick Church Road at Buck Road
Brunswick, Town of	Garfield School	NY 2 and Moonlawn Road
Brunswick, Town of	Morrison Farmstead	3842 NY 2
Castleton-on-Hudson, Village of	None	
East Greenbush, Town of	Craver Farmstead	115 Craver Road
East Greenbush, Town of	John Carner, Jr. House	1310 Best Road
East Nassau, Village of	East Nassau School	37 Garfield Road
Grafton, Town of	None	
Hoosick, Town of	Bennington Battlefield	NY 67, on Vermont state line
Hoosick, Town of	Breese-Reynolds House	601 South Street
Hoosick, Town of	Buskirk Covered Bridge	Spans Hoosic River north of NY 67
Hoosick, Town of	David Matthews House	(blank)
Hoosick, Town of	Delaney Hotel	NY 67 at NY 22
Hoosick, Town of	Tibbits House	South of Hoosick at junction of NY 22 and NY 7
Hoosick Falls, Village of	Estabrook Octagon House	8 River Street
Hoosick Falls, Village of	Hoosick Falls Armory	Church and Elm Streets
Hoosick Falls, Village of	Hoosick Falls Historic District	Central Avenue and Main Street
Hoosick Falls, Village of	St. Mark's Episcopal Church	Main Street; East side
Hoosick Falls, Village of	US Post Office--Hoosick Falls	35 Main Street
Nassau, Town of	Smith, Henry Tunis, Farm	South of Nassau on NY 203
Nassau, Village of	Albany Avenue Historic District	Albany Avenue
Nassau, Village of	Chatham Street Row	Chatham Street
Nassau, Village of	Church Street Historic District	Church Street
North Greenbush, Town of	Defreest Homestead	South of Troy at US 4 and Jordan Road
North Greenbush, Town of	John Evert Van Alen House	1744 Washington Avenue Extension
North Greenbush, Town of	Sharpe Homestead and Cemetery	44 Laura Lane
Petersburgh, Town of	Petersburg United Methodist Church	12 Head of Lane Road
Pittstown, Town of	Sherman Farm	35 Sherman Road
Poestenkill, Town of	None	
Rensselaer, City of	Aiken House	Northeast corner of Riverside and Aiken Avenues
Rensselaer, City of	Beverwyck Manor	Washington Avenue
Rensselaer, City of	Clark-Dearstyne-Miller Inn	11-13 Forbes Avenue

Table 3b.7 - Historic and Cultural Resources in Rensselaer County		
Municipality	Historic Structure / Landmark Name	Location / Address
Rensselaer, City of	Fort Crailo	South of Columbia Street on Riverside Avenue
Rensselaer, City of	Patroon Agent's House and Office	15 Forbes Avenue
Rensselaer, City of	W.P. Irwin Bank Building	156 Broadway
Sand Lake, Town of	Albert R. Fox House	2801 NY 43 and 66
Sand Lake, Town of	Sand Lake Baptist Church	2960 NY 43
Schaghticoke, Town of	Knickerbocker Mansion	Knickerbocker Road
Schaghticoke, Village of	None	
Schodack, Town of	Albany Avenue Historic District	Albany Avenue
Schodack, Town of	Blink Bonnie	1368 Sunset Road
Schodack, Town of	District School No. 3	1125 South Schodack Road
Schodack, Town of	Elmbrook Farm	2567 Brookview Road
Schodack, Town of	Muitzes Kill Historic District	An irregular pattern on both sides of Schodack Landing Road
Schodack, Town of	Schodack Landing Historic District	NY 9J
Schodack, Town of	Staats, Joachim, House and Gerrit Staats Ruin	North of Castleton-on-Hudson
Stephentown, Town of	None	
Troy, City of	Burden Ironworks Office Building	Polk Street
Troy, City of	Cannon Building	1 Broadway
Troy, City of	Central Troy Historic District	Roughly bounded by Grand Street, Fifth Avenue and Third, Adams, and First and River Streets
Troy, City of	Church of the Holy Cross	136 8th Street
Troy, City of	Emma Willard School	Pawling and Elmgrove Avenue
Troy, City of	Esek Bussey Firehouse	302 10th Street
Troy, City of	Fifth Avenue--Fulton Street Historic District	Bounded by Grand, William, and Union Streets and Broadway
Troy, City of	Fire Alarm Telegraph and Police Signaling Building	67 State Street
Troy, City of	Gardner Earl Memorial Chapel and Crematorium	Oakwood Avenue
Troy, City of	Glenwood	Eddy's Lane
Troy, City of	Grand Street Historic District	Grand St. between 5th and 6th Avenue
Troy, City of	Hart-Cluett Mansion	59 2nd Street
Troy, City of	Haskell School	150 Sixth Avenue
Troy, City of	Henry Koon House	179 Pawling Avenue
Troy, City of	Herman Melville House	214 Fourth Street
Troy, City of	Ilium Building	Northeast corner of Fulton and 4th Streets

Table 3b.7 - Historic and Cultural Resources in Rensselaer County		
Municipality	Historic Structure / Landmark Name	Location / Address
Troy, City of	Kate Mullany House	350 Eighth Street
Troy, City of	Lansingburgh Academy	4th and 114th Streets
Troy, City of	Lansingburgh Village Burial Ground	107th Street and Third Avenue
Troy, City of	McCarthy Building	255-257 River Street
Troy, City of	National State Bank Building	297 River Street
Troy, City of	Northern River Street Historic District	403-429 and 420-430 River Street
Troy, City of	Oakwood Cemetery	101st Street
Troy, City of	Old Troy Hospital	8th Street
Troy, City of	Osgood, J. C., Firehouse	316-324 Third Street
Troy, City of	Poesten Kill Gorge Historic District	Poesten Kill between Spring Avenue and NY 2
Troy, City of	Powers Home	819 3rd Avenue
Troy, City of	Proctor's Theater	82 4th Street
Troy, City of	Public School No. 10	239 Third Street
Troy, City of	Pumpkin House (Hart Tenant House)	180 Fourth Street
Troy, City of	River Street Historic District	Both sides of River Street from Congress Street to junction with 1st Street
Troy, City of	Second Street Historic District	Both sides of 2nd Street
Troy, City of	St. Barnabas Episcopal Church	2900 Fifth Avenue
Troy, City of	St. Paul's Episcopal Church Complex	58 3rd Street
Troy, City of	Trinity Church	585 Fourth Avenue
Troy, City of	Troy Gas Light Company	Northwest corner of Jefferson Street and 5th Avenue
Troy, City of	Troy Public Library	100 2nd Street
Troy, City of	Troy Savings Bank and Music Hall	32 Second Street
Troy, City of	US Post Office--Troy	400 Broadway
Troy, City of	W. & L. E. Gurley Building	514 Fulton Street
Troy, City of	Washington Park Historic District	Washington Park and adjacent properties on 2nd, 3rd, and Washington Streets and Washington Place
Troy, City of	Winslow Chemical Laboratory	105 Eighth Street
Valley Falls, Village of	None	

Population

The Countywide population as determined by the 2010 Census was 159,429 and the U.S Census Bureau estimated the 2018 population to be 159,442 – and increase of only 0.01 percent from that reported in the 2010 Census, and an increase of 4.52 percent over the 2000 Census. More information regarding likely future population trends can be found in the discussion of Land Use and Development Trends in a later section of this plan. Table 3b.8 presents the breakdown of the county population and household totals by municipality.

Table 3b.8 - Population by Jurisdiction

Jurisdiction	Population, Census 2000		Population Census 2010[1]		2018 Population Estimates, Census.gov	
	Total	Percent of County	Total	Percent of County	Total	Percent of County
Berlin, Town of	1,901	1.25%	1,880	1.18%	Not available	Not available
Brunswick, Town of	11,664	7.65%	11,941	7.49%	Not available	Not available
Castleton-on-Hudson, Village of	1,619	1.06%	1,473	0.92%	1,473	0.92%
East Greenbush, Town of	15,560	10.20%	16,473	10.33%	Not available	Not available
East Nassau, Village of	571	0.37%	587	0.37%	571	0.36%
Grafton, Town of	1,987	1.30%	2,130	1.34%	Not available	Not available
Hoosick Falls, Village of	3,436	2.25%	3,501	2.20%	3,373	2.12%
Hoosick, Town of [2]	6,759	4.43%	6,924	4.34%	Not available	Not available
Nassau, Town of [2]	4,818	3.16%	4,789	3.00%	Not available	Not available
Nassau, Village of	1,161	0.76%	1,133	0.71%	1,105	0.69%
North Greenbush, Town of	10,805	7.08%	12,075	7.57%	Not available	Not available
Petersburgh, Town of	1,563	1.02%	1,525	0.96%	Not available	Not available
Pittstown, Town of [2]	5,664	3.71%	5,735	3.60%	Not available	Not available
Poestenkill, Town of	4,054	2.66%	4,530	2.84%	Not available	Not available
Rensselaer, City of	7,761	5.09%	9,392	5.89%	9,212	5.78%
Sand Lake, Town of	7,987	5.24%	8,530	5.35%	Not available	Not available
Schaghticoke, Town of [2]	7,456	0.00%	7,679	0.00%	Not available	Not available
Schaghticoke, Village of	676	4.89%	592	4.82%	582	0.37%
Schodack, Town of [2]	12,536	0.44%	12,794	0.37%	Not available	Not available

Table 3b.8 - Population by Jurisdiction						
Jurisdiction	Population, Census 2000		Population Census 2010[1]		2018 Population Estimates, Census.gov	
	Total	Percent of County	Total	Percent of County	Total	Percent of County
Stephentown, Town of	2,873	8.22%	2,903	8.02%	Not available	Not available
Troy, City of	49,170	1.88%	50,129	1.82%	49,374	30.97%
Valley Falls, Village of	491	32.23%	466	31.44%	427	0.27%
County Total	152,538	100%	159,429	100%	159,442	100%

Note 1: Detailed breakdown data for years later than 2010 is not yet available for all municipalities.
Note 2: Population totals for these towns include villages whose municipal areas cover parts of more than one town.

For the purposes of this plan, "vulnerable" has been taken to mean residents of the county aged under five or over 65 years. Compared to the majority of the county population, people of these ages are assumed to require extra medical care and additional resources, particularly in the event of emergency evacuation. When viewed in combination with the data in Table 3b.5 and subsequent assessments of assets in individual hazard areas, this data may be used to highlight areas which may benefit from increased focus in the development of mitigation goals and strategies.

Table 3b.9 indicates that about 20 percent of the population of the planning area can be termed "vulnerable", and that the municipalities with the highest proportion of vulnerable residents are the Castleton-on-Hudson, North Greenbush and Hoosick Falls (26, 24 and 24 percent, respectively), while Grafton, Sand Lake, and the Towns of Nassau and Poestenkill have the lowest (each with 16 percent). Within the vulnerable sector of the population, the percentage of seniors outnumbers that of small children in every municipality, without exception, by an average of approximately two to one.

In Rensselaer County overall, small children account for roughly six percent of municipal populations, while seniors account for about 14 percent.

Table 3b.9 -Vulnerable Sectors of the Population by Jurisdiction (2010 Census[1])

Jurisdiction	Total Population	Under 5 Years	Percent of Municipal Total	65 Years and Over	Percent of Municipal Total	Total Vulnerable Population	Percent of Municipal Total
Berlin, Town of	1,880	99	5.3%	338	18.0%	437	23.3%
Brunswick, Town of	11,941	579	4.8%	1,878	15.7%	2,457	20.5%
Castleton-on-Hudson, Village of	1,473	102	6.9%	224	15.2%	326	22.1%
East Greenbush, Town of	16,473	846	5.1%	2,425	14.7%	3,271	19.8%
East Nassau, Village of	587	26	4.4%	77	13.1%	103	17.5%
Grafton, Town of	2,130	106	5.0%	247	11.6%	353	16.6%
Hoosick, Town of	6,924	373	4.8%	1,187	17.1%	1,560	21.9%
Hoosick Falls, Village of	3,501	205	5.9%	623	17.8%	828	23.7%
Nassau, Town of	4,789	235	4.9%	593	12.4%	828	17.3%
Nassau, Village of	1,133	56	4.9%	156	13.8%	212	18.7%
North Greenbush, Town of	12,075	593	4.9%	2,206	18.3%	2,799	23.2%
Petersburgh, Town of	1,525	75	4.9%	270	17.7%	345	22.6%
Pittstown, Town of	5,735	291	5.1%	722	12.6%	1,013	17.7%
Poestenkill, Town of	4,530	241	5.3%	548	12.1%	789	17.4%
Rensselaer, City of	9,392	655	7.0%	1,186	12.6%	1,841	19.6%
Sand Lake, Town of	8,530	433	5.1%	1,040	12.2%	1,473	17.3%
Schaghticoke, Town of	7,679	357	4.6%	1,164	15.2%	1,521	19.8%
Schaghticoke, Village of	592	42	7.1%	83	14.0%	125	21.1%
Schodack, Town of	12,794	626	4.9%	1,875	14.7%	2,501	19.6%
Stephentown, Town of	2,903	125	4.3%	442	15.2%	567	19.5%
Troy, City of	50,129	3,188	6.4%	5,486	10.9%	8,674	17.3%
Valley Falls, Village of	466	26	5.6%	51	10.9%	77	16.5%
County Total	159,429	8,822	5.5%	21,607	13.6%	30,429	19.1%

Note 1: Detailed breakdown data for years later than 2010 is not yet available for all municipalities.
Note 2: Totals for these towns include villages whose municipal areas cover parts of more than one town, and for which detailed household breakdowns are not available (see Footnote 2 under Table 3b.8)

SECTION 3c - RISK ASSESSMENT: ESTIMATED DAMAGES IN HAZARD AREAS

Atmospheric Hazards

Extreme Temperatures

Vulnerability and Impact – Extreme Temperatures (Coldwave/Heat Wave)

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for extreme temperatures (coldwaves and heatwaves). Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

Extreme temperatures are primarily a threat to human life and health, though they are also hazardous to livestock and agricultural crops and occasionally might threaten property and infrastructure and disrupt transportation systems. They can also exacerbate the impact of other hazards such as severe weather events that cause widespread power outages. Emergency responders are often called upon to work with public officials/non-profit agencies for heating/cooling venues, and to transport vulnerable sectors of the population to such venues. Extreme temperatures are likely to result in relatively minor impacts in Rensselaer County, with very few injuries (if any), minor and sporadic property damage, and minimal disruption on quality of life. Temporary shutdown of critical facilities to reduce energy usage or due to the fact that employees may not be able to get to the facility is possible. Common impacts associated with extreme heat in Rensselaer County include: injuries associated with swimming to escape extreme heat, and individuals seeking medical treatment for heat related illness (i.e., for heat stress, exhaustion, heat stroke, etc.), and power outages from an associated strain on electrical networks. Cooling centers are typically opened, and schools alter class schedules and/or activities to ensure student safety. Extreme heat events typically impact the elderly and disadvantaged most heavily. Primary impacts of concern for extreme cold temperatures include the life-threatening effects of overexposure hypothermia on people, particularly the elderly and disadvantaged. Other significant impacts include strains

on livestock and agriculture, and potential freezing of household water pipes and municipal water transmission systems[1].

Estimated Potential Losses – Extreme Temperatures (Coldwave/Heat Wave)

While all of Rensselaer County is exposed to extreme temperatures, existing buildings, infrastructure and critical facilities are not considered significantly vulnerable to substantial damage caused by extreme heat or cold events. Historic damage from extreme cold temperatures has occurred in Rensselaer County and is largely associated with water distribution lines freezing in some areas, but detailed repair costs are not available for these historic events. Overall, estimated property losses associated with extreme heat and extreme cold are anticipated to be relatively minimal across the planning area. Extreme temperatures do, however, present a significant life and safety threat to the planning area's population. Heat casualties are usually caused by lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being. Casualties resulting from extreme cold may result from a lack of adequate heat, carbon monoxide poisoning from unsafe heat sources and frostbite. The most vulnerable populations to cold casualties are the elderly or infirmed as well as low income households, as they may not be able to afford to operate a heat source on a regular basis and may not have immediate family or friends to look out for their well-being.

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 1- Countywide Statistics – Extreme Temperatures

Coldwave	
Total Losses Reported (1996-2018)	$30,800
Total Number of Episodes (1996-2018)	61
Annualized Losses Reported (1996-2018)	$1,400
Annualized Number of Episodes (1996-2018)	2.8
Daily Probability	0.76%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0
Heat Wave	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	22
Annualized Loss (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	1
Daily Probability	0.27%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

[1] Rensselaer County Planning notes that water transmission lines that had been built to code (four feet below grade) froze in the winter of 2014-2015 due to extreme cold temperatures that put the frost line below four feet. As a result, some people lost public water because the water pipes were frozen. Areas particularly impacted were the City of Troy (Lansingburgh) and some places in the Town of Brunswick.

Summary – Extreme Temperatures (Coldwave/Heat Wave)

Coldwaves and heat waves are common and affect the entire county. They cause disruptions, delays, accidents, and power outages and may lead to damage and fatalities.

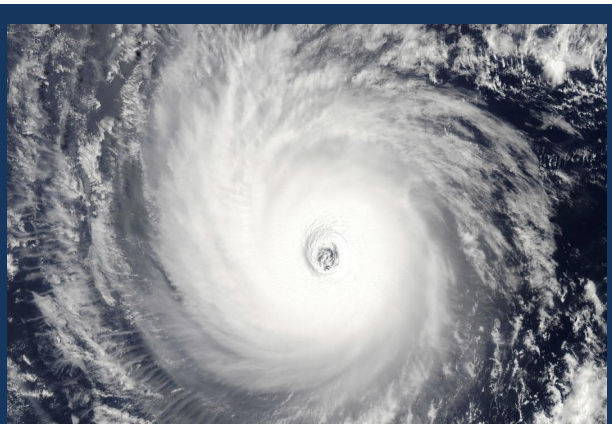
Extreme Temperatures (Coldwave/ Heat Wave)	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
	Low	Low	Low	Coldwave $1,400; Heat Wave $0	Low

Mitigation Opportunities – Extreme Temperatures (Coldwave/Heat Wave)

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for coldwaves and heat waves. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 2- Coldwave/Heatwave Mitigation Opportunities
Local Planning and Regulations
Reduce Urban Heat Island Effect
Education and Awareness Programs
Increase Awareness of Extreme Temperature Risk and Safety
Assist Vulnerable Populations
Educate Property Owners About Freezing Pipes

Hurricane/Tropical Storm



Vulnerability and Impact – Hurricane/Tropical Storm

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for hurricanes and tropical storms. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

Hurricanes and tropical storms are capable of producing catastrophic impacts. A high number of deaths and/or injuries are possible, a large percentage of property in the affected area could be damaged or destroyed, and a complete shutdown of critical facilities would be possible for 30 days or more, depending on the nature of the event. The Rensselaer County Emergency Preparedness Assessment (CEPA) characterizes hurricanes and tropical storms as a moderate hazard, with low likelihood and very high potential consequences. Impacts of hurricanes and tropical storms are associated with damages as a result of flooding (riverine and storm surge traversing up the Hudson River), and high winds. It is possible for the entire county to be impacted by hurricanes and tropical storms, though in different ways. For example, wind impacts may be widespread across the County. Riverine flooding would be expected in riverine flood zones and would cause more severe types of structure damages in areas along the Hudson River susceptible to storm surge. Roads and bridges across the county would be susceptible to overtopping and damage from floodwaters. Impacts to the general public include evacuation and sheltering needs, as well as emergency response for those who shelter in place or are injured during the event. All property types are potentially impacted. Roads, bridges, schools, hospitals and other types of critical facilities are susceptible to wind and water damage. Secondary impacts would be associated with flying debris. Transportation, communications, and governmental services may be severely impacted. Impacts would be exacerbated when coincident with high tides, or during prolonged types of events that extend across several tidal cycles. Sea level rise will increase impacts over time.

Table 3c.3 describes the damage that could be expected for each category of hurricane. Damage during hurricanes might also result from spawned tornadoes, storm surge and inland flooding associated with heavy rainfall that usually accompanies these storms.

Table 3c. 3- Countywide Statistics – Extreme Temperatures

Storm Category	Damage Level	Description of Damages	Photo Example
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery and trees. Also, some coastal flooding and minor pier damage.	
2	MODERATE	Some roofing material, door and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings might break their moorings.	
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain might be flooded well inland.	
4	EXTREME	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain might be flooded well inland.	
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas might be required.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Estimated Potential Losses – Hurricane/Tropical Storm

Hurricanes and tropical storms are complex combinations of discrete component hazards occurring simultaneously. Hurricanes and tropical storms include high winds that result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, injuries and loss of life, and the need to shelter and care for individuals who have been impacted by the events. Significant damage can also be inflicted by trees, branches, and other objects that fall on power lines, buildings, roads, vehicles, and people. Damages during these events result from the cumulative impacts of a wide range of hazards including flooding, storm surge, and high winds. No two hurricanes or tropical storms are identical. Even hurricanes of the same category can bring with them wildly different impacts depending on whether they occur during a time of high tide or low tide. Variations in inland wind affects and precipitation amounts, for example, can vary widely. Hurricanes and tropical storms often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities, and populations are considered to be exposed to the potential damage from severe storms. Because hurricanes and tropical storms can lead to damage from additional hazards such as flooding, coastal erosion, high winds, and precipitation, estimating the potential losses from all of these hazards is challenging. Current HAZUS hurricane model analyzes only hurricane winds and is not capable of modeling and

estimating cumulative losses from all hazards associated with hurricanes, only hurricane winds were analyzed. A probabilistic scenario was created using HAZUS to assess the vulnerability of Rensselaer County to hurricane winds. Default HAZUS wind speed data and damage functions and methodology were used to determine the potential estimated losses for 100- and 500-year. Table 3c.4 shows estimated potential losses as compared to structure Replacement Cost Value (RCV). Table 3c.5 shows estimated potential impacts to critical facilities. Table 3c.6 shows estimated debris volumes generated.

Table 3c. 4- Estimated Potential Losses from Hurricane Winds - RCV

Municipality	Total RCV (Structure only)	100-year Event		500-year Event	
		Estimated Loss (RCV)	% of Total	Estimated Loss (RCV)	% of Total
Berlin, Town of	$276,050,000.00	$21,165	0.01	$1,195,315	0.43
Brunswick, Town of	$1,475,405,000.00	$58,172	0.00	$1,822,517	0.12
Castleton-on-Hudson, Village of	$169,901,000.00	$11,618	0.01	$58,873	0.03
East Greenbush, Town of	$2,276,420,000.00	$231,080	0.01	$1,520,573	0.07
East Nassau, Village of	$61,081,000.00	$3,728	0.01	$115,236	0.19
Grafton, Town of	$291,506,000.00	$25,111	0.01	$837,466	0.29
Hoosick Falls, Village of	$446,353,000.00	$27,659	0.01	$1,363,610	0.31
Hoosick, Town of	$345,419,000.00	$17	0.00	$496,966	0.14
Nassau, Town of	$373,830,000.00	$31,748	0.01	$980,490	0.26
Nassau, Village of	$108,910,000.00	$5,668	0.01	$143,555	0.13
North Greenbush, Town of	$1,729,581,000.00	$93,349	0.01	$1,414,515	0.08
Petersburgh, Town of	$201,505,000.00	$71	0.00	$830,619	0.41
Pittstown, Town of	$471,799,000.00	$43,239	0.01	$977,720	0.21
Poestenkill, Town of	$599,521,000.00	$46,257	0.01	$1,349,324	0.23
Rensselaer, City of	$984,929,000.00	$64,740	0.01	$266,690	0.03
Sand Lake, Town of	$1,133,858,000.00	$89,626	0.01	$2,602,141	0.23
Schaghticoke, Town of	$876,379,000.00	$75,095	0.01	$944,449	0.11
Schaghticoke, Village of	$80,388,000.00	$961	0.00	$13,007	0.02
Schodack, Town of	$1,533,191,000.00	$187,157	0.01	$1,476,006	0.10
Stephentown, Town of	$322,143,000.00	$27,101	0.01	$1,486,618	0.46
Troy, City of	$6,438,737,000.00	$177,024	0.00	$1,911,820	0.03
Valley Falls, Village of	$49,323,000.00	$343	0.00	$7,120	0.01
County Total	$20,246,229,000.00	$1,220,928	0.01	$21,814,629.55	0.18

Table 3c. 5- Estimated Critical Facility Impacts from Hurricane Winds

Facility Type	Loss of Days	500- Year Event			
		Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
EOC	0	0	0	0	0
Medical	0	0	9	8	0
Police	0	1	0	0	0
Fire	0	1	0	0	0
Schools	0	1	0	0	0

Table 3c. 6 - Estimated Debris from Hurricane Winds								
Municipality	100 Year Event				500 Year Event			
	Brick and Wood (tons)	Concrete and Steel (tons)	Trees (tons)	Tree Volume (cubic yards)	Brick and Wood (tons)	Concrete and Steel (tons)	Trees (tons)	Tree Volume (cubic yards)
Berlin, Town of	0	0	1	1	49	74	0	7,322
Brunswick, Town of	0	0	0	0	61	169	0	3,769
Castleton-on-Hudson, Village of	0	0	1	2	2	60	0	4
East Greenbush, Town of	2	0	242	751	46	86	0	1,863
East Nassau, Village of	0	0	151	112	3	212	0	450
Grafton, Town of	0	0	2	1	27	5	0	3,708
Hoosick Falls, Village of	0	0	0	0	64	290	0	329
Hoosick, Town of	0	0	0	0	71	238	0	5,925
Nassau, Town of	0	0	1,275	951	29	89	0	3,815
Nassau, Village of	0	0	0	0	9	93	0	390
North Greenbush, Town of	1	0	307	559	50	164	0	2,934
Petersburgh, Town of	0	0	0	0	31	125	0	5,501
Pittstown, Town of	0	0	0	0	41	50	0	4,339
Poestenkill, Town of	0	0	1,039	798	39	257	0	2,396
Rensselaer, City of	5	0	51	211	17	253	0	423
Sand Lake, Town of	0	0	803	952	78	221	0	5,262
Schaghticoke, Town of	0	0	0	0	29	398	0	2,558
Schaghticoke, Village of	0	0	0	0	1	27	0	50
Schodack, Town of	1	0	1,064	1,309	39	264	0	4,523
Stephentown, Town of	0	0	0	0	62	175	0	10,426
Troy, City of	22	0	93	693	275	2,834	0	3,127
Valley Falls, Village of	0	0	0	0	0	2	0	31
Rensselaer County (Total)	31	0	5,029	6,342	1,023	6,088	0	69,144

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 7- Countywide Statistics – Hurricane/Tropical Storm	
Total Losses Reported (1996-2018)	$1,900,000
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$86,364
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary – Hurricane/Tropical Storm

Hurricanes and tropical storms are common, often causing losses to homes, businesses, government facilities, utilities, and the residents of Rensselaer County. They have caused damage to infrastructure such as bridges and have cut off communications, making immediate emergency response efforts more difficult.

Hurricane/ Tropical Storm	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
	Low	Very High	Moderate	$86,834	Moderate

Mitigation Opportunities – Hurricane/Tropical Storm

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for hurricanes and tropical storms. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 8- Hurricane/Tropical Storm Wind Mitigation Opportunities
Wind Hazard:
Local Planning and Regulations
Adopt and Enforce Building Codes
Promote or Require Site and Building Design Standards to Minimize Wind Damage
Assess Vulnerability to Severe Wind
Protect Power Lines and Infrastructure
Structure and Infrastructure Projects
Retrofit Residential Buildings
Retrofit Public Buildings and Critical Facilities
Education and Awareness Programs
Increase Severe Wind Risk Awareness

Table 3c. 9- Hurricane/Tropical Storm Flood Mitigation Opportunities
Flood Hazard:
Local Planning and Regulations
Incorporate Flood Mitigation in Local Planning
Form Partnerships to Support Floodplain Management
Limit or Restrict Development in Floodplain Areas
Adopt and Enforce Building Codes and Development Standards
Improve Stormwater Management Planning
Adopt Policies to Reduce Stormwater Runoff
Improve Flood Risk Assessment
Join or Improve Compliance with NFIP
Manage the Floodplain Beyond Minimum Requirements
Participate in the CRS
Establish Local Funding Mechanisms for Flood Mitigation
Structure and Infrastructure Projects
Remove Existing Structures from Flood Hazard Areas

Table 3c. 9- Hurricane/Tropical Storm Flood Mitigation Opportunities
Improve Stormwater Drainage System Capacity
Conduct Regular Maintenance for Drainage Systems and Flood Control Structures
Elevate or Retrofit Structures and Utilities
Floodproof Residential and Non-Residential Structures
Protect Infrastructure
Protect Critical Facilities
Construct Flood Control Measures
Natural Systems Protection
Protect and Restore Natural Flood Mitigation Features
Preserve Floodplains as Open Space
Increase Awareness of Flood Risk and Safety
Education and Awareness Programs
Educate Property Owners about Flood Mitigation Techniques

Lightning

Vulnerability and Impact – Lightning

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for lightning. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

On average, 55 fatalities and hundreds of injuries occur each year by lightning strikes in the United States. Lightning can strike communications equipment (i.e., radio or cell towers, antennae, satellite dishes, electrical transformers, etc.) and hamper communication and emergency response. Lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure, largely by igniting a fire. In addition, lightning can ignite vegetation to cause a wildfire. Lightning's impacts can typically be characterized as minor in Rensselaer County. Events are typically associated with very few injuries (if any), only minor property damage, and minimal disruption on quality of life. The shutdown of critical facilities, if at all, is typically only temporary in nature. Historical impacts in Rensselaer County have included direct health impacts to individuals struck by lightning, structure damages from fires caused by lightning, and impacts to emergency communications facilities when towers have been struck by lightning. Lightning occurs frequently in Rensselaer County, but damaging events are relatively few in number and limited in scope when they do occur. Building codes requiring buildings to be grounded work to decrease damages. Members of the general public who are outdoors are particularly vulnerable during an event. Lightning most typically occurs within 10 miles of a thunderstorm.

Estimated Potential Losses – Lightning

In general terms, estimated damages due to a single lightning event could be quite severe in any one location, however no one location or municipality in the county is any more vulnerable than another. Lightning mitigation projects would likely yield the greatest benefit for critical facilities.

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 10 - Countywide Statistics – Lightning	
Total Losses Reported (1996-2018)	$236,000
Total Number of Episodes (1996-2018)	10
Annualized Losses Reported (1996-2018)	$10,727
Annualized Number of Episodes (1996-2018)	0.5
Daily Probability	0.12%
Total Injuries (1996-2018)	11
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Lightning

Lightning is a common occurrence in Rensselaer County. However, lightning strikes and damages are less common. However, they can have catastrophic impacts on people and property and have particularly negative impacts when they strike critical infrastructure and facilities (such as the July 2010 direct strike to the Rensselaer County Bureau of Public Safety (RCBPS) building which damaged the building and equipment and required temporary operations out of the RCBPS trailer for several days).

	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Lightning	High	Low	Low	$10,727	Low

Mitigation Opportunities – Lightning

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for lightning. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 11 - Lightning Mitigation Opportunities
Structure and Infrastructure Projects
Protect Critical Facilities and Equipment
Education and Awareness Programs
Conduct Lightning Awareness Programs

Tornado

Vulnerability and Impact – Tornado

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for tornados. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

High-wind velocity and wind-blown debris, along with lightning or hail, result in the damage caused by tornadoes. Destruction caused by tornadoes depends on the size, intensity, and duration of the storm. Tornadoes cause the greatest damage to structures that are light, such as residential homes and mobile homes, and tend to remain localized during impact. Impacts are related to the strength of the storm. Weaker tornados cause minor impacts, such as loss of roof shingles, damage to rain gutters and siding, and broken tree branches. Stronger storms can tear off roofs, break windows, overturn vehicles, strip bark off of trees and/or completely uproot trees. Extremely strong tornados can cause catastrophic impacts – with homes completely blown away or leveled, and steel-reinforced buildings damaged beyond repair. Communities impacted by tornados can be affected for long periods of time. Fatalities can occur. Residents can be displaced from their homes for long periods of time, and sometimes may have to relocate outside of the community depending on the extent of the damage. When public and/or critical facilities schools are damaged or destroyed, community impacts are long-term and substantial. Functional downtime of government operations and services (i.e., the type that would occur if schools, municipal buildings, emergency services buildings are affected) can be significant and long-term. The local economy of tornado-impacted communities can be affected as well, impacting businesses, employment, employees, and their incomes. Farms can be destroyed. Impacts tend to be more extensive and longer in duration as the strength of the tornado increases, for tornados of longer width or duration on the ground (impacting the area affected), and in areas with greater development (more people and property exposed).

Estimated Potential Losses – Tornado

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 12 - Countywide Statistics – Tornado	
Total Losses Reported (1996-2018)	$10,425,000
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$473,864
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Tornado

Tornados are an infrequent occurrence in Rensselaer County. However, they have the potential to cause catastrophic impacts on people and property in localized areas when they do occur.

	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Tornado	Low	High	High	$473,864	High

Mitigation Opportunities – Tornado

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for tornados. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 13 - Tornado Mitigation Opportunities
Local Planning and Regulations
Encourage Construction of Safe Rooms
Require Wind-Resistant Building Techniques
Education and Awareness Programs
Conduct Tornado Awareness Activities

Wind

Vulnerability and Impact – Wind

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for wind. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Impacts

High wind events can result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, tree damage, injuries and loss of life, and the need to shelter and care for individuals who have been impacted by the events. Significant damage can also be inflicted by trees, branches, and other objects that fall on power lines, buildings, roads, vehicles, and people.

Estimated Potential Losses – Wind

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 14 - Countywide Statistics – Wind	
Total Losses Reported (1996-2018)	$2,640,500
Total Number of Events (1996-2018)	176
Annualized Losses Reported (1996-2018)	$120,023
Annualized Number of Episodes (1996-2018)	8.0
Daily Probability	2.19%
Total Injuries (1996-2018)	23
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Wind

Extreme wind events are a very frequent occurrence in Rensselaer County. Severe wind events tend to have low impacts on people, responders, property, and the economy in localized areas.

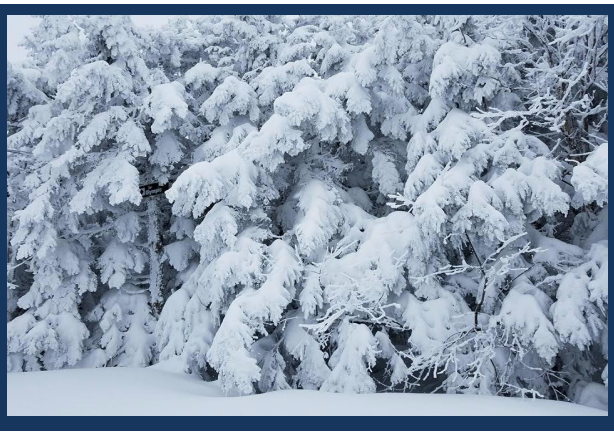
	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Wind	High	Low	High	$120,023	High

Mitigation Opportunities – Wind

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for wind. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 15 - Wind Mitigation Opportunities
Local Planning and Regulations
Adopt and Enforce Building Codes
Promote or Require Site and Building Design Standards to Minimize Wind Damage
Assess Vulnerability to Severe Wind
Protect Power Lines and Infrastructure
Structure and Infrastructure Projects
Retrofit Residential Buildings
Retrofit Public Buildings and Critical Facilities
Education and Awareness Programs
Increase Severe Wind Risk Awareness

Winter Storm



Vulnerability and Impact – Winter Storm (Ice Storm/Snow Storm)

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for winter storms (ice storms and snow storms). Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

Ice storms and snow storms are of significant concern to Rensselaer County because of their direct and indirect impacts, which include delays, accidents, health problems, cascading effects such as utility failure, and stress on community resources. Heavy snow can immobilize a region and paralyze a city by stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of removing snow and repairing damage and loss of business can have large economic impacts on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communications towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

Estimated Potential Losses – Winter Storm (Ice Storm/Snow Storm)

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 16 - Countywide Statistics – Winter Storm (Ice Storm/Snow Storm)	
Ice Storm	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	3
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.04%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0
Snow Storm	
Total Losses Reported (1996-2018)	$740,100
Total Number of Episodes (1996-2018)	147
Annualized Loss (1996-2018)	$33,641
Annualized Number of Episodes (1996-2018)	6.7
Daily Probability	1.83%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Winter Storm (Ice Storm/Snow Storm)

Winter storms and cold temperatures are common and affect the entire county. They cause disruptions, delays, accidents, and power outages and may lead to damage and fatalities.

	Likelihood	Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Winter Storm (Ice Storm/Snow Storm)	High	Moderate	Moderate	$Ice storm $0; Snow Storm $33,641	Moderate

Mitigation Opportunities – Winter Storm (Ice Storm/Snow Storm)

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for winter weather. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 17 - Winter Storm Mitigation Opportunities
Local Planning and Regulations
Adopt and Enforce Building Codes
Structure and Infrastructure Projects
Protect Buildings and Infrastructure
Protect Power Lines
Reduce Impacts to Roadways
Education and Awareness Programs
Conduct Winter Weather Risk Awareness Activities
Assist Vulnerable Populations

Hydrologic Hazards

Drought

Vulnerability and Impact – Drought

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for drought. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

Droughts are slow onset hazards, but, over time, they can severely affect crops, municipal water supplies, recreational resources, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. In addition, human actions and demands for water resources can accelerate drought-related impacts. Drought impacts occur over large areas and cross jurisdictional boundaries. All existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop losses on agricultural lands and have no impact on buildings.

Crop failure is one common impact of drought. According to the 2007 USDA Census of Agriculture, Rensselaer County has 506 farms. The Census notes that the market value of production on Rensselaer County farms in 2007 was $37.5 million. Slightly more than half of this value is accounted for by milk and other dairy products, with total crop sales accounting for approximately 38 percent. While agricultural losses during a drought, specifically losses to crops and produce, could be significant to individual farm operators, the overall impact of agricultural losses on the County economy is likely to be slight. When drought begins, the agricultural sector is usually the first to be impacted because of its heavy reliance on stored soil water, which can rapidly be depleted during extended dry periods. When precipitation returns to normal, impacts on the agricultural sector are quick to diminish again due to the reliance on stored soil moisture.

Table 3c. 18 - Cultivated Cropland in Rensselaer County		
Jurisdiction	Total Acres Cultivated Crop Land (Acres)	Percent of Total Cultivated Crop Land in Rensselaer County
Berlin, Town of	217	1.34%
Brunswick, Town of	2,143	13.18%
Castleton-on-Hudson, Village of	0	0.00%
East Greenbush, Town of	559	3.44%
East Nassau, Village of	1	0.01%
Grafton, Town of	32	0.20%
Hoosick, Town of	0	0.00%
Hoosick Falls, Village of	1,763	10.85%
Nassau, Town of	134	0.82%
Nassau, Village of	0	0.00%
North Greenbush, Town of	139	0.86%
Petersburgh, Town of	796	4.90%
Pittstown, Town of	2,136	13.15%
Poestenkill, Town of	416	2.56%
Rensselaer, City of	19	0.12%
Sand Lake, Town of	353	2.17%
Schaghticoke, Town of	4,793	29.50%
Schaghticoke, Village of	6	0.04%
Schodack, Town of	2,339	14.40%
Stephentown, Town of	385	2.37%
Troy, City of	9	0.06%
Valley Falls, Village of	7	0.04%
Rensselaer County Total	16,246	100%

Water supply shortages are a second effect of drought. While water shortages and use restrictions imposed as a result of drought conditions have a detrimental effect on many businesses, particularly certain sectors of the manufacturing industry, calculating actual dollar losses resulting from shortages and use restrictions is beyond the current scope of this study. Rensselaer County's total withdrawal of fresh water for public supply is 18.37 million gallons per day, with 10 percent from groundwater sources and 90 percent from surface water sources. Groundwater is fairly resistant to drought conditions, while surface water is more immediately susceptible to the effects of drought. The extent to which crops in the participating communities are vulnerable to drought conditions will depend to a great extent on from where they draw their water supply. The greatest source of agricultural losses under drought conditions is likely to be from those nursery, greenhouse, or floriculture businesses which rely predominantly on surface water supplies.

A third common effect of drought is fish and wildlife mortality. Nearly 55 percent of the county is undeveloped land (either used for agricultural purposes, vacant, or dedicated parkland/open space) with diverse populations of fish and wildlife, and abundant creeks, aquifers and reservoirs providing essential water resources. Because Rensselaer County has significant undeveloped land, aquatic and other wildlife habitat is fairly significant and therefore losses to fish and wildlife could potentially be significant.

A fourth common effect of drought is the increased incidence and severity of wildfires. The baseline risk of wildfire in Rensselaer County is significant, with 84 percent of the land area and 46 percent of the total estimated improved value located within wildfire hazard areas as defined in this plan. In the planning area, wildfire fuel tends to be most plentiful in areas where development densities are lowest; since Rensselaer County is largely rural in nature, and the majority of the wildfire hazard areas consist of undeveloped protected land, this works to reduce possible property damages and loss of life; however, the wildland-urban interface would be particularly vulnerable as well as transportation routes. Wildfires are a unique hazard addressed separately in this plan.

Estimated Potential Losses – Drought

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 19 - Countywide Statistics – Drought	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	2
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.1
Daily Probability	0.02%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Drought

In Rensselaer County, droughts are not particularly common and, while their potential consequences are high, they have not historically caused significant damages.

	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Drought	Low	High	Low	$0	Low

Mitigation Opportunities – Drought

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for drought. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 20 - Drought Mitigation Opportunities
Local Planning and Regulations
Assess Vulnerability to Drought Risk
Monitor Drought Conditions
Monitor Water Supply
Plan for Drought
Require Water Conservation During Drought Conditions
Prevent Overgrazing

Table 3c. 20 - Drought Mitigation Opportunities
Structure and Infrastructure Projects
Retrofit Water Supply Systems
Natural Systems Protection
Enhance Landscaping and Design Measures
Education and Awareness Programs
Educate Residents on Water Saving Techniques
Educate Farmers on Soil and Water Conservation Practices
Purchase Crop Insurance

Flood

Vulnerability and Impact – Flood

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area.

Land. Approximately six percent of Rensselaer County's land area and improved property is in the 100-year floodplain (see Table 3c.21 and Table 3c.22).

Table 3c. 21 – Land in the 100-year Floodplain

Municipality	Land Area of Municipality (Acres)	Land in the 100-year Floodplain (Acres)	Percent of Land in the 100-Year Floodplain (%)
Berlin, Town of	38,227	745	2%
Brunswick, Town of	28,284	1,765	6%
Castleton-on-Hudson, Village of	531	139	26%
East Greenbush, Town of	15,672	1,746	11%
East Nassau, Village of	3,029	178	6%
Grafton, Town of	29,711	967	3%
Hoosick Falls, Village of	950	113	12%
Hoosick, Town of	39,361	2,317	6%
Nassau, Town of	25,558	1,066	4%
Nassau, Village of	442	49	11%
North Greenbush, Town of	12,079	479	4%
Petersburgh, Town of	26,683	945	4%
Pittstown, Town of	41,256	2,516	6%
Poestenkill, Town of	20,727	991	5%
Rensselaer, City of	2,191	741	34%
Sand Lake, Town of	23,088	1,305	6%
Schaghticoke, Town of	32,545	3,031	9%
Schaghticoke, Village of	640	210	33%
Schodack, Town of	40,217	3,433	9%
Stephentown, Town of	37,263	671	2%

Table 3c. 21 – Land in the 100-year Floodplain			
Municipality	Land Area of Municipality (Acres)	Land in the 100-year Floodplain (Acres)	Percent of Land in the 100-Year Floodplain (%)
Troy, City of	7,066	1,054	15%
Valley Falls, Village of	308	29	9%
Total:	425,825	24,491	6%

Table 3c. 22 – Improved Property in the 100-year Floodplain			
Municipality	Replacement Cost Value (RCV) Structure and Contents ($)	RCV in the 100-year Floodplain ($)	Percent of RCV in the 100-Year Floodplain (%)
Berlin, Town of	$446,676,000	$20,363,981	5%
Brunswick, Town of	$2,342,127,000	$103,311,319	4%
Castleton-on-Hudson, Village of	$271,600,000	$66,023,202	24%
East Greenbush, Town of	$3,659,758,000	$100,211,645	3%
East Nassau, Village of	$94,148,000	$9,186,976	10%
Grafton, Town of	$458,781,000	$13,484,223	3%
Hoosick Falls, Village of	$583,380,000	$13,644,246	2%
Hoosick, Town of	$745,594,000	$35,729,151	5%
Nassau, Town of	$571,880,000	$17,671,547	3%
Nassau, Village of	$173,160,000	$11,701,596	7%
North Greenbush, Town of	$2,801,151,000	$134,711,130	5%
Petersburgh, Town of	$333,098,000	$22,930,876	7%
Pittstown, Town of	$737,726,000	$24,859,645	3%
Poestenkill, Town of	$945,815,000	$51,390,025	5%
Rensselaer, City of	$1,588,138,000	$372,823,892	23%
Sand Lake, Town of	$1,782,955,000	$97,593,476	5%
Schaghticoke, Town of	$1,379,356,000	$59,405,704	4%
Schaghticoke, Village of	$129,380,000	$2,653,655	2%
Schodack, Town of	$2,486,786,000	$54,039,912	2%
Stephentown, Town of	$509,235,000	$14,734,176	3%
Troy, City of	$11,211,809,000	$885,055,654	8%
Valley Falls, Village of	$81,394,000	$1,772,249	2%
Total:	$33,333,947,000	$2,107,001,207	6%

Population. Table 3c.23 presents an estimate of people living in the 100-year floodplain (generating by overlaying FEMA floodplains with HAZUS-MH 4.0 shapefiles of dasymetric population data from Census 2010 at the block level).

Table 3c. 23 – Population in the 100-Year Floodplain		
Municipality	Total Population (Census 2010)	Estimated Population in the 100 year Floodplain
Berlin, Town of	1,880	132
Brunswick, Town of	11,941	272
Castleton-on-Hudson, Village of	1,473	181
East Greenbush, Town of	16,473	156
East Nassau, Village of	587	51
Grafton, Town of	2,130	36
Hoosick Falls, Village of	3,501	158
Hoosick, Town of	6,924	165
Nassau, Town of	4,789	55
Nassau, Village of	1,133	70
North Greenbush, Town of	12,075	345
Petersburgh, Town of	1,525	133
Pittstown, Town of	5,735	92
Poestenkill, Town of	4,530	208
Rensselaer, City of	9,392	1,013
Sand Lake, Town of	8,530	374
Schaghticoke, Town of	7,679	364
Schaghticoke, Village of	592	20
Schodack, Town of	12,794	230
Stephentown, Town of	2,903	92
Troy, City of	50,129	5,933
Valley Falls, Village of	466	3
Total:	159,429	10,083

Critical Facilities. The following critical facilities (emergency facilities, critical infrastructure and utilities, and other key facilities, as presented in Section 3b) are located in the floodplain (Table 3c.24). In all, 65 critical facilities are located in the 100-year floodplain, and 11 critical facilities are located in the 500-year floodplain.

Table 3c. 24 – Critical Facilities in the Floodplain			
Municipality	Type of Facility	Name of Facility	Flood Zone[2]
Brunswick, Town of	School	Tamarac Elementary School	A/AE/AO
Brunswick, Town of	School	Tamarac Middle School High School	A/AE/AO
Castleton-on-Hudson, Village of	Freight Station	CSXT	A/AE/AO
East Greenbush, Town of	Communication Facility	WTMM 1300	A/AE/AO
East Greenbush, Town of	Oil Facility	Amerada Hess Corporation Rensselaer Terminal	A/AE/AO
East Greenbush, Town of	Oil Facility	Transmontaigne Rensselaer Terminal	A/AE/AO
East Greenbush, Town of	Port	Amerada Hess Corporation Wharf	A/AE/AO
East Greenbush, Town of	Port	International Petroleum Traders Dock	A/AE/AO
East Greenbush, Town of	Port	National Gypsum Co. East Greenbush Plant	A/AE/AO

[2] 100-year floodplain = A/AE/AO; 500-year floodplain = X500

Table 3c. 24 – Critical Facilities in the Floodplain

Municipality	Type of Facility	Name of Facility	Flood Zone[2]
Hoosick Falls, Village of	Shelter	Hoosick Falls Armory	A/AE/AO
Hoosick, Town of	Fire Station	Buskirk Volunteer Fire Department	A/AE/AO
Nassau, Town of	HAZMAT Facility	Quest Intl.	A/AE/AO
North Greenbush, Town of	Wastewater Facility	Rensselaer County SD#1 WWTP	X500
Poestenkill, Town of	Airport	Rensselaer County	A/AE/AO
Rensselaer, City of	Electric Power Facility	Rensselaer Cogeneration Facility	A/AE/AO
Rensselaer, City of	Fire Station	Rensselaer Fire Department	A/AE/AO
Rensselaer, City of	Freight Station	AMTK	A/AE/AO
Rensselaer, City of	Freight Station	CSXT	A/AE/AO
Rensselaer, City of	HAZMAT Facility	Organichem Corp.	A/AE/AO
Rensselaer, City of	HAZMAT Facility	Organichem Corp.	A/AE/AO
Rensselaer, City of	HAZMAT Facility	Organichem Corp.	A/AE/AO
Rensselaer, City of	HAZMAT Facility	Organichem Corp.	A/AE/AO
Rensselaer, City of	HAZMAT Facility	Rensselaer COGEN	A/AE/AO
Rensselaer, City of	Oil Facility	Getty Terminals Corporation	X500
Rensselaer, City of	Oil Facility	Petroleum Fuel & Terminal Company Rensselaer	A/AE/AO
Rensselaer, City of	Passenger Station	Albany-Rensselaer	A/AE/AO
Rensselaer, City of	Police Station	Rensselaer Police Department	A/AE/AO
Rensselaer, City of	Port	Bray Terminals Wharf	A/AE/AO
Rensselaer, City of	Port	Petroleum Fuel and Terminal Co., Rensselaer	A/AE/AO
Rensselaer, City of	Port	Port of Albany Rensselaer Wharf.	A/AE/AO
Rensselaer, City of	Port	Sun Refining and Marketing Co. Rensselaer	A/AE/AO
Rensselaer, City of	Shelter	Rensselaer - First Presbyterian Church	A/AE/AO
Rensselaer, City of	Wastewater Facility	Combined Sewer Overflows	A/AE/AO
Schaghticoke, Town of	Fire Station	Johnsonville Fire District	A/AE/AO
Schaghticoke, Town of	Fire Station	Pleasantdale Fire Department	A/AE/AO
Schodack, Town of	Wastewater Facility	Castleton-On-Hudson	A/AE/AO
Troy, City of	EOC	Rensselaer Emergency Operations Center	X500
Troy, City of	Freight Station	CPRS	A/AE/AO
Troy, City of	Freight Station	CSXT	A/AE/AO
Troy, City of	HAZMAT Facility	Ross Valve Manufacturing Co., Inc.	X500
Troy, City of	Police Station	Rensselaer County Sheriff Department	A/AE/AO
Troy, City of	Police Station	Troy Police Court	X500
Troy, City of	Police Station	Troy Police Juvenile Division	X500
Troy, City of	Port	Clemente-Latham Concrete Corp.	A/AE/AO
Troy, City of	Port	U.S. Army Corps of Engineers Wharf	A/AE/AO
Troy, City of	School	Ark Community Charter School (The)	A/AE/AO
Troy, City of	School	P.S. 12	A/AE/AO
Troy, City of	Shelter	Italian Community Center Charitable Foundation of Troy	X500
Troy, City of	Shelter	Troy - St. Augustine's Hall	X500
Troy, City of	Wastewater Facility	Combined Sewer Overflows	A/AE/AO
Valley Falls, Village of	Wastewater Facility	Village Wastewater Facility	X500

Historic and Cultural Resources. The following historic and cultural resources are located in the 100-year floodplain.

Table 3c. 25 – Historic and Cultural Resources in the Floodplain

Municipality	Historic Structure/Landmark/District	Location/Address
Rensselaer, City of	Clark-Dearstyne-Miller Inn	11-13 Forbes Avenue
Rensselaer, City of	Patroon Agent's House and Office	15 Forbes Avenue
Sand Lake, Town of	Fox, Albert R., House	2801 NY 43 and 66
Schaghticoke, Town of	Knickerbocker Mansion	Knickerbocker Road
Schodack, Town of	Schodack Landing Historic District	NY 9J
Troy, City of	Central Troy Historic District	Roughly bounded by Grand Street, Fifth Avenue and Third, Adams, and First and River Streets
Troy, City of	McCarthy Building	255-257 River Street
Troy, City of	National State Bank Building	297 River Street
Troy, City of	Northern River Street Historic District	403-429 and 420-430 River Street
Troy, City of	Poesten Kill Gorge Historic District	Poesten Kill between Spring Avenue and NY 2
Troy, City of	Powers Home	819 3rd Avenue
Troy, City of	Public School No. 10	239 Third Street
Troy, City of	River Street Historic District	Both sides of River Street from Congress Street to junction with 1st Street
Troy, City of	Troy Gas Light Company	NW corner of Jefferson Street and 5th Avenue
Troy, City of	Washington Park Historic District	Washington Park and adjacent properties on 2nd, 3rd, and Washington Streets and Washington Place

Potential Impacts

All types of flooding can cause widespread damage throughout rural and urban areas, including but not limited to: water-related damage to the interior and exterior of buildings; destruction of electrical and other expensive and difficult-to-replace equipment; injury and loss of life; proliferation of disease vectors; disruption of utilities, including water, sewer, electricity, communications networks and facilities; loss of agricultural crops and livestock; placement of stress on emergency response and healthcare facilities and personnel; loss of productivity; and displacement of persons from homes and places of employment. Any type of agricultural, commercial, residential, and recreational development and natural communities (e.g., wetlands, marshes) located in a floodplain (inland or coastal) are vulnerable to flooding. Increased urbanization, and thus increase in paved surfaces, enhances the threat of flooding where drainage systems cannot cope with the increased input of stormwater runoff and decrease in natural water infiltration into the soil (increasing runoff). In rural areas, property damage caused by flooding can be devastating to farmers. When flooding occurs during the growing season, farmers can suffer widespread crop loss. Livestock farmers may lose livestock if they are unable to find safe ground during rising floodwaters. This threat to agricultural areas is primarily associated with flash flooding. Flooding can also pose several threats to industrial, residential, and commercial properties. Industrial facilities of all types

typically handle and store various quantities of hazardous materials for their operations. These materials can potentially come into contact with flood waters and be released into the environment impacting local water sources, natural resources, and threaten public health. Buildings can experience significant water-related damage, sometimes beyond repair, due to flooding. Household furnishings and business inventories can be lost if there is not adequate time to remove items to safe locations. In addition to being at risk because of floodwater, people face the threat of explosions and fires caused by leaking gas lines along with the possibility of being electrocuted. Even wild animals, forced out of their homes and brought into contact with humans by floodwaters, can be a threat. Post-flood concerns could include mold growth on structures creating an increased health concern. Severe flooding can cause extensive damage to public utilities and disruptions to the delivery of services. Loss of power and communications can be expected. Drinking water and wastewater treatment facilities may be temporarily out of operation. Impacts of flooding on transportation are particularly noteworthy. Flooded streets and roadblocks make it difficult for emergency vehicles to respond to calls for service. Floodwaters can washout sections of roadway and bridges. Most importantly, the majority of fatalities that occur in floods are the result of people trying to drive on roads covered by floodwaters.

Estimated Potential Losses – Flood

A HAZUS analysis was conducted to estimate the potential loss from the flood hazard. HAZUS was used to estimate potential losses in Rensselaer County resulting from potential riverine flood events. HAZUS was used to estimate floodplain boundaries, potential exposure for each event frequency, and loss estimates based on probabilistic scenarios for various flood events using a Level 1 analysis. Table 3c.26 shows the estimated losses (Replacement Cost Value, RCV, for structure and contents) in 100-year and 500-year flooding event scenarios. Although the City of Troy and the City of Rensselaer have the greatest exposure (value of buildings in the 100-year floodplain) the City of Troy and the Town of Schodack would suffer the greatest residential building losses from a 100-year event. Table 3c.27 shows the number of buildings affected by flooding. Table 3c.28 estimates critical facilities affected by flooding. And Table 3c.29 provides estimates for debris generated during flood events.

Table 3c. 26 - Estimated Structure and Content Losses from Flooding

Municipality	Total RCV Structure and Contents ($)	RCV in the 100-year Floodplain ($)	100-year Event		500-year Event	
			Estimated Loss (RCV) ($)	% of Total	Estimated Loss (RCV) ($)	% of Total
Berlin, Town of	$446,676,000	$20,363,981	$4,523,000	1.01	$6,127,000	1.37
Brunswick, Town of	$2,342,127,000	$103,311,319	$6,517,000	0.28	$7,888,000	0.34
Castleton-on-Hudson, Village of	$271,600,000	$66,023,202	$3,191,000	1.17	$3,442,000	1.27
East Greenbush, Town of	$3,659,758,000	$100,211,645	$7,916,000	0.22	$8,553,000	0.23
East Nassau, Village of	$94,148,000	$9,186,976	$3,808,000	4.04	$4,992,000	5.30
Grafton, Town of	$458,781,000	$13,484,223	$342,000	0.07	$1,586,000	0.35
Hoosick Falls, Village of	$583,380,000	$13,644,246	$10,489,000	1.80	$12,116,000	2.08
Hoosick, Town of	$745,594,000	$35,729,151	$20,821,000	2.79	$25,466,000	3.42
Nassau, Town of	$571,880,000	$17,671,547	$2,141,000	0.37	$2,853,000	0.50
Nassau, Village of	$173,160,000	$11,701,596	$2,250,000	1.30	$2,661,000	1.54

Table 3c. 26 - Estimated Structure and Content Losses from Flooding						
Municipality	Total RCV Structure and Contents ($)	RCV in the 100-year Floodplain ($)	100-year Event		500-year Event	
			Estimated Loss (RCV) ($)	% of Total	Estimated Loss (RCV) ($)	% of Total
North Greenbush, Town of	$2,801,151,000	$134,711,130	$12,885,000	0.46	$16,734,000	0.60
Petersburgh, Town of	$333,098,000	$22,930,876	$6,170,000	1.85	$7,894,000	2.37
Pittstown, Town of	$737,726,000	$24,859,645	$1,824,000	0.25	$3,372,000	0.46
Poestenkill, Town of	$945,815,000	$51,390,025	$7,134,000	0.75	$18,487,000	1.95
Rensselaer, City of	$1,588,138,000	$372,823,892	$13,823,000	0.87	$17,457,000	1.10
Sand Lake, Town of	$1,782,955,000	$97,593,476	$10,384,000	0.58	$11,675,000	0.65
Schaghticoke, Town of	$1,379,356,000	$59,405,704	$10,053,000	0.73	$15,830,000	1.15
Schaghticoke, Village of	$129,380,000	$2,653,655	$1,165,000	0.90	$1,507,000	1.16
Schodack, Town of	$2,486,786,000	$54,039,912	$42,129,000	1.69	$46,521,000	1.87
Stephentown, Town of	$509,235,000	$14,734,176	$5,308,000	1.04	$7,577,000	1.49
Troy, City of	$11,211,809,000	$885,055,654	$63,859,000	0.57	$97,874,000	0.87
Valley Falls, Village of	$81,394,000	$1,772,249	$24,000	0.03	$26,000	0.03
County Total	$33,333,947,000	$2,107,001,207	$236,756,000	1.04	$320,638,000	1.37

Table 3c. 27 - Buildings Affected by Flooding						
Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	100-Year Flood Event		500-Year Chance Flood Event	
			Number of Buildings	% Total	Number of Buildings	% Total
Berlin, Town of	1,056	$446,676,000	21	1.99%	45	4.27%
Brunswick, Town of	4,817	$2,342,127,000	3	0.06%	9	0.19%
Castleton-on-Hudson, Village of	540	$271,600,000	18	3.33%	21	3.88%
East Greenbush, Town of	6,157	$3,659,758,000	0	0.00%	0	0.00%
East Nassau, Village of	249	$94,148,000	12	4.82%	18	7.23%
Grafton, Town of	1,237	$458,781,000	0	0.00%	0	0.00%
Hoosick Falls, Village of	1,301	$583,380,000	15	1.14%	15	1.14%
Hoosick, Town of	1,560	$745,594,000	3	0.21%	3	0.21%
Nassau, Town of	1,421	$571,880,000	0	0.00%	0	0.00%
Nassau, Village of	406	$173,160,000	13	3.28%	14	3.35%
North Greenbush, Town of	4,757	$2,801,151,000	174	3.66%	222	4.67%
Petersburgh, Town of	791	$333,098,000	27	3.41%	30	3.79%
Pittstown, Town of	2,228	$737,726,000	9	0.40%	30	1.35%
Poestenkill, Town of	1,664	$945,815,000	24	1.44%	99	5.95%
Rensselaer, City of	2,927	$1,588,138,000	57	1.95%	79	2.70%
Sand Lake, Town of	3,533	$1,782,955,000	9	0.25%	12	0.34%
Schaghticoke, Town of	2,820	$1,379,356,000	60	2.13%	78	2.77%
Schaghticoke, Village of	273	$129,380,000	0	0.00%	0	0.00%
Schodack, Town of	4,674	$2,486,786,000	50	1.06%	52	1.12%
Stephentown, Town of	1,527	$509,235,000	24	1.57%	39	2.55%

Table 3c. 27 - Buildings Affected by Flooding						
Municipality	Total Number of Buildings	Total RCV (Structure and Contents)	100-Year Flood Event		500-Year Chance Flood Event	
			Number of Buildings	% Total	Number of Buildings	% Total
Troy, City of	13,444	$11,211,809,000	332	2.47%	691	5.14%
Valley Falls, Village of	190	$81,394,000	0	0.00%	0	0.00%
Rensselaer County (Total)	57,572	$33,333,947,000	851	1.51%	1,457	2.30%

Table 3c. 28 – Critical Facilities Damaged by Flooding											
Name	Municipality	Type	Exposure		Potential Loss from 100-Year Flood Event			Potential Loss from 500-Year Flood Event			
			1% Event	0.2% Event	Percent Structure Damage	Percent Content Damage	Days to 100-Percent	Percent Structure Damage	Percent Content Damage	Days to 100-Percent	
Buskirk Volunteer Fire Department	Town of Hoosick	Fire	x	x	6.78%	7.75%	480	10.95%	37.18%	480	

Photo 3c - 1. Photo, Buskirk Volunteer Fire Department. Looking north toward the Buskirk Covered Bridge. 2217 Buskirk West Hoosick Road Buskirk, New York 12028.

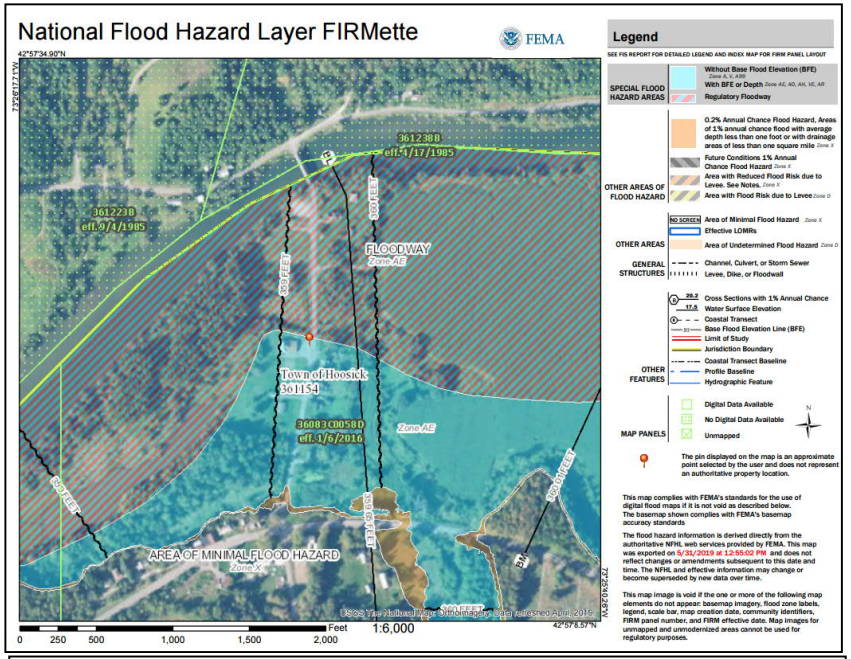


Photo 3c - 2. Buskirk Volunteer Fire Department and FEMA Floodplain, NFHL FIRMette.

Table 3c. 29 – Debris Generated by Flooding								
Municipality	100-Year Flood Event				500-Year Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Town of Berlin	101	55	27	19	132	74	34	25
Town of Brunswick	394	137	146	111	475	169	174	132
Village of Castleton-on-Hudson	58	48	6	4	70	60	6	4
Town of East Greenbush	377	81	160	136	388	86	163	139
Village of East Nassau	472	168	174	129	646	212	247	187
Town of Grafton	8	4	2	2	12	5	4	3
Village of Hoosick Falls	2,027	232	998	796	3,172	290	1,599	1,283
Town of Hoosick	648	186	249	213	856	238	333	285
Town of Nassau	107	68	22	17	139	89	28	22
Village of Nassau	104	79	14	11	135	93	24	18
Town of North Greenbush	141	134	3	5	174	164	4	7
Town of Petersburgh	299	95	110	94	408	125	154	129
Town of Pittstown	87	33	27	28	131	50	38	42
Town of Poestenkill	239	146	52	41	467	257	118	92
City of Rensselaer	220	212	4	4	283	253	17	13
Town of Sand Lake	354	189	94	70	411	221	109	81
Town of Schaghticoke	436	227	119	89	1,003	398	354	250
Village of Schaghticoke	83	20	36	28	105	27	44	35
Town of Schodack	295	184	62	49	425	264	89	72
Town of Stephentown	206	116	40	50	326	175	69	82
City of Troy	3,750	1,676	1,134	941	6,590	2,834	2,010	1,746
Village of Valley Falls	3	2	0	0	3	2	0	0
Rensselaer County (Total)	10,410	4,091	3,480	2,839	16,351	6,088	5,616	4,647

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 30 - Countywide Statistics – Flood	
Total Losses Reported (1996-2018)	$13,103,000
Total Number of Episodes (1996-2018)	54
Annualized Losses Reported (1996-2018)	$595,591
Annualized Number of Episodes (1996-2018)	2.5
Daily Probability	0.67%
Total Injuries (1996-2018)	2
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Flood

In Rensselaer County, floods are common occurrences and their potential consequences are often quite high. Historic damages have been high. Significant numbers of people, property, structures, and critical facilities are exposed to the flood hazard (including those susceptible to flooding during ice jams and failure of any one of the county's 97 dams.

Flood	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
	High	High	High	$2,367,560	High

Mitigation Opportunities – Flood

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for flooding. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 31- Flood Mitigation Opportunities
Local Planning and Regulations
Incorporate Flood Mitigation in Local Planning
Form Partnerships to Support Floodplain Management
Limit or Restrict Development in Floodplain Areas
Adopt and Enforce Building Codes and Development Standards
Improve Stormwater Management Planning
Adopt Policies to Reduce Stormwater Runoff
Improve Flood Risk Assessment
Join or Improve Compliance with NFIP
Manage the Floodplain Beyond Minimum Requirements
Participate in the CRS
Establish Local Funding Mechanisms for Flood Mitigation
Structure and Infrastructure Projects
Remove Existing Structures from Flood Hazard Areas
Improve Stormwater Drainage System Capacity
Conduct Regular Maintenance for Drainage Systems and Flood Control Structures
Elevate or Retrofit Structures and Utilities

Table 3c. 31- Flood Mitigation Opportunities
Floodproof Residential and Non-Residential Structures
Protect Infrastructure
Protect Critical Facilities
Construct Flood Control Measures
Dam Mitigation Measures[3]
Natural Systems Protection
Protect and Restore Natural Flood Mitigation Features
Preserve Floodplains as Open Space
Increase Awareness of Flood Risk and Safety
Education and Awareness Programs
Educate Property Owners about Flood Mitigation Techniques

[3] Though not in the FEMA Mitigation Ideas document, it is recommended that the county and municipalities work with dam owners to address deficiencies identified by NYSDEC in order to protect lives and property in dam inundation areas. GIS dam inundation mapping is required but not yet available from NYSDEC to quantify hazard areas and assets within them. Inundation area mapping should be made available during the plan maintenance phase and municipalities should work with DEC, dam owners, and their constituents regarding their risks and to ensure Emergency Action Plan familiarity.

Geologic Hazards

Earthquake

Vulnerability and Impact – Earthquake

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. All of Rensselaer County has been identified as a hazard area for earthquakes. Therefore, all assets in the County (i.e., population, structures, critical facilities, and lifelines), as described in Section 3b, are vulnerable.

Potential Impacts

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin. The extent of damage depends on the extent and duration of the shaking, the density of population and building and infrastructure construction in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, the age of the buildings, and building codes in place. Most earthquake-related property damage and deaths are caused by the failure and collapse of structures due to ground shaking. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (in mountain regions and along hillsides), and liquefaction. According to USGS data, damage caused by an earthquake will begin at a level of ground shaking (peak ground acceleration, or PGA) of approximately ten percent of the force of gravity (0.1g, or 10%g). Below this level, damages are typically very slight except in unusually vulnerable facilities. Damages from ground shaking at 10%g to 20%g tend to be minor to moderate, with only unusually poor buildings being subject to potential collapse. Events in the range of 20%g to 50%g may cause significant damage in some modern buildings and very high levels of damage (include collapse) in poorly designed buildings. Events more than 50%g may cause higher levels of damage in many buildings, even those designed to resist seismic forces. The probability of significant, damaging earthquake events affecting Rensselaer County is low. According to the United States Geological Survey (USGS)[4], an earthquake with a 10 percent probability of exceedance over 50 years in Rensselaer would have PGA values between 3%g and 5%g,

[4] https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga10pct.pdf

which would often be able to be felt, but only would be expected to cause minor damage. More destructive earthquakes are very rare, low probability events for Rensselaer County with highly infrequent recurrence periods.

Estimated Potential Losses – Earthquake

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as follows:

Table 3c. 32 - Countywide Statistics – Earthquake	
Total Losses Reported (1996-2018)	$0
Total Number of Episodes (1996-2018)	0
Annualized Losses Reported (1996-2018)	$0
Annualized Number of Episodes (1996-2018)	0.0
Daily Probability	0.00%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

To assess the vulnerability of Rensselaer County to earthquakes, probabilistic scenarios of various potential events were attempted using HAZUS. Analysis results are shown in Tables 3c.32 through Table 3c.36, on the following pages. Table 3c.32 presents estimated damage to structures; Table 3c.33 presents estimated shelter needs; Table 3c.34 presents critical facility impacts for a 500-year event; Table 3c.35 present critical facility impacts for a 2,500-year event; and Table 3c.36 presents estimated casualties.

Table 3c.33 - Estimated Damage to Structures, Earthquake						
Municipality	Total RCV (Structure only)	Average Annualized Loss	500-year Event		2,500-year Event	
			Estimated Loss (RCV)	% of Total	Estimated Loss (RCV)	% of Total
Berlin, Town of	$276,050,000	$1,274	$127,730	0.05%	$705,177	0.26%
Brunswick, Town of	$1,475,405,000	$6,596	$674,833	0.05%	$3,853,963	0.26%
Castleton-on-Hudson, Village of	$169,901,000	$797	$77,736	0.05%	$479,818	0.28%
East Greenbush, Town of	$2,276,420,000	$10,205	$1,019,543	0.04%	$6,144,088	0.27%
East Nassau, Village of	$61,081,000	$161	$17,300	0.03%	$95,524	0.16%
Grafton, Town of	$291,506,000	$1,270	$132,576	0.05%	$715,180	0.25%
Hoosick Falls, Village of	$345,419,000	$1,769	$173,652	0.05%	$955,643	0.28%
Hoosick, Town of	$446,353,000	$2,526	$243,495	0.05%	$1,361,445	0.31%
Nassau, Town of	$373,830,000	$1,375	$147,727	0.04%	$815,957	0.22%
Nassau, Village of	$108,910,000	$418	$43,280	0.04%	$245,446	0.23%
North Greenbush, Town of	$1,729,581,000	$7,910	$788,687	0.05%	$4,667,130	0.27%
Petersburgh, Town of	$201,505,000	$937	$94,870	0.05%	$512,665	0.25%
Pittstown, Town of	$471,799,000	$2,603	$260,176	0.06%	$1,442,664	0.31%
Poestenkill, Town of	$599,521,000	$2,395	$252,338	0.04%	$1,391,143	0.23%
Rensselaer, City of	$984,929,000	$4,098	$397,130	0.04%	$2,443,463	0.25%
Sand Lake, Town of	$1,133,858,000	$4,472	$469,589	0.04%	$2,618,191	0.23%
Schaghticoke, Town of	$876,379,000	$4,249	$441,133	0.05%	$2,476,556	0.28%
Schaghticoke, Village of	$80,388,000	$57	$5,838	0.01%	$32,821	0.04%
Schodack, Town of	$1,533,191,000	$6,715	$665,602	0.04%	$4,016,056	0.26%
Stephentown, Town of	$322,143,000	$1,442	$144,218	0.04%	$792,093	0.25%
Troy, City of	$6,438,737,000	$33,536	$3,102,965	0.05%	$19,293,695	0.30%
Valley Falls, Village of	$49,323,000	$21	$2,069	0.00%	$11,506	0.02%
Rensselaer County (Total)	$20,246,229,000	$94,827	$9,282,490	0.05%	$55,070,221.98	0.27%

Table 3c.34 – Estimated Shelter Needs, Earthquake		
Event	Displaced Households	Persons Seeking Short-Term Shelter
500-Year Earthquake	47	28
2,500-Year Earthquake	342	203

Table 3c.35 – Estimated Critical Facility Impacts, 500-Year Earthquake									
Facility Type	500- Year Event					Percent Functionality			
	Percent-Probability of Sustaining Damage					Percent-Probability of Sustaining Damage			
	None	Minor	Moderate	Severe	Complete	Day 1	Day 7	Day 30	Day 90
Medical	86-87	8-9	4	0	0	86	95	99	100
Police	86-87	8-9	3-4	0	0	86-87	95	99	100
Fire	86-87	8-9	6-8	0	0	86-87	95	99	100
Schools	80-89	8-9	3-4	0	0	86-87	96	99	100

Table 3c.36 – Estimated Critical Facility Impacts, 2500-Year Earthquake									
Facility Type	2,500- Year Event					Percent Functionality			
	Percent-Probability of Sustaining Damage					Percent-Probability of Sustaining Damage			
	None	Minor	Moderate	Severe	Complete	Day 1	Day 7	Day 30	Day 90
Medical	64-65	18	12-13	3-4	0	64	82	95	98
Police	64-65	17-18	11-12	3-4	0	64-65	82-83	95	98
Fire	64-67	17-18	11-12	3-4	0	64-66	82-83	95	98
Schools	64-67	17-18	11-12	3-4	0	64-67	82-84	95	98

Table 3c.37 – Estimated Casualties, 2500 Year Earthquake Event			
Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	68	88	68
Hospitalization	12	15	12
Casualties	2	3	2

Summary of Vulnerability Assessment – Earthquake

Earthquakes are not likely to affect Rensselaer County. If an earthquake were to affect Rensselaer County, the likelihood of damage is low.

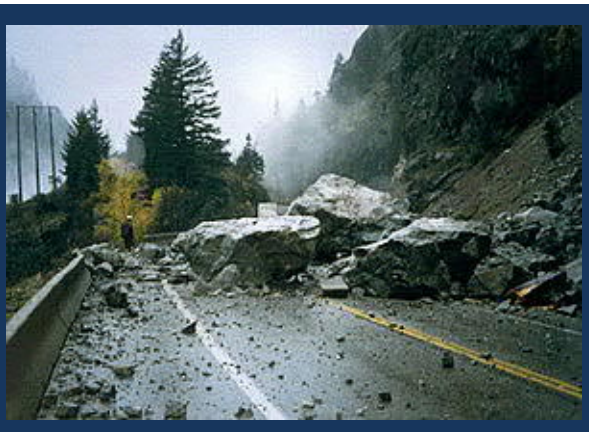
Earthquake	Likelihood	Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
	Low	High	Moderate	$94,827	Moderate

Mitigation Opportunities – Earthquake

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for earthquakes. A summary is presented below. More specific project ideas for each opportunity are online at:
https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 38- Earthquake Mitigation Opportunities
Local Planning and Regulations
Adopt and Enforce Building Codes
Incorporate Earthquake Mitigation into Local Planning
Map and Assess Community Vulnerability to Seismic Hazards
Conduct Inspections of Building Safety
Structure and Infrastructure Projects
Protect Critical Facilities and Infrastructure
Implement Structural Mitigation Techniques
Education and Awareness Programs
Increase Earthquake Risk Awareness
Conduct Outreach to Builders, Architects, Engineers, and Inspectors
Provide Information on Structural and Non0Structural Retrofitting

Landslide



Vulnerability and Impact – Landslide

Exposure

To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. USGS landslide hazard mapping divides the county into three areas based on incidence and susceptibility; acres of land and improved property in these areas are identified in Section 3b. The mapping shows However, it is important to note that because these areas are so general, they do not generate a very meaningful estimate of assets that are likely to be impacted by the landslide hazard. Risks tend to be higher in western communities along the Hudson River. Future availability of improved landslide hazard area mapping would allow for a more robust analysis. A Landslide Susceptibility Pilot Study of Schenectady County was conducted in 2008. A summary of this pilot study in the NYSGIS Newsletter of Winter 2008 concluded, "The enhancement of staffing and resources at the NYS Geological Survey would enable this agency to better serve its traditional role and responsibilities with landslides as well as serve as lead agency for a multi-agency program focusing on landslide evaluation and susceptibility mapping. This program should include, but not be limited to NYSDOT, NYSEMO and possibly NYSCSCIC, which may be in the best position to serve as an interactive clearinghouse for reporting and mapping landslide occurrences." If and when improved mapping of the hazard becomes available, this plan should be revised to incorporate and better assess Rensselaer County's exposure of people and property to this hazard.

Potential Impacts

Potential impacts of landslides include environmental disturbance, property and infrastructure damage, and injuries or fatalities. Landslide impacts are typically limited to those areas immediately surrounding the slope failure. The structural integrity of buildings in the affected area can be compromised, or the entire building can be destroyed. Roadways and drainage systems in affected areas can be damaged or destroyed as well. Because landslides happen without warning, loss of life and injuries in affected areas are also possible. Any damage resulting from a landslide would most likely be localized. It is difficult to estimate potential losses in a landslide event. Given the lack of detailed historical loss data on significant landslide occurrences in Rensselaer County, it is assumed that while one major event may result in significant losses, annualizing losses over a long period of time would most likely yield a negligible annualized loss estimate for all jurisdictions exposed to this hazard.

Estimated Potential Losses – Landslide

Standard loss estimation methodologies are not currently available for estimating landslide damages. Sufficient historical data regarding events and associated losses was not available to quantify here. For the purpose of this analysis, at this time we have determined that annual losses are unquantifiable. While damages associated with any single event could be significant at the particular location of the event, it is estimated that damages are most likely negligible when evaluated on an average annual basis. NOAA's NCEI Storm Events Database records zero landslides in Rensselaer from 1996 to the present. Known historic occurrences since 1996 include at least five landslides (two in Troy, two in Castleton-on-Hudson, and one in Brunswick); however, dollar damages are not available for these events.

Summary of Vulnerability Assessment – Landslide

Landslides are a common occurrence in some of Rensselaer County's most landslide prone communities. Most events have tended to affect local roadways. Some have damaged buildings and one, in 1843, resulted in 17 fatalities. Municipal adoption of steep slope ordinances has had a beneficial effect in hazard mitigation for the primary affected communities.

	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Landslide	High	Low	Moderate	$0	Moderate

Problem Areas for Mitigation - Landslide

The following landslide problem areas for mitigation have been identified by NRCS:

Table 3c. 39- Landslide Problem Areas for Mitigation

Municipality	Problem Area for Mitigation
Brunswick, Town of	528 McChesney Avenue Ext., residence which is located on the top of a large cliff. The land at this property is continuing to erode and fall into the creek.
Hoosick, Town of	Well-traveled route: South bank of Route 7 east of Route 22 is a well-traveled route and the NRCS reports that Route 7 has occasionally been taken out.
East Nassau, Village of	52 Bliss School House Road
Nassau, Town of	172 Bliss School House Road
Pittstown, Town of	Minor road runoff washout, Deepkill Road (a dirt road)

Mitigation Opportunities – Landslide

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for landslides. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 40- Landslide Mitigation Opportunities
Local Planning and Regulations
Map and Assess Vulnerability to Landslides
Manage Development in Landslide Hazard Areas
Structure and Infrastructure Projects
Prevent Impacts to Roadways
Remove Existing Buildings and infrastructure from Landslide Hazard Areas

Other Hazards

Wildfire

Vulnerability and Impact – Wildfire

Exposure

Land and Improved Property. To understand its vulnerability to natural hazards, a community must determine the assets that are exposed or vulnerable in the hazard area. Hazard areas were considered to be wholly within, or within a 200 feet buffer of, high hazard areas. About 80 percent of Rensselaer County's land area has characteristics which would be supportive of wildfires, and about 22 percent of the structure replacement cost value lies within these areas.

Table 3c. 41- Land and Improved Property Potentially Exposed to Wildfires

Municipality	Municipal Land Area (acres)	Land in Wildfire Hazard Areas (acres)	Municipal Structure Replacement Cost Value ($)	Municipal Structure Replacement Cost Value in Wildfire Hazard Areas
Berlin, Town of	38,227	36,574	$446,676,000	$243,652,932
Brunswick, Town of	28,284	21,244	$2,342,127,000	$588,609,008
Castleton-on-Hudson, Village of	531	355	$271,600,000	$63,812,075
East Greenbush, Town of	15,672	10,851	$3,659,758,000	$732,801,341
East Nassau, Village of	3,029	2,824	$94,148,000	$47,235,329
Grafton, Town of	29,711	28,601	$458,781,000	$340,045,542
Hoosick Falls, Village of	950	530	$583,380,000	$205,873,106
Hoosick, Town of	39,361	28,402	$745,594,000	$68,258,380
Nassau, Town of	25,558	22,999	$571,880,000	$302,106,699
Nassau, Village of	442	322	$173,160,000	$26,065,615
North Greenbush, Town of	12,079	7,895	$2,801,151,000	$599,492,739
Petersburgh, Town of	26,683	24,977	$333,098,000	$194,865,456
Pittstown, Town of	41,256	29,847	$737,726,000	$276,729,925
Poestenkill, Town of	20,727	18,678	$945,815,000	$464,367,208
Rensselaer, City of	2,191	688	$1,588,138,000	$258,237,821

Table 3c. 41- Land and Improved Property Potentially Exposed to Wildfires				
Municipality	Municipal Land Area (acres)	Land in Wildfire Hazard Areas (acres)	Municipal Structure Replacement Cost Value ($)	Municipal Structure Replacement Cost Value in Wildfire Hazard Areas
Sand Lake, Town of	23,088	20,484	$1,782,955,000	$846,946,748
Schaghticoke, Town of	32,545	21,901	$1,379,356,000	$454,247,033
Schaghticoke, Village of	640	366	$129,380,000	$37,264,933
Schodack, Town of	40,217	29,133	$2,486,786,000	$865,773,330
Stephentown, Town of	37,263	34,625	$509,235,000	$283,287,545
Troy, City of	7,066	2,276	$11,211,809,000	$403,148,667
Valley Falls, Village of	308	198	$81,394,000	$14,635,887
Rensselaer County Total	425,825	343,773	$33,333,947,000	$7,187,150,179

Facilities. The following critical and other key facilities are located wholly within, or within a 200 feet buffer of, high hazard areas for wildfire.

Table 3c. 42- Critical Facilities Potentially Exposed to Wildfires			
Municipality	Facility Type	Facility Name	Location/Address
Berlin, Town of	Communications Tower	Albany Telephone Company	Goodermote Road
Berlin, Town of	Communications Tower	Albany Telephone Company Cellular One	"Berlin" Goodermote Road
Berlin, Town of	Communications Tower	New York, State Of	Capital Game Refuge
Berlin, Town of	School	Berlin Central Junior & Senior High School	17400 Route 22
Berlin, Town of	School	Berlin Elementary School	53 School Street
Brunswick, Town of	School	George Washington Elementary School	344 Menemsha Lane
Brunswick, Town of	Communications Tower	Beeper Pple, NY State Police, Metrocall, Arch Communications, Freepage, Pni, Clear Chan	Bald Mountain, 2 Miles East of
Brunswick, Town of	Communications Tower	Cellco Partnership, Dba Verizon Wireless	Bald Mountain Road
Brunswick, Town of	Communications Tower	New York Cellular Geographic Service Area, Inc.	Bald Mountain Road
Brunswick, Town of	Communications Tower	Niagara Mohawk Power Corporation	4 Miles North East of Downtown Troy NY
Brunswick, Town of	Communications Tower	Niagara Mohawk Power Corporation	Bald Mountain 1 Mile North of State Highway 142
Brunswick, Town of	Fire Station	Eagle Mills Fire Co	627 Brunswick Road
East Greenbush , Town of	Communications Tower	Albany Telephone Company	Ridge Road
East Greenbush, Town of	School	Citizen Edmond Genet Elementary School	29 Englewood Avenue
East Greenbush, Town of	School	Howard L. Goff School	35 Gilligan Road

Table 3c. 42- Critical Facilities Potentially Exposed to Wildfires			
Municipality	Facility Type	Facility Name	Location/Address
East Greenbush, Town of	School	Red Mill School	225 McCullough Place
East Nassau, Village of	Fire Station	Tsatsawassa Protective Fire Company	9 Firehouse Lane
East Nassau, Village of	Fire Station	Hoags Corners Fire Company	7237 NY 66
Grafton, Town of	Communications Tower	Airtouch Paging	East End of Snyder Road
Grafton, Town of	Communications Tower	Hudson Valley Communications	Davitt Lake Road
Grafton, Town of	Communications Tower	New York, State Of	Dickenson Hill
Grafton, Town of	Communications Tower	Rensselaer, County Of	South Road 2 Mi 1/4 Miles East of
Grafton, Town of	Police	Rensselaer County Sheriff	45 Richmond Street
Hoosick, Town of	Church	First Baptist Church of Hoosick	648 South Street (County Route 95)
Hoosick, Town of	School	Hoosick Falls Central School	21187 State Route 22
North Greenbush, Town of	Communications Tower	New York, State Of	8/10 Miles West Southwest of Junction of US Route 4 And Jorden Road Route 2
North Greenbush, Town of	Communications Tower*	RPI, Advanced Mas Partners, Town of Colonie	WRPI Tower Glenmore Road
North Greenbush, Town of	School	Woodland Hill Montessori School	100 Montessori Way
Pittstown, Town of	Communications Tower	Albany Telephone Company Cellular One, Mobilemedia	Near Leloup Road (aka Crandall Road)
Pittstown, Town of	Church	Pittstown United Methodist Church	45 Old Route 7
Poestenkill, Town of	Communications Tower	Aat Paging Corporation Ii	Davitt Pond Road
Poestenkill, Town of	Communications Tower	Albany Telephone Company	High Meadow Road
Rensselaer, City of	School	Rensselaer Junior/Senior High School	25 Van Rensselaer Drive
Sand Lake, Town of	Communications Tower	Albany Telephone Company	2 Chamberlain Road
Sand Lake, Town of	Fire Station	Taborton Fire Company	861 Taborton Road
Sand Lake, Town of	Police	Rensselaer County Sheriff	145 Gettle Road
Sand Lake, Town of	School	Averill Park High School	146 Gettle Road #2
Sand Lake, Town of	Church	Salem United Methodist Church	349 Shaver Road
Schodack, Town of	Communications Tower	Albany Telephone Company	Route 20
Schodack, Town of	Communications Tower	Albany Telephone Company Cellular One	"Sand Lake" 0.22 Miles North of New York Route 151
Schodack, Town of	Communications Tower	Cellco Partnership	.25 Miles East of Intersection of US 9 & I-90

Table 3c. 42- Critical Facilities Potentially Exposed to Wildfires			
Municipality	Facility Type	Facility Name	Location/Address
Schodack, Town of	Communications Tower	Rensselaer, County Of	0.4 Miles from Town Hall of Schodack On Dirt Road
Schodack, Town of	Communications Tower		2000 feet East Junction Highway 9 Highway 20
Schodack, Town of	Natural Gas	Compressor Station 254	East of Route 66
Schodack, Town of	Church	House of Praise Church	1688 Route 9
Stephentown, Town of	Communications Tower	AT&T Corp	Fire Tower Road
Stephentown, Town of	Communications Tower	Cellco Partnership	Fire Tower Road
Stephentown, Town of	Communications Tower	Cellco Partnership, Dba Verizon Wireless	Fire Tower Road
Stephentown, Town of	Communications Tower	New York, State Of	Seven Hills

Historic and Cultural Resources. The following historic and cultural resources are located wholly within, or within a 200 feet buffer of, high hazard areas for wildfire.

Table 3c. 43- Historic/Cultural Resources Potentially Exposed to Wildfires		
Municipality	Historic Structure/Landmark/District	Location/Address
Brunswick	Garfield School	NY 2 and Moonlawn Road.
Brunswick	Morison Farmstead	3842 NY 2
East Greenbush	Carner, John, Jr., House	1310 Best Road
East Greenbush	Craver Farmstead	115 Craver Road
Hoosick	Bennington Battlefield	NY 67, on VT state line
Hoosick	Breese-Reynolds House	601 South Street
Nassau	Smith, Henry Tunis, Farm	S of Nassau on NY 203
Nassau, Village of	Albany Avenue Historic District	Albany Avenue
Nassau, Village of	Church Street Historic District	Church Street
North Greenbush	Defreest Homestead	S of Troy at U.S. 4 and Jordan Road.
North Greenbush	Sharpe Homestead and Cemetery	44 Laura Lane
Pittstown	Sherman Farm	35 Sherman Road
Rensselaer, City of	Beverwyck Manor	Washington Avenue
Sand Lake	Fox, Albert R., House	2801 NY 43 and 66
Sand Lake	Sand Lake Baptist Church	2960 NY 43
Schodack	Albany Avenue Historic District	Albany Avenue
Schodack	Blink Bonnie	1368 Sunset Road
Schodack	District School No. 3	1125 South Schodack Road
Schodack	Elmbrook Farm	2567 Brookview Road
Schodack	Muitzes Kill Historic District	An irregular pattern on both sides of Schodack Landing Road.

Table 3c. 43- Historic/Cultural Resources Potentially Exposed to Wildfires		
Municipality	Historic Structure/Landmark/District	Location/Address
Schodack	Schodack Landing Historic District	NY 9J
Schodack	Staats, Joachim, House and Gerrit Staats Ruin	N of Castleton-on-Hudson
Troy, City of	Earl, Gardner, Memorial Chapel and Crematorium	Oakwood Avenue
Troy, City of	Oakwood Cemetery	101st Street
Troy, City of	Poesten Kill Gorge Historic District	Poesten Kill between Spring Avenue and NY 2
Troy, City of	Willard, Emma, School	Pawling and Elmgrove Avenues

Potential Impacts

Wildfires have the potential to destroy large portions of a community. Firefighters are at risk during the time that they are trying to contain and control the blaze. Loss of life and injuries are possible for people living, working, or traveling through an impacted area. Beyond the loss of vegetation that wildfires leave in their wake, structures in the wildland/urban interface can be severely damaged or destroyed. Following a large wildfire, the possibility exists for significant increases in stormwater runoff, mudslides, and landslides which can lead to downstream flooding. Depending on the scale of the impacted area and the type and numbers of buildings and infrastructure impacted, secondary effects are possible on local economies and the social fabric of communities following the event.

Estimated Potential Losses – Wildfire

Standard loss estimation methodologies are not currently available for estimating wildfire damages. Sufficient historical data regarding events and associated losses was not available to quantify here. For the purpose of this analysis, at this time we have determined that annual losses are unquantifiable. While damages associated with any single event could be significant at the particular location of the event, it is estimated that damages are most likely negligible when evaluated on an average annual basis. Given the lack of detailed historical loss data on significant wildfire occurrences resulting in large-scale structural losses in Rensselaer County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate in each jurisdiction exposed to this hazard.

Based on historic occurrences between the years of 1996 and 2018, reported countywide statistics are as shown in the following table (Table 3c.44).

Table 3c. 44 - Countywide Statistics – Wildfire	
Total Losses Reported (1996-2018)	$2,000
Total Number of Episodes (1996-2018)	1
Annualized Losses Reported (1996-2018)	$91
Annualized Number of Episodes (1996-2018)	0.046
Daily Probability	0.01%
Total Injuries (1996-2018)	0
Total Fatalities (1996-2018)	0

Source: NOAA NCEI Storm Events Dataset (1996-2018)

Summary of Vulnerability Assessment – Wildfire

Wildfires are not a common occurrence in Rensselaer County. The likelihood of wildfires is low and potential consequences – while they could be severe at discrete locations – are overall low consequence type events.

	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses	Hazard Priority
Wildfire	Low	Low	Low	$91	Low

Mitigation Opportunities – Wildfire

The CPG evaluated mitigation opportunities as presented in FEMA's "Mitigation Ideas" document for wildfires. A summary is presented below. More specific project ideas for each opportunity are online at: https://www.fema.gov/media-library/assets/documents/30627.

Table 3c. 45- Wildfire Mitigation Opportunities
Local Planning and Regulations
Map and Assess Vulnerability to Wildfire
Incorporate Wildfire Mitigation in the Comprehensive Plan
Reduce Risk through Land Use Planning
Develop a Wildland Urban Interface Code
Require or Encourage Fire-Resistant Construction Techniques
Structure and Infrastructure Projects
Retrofit At-Risk Structures with ignition-Resistant Materials
Create Defensible Space Around Structures and Infrastructure
Conduct Maintenance to Reduce Risk
Natural Systems Protection
Implement a Fuels Management Program
Education and Awareness Programs
Participate in FireWise Program
Increase Wildfire Risk Awareness
Educate Property Owners about Wildfire Mitigation Techniques

Summary- All Hazards

The following table (Table 3c.46) is a useful tool for mitigation planning purposes only, as the County could use this information in their evaluation and prioritization of mitigation options, and development of a mitigation strategy, as municipalities may wish to stress mitigation of those hazards for which annual loss estimates are the highest. These estimated damages are not intended for use in any more formal benefit-cost analyses.

Table 3c. 46- Countywide Hazard Priorities

Hazard	Likelihood	Potential Consequence	Relative Risk	Average Annualized Losses[5]	Overall Hazard Priority
Extreme Temperatures (Coldwave/ Heat Wave)	Low	Low	Low	Coldwave $1,400; Heat Wave $0	Low
Hurricane/ Tropical Storm	Low	Very High	Moderate	$86,364	Moderate
Lightning	High	Low	Low	$10,727	Low
Tornado	Low	High	High	$473,864	High
Wind	High	Low	High	$120,023	High
Winter Storm (Ice Storm /Snow Storm)	High	Moderate	Moderate	Ice storm $0; Snow Storm $33,641	Moderate
Drought	Low	High	Low	$0	Low
Flood	High	High	High	$2,367,560[6]	High
Earthquake	Low	High	Moderate	$94,827[7]	Moderate
Landslide	High	Low	Moderate	$0	Moderate
Wildfire	Low	Low	Low	$91	Low

Table 3c.47 on the following page provides estimated average annualized losses from HAZUS-MH 4.0 runs, where available. For hazards for which HAZUS modules are not available, historic damages have been distributed across municipalities based on their proportion of improved property. It is important to note that this table reflects estimates of average annual damages. For any hazard, individual event damages could be substantially (orders of magnitude) higher.

[5] Source: NOAA NCEI, except as noted. $0 in average annualized losses had no damages recorded for events between 1996 and 2018. Actual annual damages are unquantifiable but higher.
[6] HAZUS-MH 4.0
[7] HAZUS-MH 4.0

Table 3c. 47- Summary of Annual Loss Estimates by Municipality, All Natural Hazards *

Municipality	Replacement Cost Value of Improvements ($)	Extreme Temperatures	Hurricane/ Tropical Storm - Wind	Hurricane/ Tropical Storm – Wind + Flood	Lightning	Tornado	Wind	Winter Storm (Ice Storm/ Snow Storm)	Drought	Flood	Earthquake	Landslide	Wildfire
		NOAA NCEI , 1996-2018	HAZUS	NOAA NCEI , 1996-2018	NOAA NCEI , 1996-2018	NOAA NCEI , 1996-2018	NOAA NCEI , 1996-2018	NOAA NCEI , 1996-2018	NOAA NCEI, 1996-2018	HAZUS	HAZUS	NOAA NCEI , 1996-2018	NOAA NCEI , 1996-2018
Berlin, Town of	$446,676,000	$19	$212	$1,157	$144	$6,350	$1,608	$451	$0	$45,230	$1,274	$0	$1
Brunswick, Town of	$2,342,127,000	$98	$582	$6,068	$754	$33,295	$8,433	$2,364	$0	$65,170	$6,596	$0	$6
Castleton-on-Hudson, Village of	$271,600,000	$11	$116	$704	$87	$3,861	$978	$274	$0	$31,910	$797	$0	$1
East Greenbush, Town of	$3,659,758,000	$154	$2,311	$9,482	$1,178	$52,026	$13,177	$3,693	$0	$79,160	$10,205	$0	$10
East Nassau, Village of	$94,148,000	$4	$37	$244	$30	$1,338	$339	$95	$0	$38,080	$161	$0	$0
Grafton, Town of	$458,781,000	$19	$251	$1,189	$148	$6,522	$1,652	$463	$0	$3,420	$1,270	$0	$1
Hoosick Falls, Village of	$583,380,000	$25	$0	$1,511	$188	$8,293	$2,101	$589	$0	$104,890	$1,769	$0	$2
Hoosick, Town of	$745,594,000	$31	$277	$1,932	$240	$10,599	$2,685	$752	$0	$208,210	$2,526	$0	$2
Nassau, Town of	$571,880,000	$24	$317	$1,482	$184	$8,130	$2,059	$577	$0	$21,410	$1,375	$0	$2
Nassau, Village of	$173,160,000	$7	$57	$449	$56	$2,462	$623	$175	$0	$22,500	$418	$0	$0
North Greenbush, Town of	$2,801,151,000	$118	$933	$7,257	$901	$39,820	$10,086	$2,827	$0	$128,850	$7,910	$0	$8
Petersburgh, Town of	$333,098,000	$14	$1	$863	$107	$4,735	$1,199	$336	$0	$61,700	$937	$0	$1
Pittstown, Town of	$737,726,000	$31	$432	$1,911	$237	$10,487	$2,656	$745	$0	$18,240	$2,603	$0	$2
Poestenkill, Town of	$945,815,000	$40	$463	$2,450	$304	$13,445	$3,406	$955	$0	$71,340	$2,395	$0	$3
Rensselaer, City of	$1,588,138,000	$67	$647	$4,115	$511	$22,576	$5,718	$1,603	$0	$138,230	$4,098	$0	$4
Sand Lake, Town of	$1,782,955,000	$75	$896	$4,619	$574	$25,346	$6,420	$1,799	$0	$103,840	$4,472	$0	$5
Schaghticoke, Town of	$1,379,356,000	$58	$751	$3,574	$444	$19,608	$4,967	$1,392	$0	$100,530	$4,249	$0	$4
Schaghticoke, Village of	$129,380,000	$5	$10	$335	$42	$1,839	$466	$131	$0	$11,650	$57	$0	$0
Schodack, Town of	$2,486,786,000	$104	$1,872	$6,443	$800	$35,351	$8,954	$2,510	$0	$421,290	$6,715	$0	$7
Stephentown, Town of	$509,235,000	$21	$271	$1,319	$164	$7,239	$1,834	$514	$0	$53,080	$1,442	$0	$1
Troy, City of	$11,211,809,000	$471	$1,770	$29,048	$3,608	$159,383	$40,370	$11,315	$0	$638,590	$33,536	$0	$31
Valley Falls, Village of	$81,394,000	$3	$3	$211	$26	$1,157	$293	$82	$0	$240	$21	$0	$0
Rensselaer County Total	$33,333,947,000	Coldwave $1,400; Heat Wave $0	$12,209	$86,364	$10,727	$473,864	$120,023	Ice storm $0; Snow Storm $33,641	$0	$2,367,560	$94,827	$0	$91

* **It is important to note that this table reflects estimates of average annualized damages. For any hazard, individual event damages could be substantially higher.**

Climate Change

Climate change is a shift in long-term weather patterns. Climate change is a reality of Rensselaer County's future. Long-term data documents a significant increase in average temperature, and a significant rise in sea level that is consistent with observed and predicted global trends. While incremental rises in temperature and sea level over a one-year planning window are virtually undetectable, their cumulative impacts over perhaps several decades are expected to be virtually impossible to ignore.

Earth's climate is warming as a result of three main factors: (1) increased emissions of greenhouses gases, (2) burning of fossil fuels, and (3) land use change. This warmer climate, in turn, melts ice sheets, ice caps, and glaciers; and warms ocean waters which expand with the elevated temperature thus increasing overall ocean volumes. Future projections of sea-level rise for the twenty-first century vary widely, ranging from several centimeters to more than a meter.

Climate change is not a hazard in and of itself; rather, it is a condition that will exacerbate the impacts of hazards. Climate change is expected to increase the frequency and intensity of natural hazards such as flooding, drought, wind, and wildfires. For each hazard profiled in Section 3a, the "probability of occurrence" subsections included information on climate change impacts on probability of occurrence. Impacts of the hazards themselves are discussed earlier in this Section 3c.

The 2019 SHMP discusses climate change. Environmental variables vulnerable to climate change include: temperature (air, water, and ground), precipitation, water quantity/quality, snow/ice, sea level rise, storm frequency and intensity, humidity, evaporation, wind speed and direction. It concludes:

> "Exacerbating the growing cost and number of natural disasters is the reality that the global climate is changing. With these changes the frequency, severity, and duration of natural hazard events are likely to increase. Mitigation efforts that address the projected effects of climate change and considers changing future conditions will be more successful at the long-term reduction of risk to hazard events and the growth of stronger communities."

Climate change is expected to alter local climate conditions, and the frequency and intensity of extreme weather events and, in turn, the consequences and impacts of those events. This would result in an increase in risk to people, property, the environment, and the economy.

Governor Cuomo signed the Community Risk and Resiliency Act (CRRA) in September 2014. CRRA requires applicants for certain permit and funding programs to demonstrate consideration of future physical risks due to sea-level rise, flooding and storm surge. DEC is required by CRRA to adopt state sea-level rise projections. Therefore, the Department proposed a new 6 NYCRR Part 490, Projected Sea-level Rise (Part 490). Part 490 establishes

projections of sea-level rise in three specified geographic regions over various time intervals but does not impose any requirements on any entity. Sea level rise is defined as the increase in the average level of the surface of marine or tidal water relative to the baseline level. Adopted sea-level rise projections[8] for the 'Mid-Hudson Region' (the main stem of the Hudson River, from the federal dam at Troy to the mouth of Rondout Creek at Kingston, New York) show a great degree of uncertainty, and are as follows:

Table 3c. 48- Hudson River Sea Level Rise Projections

Time Interval	Low Projection	Low-Medium Projection	Medium Projection	High-Medium Projection	High Projection
2020s	1 inch	3 inches	5 inches	7 inches	9 inches
2050s	5 inches	9 inches	14 inches	19 inches	27 inches
2080s	10 inches	14 inches	25 inches	36 inches	54 inches
2100	11 inches	18 inches	32 inches	46 inches	71 inches

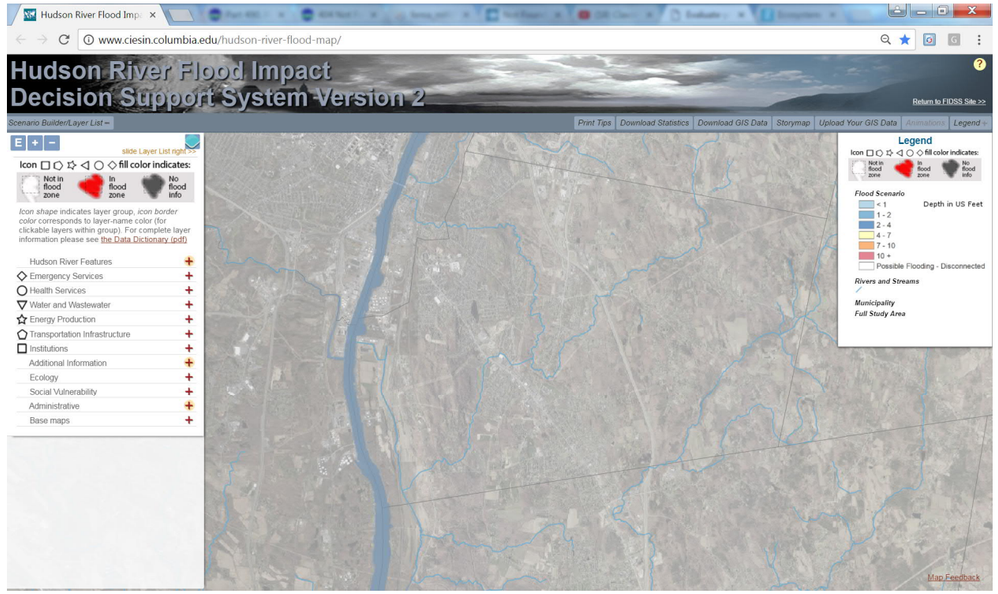
The Hudson River Flood Impact Decision Support System is an interactive online map application that allows users to evaluate the scale of potential flooding for tidally affected shorelines of the Hudson River Valley and Westchester County under a variety of sea level rise and storm scenarios. It is located at: http://fidss.ciesin.columbia.edu/ . Maps can be generated for sea level rise scenarios of 6, 12, 18, 24, 30, 36, 48, 60, or 72 inches; and with or without storms of various return periods. On the pages to follow, for each Hudson River community (Troy, North Greenbush, Rensselaer, East Greenbush, Schodack, and Castleton-on-Hudson), the tool was used to generate maps to show the following conditions:

- No sea level rise, no storm
- No sea level rise, 100-year storm
- Sea level rise 24", no storm
- Sea level rise 24", 100-year storm

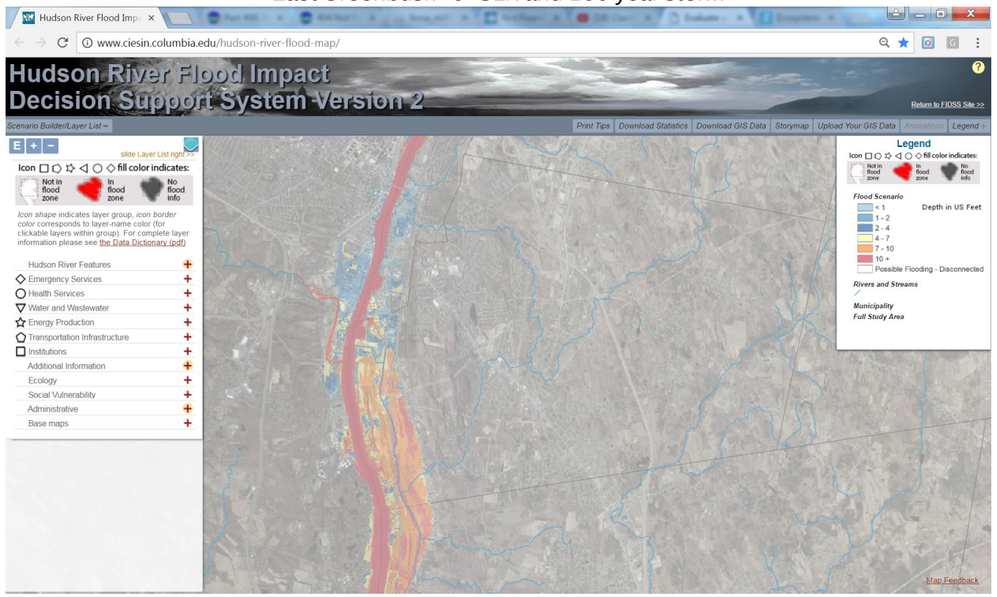
In very simplified terms, water is generally projected to flood the same areas to greater depths.

[8] (h) 'High-medium projection'. The amount of sea-level rise that is unlikely (the 75th percentile of ClimAID model outputs) to be exceeded by the specified time interval.
(i) 'High projection'. The amount of sea-level rise that is associated with high rates of melt of land-based ice and is very unlikely (the 90th percentile of ClimAID model outputs) to be exceeded by the specified time interval.
(l) 'Low-medium projection'. The amount of sea-level rise that is likely (the 25th percentile of ClimAID model outputs) to be exceeded by the specified time interval.
(m) 'Low projection'. The amount of sea-level rise that is consistent with historical rates of sea-level rise and is very likely (the 10th percentile of ClimAID model outputs) to be exceeded by the specified time interval.
(n) 'Medium projection'. The amount of sea-level rise that is about as likely as not (the mean of the 25th and 75th percentiles of ClimAID model outputs) to be exceeded by the specified time interval.

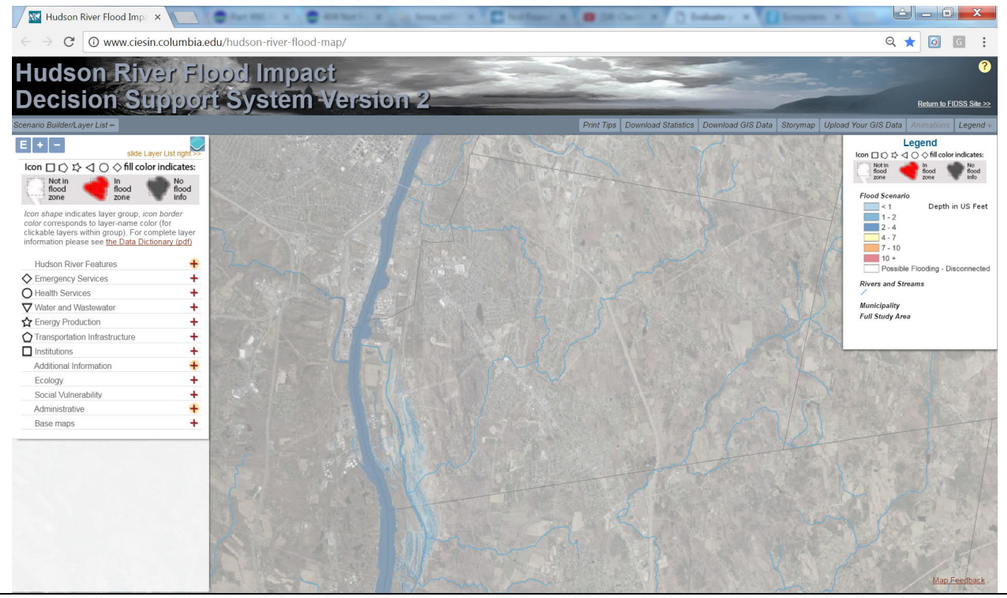
East Greenbush – 0” SLR and no storm



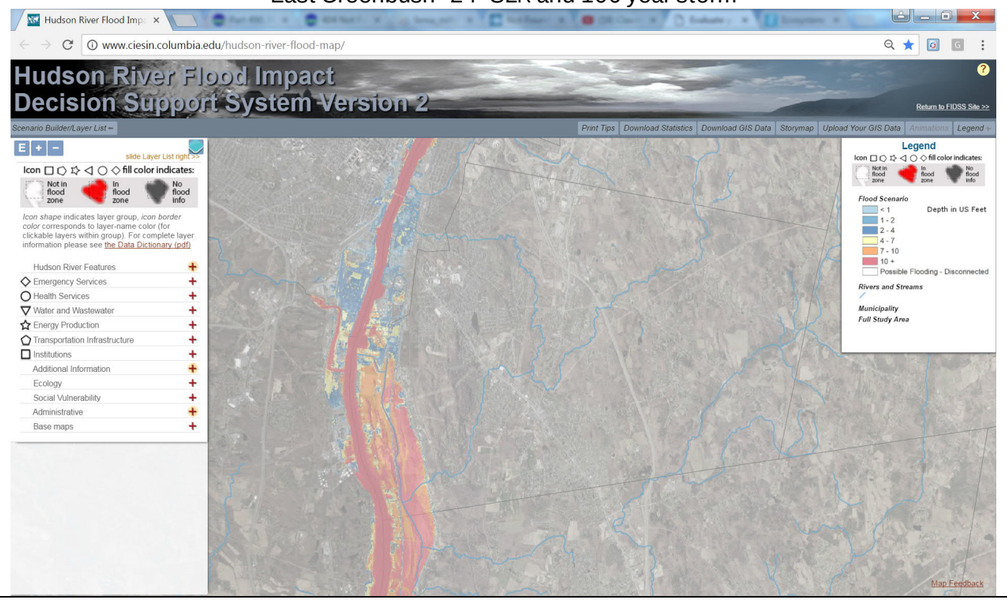
East Greenbush- 0” SLR and 100 year storm



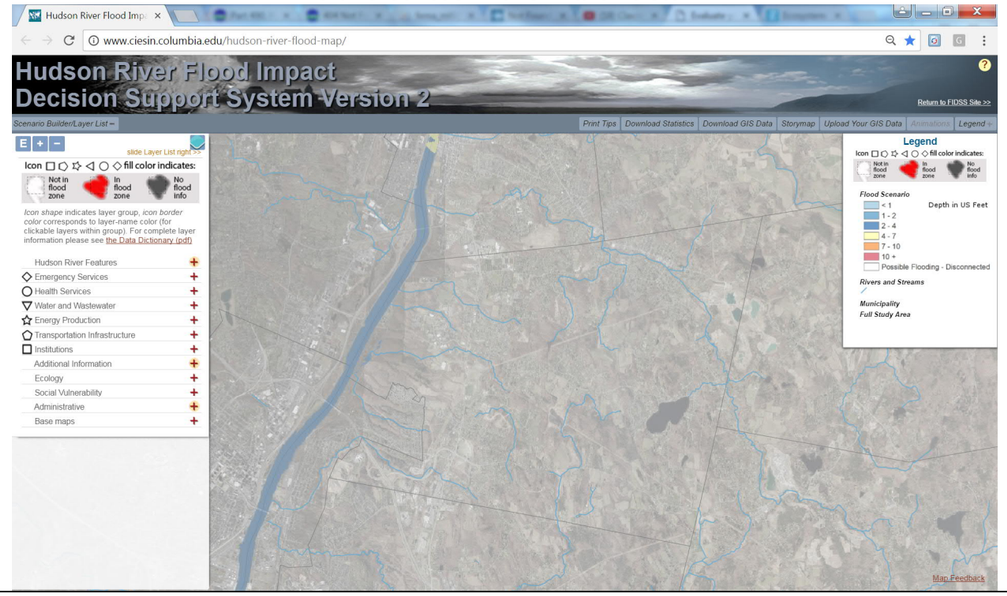
East Greenbush – 24” SLR and no storm



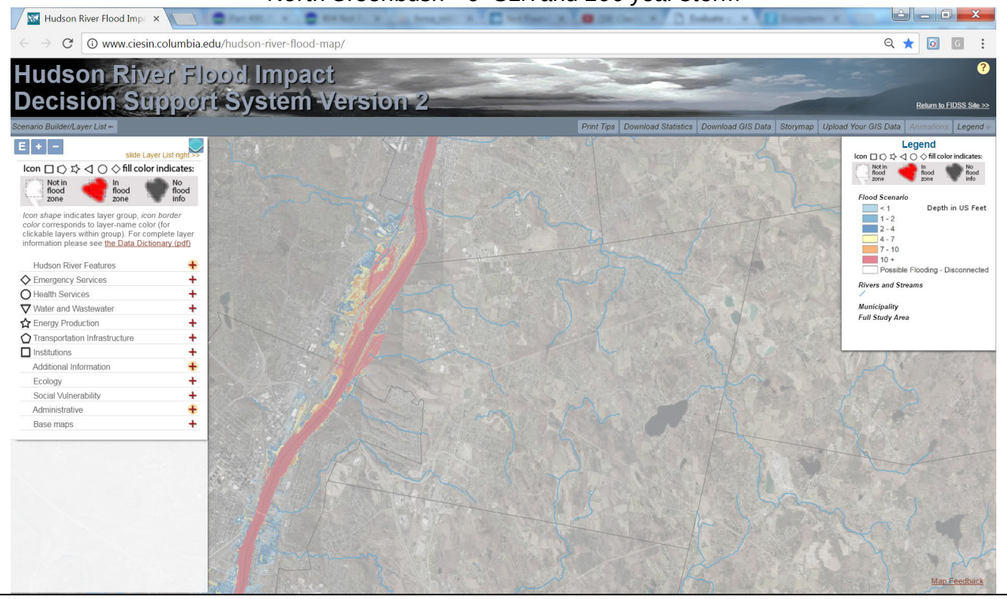
East Greenbush- 24” SLR and 100 year storm



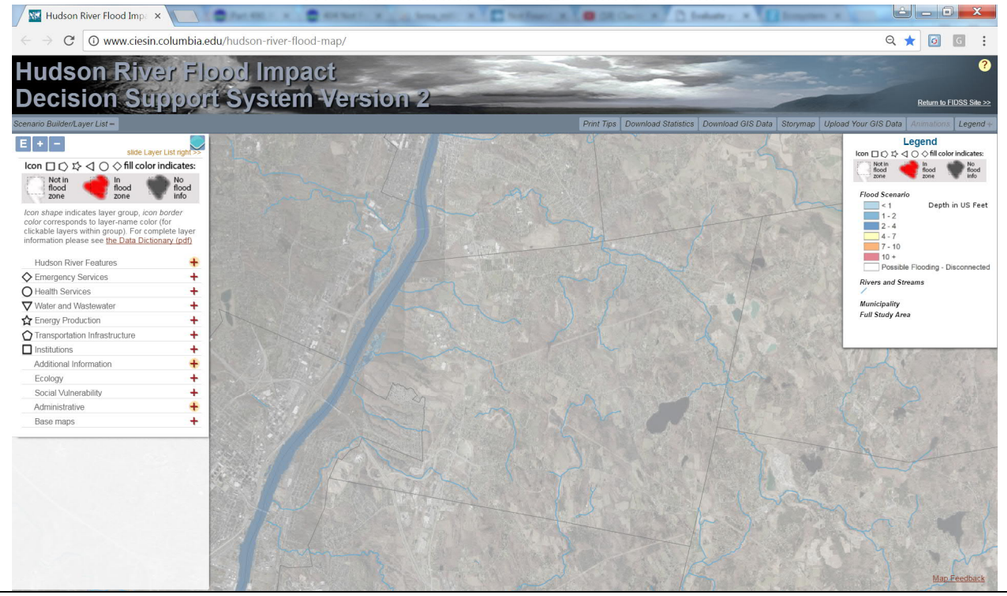
North Greenbush – 0” SLR and no storm



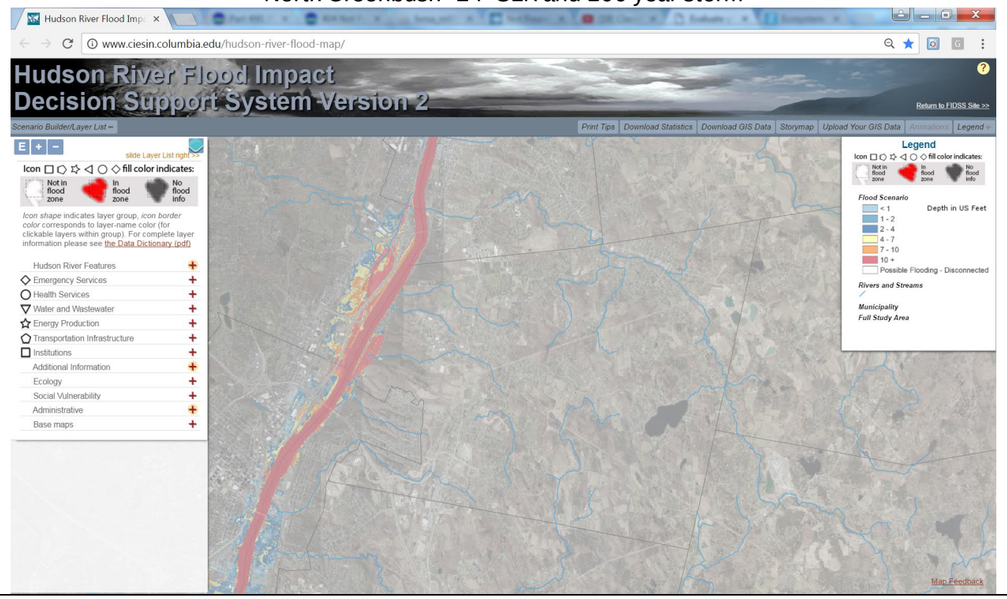
North Greenbush – 0” SLR and 100 year storm



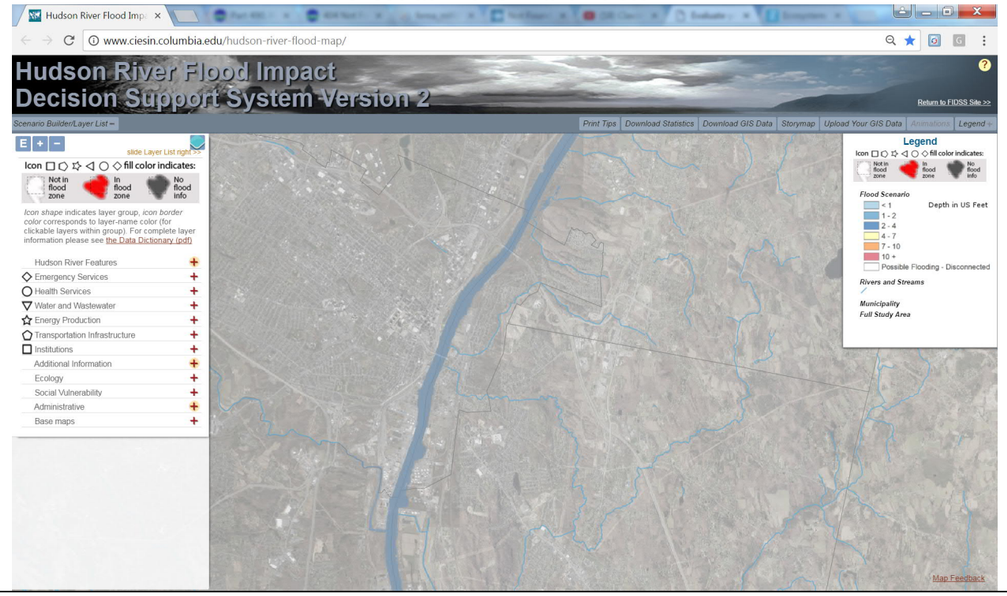
North Greenbush – 24” SLR and no storm



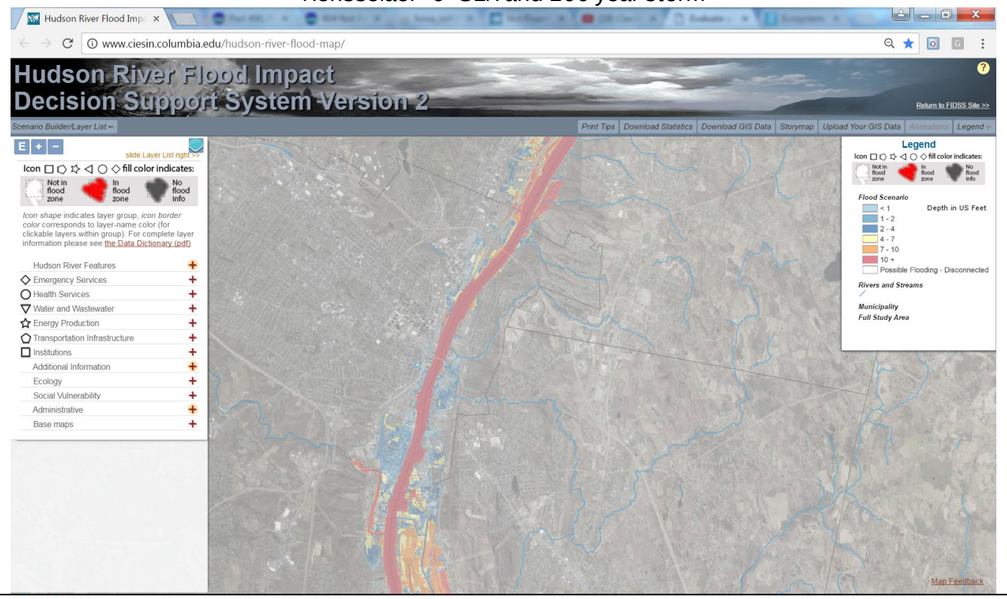
North Greenbush- 24” SLR and 100 year storm



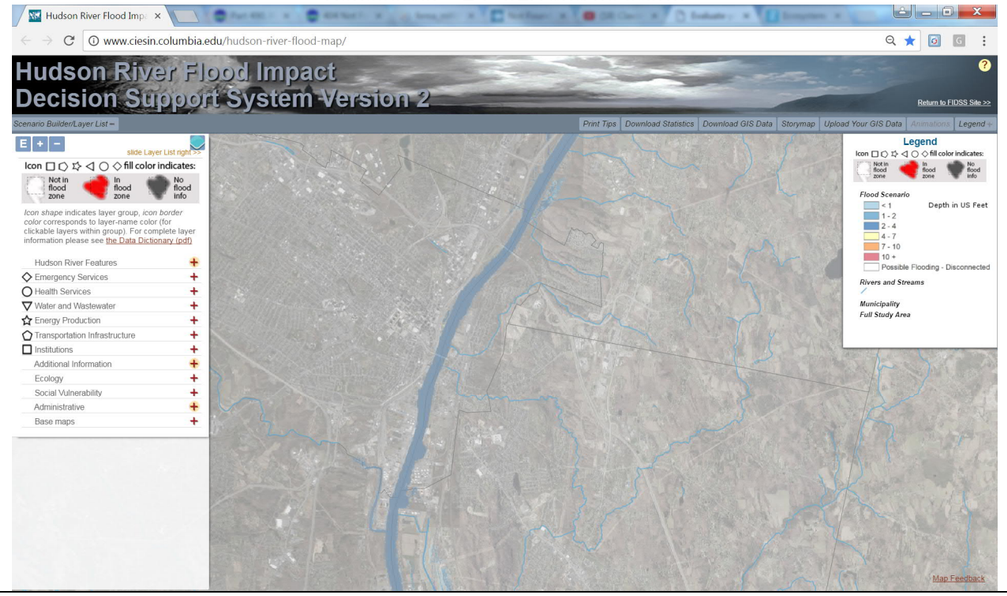
Rensselaer – 0” SLR and no storm



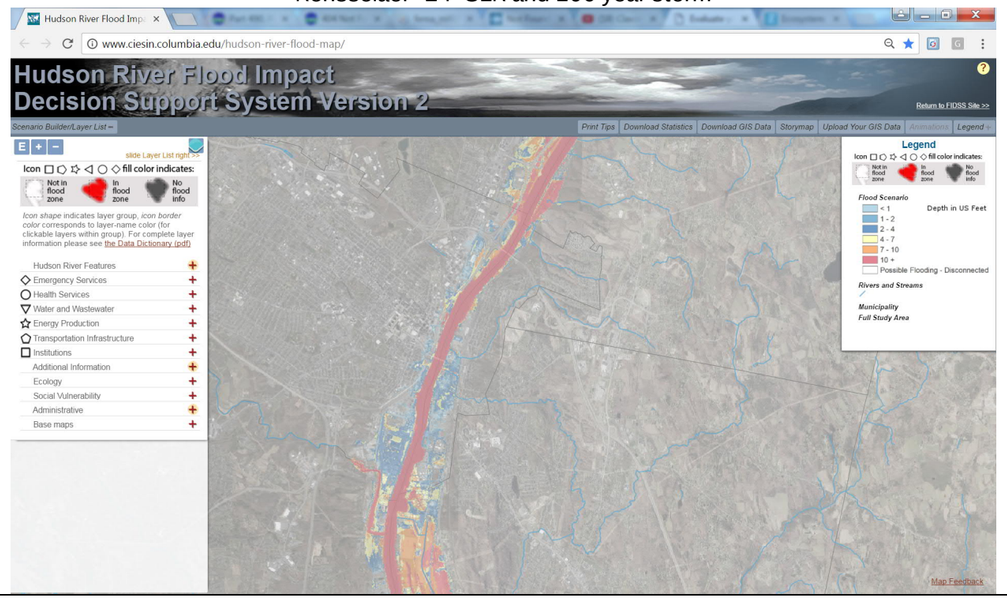
Rensselaer- 0” SLR and 100 year storm



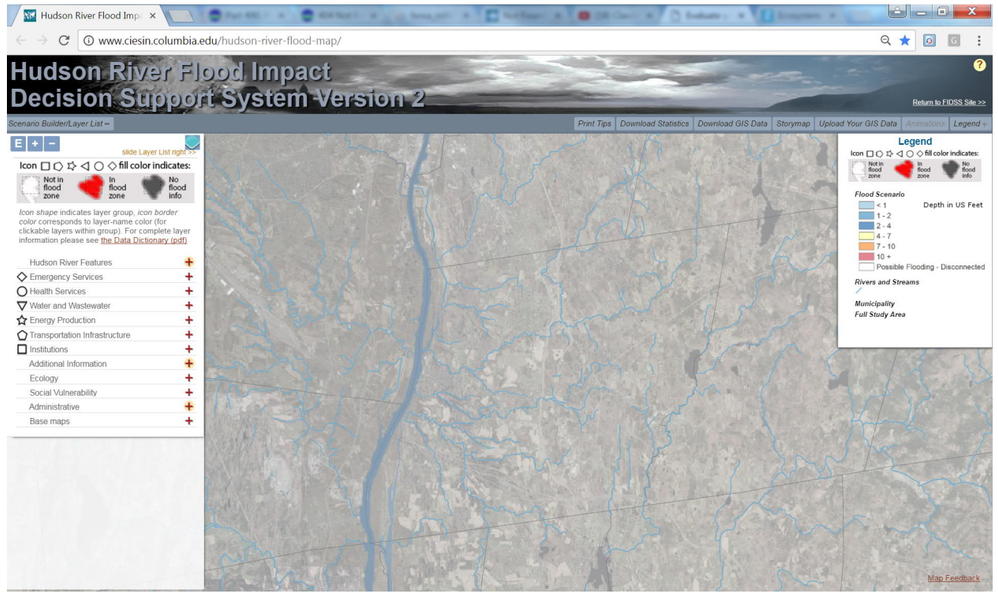
Rensselaer – 24” SLR and no storm



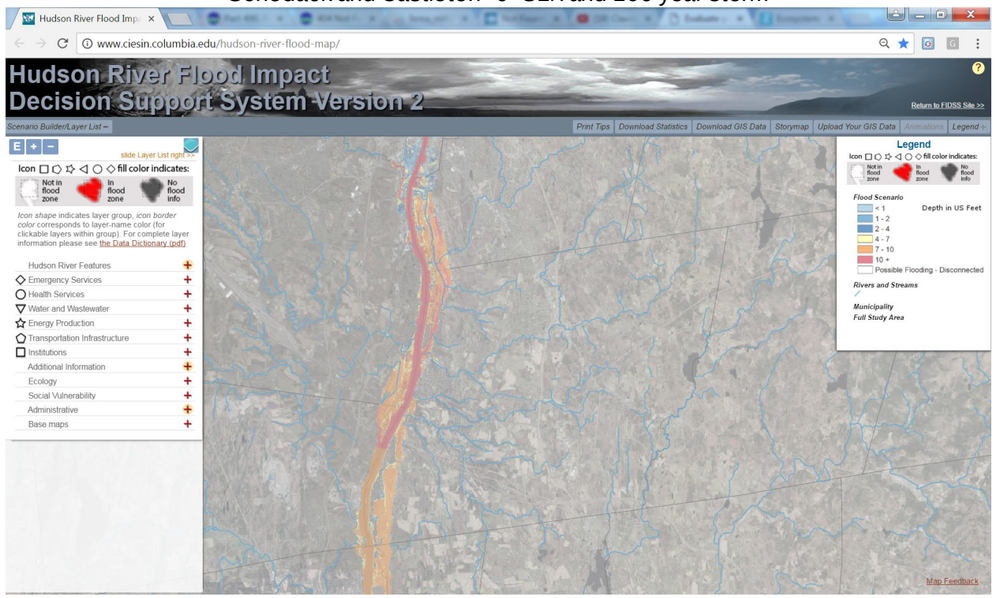
Rensselaer- 24” SLR and 100 year storm



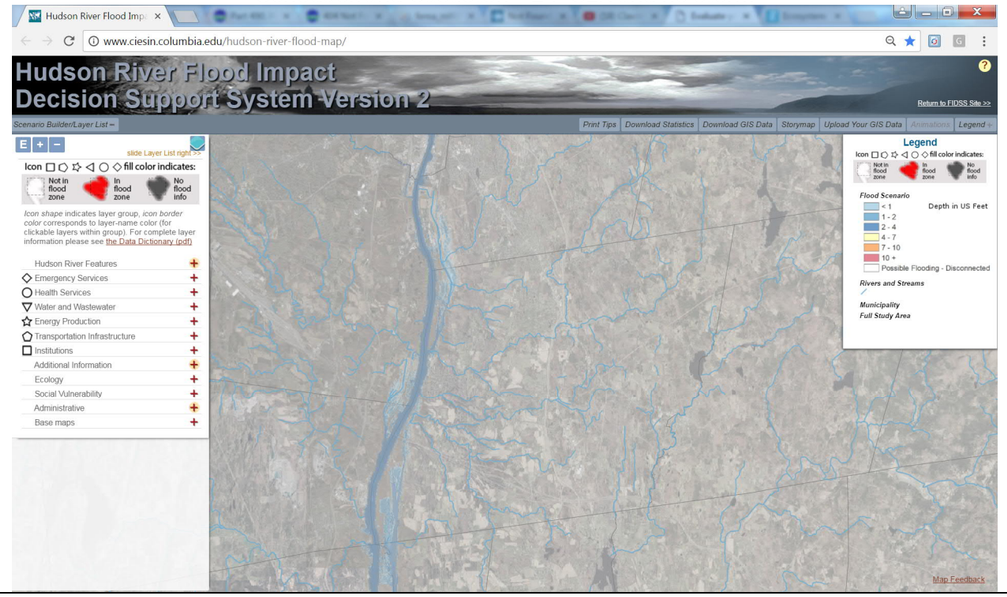
Schodack and Castleton – 0” SLR and no storm



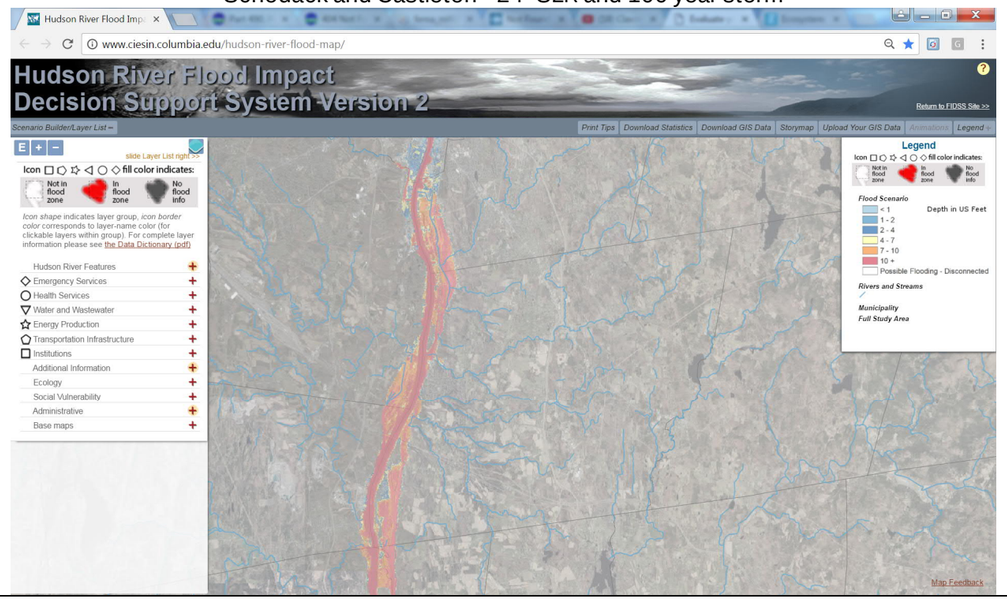
Schodack and Castleton- 0” SLR and 100 year storm



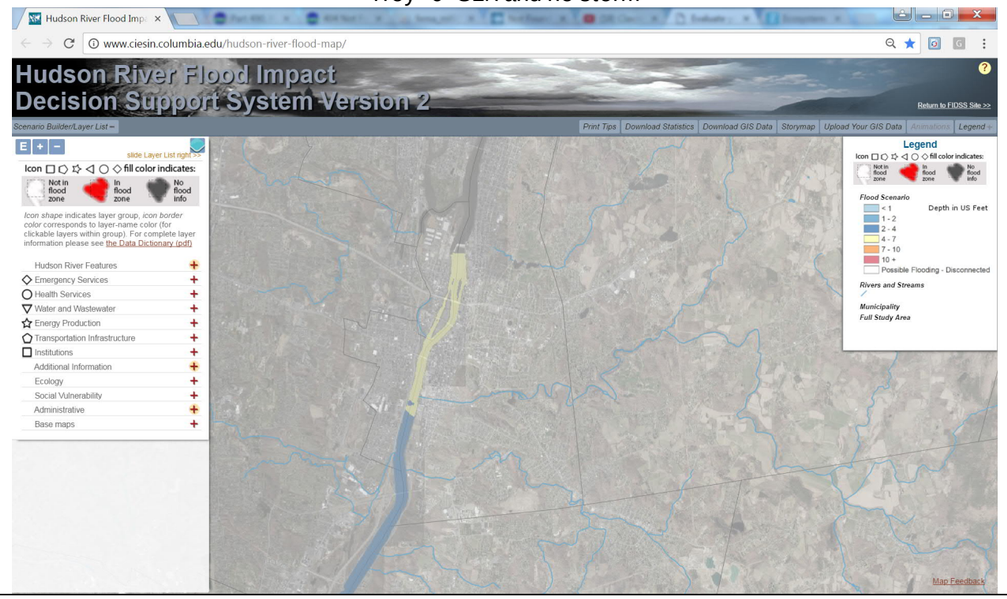
Schodack and Castleton – 24” SLR and no storm



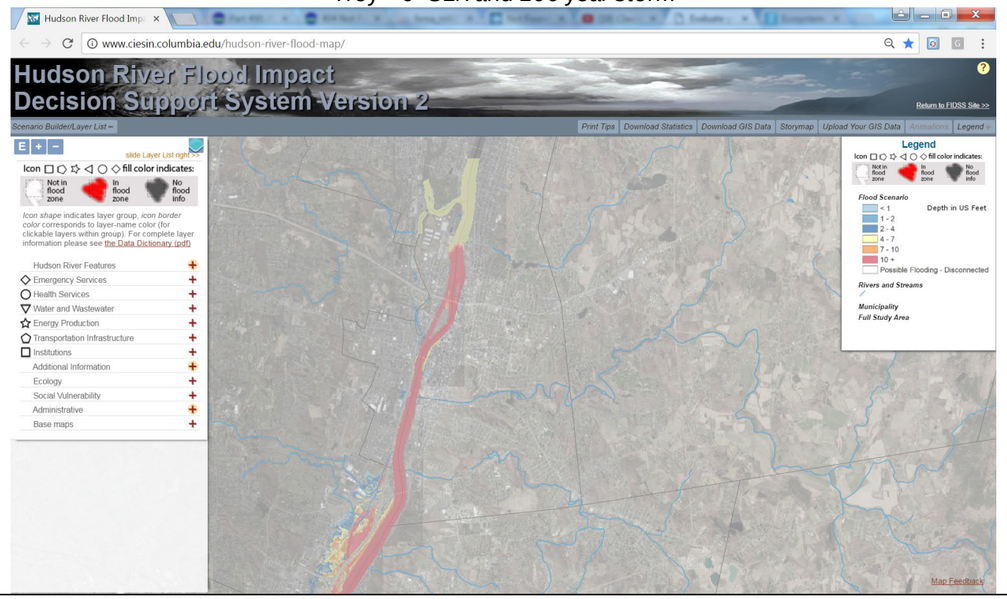
Schodack and Castleton - 24” SLR and 100 year storm



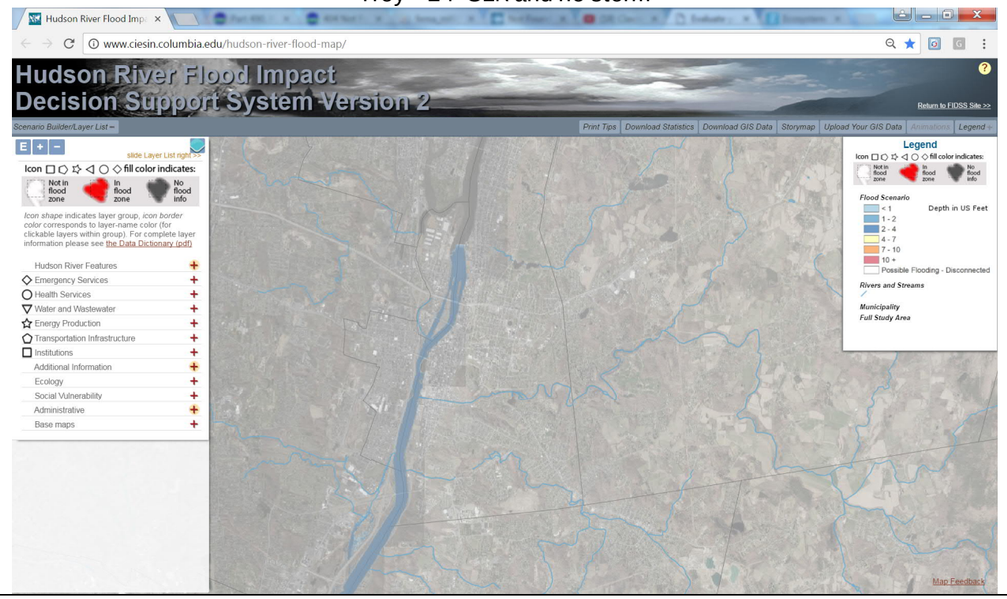
Troy- 0” SLR and no storm



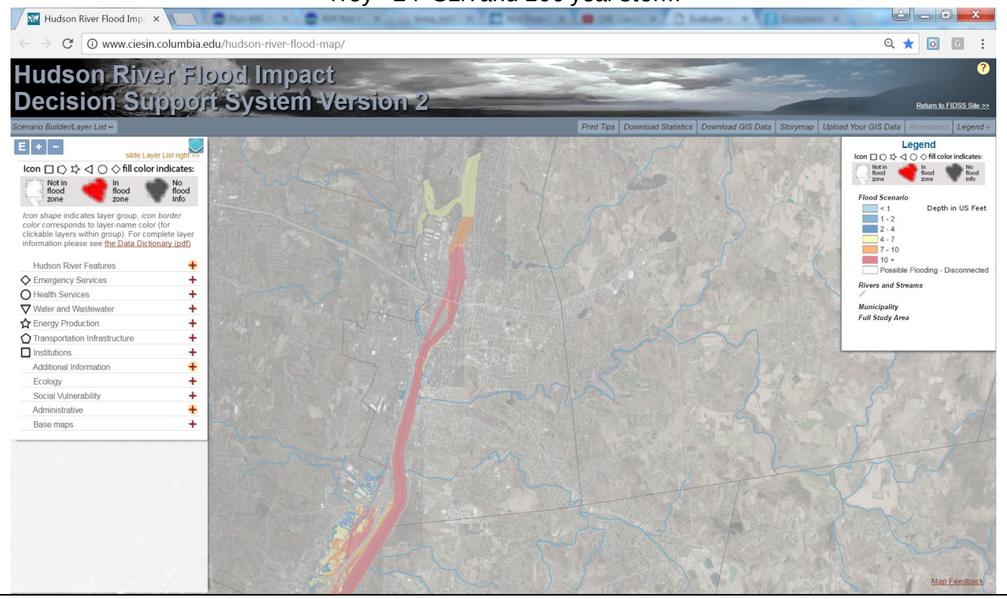
Troy – 0” SLR and 100 year storm



Troy – 24” SLR and no storm



Troy - 24” SLR and 100 year storm



Impacts. Impacts of climate change can be varied and widespread. In the years to come, it is anticipated that Rensselaer County may observe drastic changes in storm character, intensity, frequency, and storm tracking. Hurricanes are projected to become more intense with rising sea water temperatures. The following types of impacts may be anticipated in Rensselaer County's future as a result of climate change:

- More frequent inundation of low-lying areas
- Increased frequency and extent of storm-related flooding
- Wetland loss
- Land loss through submergence and erosion of lands along the Hudson River due to sea level rise
- Increased salinity in estuaries and coastal freshwater wetlands
- Impacts to human populations (property losses, more frequent flood damage, more frequent flooding of roadways and urban centers, risks to people as the population of coastal areas increases)
- More buildings and infrastructure exposed
- Currently exposed buildings and infrastructure could be subject to potentially greater losses as water levels increase, and continued rapid coastal development exacerbates the impacts of sea level rise
- Impacts on gravity flow stormwater systems

Climate change has the potential to impact: transportation infrastructure (ports, marinas, airports, roads, bridges, railways); public infrastructure (stormwater and wastewater management systems, drinking water supply and distribution systems, power utility systems, communications systems); public facilities (i.e., police, fire, ambulance, hospitals, schools, daycare centers, adult living facilities, historic landmarks, government buildings, libraries, parks, etc.); economic viability of a community.

Adaptation Strategies. Implementing climate adaptation strategies in project design and routine permit and funding decision making will result in more resilient projects and safer communities to live, work and conduct business in. Types of actions to offset impacts come in four basic categories: protection, accommodation, adaptation, and retreat.

- Protection - structurally defensive measures that provide protection by preventing flooding/inundation (i.e., shoreline armoring, beach re-nourishment, streambank stabilization, dunes, dikes, levees)
- Accommodation - strategies that provide protection via altered design measures to accommodate water (i.e., building elevation, bridge elevation, stormwater improvements, floodproofing)
- Adaptation – modifying design standards, building codes
- Retreat - strategies that provide protection via the removal of existing, at-risk development and possible relocation to other areas that are not flood-prone (i.e., acquisition of vulnerable land for public ownership, transfer of development rights, purchase of development rights, rolling easements, conservation easements, zoning laws, disincentives to

building in hazard areas, incentives to building in low risk areas, designating at-risk land as open space, or requiring critical facilities to be located outside of hazard areas.

There are ways that jurisdictions can plan ahead and take action to mitigate climate change impacts.

- Prepare for more severe storms to be the new norm. Take this into account when implementing local ordinances and zoning changes, as well as when planning for emergency management
- Encourage development away from coastal areas that are at the greatest risk for being impacted by sea level rise due to climate change.
- Encourage the implementation of more natural mitigation techniques along the coast such as dune stabilization, while discouraging the use of, or designing ways to phase out the use of hard structures that ultimately increase beach erosion such as jetties, groins, and seawalls
- Encourage the use of permeable ground cover and stormwater management in planning designs
- Require buildings in floodplains to be on higher foundations (freeboard)
- Recognize increased flooding through 2050 by adopting a 'floodplain planning zone'
- Adopt Coastal A Zone requirements in areas where waves may be 1.5 feet or higher
- Redelineate the landward boundary of Conservation Zone to coincide with the 2050 inundation area and reduce the allowed density (retain current zoning for existing villages)
- Recognize that wetlands will migrate inland, groundwater levels will rise, and saltwater intrusion will increase
- Modify on-site septic requirements to anticipate impaired performance as water table levels rise
- Require stream/tributary buffers or conservation easements
- Require planning for certain roads to anticipate more frequent flooding
- Anticipate that some buildings will need to be relocated, elevated on higher foundations, or abandoned

Re-evaluation. Mitigation strategies regarding development and redevelopment (particularly in the post-disaster scenario) presents an opportunity to rebuild in a stronger, more sustainable, and more resilient manner. Climate change adaptation strategies, particularly with regard to sea level rise, should be re-evaluated on a regular basis over the course of the plan maintenance phase - particularly when a community is devastated by a disaster, as strategies which may not have been economically, politically, or socially feasible in the pre-disaster scenario may have markedly different levels of community support.

SECTION 3d - RISK ASSESSMENT: EXISTING LAND USES AND FUTURE DEVELOPMENT TRENDS IN HAZARD AREAS

Historic

Rensselaer County was originally inhabited by the Mohican Indians who thrived on the area's abundant natural resources for centuries. In 1609, Henry Hudson sailed up the river which would later bear his name, discovering the Albany area on his voyage. The Dutch would later claim this area as their own (as part of "New Netherland"). In 1620, the Dutch West India Company (a company of Dutch merchants) was granted authority to make contracts and alliances with princes and natives, build forts, administer justice, appoint and discharge governors, soldiers, and public officers, and promote trade. Through the DWIC's Charter of Freedoms and Exemptions of 1629, members of its company were granted the sole privilege of establishing patroonships in New Netherland. Upon being deeded the land, patroons were commissioned to establish a settlement of at least 50 families within four years. Substantial settlement and development of Rensselaer County began largely when the County's lands were deeded to Kiliaen van Rensselaer by the Dutch West India Company in 1630. A Dutch jeweler and merchant and one of the original directors of the Dutch West India Company, van Rensselaer incorporated in his patroonship "Rensselaerswyck". Dutch patrons owned all of the land in the patroonship and used feudal leases to maintain control of the land. Beginning with the death of Stephen van Rensselaer III (the eleventh patroon of Rensselaerswyck) in 1839, tenant farms began to revolt the feudal system, refusing to pay taxes to the sheriff's deputies and eventually marking the beginning of the end of the van Rensselaer patroonship.

Rensselaer County's economy has traditionally been dominated by agriculture, back as far as the early tenant farms of van Rensselaer's patroonship. Settlement was slow in many areas until after the American Revolution for fear of attack by natives and Tories. Following the American Revolution, New Englanders began to migrate and settle in Rensselaer County.

Because of the ideal geographic location of Rensselaer County and the abundant water supply available, the area became a fast leader in the industrial development of the Northeast. Agriculture remained strong as population centers grew up near streams, where the water powered mills of various kinds (woolen, flax, paper, powder, grist mills, sawmills, textile mills, etc). Most residents were farmers, growing crops used in the local industries. Opportunities for transport of goods and services abounded with the County's natural waterways combined with the construction of the Erie and Champlain Canal systems as well as the birth of the railroad.

In the 19th century Rensselaer County enjoyed being one of the leading producers of livestock, orchard and dairy products, lumber and iron in New York State. Schaghticoke's powder mills; Sand Lake's glass factory; Walter Wood's agricultural equipment business in Hoosick Falls; the Burden Iron Works (which was powered by the largest waterwheel in the world); Fuller, Warren and Company, Troy's largest stoveworks; the iron products of the Albany Rolling and Slitting Mill (later the Albany Nail Factory and Rensselaer Iron Works); and

the precision instruments made by W. & L.E. Gurley – to name a few. During the mid-1900's, the City of Troy became known for its clothing products - collars, cuffs and shirts. The nickname, "The Collar City" still is heard today. The cities of Troy and Rensselaer became centers for shipping these products to New York City, Chicago, Boston and beyond. The large labor force needed to work the County's many factories and farms fostered the growth of the towns and cities in Rensselaer County.

The early 20th century brought with it an expanding industrial economy driven primarily by profit, with little regard for workers or surrounding environments. Legislation abolishing abusive labor practices, and promoting child welfare and education, wildlife protection and reforestation, city planning, and subdivision control all were created during this period. Major construction projects of the day included local efforts to widen and deepen the Hudson River, dam Rensselaer County's rivers and lakes, and expand its transportation networks. Development of many kinds was cut short by the stock market crash of 1929 and the Depression which followed.

Over the course of the latter half of the 20th century, and after years of relocated industry and population, Rensselaer County (like much of the post-war United States) began to turn its attention to renewing its blighted cities. Federal and state funding for urban renewal and highway construction played a significant role in re-shaping not only Rensselaer County's urban centers but also its transportation routes through rural areas. Roadway systems were expanded, and public services were extended, bringing with them increased residential and commercial development in new areas.

Many of these old industries are gone, but they have been replaced by others who have come to rely on the highly skilled workforce available in Rensselaer County. Today, while Rensselaer County is still a largely rural county with a strong agricultural base, it is becoming a fast leader in high technology. Rensselaer County is the location of choice for numerous national and global companies across a variety of industries, including Regeneron Pharmaceuticals, Pitney Bowes Software (formerly MapInfo Corporation), and MetLife. In addition, Rensselaer County is home to Rensselaer Polytechnic Institute's Incubator Center, housing dozens of promising start-up companies; as well as the Rensselaer Technology Park in North Greenbush, representing a wide diversity of technologies from electronics to physics research and biotechnology to software. The County has implemented a farm protection plan to help sustain existing farm families.

Existing Land Use

Rensselaer County is located in the eastern portion of New York State in what is known as the Capital Region. The Hudson River and adjacent Saratoga and Albany Counties make up the western boundary of the County, and its eastern boundary is shared by the states of Vermont and Massachusetts. Washington County is located to the north. The county seat of Troy lies approximately 150 miles east of Syracuse, and seven miles northeast of Albany. According to the US Census Bureau, the County is 654 miles in area (not including open water). Rensselaer County is bounded to the west by Saratoga and Albany Counties and to the east by the States

of Vermont and Massachusetts. Washington Counties lies to the north, and Columbia County is to the south.

There are 22 municipal jurisdictions in addition to the County, with the City of Troy designated as the County seat. Rensselaer County's population has not changed dramatically over time, increasing only marginally from its 1940 population of 121,834. The Countywide population as determined by the 2010 Census was 159,433 (a slight increase of Census 2000 population of 152,684) and the U.S Census Bureau estimated the 2018 population to be 159,442. Between today and 2040, the Cornell Program on Applied Demographics projects the County's population to increase steadily to 2027, where it is projected to peak at 162,070 before declining steadily thereafter to approximately 160,846 by 2040. The Census 2010 population gives the County a population density of 244 people per square mile (up from 233 people per square mile in 2000), while the population density for New York State overall is significantly higher at 411 people per square mile (up slightly from 402 people per square mile in 2000).

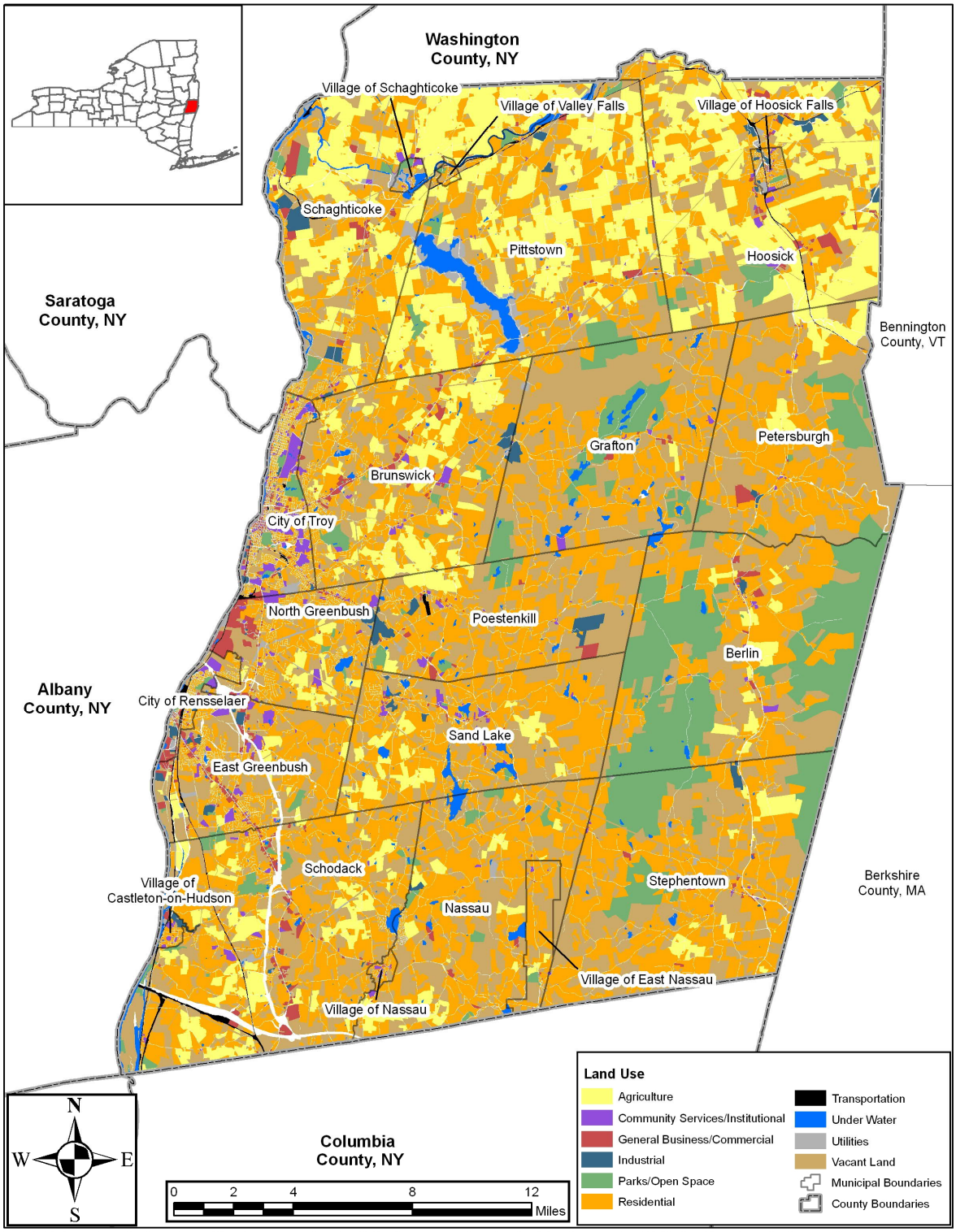
Figure 3d.1 presents a graphical depiction of land use in Rensselaer County, and the component data used to compile this figure is presented in Tables 3d.1 and 3d.2, which present total acreages of land currently under various land use categories and their relative percentages within each municipality and in the County overall.

Together, Tables 3d.1 and 3d.2 and Figure 3d.1 show that 16.4 percent of the county is currently used for agriculture, 39.6 percent is residential, and 29.6 percent of the land is vacant. Furthermore, 8.9 percent of the land is parks and open space and 1.6 percent is used for office, general business, and commercial uses. The remaining 3.9 percent is comprised of community services/institutional, industrial, utilities, transportation, or open water.

Significant areas of designated protected undeveloped land include the following:

Location	Number of Acres
• Cowee Conservation Easement – Petersbugh, Berlin, Stephentown	5,501
• Capital District State Wildlife Management Area - Berlin	4,048
• Taconic Ridge State Forest - Petersburgh, Stephentown	3,330
• Berlin State Forest – Berlin	2,508
• Grafton Lakes State Park – Grafton	2,312
• Pittstown State Forest – Grafton, Pittstown	1,192
• Schodack Island State Park – Schodack	958
• Tibbetts State Forest – Hoosick	907
• Dyken Pond Environmental Education Center – Grafton	523
• Frear Park – City of Troy	216
• Papscanee Island Nature Preserve – East Greenbush	201
• Bennington Battlefield State Historic Site – Hoosick	160
• Cherry Plain State Park – Berlin	150
• East Greenbush Town Park – East Greenbush	122

Figure 3d.1: Rensselaer County Land Use



SOURCES: ESRI, U.S. Counties, 2005; Rensselaer County BRIS, Rensselaer County Municipal Boundaries, 2009, Tax Parcels; U.S. Census Bureau, Rensselaer Area Hydrography, 2007.

Table 3d.1 - Land Use Acreage Breakdowns by Municipality											
Municipality	Residential	Community Services /Institutional	Offices/ General Business/ Commercial	Industrial	Utilities	Transportation	Agriculture	Parks/ Open Space/ Conservation	Vacant	Under Water	Total (Acres)
Berlin, Town of	10,610	140	231	58	75		1,342	16,224	8,927	92	37,699
Brunswick, Town of	12,196	350	569	192	171		5,893	554	7,360		27,285
Castleton-on-Hudson, Vill. of	208	63	5	99	5	9		6	27		422
East Greenbush, Town of	6,213	643	650	276	86	123	766	207	5,396		14,361
East Nassau, Village of	1,569	18	6		1		100	72	1,171		2,937
Grafton, Town of	10,349	166	136	161	26		128	4,325	13,574	23	28,888
Hoosick, Town of	10,515	341	610	355	45	227	17,337	1,292	7,641		38,363
Hoosick Falls, Village of	388	51	20	61	46	19		52	182		818
Nassau, Town of	12,401	38	143	52	107	0	2,005	673	9,123	247	24,789
Nassau, Village of	244	42	10		2			2	108		408
North Greenbush, Town of	4,865	386	944	157	214	25	1,189	104	3,223		11,108
Petersburgh, Town of	10,929	38	207	54	40	23	1,782	2,464	10,558		26,095
Pittstown, Town of	14,474	74	185	120	3,201	154	14,115	1,174	6,691		40,188
Poestenkill, Town of	9,175	124	328	690	23	53	809	767	8,258		20,227
Rensselaer, City of	499	177	205	115	39	120		72	480		1,707
Sand Lake, Town of	11,774	237	95	122	40		1,956	89	7,432	500	22,245
Schaghticoke, Town of	9,100	119	694	601	676	123	12,881	538	5,947		30,680
Schaghticoke, Village of	93	43	12		77	10	15	88	111		449
Schodack, Town of	16,951	234	828	89	292	534	5,301	964	11,834		37,026
Stephentown, Town of	17,054	42	175	145	34		1,258	6,212	11,635		36,554
Troy, City of	2,082	1,312	414	101	125	89		455	1,075	11	5,663
Valley Falls, Village of	118	2	3	1	2	11	34	30	61		262
County Total	161,807	4,640	6,470	3,449	5,327	1,520	66,911	36,364	120,814	873	408,174

Table 3d.2 - Land Use Percentage Breakdowns by Municipality											
Municipality	Residential	Community Services/ Institutional	General Business/ Commercial	Industrial	Utilities	Transportation	Agriculture	Parks/ Open Space	Vacant	Under Water	Total (Acres)
Berlin, Town of	28.1%	0.4%	0.6%	0.2%	0.2%	0.0%	3.6%	43.0%	23.7%	0.2%	37,699
Brunswick, Town of	44.7%	1.3%	2.1%	0.7%	0.6%	0.0%	21.6%	2.0%	27.0%	0.0%	27,285
Castleton-on-Hudson, Vill. of	49.3%	15.0%	1.1%	23.5%	1.2%	2.1%	0.0%	1.4%	6.4%	0.0%	422
East Greenbush, Town of	43.3%	4.5%	4.5%	1.9%	0.6%	0.9%	5.3%	1.4%	37.6%	0.0%	14,361
East Nassau, Village of	53.4%	0.6%	0.2%	0.0%	0.0%	0.0%	3.4%	2.5%	39.9%	0.0%	2,937
Grafton, Town of	35.8%	0.6%	0.5%	0.6%	0.1%	0.0%	0.4%	15.0%	47.0%	0.1%	28,888
Hoosick, Town of	27.4%	0.9%	1.6%	0.9%	0.1%	0.6%	45.2%	3.4%	19.9%	0.0%	38,363
Hoosick Falls, Village of	47.4%	6.2%	2.5%	7.4%	5.6%	2.3%	0.0%	6.4%	22.3%	0.0%	818
Nassau, Town of	50.0%	0.2%	0.6%	0.2%	0.4%	0.0%	8.1%	2.7%	36.8%	1.0%	24,789
Nassau, Village of	59.7%	10.3%	2.5%	0.0%	0.4%	0.0%	0.0%	0.4%	26.6%	0.0%	408
North Greenbush, Town of	43.8%	3.5%	8.5%	1.4%	1.9%	0.2%	10.7%	0.9%	29.0%	0.0%	11,108
Petersburgh, Town of	41.9%	0.1%	0.8%	0.2%	0.2%	0.1%	6.8%	9.4%	40.5%	0.0%	26,095
Pittstown, Town of	36.0%	0.2%	0.5%	0.3%	8.0%	0.4%	35.1%	2.9%	16.6%	0.0%	40,188
Poestenkill, Town of	45.4%	0.6%	1.6%	3.4%	0.1%	0.3%	4.0%	3.8%	40.8%	0.0%	20,227
Rensselaer, City of	29.2%	10.4%	12.0%	6.8%	2.3%	7.0%	0.0%	4.2%	28.1%	0.0%	1,707
Sand Lake, Town of	52.9%	1.1%	0.4%	0.5%	0.2%	0.0%	8.8%	0.4%	33.4%	2.2%	22,245
Schaghticoke, Town of	29.7%	0.4%	2.3%	2.0%	2.2%	0.4%	42.0%	1.8%	19.4%	0.0%	30,680
Schaghticoke, Village of	20.8%	9.5%	2.6%	0.0%	17.1%	2.3%	3.4%	19.6%	24.7%	0.0%	449
Schodack, Town of	45.8%	0.6%	2.2%	0.2%	0.8%	1.4%	14.3%	2.6%	32.0%	0.0%	37,026
Stephentown, Town of	46.7%	0.1%	0.5%	0.4%	0.1%	0.0%	3.4%	17.0%	31.8%	0.0%	36,554
Troy, City of	36.8%	23.2%	7.3%	1.8%	2.2%	1.6%	0.0%	8.0%	19.0%	0.2%	5,663
Valley Falls, Village of	45.0%	0.8%	1.1%	0.3%	0.7%	4.1%	13.1%	11.5%	23.4%	0.0%	262
County Total	39.6%	1.1%	1.6%	0.8%	1.3%	0.4%	16.4%	8.9%	29.6%	0.2%	100%

Land Use Planning

Land use planning in the State of New York is primarily a function of local communities, with Rensselaer County serving a coordination function for those elements that are best served on a regional level. The Rensselaer County Planning Department serves as technical staff to the County and its municipalities.

In support of a multitude of specific County programs, staff provides project development and administration, grant writing, and research and analysis services. Many other County-wide project and program areas are also administered.

Also, the Department provides local government technical assistance to various town and village boards in the development and implementation of comprehensive plans, land use regulations, and community and economic development plans and strategies. The Department staff members also review new laws pertaining to land use, as well as some land use proposals.

Administration and enforcement of the New York State Uniform Fire Prevention and Building Code (Uniform Code) occurs at the local level in all municipalities. Further, 86 percent of municipalities have zoning statutes; 86 percent have subdivision statutes; and 77 percent have master plans in place. Table 3d.3 presents a summary of standard land use regulation tools by municipality, as updated by each jurisdiction for this 2019 Plan.

Table 3d.3 - County Communities with Land Use Regulations
(Source: Worksheet 4 Capability Assessment Worksheet Responses)

Municipality	Building Code	Zoning Statutes	Subdivision Statutes	Comprehensive /Master Plan
Berlin, Town of	Y	Y	Y	N (in progress)
Brunswick, Town of	Y	Y	Y	Y
Castleton-on-Hudson, Village of	Y	Y	Y	Y
East Greenbush, Town of	Y	Y	Y	Y
East Nassau, Village of	Y	Y	Y	Y
Grafton, Town of	Y	N	Y	Y
Hoosick Falls, Village of	Y	Y	Y	N
Hoosick, Town of	Y	Y	Y	Y
Nassau, Town of	Y	Y	Y	Y
Nassau, Village of	Y	Y	N	Y
North Greenbush, Town of	Y	Y	Y	Y
Petersburgh, Town of	Y	N	Y	N
Pittstown, Town of	Y	Y	Y	Y
Poestenkill, Town of	Y	Y	Y	Y
Rensselaer, City of	Y	Y	Y	Y
Sand Lake, Town of	Y	Y	Y	Y
Schaghticoke, Town of	Y	Y	Y	Y

Table 3d.3 - County Communities with Land Use Regulations
(Source: Worksheet 4 Capability Assessment Worksheet Responses)

Municipality	Building Code	Zoning Statutes	Subdivision Statutes	Comprehensive /Master Plan
Schaghticoke, Village of	Y	N	N	N
Schodack, Town of	Y	Y	Y	Y
Stephentown, Town of	Y	Y	Y	Y
Troy, City of	Y	Y	Y	Y
Valley Falls, Village of	Y	N	N	N

At both the County and municipal levels, land use and development planners in departments, federations, boards and councils are active in guiding Rensselaer County's growth and work toward providing a unified framework for development that coordinates activities between municipalities and the County overall.

Future Development Trends – County Overview

Rensselaer County is striving to achieve new development in a manner that is sustainable and adds to the character, desirability, and quality of its rural areas while minimizing the potential to negatively impact current communities and their transportations systems, infrastructure, open space and parks, and quality of life. It is likely that, in the future, Rensselaer County will continue to balance the pressures of supporting its agricultural communities while fostering the development of new industries. County Planning has indicated that they expect to see future development trends characterized by infill development in the western portion of the County, more development of low-density housing in the woodlands of the central-eastern section and proposed higher density development in regions around the cities with some loss of existing farmland.

NY is a home rule state, and Rensselaer County does not maintain a database of areas targeted for new development. In general, most new develop is occurring out of the floodplain. Infill development continues in western portion of County, more development of low-density housing in woodlands of central-western sections. Proposed higher density in rings around cities continues. Some loss off farmland and abandoned farmland is a common trend. Since the initial plan was prepared in 2011, there has been somewhat of an increase in the observed pace of new development in rural areas.

On March 13, 2019, County Executive Steve McLaughlin delivered an optimistic State of the County address in which he noted historic economic development success and highlighted the following development plans:

- Amazon. Recent selection by Amazon for a one million square foot distribution center in Schodack, which is expected to create 800 new jobs

- Regeneron. Expansion of Regeneron Pharmaceuticals by several hundred employees in East Greenbush
- Fort Orange Paper Company Site. County creation of a new public park on Brookview Road in Schodack on county-owned property once used by the Fort Orange Paper Company. The site includes a waterfall, access to the Moordener Kill, hiking trails and beautiful views.
- Mohawk Ambulance. Plans by Mohawk Ambulance to construct a new and expanded facility on McChesney Avenue in Brunswick. Along with the bigger facility, Mohawk will be increasing their presence in Rensselaer County, from one to two ambulances per shift to six ambulances during the day shift and four to five ambulances during the night shift, primarily assigned to Rensselaer County.

Other notable development highlighted by the County JAT includes:

- Rensselaer Waterfront. The City of Rensselaer has potential new riverfront development along the Hudson River. The property is shovel-ready for a proposed $200 million development. The County has recommended regular coordination with the City's floodplain manager to manage and limit risk with this new development in the floodplain.
- Troy Ridge and Waterfront. The City of Troy is tending toward development on the ridge. The City does not presently have a steep slope ordinance. The City is also developing parcels nearest to the Hudson River, in the floodplain (particularly redevelopment of old mill properties, from commercial to residential uses). County Planning coordinates regularly with the City regarding risk management for new development on steep slopes and in floodplains.
- Mill Green Commerce Park. Mill Green Commerce Park is a fairly substantial new development in East Greenbush (out of the floodplain).
- Town of Schaghticoke. Limited floodplain development is occurring in the Town of Schaghticoke.

Rensselaer County is not planning any major new development of County facilities. The County does not maintain a database of areas targeted for new development in each municipality. The County does not have jurisdiction to regulate new development; this falls to the municipalities. Stormwater for MS4, however, addresses County facilities and County properties. The County has no enforcement powers; it assists communities in updating and adopting local land use laws, comprehensive plans, etc.; and reviews new laws pertaining to land use, as well as some land use proposals.

Future Development Trends in Each Municipality

The County and each jurisdiction participating in this 2019 HMP provided updated information regarding future development trends occurring in their respective communities, as well as regulations, codes, or ordinances in place to protect new development from natural hazards. More information can be found in each Jurisdictional Annex.

Potential for Future Development in Delineated Hazard Areas

While future development patterns are subject to many regulatory and market-driven factors, it is possible to prepare general estimates of the relative potential for future development to occur in hazard areas by analyzing vacant parcels and their relation to the various hazard areas. As discussed in detail in the Risk Assessment, the planning area is susceptible to certain hazards uniformly. However, the nature of other hazards is such that only delineable portions of the study area are at risk. Using GIS, land use mapping provided by the County was evaluated to estimate the number of vacant and potentially developable parcels in each municipality. Vacant and potentially developable parcels have been assumed to be inclusive of currently unused agricultural lands, forested lands that are not in State ownership or otherwise protected, and barren lands. It was assumed that all of these land uses would be potentially developable in the immediate future, at least to some extent. In this way the analysis is quite conservative, since it does not include currently productive agricultural land, any part of which in the County may face development pressure at some point further in the future.

Next, "vacant" parcels were combined with geographically delineated hazard area boundaries to tally the acreage of vacant, potentially developable parcels within each municipality and further, the relative percentage of this acreage lying within each of the geographically delineated hazard areas.

According to the analysis, it is estimated that there are 120,814 acres of vacant, potentially developable land in the County's 22 jurisdictions – about 23 percent of the County's total land area. On a municipal level, this ranges from a minimum of 27 acres in Castleton to a maximum of 13,574 acres in Grafton. In the Rensselaer County communities, there are 5,739 acres of vacant land in the 100- and 500-year floodplain hazard areas; 110,167 acres of vacant land in wildfire hazard areas; 21,136 acres of vacant land in the earthquake zone 35-75; 21,136 acres in soil types D & E; 27,905 acres of vacant land in the high susceptibility and high/moderate incidence landslide hazard area; and 1,324 acres of vacant land in the dam inundation hazard area.

Table 3d.5 lists the estimated acreage of potentially developable vacant parcels in each municipality and quantifies the acres of vacant land as a percentage of the total acreage of each municipality. It further indicates the percentage of each municipality's vacant land area that lies within geographically delineated hazard zones. Ideally, municipalities would strive to minimize future development in hazard areas, or to impose certain development restrictions which would offer some form of protection from hazard events.

Table 3d.5
Summary of Vacant Land in Delineated Hazard Areas

Municipality	Total Acres Vacant Land	Vacant Land as % of Municipality's Total Acreage	% of Municipality's Vacant Land in Flood Hazard Areas (100- and 500- year floodplains)	% of Municipality's Vacant Land in Wildfire Hazard Areas	% of Municipality's Vacant Land in Earthquake Hazard Area (SA 35 – 75)	% of Municipality's Vacant Land in Earthquake Hazard Zone (Soils D&E)	% of Municipality's Vacant Land in Landslide Hazard Area (High Susceptibility and High/Moderate Incidence)
Berlin, Town of	8,927	24%	1%	97%	3%	3%	39%
Brunswick, Town of	7,360	27%	8%	88%	16%	16%	10%
Castleton-on-Hudson, Vill. of	27	6%	6%	93%	100%	100%	100%
East Greenbush, Town of	5,396	38%	17%	80%	49%	49%	77%
East Nassau, Village of	1,171	40%	4%	99%	14%	14%	0%
Grafton, Town of	13,574	47%	2%	100%	<1%	< 1%	0%
Hoosick, Town of	7,641	20%	2%	86%	7%	7%	1%
Hoosick Falls, Village of	182	22%	8%	88%	19%	19%	0%
Nassau, Town of	9,123	37%	2%	96%	8%	8%	0%
Nassau, Village of	108	27%	18%	95%	85%	85%	0%
North Greenbush, Town of	3,223	29%	5%	82%	34%	34%	53%
Petersburgh, Town of	10,558	40%	2%	98%	3%	3%	34%
Pittstown, Town of	6,691	17%	1%	88%	11%	11%	0%
Poestenkill, Town of	8,258	41%	4%	97%	7%	7%	0%
Rensselaer, City of	480	28%	33%	56%	100%	100%	100%
Sand Lake, Town of	7,432	33%	6%	96%	11%	11%	0%
Schaghticoke, Town of	5,947	19%	5%	86%	49%	49%	79%
Schaghticoke, Village of	111	25%	29%	95%	42%	42%	76%
Schodack, Town of	11,834	32%	12%	82%	51%	51%	50%
Stephentown, Town of	11,635	32%	1%	96%	15%	15%	17%
Troy, City of	1,075	19%	17%	57%	66%	66%	97%
Valley Falls, Village of	61	23%	3%	90%	<1%	<1%	0%

Future Development Trends in Hazard Areas – Study Area Overview

Rensselaer County is striving to achieve new development in a manner that is sustainable and adds to the character, desirability, and quality of its rural areas while minimizing the potential to negatively impact current communities and their transportations systems, infrastructure, open space and parks, and quality of life. It is likely that, in the future, Rensselaer County will continue to balance the pressures of supporting its agricultural communities while fostering the development of new industries. County Planning has indicated that they expect to see future development trends characterized by infill development in the western portion of the County, more development of low-density housing in the woodlands of the central-eastern section and proposed higher density development in regions around the cities with some loss of existing farmland.

Rensselaer County is cognizant of the risks that it faces due to the impacts of natural hazards. Many municipalities have programs in place today which address certain natural hazards – whether it is a comprehensive or master plan, floodplain management ordinance, or erosion hazard area construction limitations.

Together, Rensselaer County's 22 municipalities have a total of 120,814 acres of vacant, potentially developable land – about 23 percent of the County's total land area. The paragraphs below analyze the likelihood for future development in each of the identified hazards areas to incorporate hazard-resistant design. Overall, while new development is expected to result in an increasing number of structures present in Rensselaer County municipalities, codes and standards in place today will require that they be designed to provide a certain degree of protection from the hazards to which the County and its municipalities are susceptible.

Future Development Trends – Extreme Temperatures Hazard Area

The extreme temperature hazard area for coldwaves and heat waves covers the whole of Rensselaer County and is essentially uniform for all jurisdictions, therefore future development trends for the extreme temperature hazard area would be the same as those county-wide. If current demographic trends continue, the proportion of the population whose health can be particularly vulnerable to extremes in temperature is likely to increase somewhat in the foreseeable future.

Future Development Trends – Hurricane / Tropical Storm

Hurricanes and tropical storms cause damage in Rensselaer County because of extreme winds and flooding.

Extreme wind from these types of systems can occur anywhere in Rensselaer County, and the hazard area is essentially uniform from one jurisdiction to the next. Therefore, future

development trends for the wind component of hurricanes and tropical storms would be the same as those county-wide and, while an increased number of new structures could be exposed in the future, all municipalities must adhere to the New York State Building Code in addition to any local changes that they may have made, so that they will be constructed with a certain degree of protection from the most frequent high wind events.

Development within mapped flood hazard areas is currently regulated for communities participating in FEMA's National Flood Insurance Program (NFIP). All but one of the municipalities in Rensselaer County participate in the NFIP[1] (based on FEMA's Community Status Book Report of November 7, 2018), and thereby must have a floodplain management ordinance in place to regulate activities in the floodplain, as well as a designated floodplain manager/NFIP Coordinator to enforce the relevant ordinances. This will work to protect new development and substantial improvements in the County's floodplains. While it is likely that an increased number of assets could be susceptible to flooding, it is assumed that new structures will be built to codes that will offer a certain degree of protection from the most frequent events.

Furthermore, it is noted that climate change projections for the Hudson River show generally the same floodplain areas, but flooding to greater depths, in years to come. See Section 3c. Therefore, the County's susceptibility to damage during these types of extreme conditions could increase over time particularly given recent trends in municipal riverfront development in Troy, Rensselaer, and Schaghticoke.

Future Development Trend – Lightning Hazard Area

The lightning hazard area encompasses the whole of Rensselaer County and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the lightning hazard area would be the same as those county-wide. While an increased number of new structures could be exposed in the future, all municipalities must adhere to the New York State Building Code in addition to any local changes that they may have made, so that they will be constructed with a certain degree of protection from the most frequent lightning events.

Future Development Trends – Tornado Hazard Area

The tornado hazard area encompasses the whole of Rensselaer County and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the tornado hazard area would be the same as those county-wide. While an increased number of new structures could be exposed in the future, all municipalities must adhere to the New York State Building Code in addition to any local changes that they may have made, so that they will be constructed with a certain degree of protection from the most frequent high wind events.

[1] The Village of Valley Falls was suspended from the NFIP on 01/07/16.

Future Development Trends – Wind Hazard Area

The wind hazard area encompasses the whole of Rensselaer County and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the wind hazard area would be the same as those county-wide. While an increased number of new structures could be exposed in the future, all municipalities must adhere to the New York State Building Code in addition to any local changes that they may have made, so that they will be constructed with a certain degree of protection from the most frequent high wind events.

Future Development Trends – Winter Storm Hazard Area

The risk of significant snow and ice storms encompasses the entire County and is uniform from one jurisdiction to the next. Therefore, future development trends for the winter storm hazard area would be the same county-wide. It is anticipated that while an increasing number of new structures will be present in the County, they will be constructed at least in accordance with currently adopted building codes which include basic measures to minimize damages caused by winter storms, particularly with regard to snow loading and the protection of utilities.

Future Development Trends – Drought Hazard Area

The drought hazard area encompasses the entire County and is essentially uniform from one jurisdiction to the next, although the local impact depends on the prevalence of agricultural land in individual municipalities. While the individual jurisdictions would prefer to focus on the preservation of farmland and other open space, possible pressures on agricultural land in Rensselaer County to be zoned for residential and other development, may reduce the economic effects of drought on agriculture, while the impact on potable water supplies may increase.

Future Development Trends – Flood Hazard Area

Flooding

Individuals and larger developers often look toward land along rivers, streams, canals, bays, and lakes for development because of the passive and active recreational opportunities that they offer. In turn, flood hazard areas are often areas where development pressures are high due to the recreational and aesthetic value of these lands, particularly in communities where the amount of undeveloped land is small, and the density of development is high. Various County plans explicitly recommend the creation of additional recreational, entertainment and retail use along various waterfront areas. Specifically, the aim is to foster the economic success of the County's waterfront communities by promoting increased water-related and

water-dependent activities, fostering cooperative planning and promotional activities between waterfront communities, accommodating water-dependent uses with landside impacts, developing waterfront linkages, creating special waterfront zoning techniques for adoption by local municipalities, and assisting in the coordination and implementation of local waterfront revitalization plans.

Development within mapped flood hazard areas is currently regulated for communities participating in FEMA's National Flood Insurance Program (NFIP). All but one municipality in the County participate in FEMA's National Flood Insurance Program (based on FEMA's Community Status Book Report (of 02/21/19)[2], and thereby must have in place a floodplain management ordinance to regulate activities in the floodplain, as well as a designated floodplain manager/NFIP Coordinator to enforce the relevant ordinances. This will work to protect new development and substantial improvements in the County's floodplains. While it is likely that an increased number of assets could be susceptible to flooding, it is assumed that new structures will be built to codes that will offer a certain degree of protection from the most frequent events.

Recent County JAT observations also include development along the Hudson River (for example, the Cities of Troy and Rensselaer and in the Town of Schaghticoke).

Dam Failure

The New York State Department of Environmental Conservation Dam Safety Program maintains an inventory of dams in the State and conducts safety inspections of dams, completes technical reviews of proposed dam construction or modification, monitors remedial work for dam safety compliance, and is involved in emergency preparedness activities. At the time of writing, research of readily available data sources did not reveal any dams proposed or under construction in Rensselaer County in addition to those listed by the US Army Corps of Engineers National Inventory of Dams, or the Stanford University National Performance of Dams Program.

Ice Jams

While there exists no formal mapping of ice jam hazard areas, due to the unpredictable and localized nature of the hazard, the ice jam hazard is similar to the flood hazard in that ice jams may cause rivers and streams to overflow their banks. If a structure is near the banks of the rivers or streams, it may also be subject to structural damage from the impact of ice striking the structure. The jurisdictions' flood hazard ordinances are assumed to currently deal with the flooding aspect of the ice jam hazard, and future damages due to this hazard will depend on development within the floodplain and adherence to the relevant building codes. While an increased number of assets could be susceptible, it is assumed that they will be built to codes that will offer a certain degree of protection from the most frequent events.

[2] The Village of Valley Falls is presently suspended from the NFIP.

Future Development Trends – Earthquake Hazard Area

All of Rensselaer County is potentially susceptible to earthquakes. All communities have adopted the New York State Building Code in addition to any local changes that they may have made. While an increased number of assets could be susceptible with new development, it is assumed that they will be built to codes that will offer a certain degree of protection from the most frequent events.

Future Development Trends – Landslide Hazard Area

Certain areas within Rensselaer County have been specifically identified as experiencing a high landslide incidence or susceptibility. According to the USGS, the western and eastern portions of Rensselaer County (roughly 25 percent of the County's total land area) are most vulnerable, being classified as highly susceptible to landslide events. Landslide events are a fairly common occurrence in Rensselaer County. Future development in landslide hazard areas is expected to mirror those trends observed County-wide. All communities have adopted the New York State Building Code in addition to any local changes that they may have made. While an increased number of assets could be susceptible, it is assumed that they will be built to codes (such as those regulating development in areas with steep slopes) that will offer a certain degree of protection from the most frequent events. The Rensselaer County JAT has noted recent development along the ridge in the City of Troy; the City does not have a steep slope ordinance.

Future Development Trends – Wildfire Hazard Area

Most vacant parcels in Rensselaer County (approximately 92 percent) are located in areas susceptible to wildfire - a total of 110,767 acres of potentially developable land. The severity of the hazard is greatest in areas of high fuel loading and steep slopes. Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity such as those forested areas in many parts of the study region. Pressure to develop some forested areas and open land adjacent to forested areas, especially for residential use, will generally result in increases to the wildland-urban interface and the value of improved property within these areas in most jurisdictions, and hence an increased risk of future property damage and public danger due to wildfires.

SECTION 4 - CAPABILITIES AND RESOURCES

This capability assessment examines the ability of the Rensselaer County Communities and other participating jurisdictions to implement and manage a comprehensive mitigation strategy, which includes a range of mitigation actions. The strengths, weaknesses, and resources of participating jurisdictions are identified in this assessment as a means to develop an effective hazard mitigation program. Furthermore, the capabilities identified in this assessment are evaluated collectively to develop recommendations, which support the implementation of effective mitigation actions throughout the County.

Capability Assessments were undertaken by each participating jurisdiction as part of the development of the first edition of the Hazard Mitigation Plan in 2011. At that time, URS (which subsequently merged with AECOM in 2014) provided questionnaires[1] to the Rensselaer County Bureau of Public Safety (BPS) for distribution to the municipal representatives in order to initiate this capability assessment. The questionnaires requested information pertaining to existing plans, polices, and regulations that contribute to or hinder the ability to implement hazard mitigation actions. They also requested information pertaining to the legal and regulatory capability, technical and administrative capacity, and fiscal capability of each jurisdiction. Thirteen towns, five villages and a city submitted completed questionnaires in a timely manner (by December 2010) illustrating their capability to implement a mitigation strategy.

For the 2019 Plan Update, each JAT was asked to review their prior feedback, and identify any changes that have occurred since the initial plan was developed. Each JAT either: (a) reviewed their prior feedback and certified that all information previously provided was still current, or (b) reviewed their prior feedback and provided markups to the consultant noting any changes in capabilities that have occurred since that time. Jurisdictions that had not performed a local capability assessment during the development of the initial plan were required to do so during the plan update. During the 2019 Plan Update, each JAT also provided an assessment of their overall legal and regulatory, technical and administrative, and fiscal capabilities; and then identified opportunities for bridging recognized gaps in capabilities to ensure that they align with jurisdictional mitigation actions and goals. Each jurisdiction documented their assessment of capabilities on Worksheet 4 – Capability Assessment Update. AECOM used worksheet responses to update this plan section to reflect each jurisdiction's assessment of their current capabilities. Capability assessment updates for each jurisdiction are included in **Section 11: Jurisdictional Annexes**. As part of the 2019 plan update process, the County and its 22 jurisdictions have reassessed their capabilities and provided updates to their local capabilities that have occurred over the first plan maintenance cycle.

This section describes the activities currently underway, which contribute to or can be utilized for hazard mitigation. Due to the limited response received from participating jurisdictions, the capability assessment emphasizes the technical and financial resources available at the State and Federal levels, which the communities in the County can access to effectively implement a hazard mitigation program.

[1] During the initial plan development process, URS distributed FEMA's Capability Assessment Worksheet to each jurisdiction ("Worksheet Job Aid #2: Local Hazard Mitigation Capabilities", as included in the FEMA How-To #3 Developing the Mitigation Plan, online at http://www.fema.gov/media-library-data/20130726-1521-20490-5373/howto3.pdf).

Capabilities and Resources – Rensselaer County Jurisdictions

Legal and Regulatory Capabilities

Rensselaer County and its jurisdictions have several policies, programs, and capabilities at their disposal which can be used to help prevent and minimize future damages resulting from hazards. These tools are valuable instruments in pre- and post-disaster hazard mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework of the community. These policies, programs, and capabilities are described in greater detail for the participating jurisdictions, as well as the State and Federal levels. The diamond symbol (♦) in **Table 4.1** indicates that the resource/capability was reported by the JAT as known to be available in the local jurisdiction.

Table 4.1 - Jurisdictional Legal and Regulatory Capabilities

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purpose Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive/ Master Plan	Capital Improvements Plan	Economic Development Plan	Emergency Response Plan[2]	Post-Disaster Recovery Plan	Post-Disaster Recovery Ordinance	Real Estate Disclosure Ordinance
Berlin, Town of	♦	♦	♦			♦				♦			
Brunswick, Town of	♦	♦	♦	♦		♦	♦			♦	♦		
Castleton-on-Hudson, Village of	♦	♦	♦	♦		♦	♦			♦			♦
East Greenbush, Town of	♦	♦	♦	♦	♦	♦	♦	♦		♦	♦		
East Nassau, Village of	♦	♦	♦	♦	♦	♦	♦	♦		♦			
Grafton, Town of	♦		♦	♦		♦	♦			♦			
Hoosick Falls, Village of	♦	♦	♦	♦	♦	♦							
Hoosick, Town of	♦	♦	♦	♦	♦	♦	♦		♦	♦			
Nassau, Town of	♦	♦	♦	♦	♦	♦	♦			♦			
Nassau, Village of		♦		♦		♦	♦	♦		♦			
North Greenbush, Town of	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦		
Petersburgh, Town of	♦		♦			♦							
Pittstown, Town of	♦	♦	♦	♦		♦	♦			♦			
Poestenkill, Town of	♦	♦	♦	♦		♦	♦			♦			
Rensselaer, City of	♦	♦	♦	♦		♦	♦	♦	♦	♦			
Sand Lake, Town of	♦	♦	♦	♦	♦	♦	♦		♦	♦			
Schaghticoke, Town of	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦	
Schaghticoke, Village of		♦				♦	♦						
Schodack, Town of	♦	♦	♦	♦		♦	♦		♦	♦	♦		
Stephentown, Town of	♦	♦	♦	♦		♦	♦			♦			♦
Troy, City of	♦	♦	♦	♦	♦	♦				♦	♦	♦	♦
Valley Falls, Village of	♦									♦			
Rensselaer, County of							♦	♦		♦	♦		

[2] Rensselaer County's Comprehensive Emergency Management Plan (CEMP) is posted on the County web site at (http://www.rensco.com/wp-content/uploads/2019/07/Rensselaer-County-CEMP.pdf). The RCBPS has analyzed its current CEMP and has identified a need for the CEMP to be updated. The CEMP update was currently in progress at the time of this 2019 HMP update. The updated CEMP will expand upon evacuation needs and sheltering measures and will meet the 2017 NYS Hazard Mitigation Planning Standard 4.

Administrative and Technical Capabilities

The ability of a local government to develop and implement mitigation projects, policies, and programs is contingent upon its staff and resources. Administrative capability is determined by evaluating whether there are an adequate number of personnel to complete mitigation activities. Similarly, technical capability can be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in surveying and Geographic Information Systems. **Table 4.2** provides a summary of the administrative and technical capabilities currently in place in each participating jurisdiction. The diamond symbol (♦) indicates that the resource/capability was reported by the JAT as known to be available in the local jurisdiction. It should be noted that several communities indicated that their administrative and technical capabilities are handled in full or in part by a consultant with personnel hired as needed, and several indicated that they did not have staff for any of the functions.

Table 4.2 - Jurisdictional Administrative and Technical Capabilities

Jurisdiction	Planner(s) or engineer(s) with knowledge of land development and management practices	Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Planner(s) or engineer(s) with an understanding of natural and/ or human caused hazards	Floodplain manager *	Surveyors	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant writers	Staff with expertise or training in benefit/cost analysis
Berlin, Town of				♦							
Brunswick, Town of	♦	♦	♦	♦		♦	♦				
Castleton-on-Hudson, Village of				♦					♦	♦	♦
East Greenbush, Town of	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦
East Nassau, Village of	♦	♦	♦	♦		♦			♦		
Grafton, Town of	♦	♦	♦	♦		♦			♦		
Hoosick Falls, Village of				♦		♦			♦		
Hoosick, Town of				♦		♦			♦		
Nassau, Town of	♦	♦		♦		♦			♦	♦	
Nassau, Village of	♦		♦	♦							
North Greenbush, Town of	♦	♦	♦	♦	♦	♦			♦	♦	♦
Petersburgh, Town of		♦		♦			♦		♦	♦	
Pittstown, Town of				♦					♦		
Poestenkill, Town of	♦	♦	♦	♦							
Rensselaer, City of	♦	♦	♦	♦		♦	♦			♦	♦
Sand Lake, Town of	♦			♦						♦	♦
Schaghticoke, Town of		♦	♦	♦		♦		♦			
Schaghticoke, Village of	♦	♦	♦	♦	♦	♦			♦	♦	♦
Schodack, Town of	♦	♦	♦	♦		♦			♦		
Stephentown, Town of				♦		♦					
Troy, City of	♦	♦	♦	♦		♦	♦				
Valley Falls, Village of				♦							
Rensselaer, County of	♦	♦	♦			♦	♦		♦	♦	

*****All jurisdictions (except Rensselaer County) participate in the National Flood Insurance Program; as such, they are required to have an appointed floodplain manager. Note: The Village of Valley Falls is presently suspended from the program.

Fiscal Capabilities

The ability of a local government to implement mitigation activities is also associated with the funding available for policies and projects. Funding for such initiatives is often locally based revenue and financing, as well as outside grants. Costs associated with mitigation activities range from staffing and administrative costs to the actual cost of the mitigation project. **Table 4.3** provides a summary of the fiscal capabilities currently in place in each participating jurisdiction. The diamond symbol (♦) indicates that the resource/capability was reported by the JAT as known to be available in the local jurisdiction. It should be noted that a number of the communities answered that they did not know whether they had one or more of the financial capabilities available to them. It is recommended that communities research the capabilities further during the plan maintenance phase so that they may make use of a wider range of capabilities.

Table 4.3 - Jurisdictional Fiscal Capabilities

Jurisdiction	Community Development Block Grants (CDBG)	Capital Improvements Project Funding	Authority to Levy Taxes for Specific Purposes	Fees for Water, Sewer, Gas, or Electric Service	Impact Fees for Homebuyers or Developers for New Developments/Homes	Incur Debt through General Obligation Funds	Incur Debt through Special Tax and Revenue Bonds	Incur Debt through Private Activity Bonds	Withhold Spending in Hazard-Prone Areas	State Mitigation Grant Programs	Other
Berlin, Town of		♦		♦		♦					
Brunswick, Town of		♦	♦	♦	♦	♦	♦	♦	♦	♦	
Castleton-on-Hudson, Village of	♦	♦	♦	♦	♦	♦					
East Greenbush, Town of	♦	♦	♦	♦	♦	♦	♦		♦	♦	
East Nassau, Village of		♦	♦	♦	♦	♦	♦				
Grafton, Town of	♦	♦	♦			♦	♦				
Hoosick Falls, Village of	♦	♦	♦	♦		♦	♦				
Hoosick, Town of	♦	♦	♦	♦		♦	♦			♦	♦
Nassau, Town of	♦	♦	♦	♦	♦	♦	♦			♦	
Nassau, Village of		♦	♦	♦		♦	♦				
North Greenbush, Town of	♦	♦	♦	♦	♦	♦	♦	♦	♦		
Petersburgh, Town of			♦	♦		♦					
Pittstown, Town of		♦	♦			♦	♦				♦
Poestenkill, Town of			♦	♦		♦	♦				
Rensselaer, City of	♦	♦	♦	♦	♦	♦			♦	♦	
Sand Lake, Town of	♦		♦	♦	♦	♦		♦		♦	♦
Schaghticoke, Town of	♦		♦	♦	♦	♦	♦		♦		
Schaghticoke, Village of	♦	♦	♦	♦		♦			♦		
Schodack, Town of	♦	♦	♦	♦	♦	♦					
Stephentown, Town of	♦	♦	♦			♦	♦				
Troy, City of	♦	♦	♦	♦	♦	♦	♦			♦	
Valley Falls, Village of		♦	♦	♦		♦	♦				
Rensselaer, County of	♦	♦	♦	♦		♦	♦	♦	♦	♦	

Conclusion

This capability assessment finds that, based on updated capability assessment worksheets submitted by each JAT, Rensselaer County's communities have generally limited resources necessary to implement hazard mitigation strategies.

As detailed in the preceding tables and further summarized in **Table 4.4**, overall legal and regulatory capabilities to implement hazard mitigation strategies were considered to be moderate to high in 36 percent of the jurisdictions. Overall technical capabilities were characterized as moderate to high in 18 percent of the jurisdictions; and administrative capabilities were considered to be moderate to high in 23 percent of the jurisdictions. Fiscal capabilities to implement hazard mitigation strategies were considered to be moderate to high by far fewer respondents, with only 9 percent of communities reporting moderate to high fiscal resources available to implement hazard mitigation initiatives. Furthermore, only 45 percent of the responding JATs characterized their political leadership's willingness to enact policies and programs that reduce hazard vulnerabilities as moderate or high.

Each jurisdiction also considered ways of improving their capabilities to ensure that they are in-line with their mitigation actions and goals. Local responses are provided in **Table 4.4**. This table also shows that municipalities have attempted to identify opportunities that may exist to bridge recognized gaps in capabilities and resources to better serve jurisdictional mitigation actions and goals.

Table 4.4 – Local Assessment of Overall Capabilities and Opportunities for Improvement						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Administrative Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
Berlin, Town of	Moderate	Low	Low	Moderate	High	Need funding to provide these services
Brunswick, Town of	Moderate	High	Low	Moderate	Moderate	Programs and Policies need to be reviewed. Up to date information needs to be incorporated into any review considering current hazards and any potential climate change hazards. New flood hazard information is needed, past data is out of date. A public education campaign is needed to inform the citizenry of actions which the Town and Public need to take to mitigate hazards around them and to reduce the cost of hazards and reduce recovery time. There are limited funds available within the Town to reduce hazards and purchase properties which may be in hazard areas. Funds for Hazard mitigation should not be tied to the two percent tax cap threshold.
Castleton-on-Hudson, Village of	High	Moderate	Moderate	High	Moderate	Continued support for Hazard Mitigation Plan, Funding for engineered projects
East Greenbush, Town of	High	Moderate	Moderate	Moderate	High	Like many municipalities across the state, the Town has limited resources to administer required programs, including hazard mitigation strategies. Additional resources can be obtained through grant programs. The Town will continue to cooperate with involved agencies, such as the local fire protection organizations.
East Nassau, Village of	Moderate	Low	Low	Low	Moderate	Money
Grafton, Town of	High	High	High	High	High	Municipality did not note any ways to expand existing capabilities.
Hoosick, Town of	High	Moderate	Moderate	High	High	The Town is willing to improve capabilities, but the reality is there just is not the funding and or staff to do so.
Hoosick Falls, Village of	High	High	Low	Moderate	High	The Village is more than willing and is working to improve capabilities such as with the Woods Brook Project, but the reality is there is not much funding for projects, and we operate with a very small staff.

Table 4.4 – Local Assessment of Overall Capabilities and Opportunities for Improvement

Jurisdiction	Overall Legal & Regulatory Capability	Overall Technical Capability	Overall Fiscal Capability	Overall Administrative Capability	Overall Level of Political Willingness	Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals
Nassau, Town of	Low	Low	Low	Low	Moderate	Community outreach. Staff training. Public forums. Inter cooperation with State, County and Town municipalities. Improve staff resources.
Nassau, Village of	Moderate	Moderate	Moderate	High	High	Legal/regulatory capability: ensure that our existing law regulating the floodplain meets current standard (effort underway); review subdivision law (effort underway); implement regulatory items from water source protection plan (2018) recommendations. Technical capability: Due to the size of the Village, some of the staff required to implement hazard mitigation strategies (i.e., engineers, planners, surveyors, scientists, grant writers, etc.), are not employees, but rather are contracted on an as-needed basis. Fiscal capability: while the Village is not financial stressed for the time being, there are limited unrestricted funds to implement hazard mitigation strategies.
North Greenbush, Town of	Low	Moderate	Low	Moderate	High	The lack of dedicated resources and budget prevent further progress in these important areas. Following a Major Disaster Declaration, the town would apply for eligible hazard mitigation funding.
Petersburgh, Town of	Low	Low	Low	Low	High	Probably would need more training in regard to all of this. It appears that we do not have anyone that is aware of all of this.
Pittstown, Town of	Low	Low	Low	Low	Low	The main item needed for a town the size of Pittstown to expand or improve to reduce risk is funding. When the storm of July 2017 devastated many areas of the town, FEMA came three times and said the town would qualify for funding for improvements to roads and upgrades but then the hurricane struck Puerto Rico and no funding was available for upstate NY.
Poestenkill, Town of	High	Low	Moderate	Moderate	High	We are working on a program that would allow all the technical information on a parcel to be accessed by all personnel need lot information relative to flood plain and other factors.

Table 4.4 – Local Assessment of Overall Capabilities and Opportunities for Improvement

Jurisdiction	Overall Legal & Regulatory Capability	Overall Technical Capability	Overall Fiscal Capability	Overall Administrative Capability	Overall Level of Political Willingness	Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals
Rensselaer, City of	Moderate	Moderate	Moderate	Moderate	Moderate	1) Better written Standard Operating Procedures for job titles and department operations, to include communication and cooperation between departments. 2) Update Comprehensive Plan to include Hazard Mitigation Policies 3) Join CRS 4) Increased Training and GIS proficiency for building/planning personnel
Sand Lake, Town of	Moderate	Low	Low	Moderate	Moderate	The Town of Sand Lake is working to improve our communication with our residents. We recently developed a new website that is more user-friendly and contains current information. However, the Town has limited financial resources and cannot hire engineers, surveyors, or other technical positions on a full-time basis. There also is a general reluctance among the public to enact new laws which are perceived to interfere in the daily lives of our citizenry.
Schaghticoke, Town of	Moderate	Moderate	Moderate	Moderate	Moderate	More government funding would help implement strategies.
Schaghticoke, Village of	Low	Low	Low	Low	Low	We are a small Village in Rensselaer County with approximately 600 residents. Also located is our municipal building, water and fire departments and the Hoosic Valley School system. There are 5 elected officials which are part time including our Mayor, Deputy Mayor/Trustee, and three other Trustees along with 2 part time employees. There are no other departments and the two that we have are under the jurisdiction of our village government. We occasionally rely on third party professionals for legal, financial and other specialty needs. Most of our village is built up with very little land exposed in a floodplain next to the Hoosic River. That land is unsuitable for further growth due to topography. Our major concern regarding hazards are the steep escarpments which border much of the village that could be subject to landslides due to earthquakes and heavy rains.
Schodack, Town of	Moderate	Moderate	Low	Low	Moderate	Funding from the federal government.

Table 4.4 – Local Assessment of Overall Capabilities and Opportunities for Improvement						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Administrative Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
Stephentown, Town of	Low-Moderate	Low	Low	Low	Moderate	We would like to be able to have enough funding to hire and effectively train new positions to implement policies and regulations adopted by the town.
Troy, City of	Moderate	Low	Low	Moderate	Low	In order to increase the community's capabilities a large financial interest must be taken by the administration and the community. This would include equipment and personnel for the planning and response to hazards.
Valley Falls, Village of	Low	Low	Low	Low	Moderate	Our municipality of fewer than 450 total residents, a total annual Village property tax levy of less than $60,000, and only two part-time staff (Village Clerk and Village Treasurer) limits the functions we are able to undertake, including hazard mitigations strategies.
Rensselaer, County of	**Low**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Legal and regulatory is low and isn't really able to be improved; New York State is a home rule state; Rensselaer County does not have jurisdiction in a lot of cases and the authority lies with the municipalities. Technical capability is moderate because of a lack of staff, and people wearing multiple hats. The County's fiscal position is favorable, however, there are no line items in the budget for mitigation outside of activities that are grant-funded. County capabilities could be expanded by: (1) adding more staff, and/or (2) increasing the level of coordination with the municipalities and the State for training, projects, etc.**

Capabilities and Resources – State of New York

The 2019 SHMP includes an evaluation of capabilities and resources at the State's disposal for disaster preparedness, response, recovery, and mitigation. The evaluation includes assessments of state resources in the following categories:

- NYS Capabilities
- Agencies
- Resiliency
- Risk Assessment
- Technical Support
- Funding
- Project Management
- Construction
- Outreach
- Research
- Climate
- Historic/Environmental
- Regulatory

The Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan incorporates many of the resources identified in the State Plan to demonstrate the capabilities present for local jurisdictions to consider in the development of local hazard mitigation.

A snapshot of state capabilities is described briefly in this portion of the assessment.

More detailed information can be found in the 2019 SHMP section on New York State capabilities, online at: https://mitigateny.availabs.org/capabilities.

State Agencies, Departments, and Partnerships with Roles in Mitigation

DPC. The State of New York, through the New York State Consolidated Laws, Executive Law Article 2-B entitled "State and Local: Natural and Man-Made Disaster Preparedness" established the Disaster Preparedness Commission (DPC) to examine all aspects of natural and human induced disasters. The DPC is tasked to examine all aspects of disaster prevention, response, and recovery, as well as prepare the state disaster preparedness plans. It consists of commissioners, directors, and chairs of 29 State agencies and the American Red Cross; as well as four participating Federal agencies (FEMA, NOAA, USACE, USGS). The DPC meets annually to discuss hazard management programs across the state. The responsibilities of the DPC include: the preparation of State disaster plans; the direction of State disaster operations and coordinating those with local government operations; and the coordination of federal, State and private recovery efforts.

DHSES. The Division of Homeland Security and Emergency Services (DHSES) is the state's primary agency for response, recovery, and mitigation. DHSES manages FEMA's Public

Assistance (PA), Hazard Mitigation Assistance (HMA), and Individual Assistance (IA) programs. These programs provide annual and/or disaster-specific funding resources to assist communities when damages incurred exceed local resources. DHSES also works to fund, coordinate and implement efforts that are specific and appropriate for hazards in local contexts, and oversees the development of federally mandated Hazard Mitigation Plans.

DOS. The New York State Department of State (DOS) works to fund, coordinate and implement efforts that are specific and appropriate for hazards in local contexts. DOS oversees the development of Countywide Resiliency Plans and strives strengthen resiliency through a better understanding of risk. DOS offers local governments many forms of assistance for preparing, implementing, and sustaining mitigation activities. The DOS Division of Coastal Resources, for example, provides local governments with technical assistance in the completion of Local Waterfront Revitalization Plans (LWRP). These plans are comprehensive land and water use plans which contain many components and address issues such as coastal erosion management and waterfront development. Upon completion of the LWRP, the plan is reviewed by the DHSES Mitigation Section to ensure that the policies and strategies outlined do not place people or property at undue risk to a hazard event. Approximately sixty-six local jurisdictions in the State have approved LWRPs.

DEC. The NYS Department of Environmental Conservation (DEC) directs many programs and forms of assistance useful to local governments developing mitigation strategies. DEC provides technical assistance to local governments through the Floodplain Management Program and the Flood Protection Bureau. The Floodplain Management Program provides assistance to local governments adopting and administering local floodplain management ordinances. Similarly, the Flood Protection Bureau provides technical assistance in eligibility requirements for the National Flood Insurance Program in order to qualify local governments for entrance into the program. Each of these forms of assistance aids local governments in the development and implementation of flood mitigation activities to eliminate or reduce future flood damages. Further technical assistance in floodplain management is provided through “Community Assistance Visits” administered by the DEC in collaboration with the DHSES. These two agencies partner in this effort to provide technical assistance on floodplain management program development. The visits are prioritized by an assessment of needs conducted by the DEC and the DHSES. In addition to the “Community Assistance visits,” these agencies also coordinate to provide assistance for flood mitigation planning and sponsor technical assistance workshops for local governments interested in developing flood mitigation programs.

DOT. The New York State Department of Transportation (DOT) incorporates mitigation techniques into routine design, construction, and maintenance procedures throughout the State and engages in mitigation projects, technical assistance activities, and training. For example, DOT provides guidance to local communities developing plans for the long-term re-routing of traffic due to a disaster. Furthermore, DOT engages in mitigation projects such as the elevation of roads in flood prone areas, cleaning of ditches and streams, management of stormwater erosion, tree pruning, and bi-annual inspection of bridges. DOT also develops and conducts training sessions on heavy snow removal and snow plowing for highway maintenance supervisors and equipment operators.

GOSR. The Governor's Office of Storm Recovery was created in response to Hurricane Sandy to manage the statewide recovery effort. The State Hazard Mitigation Planning Team is evaluating ways to integrate GOSR into existing state agency structures for future administration of disaster recovery funding.

IAWG. Interagency Adaptation Working Group. Addresses climate change and climate adaptation issues through an interagency partnership of 11 agencies. The IAWG has conducted downscaled climate change projections; a statewide assessment of climate change adaptation needs; sea level rise mapping; impacts of climate variables including precipitation, wind and heat on various sectors; and has created a Climate Change Science Clearing House with centralized information on the latest science on climate in New York State (available online at https://www.nyclimatescience.org/).

Statewide Planning Efforts

CEMP. The NYS Comprehensive Emergency Management Plan (CEMP) identifies the State's overarching policies, authorities and response organizational structure to be implemented preceding and following an emergency or disaster situation. The CEMP includes three volumes. Volume 1 is the New York State Hazard Mitigation Plan; Volume 2 is the State Response and Short-Term Recovery Plan; and Volume 3 is the State Long-Term Redevelopment Plan.

CEPA. The New York County Emergency Preparedness Assessments (CEPA) CEPA is a tool to help State and local stakeholders assess risk, capabilities, and the potential need for support and resources during emergencies or disasters.

EMAP. The New York State Emergency Management Accreditation Program (EMAP) is a voluntary assessment and accreditation process for state and local government programs responsible for coordinating prevention, mitigation, preparedness, response, and recovery activities for disasters.

Technical Support, Training, and Funding Resources

Technical Support and Training Resources. New York State offers many programs to assist individuals and communities in assessing, communicating and mitigating natural hazard risk. Technical support programs and specialized training resources at the state level can be accessed by local municipalities to build the capacity for individuals and communities to implement mitigation actions and projects. The 2019 SHMP identifies 66 technical support and training capabilities. More information can be found online at:
https://mitigateny.availabs.org/capabilities/techsupport .

Funding Resources. Financial capabilities are the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions. The state and federal governments administer funding to encourage the development and implementation of long-term, cost-effective, and resilient mitigation projects. The 2019 SHMP identifies more than 75 state and federal funding resources for hazard mitigation. More information can be found online at:
https://mitigateny.availabs.org/capabilities/administerfunding .

Conclusion - State Resources

This capability assessment finds that the State of New York's various departments collectively have a significant level of legal, technical, and fiscal tools and resources necessary to implement hazard mitigation strategies and support the mitigation initiatives of local governments.

Capabilities and Resources – Federal

Federal Resources

FEMA has developed a large number of documents that address implementing hazard mitigation at the local level. Key resource documents are briefly described.

Local Mitigation Planning Handbook. This handbook is the official guide for local governments to develop, update and implement local mitigation plans. While federal requirements have not changed, the Handbook provides revised and expanded guidance, offering practical approaches, tools, worksheets and local mitigation planning examples for how communities can engage in effective planning to reduce long-term risk from natural hazards and disasters. The Handbook can be found on the FEMA web site at:
http://www.fema.gov/library/viewRecord.do?id=7209

Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013. The purpose of this document is to provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. The focus of this document is mitigation, which is action taken to reduce or eliminate long-term risk to hazards. Ideas for mitigation actions are presented for the following natural hazards: drought, earthquake, erosion, extreme temperatures, flood, hail, landslide, lightning, sea level rise, severe wind, severe winter weather, storm surge, subsidence, tornado, tsunami, and wildfire. This resource can be found on the FEMA web site at: http://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf

Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials. The purpose of this document is to provide succinct and practical information to local government officials on how to best integrate hazard mitigation into the full range of community planning activities. It is intended for those who are engaged in any type of local planning, but primarily community planners and emergency managers that bear responsibility for hazard mitigation planning. This resource can be found on the FEMA web site at: http://www.fema.gov/media-library-data/20130726-1908-25045-0016/integrating_hazmit.pdf

How-to Guides. FEMA has developed a series of nine "how-to guides" to assist States, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as using benefit-cost

analysis and integrating man-made hazards. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.

Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA, DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows State and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

Mitigation Resources for Success CD. FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for State and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of State and local governments, the President's disaster assistance program (administrated by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance and provides a brief overview of each program.

The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that companies can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a company's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Rensselaer County industries and businesses located in hazard prone areas.

Important Websites

The following are important websites that provide focused access to valuable planning resources for communities interested in sustainable development initiatives.

- http://www.fema.gov - Web site of the Federal Emergency Management Agency includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures. Most notably:
  - http://www.fema.gov/what-mitigation - To learn more about mitigation and how to make it work for you.
  - http://www.fema.gov/multi-hazard-mitigation-planning - For information about multi-hazard mitigation planning.
  - http://www.region2coastal.com/ - For the latest information about flood risk in coastal New York and New Jersey.

- https://www.floodsmart.gov/floodsmart/ - The official site of FEMA's National Flood Insurance Program (NFIP).

- http://mitigationguide.org/ - "Beyond the Basics: Best Practices in Local Mitigation Planning", a website developed as part of a multi-year research study funded by the U.S. Department of Homeland Security, and led by the Center for Sustainable Community Design within the Institute for the Environment at the University of North Carolina at Chapel Hill.

- http://www.planning.org – Web site of the American Planning Association, a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
    - https://www.planning.org/nationalcenters/hazards/mitigationplanning.htm Includes information about hazard mitigation planning prepared by the association's Hazards Planning Research Center.

- http://www.ibhs.org – Web site of the Institute for Business and Home Safety, an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways you can protect your property from damage.

Federal Technical Assistance and Funding

The Federal government offers a wide range of funding and technical assistance programs that communities can access to assist in their long-term recovery. Some of these programs are geared to disaster preparedness and mitigation planning, while the focus of others is the long-term vitality of the communities. **Table 4.5** presents a summary of Federal funding sources available for mitigation activities. Further information on these and other Federal programs can be found in the 2019 SHMP at https://mitigateny.availabs.org/strategies/funding and in the Catalog of Federal Domestic Assistance (CFDA) available on online at **www.cfda.gov**.

Table 4.5 - Federal Funds Available for Mitigation Activities	
Funding Source	**Description**
Funding that Requires an Approved Hazard Mitigation Plan:	
Flood Mitigation Assistance Program (FMA)	Availability: Pre-disaster, annually Description: FMA provides funds for planning and projects to reduce or eliminate long-term risk of flood damage to repetitive loss (RL) properties and severe repetitive loss (SRL) properties, including residential and non-residential structures insured under the National Flood Insurance Program (NFIP).
Hazard Mitigation Grant Program (HMGP)	Availability: Post-Disaster; After FEMA disaster and emergency declarations Description: Following a Presidential major disaster declaration, the state receives 15% of the total federal share of the declared disaster damage amount to fund hazard mitigation plans and projects under the HMGP. HMGP funds projects in accordance with priorities identified in State, Tribal or local hazard mitigation plans, and enables mitigation measures to be implemented during the recovery from a disaster. The Federal government may fund up to 75 percent of total eligible project costs, with a 25 percent non-Federal match.
Pre-Disaster Mitigation Program (PDM)	Availability: Pre-disaster; annually Description: To provide funds to states, territories, Indian Tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations.
Public Assistance Program (PA) Mitigation	Availability: Post-Disaster; After FEMA disaster and emergency declarations Description: Section 406 of the Stafford Act, provides funding for mitigation measures in conjunction with the repair of disaster-damaged public facilities. This allows the opportunity to maximize recovery dollars by building back stronger and more resilient, thus reducing potential damage in the future.
Other Available Federal Funds for Mitigation Planning and Implementation:	
RiskMAP	Availability: Pre-disaster Description: FEMA's Risk Mapping, Assessment and Planning (RiskMAP) program provides high quality flood maps and information, tools to better assess the risk from flooding and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.
National Flood Insurance Program (NFIP)	Availability: Pre- or post-disaster Description: New York State Department of Environmental Conservation administers the National Flood Insurance Program (NFIP) within the State of New York. The office of the State NFIP Coordinator facilitates municipal participation in the NFIP; provides technical assistance, training and support to local Floodplain Administrators on the minimum NFIP design standards; and encourages participation in the Community Rating System (CRS) program.
FEMA Cooperating Federal Partners (CTP)	Availability: Pre-disaster Description: FEMA's Cooperating Technical Partnership (CTP) Program was created to partner with communities, state or regional agencies, universities or Tribal nations to enhance hazard data in the creation of Flood Insurance Rate Maps (FIRMs) and Digital FIRMs. DHSES intends to pursue this partnership in the future and enhance our awareness of and involvement in the RiskMAP process.

Table 4.5 - Federal Funds Available for Mitigation Activities	
Funding Source	**Description**
Fire Management Assistance Grant Program	Availability: Post-disaster Description: Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
Community Development Block Grant (CDBG) and Community Development Block Grant – Disaster Recovery (CDBG-DR)	Availability: Pre- or post-disaster Description: Federal grant provided to CDBG "entitlement communities" (typically, municipalities with populations over 50,000 and urban counties with populations over 200,000) and to all states. The Community Development Block Grant (CDBG) and Community Development Block Grant- Disaster Recovery (CDBG-DR) funds are some of the limited number of federal grant funds that lose federal identity when it is allocated to the state and therefore can be used to assist with meeting the non-federal match for Hazard Mitigation Assistance (HMA) grant programs. The 2019 NYSHMP notes that the State is using Hurricane Sandy CDBG-DR to assist with meeting non-federal match for several disasters, including Hurricane Sandy (DR-4085) HMGP projects.
Reimbursement for Firefighting on Federal Property	Availability: Post-disaster Description: Provides reimbursement only for direct costs and losses over and above normal operating costs
National Dam Safety Program	Availability: Pre-disaster Description: The NDSP was formally established by the Water Resources and Development Act of 1996. Led by FEMA, the NDSP is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety. Provides vital support for the improvement of the state dam safety programs that regulate most of the 79,500 dams in the United States.
Land and Water Conservation Fund (LWCF)	Availability: To States, local and conservation organizations Description: Funding for outdoor recreational development, renovation, land acquisition, and planning. The program is divided into two distinct funding pots: State grants, and Federal acquisition funds.
The Forest Legacy Program (FLP)	Availability: Participation in Forest Legacy is limited to private forest landowners. Description: Federal program in partnership with States, supports State efforts to protect environmentally sensitive forest lands. Designed to encourage the protection of privately-owned forest lands, FLP is an entirely voluntary program. To maximize the public benefits it achieves, the program focuses on the acquisition of partial interests in privately owned forest lands. FLP helps the States develop and carry out their forest conservation plans. It encourages and supports acquisition of conservation easements, legally binding agreements transferring a negotiated set of property rights from one party to another, without removing the property from private ownership. Most FLP conservation easements restrict development, require sustainable forestry practices, and protect other values. To qualify, landowners are required to prepare a multiple resource management plan as part of the conservation easement acquisition. The federal government may fund up to 75 percent of project costs, with at least 25 percent coming from private, State or local sources. In addition to gains associated with the sale or donation of property rights, many landowners also benefit from reduced taxes associated with limits placed on land use. In 2008, NJ has one project funded: Sparta Mountain South at $2,474,000.

Table 4.5 - Federal Funds Available for Mitigation Activities	
Funding Source	**Description**
Transportation Trust Fund (TTF)	Availability: Pre- and post-disaster Description: Grants are funded by the TTF through a competitive application-based process administered by the Local Aid District Offices. The County Aid Program is funded through the TTF and provides funding for eligible costs of projects included in the County's approved Annual Transportation Program. The program is intended for road and bridge infrastructure improvements under county jurisdiction. Each County receives an annual formula-based allotment that takes into consideration county road lane mileage and population.

SECTION 5 - MITIGATION STRATEGY

The Rensselaer County mitigation strategy emerged as a result of the discussions held during plan update meetings, a review of the previously proposed hazard mitigation actions from the 2011 Plan, and a review of existing resources and capabilities. This plan section presents the guiding principles for this Plan, and the mitigation initiatives that have been identified to reduce or avoid long-term vulnerabilities to the County's most significant hazards.

Vision Statement and Goals

Per FEMA guidance (386-1), a mission statement (vision statement) or guiding principle describes the overall duty and purpose of the planning process and serves to identify the principle message of the plan. Hazard mitigation plan goals are long-term statements of what the participating jurisdictions hope to achieve over time through implementation of the plan. They are based on the findings of the risk assessment and apply to each jurisdiction adopting the plan (and its updates).

New York State Hazard Mitigation Plan Vision Statement and Goals

New York State's 2019 Hazard Mitigation Plan (2019 SHMP) provides the following broad overview of its mitigation strategy:

> "New York will continually aim to reduce deaths, injuries, and economic losses stemming from natural hazards, and lead by example in fostering community resilience and protecting the environment in the face of future natural events to improve the lives of the people of the State."

The 2019 SHMP goals are:

1) Federal, State, and Local Coordination. Promote a comprehensive state hazard mitigation policy framework for effective mitigation programs that includes coordination among federal, state, and local organizations for planning and programs.
2) Protect Existing Property. Protect existing property including public, historic, private structures, state-owned/operated buildings, and critical facilities and infrastructure.
3) Increase Awareness. Increase awareness of hazard risk and mitigation capabilities among stakeholders, citizens, elected officials, and property owners to enable the successful implementation of mitigation strategies.
4) Preserve or Restore Natural Systems. Encourage the development and implementation of long-term, cost effective, and resilient mitigation projects to preserve or restore the functions of natural systems.
5) Build Stronger. Build stronger by promoting mitigation actions that emphasize sustainable construction and design measures to reduce or eliminate the impacts of natural hazards now and in the future.

Rensselaer County Mitigation Planning Vision Statement and Goals

Rensselaer County did not opt to develop a formal vision statement as part of its 2011 Plan. The planning team did, however, choose to do so for this 2019 Plan Update. In March 2019, the County worked to develop a draft vision statement. At a CPG Meeting of March 25, 2019, the County distributed this draft vision statement to the CPG for review and comment by representatives of the County and participating jurisdictions. CPG comments were evaluated by the RCBPS and, in coordination with County Planning, appropriate changes were incorporated. The County has ensured that its vision statement is compatible with that of the New York State Hazard Mitigation Plan.

The statement below represents Rensselaer County's final vision statement for its 2019 Plan Update:

> Reduce the potential dangers and losses caused by natural hazards that pose a significant risk to Rensselaer County and its communities through the sustained implementation of hazard mitigation projects and initiatives; proper design of new development; and the regular maintenance of this County-wide, multi-jurisdictional, hazard mitigation plan.

As part of the mitigation plan update process, the 2011 Plan goals were reevaluated by each participating jurisdiction. Goals included in the 2011 Plan were reviewed and refined by the County, then distributed to the CPG for review and comment at a progress meeting held on March 25, 2019. The draft vision and goals were also distributed via email, and some CPG members responded with comments via email after the March 25th meeting. CPG comments were evaluated by the County and used to shape the final goals that are listed below for inclusion in the updated 2019 Plan.

Goals were developed by taking into consideration both state and jurisdictional goals for hazard mitigation. Rensselaer County's updated goals are compatible with the needs and goals expressed in other available community planning documents as well as the New York State Hazard Mitigation Plan. The goals in this County plan are broadly aligned with the goals of the New York State Hazard Mitigation Plan.

Rensselaer County's updated 2019 Plan Goals are as follows:

1) Increase Public Awareness. Promote and sustain disaster resilient communities by increasing the awareness of hazard risks within the whole community (general public, County government, local governments, and key stakeholders), and how these risks can be mitigated.
2) Improve Capabilities. Enhance and support the capacity and capability of the County and its communities to prepare for, respond to, and recover from disasters and ensure continuity of operations.
3) Protect Existing Assets. Reduce the potential dangers and losses caused by hazards that pose a significant risk to Rensselaer County through implementation of hazard

mitigation initiatives that will protect people and property in harm's way (structures, infrastructure, and critical facilities) during future hazard events.

4) Promote Resilient New Development. Promote mitigation actions and construction and design techniques that will minimize or eliminate potential impacts of natural hazards at sites where new development is taking place or where existing development is being expanded.

Rensselaer County and its participating jurisdictions will continually aim to reduce deaths, injuries, and economic losses stemming from natural hazards, and to lead by example in fostering community resilience and protecting the environment in the face of future natural events to improve the lives of the people of the County and its communities.

Mitigation Alternatives Considered

A wide range of potential mitigation actions was considered for each of the identified hazards by the County and each City/Town/Village JAT. The list below has been developed by simplifying and adapting what's in FEMA's "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards" (January 2013). The intent is to provide an overview of mitigation options available to the County and participating jurisdictions, not only for this plan update but continuously in future. More detailed information for each type of opportunity can be found in the Mitigation Ideas document, online at:
https://www.fema.gov/media-library/assets/documents/30627

Table 5.1 – Mitigation Alternatives Considered

Coldwave/Heatwave	**Local Planning and Regulations**
	Reduce Urban Heat Island Effect
	Education and Awareness Programs
	Increase Awareness of Extreme Temperature Risk and Safety
	Assist Vulnerable Populations
	Educate Property Owners About Freezing Pipes
Hurricane/Tropical Storm Wind	**Local Planning and Regulations**
	Adopt and Enforce Building Codes
	Promote or Require Site and Building Design Standards to Minimize Wind Damage
	Assess Vulnerability to Severe Wind
	Protect Power Lines and Infrastructure
	Structure and Infrastructure Projects
	Retrofit Residential Buildings
	Retrofit Public Buildings and Critical Facilities
	Education and Awareness Programs
	Increase Severe Wind Risk Awareness

Table 5.1 – Mitigation Alternatives Considered	
Hurricane/Tropical Storm Flood	Local Planning and Regulations
	Incorporate Flood Mitigation in Local Planning
	Form Partnerships to Support Floodplain Management
	Limit or Restrict Development in Floodplain Areas
	Adopt and Enforce Building Codes and Development Standards
	Improve Stormwater Management Planning
	Adopt Policies to Reduce Stormwater Runoff
	Improve Flood Risk Assessment
	Join or Improve Compliance with NFIP
	Manage the Floodplain Beyond Minimum Requirements
	Participate in the CRS
	Establish Local Funding Mechanisms for Flood Mitigation
	Structure and Infrastructure Projects
	Remove Existing Structures from Flood Hazard Areas
	Improve Stormwater Drainage System Capacity
	Conduct Regular Maintenance for Drainage Systems and Flood Control Structures
	Elevate or Retrofit Structures and Utilities
	Floodproof Residential and Non-Residential Structures
	Protect Infrastructure
	Protect Critical Facilities
	Construct Flood Control Measures
	Natural Systems Protection
	Protect and Restore Natural Flood Mitigation Features
	Preserve Floodplains as Open Space
	Increase Awareness of Flood Risk and Safety
	Education and Awareness Programs
	Educate Property Owners about Flood Mitigation Techniques
Lightning	Structure and Infrastructure Projects
	Protect Critical Facilities and Equipment
	Education and Awareness Programs
	Conduct Lightning Awareness Programs
Tornado	Local Planning and Regulations
	Encourage Construction of Safe Rooms
	Require Wind-Resistant Building Techniques
	Education and Awareness Programs
	Conduct Tornado Awareness Activities
Wind	Local Planning and Regulations
	Adopt and Enforce Building Codes
	Promote or Require Site and Building Design Standards to Minimize Wind Damage
	Assess Vulnerability to Severe Wind
	Protect Power Lines and Infrastructure
	Structure and Infrastructure Projects
	Retrofit Residential Buildings
	Retrofit Public Buildings and Critical Facilities
	Education and Awareness Programs
	Increase Severe Wind Risk Awareness

Table 5.1 – Mitigation Alternatives Considered	
Winter Storm	**Local Planning and Regulations**
	Adopt and Enforce Building Codes
	Structure and Infrastructure Projects
	Protect Buildings and Infrastructure
	Protect Power Lines
	Reduce Impacts to Roadways
	Education and Awareness Programs
	Conduct Winter Weather Risk Awareness Activities
	Assist Vulnerable Populations
Drought	**Local Planning and Regulations**
	Assess Vulnerability to Drought Risk
	Monitor Drought Conditions
	Monitor Water Supply
	Plan for Drought
	Require Water Conservation During Drought Conditions
	Prevent Overgrazing
	Structure and Infrastructure Projects
	Retrofit Water Supply Systems
	Natural Systems Protection
	Enhance Landscaping and Design Measures
	Education and Awareness Programs
	Educate Residents on Water Saving Techniques
	Educate Farmers on Soil and Water Conservation Practices
	Purchase Crop Insurance
Flood	**Local Planning and Regulations**
	Incorporate Flood Mitigation in Local Planning
	Form Partnerships to Support Floodplain Management
	Limit or Restrict Development in Floodplain Areas
	Adopt and Enforce Building Codes and Development Standards
	Improve Stormwater Management Planning
	Adopt Policies to Reduce Stormwater Runoff
	Improve Flood Risk Assessment
	Join or Improve Compliance with NFIP
	Manage the Floodplain Beyond Minimum Requirements
	Participate in the CRS
	Establish Local Funding Mechanisms for Flood Mitigation
	Structure and Infrastructure Projects
	Remove Existing Structures from Flood Hazard Areas
	Improve Stormwater Drainage System Capacity
	Conduct Regular Maintenance for Drainage Systems and Flood Control Structures
	Elevate or Retrofit Structures and Utilities
	Floodproof Residential and Non-Residential Structures
	Protect Infrastructure
	Protect Critical Facilities
	Construct Flood Control Measures
	Dam Mitigation Measures

Table 5.1 – Mitigation Alternatives Considered	
Flood, continued	Natural Systems Protection
	Protect and Restore Natural Flood Mitigation Features
	Preserve Floodplains as Open Space
	Education and Awareness Programs
	Increase Awareness of Flood Risk and Safety
	Educate Property Owners about Flood Mitigation Techniques
Earthquake	Local Planning and Regulations
	Adopt and Enforce Building Codes
	Incorporate Earthquake Mitigation into Local Planning
	Map and Assess Community Vulnerability to Seismic Hazards
	Conduct Inspections of Building Safety
	Structure and Infrastructure Projects
	Protect Critical Facilities and Infrastructure
	Implement Structural Mitigation Techniques
	Education and Awareness Programs
	Increase Earthquake Risk Awareness
	Conduct Outreach to Builders, Architects, Engineers, and Inspectors
	Provide Information on Structural and Non-Structural Retrofitting
Landslide	Local Planning and Regulations
	Map and Assess Vulnerability to Landslides
	Manage Development in Landslide Hazard Areas
	Structure and Infrastructure Projects
	Prevent Impacts to Roadways
	Remove Existing Buildings and infrastructure from Landslide Hazard Areas
Wildfire	Local Planning and Regulations
	Map and Assess Vulnerability to Wildfire
	Incorporate Wildfire Mitigation in the Comprehensive Plan
	Reduce Risk through Land Use Planning
	Develop a Wildland Urban Interface Code
	Require or Encourage Fire-Resistant Construction Techniques
	Structure and Infrastructure Projects
	Retrofit At-Risk Structures with ignition-Resistant Materials
	Create Defensible Space Around Structures and Infrastructure
	Conduct Maintenance to Reduce Risk
	Natural Systems Protection
	Implement a Fuels Management Program
	Education and Awareness Programs
	Participate in FireWise Program
	Increase Wildfire Risk Awareness
	Educate Property Owners about Wildfire Mitigation Techniques

Selection and Prioritization of Mitigation Actions

Rensselaer County and each participating jurisdiction updated their respective mitigation strategies with a four-step process.

1. Report on Progress of 2011 HMP Initiatives
   First, each jurisdiction assessed the progress of actions identified in the 2011 Plan. Team members described whether each project was completed, initiated but not completed, ongoing, or not initiated. Then, each action was either deemed to be still relevant for carrying forward to the updated 2019 mitigation strategy; or no longer relevant, and hence slated for omission from the updated 2019 mitigation strategy.

2. Identify Past Mitigation Accomplishments
   NYS DHSES requires the documentation of local mitigation efforts and accomplishments since the previous hazard mitigation plan was prepared, regardless of funding source and regardless of whether the project was included in the prior plan. They note that the goal of this requirement is to provide a context for each jurisdiction's projects, act as a source of ideas for mitigation projects, and evaluate the accuracy of assumptions and engineering solutions to inform future projects, and to support future mitigation planning and its coordination with other planning, zoning, and environmental procedures within the jurisdiction. Each jurisdiction highlighted its past mitigation accomplishments from the time the 2011 HMP was approved through its first update in 2019. Jurisdictions identified each project, the hazard(s) addressed, provided a brief summary of the original problem and the solution (project), project cost, level of protection, and damages avoided (and/or evidence of success).

3. Develop an Updated Local Mitigation Strategy for the 2019 HMP
   Next, each community developed a unique mitigation strategy to address their highest hazards and key risks, guided by the results of the risk assessment and FEMA's Mitigation Ideas document. Local mitigation strategies in this 2019 Plan Update include: (1) actions carried forward from the 2011 Plan, and (2) new actions added over the course of this first plan update. For each action, jurisdictions have laid out the initiative name, goals being met, hazard(s) to be mitigated, a description of the problem and proposed solution. They also have identified whether the project is related to critical facility, whether there are known environmental or historic preservation issues, provided an estimated timeline for completion, identified a local lead for project implementation, estimated costs and benefits, and identified potential funding sources. Project priorities were determined using a qualitative prioritization process. A higher priority was assigned to projects where: the life/safety risk of taking no action was deemed to be unacceptably high; the project addresses one of the community's highest hazards and/or key risks; benefits were projected to equal or exceed project costs; critical facilities or key local assets were being protected; funding and staff resources were deemed to be sufficient and/or accessible for project implementation; negative impacts were not anticipated on environmental and/or historic resources or any segment of the population; and/or where there was overall

support for the project from the local community (government officials, public, and stakeholders).

4. Prepare Action Worksheets for the Community's Two Highest Priority Projects
   In accordance with NYS DHSES State Standard 7, each jurisdiction gave further consideration to their two highest priority projects, and documented this step using the required NYS DHSES Action Worksheet. For jurisdictions containing a Special Flood Hazard Area, at least one of these Action Worksheets has been prepared for a project that addresses flooding.

Local Mitigation Strategies

Using this four-step process, the County and each participating jurisdiction developed an updated mitigation strategy for this 2019 HMP. The County and its consultant facilitated this process through a Mitigation Strategy Working Session on June 5, 2019 at the Center Brunswick Fire Company at 1045 Hoosick Road in Troy. Telephone and email support were provided by the consultant both before and after the June 5th meeting via telephone and email correspondence. During the week of July 29, 2019, the consultant and RCBPS also met individually with a subset of municipalities who were still having trouble; these meetings were held at local municipal offices. Subsequent telephone and email assistance were provided until all municipalities had their inputs completed (most jurisdictions finished in August; two wrapped up in September).

This plan proposes the actions determined to be the most appropriate for the resources and capabilities of the County and each of the participating jurisdictions based on the experience of local officials, with input from the public and other stakeholders. The relatively large number of flood mitigation actions proposed in the Rensselaer County mitigation strategy reflects the fact that flooding is the hazard of greatest concern. Actions determined to be appropriate for the plan were reviewed during public and committee meetings and there was consensus that those intended to mitigate the effects of flooding should be the highest priorities for most communities. As with the 2011 Plan, this 2019 Plan Update includes a series of County-led initiatives with municipal participation to address a wider range of hazards. In addition, each local mitigation strategy proposes actions reflecting the commitment of the County and local jurisdictions to compliance with requirements of the NFIP. Potential actions were reviewed relative to potential financial as well as administrative and legal costs and the degree to which they would be endorsed by the public. Potential actions were reviewed during the meetings relative to their potential benefit of effectiveness in saving lives, protecting the natural environment, and reducing disruption and damage. Actions selected by each jurisdiction include activities to protect existing and future structures and infrastructure and enhance community resilience.

Part of enhancing community resilience involves adapting to a changing climate. In accordance with NYS Mitigation Planning Standard 9, plans developed with NYS DHSES-administered funds must include information on climate change as part of the hazard vulnerability analysis and contain strategies/projects to address increased vulnerability that

may result from climate change. This requirement was established to encourage jurisdictions to plan for and accommodate climate change and sea level rise. By developing mitigating strategies and/or projects for hazards that are exacerbated by climate change, jurisdictions will better protect residents, avoid, or reduce damage to property and public infrastructure, and reduce personal hardship. In accordance with this State Standard, previous sections of this plan have presented information on how climate change may affect jurisdictional vulnerability or increased frequency of occurrence and/or severity in exposure to flooding, wildfire, drought, and extreme temperatures. Climate change is addressed by mitigating the various hazards that it exacerbates. As detailed in the Jurisdictional Annexes of this plan, communities in Rensselaer County have proposed a range of hazard mitigation initiatives to address their highest hazards including those hazards that are exacerbated by a changing climate.

Additionally, New York State's Climate Smart Communities (CSC) program helps local governments take action to reduce greenhouse gas emissions and adapt to a changing climate. The CSC program is jointly sponsored by the following six New York State agencies: Department of Environmental Conservation; Energy Research and Development Authority (NYSERDA); Department of Public Service; Department of State; Department of Transportation; and Department of Health. The program offers free technical assistance, grants, and rebates for electric vehicles.

Registered CSCs have made a commitment to act by passing the state's CSC pledge, a resolution documenting the community's commitment to join the program. The program's model resolution is shown on the next page. After this resolution is adopted, communities designate a primary contact person to complete an online registration form and upload the adopted municipal resolution. Once the registration is reviewed and approved by the State, the community is designated a Registered CSC by New York State. There are four Registered CSCs in Rensselaer County: the City of Rensselaer, City Troy, Village of East Nassau, and Town of East Greenbush.

Certified CSCs are the foremost leaders in the state. These communities have undergone a rigorous review process to confirm their completion of a suite of concrete actions that mitigate and adapt to climate change. There were no Certified CSCs in Rensselaer County as of the time of this plan update.

Regulatory Approvals and Environmental Review

The potential mitigation strategies identified in Table 5.3 include a variety of measures, some of which involve construction of or improvements to public infrastructure. By listing these projects in this planning document, no agency is committed to funding, undertaking or approving any specific project. Each project, if pursued, would be subject to all necessary federal, state, and local approvals and environmental review prior to being undertaken, funded, or approved. Those approvals would include all necessary environmental permits and review under the State Environmental Quality Review Act (SEQRA), where applicable.

NEW YORK STATE OF OPPORTUNITY. Climate Smart Communities

Model Resolution

Any city, town, village, or county government in New York State can take a stand by adopting the Climate Smart Communities pledge. Local governments may amend the preamble of the pledge below, but all ten points of the pledge must be adopted verbatim by the highest body of elected officials (e.g., town board or city council). The final resolution document must include a signature from the municipal clerk verifying the authenticity of the resolution and indicating the date of passage. Local governments should then designate a primary contact person to complete the online registration form and upload the resolution by following the steps at https://climatesmart.ny.gov/actions-certification/getting-started/ . After the registration is reviewed, the community will be designated a Registered Climate Smart Community and be added to the online list. Join us!

Councilmember_____ moved and Councilmember _____ seconded that

WHEREAS, the Town/Village/City/County of _____ (hereinafter "local government") believes that climate change poses a real and increasing threat to our local and global environments and is primarily due to the burning of fossil fuels; and

WHEREAS, the effects of climate change will endanger our infrastructure, economy and livelihoods; harm our farms, orchards, and ecological communities, including native fish and wildlife populations; spread invasive species and exotic diseases; reduce drinking water supplies and recreational opportunities; and pose health threats to our citizens; and

WHEREAS, we believe that our response to climate change provides us with an unprecedented opportunity to save money, and to build livable, energy-independent and secure communities, vibrant innovation economies, healthy and safe schools, and resilient infrastructures; and

WHEREAS, we believe the scale of greenhouse gas (GHG) emissions reductions required for climate stabilization will require sustained and substantial efforts; and

WHEREAS, we believe that even if emissions were dramatically reduced today, communities would still be required to adapt to the effects of climate change for decades to come,

IT IS HEREBY RESOLVED that Town/Village/City/County of _____ , in order to reduce greenhouse gas emissions and adapt to a changing climate, adopts the New York State Climate Smart Communities pledge, which comprises the following ten elements:

1) **Build a climate-smart community.**
2) **Inventory emissions, set goals, and plan for climate action.**
3) **Decrease energy use.**
4) **Shift to clean, renewable energy.**
5) **Use climate-smart materials management.**
6) **Implement climate-smart land use.**
7) **Enhance community resilience to climate change.**
8) **Support a green innovation economy.**
9) **Inform and inspire the public.**
10) **Engage in an evolving process of climate action.**

Additionally, at the County level, Rensselaer County plays an active role in supporting and advocating for wetlands preservation activities along the Hudson River.

Climate change is addressed in this plan through local initiatives to mitigate the hazards that are exacerbated by a changing climate. Local mitigation strategies are summarized briefly in Table 5.2 (for County projects) and Table 5.3 (for municipal projects); they are presented in much greater detail in each Jurisdictional Annex.

Table 5.2 – Overview of Rensselaer County Mitigation Strategy Detailed information is provided in the Rensselaer County Jurisdictional Annex			
Project Number	Project Name	Hazard(s) Addressed	Priority
1	NEW – Dam Inundation Mapping GIS	Flooding	High
2	NEW – Construction of new County EOC outside of the floodplain	Flooding	High
3	NEW – Beaver Dam in Town of Hoosick	Flooding	Medium-Low
4	NEW – Town of Brunswick Beach Reservoir Dam	Flooding	Medium
5	NEW-Sand Lake Dam Inundation Areas	Flooding	Medium-Low
6	NEW-Ice Jam Mitigation on the Hudson	Flooding	Medium
7	Courtesy review of local comprehensive plans (2011 RC-1)	Drought, flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	High
8	Public Outreach at Schaghticoke Fair (2011 RC-2)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	Medium
9	GIS Hazard Data Repository (2011 RC-5)	Drought, flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	Medium
10	Redundant systems for critical facilities (2011 RC-6)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, tornadoes	Medium
11	CERT Support (2011 RC-7)	Flooding, earthquakes, landslides, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	High
12	Hazard Information Center (2011 RC-8)	Drought, flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	Medium
13	Hazard Awareness and Hazard Mitigation Outreach (2011 RC-9)	Drought, flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	Medium
14	County GIS Parcel Data Expansion (2011 RC-10)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, tornadoes	High
15	Hazard Event Notification (2011 RC-11)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, tornadoes	Low
16	Hazard Management Asset Facility (2011 RC-13)	Flooding, earthquakes, landslides, lightning, dam failures, wildfires, extreme temperatures, tornadoes	Medium
17	Shelters (2011 RC-14)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	High
18	BMPs for Floodplains (2011 RC-17)	Flooding, hurricanes, ice jams, dam failures, nor'easters	Medium
19	Retrofit/Reconstruct Aging Critical Facilities (2011 RC-19)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, extreme temperatures, tornadoes	Medium

20	Mitigation Videos/Brochures (2011 RC-20)	Flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, extreme temperatures, tornadoes	Low
21	Earthquake Retrofits (2011 RC-21)	Earthquakes, landslides	High
22	Municipal Assistance, Steep Slope Regulations/ Ordinances (2011 RC-22)	Earthquakes, landslides	Medium
23	Detailed Landslide Hazard Mapping (2011 RC-23 RC-24)	Earthquakes, landslides	Medium
24	McChesney Avenue Landslide Mitigation (2011 RC-25)	Earthquakes, landslides	High
25	Building Safety Code Proponent (2011 RC-26)	Flooding, earthquakes, landslides, lightning, wildfires, winter storms, extreme temperatures, tornadoes	High
26	Ground Outlets and Surge Protector Awareness (2011 RC-27)	Lightning	Medium
27	Power and Communications System Resiliency (2011 RC-28)	Lightning, winter storm, tornadoes	Low
28	Ice Control Structures (2011 RC-30)	Ice jams	High
29	Dam Safety Program Advocate (2011 RC-31)	Dam failure	Medium
30	Dykan Pond Inundation Awareness (2011 RC-33)	Dam failure	Low
31	Detailed WUI Mapping (2011 RC-34)	Wildfire	Medium
32	EOP Reviews for Wildfire (2011 RC-36)	Wildfire	Medium
33	Wildfire Resistance Awareness (2011 RC-37)	Wildfire	Low
34	Wildfire Resistant Building Retrofits (2011 RC-38)	Wildfire	High
35	Extreme Temperatures Public Information (2011 RC-42)	Winter storms, extreme temperatures	High
36	Emergency Response and Warning (2011 RC-43)	Drought, flooding, earthquakes, landslides, lightning, ice jams, dam failures, wildfires, winter storms, extreme temperatures, tornadoes	Low
37	Safe Room Information (2011 RC-44)	Tornadoes, earthquakes	Low
38	Wind Retrofits (2011 RC-45)	Tornadoes, nor'easters, wind storms	Medium
39	Emergency Facility Level of Protection Assessment (2011 RC-46 and 2011 RC-47)	Flooding, earthquakes, landslides, lightning, wildfires, winter storms, extreme temperatures, tornadoes, high winds, nor'easters	High
40	Dunham Hollow Road (2011 RC-48)	Landslides, earthquakes, floods	Medium
41	Tamarac Road (2011 RC-49)	Flooding	Medium
42	Hampton Avenue (2011 RC-50)	Flooding	High
43	Dill Brook Hollow Road (2011 RC-51)	Land slide, earthquake	Medium
44	Garfield-East Nassau Road (2011 RC-52)	Flooding	Low

45	Schodack Landing Road at NYS-9J (2011 RC-53)	Flooding	High
46	5392 South Stephentown Road (2011 RC-54)	Flooding	Medium
47	River Road (2011 RC-55)	Flooding, Ice Jams	Medium
48	New Turnpike Road (2011 RC-56)	Flooding	Medium
49	Hoags Corners Road (2011 RC-57)	Landslides, earthquake	Medium
50	Green Hollow Road (2011 RC-58)	Landslides, earthquake	Medium
51	North Lake Avenue (2011 RC-60)	Flooding	High
52	Groveside Road (2011 RC-62)	Flooding	High
53	Roof Drains at Main Garage (2011 RC-63)	Flooding, Winter Storms, Nor'easters	Low
54	Winter Street (2011 RC-64)	Flooding	Low
55	Lape Road (2011 RC-65)	Flooding	High
56	Public Awareness Program (2011 RC-CL-1)	All hazards	Medium
57	Code Review/Updates (2011 RC-CL-2)	All hazards	Medium
58	Code Enforcement Officer Training (2011 RC-CL-3)	All hazards	High
59	Courtesy Review of Draft Comprehensive Plans (2011 RC-CL-4)	All hazards	Low
60	Municipal Mitigation Workshops (2011 RC-CL-5)	All hazards	Moderate
61	Rural Firefighting Water Supply Upgrade *New*	Lack of Sufficient Water to Fight Fires in Rural Areas	Moderate
62	Little Hoosick River Flood Control Project Repair & Maintenance *New*	Flooding of Village of Berlin, Ny	Moderate
63	Buskirk Covered Bridge *New*	Flooding, ice jams	High
64	Mitigation of RLPs *NEW*	Flooding	Moderate

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
Berlin, Town of	1	Comprehensive Plan Update *NEW*	All	High
	2	Land Use Ordinance Update *NEW*	All	High
	3	Debris Removal (2011 BE-1)	Flooding	High
	4	Participate in County-Led Hazard Mitigation Outreach (2011 BE-CL-1)	All hazards	High
	5	Request code/ordinance review by County as needed (2011 BE-CL-2)	All hazards	Medium
	6	Send CEO to County-Led Training (2011 BE-CL-3)	All hazards	Medium
	7	Send Comprehensive Plan Update to County for Review by County Planning (2011 BE-CL-4)	All hazards	High
	8	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 BE-CL-5)	All hazards	Low
	9	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 BE-NFIP-1)	Flooding	Medium
	10	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 BE-NFIP-4)	Flooding	Medium
Brunswick, Town of	1	Resolve safety issues with town dam for town reservoir (2011 BR-1)	Flooding	High
	2	Public awareness program on Hazards, Prevention, and mitigation (2011 BR-CL-1)	All Hazards	Medium
	3	Code Update (2011 BR-CL-2)	All Hazards	Medium
	4	Code enforcement (2011 BR-CL-3)	All Hazards	Medium
	5	Comprehensive Plan (2011 BR-CL-4)	All Hazards	Medium
	6	Workshop Hazard Prevention (2011 BR-CL-5)	All Hazards	Low
	7	Floodplain Ordinance (2011 BR-NFIP-1)	Flooding	Medium
	8	Deepkill & NYS Rt7 *NEW*	Flooding	Medium
	9	White Church Lane *NEW*	Flooding	Medium
	10	Pennyroyal Lane *NEW*	Flooding	Medium
	11	South Road *NEW*	Flooding	Medium
	12	Mitigation of RLPs *NEW*	Flooding	Medium
Castleton-on-Hudson, Village of	1	Redevelopment Study of the Old Fort Orange Paper Company Site *New*	Flooding, Landslides	High

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	2	New Development and Steep Slopes *NEW*	Landslides	Medium
	3	Planting of Ice and Wind-Resistant Trees (2011 CA-1)	Winter storms, High winds	High
	4	Seaman Avenue Stormwater (2011 CA-2)	Flooding, Landslides	High
	5	Green Avenue Stormwater (2011 CA-3)	Flooding, Landslides	High
	6	Main Street Stormwater (2011 CA-4)	Flooding	Low
	7	Benedict Street Stormwater (2011 CA-5)	Flooding, Landslides	Low
	8	Participate in County-Led Hazard Mitigation Outreach (2011 CA-CL-1)	All hazards	High
	9	Request code/ordinance review by County as needed (2011 CA-CL-2)	All hazards	Medium
	10	Send CEO to County-Led Training (2011 CA-CL-3)	All hazards	Medium
	11	Send Comprehensive Plan Update to County for Review by County Planning (2011 CA-CL-4)	All hazards	High
	12	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 CA-CL-5)	All hazards	Low
	13	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 CA-NFIP-1)	Flooding	High
	14	Designate a Floodplain Administrator (2011 CA-NFIP-2)	Flooding	Medium
	15	Add/Train sufficient members of staff to adequately enforce NFIP regulations and floodplain management ordinance (2011 CA-NFIP-3)	Flooding	Low
	16	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 CA-NFIP-4)	Flooding	Low
	17	CFM Certification (2011 CA-NFIP-5)	Flooding	Low
East Greenbush, Town of	1	Upgrade Hampton Manor Drainage (2011 EG-1)	Flooding	1
	2	Recondition Catskill Avenue Dam (2011 EG-2)	Flooding	5
	3	Michael Road Pipe Arch Replacement (2011 EG-3)	Flooding	4
	4	Sherwood Park Drainage *NEW*	Flooding	3
	5	Prospect Heights Drainage *NEW*	Flooding	2
	6	Participate in County-Led Hazard Mitigation Outreach (2011 EG CL-1)	All Hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	7	Request code/ordinance review by County as needed (2011 EG CL-2)	All Hazards	Medium
	8	Send CEO to County-Led Training (2011 EG CL-3)	All hazards	Medium
	9	Send Comprehensive Plan Update to County for Review by County Planning (2011 EG CL-4)	All hazards	High
	10	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 EG CL-5)	All hazards	Low
	11	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 EG-NFIP-4)	Flooding	Low
	12	Join FEMA's CRS (2011 EG-NFIP-6)	Flooding	Low
East Nassau, Village of	1	Webster Hill Road *NEW*	Flooding	Medium
	2	Public Awareness Program (2011 EN-CL-1)	All hazards	High
	3	Land Use Regulation Update (2011 EN-CL-2)	All Hazards	Medium
	4	Code Enforcement Training (2011 EN-CL-3)	All Hazards	Medium
	5	HMP incorporated in Village Comprehensive Plan (2011 EN-CL-4)	All hazards	High
	6	Attend County-led Mitigation Planning and Zoning Workshops (2011 EN-CL-5)	All hazards	Low
	7	Update Floodplain Management Ordinance when new FIRMs are released (2011 EN-NFIP-4)	Flooding	High
Grafton, Town of	1	Jay Hakes Road Culvert Replacement New	Flooding	1
	2	Cranberry Pond Road New	Flooding	2
	3	Roadway Improvements G-1	Flooding	High
	5	Johnson Road Bridge G-3	Flooding	Medium
	6	Participate in County-Led Hazard Mitigation Outreach (2011 G-CL-1)	All hazards	High
	7	Request code/ordinance review by Count as needed (2011 G-CL-2)	All hazards	Medium
	8	Send CEO to County-Led Training (2011 G-CL-3)	All hazards	Medium
	9	Send Comprehensive Plan Update to County for Review by County Planning (2011 G-CL-4)	All hazards	High
	10	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 G-CL-5)	All hazards	Low

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	11	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 G-NFIP-1)	Flooding	High
	12	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 G-NFIP-4)	Flooding	Low
Hoosick Falls, Village of	1	Woods Brook (2011 HF-1)	Flooding	High
	2	Zoning & building code Dept. (2011 HF-2)	All	High
	3	Storm Water Drain Infrastructure *NEW*	Flooding Damage	High
	4	Pan Am Rail *NEW*	Flooding and severe storms	High
	5	Participate in County-Led Hazard Mitigation Outreach (2011 HF-CL-1)	All hazards	High
	6	Request code/ordinance review by County as needed (2011 HF-CL-2)	All hazards	High
	7	Send CEO to County-Led Training (2011 HF-CL-3)	All hazards	High
	8	Send Comprehensive Plan Update to County for Review by County Planning (2011 HF-CL-4)	All hazards	High
	9	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 HF-CL-5)	All hazards	High
	10	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 HF-NFIP-1)	Flooding	High
	11	Staff Training in NFIP (2011 HF-NFIP-3)	Flooding	High
	12	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 HF-NFIP-4)	Flooding	High
	13	Join the CRS (2011 HF-NFIP-6)	All hazards	Low
	14	Mitigation of RLPs *NEW*	Flooding	Medium
Hoosick, Town of	1	Relocate Buskirk Fire Station Out of Floodplain (2011 H-1)	Flooding	High
	2	Acquisition of Two Houses in the Floodplain (2011 H-2)	Flooding	Medium
	3	Culvert/Drainage Upgrades/Replacement (2011 H-3)	Flooding	High
	4	Beaver Dam Removal *NEW*	Flooding	High
	5	Participate in County-Led Hazard Mitigation Outreach (2011 H-CL-1)	All hazards	High
	6	Request code/ordinance review by Count as needed (2011 H-CL-2)	All hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	7	Send CEO to County-Led Training (2011 H-CL-3)	All hazards	High
	8	Send Comprehensive Plan Update to County for Review by County Planning (2011 H-CL-4)	All hazards	High
	9	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 H-CL-5)	All hazards	High
	10	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 H-NFIP-1)	Flooding	High
	11	Staff Training in NFIP (2011 H-NFIP-3)	Flooding	High
	12	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 H-NFIP-4)	Flooding	High
	13	Join the CRS (2011 H-NFIP-6)	Flooding	Low
	14	Mitigation of RLPs *NEW*	Flooding	Medium
Nassau, Town of	1	Kronuner Road Large Culvert/Bridge (New)	Flooding	High
	2	Road / Culvert Assessment (New)	Flooding	High
	3	Culvert/Bridge upgrades, replacements, drainage improvements to Old Mill Pond, Krouner, Clarkes Chapel, Mashodack, Fredenburg, Alps Mt., McGill, Dusenberry roads. Replace functionally or structurally obsolete large culverts/bridges. (2011 NT-1)	Flooding	Low
	4	Ice and Windstorm. (2011 NT-2)	Ice Storm, Winter Storm, Wind	Low
	5	Participate in County-Led Hazard Mitigation Outreach (2011 NT-CL-1)	All hazards	Low
	6	Request code/ordinance review by Count as needed (2011 NT-CL-2)	All hazards	Low
	7	Send CEO to County-Led Training (2011 NT-CL-3)	All hazards	Low
	8	Send Comprehensive Plan Update to County for Review by County Planning (2011 NT-CL-4)	All hazards	Low
	9	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 NTCL-5)	All hazards	Low
	10	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 NT-NFIP-1)	Flooding	Low
	11	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 NT-NFIP-4)	Flooding	Low
Nassau, Village of	1	Chatham St (NYS Route 203) Flood Protection Project (2011 NV-1)	Flooding	High

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	2	23 Albany Avenue Drainage Improvement Project (2011 NV-2)	Flooding	Medium
	3	37 Albany Avenue Channel Improvements Project (2011 NV-3)	Flooding	Low
	4	34 Tremont Drive Drainage Improvement Project NEW	Flooding	Low
	5	Early warning system (2011 NV-4)	All Hazards	High
	6	Participate in County-Led Hazard Mitigation Outreach (2011 NV-CL-1)	All hazards	High
	7	Request code/ordinance review by County as needed (2011 NV-CL-2)	All hazards	Medium
	8	Send CEO to County-Led Training (2011 MV-CL-3)	All hazards	Medium
	9	Send Comprehensive Plan Update to County for Review by County Planning (2011 NV-CL-4)	All hazards	High
	10	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 NV-CL-5)	All hazards	Low
	11	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 NV-NFIP-1)	Flooding	High
	12	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 NV-NFIP-4)	Flooding	High
North Greenbush, Town of	NG-1	Wetlands Restoration - Wynantskill Creek Wetlands Restoration @ Jack's Drive-in Project (2011 NG-1)	Flooding	High
	NG-2	Stormwater Management - Douglas and Pine Streets Project (2011 NG-2)	Flooding	High
	NG-3	Disaster Preparedness – Continue to improve disaster preparedness and continuity of government (2011 NG-3)	Enhance Readiness	Medium
	NG-4	Stormwater Management – Red Oak Lane Project (2011 NG-4)	Flooding	Medium
	NG-5	Stormwater Management – Snyder's Lake Project (2011 NG-5)	Flooding	High
	NG-6 *NEW*	Establish Town Stormwater Committee *NEW*	Flooding	Medium
	NG-CL-1	Public Awareness Program, etc. (2011 NG-CL-1)	All Hazards	Medium
	NG-CL-2	Maintain Code Update (2011 NG-CL-2)	All Hazards	Medium
	NG-CL-3	Attend workshops and training (2011 NG-CL-3)	All Hazards	Low
	NG-CL-4	Ensure plans incorporate natural disaster hazard mitigation techniques thru review by County (2011 NG-CL-4)	All Hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	NG-CL-5	Periodic Workshops for zoning and planning issues (2011 NG-CL-5)	All Hazards	Low
	NG-NFIP-1	Update Floodplain ordinance to FEMA regulations (2011 NG-NFIP-1)	Flooding	Medium
	NG-NFIP-3	Add/Train staff to enforce NFIP and floodplain regulations (2011 NG-NFIP-3)	Flooding	Medium
	NG-NFIP-4	Revise Floodplain ordinance to FIRMs (2011 NG-NFIP-4)	Flooding	Medium
Petersburgh, Town of	1	Generators for Town Buildings *NEW*	All hazards	High
	2	Tree Service for Dead Trees *NEW*	Snowstorm, Ice Storm, Wind, Wildfire	High
	3	Flood Risk Awareness and Mitigation Project *NEW*	Flooding	Medium
	4	Landslide Mitigation Project *NEW*	Landslide	Medium
	5	Public Awareness Program (2011 P-CL-1)	All hazards	Medium
	6	Land Use Regulation Update (2011 P-CL-2)	All Hazards	High
	7	Code Enforcement Training (2011 P-CL-3)	All Hazards	High
	8	HMP incorporated in Village Comprehensive Plan (2011 P-CL-4)	All hazards	Low
	9	Attend County-led Mitigation Planning and Zoning Workshops (2011 P-CL-5)	All hazards	High
	10	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 P-NFIP-1)	Flooding	High
	11	Designate a Floodplain Administrator (2011 P-NFIP-2)	Flooding	Low
	12	Staff Training in NFIP (2011 P-NFIP-3)	Flooding	High
	13	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 P-NFIP-4)	Flooding	Low
Pittstown, Town of	1	NEW - Country Acres Mobile Home Park	Flooding	High
	2	NEW- 517 Groveside Road	Flooding	High
	3	NEW- Peter Hansen Lane	Flooding, road erosion	Medium
	4	NEW - North Pole Rd Widening	Winter Storms (Snow Storms, Ice Storms)	Medium
	5	North Pole Road Culvert Upgrade / Drainage Improvement (2011 PI-1)	Flooding, land erosion, road washouts	Medium
	6	Hazard Outreach (2011 PI-5)	All hazards	High
	7	Participate in County-Led Hazard Mitigation Outreach (2011 PI-CL-1)	All hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies
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Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	8	Request code/ordinance review by Count as needed (2011 PI-CL-2)	All hazards	Medium
	9	Send CEO to County-Led Training (2011 PI-CL-3)	All hazards	Medium
	10	Send Comprehensive Plan Update to County for Review by County Planning (2011 PI-CL-4)	All hazards	High
	11	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 PI-CL-5)	All hazards	Low
	12	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 PI-NFIP-1)	Flooding	High
	13	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 PI-NFIP-4)	Flooding	High
	14	Floodplain Manager CFM Certification (2011 PI-NFIP-5)	Flooding	Low
Poestenkill, Town of	1	Map and Code Update (2011 PO-1)	Flooding	1
	2	Culvert Replacement (2011 PO-2)	Flooding	2
	3	Public Awareness (2011 PO-CL-1)	Flooding	3
	4	Removal of Floodprone Structures NEW	flooding	4
	5	Request code/ordinance review by County as needed (2011 PO-CL-2)	Flooding	Low
	6	Send CEO to County-Led Training (2011 PO-CL-3)	Flooding	Medium
	7	Send Comprehensive Plan Update to County for Review by County Planning (2011 PO-CL-4)	Flooding	Low
	8	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 PO-CL-5)	Flooding	Low
	9	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 PO-NFIP-1)	All Hazards	Medium
	10	Floodplain Administrator (2011 PO-NFIP-2)	All Hazards	Low
	11	Floodplain Staffing/Training (2011 PO-NFIP-3)	All Hazards	Medium
	12	Floodplain Management Ordinance (2011 PO-NFIP-4)	All Hazards	Medium
	13	Floodplain Manager (2011 PO-NFIP-5)	Flooding	Medium
	14	Mitigation of RLPs *NEW*	Flooding	Medium
Rensselaer, City of	1	Old initiative R-5 (Hollow Slope) Code Review and Upgrade	Landslide/Flooding	High

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	2	Old initiative R-6 (Valley View) Slope Stabilization Valley View	Landslide	High
	3	Old Initiative R-7 (Mill Creek) Second Ave. Bridge Removal	Flooding	Medium
	4	Slope stabilization Quackenderry Creek	Landslide	Medium
	5	Killeans Landing GEIS Environmental Recommendation Implementation	Flooding	High
	6	Stream Overlay District	Flooding	Medium
	7	Harrison Street Culvert Replacement	Flooding	Low
	8	Floodplain Management Training	Flooding	High
	9	Partition St. Culvert Replacement	Flooding	High
	10	Participate in County-Led Hazard Mitigation Outreach (2011 R-CL-1)	All hazards	High
	11	Request code/ordinance review by Count as needed (2011 R-CL-2)	All hazards	High
	12	Send CEO to County-Led Training (2011 R-CL-3)	All hazards	High
	13	Send Comprehensive Plan Update to County for Review by County Planning (2011 R-CL-4)	All hazards	Medium
	14	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 R-CL-5)	All hazards	Medium
	15	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 R-NFIP-1)	Flooding	Medium
	16	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 R-NFIP-4)	Flooding	Medium
	17	Floodplain Manager CFM Certification (2011 R-NFIP-5)	Flooding	High
	18	Join the CRS (2011 R-NFIP-6)	Flooding	Medium
	19	Mitigation of RLPs *NEW*	Flooding	Medium
Sand Lake, Town of	1	Update Floodplain Maps (2011 SL-1)	Flooding	High
	2	Develop Dam Emergency Action Plan NEW	Flooding	High
	3	Replace Orchard Lane Culvert NEW	Flooding	Medium
	4	Investigate dredging the Wynantskill Creek (5-7 miles) (2011 SL-2)	Flooding	Medium
	5	Reduce Tree Related Hazards (2011 SL-4)	Snow Storm, Ice Storm, Wind	Medium
	6	Participate in County-Led Hazard Mitigation Outreach (2011 SL-CL-1)	All hazards	Medium
	7	Request code/ordinance review by Count as needed (2011 SL-CL-2)	All hazards	Low

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	8	Send CEO to County-Led Training (2011 SL-CL-3)	All hazards	Low
	9	Send Comprehensive Plan Update to County for Review by County Planning (2011 SL-CL-4)	All hazards	Medium
	10	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 SL-CL-5)	All hazards	Medium
	11	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 SL-NFIP-1)	Flooding	Medium
	12	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 SL-NFIP-4)	Flooding	Medium
	13	Mitigation of RLPs *NEW*	Flooding	Medium
Schaghticoke, Town of	1	(old ST-2) Hazard Mitigation Code Training	All Hazards	7
	2	(old ST 3) Drought Management	Drought	10
	3	(old ST- 6) Steep Slope Regulations	Landsides	9
	4	(old ST-10) Tree Trimming	Wind	8
	5	(old ST-CL-1) Public Outreach (County lead)	All Hazards	4
	6	(old ST-CL-2) Code Updates (County Lead)	All Hazards	5
	7	(old ST-CL-4) Comp. Plan Review (County Lead)	All Hazards	6
	8	(old ST-CL-5) Workshops for hazard prevention (County Lead)	All Hazards	11
	9	(old ST-NFIP-1) Update Flood Management Ordinances to comply with FEMA	Flooding	1
	10	(old ST-NFIP-4) Update Flood Management Ordinances to comply with FIRM	Flooding	2
	11	(old ST-CL-3) All Building Code training	Flooding	3
	12	Mitigation of RLPs *NEW*	Flooding	Medium
Schaghticoke, Village of	1	Landslide Prevention, Pleasant Ave Water Tower Location (2011 SV-1)	Possible landslide potential behind existing water tank. Also, flood.	Top Priority
	2	Lightning Mitigation for Village Owned Municipal Buildings and Properties (2011 SV-2)	Lightning	Low

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	3	Landslide prevention, Route 40 between Pleasant Avenue and 5th Street (Diver Memorial Library) – Relocate Diver Memorial Library (2011 SV-3)	Landslide	Top Priority
	4	Participate in County-Led Hazard Mitigation Outreach (2011 SV-CL-1)	All hazards	High
	5	Request code/ordinance review by County as needed (2011 SV-CL-2)	All hazards	Medium
	6	Send CEO to County-Led Training (2011 SV-CL-3)	All hazards	Medium
	7	Send Comprehensive Plan Update to County for Review by County Planning (2011 SV-CL-4)	All hazards	High
	8	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 SV-CL-5)	All hazards	Low
	9	Update Floodplain Management Ordinance (2011 SV-NFIP-1)	Flooding	High
	10	Staff Training in NFIP (2011 SV-NFIP-3)	Flooding	Medium
	11	Update Floodplain Management Ordinance when new FIRMs are released (2011 SV-NFIP-4)	Flooding	High
Schodack, Town of	1	Clove Road Flooding (2011 SD-1)	Flooding	High
	2	Clove Road Sloughing (2011 SD-2)	Flooding and Landslide	High
	3	Western Road Sloughing (2011 SD-3)	Flooding and Landslide	Medium
	4	Participate in County-Led Hazard Mitigation Outreach (2011 SD-CL-1)	All hazards	High
	5	Request code/ordinance review by County as needed (2011 SD-CL-2)	All hazards	Medium
	6	Send CEO to County-Led Training (2011 SD-CL-3)	All hazards	Medium
	7	Send Comprehensive Plan Update to County for Review by County Planning (2011 SDF-CL-4)	All hazards	High
	8	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 SDF-CL-5)	All hazards	Low
	9	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 SD-NFIP-1)	Flooding	High
	10	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 SD-NFIP-4)	Flooding	High
	11	Require CFM Certification (2011 SD-NFIP-5)	Flooding	High
Stephentown, Town of	1	Generators, Fire Hall and Food Pantry *NEW*	All hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies
Detailed information is provided in each Jurisdictional Annex.

Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	2	Drainage Improvements 2019 *NEW*	Flooding, Ice Jams, Hurricane/ Tropical Storms, Winter Storms	High
	3	Bridge Upgrades (2011 SP-1)	Flooding, Ice Jams, Hurricane/Tropical Storms, Winter Storms	High
	4	Gould Road (2011 SP-2)	Flooding, Ice Jams, Hurricane/Tropical Storms, Winter Storms	Medium
	5	Drainage Improvements 2011 (2011 SP-3)	Flooding, Ice Jams, Hurricane/Tropical Storms, Winter Storms	Medium
	6	Generators- Town Highway Garage and Town Hall (2011 SP-4)	All hazards	Medium
	7	Update Land Use Plan (2011 SP-5)	All hazards	Low
	8	Participate in County-Led Hazard Mitigation Outreach (2011 SP-CL-1)	All hazards	High
	9	Request code/ordinance review by Count as needed (2011 SP-CL-2)	All hazards	Medium
	10	Send CEO to County-Led Training (2011 SP-CL-3)	All hazards	Medium
	11	Send Comprehensive Plan Update to County for Review by County Planning (2011 SP-CL-4)	All hazards	High
	12	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 SP-CL-5)	All hazards	Low
	13	Update Floodplain Management Ordinance per New FEMA Regulations (as needed) (2011 SP-NFIP-1)	Flooding	Medium
	14	Update Floodplain Management Ordinance when New FIRMs are Issued (2011 SP-NFIP-4)	Flooding	Low
Troy, City of	1	Tomhannock transmission line replacement *NEW*	Continuous Water Supply to municipality	1
	2	Ida Lake Dam Replacement *NEW*	Flooding	2
	3	Relocate the 911 communications vault (2011 T-1)	All hazards	High
	4	Transmission pipeline repair and replacement. (2011 T-2)	Continuous Water Supply to municipality	High
	5	CCTV for water storage tanks (2011 T-3)	Continuous Water Supply to municipality	High

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Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	6	Water supply protection (2011 T-4)	Continuous Water Supply to municipality	High
	7	Dam mitigation (2011 T-5)	Flooding	High
	8	Landslide slope stabilization (2011 T-6)	Landslide	High
	9	Bulkhead wall stabilization (2011 T-7)	Seawall Failure	High
	10	Gas pipeline replacement (2011 T-8)	Possible explosion	High
	11	Propane gas farm drills (2011 T-9)	Possible explosions	High
	12	Haz-Mat drills and pre-planning (2011 T-10)	Haz-Mat mitigation	High
	13	Participate in County-Led Hazard Mitigation Outreach (2011 T-CL-1)	All hazards	Medium
	14	Request code/ordinance review by County as needed (2011 T-CL-2)	All hazards	Medium
	15	Send CEO to County-Led Training (2011 T-CL-3)	All hazards	Medium
	16	Send Comprehensive Plan Update to County for Review by County Planning (2011 T-CL-4)	All hazards	Medium
	17	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 T-CL-5)	All hazards	Medium
	18	Update Floodplain Management Ordinance (2011 T-NFIP-1)	Flooding	High
	19	Designate a Floodplain Administrator (2011 T-NFIP-2)	Flooding	High
	20	Staff Training in NFIP (2011 T-NFIP-3)	Flooding	High
	21	Update Floodplain Management Ordinance when new FIRMs are released (2011 T-NFIP-4)	Flooding	High
	22	Require CFM Certification (2011 T-NFIP-5)	Flooding	High
	23	Mitigation of RLPs *NEW*	Flooding	Medium
Valley Falls, Village of	1	Playground Drainage *NEW*	Flooding	High
	2	Drainage System, Corner of Edward and Ella *NEW*	Flooding	High
	3	Possible Reinstatement in the NFIP *NEW*	Flooding	High
	4	Floodplain Ordinance (2011 VF-1)	Flooding	High
	5	Mill Site Cleanup (2011 VF-3)	Flood-caused river contamination	High
	6	Participate in County-Led Hazard Mitigation Outreach (2011 VF-CL-1)	All hazards	High

Table 5.3 – Overview of Municipal Mitigation Strategies Detailed information is provided in each Jurisdictional Annex.				
Jurisdiction	Project Number	Project Name	Hazard(s) Addressed	Priority
	7	Request code/ordinance review by County as needed (2011 VF-CL-2)	All hazards	Medium
	8	Send CEO to County-Led Training (2011 VF-CL-3)	All hazards	Medium
	9	Send Comprehensive Plan Update to County for Review by County Planning (2011 VF-CL-4)	All hazards	High
	10	Attend County-Led Workshops on Natural Hazards and Hazard Mitigation (2011 VF-CL-5)	All hazards	Low
	11	Update Floodplain Management Ordinance (2011 VF-NFIP-1)	Flooding	High
	12	Designate a Floodplain Administrator (2011 VF-NFIP-2)	Flooding	Low
	13	Staff Training in NFIP (2011 VF-NFIP-3)	Flooding	High
	14	Update Floodplain Management Ordinance when new FIRMs are released (2011 VF-NFIP-4)	Flooding	Low

SECTION 6 - PLAN MAINTENANCE AND INTEGRATION

A formal plan maintenance process for monitoring, evaluating, and updating the Hazard Mitigation Plan must take place to ensure that the Plan – and specifically the mitigation strategy - remains current and relevant. Updates are required every five years from the date the plan is approved[1]. Regularly scheduled evaluations during the five-year cycle are important to assess the effectiveness of the program and to reflect changes that may affect mitigation priorities, and a process must be undertaken to keep the public engaged throughout the plan's ongoing implementation. As part of the 2019 Plan Update, the RCBPS and the County JAT have reviewed the 2011 HMP plan maintenance procedure, and have opted to pursue a very similar strategy for the next five years (2019 to 2024) though some changes have been made to account for both expressed municipal preferences for a slightly modified approach in some areas, and minor differences in the FEMA guidance since the initial plan was prepared.

The RCBPS will continue to take the lead role in coordinating the overall plan maintenance effort, with ongoing support and feedback from the County JAT. Mr. Jay Wilson, who was identified as Coordinator for the 2019 Plan Update, will oversee the overall plan maintenance process with support from Mr. Eric Gaunay. Each CPG member will take the lead role on plan maintenance activities for their respective jurisdiction[2]. Details of County and municipal responsibilities with regard to plan maintenance are described in the remainder of this section; specifics regarding plan integration per municipality are included in each jurisdictional annex.

Monitoring the Plan

An important step in any mitigation planning process is to document the method by which the CPG will monitor the plan's implementation throughout the five-year period of record. The lead entity in each jurisdiction coordinates with other departments/agencies responsible for implementing hazard mitigation actions identified in the plan in order to maximize the opportunities to implement actions, track progress of actions, identify and address any barriers to implementation of the actions, and to take advantage of grant funding opportunities. Monitoring the plan, therefore, becomes part of the regular function of the office and position to which it is assigned.

Past Progress (2011 to 2019)

The 2011 HMP was approved by FEMA in November 2011; therefore, Annual Work Progress Monitoring Reports were targeted for municipal completion and submittal to RCPBS in November of each year thereafter. Jurisdictions took strides toward implementing their

[1] After FEMA completes its plan review and determines that all requirements have been adequately addressed, it issues a determination of "Approvable Pending Adoption". Participating jurisdictions then each move forward with formally adopting the plan. For multi-jurisdictional plans, FEMA considers the plan approval date to be the date of the first jurisdictional adoption.

[2] Many jurisdictions have more than one individual CPG member. In completing the Statement of Authority to Participate (discussed in Section 1), each jurisdiction designated a primary CPG representative as well as an alternate. For plan maintenance purposes, it is the position title of the person designated as the 'primary representative' who is responsible for shepherding plan maintenance activities.

hazard mitigation initiatives. However, formal project tracking and monitoring were hampered by lack of funds and lack of staff. RCPBS received a very limited number of Annual Work Progress Monitoring Reports during the first plan maintenance cycle (2011-2019). Monitoring tended to occur on a more ad-hoc level, with verbal evaluations and discussions as opposed to direct, paper tracking. This highlighted a need for increased vigilance at the local level to both implement mitigation strategies and monitor progress accordingly.

- 2011 to 2017 – Plan monitoring occurred on an ad-hoc basis at the jurisdiction and County levels, with verbal evaluations and discussions of progress as opposed to direct, paper tracking.
- 2018 to 2019 – As part of this hazard mitigation plan update, project progress was tracked via Worksheet #6, for all progress made on mitigation projects over the whole of the first plan maintenance cycle. Detailed tracking for each jurisdiction is included in each municipal annex.

Approach (2019 to 2024)

The plan monitoring approach outlined in the 2011 HMP was reselected for the next 5-year cycle. Annual Work Progress Monitoring Reports will be prepared by the County and each participating jurisdiction to track the progress of each of their respective hazard mitigation actions. Annual Work Progress Monitoring Reports shall be prepared by the municipal Lead and Alternate for each participating jurisdiction and submitted on an annual basis to both RCBPS and their local governing body at this same time to demonstrate local progress or changes to-date, beginning one year from the date of FEMA's approval of the Final plan. RCBPS will maintain a central repository of responses. A blank Annual Work Progress Monitoring Report is included at the end of this subsection[3]. The Annual Work Progress Monitoring Reports provide an overview of the hazard mitigation action(s), responsible and supporting agencies/entities responsible for implementation, a delineation of the various project milestones, the current status of the project, any issues that may hinder implementation; and next steps. Annual Work Progress Monitoring Reports are to be completed by each municipality once per year for each project in their mitigation strategy, beginning one year from the date of FEMA's approval of the Final plan[4].

[3] The 2011 HMP identified a FEMA form for annual work progress monitoring; the form in this plan update represents an abbreviated version of that form.

[4] For multi-jurisdictional plans, this is the date of the first jurisdictional adoption of the plan, regardless of whether the first jurisdiction is a county government entity or some other local municipal government.

Annual Work Progress Monitoring Report

Municipality:		Progress Report Period:		Date Prepared:	

Mitigation Action Project Title:

Brief Project Description:			
Risk Addressed:			
Who is responsible for implementing the action?	Contact Person (include name, title, department, phone, email):		
Has the project been initiated (check one): __yes ___no If yes, when? If no, why not?	List Supporting Agencies and Contacts (if any):		
Status (check one): __on schedule __completed __delayed* * If delayed subsequent to initiation, explain here:	Original target date for completion:	Current estimated target date for completion:	
Original cost estimate:	Cost Status (check one): __ unchanged __overrun _underrun If overrun/underrun, explain here:	Anticipated overrun amount:	Anticipated underrun amount:

Description of the Project (fill in table with a description of each phase, if applicable, and the time frame for completing each phase):		
Project Milestones (e.g. grant application, approval, design, permitting, construction, etc.)	Complete? (y/n)	Projected Completion Date

Indicator of Success: In most cases, you will describe any damages/losses that have been avoided as a result of the project. Leave blank if project is not completed. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

What was accomplished during this reporting period?

What obstacles, problems, or delays did you encounter, if any?

How was each problem resolved?

What is/are the next step(s) to be accomplished over the next reporting period?

If the action has been completed, were the outcomes as expected?

Other comments:

Evaluating the Plan

After a mitigation plan is formally approved by FEMA and adopted by participating jurisdictions, it should be evaluated on a regular basis in order to assess the effectiveness of the plan at achieving its stated purpose and goals.

Past Progress (2011 to 2019)

The 2011 HMP was approved by FEMA in November 2011. According to the process outlined in the 2011 HMP, Annual Plan Evaluation Meetings were targeted for November of each year thereafter. However, plan evaluation discussions occurred on an ad-hoc basis at the jurisdiction and County levels, with verbal evaluations and discussions of progress as opposed to direct, paper tracking. This highlighted a need for increased vigilance at the local level to both implement mitigation strategies and monitor progress and overall plan evaluation accordingly.

Approach (2019 to 2024)

The 2011 plan evaluation approach was reselected for the 2019 Plan Update. The CPG will convene once per year for an Annual Plan Evaluation Meeting. Annual Plan Evaluation Meetings will be led by RCBPS and will be conducted within three months after each annual batch of Annual Work Progress Monitoring Reports are due (see “Monitoring”, above). At each meeting, the CPG will review the Annual Work Progress Monitoring Reports, and use the following criteria as points for group discussion to evaluate the effectiveness of the plan at achieving its stated purpose and goals:

- Do the goals and objectives address current and expected conditions?
- Has the nature and magnitude of risks changed?
- Are the current resources appropriate for implementing the plan?
- Are there any implementation problems (such as technical, political and/or legal), or coordination issues with the other agencies and/or Committee members?
- Have the outcomes occurred as expected?
- Have the agencies and other Committee partners participated as proposed?
- Where shortcomings are identified, what can be done to bring things back on track?
- What is the current progress with regard to plan integration?
- Have any comments been received on the plan from municipalities, the general public, or other stakeholders?

Following each Annual Plan Evaluation Meeting, the RCBPS will prepare meeting minutes that will document, at a minimum, the CPG’s consensus responses to the topics above. RCBPS will distribute meeting minutes to all CPG members via email and will post meeting minutes on the web site.

Updating the Plan

As part of the process to maintain FEMA mitigation funding eligibility, a plan update must always be submitted to NYSDHSES/FEMA for their review. This must occur within five years of the plan's approval by FEMA (and during subsequent five-year cycles thereafter).

Past Progress (2011 to 2019)

The 2011 HMP was first approved by FEMA in November 2011. An update was due in November 2016. Actual update proceedings were not initiated until 2018 due primarily to a lack of funds to complete the update, and changes in staff at RCBPS. Rensselaer County initiated the process for this first required plan update by submitting a planning grant application to FEMA on May 11, 2016 under the PDM program. Notification of grant award was received on October 6, 2017. An RFP was issued on March 16, 2018, with proposals due on April 30, 2018. AECOM was identified by the County to facilitate the update process; with notification of award on June 11, 2018, and a contract and notice to proceed was issued on October 1, 2018. A project initiation meeting was held between AECOM and the County on November 5, 2018, and a project kickoff meeting was held with the CPG on December 10, 2018. This 2019 plan update represents the first required update of the 2011 HMP.

Approach (2019 to 2024)

The plan update approach outlined in the 2011 Plan was expanded upon and slightly modified here as part of the 2019 Plan Update.

RCBPS has taken the lead on Plan development and updates and will continue to do so in the future. RCBPS shall be responsible for ensuring that the plan is maintained in accordance with all applicable guidance and regulations.

Regardless of whether or not a plan update is grant funded[5], the following must occur within 5 years from the date that the plan is adopted by the first of its participating jurisdictions:

- An updated planning process must be undertaken.
- An updated plan document must be prepared.
- The updated document must be resubmitted to FEMA (through NYSDHSES).

[5] Funding HMP Updates. In the past, Rensselaer County has sought out grant funding to offset the fairly significant costs associated with both the initial plan development and the first plan update. Should the County wish to do so in the future, FEMA's Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation Program (PDM) would continue to be the most applicable funding sources. The HMGP is a post-disaster program. Under this program, funds become available state-wide for applicants with approved hazard mitigation plans in place each time there is a Federal disaster declaration anywhere in the state. A certain portion of HMGP disaster funds are set aside for projects; the remainder is set aside for planning. The PDM program is a pre-disaster program. Under this program, funds are appropriated annually and are competitive at a national level. Annual appropriation amounts tend to vary widely, and its availability in the future is not guaranteed. If the RCPGS is interested in obtaining grant funds for the next required plan update (2019 to 2024) then a grant application should be submitted for the first opportunity after the plan is adopted. This would allow for the possibility of the application not being approved on the first pass and would allow sufficient time for an alternate approach to be taken within the requisite 5-year window. If grant funding is selected as the primary funding source for any given update cycle, the County should be keenly aware of grant application review times, as well as applicable County procurement rules, when moving forward. It is not uncommon for grant submittal, review, approval, RFP issuance, review of proposals, selection of a contractor, and contract negotiations and contract execution to take one to two years out of the 5-year cycle. In addition, grant funding is not guaranteed so the County should be prepared with a backup funding source for meeting requirements if outside assistance does not materialize.

- The updated plan must be reviewed by FEMA, who will provide formal comments indicating both required and recommended revisions.
- At a minimum, all required revisions must be addressed.
- The revised document needs to be routed back to FEMA, who will review to ensure that all required revisions have been satisfactorily addressed. If so, they will deem the plan "approvable pending adoption."
- The plan must then be adopted by participating jurisdictions.

Allowing one year for the update process, and one year for the review/approval/adoption process has historically been observed. That having been said, it is recommended that the County initiate each requisite plan update no later than three years after the plan's approval date[6]. If grant funding is sought, applications should be submitted at the first opportunity following the plan's approval date (and no later than two years after the plan is approved).

The plan update involves a comprehensive review and evaluation of each section of the plan, and also discusses the results of evaluation and monitoring activities detailed in the Plan Maintenance section of the previously approved plan. Plan updates may validate the information in the previously approved plan or may involve a major plan rewrite. A plan update cannot be an annex referring to the previously approved plan; it must stand on its own as a complete and current plan. Plans are required to be updated to reflect changes in development, progress in local mitigation actions, and changes in priorities. Other criteria considered during the update included:

- if changing situations have modified goals/objectives/actions and/or hazards;
- if additional information is available to perform more accurate vulnerability assessments;
- if it is determined that participating jurisdictions wish to be added to and/or removed from the Plan; or
- if it is determined that the Plan no longer addresses current and expected future conditions.

At the time of each update, RCBPS shall consult with NYSDHSES and FEMA for the latest Guidance in place regarding plan updates to ensure that the latest criteria are addressed in the update process. Plan updates will be posted on the County web site and made available in hard copy at the RCBPS offices.

Public Participation in Plan Maintenance

The public and other stakeholders must be given opportunities to become involved during the Plan's regular maintenance and implementation. It is important to understand perceptions of the plan's effectiveness and degree of success to help maintain support for the plan and provide accountability for those responsible for its maintenance and implementation.

[6] After FEMA completes its plan review and determines that all requirements have been adequately addressed, it issues a determination of "Approvable Pending Adoption". Participating jurisdictions then each move forward with formally adopting the plan. For multi-jurisdictional plans, FEMA considers the plan approval date to be the date of the first jurisdictional adoption.

Past Progress (2011 to 2019)

RCBPS reports the following progress was made in continued outreach to the public and other stakeholders over the first plan maintenance cycle:

- RCBPS has successfully continued to maintain the mitigation planning website.
- Continual outreach to the public at various events.
- RCBPS provides Multi-Jurisdictional Hazard Mitigation Plan Fact Sheet and website information to county staff.
- Beginning in 2018, all participating jurisdictions conducted regular outreach to the public and other stakeholders regarding the plan update. Their activities, along with any comments received, are summarized in each Jurisdictional Annex.

Approach (2019 to 2024)

The following array of activities was selected by RCBPS based on feedback received from CPG Members at the time of development of the initial plan in 2011. These activities were reviewed as part of the 2019 Plan Update and the following activities were selected for the 2019 to 2024 planning cycle:

- RCBPS will continue to maintain the mitigation planning website.
- Each participating jurisdiction will maintain a link on their jurisdiction's web page to the County mitigation planning website, if they have not already done so.
- RCBPS will prepare an annual fact sheet on the plan. This fact sheet will be submitted via email to CPG members for posting on community notice boards, at a minimum, and preferably supplemented with distribution at meetings as applicable. RCBPS will post the fact sheet on the County mitigation plan web site.
- Participating jurisdictions will conduct annual interviews and/or smaller meetings with civic groups, the public and other stakeholders. This will be accomplished through incorporating discussion of the mitigation plan into other regularly attended meetings.
- Participating jurisdictions will consider annual flyers, newsletters, newspaper advertisements, and Radio/TV announcements to supplement annual interviews/meetings and will implement some or all of these at the discretion of the jurisdiction. At a minimum, the County will issue an annual press release.
- Participating jurisdictions are responsible for keeping track of any comments they receive on the plan and bringing them forward for discussion at the Annual Plan Evaluation Meetings.

Plan Integration

For a participating jurisdiction to succeed in reducing risk in the long term, the information and recommendations of the hazard mitigation plan must be integrated into day-to-day local government operations, as well as into comprehensive plans. Throughout the planning process, partnerships are formed between departments and agencies, and sustained actions between these partners will increase the community's resilience to disasters. "Plan integration" can be thought of as the process whereby each participating jurisdiction will incorporate the mitigation plan findings and projects into other planning mechanisms (local

governance structures that are used to manage local land use development, building codes and community decision making).

Past Progress (2011 to 2019)

As part of the 2019 Plan Update, the targeted plan integration activities from the 2011 HMP were put into tabular form on a worksheet, and each jurisdiction was asked to complete the worksheet to indicate their respective accomplishments over the first plan maintenance cycle. A summary of Plan Integration activities undertaken by the County and each community is provided in each Jurisdictional Annex. Overall, plan integration activities that were undertaken were generally limited, highlighting a need for increased vigilance at the local level to both implement mitigation strategies and monitor progress and overall plan evaluation accordingly.

Approach (2019 to 2024)

The overall approach of the 2011 HMP included various plan integration options for municipalities to choose from during the plan maintenance phase. It was not specific as to which jurisdictions would undertake which activities. However, the latest FEMA guidance requires multi-jurisdictional plans to be more specific, identifying what particular activities will be undertaken by each specific jurisdiction. To this end, as part of the 2019 Plan Update process, municipalities were asked to consider a range of possible plan integration activities, and by completing a worksheet, select a series of jurisdiction-specific activities from this list of options (with flexibility to add additional, unlisted options at their individual discretion). A wide range of possibilities was considered, such as: protecting life and property in high hazard areas by limiting densities of new development; increasing resilience by limiting the extension of public infrastructure in high hazard areas; and adding a specific hazard mitigation element to the next update of local master, general or comprehensive plans - to name a few.

Each jurisdiction's identified plan integration activities that will be undertaken during the 2019 to 2024 plan maintenance cycle are included in each Jurisdictional Annex.

SECTION 7 - FOR MORE INFORMATION

If you have any questions or comments on the Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan, additional information can be obtained by contacting:

Jay Wilson, Director
Rensselaer County Bureau of Public Safety
Public Safety Building
4000 Main Street
Troy, New York 12180
Phone: (518) 266-7676
E-Mail: jwilson@rensco.com

or

Eric Gaunay, Emergency Preparedness Coordinator
Rensselaer County Bureau of Public Safety
Public Safety Building
4000 Main Street
Troy, New York 12180
Phone: (518) 266-7671
E-Mail: egaunay@rensco.com

For specific information regarding a particular community, please contact the Jurisdictional Representative and/or Alternate as identified in that community's Jurisdictional Annex.

Plan information is also continuously maintained on the Rensselaer County web site at:

http://www.rensco.com/departments/public-safety/hazard-mitigation-planning/

SECTION 8 – JURISDICTIONAL ANNEXES

Section 8 – Jurisdictional Annexes PLEASE SEE ENCLOSED CD

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